



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**REDUCING CYCLE TIME TO IMPROVE PRODUCTIVITY IN
LAY-UP PROCESS AT AEROSPACE COMPANY**

This report submitted in accordance with requirement of the Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering
(Manufacturing Management) with Honours

by

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DECLARATION

I hereby, declared this report entitled “Reducing the Cycle Time to Improve Productivity in the Lay-up Process in Aerospace Industry” is the results of my own research except as cited in the references

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Date : 30 June 2015

APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Management) with Honours. The member of the supervisory committee is as follow:

.....
(Dr Seri Rahayu Binti Kamat)

ABSTRACT

This research is about the reducing of cycle time to increase the productivity in the lay-up process in the Composite Technology Research Malaysia (CTRM) Sdn Bhd aerospace industry. The selected manufacturing company for this study is a composite fibre for aerospace product industry . This company is one of the composite fibre for aerospace product in Malaysia. Referring to ishikawa, analysis the serious factor for increasing productivity is on cycle time and layout where the process is conducted. Hence the aims of the research is to study the process cycle time based on current standard operating procedure (SOP) of the lay-up process. Through the current cycle time the value added and non-value added activity can be determined and the improvement done by using lean tool and technique in order to reduce the cycle time. Using the Witness simulation software the result show that by utilize the work station from two workstation become three workstation it can increase productivity 25%. The total cycle time also can be improve by 13.4% without any non-value added cost.

ABSTRAK

Kajian ini adalah mengenai mengurangkan masa kitaran untuk meningkatkan produktiviti syarikat Composite Technology Research Malaysia (CTRM) Sdn Bhd di dalam proses “lay-up” di industri aeroangkasa. Syarikat pembuatan yang dipilih untuk kajian ini adalah serat komposit bagi industri produk aeroangkasa. Syarikat ini merupakan salah satu daripada gentian komposit untuk produk aeroangkasa di Malaysia. Merujuk kepada analisis Ishikawa, faktor yang serius untuk meningkatkan produktiviti adalah pada masa kitaran dan susun atur di mana proses ini dijalankan. Oleh itu, matlamat kajian ini adalah untuk mengkaji masa kitaran proses berdasarkan prosedur semasa standard operasi (SOP) dalam proses “lay-up”. Melalui masa kitaran semasa nilai tambah dan bukan nilai aktiviti tambah boleh ditentukan dan penambahbaikan yang dilakukan dengan menggunakan kaedah pembuatan kejut untuk mengurangkan masa kitaran. Dengan menggunakan perisian simulasi “Witness” menunjukkan keputusan bahawa dengan menggunakan stesen kerja dari dua stesen kerja menjadi tiga stesen kerja ia boleh meningkatkan produktiviti 25%. Disamping itu, jumlah masa kitaran juga boleh dipertambahbaikan sebanyak 13.4% tanpa apa-apa kos yang tidak bernilai tambah.

DEDICATION

Dedicated to my beloved parents, Mr. Norman Bin Musa and Mrs. Rehan Binti Rahim. Also, to my supervisor and all panels that always gives guide in completing this final year project. Besides that, my family and friends for all the encouragements given.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURES

Bhd	-	Berhad
CTRM	-	Composite Technology Research Malaysia
MLGD	-	Main Landing Gear Door
PSM 1	-	Projek Sarjana Muda 1
PSM 2	-	Projek Sarjana Muda 2
Sdn	-	Sendirian
SMED	-	Single Minute Exchange Die
SOP	-	Standard Operating Procedure
SOT	-	Standard Operating Procedure

CHAPTER 1

INTRODUCTION

This chapter describes the basic idea and background of the project. Moreover, it explain the purpose of this report and the limitation need to be considered during the study is conducted. Generally, this chapter consists of five (5) main section which are background, problem statement, objectives and the scope of the project.

1.1 Background of the study

Cycle time is the total processing time of each process involve in producing a product in manufacturing industry and it is defined by the customer and manufacturer. In the aviation industry, cycle time to produce a product is an important key in their business industry, this is due to fulfill the prescribed dateline set by the customer. In order to fulfill the dateline on time according to the time framed defined, the cycle time or more precisely time study, research would be conducted in order to improve the cycle times. Time study is one of important element in manufacturing industry, where the completion of process work to produce a product based on a time frame that are defined by the customer. Time study is described as a method used for work measurement study, and to do improvement effort or as a tool to control performance of the basic times or standard time to carry out specific work. This time study is an active area in the field of research for many types of industry, especially in manufacturing and service industry. Issues that often resurrected is a time in a bottleneck process that exceed the standard times of the process thus increased the cycle time to produce the product. According to Mayer's F. E. (1992), time study was

developed by Frederick W. Taylor in about 1880 which is the first person use stopwatch to study and measure work content with his purpose to define “a fair day’s work”. Among his study is ‘Taylor Shoveling Experiment’ which he studied between 400 and 600 men that using his own shovel from home to moving material from mountains of coal, coke and iron ore in around two mile-long yards. The results was impressive where it’s managed to reduced time, saving number of workers and budgeting every year.

Lean tools is one of tool that can be used as improvement tool in reducing the cycle time. According to Kilpatrick (2003) the benefit of implementing lean can be broken down into three broad categories that is operational, administrative and strategic improvement. As for this study it’s in operational categories which is the lean tool is applied to reducing the cycle time in order to improve the productivity.

Simulation is widely used mainly in manufacturing industry as a method to analyze the current situation and improvement situation made in the process or operation. This method is used since the competitiveness among the industry, this is due to greater emphasis of reducing cycle time of a process in order to improve productivity and quality in the process. Since in the layup process involve many others activities, this time study require a suitable method to analyze the time study in order to improve it by using lean tool and analyze by using Witness software to simulate the actual situation of the improvement process is the essential way to overcome this particular problem. Hence, in this report the objective and constraint in reducing cycle time problem will be determined. A proper methodology approach will be using in order to propose a better suggestion to overcome the problem and at the same time the productivity is improved.

1.2 Problem Statement

Productivity is one of the main goal in manufacturing industry, where with the higher productivity produce in the industry it will gain more profit. The countermeasure for a company to success in this manufacturing industries is not only by looking on the profit gain from the productivity only but it need to consider how the process to achieve the productivity is implemented. The CTRM industry product that is main landing gear door (MLGD) for A400M, it have a problem on cycle time in the layup process that need to be determine is there have a waste involving that relate to time in the process during this productivity is been carried out or is the recent process conducted has achieve the optimum productivity. In this research, the focus is more on the process cycle time that are based on the standard operating procedure (SOP) that have been follow by the company for the lay-up process in this project. According to De Treville et al. (2005) state that they are research are generally agreed that requiring employees to perform their tasks according to Standard Operating Procedures (SOPs) can improve production outcomes in the context of repetitive manufacturing. Based on the standard operating procedure (SOP) the value added and non-value added activity in term of time will be determined in order to reduce the cycle time. By reducing the cycle time, the productivity can be increased up and recommendation for improvement by using lean tool can be apply especially those that can reduce the overall total cost and cycle time of the operation for the layup process. The cycle time reduction is one of importance in improving company productivity which it help company in their competitive position in marketplace.

1.2.1 Ishikawa Diagram

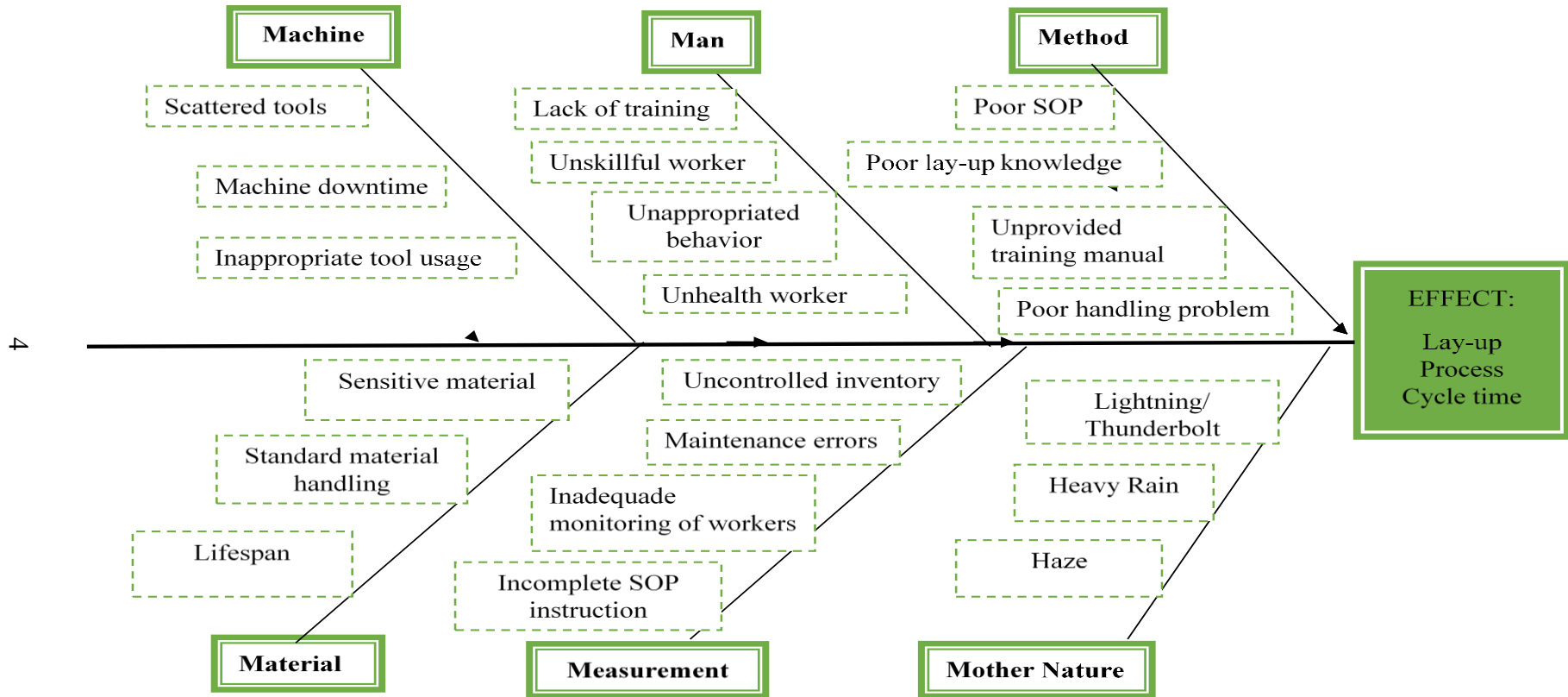


Figure 1.1: Ishikawa Diagram

By referring to figure 1.1 Ishikawa diagram or cause and effect analysis for this problem statement generated from brainstorming with the manufacturing engineer for this main landing gear door project at the CTRM. Through the Ishikawa diagram the root cause of a problem can be determine and also can uncover the bottleneck in the process. This is identify process to determine why and where the lay-up process not working smoothly. From the Ishikawa diagram all factor that can cause or give effect toward the cycle time is analyzed through discussion and brainstorming with the manufacturing engineer and also the operator involve during the conducted process. First factor that has been discussed is regarding the method involve during the process where under this factor many sub-factor that contribute to the increase of the cycle time such as poor SOP for the process, new worker that has poor lay-up knowledge, un-provided lay-up training manual due to time constraint and also poor handling problem among the workers.

For the man factor the manufacturing engineer stated that the operator in the lay-up process is lack of training and skill due to many new operator start working during their peak time to produce the demand. Besides that, unappropriated behavior such as wasting time during the working hour also cause the cycle time in the process increase including the health of worker that effect their performance during work.

For machine factor, situation such as scattered tool in the working layout also lead to increasing cycle time due to uncomfortableness to do work. Besides that, inappropriate tool usage and machine downtime also need to be considered this is because even lay-up is manual job task but in the process it has drying sub-process where autoclave machine would be used to complete the process.

Others factor such as material factor involving the lifespan of sensitive material also become one of the reason that give effect to lay-up process cycle time. This is because material involve during this process has standard material handling such as composite fiber use must be handled while wearing glove to avoid any problem that would lead to defect on the material. The others two factor that is measurement and mother nature also been considered the effect of the lay-up cycle time.

1.2.1 Pareto Diagram

All the causes from Ishikawa has been analyzed through and all opinion regarding the causes that effect on the lay-up process cycle time has been analyzed from 10 people involved in that process that include the operator and engineer. From Figure 1.2 it show the Pareto chart that show the number of person choose the several causes that effect the lay-up process cycle time.

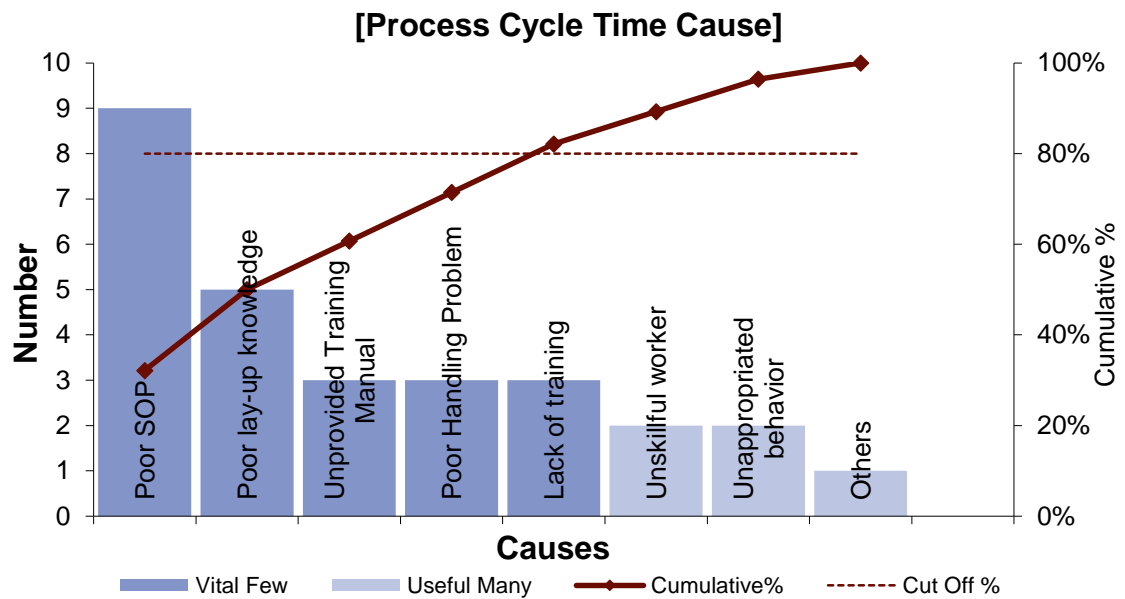


Figure 1.2: Pareto Chart

Table 1.1: Pareto Analysis

No	Causes	Number	Cumulative%
1	Poor SOP	9	32.1%
2	Poor lay-up knowledge	5	50.0%
3	Unprovided Training Manual	3	60.7%
4	Poor Handling Problem	3	71.4%
5	Lack of training	3	82.1%
6	Unskillful worker	2	89.3%
7	Unappropriated behavior	2	96.4%
8	Others	1	100.0%

From Table 1.1 it show the number of person choose the causes that effect the lay-up process cycle time based on the interview with the manufacturing engineer and operator in the lay-up process the main effect causes has been determined by using Pareto rule. From the Pareto it show that the standard operating procedure is the main causes that give effect on the lay-up process cycle time. The problem statement has been come out from this analysis.

1.3 Objective

The objective of this project is significantly help in the making of the report as it can control the performance before any implementation of improvement. Therefore, the specific objective for this project are set to:

- i. Identify the current cycle time in the lay-up process for product main landing gear door (MLGD) in CTRM.
- ii. Analyze the main effect that cause the bottleneck problem due to increase of cycle time in the lay-up process.
- iii. Identify any waste in term of time that cause the long period cycle time in the process.
- iv. Improve the process cycle time to solve the bottleneck problem in the lay-up process by using lean tool and technique.

1.4 Scope of Study and Limitation

The scope of this report is explaining the field of the research and project limitations toward the report result and recommendations. Therefore the scope for this project is as below:

- i. The scope of this project is to evaluate the current lay-up process cycle time in that company.
- ii. Since the time allocated is limited to make this research, the data collection for this research only cover for a latest data but for several month data only.
- iii. Regarding to my past industrial training in aviation manufacturing industry, there are certain product that are not produce continuously, this is due for a certain project it depends on customer need. Therefore this project only cover on the product that always produce continuously in the company. The reason is because product that produced continuously it means that the demand is always available and it has great positive impact on company profit.