IMPLEMENTATION OF SINGLE MINUTE EXCHANGE DIE (SMED) TECHNIQUE TO ACCELERATE THE MOLD CHANGING TIME AT SME COMPANY

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ABSTRACT

The purpose of the Single Minute Exchange Die (SMED) is to eliminate waste of time. Longer set-up time means that the production line is not productive and will left behind by their competitor. Nowadays, everything is been done faster and just-in-time, where manufactures need to produced product in fast and without neglecting the quality issue and deliver it to customer right on time. In this project, SMED had provided the method to eliminate waste of time with their eight technique of SMED introduced by Mr. Shigeo Shingo. In SMED mold or die exchange should be less in 10minute and it took lots of improvement involve by the employee. The project objective is to reduce mold set-up time to 40% is exceeding the expectation where they able to reduce until 51% from the total set-up time previously. In overall with the help of everyone, especially from top management of company to their employee, SMED is successfully done and achieve the objective.

ABSTRACT

Tujuan utama Penuukaran Acuan Secara Cepat (SMED) adalah untuk menghapuskan pembaziran masa. Masa penyediaan yang panjang menunjukkan bahagian pengeluaran tidak produktif dan akan ditinggalkan oleh pesaing mereka. Kini, segala-galanya dilakukan dengan cepat dan di hantar pada masa yang ditetapkan, begitu juga di dalam dunia pembuatan di mana pengilang perlu menghasilkan produk dengan cepat tanpa mengabaikan kualiti dan menghantar kepada pelanggan tepat pada masanya. Oleh itu, SMED telah menyediakan kaedah untuk menghapuskan pembaziran masa dengan 8 teknik dari SMED yang diperkenalkan oleh Encik Shigeo Shingo. Mengikut SMED, masa penyediaan harus kurang dari 10minit dan ia memerlukan banyak aktiviti penambahbaikan oleh pekerja. Objektif project ini adalah untuk mengurangkan masa penyediaan acuan kepada 40% dari masa penyediaan sebelum adalah melebihi jangkaan di mana mereka dapat mengurangkan sehingga 51% dari jumlah masa penyediaan sebelum ini. Keseluruhannya, dengan bantuan semua orang, terutama dari pihak pengurusan syarikat sehingga pekerja mereka, SMED berjaya dilakukan dan mencapai objektif yang dikehendaki.

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INTRODUCTION

1.1 BACKGROUND OF STUDY

In this globalization world, the small and medium enterprise companies are competing each other to be the best. For them who involve in automotive industries they have another challenge, tax from government that been reduce periodically.

Now a day, target to enhance level of productivity, the ability and efficiency in all production fields is being number one priority in industries they involve. Competition in this day is depends on time, production cost and the ability to sell in manufacturing field. (Charles et al, 2001). Back in few years ago, industries just focus on marketing and customer demand. This is why automotive industries take an action to involve in lean production system.

Fluctuation order with the small amount caused the supplier (mostly SME companies) had to apply the just in time concept (Eduardo et al, 2006). Lean production system gives the better result for industries to apply, however they had to use techniques

from lean production system such as Single Minute Exchange Die-SMED, takt time, kanban and others. (Suri, 1988).

Based on the effort to success through Lean Production System (LPS), one study is conduct to one of the SME companies at port Klang. Marutech Elastomer Industries Sdn. Bhd. (MEI) established from 1994 with three share holder Zebcyle (M) Sdn. Bhd, (51%), Proton (25%) and Marugo Rubber Industries Ltd. (24%). Instead of manufacturing, they also help their customer in designing, production and component quality inspection. MEI capable to manufactures product such as roll mounting, hanger, air intake hose and rubber based product for automotive purposed.

MEI has a few departments in manufacturing division:

1. Metal treatment
2. Raw material mixing
3. Rubber injection
4. Trim and paint
5. Assembly
6. Quality checking

Day by day, MEI had to meet the customer demand while the car technologies keep developing. So, this is challenge for MEI to meet the customer demand based on quality, product variant and also deliveries. In LPS, one of the wastes is waste of inventory (Liker, 2004). Waste of inventory is very difficult to control if there are so many product in different shape and size.

More significant problem happen when MEI got a very high order for every model. This makes each product from injection division to run in schedule (not enough injection machines). It is also involve die exchange time to be faster so that they can meet the customer demand. The solution is- Single Minute Exchange Die (SMED).

SMED is a tool use to accelerate die change time during production. This set-up should not take more than 9 minutes. That why it is called single minute exchange die. It is also must be systematic approach that eliminate waste and problem. We must list down first the traditional approach by that company during the set-up time and then from the list, we identify what the waste happen during the set-up time. Just imagine how much time we save if we do SMED from 1 hour set-up time to 9 minutes set-up time.

Hopefully this study can solve or minimize the problem state above so that we can increase the productivity.

1.2 OBJECTIVE

Main objective is to implement Single Minutes Exchange Die at Marutech Elastomer Industries (MEI). This study includes the implication method, the ability and efficiency of Single Minutes Exchange Die in order to reduce the stock and order lead time.

Specifically, this is what this study will do:

- To implement Single minutes Exchange Die in SME company.
- To reduce the die exchange time to 40%

1.2 SCOPE OF PROJECT

This study was conducted in Marutech Elastomer Industries Sdn Bhd, Port Klang, Selangor.Ia covers the entire part in the manufacturing sector. The study will be focusing to the reduction in the mold exchange according based on the SMED system manufacturing LPS.

Generally scopes that cover in LPS are:

- 7 waste
- Kaizen team
- Time study
- Improvement activities
- SMED techniques

1.4 PROBLEM STATEMENT

This study is focusing on Single Minutes Exchange Die and also other system that support or make improvement to the exchange die system for the company. The research will focused on rubber injection moulding in injection department.

Based on customer demand, most of them want the suppliers to deliver the product right after the order is valid. Back in few years ago, customer wants the suppliers to deliver the product after one or two weeks. Now, customer wants the product to be delivered after three or four day after the order was confirmed. This also makes change on the total of order; because we must bear that the customer also practicing Lean Manufacturing System, so every ordered product must be in small lot to reduce the waste.

Because of the high order from customer, so production planning and control had difficult task to make a details planning because of the lack of inventory information. They also had to check the inventory twice per day. We can see how difficult to finish all this work, not once a week, but every day.

Specifically, this is the problems that lead to this study:

- Long change over time during die exchange that lead to inefficient production.
- Injection molding division cannot handle high and variability order from customer due to inefficient production.

1.5 OUTPUT EXPECTED FROM THE STUDY

- Able to develop and implement Single Minute Exchange die
- Able to develop a method and technique to apply single minute exchange die that can be applied by Small and Medium Enterprise companies (SME).
- This research could be able to be a reference by other SME companies for them to apply single minute exchange die.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This section will give a full explanation about the basic concept of manufacturing system and discuss about lean production system principle. It will be focusing on time reducing between set-.up times in Marutech Elastomer Industries Sdn Bhd that producing rubber mounting engine, located at Pelabuhan Klang by applying Single Minutes Exchange of Die (SMED). This study will be as a LPS tool that can be introduced to other manufacturing sectors that give a drastic change in reducing die set-up time. Next, applying LPS concept and SMED techniques at MEI will be explained in details in this section.

2.2 LEAD TIME OF MANUFACTURING SYSTEM

Because of the difficulties to fulfill customer demand and competition in industries among other companies, most of the company feels intense in producing and delivering product in short time. They always in intense state to reduce lead time and always been

push to have short lead time (Melnyk and Christensen, 2000). According to their book, Melnyk and Christensen define lead time as time between time given by production planning and control (PPC) to manufacturing division. These also involved each process in production in sequence from accepting the raw material until it becomes inventory stock.

Lead time is defined as the time that need to delivery product to customer or buyer (Wikipedia, 2009). There is lot of component in manufacturing lead time and one of those is production lead time. Productions lead time divide by four elements; waiting time; set-up; transfer time and production time. Waiting time set-up time, and transfer time is one of the non-value added to product and consider as a waste. Meanwhile, production time is the only element that gives value added to product. This is very important to eliminate non-value added elements and shorten overall lead time.

This section will be explained with details for element of set-up time and why this element is important and how to reduce it.

2.3 REDUCING SET-UP TIME

To give better understanding about set-up and why it must be reduced, next section will be explaining set-up definition and benefits in reducing set-up and production cost in manufacturing system.

2.3.1 DEFINITION OF SET-UP TIME

Set-up time can be define as a total time taken when machine not in operation (machine downtime) while model exchange for machine or machine configuration after first production finish (example: production for product A) until the second operation start for next process (example; production for product B). Please refer Figure 2.1 for better understanding.

In operation, there are many type of product that been produced and each product have its own set-up method or machine configuration. Because of its unique setting and configuration, machine should stop before start to run next production. While machine stop and not operate, change of tool took place and each minute lost between production for product A stop until production for product B took place is called waste. When machine stop for any production, setting for machine A must be change according setting for production B. Each operation that occurs for this stage is called set-up time.

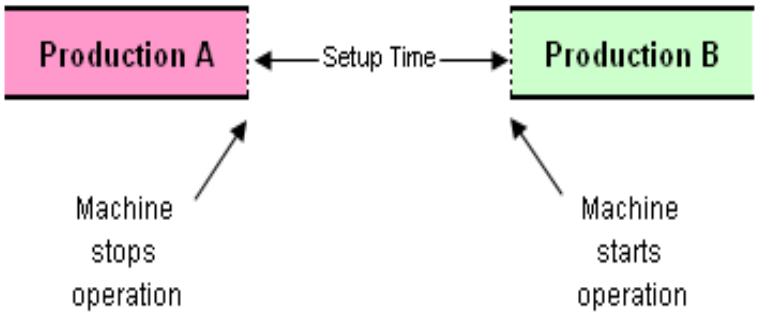

Figure 2.1: Set-up time

Usually, total time needed for preparing and change model or die at machine should not take long time until one day or two to three hour. But it should take less than one hour. Every not needed task or operation happen in set-up time and changing die is waste because that activities lead to long set-up time. There is a LPS concept told that how important to have short set-up time and changing time below that one hour.

Maynard and Zandin (2001) defined set-up process as transformation of manufacturing model system from produce one product to another product, including stopping the current work for preparation for the next process except for the special case where certain product is produced at special machine or production line. It is important to change finish product from product A to product B. in this context, set-up can be define a; from production A stop until start next product B without defect.

Maynard and Zandin (2001) also stressed that the set-up is not referring to the changing of mold or other equipment and products, but the entire production of the previous stop production so that no defective products that have been issued for the next product.

Van Goubergen and Van Landeghem (2002) define set-up time as time the final product (Product A) to leave the machine until the next product (Product B), which has produced good quality.

Reduction of setup time is always give attention to the reduction of downtime machine. Each time that happened during the time-consuming activities during downtime can increase the cost of production. In this case, the internal time is priceless and sign are very important to measure the operating efficiency, because time will pass and cannot be

replaced for future use. Most manufacturing companies can take up to several hours or up to several days to perform the operations preparation and changing activities. Reduction of setup time and waste disposal is not as easy as it looks and can get very expensive if it is counted in detail.

There are many methods of LPS that can be used to reduce setup time and one of the rules of the LPS that had been used and implemented by the manufacturing companies are SMED. This method will be described in greater detail in the next section

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2.3.2 IMPORTANCE OF REDUCING THE SET-UP TIME

The need to reduce the set-up time has been known since years ago. Although the need to shorten the set-up time is not new, but lately all the types of industry more focused on the preparation for this. Needs a short set-up time is larger than it looks. Globalization of the market, product diversification and ongoing efforts to achieve better efficiency in existing production is the main factor that drives this phenomenon to continue to occur (Van Goubergen and Lockhart, 2005).

Reduction of setup time has many advantages such as increasing the manufacturing systems and its capacity such as reducing lead times, reduced inventory levels and production costs. Typically, a short set-up time can be achieved if the overall lead times can be reduced. Short set-up time can reduce the losses and defects, thus enhancing the quality of a product. The next section will describe the importance in reducing the set-up time.

2.3.2.1 REDUCING SET-UP TIME AND CHANGING TIME

The highest achievement in the total cessation of downtime is to reduce the set-up time and changing time. This achievement can be achieved through good planning, redrawing the product, process sketching and upgraded existing machines and equipment if necessary.

In manufacturing systems, prototype product design is a stage before performing the actual production. Results from these sketches took large impact on production costs. At this stage all the results from sketches made by the design engineer, is the measurement of time required in each method, the component materials and manufacturing processes that will be used to produce the product. Since each product has its own shape, its own materials, equipment and machinery of its own, its own engineering drawings and production stages of its own, it becomes very important to design engineer to estimate the manufacturing cost. These costs include preparation of cost estimates for the exchange of mold, but the manufacturing costs will increase if the cost preparations of estimates is lower than the actual costs of providing.

Roy (2005) stressed that the set-up time can be reduced and eliminated by using SMED concept which can be achieved with good planning, drawing and sketching the product of the process.

2.3.2.2 REDUCING LOT SIZE AND INVENTORY COST

In the past, the increase of the set-up time can be achieved through efficiency and large-scale production. The concept of economic lot sizes has been introduced to improve inventory control. Lot size of the economy has been regarded as a rational approach (Shigeo, 1985).

Due to a change in the market and the lack of available capital cost after World War II, most Japanese car makers realize the importance and the need to develop production Small Lot Size. They have to produce various types of cars and heavy vehicles in low quantities and low prices, to meet a small number of orders (Cusuinano, 1986).

Wikipedia defines economic lot size as the number of identical products where these products should be produced to determine the cost of changes in production processes as compared with the same product but with different lot size (Wikipedia, 2009).

If the lot size is the same (unchanged) and can reduce setup time, machine utilization can be reduced and so the performance can be improved. However, research and training shows that the lot size should be reduced proportional with the preparation of (Enns et al. Al. 2009). If you require the production of small lot sizes, then you need to shorten the time of preparation (Esrock 1985; Shingo 1985; Van Landeghem and Van Goubergen 2002).

Short set-up time can reduce the lot size and thus reduce inventory levels where existing products are delivered to customers more quickly. This will cause a reduction in

inventory costs and other costs. Inventory costs can be reduced to a smaller lot size and a reduction in setup time by removing scrap, defects and restoration work.

This can be easily seen because of the relationship between lot size and setup time. The shorter the time of preparation, the smaller lot sizes can be produced in good condition and able to follow the real order size. Not impossible if you want to introduce the production policies of customized manufacturing system (Make to order) (Van Gourbergen, 2000).

By reducing the set-up, lot sizes and inventory levels could be reduced which will facilitate the operation in exchange of work or model. Use of standard jig to produce a product on the machine is one way to reduce setup time and indirectly provides a standard method of conversion of the goods (Pratsini, 1998).

2.3.2.3 REDUCING LEAD TIME AND INCREASE CUSTOMER SATISFACTION

Lead times play an important role in determining the ability of a company. Lead time affecting the work in process together with the finished goods, the information requirements, quality control management practices, and customer service (Yücesan and De Groote, 2000). As described previously, the overall production costs can be reduced if production lead times are reduced. set-up time is one of the main components in the production lead times (production lead time). When the set-up time is reduced, eliminate indirect waste (Muda) in the production of excess / many (waste of overproduction).