Quality Improvement for Product Body 2-1 at PT. X

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Abstract. Customer satisfaction is an important indicator for companies to improve the quality of products or services. And if the customer feels satisfied it will automatically increase sales so that it also impacts on the company profits. PT Y is one of the customers who are not satisfied with the product produced PT X, because based on data from January to December 2018, the average monthly defect is 2.34 % whereas the company target is 0.2 %. Therefore, in this research it is necessary to minimize the level of defects with the Six Sigma. With five stages, Define, Measure, Analyse, Improve and Control. The proposed improvement provided are installing pins on the stopper, making checklist form of dies check, updating the SOP on the bending process, the results Defect per Million Opportunities (DPMO) before implementing is 19.268 after implementing is 18.229 or decrease (5.3 %) and Sigma level before implementing is 3.57, after implementing is 3.59 increase (0.5 %)

Keywords: Six Sigma, DMAIC, DPMO, Sigma Level

1. Introduction
The development of the manufacturing industry is currently very rapidly. Companies must be able to compete to meet the consumer demand for increasingly high. An industry definitely wants the production process can continue to run well so the viability of the company can be assured. Companies are required to competitive and able to survive in the face of competition that goes with running a business strategy.

PT.X is a company engaged in the field of automotive manufacturing for the manufacture of dies and stamping products using raw materials such as sheet / coil steel. Product placement strategies applied by the company is the make to order, in which production is carried out in accordance with customer demand in the form of numbers and specifications. Every day the company can produce hundreds to thousands of products stamping, from the number of products produced, there is the output of a process that does not comply with the company’s expectations that the product NG (Not Good). PT.X has eight fixed customers who always contributed stamping products in certain periods with different specifications. This research is devoted to products made for one customer, namely PT.Y. It is always to order stamping products each month with varying amounts. According to historical data the company since January to September 2018, stamping the resulting products to customers PT. Y are contributing to the biggest problem of the seven other customers. Based on historical data the company, from January to September 2018, defect amounting to 2453 unit of products or equivalent with 2.34 %, in the other side the target of company is 0.2 %.

This study focused on a 2-1 body products which the product is produced to customer PT.Y because, it is reach about 24% defects, the biggest defects from the other. The expected goals of their
improvement in the quality of the product body 2-1 with six sigma methodology through the stages of DMAIC is generated defects in the product can be minimized, so that the company can reduce the losses caused by a defect of the product in the form of fees, timing and effectiveness of production.

| No  | TOPIC                                                                                     | Source |
|-----|-------------------------------------------------------------------------------------------|--------|
| 1   | Application of the method through the stages of the DMAIC Six Sigma for quality control of raw water in food production | [4]    |
| 2   | Proposed Improvements To Reduce Number of Defect Product on Sandal Eiger-101 Lightspeed with Method Using Six Sigma | [5]    |
| 3   | Implementation of Six Sigma Method To Reduce Paint Bucket in PT.X                         | [6]    |
| 4   | Implementation of DMAIC approach for PVC Pipe Production Process Improvement (Case Study PT. Rusli Vinilon)   | [7]    |
| 5   | Implementation of Six Sigma and Data Mining to Improve Die Casting Production Process at PT.B | [8]    |
| 6   | Quality Improvement for Product Body 2-1 at PT.X                                           | This research position |

Table 1 is a research table on Six Sigma with DMAIC. This position of this research among other studies around the world, can be seen from various aspects above improvement of Product Body 2-1 can be seen from Quality Control methodology is combination with data mining, Failure Mode and Effect Analysis and Fault Tree Analysis.

2. Method
The preliminary study carried out by observing the production process for a 2-1 body products, as well as observe the conditions of the working environment, machinery, working methods, raw materials and labor as well as direct interviews with the head of the quality control related to the issues raised in the field of quality. Data used in the study consisted of secondary data and primary data. Secondary data is data that the company has been given, such as product defects historical data, production data and other general data. While the primary data is data collected directly, such as interviews and observations on the production floor. In data processing, analysis of the results.

2.1 Define
Define phase is the initial phase in DMAIC phases. In this stage, how we done to identification

2.2 Measure
The second phase in DMAIC phases is the measure phase. In this stage, the determination of the key characteristics of the product quality (CTQ), the calculation of the proportion control map (Map P), the calculation of the value of DPMO (Defect per Million opportunities) and sigma level.

2.3 Analyze
Analyze stage is the third stage in the DMAIC phases. At this stage begin to analyze the underlying causes of problems that occur are defects in the product attribute body 2-1. Tools used in this stage is a decision tree-data mining, Pareto diagrams, fishbone diagram, FMEA (Failure Mode and Effect Analysis) and FTA (Fault Tree Analysis).
2.4 Improve
Phase repair or improve a fourth phase in DMAIC phases. At this stage, given the proposed improvements in the quality of the product body 2-1 by basic event that has the highest value on the probability of failure of the FTA.

2.5 Control
Phase control is the latest stage in a phase of DMAIC. At this stage the proposed improvements that have been given in the previous stage, namely the improve phase will be implemented and measured return value DPMO and sigma level, to determine whether the improvements made a significant impact on product quality.

3. Result and discussion

3.1. Define
According to methodology in define stage, we done how to indentification defects of product. In this research defects of products is Bland Not Good (Figure 2), Appearance Not Good (Figure 3) and Blank Minus (Figure 4)

3.2. Measure
Measuring is one of the stages used in six sigma, at this stage, control charts are usually in accordance with the data patterns in the production process which is useful for knowing whether the production process is stable or not [1]

Based on the graph p control chart in Figure 5 below, it can be seen that all the data is within the control limit (in control) because all the data is between the upper control limit (UCL) and lower control limit (LCL). These results indicate that the process runs steadily. Therefore, there is need for revision of the data.

Value Defect per Million Opportunities (DPMO) in the production process body2-1 products amounted to 19 268 defects in one million opportunities. DPMO value is converted to the sigma level to 3.57 sigma. Results value DPMO and sigma level is still far from the desired target of DPMO value
that is equivalent to 3.4 DPMO and 6 sigma. The Company has not yet reached the desired target is 6 sigma. Therefore, it is necessary revisions to the production process of the 2-1 body products enable companies to improve the achievement levels as well as lowering the value of DPMO sigma.

3.3. Analyse

Analyse conducted is to use data mining, which aims to extract information from a collection of data. Information collected is usually the hidden nature, then carried out to predict. [2]

Based on the processing of data mining has been done, the quality characteristics of the most influential are the attributes that include appearance NG (performance of the product is not good), blank minus (Results pieces are not intact), bend NG (Bending is not perfect) and hole NG (The shape of the hole is not well). Type of disability are prioritized for repair is based on 80% of the most dominant disability. 80.20 Pareto diagram is shown in Figure 6.
After all cause problems for the three types of disability described by using ishikawa diagram, then made tables FMEA (Failure Mode and Effect Analysis) is a one the method to analyze the process production before the product reach to the customer [3]. The severity, frequency and focus on the detection of failures in the production process of the body 2-1. Determining the value of the criteria of severity, occurrence and detection based on interviews with Mr. Julian as the head of the quality control. The main objective of FMEA table is to determine the cause of problems that must be prioritized to be handled by the largest RPN value. FMEA table can be seen in Table 2.

### Table 2: Process Failure Mode and Effect Analysis

| No | process functions | Failure Occurs | Effect of Failure | S | Cause of Failure Process | O | This time controls Do | D | RP N |
|----|-------------------|----------------|-------------------|---|--------------------------|---|-----------------------|---|------|
| 1  | blanking          | Blank Minus (Results Pieces Not Intact) | part can not proceed to the next process and should be rejected | 8 | Operators are not careful and do not complete the first cycle of the process | 5 | Supervision of the performance of the operator Supervision Repair dies Checks were tightened when the incoming material | 2 | 80   |
| 2  | bending           | Appearance NG (No Good Appearance) | Aesthetics products are not good and not in accordance with the wishes of the customer, so that part should be repaired even rejected if conditions are too severe | 7 | Slamming or throwing the material carriers | 5 | Supervision of the performance of the operator Repair and replace dies when part results found NG | 2 | 70   |
|    |                   |                |                   | 7 | dies dirty               | 4 | Supervision            | 5 | 140  |
|    |                   |                |                   | 7 | Lack of lubrication during the process | 8 | Supervision            | 3 | 168  |
|    |                   |                |                   | 7 | The laying of the material is not in accordance with the stopper | 6 | Supervision            | 2 | 84   |
|    |                   |                |                   | 7 | punch and dies not center | 3 | Justifying the location of punch and dies in order to become a center | 7 | 147  |
|    |                   |                |                   | 7 | dies rude                | 7 | Repair dies when found part NG | 3 | 147  |
|    |                   |                |                   | 8 | Been lazy and imprecise  | 4 | Supervision of the performance of the operator Lay off the process and strengthen the bolt | 2 | 64   |
|    |                   |                |                   | 8 | stopper shifted         | 6 | Supervision            | 3 | 144  |
|    |                   |                |                   | 8 | dies height unlocked    | 4 | Lay off and lock the height dies | 3 | 96   |
|    |                   |                |                   | 8 | Errors put the material on stopper | 6 | Supervision            | 2 | 96   |

3.4 **Improve the Installation of the Stopper Pin**

Based on discussions with the head of the quality control is a pack of Julian, the need for tools / instruments in addition to fasteners that also serves as a binder stopper on the dies. Additional tools are pin, that is objects that also serves to put a stopper on the dies with directional positions and sturdiness. With the pin mounted on a stopper, be expected if the fasteners loose stopper during the process do not move, because pin as the locking pin and still firmly bind stopper on the dies. Proposal improvement of the stopper placement on the stopper can be seen in Figure 7.
3.5 Control

After the proposed improvements are implemented in the company, the results of defects per Million Opportunities (DPMO) is 18.229 and sigma level is 3.59, if we compare with before implementation there will be an increase and decrease as can be seen in Table 3.

| No. | Indicator     | Before  | After   | (%)    |
|-----|---------------|---------|---------|--------|
| 1   | DPMO          | 19.268  | 18.229  | Decrease: (5.3%) |
| 2   | Sigma Level   | 3.57    | 3.59    | Increase: (0.5%)  |

4. Conclusion

Based on the results and discussion that has been presented, the conclusion that can be drawn are:

1. Types of defects found in production process 2-1 body composed of defect types of attributes. For this type of defect attributes include appearance NG (56,7%), bend NG (20,8%), blank minus (20,8%).
2. Value DPMO (Defect per Million Opportunities) of the production process of body products amounted to 19 268 disability 2-1 in a million chance, while for sigma level is at 3.57 sigma.
3. After the implementation of the proposed improvements, disability percentage obtained by 7.3%, amounting to 18229 DPMO value defects in one million opportunities and sigma level of 3.59. Value percentage disability and DPMO on after the implementation of the proposed improvements decreased and increased sigma level. This shows that the proposed improvements given a significant impact on the improvement of product quality body 2-1.

5. References

[1] DC Montgomery 2009 Introduction to Statistical Quality Control 6th ed. (New York: John Wiley and Sons, Inc.).
[2] S Adinugroho, YES Sari 2018 Implementation Data Mining Using Weka 1st (Malang: UB Press)
[3] DH Stamatis 2003 Failure Mode and Effect Analysis 2nd (Milwaukee: American Society for Quality Press).
[4] D Rimantho, DM Mariani 2017 Application of Six Sigma Method on Raw Water Quality Control on Food Production, J. of Industrial Engineering 16, p.1.
[5] Nailah, A Harsono, GP Liansari 2014 Proposed Improvements to Reduce Number of Defect Product on Sandal Eiger-101 Lightspeed with Method Using Six Sigma. Online J of National Institute of Technology 2, pp.257-258.
[6] H Fransiscus, CP Sudarsono IS Astari 2014 Implementation of Six Sigma Method to Reduce Paint Bucket in PT. X. J. of Industrial Systems Engineering 3, p.54.
[7] D Caesaron, SYP Simatupang 2015 Implementation of DMAIC approach for PVC Pipe Production Process Improvement (Case Study PT. Rusli Vinilon), J. Metris 3, p.91.

[8] R Fitriana, J Saragih, S Sarasaty 2012 Implementation of Six Sigma and Data Mining to Improve Die Casting Production Process at PT. B Proceeding 7th Proceeding International Seminar on Industrial Engineering and Management, pp.64-67.