Faculty of Mechanical and Manufacturing Engineering Technology

MINIMIZATION OF UNNECESSARY INVENTORY BY USING THE APPLICATION OF PULLING SYSTEM IN MANUFACTURING INDUSTRIES

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Bachelor of Manufacturing Engineering Technology (Product Design)

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DEDICATION

Every challenging work needs self-efforts as well as guidance of elders, especially those

who very close to our heart.

My humble effort I dedicate to my sweet and lovely

Family members

Whose affection, encouragement and prayers of day and night make me able to get such

success and honour.

Project supervisor, Ts. Dr. Amir Hamzah Bin Abdul Rasib

Along with all hardworking and respected

Lecturers and friends

ABSTRACT

Inventory is the goods or material that a manufacturer holds until it can be sold to the consumer. It is essential to maintain a strategic amount of inventory in the warehouse to ensure there is enough material to meet customer demand. There are three types of inventory which are raw material, Work-in-Progress (WIP), and also finished goods inventory. It is important to ensure that there is enough inventory amount in the warehouse, but extra amount of inventory will lead to negative impact to the company. This is because excessive unnecessary inventory might lead to the occurrence of other waste such as over-production of finished goods and at the end will causes losses to the company. Based on this statement, the first objective of this study which to determine the critical factor that gives impacts on the company's inventory efficiency were achieved since it is identified that finished goods inventory is the most critical type of inventory waste that happen in this company. This project is about how to reduce the production of unnecessary finished goods in food and beverages industry by using the application of Pulling System. A Kanban Card-based system approach were used in order to solve this issue. In this study, there are a few methods that were used in order to achieve the objectives. Firstly, the identification of problems occurred need to be clarified and then followed by data collection process. For data collection process, there are three methods used to gain the data which are by observations, interview session with the company's employee and also the data provided by the company. Based on the data collected, data analysis was generated by using Ishikawa Diagram and Why Why Analysis to identify the root cause of the problems that occur. By using this analysis tool, the second objective of this study which to analyse the efficiency of existing production process by using Ishikawa diagram, and the Why Why Tool is achieved. Based on the root cause analysis, three proposed improvements were suggested to solve the problems occurred that effecting to the unnecessary finished goods inventory. The suggested improvements are by applying Kanban Card-Based Method, redesign the store area layout of the soybeans production line and lastly use Heijunka Levelling Method to make a production planning of the soybeans products. However, a limitations was occurred in the completion process of this study which the data collection of the processes was not fully completed since the operators did not record the data every day. In the other side, this case study is suitable to be as a guidance for the manufacturing manager and company that intended to improve their manufacturing system in order to reduce inventory waste regardless raw materials inventory, Work-in-Progress (WIP) inventory, or also finished goods inventory since all type of inventory can be controlled by using the application of Kanban Card-Based System. This study also describe what is believed to be the first study that explicitly examines the issues faced in achieving low amount of unnecessary finished goods inventory in manufacturing industries. By proposing the three improvement action, the last objective of this study which to propose an action to minimize inventory waste in the production system is achieved.

Keywords: Unnecessary Inventory, Pulling System, Ishikawa Diagram, Why Why Analysis, Kanban Card-Based Method, Heijunka Levelling Method

ABSTRAK

Inventori adalah barang atau bahan yang dipegang oleh pengilang sehingga dapat dijual kepada konsumen. Adalah penting untuk mengekalkan jumlah inventori strategik dalam gudang untuk memastikan terdapat bahan yang cukup untuk memenuhi permintaan pelanggan. Terdapat tiga jenis inventori iaitu bahan mentah, Work-in-Progress (WIP), dan juga inventori barang siap. Adalah penting untuk memastikan terdapat jumlah inventori yang cukup di dalam gudang, tetapi jumlah inventori tambahan akan membawa kepada kesan negatif kepada syarikat. Ini adalah kerana inventori berlebihan yang tidak diperlukan mungkin menyebabkan berlakunya sisa lain seperti pengeluaran produkk yang telah siap dan pada akhirnya akan menyebabkan kerugian kepada syarikat. Berdasarkan kenyataan ini, objektif pertama kajian ini dimana faktor kritikal yang memberi impak ke atas kecekapan inventori syarikat telah dicapai kerana ia telah dapat dikenalpasti bahawa inventori produk yang telah siap merupakan jenis sisa inventori yang paling penting yang berlaku di syarikat ini. Projek ini adalah tentang bagaimana untuk mengurangkan pengeluaran produk yang tidak perlu dalam industri makanan dan minuman dengan menggunakan aplikasi 'Pulling System'. Pendekatan sistem berasaskan Kad Kanban digunakan untuk menyelesaikan masalah ini. Dalam kajian ini, terdapat beberapa kaedah yang digunakan untuk mencapai matlamat tersebut. Pertama, pengenalpastian masalah yang berlaku perlu diperincikan dan kemudian diikuti dengan proses pengumpulan data. Untuk proses pengumpulan data, terdapat tiga kaedah yang digunakan iaitu melalui pemerhatian, sesi wawancara dengan pekerja syarikat dan juga data yang sedia ada diberi oleh syarikat. Berdasarkan data yang dikumpulkan, analisis data dihasilkan dengan menggunakan Ishikawa Diagram dan 'Why Why Analysis' untuk mengenal pasti punca masalah yang berlaku. Dengan menggunakan alat analisis ini, objektif kedua kajian ini iaitu untuk menganalisis kecekapan proses pengeluaran yang sedia ada dengan menggunakan Ishikawa Diagram dan Why Why Analysis dapat dicapai. Berdasarkan 'root cause analysis', tiga cadangan penambahbaikan telah dicadangkan untuk menyelesaikan masalah yang berlaku. Penambahbaikan yang dicadangkan adalah dengan menggunakan Kanban System, mengubah reka bentuk susun atur barisan pengeluaran barisan kacang soya dan akhirnya menggunakan Kaedah Penghajaran Heijunka untuk membuat perancangan pengeluaran produk-produk soya. Walau bagaimanapun, terdapat batasan dalam proses penyiapan kajian ini yang pengumpulan data proses tidak lengkap kerana pengendali tidak merekodkan data setiap hari. Di sisi lain, kajian kes ini sesuai untuk dijadikan panduan bagi pengurus dan syarikat pembuatan yang bertujuan untuk meningkatkan sistem pembuatan mereka untuk mengurangkan sisa inventori tanpa mengira persediaan bahan mentah, inventori Work-in-Progress (WIP), atau juga siap inventori barang kerana oleh semua jenis inventori dapat dikendalikan dengan menggunakan sistem Kanban Kartu Kanban. Kajian ini juga menggambarkan apa yang dipercayai merupakan kajian pertama yang secara eksplisit mengkaji isu-isu yang dihadapi dalam mencapai jumlah inventori barang siap yang tidak perlu dalam industri pembuatan. Dengan mencadangkan tiga tindakan penambahbaikan, matlamat terakhir kajian ini yang mencadangkan tindakan untuk meminimumkan sisa inventori dalam sistem pengeluaran dicapai.

Kata kunci: Inventori yang Tidak Perlu, Pulling system, Ishikawa Diagram, Why Why Analysis, Kanban Card-based System, Heijunka Levelling Method

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CHAPTER 1

INTRODUCTION

1.1 Research Background

In the manufacturing industry, to create quality products that customers can afford, it is important to maintain or increase the efficiency of manufacturing processes. The inefficient manufacturing process can lead to higher cost of products made. Factors that can reduce the efficiency level of the manufacturing process are such as broken machines, undisciplined worker, not functioning manufacturing system, and wastes occurred that at the end will lead to problems such as unnecessary finished goods inventory that will increase the on-hold cost faced by the company. To maintain efficiency, all the factors need to be controlled. The waste factor is one of the critical factors that need to be controlled in order to maintain the efficiency level.

Waste can be defined as any tasks which do not provide benefit to the product being manufactured. It will be affecting the cost of products manufactured, either increase the price paid or decreasing the profit of the company. Originally according to Toyota Production System (TPS), 'Muda' or waste divided into 7 types which also widely known through the acronym of 'TIMWOOD' which referring to Transportation, Inventory, Unnecessary Motion, Waiting, Over-Production, Over-Processing, and Defects. Normally, waste always occurred in a manufacturing system. It is depending on the manufacturer to use which lean manufacturing tool to eliminate the waste occurred. This study will specifically show how to reduce unnecessary inventory waste by using a pulling system.

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Between all of the seven types of Muda, inventory waste is one of the critical waste that needs to be encounter to decrease the production cost of the product produced. Inventory is the goods or materials that a manufacturer holds until it can be sold to the consumer. It is essential to maintain a strategic amount of inventory in the warehouse to ensure there is enough raw material or component to meet customer demand. The amount of the inventory must not exceed the actual need of the company. Excessive unnecessary inventory might lead to the occurrence of other waste such as over-production of finished goods. That is why many manufacturers choose to control their inventory by using a certain type of manufacturing approaches in order to reduce or eliminate unnecessary inventory waste.

Scheduling or forecasting need to be implemented to plan the amount of inventory need to be held in the warehouse to be processed later. It can be applied thru the implementation of pulling system. Pulling system is one of the most popular lean manufacturing tool used by the manufacturer to minimize and control the inventory movement in the manufacturing system. By applying a pulling system, the job in the manufacturing system will only start if the company receive customer demand. Other than that, the inventory will not come out of the warehouse. This situation will lead to reduction of waste, overhead cost, and will optimize storage costs to the most ideal amount. The Pulling system usually applied thru a card-based system that called Kanban system. Kanban is a method used in the manufacturing process that functioning to limit the number of finished goods produced. It strictly limits the value of stock comes out of the warehouse so that the on-hand stock is just enough to cover the value of raw material needed in the production line until the next batch of raw material released from the warehouse. This process will be repeated until the daily production achieves customer demand. Once it achieves customer demand, no more stock will be released from the warehouse.

The Pulling System can really help in order to minimize unnecessary inventory in the manufacturing system. Therefore, this study aims to implement the pulling system so that unnecessary inventory waste can be minimized and later will lead to increases in efficiency.

1.2   Problem Statement

In this manufacturing sector, inventory is one of the most important assets that need to be controlled. Increases in cost and waste will happen if the inventory did not get monitored. Inventory can be divided into three common types which are inventory of raw materials, inventory of work in progress (WIP) and inventory of finished goods. In this study, the critical type of inventory needs to be managed so that the waste that occurs can be successfully decreased.

Other than that, for those companies that do not have enough knowledge regarding inventory management and pulling system implementation tend to hold a high operation cost especially for small and medium enterprise (SME). This is because they will purchase the raw materials or components without any trustable reference amount. This situation can lead to whether excessive or shortage amount of inventory purchased. When these situations occurred, the company may suffer loses in terms of short-production if the inventory was not enough. Besides that, if the inventory amount is exceeding the strategic amount of inventory, quality issues might occur. This is because the raw material might need to be stored in a longer period than they should and later may pass their shelf life. All of this situation may cause by inaccurate inventory planning. Any manufacturing company that does not have proper inventory planning will often carry excessive purchases that at the end will leads to the existence of unnecessary inventory. On the other hand, some of the manufacturers will purchase extra inventory to act as a protection to avoid the occurrence of stock outs or inadequate inventory to meet customer

demand. Whenever there is no unusual high customer demand for the product, the manufacturer will face loses in terms of the raw material purchased, the unnecessary process occurred, and unwanted finished goods.

Developing an accurate inventory planning and forecasting method can help the organization purchase and store appropriate levels of inventory. In this case, the implementation of Lean Manufacturing tool is a very important step to be considered to encounter the inventory issues so that later, an improvement action could be taken.

1.3 Research Question

Based on the problem statements that have been stated, can be identified that there are three research question raised.

RQ1: What is the critical inventory type of wastes that need to be encountered to ensure the efficiency of the company operation?

RQ2: How Pulling System can be used in order to reduce inventory waste?

RQ3: How Pulling System can minimize inventory waste in a production system?

1.4 Objective

By referring to the problem statement, the main intention of this study is to emerging a suggestion of minimization of unnecessary inventory for the manufacturing industry. The other aims of this research study are:

i. To determine the critical factor that gives impacts on the company's inventory efficiency.

ii. To analyse the efficiency of existing production process by using Ishikawa diagram, and the Why Why Tool.

iii. To propose an action to minimize inventory waste in the production system.

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1.5 Scope

For this study, an observation will be focused on the production activities in the manufacturing industry. The main purpose of this assignment is to practice Pulling System with the help of Kanban card-base method to increase the efficiency of the company by minimizing the unnecessary amount of inventory. In order to know the relationship between the finished goods inventory waste with a pulling system that will be used to eliminate the waste, a K-Chart was generated to know the flow of the process (Appendix B, page 95).

1.6 Expected Result

The expected result of this research study is to ensure that a fit solution can be generated to encounter the crisis faced by the manufacturing company regarding the inventory management in the company. This research will assist the company to identify the most critical inventory type that can contribute to the highest inventory waste. The inventory types that involved are raw materials stock, work in progress stock (WIP), and finished goods stock. Based on the identified critical waste, Pulling System will be applied to reduce the waste. The pulling system will be implemented by using the help of Kanban card-based system.

From the result of the pulling system practiced to the manufacturing company, it is expected that the finished goods inventory will be reduced and later can be proven that pulling system is the best way to encounter inventory problem.

In the end, From the result of the pulling system practiced to the manufacturing company, it is expected that the finished goods inventory will be reduced and later can be proven that pulling system is the best way to encounter inventory problem.

the expected result from this study is that the research will help in terms of proposing a solution that will assist the company to control the inventory waste and at the end will lead to

increases in efficiency of the manufacturing system of the company. One of the initiatives that can be proposed to maintain the inventory control is by using a Cause and Effect Diagram or Fishbone diagram from the 7QC tool and also forecasting planning.

1.7   Thesis Outline

The thesis outlines for this study divided into five chapters. For the first chapter, an introduction to the whole thesis was explained to ensure that the aim of the study was explained clearly. This is where all of the descriptions of the study were mentioned briefly to ensure the information can be understood by the reader. The topics that were explained in this chapter is regarding the problem statement, objective of the research, the scope of the study, and also the expected result that will be gained at the end of the study.

Next, for chapter two, a literature review will be developed in order to gain knowledge regarding the related topic to this research study. It functioning to find the previous study generate by prior researchers to prevent duplication and give credit to them. The knowledge of the topics can be gained by referring to the previous research, journal, case study, and also books. In this chapter, brief information regarding inventory, process improvement approaches, Six Sigma, Lean Manufacturing, and Lean Six Sigma were explained in detail. Other than that, other information in term of the topic was explained in the forms of sub-topics. Each sub-topic will be explained suited to its title.

Then, chapter three created in order to elaborate on the list of the methodology used in the study to obtain information and data results of this study. This chapter also will be applied with Detailed Process Flow of the Research Methodology to ensure that every process to complete the study was followed step by step in order to ensure no process will be left behind.

Other than that, chapter four which is results and discussion will be the chapter that where Pulling System tool that was mentioned in chapter one will be applied. The Pulling System tool will be briefly explained on how it can affect the production system of the company to achieve the aim that has been set in the beginning.

Lastly, chapter five representing the overall conclusion of the whole study that was conducted. All of the results will be mentioned in a simple form and at the end, an improvement suggestion will be given so that the study can be improved in the future.

1.8   Summary

Excellent performance of a manufacturing system is critically depending on the efficiency of the production line and the management of the company assets such as the inventory or also known as stock. Well management of the inventory amount in the company warehouse can reduce the loss faced by the company. Failure in inventory management can lead to other types of waste such as over-production waste. Several reasons for over-production waste can be occurred is because of the doubt toward suppliers to deliver new stock in the scheduled time, uncontrolled processes or even the changes amount of customer demand. Because of these situations, the manufacturer needs to put in place a "comfort stock" to control buffer existed if any unusual event happens. With the existence of the comfort stock, it will buffer against the problems that occur. Because of that, it would not lead to short-production to the manufacturer. But on the other hand, it would be a waste if no unusual event happens, and it will cost money to the company.

The method chosen to encounter the inventory issue depends on the types of business conducted and the conditions that should be followed. In order for a company to survive, inventory control is one of the most crucial events that need to be applied. If the manufacturers

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unable to handle the inventory, the true account of the business performance will never be identified. Inventory excess or shortage should not become the reason for the downfall of the business.

In this study, the most suitable Lean Manufacturing tool that can be used to encounter the inventory issue is by using the Pulling System. With the application of Kanban card-based method, it is believed that the inventory waste issue can be reduced.

CHAPTER 2

LITERATURE REVIEW

2.1   Preliminaries

Asset is a critical aspect that should be contained in a financial statement. According to Mejia et al. (2007), it is divided into two categories which are current and non-current assets. To be compared, non-current assets are expensive and have a lifespan for more than a year meanwhile, current assets are the assets that have lifespan less than a year. Inventory is one of the current assets. Current assets are more flexible than non-current assets that they could be changed into cash in a short time. In the same way, Dennis and Meredith (2000) as cited by Abd Karim et. al. (2017) admits that inventory and its handling process will be fixed for a considerable time. Complementary to this, Elsayed and Wahba (2013) as cited by Abd Karim et. al. (2017) outlines that inventory as one of the most important assets that contained in the balance sheet, which can be controlled by the manufacturer whether for a large corporation or small and medium enterprise (SME). This is why the assets need to be managed to ensure the efficiency of the company could be maintained. Relatable lost can occur if the inventory management failed. Management of inventory requires large cost, for an example to set up huge warehouses. Wrong decisions made will cause the company to face huge waste and loss, and at the end will affect the downfall of the company's financial performance Abd Karim et. al. (2017).