

CHAPTER V

DISCUSSION

5.1 Define the Number of Generation

Based on the stages of data processing using AG, the results of the solutions obtained are very dependent on the number of results performed. Although the control parameters used (popsize; pm; pc) also function to resolve the generation, generations will continue to be carried out, but until now there is impossible to find the best solution quickly, by considering the AG search techniques requirements and a random number. The parameters for reducing generation no longer increase fitness in a minimum amount of half of the total generation carried out.

The number of generations carried out in this study is only 6740 generations. This generation increase occurred insignificantly from generation 1 – 1205 from the number of balancing for manpower used from Figure 4.1c, which show the maximum point in generation that is already found. Besides the computation time carried out for 6740 generations succeeded for almost 2 hours then AG was cancelled in 6740 generations after discovering the 6740 evolves to get the last population.

5.2 Maintenance Scheduling Suggestion by Genetic Algorithm

Based on the results of maintenance scheduling data processing using AG the graph results are shown in Figure 4.1. From the graph, lines always fluctuate an upward because the AG system in program stores the results of the previous best fitness values and maintains them from a worse fitness offspring value and will be replaced with a better

offspring chromosome fitness value. For the chromosome initialization fitness value which is the initial maintenance scheduling added with the assumption that the starting time of some jobs as in Table 4.4 produces a fitness value of it is converted into a minimization fitness value to be 280.66. The weight of the penalty value for chromosome initialization is as follows:

Table 5. 1 Initial Scheduling Penalty Score

Penalty	Score
Man Penalty	175
Duration Penalty	1
Standard Deviation Penalty	105.64
Fitness	280.66

From Table 5.1, information was obtained that there was a total of 175 people within 120 days of work which exceeded the number of 77 workers per day that contracted by the company. From a duration penalty, it can be seen that there is scheduling work that exceeds the set time (120 days). As for the equal distribution of workers' allocations on a single day, the standard deviation value is $105.64 / 5 = 21.129$.

Based on the fitness solution that has been made, the best value for proposal scheduling can reach the maximum fitness value minimizing 0.01 if all the variables in the fitness calculation do not exceed the provisions. The results of maintenance scheduling data with Genetic Algorithms of some 6740 generations succeeded in obtaining a maximized fitness value of 280.66, with details of penalty value weights on chromosome results in generation 6740.

From Table 5.1, information is obtained that there are workers that exceed the number of 77 workers per day contracted by the company as evidenced by a value of 175. From time penalty it can be seen that there is no scheduling work that exceeds the set time (120 days) as evidenced by the value 1. As for the even distribution of workers' allocations on a single day, the standard deviation value is $21.129 / 5 = 4.22$.

5.3 Comparison Penalty of Initial and Suggestion Scheduling

Based on the results of scheduling proposals that have been obtained, it is important to compare the results obtained with the initial/actual conditions of the company. Based on the results of both, they will be shown in the following Table 5.2:

Table 5. 2 Penalty Comparison

Penalty	Initial	Suggestion
Man Penalty	175	0
Duration Penalty	1	1
Standard Deviation Penalty	105.64	17.58
Fitness	280.66	17.58

From Table 5.2, information is obtained about a decreasing in fitness value from 280.66 to 0. With details of the weights on the value of penalties that have been made in making fitness with the results, from the results of the propose schedule there are no workers who exceed the allocation of workers in one day compared to the scheduling of initial maintenance. From this, it results in a balance of workers' allocations with a reduction in the unequal allocation of workers in one day.

From the beginning the standard deviation value was $105.64 / 5 = 21.129$ to $17.58 / 5 = 3.52$. So, it can be said that the results of the proposal schedule are in accordance is better than the initial maintenance, namely the first workload that is in the company when maintenance activities are still in accordance with the limits of the number of workers in the company. Second, the overall maintenance workload at the centre factory station has been scheduled in accordance with the set time, which is 120 days from November 1, 2017, to March 31, 2018. Third, the performance of workers in the company has been arranged in such a way as to reduce the number of workers unemployed on one day, by improving the allocation of workers each day.

Table 5. 3 Allocation of work every month

Day	November	December	January	February	March
1	61	63	65	68	61
2	61	63	65	68	65
3	61	63	65	68	65
4	61	63	65	68	65
5	61	75	65	64	65
6	61	75	62	67	65
7	61	75	62	67	61
8	61	75	62	67	61
9	61	75	62	67	61
10	61	69	62	67	61
11	65	69	62	67	61
12	65	69	62	67	61
13	65	69	62	67	61
14	65	69	62	67	61
15	65	66	62	67	61
16	63	66	65	67	61
17	63	66	65	67	65
18	63	66	65	67	65
19	63	66	65	67	65
20	63		65	61	65
21	63		62	61	65
22	63		62	61	58
23	63		62	61	58
24	63		62		58
25	60		62		58
26	63		68		58

From the Table 5.3, researcher found that the maximum number of allocation worker in proposed schedule is 75 and the minimum is 58 workers. This means that the

allocation cost to pay the workers is decreasing. Also, the balancing of worker used in one day better than the initial schedule.

5.4 Implementation of Suggestion Maintenance Scheduling

PT. Madubaru divides employees into 4 groups, Silinder, Turbin, Konstruksi and Contract Groups in this case maintenance workers. All workers are assigned to care for a full year both during the maintenance period before the milling season and during the milling period, while contract workers are workers who are only employed during the maintenance season before the milling season alone. Labour costs are determined in two ways, namely, contract workers are employed for one month and for five months. This is done to find out whether there are differences in labour costs on the initial scheduling and labour costs in the scheduling of proposals, because we know from the previous scheduling that there is an imbalance in the allocation of workers on one day, of course, it is important to know whether there are improvements in terms of labour costs.

The company stipulates that there are 77 workers. To determine the number of workers contracted in one month is based on the highest number of workers on one day, as well as for contracts in 5 months. It aims to avoid shortages of workers when the work takes place in one month when there are days that have the most workers who need workers, even though there will be a number of unemployed workers on the other day. The results of the comparison of scheduling prefixes and proposals are as follows:

Table 5. 4 Comparison of Manpower Cost

Month	Maximum manpower Used per week		Manpower Cost (Rp)	
	Before	After GA	Before	After GA
1	71	65	134900000	123500000
2	77	75	146300000	142500000
3	77	68	146300000	129200000
4	77	68	146300000	129200000
5	69	65	131100000	123500000
TOTAL			704900000	647900000

From the results of Table 5.4, it is shown that the results of scheduling proposals for monthly contracts amounted to Rp 647.900.000 is better than the initial scheduling of Rp 704.900.000. From these results provide answers to proposals given better or can improve cost efficiency, both in terms of monthly contracts and in full 5 months. It is based on the initial scheduling still unable to allocate workers in a balanced manner on a daily basis, in contrast to the proposed scheduling using Genetic Algorithms that reduce the number of imbalances in the allocation of workers for 5 months. From these results, it is also found that it is important for each company to be able to allocate workers in accordance with the limits and balanced allocation of resources so that worker productivity can be increased and losses to labour costs can be minimized as little as possible.

5.5 Maintenance Scheduling Sequence

Searching for information about the order of work in the middle factory station is very difficult. Although they have schedules that come from existing gantt charts, but the results of previous interviews, they do not have standard rules regarding the order of work, which means the existing gantt chart does not represent the order of work and each job. This is interesting because when field observations are carried out, from the researchers' point of view there is work done when the previous supporting work has been completed. Due to the difficulties of the researcher regarding the time of observation that is very unlikely to be carried out for 5 months and there is no recording in terms of the start time and date of use of material from a particular job, matters regarding the sequence of work are very difficult to consider in calculations.

However, this can be somewhat overcome in the case of the middle factory station from the results of observation and analysis of researchers in the field. Testing work is an evaluation work on the work of revision of equipment and machinery in certain parts of the facility. Based on this, assumptions are made as in Table 4.4, which places the results of the last time assumptions of chromosome initialization. However, the explanation of the sequence of work is not a major consideration in scheduling this maintenance, so it does not make the results of this final report to be minimal data or not

feasible to process. It's just that researchers hope that when there is a detailed framework of work and according to field conditions, making the results of planning maintenance scheduling better to be implemented later.

