

# CHAPTER 2

## THEORIES AND LITERATURE REVIEW

Machine set up operations are very common in manufacturing. There are some parts scrapped and loss time at an earlier operation, this results in making low productivity and high costing. Set up operations are of extreme importance in the job shop when production runs tend to be small and when the ratio of set up time to the production-run time is high.

### 2.1 Theoretical background

#### 2.1.1 Principle of machine set-up time improvement

In this study; the machine set-up time was classified into (1) Walk up to machine, (2) Set change parts in place (exactly), (3) Secure change parts (quickly), (4) Install tool (precisely) and (5) Make the first part as the good quality.

The strategies of machine set-up improvement are provided for improving set up operation for the company. The framework could be explained as the followings.

1. Collecting data from cable production jacketing process where the set up time is high because lost time is high. Data collection had been emphasized on the actual of setting times that effect loss time in process.

2. Pareto diagram is used to identify the priority factors such an analysis. It will help to identify the problems which must be solved before improving the factor-related work process.

3. Brain storming method was developed to identify the problems situation in the priority area.

4. Solution strategies should be identified to minimize the adverse causes and obtain implementation guidelines. Almost improvement will be done by reducing set up time by searching for possible solution for develop the preferred method. The following approaches should be considered in developing possible solutions where the preferred work method is applied.

#### 2.1.1.1 Eliminate all unnecessary work,

Too much unnecessary work is done today. In many instances, the job or the process should not be a subject for simplification or improvement, but rather it should be eliminated entirely.

Benefits of work elimination comparing with simplification or improvement are

1. If a job can be eliminated, there is no need to spend money on installing an improved method.

2. No interruption or delay is caused while the improved method is being developed, tested and installed.

3. It is not necessary train new operators on the new method.

4. The problem of resistance to change is minimized when a job or activity that is found to be unnecessary is eliminated.

These 3 areas is considered to eliminate all work that they should be done which are:

1. Eliminate quality problems

The cause of quality problems had been checked whether it is concerned set up operation and what those problems cause from what parts of set up.

2. Eliminate unnecessary elements

3. Eliminate nonvalue-added elements

The nonvalue-added and unnecessary elements are the one that is not worth while doing and are not completed in the least amount of time. Each element had been looked to be classified as getting ready, preparing to run, and trials to determine if it is value added. If the answer is no, the element should be eliminated.

Here the checklist used to consider for nonvalue-added and unnecessary elements are as following.

1. Rework
2. Scrap
3. Walking
4. Searching for something
5. Waiting
6. Making repeated adjustments
7. Counting
8. Doing "dry runs"

All the nonvalue-added items had been looked for identified and eliminate. There may even be many nonvalue-added elements in removing the old job or installing the new job. The document had been reviewed and also a particular element should be reviewed for elimination. Some elements were found that are candidates for elimination, had been checked more detail before determined and assigned develop methods or procedural changes to eliminate that element.

#### 2.1.1.2 Combine operations or elements

A process had been broken into many simple operations, it is possible to subdivide a process into too many operations, causing excessive handling of materials, tools and equipment, also such problems as the following may be created: accumulation of work between operations when improper planning exists, and delays when inexperienced operators are employed or when regular operators are off the job. It

is sometimes possible to make the work easier by simply combining two or more operations.

#### 2.1.1.3 Change the sequence of operations;

The purpose of change the sequence of operations are in order to reduce waiting and transportation such as do all jobs in the same area before move to the others area.

#### 2.1.1.4 Move elements to external

Internal elements are those elements that are done while the machine is stopped and external elements are those elements that are done while the machine is running.

Whenever something had been moved to external, that element could be done externally once an element was decided to move to external, then it should be decided who should do that external element. In essence, all elements could be moved to external as long as they don't require the machine or its components to be available to complete the element.

In some cases additional machine components could be purchased to move the element to external. Most of the elements to be moved to external are simply a change in responsibility. It should be clearly identify.

When the set-up expert is doing any of the things in the following list and make every effort to move them to external.

- 1 Any time spent getting change parts, tools, gauges and so forth.
- 2 Any time spent taking tooling, fixtures, dies, and so forth.
- 3 Any time spent getting information or paperwork
- 4 Any time spent reviewing information or paperwork
- 5 Any time spent getting production materials
- 6 Any time spent recording data

7 Any time spent cleaning up change parts, gauges, tooling and so forth

8 Any time spent returning change parts, tools, gauges, and so forth

9 Any time spent returning information or paperwork

10 Any time spent returning production materials

11 Any time spent due to repair or maintenance problems

#### 2.1.1.5 Simplify the necessary operations;

After the process has been studied and all possible improvements that seem worth while have been made, the next step is to analyze each operation in the process and try to simplify or improve it.

#### 2.1.2 Motion and time study

Time study and motion study should be used which have been given many interpretations since their origin to make operation improvement.

Time study, has been begun in the machine shop of the Midvale steel company in 1881, originated by Frederick W. Taylor. It was used mainly for determining time standards, and motion study, developed by Gilbreths, was employed largely for improving methods. Until the 1930s , it was the first time that motion study and time study were used together.

Motion and time study is the systematic study of work systems concerning the design of work systems and methods with the purposes of

1. Developing the preferred system and method-usually the one with the lowest cost.

2. Standardizing the operation, system and method for the best method for doing the work.

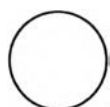
3. Determining the time standard required by a qualified and properly trained person working at a normal pace to do a specific task or operation; and determine the standard number of minutes that a qualified, this time standard will be used for planning and scheduling work, for cost estimating, of for labor cost control.

The most common method of measuring work is stop-watch time study or electronic time study. The operation is divided into small elements, each of which is timed with a stop watch. The adjust time is called normal time. This normal time is added allowances for personal time, fatigue, and delay, the result being the standard time for the task.

4. Motion and time study will be used to training or assisting in training the operator for the best method to do the work.

#### 2.1.2.1 Process chart

A flow- process chart had been used to explain the process operation in next chapter because it is useful to find out operations which can be eliminated entirely or that a part of an operation can be eliminated, that one operation can be combined with another. It is a device for recording a process in a compact manner, as a means of better understanding it. The chart usually begins with the raw material entering the factory and follows it through every step, such as transportation to storage, inspection, machining operations, and assembly, until it becomes either a finished unit itself or a part of a subassembly.



**OPERATION;** an operation occurs when an object is intentionally changed in one or more of its characteristics. An operation represents a major step in the process and usually occurs at a machine or work station.



**TRANSPORTATION;** a transportation occurs when an object is moved from one place to another, except when the movement is an integral part of an operation or an inspection.



INSPECTION; an inspection occurs when an object is examined for identification or is compared with a standard as to quantity or quality.



DELAY; a delay occurs when the immediate performance of the next planned action does not take place.



STORAGE; a storage occurs when an object is kept under control such that its withdrawal requires authorization.

#### 2.1.2.2 Check Sheet

All information requested should be carefully recorded. Accurate record should be made of the machine number, product name, date of manufacturing, and set up time. The name and number of the operator should also be recorded.

Dividing the operation into elements and recording a description of the method of set up time. The operators have been performed the job in the same way during the time study made

Reasons for element breakdown;

Breaking the operation down into short elements and timing each of them separately are essential for the following reasons;

1. It can be described into definite and measurable elements which are easy to train and understand.
2. Standard time values are determined for the elements of the job. It possible to determine the total standard time for an operation more accuracy.
3. A time study may show that excessive time is being taken to perform certain elements of the job or that too little time are being spent on other elements.

Three rules used for dividing an operation into elements are:

1. The elements should be as short in duration as can be accurately recorded.
2. Handling time should be separated from machine time.

3. Constant elements should be separated from variable elements.

The continuous timing is used as a method for reading stop watch which the observer starts the watch at the beginning of the first element and permits it to run continuously during the period of the study.

It is common for employees, especially the set-up employees, to resist initially the idea of set up time. They need to be explained more details and benefits before doing activity or implementation.

## 2.2 Literature review

1. Chavarit Rungtittivong, (1987)

In this papers studied in details about job order controlling techniques to reduce down time and increase productivity. There were many techniques suggested which useful for manufacturing.

2. Tanawan Assawapaiboon, (1992)

This thesis was to propose the study of motion & time study and plant lay-out in order to reduce down time, idle time and improve productivity in the production line for the toy manufacturing. This study found that company got problem of high idle times came from high transportation time due to no machine arrangement in process and high defective caused from transportation. So company should rearrange plant lay-out.

3. Charoen Suntornvanich, (1987)

This research dealt with the problem concerning planning schedule and capacity problem in case that company has many kinds of products, no control the important document and no control planing schedule. This study suggested the



company to make the system for controlling planning schedule concerning the product changed and inventory in process.

4. Sunan Visatsunchok, (1991)

This thesis was to propose the study about productivity improvement in the automobile parts manufacturing by reducing down time, set standard method and standard time and improve planning schedule because the company had many idle time in process and no standard operation for their operators and there was no control planning schedule.

5. Suppachai Phisutpen, (1995)

This thesis studied about the method to make productivity improvement by work study to improve production line and reduce down time in process of canned manufacturing which emphasized on preparation process. The research had purposed the guideline of the problem solution via setting up the standard operating procedure, inspection procedure and work study.