THE STUDY ON IMPLEMENTATION OF LEAN PRODUCTION SYSTEM IN FRONT DISC D54T LINE AT SAPURA MACHINING CORPORATION SDN.BHD.

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ABSTRACT

This final year project is about Lean Production System (LPS) implementation that has been applied at Sapura Machining Corporation Sdn Bhd. This study is deals with the development of a new approach for supporting the improvement, focusing on Front Disc D54T line in order to achieve excellent performances that can increase the productivity, quality of product and benefits in future. In reality, productivity improvement is a concern of industry. This research is an alternative to reduce idle efficiency of production. By studying the line balancing method can lead to improvement. Besides that, there are still have problems in the entire industry due to variable process time, line balancing problems deals with multiple workstations, human factors, and length of cycle time. Therefore, analyzing and studying this current problem is important through the methodology of the four phases which are description, examination, implementation, and monitoring phase. This study is done by experimentally. Lean techniques are applied and practiced such as by doing time measurement, cycle time, standardized work, establishing Takt time, eliminate waste (MUDA) and do continuous improvement (Kaizen). By this, it can enhance the learning and understanding of basic concepts of lean and create ability to implement Lean Production System (LPS) in current manufacturing industry to achieve required standard and goal.

ABSTRAK

Projek tahun akhir ini adalah mengenai pelaksanaan *Lean Production System* (LPS) yang telah digunakan di Sapura Machining Corporation Sdn Bhd. Kajian ini adalah pendekatan yang baru untuk menyokong peningkatan, dengan memberi tumpuan pada *Front Disc D54T line* selaras untuk mencapai persembahan cemerlang yang boleh meningkatkan produktiviti, kualiti produk dan faedah pada masa akan datang. Dalam realiti, peningkatan produktiviti adalah diambil berat dalam industri. Kajian ini adalah satu alternative untuk mengurangkan kecekapan terbiar dalam pengeluaran. Dengan mengkaji kaedah garis pengimbangan boleh membawa kepada peningkatan. Selain itu, seluruh industri masih mempunyai masalah kerana masa proses berubah-ubah, masalah pengimbangan berkaitan stesen kerja yang pelbagai, faktor manusia, dan panjang masa kitaran. Oleh itu, menganalisis dan mengkaji masalah ini adalah penting melalui kaedah empat fasa, iaitu penerangan, pemeriksaan, pelaksanaan dan fasa pemantauan. Kajian ini dilakukan oleh ujikaji. . Teknik *Lean* digunakan dan diamalkan seperti melakukan pengukuran masa, masa kitaran, kerja diseragamkan, menubuhkan *Takt time*,menghapuskan sisa (MUDA) dan melakukan penambahbaikan yang berterusan (Kaizen).Dengan ini,ia boleh meningkatkan pembelajaran dan pemahaman mengenai konsep asas *Lean* dan mewujudkan keupayaan untuk melaksanakan *Lean Production System* (LPS) dalam industri pembuatan untuk mencapai standard dan matlamat yang dikehendaki.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION OF BACKGROUND

This study is deals with the development of a new approach for supporting the improvement of new line of Front Disc D54T line in Sapura Machining Corporation in Bangi, Selangor. In particular, this paper discusses the implementation of lean production system in Front Disc D54T line at Sapura Machining Corporation, in order to achieve excellent performances that can increase the productivity, quality of product and benefits in future.

The study is on implementation of lean production system in Front Disc D54T line at Sapura Machining Corporation Sdn.Bhd.is the title of the project that discuss some analysis about the manufacturing management industry. In this case, I choose type of this product, Front Disc D54T for new myvi car which is one of the Perodua company product. From this selection, it is important to recognize the cycle time of the production from the selection product. Each operation of the workstation can be influence the design of the layout and the production time.

This project requires the student to understand the concept of manufacturing and design of production process. The explanation of how manufacturing design will be built by using line balancing or process flow. This study also require student to make some observation in the industry to observe about process flow of the product, production time that including cycle time for one product, quality of the product and layout of the manufacturing cell in Front Disc D54T line. In this new line of Front Disc D54T, the process improvement activity is still ongoing.

1.2 PROBLEM STATEMENTS

Productivity improvement has been concern of industry. There are many ways to improve productivity, involving any activity in the value chain process in the company. This project is concern on the improvement of manufacturing process.

In particular, this research is an alternative to reduce idle efficiency of a company. Therefore, in my rough observation, many industries have the same problem due to reducing cycle time of the product and they have difficulty to make improvement in productivity. The main factor that we clearly define is because they cannot manage the process flow or product layout well , having problem due to using of material, machinery and the unnecessary of layout manufacturing plant that can influence the production time (correlation with human factor).

One of the major necessary steps in production is to design of manufacturing process. According to expert, it determines 70% of the total cost incurred. This step controls the sequence of production, production time, resource allocation (man and material), and at the end quality of manufacturing product. One method used for analyzing design of manufacturing process by means of the line balancing.

This title of this project is applicable with the subject of manufacturing process to analyze the problem in the industry, besides to improve the product quality. From this problem, we can create an idea of how this current engineering problems can be improve by make some observation of the weakness in the industry and then come out with improvement due to current problems occurs by analyze the root problems.

Besides that, the using of human in the industry at Malaysia was still popular because the human can give more advantage than the machining technology. Therefore, by studying the line balancing method that involving human in manufacturing process can lead to improvement. Besides that, there are still have problems in the assembly line balancing in the entire industry due to variable process time, line balancing problems deals with multiple workstations, human factors, and length of cycle time. Therefore, analyzing and studying this current problem is important to be considered.

1.3 OBJECTIVE OF THE RESEARCH

1. To improve current manufacturing process time by reducing idle time of workers or machine time.

   This research is an alternative to reduce idle efficiency of a company. Many industries have the same problem due to reducing cycle time of the product and they have difficulty to make improvement in productivity. The main factor is because they cannot manage the process flow or product layout well , having problem due to using of material, machinery and the unnecessary of layout manufacturing plant that can influence the production time, also related with human factor. So, reducing the idle time of workers or machine time in current manufacturing process was needed in or orders to make improvement.

2. To apply line-balancing methodology in improving productivity and reduce production time and cycle time by reduce or eliminating the bottleneck.

Line and work cell balancing is an effective tool to improve the throughput ofassembly lines and work cells while reducing manpower requirements and costs.The general way to balancing the line are by subdivide the work into groups of tasks and each group is performed at some specific location along the line called a workstation. However, a workstation might be a single employee or may consist of a small cluster of employees if the tasks required more than one person to do the job. In assembly line balancing, the term cycle time always to be use. The cycle time is the span of time a unit of product is at a workstation.

3. To provide suggestion for overcoming problems in future

The suggestion for overcoming problems in future is important in order to achieve excellent performances that can increase the productivity, quality of product and benefits in future. In this more towards the continues improvement(Kaizen).

1.4 SCOPES OF STUDY

This study is deals with the development of a new approach for supporting the improvement of new line of Front Disc D54T line in Sapura Machining Corporation through the implementation of lean production system (LPS), This study require student to make some observation in the industry where the process improvement is still ongoing.

The scopes of this project are:

i. Reducing idle time.
ii. Reduce or eliminating the bottleneck.
iii. Apply line balancing method.
iv. Provide suggestion for overcoming problems in future

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This topic discuss about the implementation of lean production system and also design manufacturing process analysis by using line balancing method to improve process layout and reduce the production time. It is about how to do improvement using observation and analysis in the operation in each workstation of front disc D54T line to improve the productivity of the product. This is including improving process layout and reducing production time.

In this case, the meaning of lean production system in manufacturing, process analysis, the assembly line balancing that the most important component that give big impact to process layout and production time, and what the relationship of the three main components to this purpose that can lead to approaches to increase production.

2.2 LEAN DEFINITION

The core idea is to maximize customer value while minimizing waste. Simply, lean means creating more value for customers with fewer resources. A lean organization understands customer value and focuses its key processes to continuously increase it. The ultimate goal is to provide perfect value to the customer through a perfect value creation process that has zero waste. To accomplish this, lean thinking changes the focus of management. Eliminating waste along entire value streams, instead of at isolated points, creates processes that need less human effort, less space, less capital, and less time to make products and services at far less costs and with much fewer defects, compared with traditional business systems. Companies are able to respond to changing customer desires with high variety, high quality, low cost, and with very fast throughput times. Also, information management becomes much simpler and more accurate.

2.2.1 Lean for Production and System

A popular misconception is that lean is suited only for manufacturing. Lean applies in every business and every process. It is not a tactic or a cost reduction program, but a way of thinking and acting for an entire organization. Businesses in all industries and services, including healthcare and governments, are using lean principles as the way they think and do. Many organizations choose not to use the word lean, but to label what they do as their own system, such as the Toyota Production System or the Danaher Business System. This is because lean is not a program or short term cost reduction program, but the way the company operates. The word transformation or lean transformation is often used to characterize a company moving from an old way of thinking to lean thinking. It requires a complete transformation on how a company conducts business. This takes a long-term perspective and perseverance.

2.2.2 Lean Thinking

The concept of 'lean' was first introduced by Womack, Jones and Roos (1990) in order to describe the working philosophy and practices of the Japanese vehicle manufacturers and in particular the Toyota Production System (TPS). More specifically, it was observed that the overall philosophy provided a focused approach for continuous process improvement and the targeting of a variety of tools and methods to bring about such improvements. Effectively, the philosophy involves eliminating waste and unnecessary actions and linking all the steps that create value.

In order to introduce lean thinking within manufacturing environments the philosophy relies on the identification and elimination of waste and it is this fundamental aspect, which must first be understood, in order to effectively target and apply the various lean tools. In genera, lean transformations employ techniques such as Kaizen (Imai, 1986), SMED (Shingo, 1985), Six Sigma (Pyzdek, 2003), value stream mapping (Hines & Rich, 1997) and the five 'S's (Warwood & Knowles, 2004) in order to remove waste and deliver improvements in specific areas. However, it is the fundamental understanding of waste that is critical to successful lean transformation.

More recently the focus of many companies has been on Lean Manufacturing, which strives for simplicity. The essential principles of Lean manufacturing are "Define Value" as seen through the eyes of the customer and then, "Eliminate Waste to Make Value Flow." The processes left standing after testing against these principles are simple and cost effective.

2.2.3 Lean Production System

Lean Production System (LPS) is an assembly-line methodology developed originally for Toyota and the manufacturing of automobiles. It is also known as the Toyota Production System or Just-In-Time production.

Engineer Taiichi Ohno is credited with developing the principles of lean production after World War II. His philosophy were:

- focused on eliminating waste and
- empowering workers,
- reduced inventory and
- improved productivity.

2.2.4 Objective of Lean Production System

The main objective of lean is to remove all forms of WASTE from the value stream. Waste includes cycle time, labor, materials, and energy.

2.3 THE SEVEN DEADLY WASTES

Within the context of manufacturing systems there exist seven types of waste. These were first identified by Taichi Ohno (1988) of Toyota and reported by Womack and Jones (1996). The seven wastes include:

1. Overproduction

Producing more than the internal or external customer needs. Occurs when operations continue after they should have ceased. This results in an excess of products, products being made too early and increased inventory.

It is waste because overproduction results in obsolescence, handling damage and undetected defects. It requires extra handling, extra space, extra interest charges, extra machinery and extra labour.

It is causes by lack of communication, inappropriate reward system, focus on keeping busy rather than meeting customer needs

2. Waiting

People waiting for Machinery, Tooling, Raw Materials, Maintenance, etc. Sometimes it referred to as queuing and occurs when there are periods of inactivity in a downstream process because an upstream activity has not delivered on time. Sometimes idle downstream processes are used for activities that either do not add value or result in overproduction.

It is causes by Inconsistent work methods, long changeover times.

3. Transport

Moving materials or people over long distances can double or triple handling. Unnecessary motion or movement of materials, such as work in progress (WIP) is being transported from one operation to another. In general transport should be minimized as it adds time to the process during which no value is added and handling damage can occur.

It is causes by poor layout, lack of co-ordination of processes, poor housekeeping, poor workplace organization, multiple storage locations

4. Extra processing

Extra processing is unnecessary or inefficient processing. For example removing burrs caused by dull tool. Extra operations such as rework, reprocessing, handling or storage that occur because of defects, overproduction or excess inventory.

It is causes by inappropriate tooling or equipment, poor tooling maintenance, failure to combine operations.

5. Inventory

Inventory hides problems and causes extra handling, extra paperwork, extra space and extra cost. All inventory that is not directly required to fulfill current customer orders. Inventory includes raw materials, work-in-progress and finished goods. Inventory all requires additional handling and space. Its presence can also significantly increase extra processing.

It is causes by long changeover times, unreliable equipment, unbalanced flow, incapable suppliers, inaccurate forecasting, large batch sizes

6. Motion

Meaning any motion of people or machines which does not add value to the product or service. It refers to the extra steps taken by employees and equipment to accommodate inefficient layout, defects,

reprocessing, overproduction or excess inventory. Motion takes time and adds no value to the product or service.

It is causes by lack of workplace organization, poor layout, inconsistent work methods, poor machine design.

7. Defects

Scrap, rework, customer returns, customer dissatisfaction or finished goods or services that do not conform to the specification or customer's expectation, thus causing customer dissatisfaction.

It is causes by incapable processes, insufficient training, lack of standardized procedures

In addition to these seven deadly wastes, Womack and Jones (1996) identified an eighth category. This relates to the underutilisation of people and in particular their ideas and creative input for improving the processes and practices. This eighth category of waste is not dealt with in this work as it is arguable that the consequence of this eighth category is inherent in the seven wastes previously defined.

2.4 PROCESS ANALYSIS ON CYCLE-TIME REGARDING PROCESS FLOW

Throughput time or lead time is the average time that a unit requires to flow through the process from the entry point to the exit point. The flow time is the length of the longest path through the process. Flow time includes both processing time and any time the unit spends between steps.

Cycle time is the time between successive units as they are output from the process. Cycle time for the process is equal to the inverse of the throughput rate. Cycle time can be

thought of as the time required for a task to repeat itself. Each series task in a process must have a cycle time less than or equal to the cycle time for the process. Put another way, the cycle time of the process is equal to the longest task cycle time. The process is said to be in balance if the cycle times are equal for each activity in the process. Such balance rarely is achieved.

Process time is the average time that a unit is worked on. Process time is flow time less idle time (Cunningham, J. Barton and Ted Eberle (1990).)

In other definitions of cycle time is the maximum time allowed at each workstation to perform assigned tasks before the work moves on. The cycle time also establishes the output rate of a line. For instances, if the cycle time is two minutes, units will come off the end of the lime at the rate of one every two minutes (Shunk, Dan L, 1992). Regarding to the process flow, there is correlation between process flow and the cycle-time and the production time. The purpose of this two-correlation is to improve the productivity of the product. The terms of productivity is an index that measures output relatives to the input used to produce them? Productivity ratio can be computed for a single operation, a department, an organization, or an entire country. It is starting at production line, which is there, are two-correlation that involved on producing productivity: process flow product and its cycle time in each operation. By the process flow, we can determine the suitable cycle time of the production.

2.4.1 Cycle time

The primary determinant is what the line's cycle time will be. The cycle time is the maximum time allowed at each workstation to perform assigned tasks before the work moves on. The cycle time also establishes the output rate of a line. Cycle time - the time between successive units as they are output from the process.Cycle time for the process is equal to the inverse of the throughput rate. Cycle time *can* be thought of as the time required for a task to repeat itself. Each series task in a process must have a cycle time less

than or equal to the cycle time for the process. Put another way, the cycle time of the process is equal to the longest task cycle time.

2.5 LINE BALANCING

2.5.1 Introduction of assembly line balancing: Definition

The assembly-line balancing problem has received considerable attention in the literature since its formulation by Bryton (1954). According to Stevenson (2002), the line balancing can be define as the process of assigning tasks to workstations in such a way that the workstation have approximately equal time requirement. In assembly of the product, the line balancing have been used to make the flow of semi-finished good in the assembly line in smooth condition and also to achieve the best possible utilization of both the labor force and the plant. The general way to balancing the line are by subdivide the work into groups of tasks and each group is performed at some specific location along the line called a workstation. However, a workstation might be a single employee or may consist of a small cluster of employees if the tasks required more than one person to do the job.

In assembly line balancing, the term cycle time always to be use. The cycle time is the span of time a unit of product is at a workstation. Meanwhile, Driscoll and Thilakwardana (2001) define cycle time as the speed of the assembly line and length of each uniform station dictates time available per operator. Both the cycle time and the number of workstations have been determined concurrently when balancing the line based on (Stevenson, 2002):

1. The number of units of product to be produced in a working day

2. The total of the times of the tasks needed to make one unit of the product

3. The amount of effective clock time available in a day, after allowing for rest periods, breaks and planned shutdowns of the line.

The minimum number of workstations in the assembly layout is the quotient of the sum of the task times for a single unit of product divided by the cycle time, rounded to the next highest integer. Stevenson (2002) cited that assigning tasks to workstations is done with heuristics (rules of thumb) where:

1. Consider precedence; make sure that all jobs are done in a logical sequence.

2. Try to keep all stations busy all of the time by filling up the cycle time with tasks. Do not assign a station more tasks than it has time to perform.

3. The greatest positional weight rule, one of several heuristics for assigning tasks to stations assigns tasks according to the greatest sum of remaining task times to a free station.

4. Measures of effectiveness guide decision makers to satisfactory, but not necessarily optimum decisions on assembly layouts.

2.5.2 The purpose of the assembly line balancing technique is (Mayers and Stephens,2000):

1. To equalize the work load among the assemblers

2. To identify the bottleneck operation

3. To establish the speed of the assembly line