CHAPTER III

RESEARCH METHOD

3.1. Research Subject

These research objectives are to evaluate the maintenance scheduling on front factory using Genetic Algorithm (GA) as a method to create the suggestion of new maintenance scheduling by following the requirements of manpower and duration of each activity needed. This research placed in PT. Madu Baru, Madukismo, Bantul, Yogyakarta.

3.2. Problem Identification

The problem that was feared the most is the absence of scheduling evaluation carried out at the previous front factory station. Facts on the ground that the recent scheduling exceeds the maximum capacity of workers in one day. This is the basis for researchers to make scheduling proposals that are in line with the worker's limits and the time determined by the company, by determining the time to start each maintenance work activity. With the aim of scheduling proposals, making it a framework for maintenance work at the front plant station.

3.3. Research Flowchart

There are several stages to be conducted in this research, the first step is the problem identification done by the researcher after determining the research question and research objectives. The literature review consists of inductive study which explained about the previous research that has been done in the past and deductive study which explained about the basic theory of supplier selection. The next step is data collection and will be

processed in the data processing. The data that has been collected will be processed using Genetic Algorithm method that will be run in Evolver Programme.

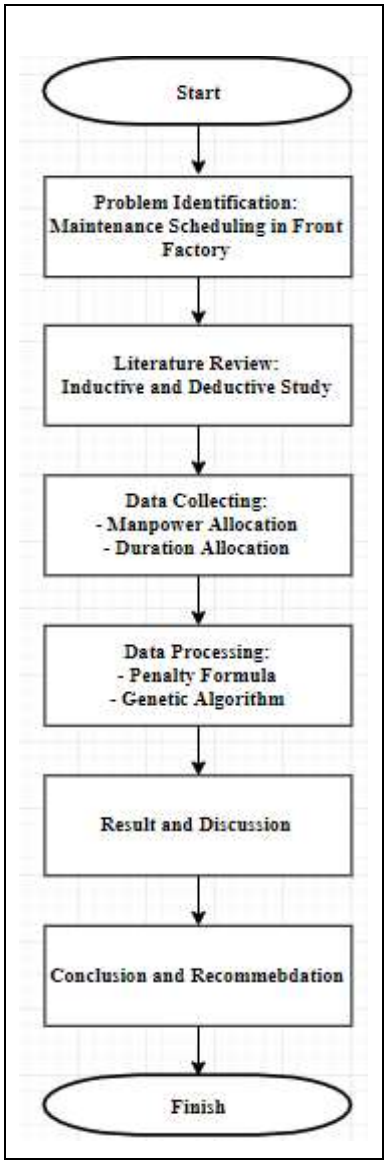

Figure 3. 1 Research Flowchart

Research flowchart of this research will be customized with the GA's requirements that needed in this research. Research flowchart is commonly used as a guide of the process in research from the beginning till the end.

3.4. Data Collection Method

There are two types of data used in this study. The description for each type described below:

a. Primary

Primary data are data obtained directly from the object of research which is PT. Madubaru PG. Madukismo. The primary data of this study were obtained from the historical data provided by an expert in PG. Madukismo. The data that obtained in primary data are the result of historical data in order to evaluate the last maintenance activity of the front factory. Primary data that collected by researcher are shown below:

- Maintenance Schedule Sheet
- Daily Activity Note

b. Secondary

Secondary data obtained from sources related to the research that have been done that can support the research. For examples, such as published journals/papers, laboratory data, books, and information obtained through the internet. Then, the secondary data on this study is research or article obtained from article, book, journal and any other internet-based sources.

3.5. Data Processing and Analysis

GA processing to create the optimization of maintenance scheduling needs several steps requirement. In the use of AG there are several processes that must be carried out and adjusted to the case to be completed, which will be explained as follows:

a. Initial Population

The coding technique in this study uses an integer number from 1-35. This coding is chosen because the chromosomes that will be made represent the type of task maintenance. There are 120 days of time limits given for completing maintenance activities, in the table formulated t_n (day-to-day). For example, t_1 is the first day, t_2 is the second day, and so on.

b. Fitness Function

The fitness value used as a reference in assessing whether a good chromosome is used as a solution to the problems in this study, in this case, the fitness solution is formulated from the desire for the absence of an excessive number of workers in one day, the balance of allocation of workers, and completion of maintenance according to applicable limits. The fitness function is as follows:

$$Fitness = \sum (\sigma\ Penalty\ Manpower_{t1\text{-}120} + Manpower_{t120-n} + 0.001)\ x\ Time\ Penalty$$

Description:

- Penalty Manpower : number of operators that exceed the operator allocation
- Manpower $_{t120-n}$: operator used during the maintenance period
- Time Penalty : Activity exceed the duration allocation.

In making an evaluation function that uses a penalty. The weighting coefficient is chosen in such a way that violations, which have very high limits are given a penalty value that is greater than the weak limit (Dahal & McDonald, 1997). To evaluate the penalty that the penalty for the standard deviation of the number of workers is greater than the weight of the worker penalty, because by focusing on balancing the number of workers (Sutartono, 2018). This is intended for workers who have been contracted in one maintenance period to work without being unemployed. The number of workers allocated can increase along with the allocation that has been adjusted to the time limit, so that this limitation is not a priority in this study. While time penalties are given a weight of 2. By the above description, the researcher conducts the penalty in this study shown in Table 3. 1:

Table 3. 1 Penalty Formula

Penalty	Formula
Manpower Penalty	IF (Total task t_n > 33) then (Total task t_n - 33) * 1), IF False (0)
σ Manpower Penalty	σ Manpower * 5
Time Penalty	IF (End Date per Task > 120) then ((End Date per Task – 120) * 2), IF False (1)

Determination of functional parameters for AG control devices, namely: population size (popsize), crossover probability (p_c) and mutation probability (p_m). In determining the parameters there are no exact numbers. It was stated by Kusumadewi (2003) recommends that the fitness of the best individuals be monitored in each generation, then the parameters (popsize; p_c; p_m) = (80; 0.45; 0.01). But keep it in mind, for the determination (popsize; p_c; p_m) there is no definite way in every problem because the numbers that appear in the generation are random numbers, so whatever probability is determined, it will still get the desired solution.

Based on the data processing stages using AG, the results of the solutions obtained depend on the number of generations performed. Although the control parameters used (popsize; pm; pc) also effect on how long the generation will continue, but until now there is no certain way how the best solution can be found quickly, given that the AG search technique is based on probability and random numbers. However, according to Purnomo (2016) the parameter to stop generation is when there is no increase in fitness at the minimum amount of half of the total generation carried out.

3.6. Result Analysis

The result analysis of this research is to determine the effective design of maintenance scheduling from optimum solution based on the highest value of fitness, to determine the highest value of fitness, the researcher should build the logic of GA in Evolver. After getting the highest value of fitness, then researcher analyse the scheduling that has been set following the fitness into the cost estimation to implement this result.

3.7. Conclusion and Recommendation

3.7.1 Conclusion

After discussion of the solved cases, in the final stage, it is necessary to draw conclusions from the cases that were resolved. This aims to answer the research objectives that have been set. After the researcher gets the number of costs that should be an allocation to implement the result of GA, then the researcher gives the conclusion of cost estimation if there is differential.

3.7.2 Recommendation

As the recommendation in this study, researcher suggests conducting the limitation of this study that stated in chapter I. And the researcher suggests developing a new model of GA to run in Evolver to get more precise result with the same environment.