

## CHAPTER V

### DISCUSSION

#### 5.1 Product Defect

The research on product defect analysis has been performed by obtaining the data from historical data, questionnaire, and interview with the experts and literatures. This research was conducted in PT. Gula Putih Mataram (PT. GPM), which is in Gulaku department. There are four detected defects that recorded from one-year production period, from the 1st of October 2017 until 30th of September 2018. The defects are *sapon*, *curah*, dust and production. *Sapon* is obtained from the scattered sugar sweep, *curah* is obtained from overflow vibrating, broken packaging from inside reject barrel and outside reject barrel, sugar from scrap bin and budpak, dust is obtained from dust collector (blower), and production is obtained from an outer reject barrel because of a deviation in the quality of sugar, off colour (brown sugar).

The method to determine the possibility number of sugar that experiences defect is using Six Sigma metric, which is defect per million opportunities (DPMO). On every batch, DPMO and Sigma level can be calculated to get overall DPMO value and sigma level from average of 3 production batches. The result of DPMO for 3 product types are 29180 for 1 kg, 44241 for ½ kg, and 57160 for 200 g. Hence, from average calculation, DPMO valued as 43527 and sigma level valued as 3,23. DPMO indicates that in one million chances of sugar production for each month or for one production time, there are 43527 possibilities of sugar for experiencing defects.

#### 5.2 Rank of Product Defect

Rank of product defect is determined by obtaining the Risk Priority Number (RPN) after being calculated by Fuzzy AHP-FMEA method. Rank of product defect is to obtain the

failure that has the highest RPN. RPN is used to prioritize the failures identified (Adar et al., 2017).

The method used to determine the potential effect and causes of failure mode is Failure Mode and Effect Analysis (FMEA). FMEA is used to assess the risk that turns to be the potential cause of failure (Vitho, et al., 2013). From the research, the result of FMEA analysis is the Risk Priority Number (RPN). The value of RPN is derived from the result of multiplication between severity (S), occurrence (C) and detectability (D). On the analysis of FMEA, the highest value of RPN with the value of 112 is recorded on production defect. The second one with the value of 96 is recorded on *curah* defect. The third one with the value of 40 is recorded on *sapon* defect. The last one is dust defect with the value of 36. However, RPN of FMEA is not used for the next calculation. Rating of FMEA criteria, which are severity, occurrence, and detectability that had been discussed with the expert are used for the RPN calculation by considering the weighting of Fuzzy AHP.

Then, the method used to weight the criteria is Analytical Hierarchy Process (AHP). Coupled comparison on AHP will be more accurate if the comparison scale specified by experts applies Fuzzy AHP. The assessment of Fuzzy AHP is more objective and realistic (Li, et al., 2018). Kaganski, et al. (2018) stated that Fuzzy AHP is an approach for evaluation the relative importance between attributes by means of pairwise comparison and an opportunity to rank metrics. The result showed that there is difference between weight's comparison of initial AHP and weight's comparison of Fuzzy AHP. Severity criteria increase from 0.49 to 0.53. Then, occurrence criteria increase from 0.44 to 0.48. The last is detectability criteria steady in 0.08. From the result of Fuzzy AHP, severity criterion has the highest value than another two criteria. The first priority for actions is given to severity, the second one is occurrence, and the last is detectability.

After obtaining the weight of criteria by using Fuzzy AHP, the next step is to calculate RPN value with the weighting of Fuzzy AHP. The calculation is multiplication of initial FMEA criteria rating with the weight of criteria by using Fuzzy AHP. The result of this step is final RPN after being calculated by Fuzzy AHP-FMEA, which are *sapon* with 4.73, *curah* with 5.42, dust with 4.78, and production with 7.71. Based on the result,

production has the highest risk priority number, which is production defect can cause the biggest risk. It makes production to be the first priority for improvement and control actions given. The overall rank is production is the first, *curah* is the second, dust is the third, and *sapon* is the fourth.

### 5.3 Improvement

After obtaining the overall rank, the production has the highest risk priority number. It makes production to be the first priority for improvement actions given. Vibrating screen checking is really important to be implemented by the company because sugar size less than mesh 5 that are passed to the next process, it will make the sugar is not in a uniform size as the standard. Therefore, vibrating screen checking is needed to make the sugar size meets the standard. Magnetic separator checking is also important to be implemented by the company because some of black spots are passed to the next process, it will make the sugar contains contaminant and the sugar is not in a clean condition. Hence, magnetic separator checking is needed to make the clean sugar without contaminant inside. Sew back the moist sugar in the sack is as important as previous two improvements, it has to be implemented by the company because dry and moist sugar are not separated well, it will make the sugar is not 100% dry and the sugar is not in a good condition. Therefore, sew back the moist sugar in the sack is needed to make the dry and moist sugar separated well and the final sugar condition is dry.

Based on the Table 4.24 above, it explains that if vibrating screen checking is applied, it will give positive impact to the magnetic separator checking action result, which is the clean sugar that free from contaminant with standard size. Then, if vibrating screen checking is applied, it will give positive impact on sugar which will be released in dry condition by sewing back the moist sugar in the sack as action result. Next, if magnetic separator checking is applied, it will give positive impact on sugar that will be distributed with a clean condition without contaminant by performing sew back process on the moist sugar in the sack as action result. All of the actions have the positive impact to other actions and vice versa. Then, if all of the actions are applied by the company, the result of the sugar will be as expected and minimize the defect on the sugar.

## 5.4 Control

Person in charge (PIC) and time action taken are needed to control the indicator of improvement. First, the PIC on vibrating screen checking are production officer, shift chief, and vibrating screen operator. The first action is taken for every work shift, which are shift 1, shift 2 and shift 3. Second, the PIC of magnetic separator checking are production officer, shift chief, and magnetic separator operator. The second action is taken for every work shift, which are shift 1, shift 2 and shift 3. Third, the PIC of sew back the moist sugar in the sack are production officer, shift chief, and *curah* operator. The third action is taken for every work shift, which are shift 1, shift 2 and shift 3. Overall, three improvement indicators are suggested to be implemented by the company for all of shifts, which means that the actions should be taken before every shift will be started.