Faculty of Mechanical and Manufacturing Engineering Technology

ENHANCEMENT OF PRODUCTIVITY USING OVERALL EQUIPMENT EFFECTIVENESS (OEE) THROUGH PERFORMANCE IMPROVEMENT IN MANUFACTURING INDUSTRIES

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Bachelor of Manufacturing Engineering Technology (Product Design) with Honours

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Date	: ……...

DEDICATION

This dissertation is dedicated to my beloved father and mother whose unwavering love, support and encouragement have enriched my soul and inspired me to pursue and complete this research.

ABSTRACT

Productivity plays an important role in the manufacturing industry. There are many alternatives available to enhance productivity. This research aimed to evaluate the cause of the poor performance at Zaliza Food Industries Sdn Bhd and determine the way to be repaired so that the performance can be improved. This research uses a descriptive quantitative approach with an overall Equipment Effectiveness (OEE) analysis method. The result of the OEE values was analyzed using the six major loss method to detect the occurrence of loss factors and the root causes of the performance analysis using the Ishikawa diagram, as well as to make any suggestions for improvement that can be made using the 5W1H analysis. Based on the research results, Zaliza Food Industries Sdn Bhd has an average rate of the effectiveness (OEE) of 71.11%, an availability ratio of 100%, a performance efficiency rate of 71.60% and a quality rate of 99.31%. Through a literature review, classification of issues has been done; therefore, results can be obtained on the basis of issues studied by different authors in different industries. This paper is useful for manufacturing companies where the company wants to increase production productivity. The problems identified help the academy with a comprehensive list of issues. This paper describes what is believed to be the first research that specifically discusses the problems faced by manufacturing companies with a view to improving production efficiency.

ABSTRAK

Produktiviti memainkan peranan penting dalam industri perkilangan. Terdapat banyak alternatif untuk meningkatkan produktiviti. Penyelidikan ini bertujuan untuk menilai penyebab prestasi buruk di Zaliza Food Industries Sdn Bhd dan menentukan cara untuk dibaiki supaya prestasi dapat dipertingkatkan. Kajian ini menggunakan pendekatan kuantitatif deskriptif dengan kaedah analisis "Overall Equipment Effectiveness (OEE)". Hasil daripada nilai OEE dianalisis dengan menggunakan enam kaedah kehilangan utama untuk mengesan kejadian kehilangan faktor dan penyebab utama analisis prestasi menggunakan gambarajah Ishikawa, serta membuat sebarang cadangan untuk penambahbaikan yang boleh dibuat dengan menggunakan 5W1H analisis. Berdasarkan hasil kajian, Zaliza Food Industries Sdn Bhd mempunyai kadar purata keberkesanan "OEE" sebanyak 71.11%, nisbah ketersediaan 100%, kadar kecekapan prestasi 71.60% dan kadar kualiti 99.31%. Melalui kajian literatur, klasifikasi isu telah dilakukan; Oleh itu, keputusan boleh didapati berdasarkan isu-isu yang dikaji oleh penulis yang berlainan dalam industri yang berbeza. Kertas ini berguna untuk syarikat perkilangan di mana syarikat ingin meningkatkan produktiviti pengeluaran. Masalah yang dikenal pasti membantu akademi dengan senarai isu komprehensif. Maka ini menerangkan apa yang dipercayai sebagai penyelidikan pertama yang secara khusus membincangkan masalah yang dihadapi oleh syarikat pembuatan dengan tujuan meningkatkan kecekapan pengeluaran.

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LIST OF ABBREVIATIONS

OEE	-	Overall Equipment Effectiveness
ROI	-	Return In Investment
TPM	-	Total Productive Maintenance
IoT	-	Internet of Things
JIT	-	Just In Time
MOST	-	Maynard operation sequence technique
QC	-	Quality Control
QA	-	Quality Assurance
PM	-	Performance Measurement
P	-	Performance
A	-	Availability
Q	-	Quality
BDP	-	Bachelor Degree Project
min	-	Minutes
sec	-	Seconds
CPM	-	Carton Per Minute
N/A	-	Not Applicable

CHAPTER 1

INTRODUCTION

1.1 Research Background

Markets and trends are making industries increasingly competitive today. In order to achieve the highest level of competitiveness, overall productivity within an industry must always be increased. Then, the industries must target for sustainable creative and innovative growth, short recovery times and good quality products in order to remain competitive. Besides, performance manufacturing technique is designing flexible and strong manufacturing applications. Performance targets such as cost, quality, flexibility, and speed will reveal the dynamic expectations of the market in the word of production output. According to Hasan (2014), express that a manufacturing production facing many issues like minimal profit if failure to do performance targets.

Saleem (2017), states Overall Equipment Effectiveness (OEE) is a measurable Total Productive Maintenance (TPM) component used to benchmark and evaluate each production process. The OEE method enables measuring machine to enhance productivity. Nakajima (1960) suggested OEE, which is essentially a metric for categorizing potential ranges for productivity enhancement that could lead to higher equipment efficiency by assessing three main OEE factors, including availability, performance, and quality.

Furthermore, OEE is concentrating on six major losses such as idling and minor stops, reduced speed, equipment failure, a process failure, defects in a process, and reduced yield (Saleem, 2017). All these losses are under the factors of performance, availability, and quality. Firstly, owing to equipment idling and minor stops, the performance takes into

consideration speed losses. Aman et al. (2017), emphasize that performance is a percentage of internal equipment operating speeds at its desirable speed. Secondly, due to equipment failure and process failure, availability takes into consideration the inaccessibility time of the equipment. The percentage of the initial production time the machine runs to the machine's available production time. Finally, quality is among the key factors that must be evaluated by OEE calculation. Quality is a percentage of acceptable parts produced for the total parts produced by the equipment (Aman et al., 2017).

As stated by Raguram (2014), there are many reasons why OEE is being used as a method of continuous improvement in industries around the world. Firstly, industries invest heavily in manufacturing equipment and need to make maximum returns on their investments in the least amount of time. The goal of OEE is to achieve maximum productivity from these procedures as well as return on investment (ROI) from the OEE as it is highly applied. The return is also fast. Then, decreasing production losses and increasing competitiveness are crucial. For instance, if a production line can produce 200 pieces per hour but produces only 170, the OEE clearly shows why that line fails, thus helping to develop the industry's competitiveness. Besides, the greatest advantage of using the OEE method is that machine performance increases dramatically from the time of application. Last but not least, the previous performance of the machine knowing with that machine works functionally or not, or that there are problems that could lead to long - term repair. Having an OEE method of predicting these losses such as reduced speed, investigating unexpected shutdowns, etc. represents a significant saving both in the basic maintenance of the machinery and in the huge costs associated with the machine's own failure. As stated by Tsarouhas (2018), states the OEE method provides an important point of view and helps manufacturers to come up with a good solution to enhance performance and productivity.

1.2 Problem Statement

Productivity is an average measure of production efficiency. Productivity measurements are crucial for the kind of industry. Changing efficiency fulfils the customer and reduces the time and cost of producing, creating and conveying items. Many industries are now alert of how problems in their production line will impact productivity and efficiency in their manufacturing. Besides, manufacturing industries are more focusing on improving the production line through OEE's performance in term of productivity output in order to survive in the competitive market, because high productivity has a direct relationship with the equipment efficiency and process control. Absence of the proper productivity measurement indicators locates manufacturing industry at an unknown production line performance. While, the unstable and uncontrollab56le process causes producing nonconforming product, which affects the OEE's performance in production. Overall Equipment Efficiency (OEE) method is proposed to achieve continuous improvement in the production performance.

Besides that, the major daily problems that encountered by many manufacturing industries are small stops and increased speed. These problems have a great impact on the OEE's performance in productivity and delivery time. According to Amir (2015), OEE's performance for productivity significantly affect the company profitability as 25- 30% of total production cost that is attributed to productivity actions in the production line. When manufacturing industries run up against performance problems today, managers immediately look to increase over time, add shifts, or purchase new equipment. Instead, they should look to optimize the performance of their existing machines to increase equipment, minimize minor stops, reduced speed and improve operator performance. The best way to deal with these problems is to implement and practice the OEE method as an effective tool to benchmark, analyse, and improve production processes.

1.3 Research Question

There are research questions that are standard from the problem statement.

RQ1: What are the factors occurs in the production line?

RQ2: How can the performance measures of OEE be practiced in production?

RQ3: How can OEE enhance the production yield?

1.4 Research Objective

The primary objective of this survey is to develop an enhancement proposal for Zaliza Food Industries. To do so, the aim of this research is to achieve the following objectives:

i. To study the OEE's performance factor occur in the production line.
ii. To practice the performance measures of OEE on production assembly in manufacturing industries.
iii. To propose the OEE method for enhancing productivity.

1.5 Research Scope

The scope of this project focused on the OEE's performance in the production line at Zaliza Food Industries. This main study in order to increase the productivity of the food industry. Therefore, all preparations should be pursued in order to achieve the purpose of this report. Then, K-Chart is a way of systematically organizing research that can be seen shows in Appendix A.

1.6 Expected Results

The expected outcome of this research is to develop the appropriate solution for productivity through the OEE's performance that can be used in Zaliza Food Industries. This research will also help to identify critical issues in the production line that need to be reduced

in the industry. Besides, this research will also show the importance of OEE's performance in productivity in the manufacturing industry. Then, the expected result for this research is the application of the Overall Equipment Effectiveness (OEE) to the industry. Finally, the expected outcome of this research will help to suggest a solution that will help enhance the daily output of the industry.

1.7 Thesis Frame

In this study, chapter 1 is the chapter which the entire study is introduced. In this chapter, an overall explanation of what this research is about to be developed. Then, the problem statement and objective of this research also stated in this chapter. In addition, the scope of the research and the expected result for this research also detailed in this chapter.

Then, chapter 2 is the chapter where the literature review is described. In this chapter, information about manufacturing performance is elaborated in detail. Then, the productivity performance and OEE method also explained detail in this chapter. All this is done by the summary of the 30 journals. Other than that, this chapter also explains all definitions directly related to the title of this research through its own subtopics. Then each subtopic will provide the relevant description for its title.

As for chapter 3 where the chapter discusses the methodology of the study conducted. This chapter will also show the methods to be used to carry out this research. Finally, the detailed process flow will also be described in this chapter.

Next, chapter 4 serves as the chapter explain how to apply the method implemented in the previous chapter. Then, this chapter also shows how the method applied can meet the objectives of the research.

Finally, in chapter 5 where the overall results of this research are discussed. This chapter will also present a recommendation for the enhancement of the research. Last but not least, the conclusion to the overall research will be presented in this chapter.

1.8 Summary

The research conducted OEE's performance in manufacturing based on the industry's objective of achieving maximum productivity. In this research, the OEE method is used to achieve higher productivity. By understanding the losses, OEE aims to help manufacturers improve their performance. OEE is a measure that reduces apparently complicated production issues and functional information that can help make the right decisions to increase efficiency and reduce operating costs. If the OEE method is applied in a machine, there is no limit on the amount that managers and engineers can profit from it.

Other than this, OEE finds a performance by taking the most repeated and crucial sources of productivity losses, identifying them as three main factors in performance, availability, and quality, and then processing them into a single factor that shows where the manufacturer currently occurs and how to improve. Besides, manufacturers may start a single procedure with an OEE system to increase their application until they work across many production lines. This scalability ensures that a quite flexible system is developed that can be used for any industry. According to Tsarouhas (2018), states OEE has a major impact on the industry, but it has minimal impact on the educational community. Thus, creating a space in which the two can interact with huge, essential advantages for both sides, including the world of education and manufacturing.

CHAPTER 2

LITERATURE REVIEW

2.1 Preliminaries

Companies must meet several requirements in order to be successful in today's world class manufacturing environment. Ounnar (2015), express that the organizations are making hard efforts to improve the productivity and quality to stay competitive. In the article by Mohamed Ismail et al. (2015), states that manufacturing performance is one of the most important performances in every company. There are three main things that may be considered in the manufacturing performance are productivity, flexibility, and quality. Firstly, Abdullah (2013), shows that productivity is a measure of production efficiency. Productivity is defined as the total output per unit of total input. According to Leong (2017), high productivity can lead to higher profits for businesses and higher income for individuals. Nowadays, production plant facing the capacity problems, they instantly decide to increase over time, add shifts or buy new equipment. As an alternative, they should decide to improve the performance of their existing machines to improve the reliability equipment, improve the performance of the operator and minimize the whole idle time. All these things can be prepared to increase productivity in order to increase capacity. Then, flexibility has been widely defined by different researchers, proving it to be a different concept (Teoh and Abu, 2017). Last but not least, as explained by Atiyah (2016), quality is based on the result that gets from any task or job. In order to improve manufacturing performance, specific tool OEE is selected.

Overall Equipment Effectiveness (OEE) is a way of observing and increasing the efficiency of the production plant (Skoogh et al, 2017). OEE is divided into three measure terms which are Availability, Performance, and Quality. These terms help to improve efficiency and effectiveness of the plant and classify the basic productivity losses of productivity that occur within the plant (Zennaro et al, 2018).

2.2 Performance of manufacturing

Zhong et al. (2017), express that our next generation of the industry –Industry 4.0- promises increased manufacturing flexibility, mass customization, higher quality and improved productivity. This enables companies to face the challenges of producing increasingly individualized products with short lead time and higher quality. Assembling is one of the wise assemblies that plays an important role in industry 4.0. The running of the mill assets is transformed into clever questions so that they can detect, act and act in a brilliant situation. With a specific aim of fully understanding clever assembly with regard to Industry 4.0, this paper provides how to use intelligent assembly by using the Internet of Things (IoT) -empowered assembly and cloud production. According to Mohamed Ismail et al. (2015), to date, the Malaysian manufacturing sector has faced various challenges and exhibited fluctuating performance in response to these challenges. This paper provides a fundamental framework for experts in the field of manufacturing strategy and performance, emphasizing the complementary effect of multiple strategies on performance. The Malaysian manufacturing sector still lacks a strategic approach to its national manufacturing direction and guideline, to serve as the launch pad for sustainable growth in the sector. Figure 2.1 shows that the performance of manufacturing classified into 3 elements.