

## CHAPTER I

### INTRODUCTION

#### 1.1. Background

To encounter the current globalization, manufacturing company was forced to improve its competitiveness. The value of its asset has become the opportunity of a company to keep sustaining in a market that has a high tendency. The market will go to the company who capable to fulfil demand and quality, also the certainty delivery. Then, the manufacturer should improve the innovation and product with high quality by short lead time and create a robust production system as a requirement to achieve the best operation (Bellgran, 2009). Based on data from Indonesian Statistics Bureau (2017) the growth of manufacturing sector is increasing by 4% in 2016 and creating the fiercer competitiveness among companies.

The option for increasing productivity and efficiency on production system there is a theory called lean manufacturing (Chiabert, D'Antonio, & Bedolla, 2017). Lean manufacturing is a systematic approach to identify and eliminate waste by several improvement tools (Karl & Dombrowski, 2017). Lean manufacturing is capable to produce the output well with efficient resource used to minimize the waste by following the high quality and productivity (Wahab, Mukhtar, & Sulaiman, 2013).

In the production system, the machine has an important role. The machine is used to increase the possibility to achieve productivity and efficiency. Each machine has the durability. Durability is the opportunity of a component to run functionally in a certain duration. The machine failure could be impacted to delay of delivery, loss of profit,

and miss the chance to gain the market for the manufacture (Zaim, Turkey-ilmaz, Acar, & Demirel, 2012).

Regularly, the company does maintenance to keep the longest durability for each machine and avoiding machine failure. Maintenance process is performed to service the production facilities and to guarantee high productivity (Faccio, Persona, & Zanin, 2014). By this statement, Maintenance has the role in competitive manufacturing that is focused on performance production. Following to journal of (Márquez, 2007) the process of maintenance is planned and unplanned, depends on the condition of a physical asset to run the process of production. Based on the condition and durability of each machine, maintenance could be difficult to suit the characteristic of the machine.

Manufacturing company should organize the strategy of maintenance by following the character of the machine. The classification of maintenance strategies based on the time of maintenance activities and failure include corrective maintenance, preventive maintenance, and design-out maintenance (Ruiz, Foguem, & Grabot, 2013). Maintenance flow process might be conducting the risk existence of waste. On maintenance activity, the manufacture should consider several attributes that influence the activity. Because the maintenance of each machine is different, the failure also different. Each step-in maintenance process should be analysed in detail to create an effective and efficient process. Process mapping every flow process will use to knowing the cause of existence waste in production floor (Hines & Taylor, 2000).

In every machine maintenance, PT. Madubaru carries out its activities in a vulnerable time of 5 months in one year starting from November to March before the milling season. PT. Madubaru in carrying out maintenance activities only relies on scheduling data in the form of Gantt Chart which provides information about the number of workers, the estimated time of work for each element in each machine that is employed for over than 5 months. Also, from the results of observations and field interviews, information was obtained, that during this time the maintenance work could be completed in accordance with the given time of 5 months, due to the policies of the foremen/supervisors without seeing the scheduling on the Gantt Chart.

From above description, scheduling has not been implemented well, because there is no definite way of arranging the sequence of activities that must be done, so to start and complete a job only relies on the experience of the foreman/supervisor to complete maintenance activities according to the time used. Besides that, the distribution of manpower or workers is not evenly distributed every week so that there is something that exceeds the capacity of workers and the lack of workers who are used at certain times. Therefore, it is necessary to have good and measurable planning in each stage of the maintenance that will be carried out on each existing machine, namely the number of workers and the completion time according to the limits imposed and the allocation of workers must be balanced every day.

Until now there has been no evaluation regarding maintenance schedules in the company. For this reason, the researcher tries to make more regular scheduling, which is useful to become the basis for controlling the activities and maintenance framework in the future. The main purpose of this evaluation to be carried out at the front factory station is to prevent delays in the completion of maintenance that will lead to another delay in the production schedule, such as if the foreman has retired or is replaced then the proposed scheduling is a reference in controlling each maintenance to be carried out. Based on Raben (2018), PT. Madubaru will experience an opportunity of loss Rp. 163,228.00 per minute, and the total per day is Rp. 235,048,320. If production cannot go according to plan. In addition, if the maintenance scheduling plan is carried out properly and correctly, the maintenance costs, in this case, will be more optimal labour costs.

Maintenance activity in PT. Madubaru is conducted with several factors such as order of schedule of each task, time limitation and number of operators who handle the task. To develop the maintenance scheduling to be more effective, the heuristic algorithm is suggested to be able to solve the problem. The main problem of this manufacture is said to be NP-hard if all problems in the NP-class are reducible to the main problem. Although complexity of NP-hard problems is high these problems, in the case of larger  $n$ , cannot be solved in a reasonable amount of time using deterministic techniques. The GA starts the adaptation process from a random generated population of individuals.

Then, each individual is assigned a fitness that predicts its adaptability and, finally, natural selection, crossover and mutation are simulated.

To be able to facilitate the search for the start of a maintenance component work on correct scheduling, the balance of worker allocations and time limits specified, these problems fall into the NP-Hard category. Many methods can be done to solve this problem, one of them is using the Genetic Algorithm (AG) method as a heuristic search method that can be used to solve complex optimization problems. Therefore, with the use of AG, it is expected to be able to answer scheduling problems and then the results obtained can be used as a scheduling evaluation conducted by PT. Madubaru.

## **1.2. Problem Formulation**

This research is generally about the designing effective maintenance scheduling that proposed by genetic algorithm. Based on the description above, the problem that comes up in the research would be “How to design optimum maintenance scheduling to reduce the cost of maintenance?”

## **1.3. Research Objectives**

This research proposed to answer several objectives as mentioned below:

1. To design the optimum maintenance scheduling.
2. To generate GA based on parameter existed.

## **1.4. Significant of Research**

This research can provide for the parties as follows:

1. Manufacturing Company

The results of this study can be used as material for evaluation and consideration for the manufacturing company in determining the steps of improvement in order to achieve and improve the management of asset in that company in an increasingly tight competition among companies.

2. Researcher

This study will be a tool for the researcher to practice what has been learned during lectures, so the researcher can add insight, knowledge, and experience in the working field.

### 3. Educational Institution

The results of this study are expected to be an additional reference for future research, especially those which discuss about customer's satisfaction and can be considered as knowledge guidance in general.

## 1.5. Limitation of Research

The arrangement to design the GA of maintenance schedule, the proposed scheduling only shows the scheduling of each task that conducted in the same duration with the initial but different sequence task. The task that is not previously in the initial schedule will be excluded from the proposed schedule. Below are for the limitations of this study described as follows:

1. Period of maintenance activity is determined on November 2017 until March 2018
2. All manpower has the same knowledge and skill.
3. Number of manpower is constant every day (vacation)
4. Conducting no overtime for manpower.

## 1.6. Organization of Thesis

Systematical of thesis writing is arranged to make this research more structured and easier to be read. Therefore, the research has six chapters as follows:

### **CHAPTER I: INTRODUCTION**

This chapter will briefly explain the background of the problems that lead to research and methods that matched the problem, namely the Genetic algorithm to design the maintenance schedule. The formulation of the problems to be examined, the research objectives to be achieved, the benefits of research, the limitations of the problem and writing system.

**CHAPTER II LITERATURE REVIEW**

The literature review chapter contains some of the results of previous research that have to do with research conducted on improving company productivity using the implementation of GA and Maintenance schedule. Besides, it also contains concepts and theories needed to solve research problems, theoretical foundations to support studies that will be carried out such as the basic concepts of Genetic algorithm, type of maintenance strategy.

**CHAPTER III RESEARCH METHODOLOGY**

This third chapter describes the subjects and objects of research, namely total productivity in Manufacture Company, the type of data used primary, namely the data cycle of each process of critical machine, identification of waste, determination of detailed manpower used, and input from history data, secondary data, namely the number of product requests, books and journals. The method of collecting and processing the data is used, the analysis is performed in accordance with the flow of framework made.

**CHAPTER IV DATA COLLECTION**

This chapter describes the procedures for data collection which include data generated during the research in the form of primary and secondary data. Data processing is done to identify the highest fitness value of GA processing and calculate the final cost spent to run the suggestion schedule.

**CHAPTER V RESULT AND DISCUSSION**

Discussing the results of the research that have been carried out in the form of data processing, graphs, tables and analysis which relate to theoretical explanations quantitatively, qualitatively, and statistically from the results of research and studies to answer the research objectives. Analysis of the discussion using predetermined methods namely Genetic Algorithm.

**CHAPTER VI CONCLUSION AND RECOMMENDATION**

This chapter contains conclusions and suggestions. The conclusions contain a brief and concise statement which is presented from the

results of the research and discussion to answer the problem. Suggestions are made based on the experiences and considerations of researchers, aimed at companies or related research sites and researchers in similar fields.