ACADEMIC ADVISOR
RECOMMENDATION LETTER

This Internship report is prepared and submitted by **Muhammad Arif** in partial fulfillment of the requirements for the degree of Bachelor Degree in the Faculty of Engineering has been reviewed and found to have satisfied the requirements for a report fit to be examined.

Cikarang, Indonesia, July 9th, 2015

<u>Herwan Yusmira, B.Sc. MET, MTech</u>

COMPANY'S SUPERVISOR RECOMMENDATION LETTER

Muhammad Arif has performed and completed an internship in **PT. Mitsubishi Electric Automotive Indonesia** in partial fulfillment of the requirements for the degree of Bachelor Degree in the Faculty of Engineering. I therefore recommend this report to be examined.

Cikarang, Indonesia, July 9th, 2015

Suryani

INTERNSHIP REPORT AT PT. MITSUBISHI ELECTRIC AUTOMOTIVE INDONESIA, BEKASI, INDONESIA

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ABSTRACT

This project is done to minimize the NG existence at PT. MEAINA especially the bracket flowing to machining process. The elimination of NG existence is done through Plan, Do, Check, Act (PDCA) method. NG existence has become one of the main problems. Generally, NG can be categorized into two categories, NG caused by supplier and NG caused by machining process. 36.8% of total NG is caused by machining process and 63.2% of total NG caused by suppliers. Then, the most defective line found is Starter Bracket Front line. The most type of NG caused by supplier is small diameter lever which contribute 3,711 pieces and shown as the highest. Based on the analysis, the small diameter lever is mainly caused by the wrong inspection method and no supporting tools. Thus, diameter lever area is added to the inspection check sheet and the new jig is used to check the diameter lever area. This treatment result in 0% defect of diameter lever area and save cost up to IDR 218,970,000.

Key words: *NG, PDCA method, SBF, jig, diameter lever, supplier, cost saving*

ACKNOWLEDGEMENT

This report would never be done without a big support. Therefore, I would like to send my thanks to:

1. Allah SWT, the Al-Mighty one. My words would never be enough to say thanks to You.
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PDCA   :Iterative four-step method to control and continues
                        improvement of processes and product.
NG   :Defect product
SBF   :Starter Bracket Front Line which usually produces
                        Bracket for Starter
Bracket   :The product produced by PT. MEAINA
Incoming inspector   :Member of Quality Assurance team and part of
                        incoming section who usually works on inspecting the
                        quality of blank bracket sent by suppliers.

CMM   :Coordinate Measuring Machine used to measure the
                        dimension of product of measurement tools.

Blank   :Bracket that has not yet been machined.
Diameter lever   :The diameter of inner circle in the middle of bracket.
Burry   :Remaining casted iron stick to the blank bracket which
                         is not supposed to be there.

Swelling   :Part of blank bracket is felled off and specification
                        changed.
Black spot   :A black dot or stain at the blank bracket.
Deform   :Change of bracket form.
MEAINA   :Mitsubishi Electric Automotive Indonesia

CHAPTER I
INTRODUCTION

1.1 Problem Background

In running a mass production, there must be a lot of problem faced by the company. This kind of problem may vary between one company to the other companies. It is usually based on in what field the company work on. The problem faced by the company can defect product, unbalanced line, inventory overload, safety problem, etc.

There is one thing that cannot be avoided by companies producing products in mass production. The main problem is defect product. One of the ways to avoid defect product is by assuring quality of product. Because of that, Quality assurance has been one of main concern of companies. Producing *NG (Not Good)* product is not an option for the companies. Thus, it is a general fact that every single company in this world has been trying hard to concern on quality matter by minimizing NG product produced by the company.

Minimizing NG product is one of the main goals of PT. Mitsubishi Electric Automotive Indonesia. There are various existing types of NG at PT. Mitsubishi Electric Indonesia. In general, there are two types of NG; NG caused by supplier and NG caused by machining process of PT. Mitsubishi Electric Automotive Indonesia. Product is judged NG by machining when the blank brackets have been processed to production process. Product is judged NG by supplier when the incoming quality inspector of PT. Mitsubishi Electric Automotive Indonesia found it, and PT. Mitsubishi Electric has right to return it to the supplier for repair. But, when the NG found after machining process, it is responsibility of PT. Mitsubishi Electric Automotive Indonesia for repair, of course the cost of repair will be from company's

budget and in fact, the NG caused by supplier is always bigger than NG caused by machining process.

To minimize NG product caused by PT. Mitsubishi Electric Automotive Indonesia process, incoming quality inspection must be maximized. There are many types of NG caused by supplier which usually found by quality incoming inspector, the NG are Noise, base abnormal, overcut, bending, black spot, blow hole, folded, bumping, burry, chipping, scratch, dented, etc.

Since there have been various types of NG caused by supplier, continuous study to eliminate those NG's product must be done as the time goes by. 63% of the total NG is caused by suppliers,. it is very important to start the elimination of NG product from the NG type that mostly happened recently since the highest NG can lead to the biggest loss of money.

It is best to start eliminating the NG from the types of NG that have been contributing the biggest loss of the company, then is continued by eliminating the next biggest NG as the application of continuous improvement until we can reach the very minimum level of NG because it is almost impossible to experience zero defect in one period of production process. Through this study, it is expected that the continuous elimination of NG can be realized started from the NG causing biggest loss until the NG causing lowest loss systematically. It is considered that the best way to follow those systems is by applying Plan, Do, Check, and Act usually known as PDCA approach.
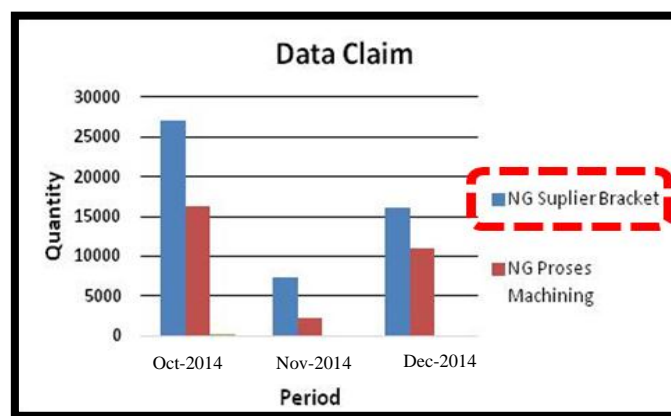
Figure 1.1 Data claim report at the end of 2014

1.2 Problem Statement

The background of the problem leads to several problem statement as follow

1. What kind of NG bracket that mostly existed at incoming area?
2. What production lines that commonly experienced that NG type?
3. How to minimize the NG that is mostly existed?
4. How much cost is saved by minimizing NG that is mostly happened?

1.3 Objectives

There are several objectives of this research, including:

1. To identify the NG that outflow to machining process
2. To identify what kind of NG that is mostly happen
3. To find the way of minimizing NG that mostly happened
4. To save the cost by minimizing NG

1.4 Scope

In this research, there are scopes due to limitation of resource.

1. The continuously observed NG type is only at the most defective lines.
2. The research is done at incoming section of PT. Mitsubishi Electric Automotive Indonesia until right before machining process.
3. The observation is started from March 2015 until June 2015.

1.5 Research Outline

Here are the descriptions of chapters which systematically construct the research.

Chapter I   **Introduction**

This chapter includes the problem background, research questions, objectives, scope and limitation of the research as well as the research outline.

Chapter II   **Literature Study**

This chapter consists of all related and supporting concepts and theories as the guidance to keep the research on the right track categorized as QC 7 tools such as Flowchart Diagram, Pareto Chart, histogram, Fish Bone Diagram and also the literature about gauge and cost analysis.

Chapter III   **Research Methodology**

All systematic steps and detailed framework are provided in this chapter to arrange this research to be conducted methodically. The framework is made regarding the literature study as well.

Chapter IV   **Company Profile**

Company profile is explained in this chapter together with the general product and operation scheme of the company. The company profile in this report consist of company description, company's operation, organization chart of human resource department, job description of human resource department, company's production process, and company's product

Chapter V   **Data Collection and Analysis**

Data will be taken and collected during the research and finally be processed as well as analyzed whether the research could meet the objectives or not.

Chapter VI   Conclusion and Recommendation

In this chapter, conclusion is drawn through analysis of data to meet the research objectives and recommendations are given for future research

CHAPTER II
LITERATURE STUDY

2.1 Flow Chart

A Flowchart diagram is a type of diagram which depicts the flow or sequence of processes using several types of symbols and arrows as the connectors. There are "Start" and "End" symbols symbolized by rounded rectangles at the beginning and the end of the diagram. The two most general types of symbols used in a flowchart are rectangular box which represents a processing step or activity and diamond which denotes decision. When it comes to decisions, one of them may lead to repetition of previous processes or initiate new and different activities. An example of a basic flowchart is shown in Figure 2.1.
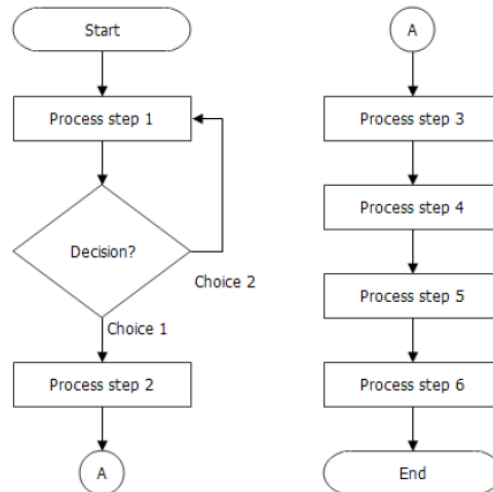
Figure 2.1 Basic Flowchart
Source: google image

2.2 Pareto Chart

Pareto chart is one of exploratory tools which consist of vertical bars which visually symbolizes frequency of data and summarizes the significance of each data and line

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graph which shows the cumulative data in percentage. This chart is very helpful to depict the most significant or frequent data to focus on when there are lots of problems or causes found in the processes by placing the problems in decreasing order (Mitra, 2008).
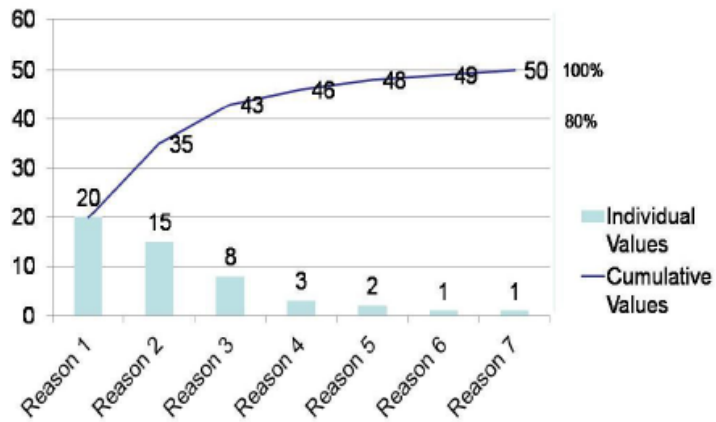
Figure 2.2 Structure of Pareto Chart
Source: http://viramidwifery.blogspot.com

2.3 Fish Bone Diagram

Fish Bone Diagram or Cause-and-Effect Diagram is a causal diagram created by Kaoru Ishikawa in 1943 that detects and categorizes possible causes of a problem as the effect (Mitra, 2008). This diagram is called fishbone diagram because it is drawn as the fish's skeleton and the main causal categories are represented by the bones. The structure of Fish Bone Diagram is shown is Figure 2.3. The main causes are usually grouped into several categories that are used in manufacturing industry which include:

❖ People : anyone that is involved in the process.

❖ Methods : the way the process is performed and the requirements for doing it such as procedures, rules and etc.

❖ Machines : any equipment or tools needed to complete the process.

❖ Materials : basic things that are transformed to produce final product in the process.

❖ Measurements : data that are generated from the process as the evaluation of its quality.

❖ Environment : the conditions, such as time, temperature, location, and culture in which the process is completed.
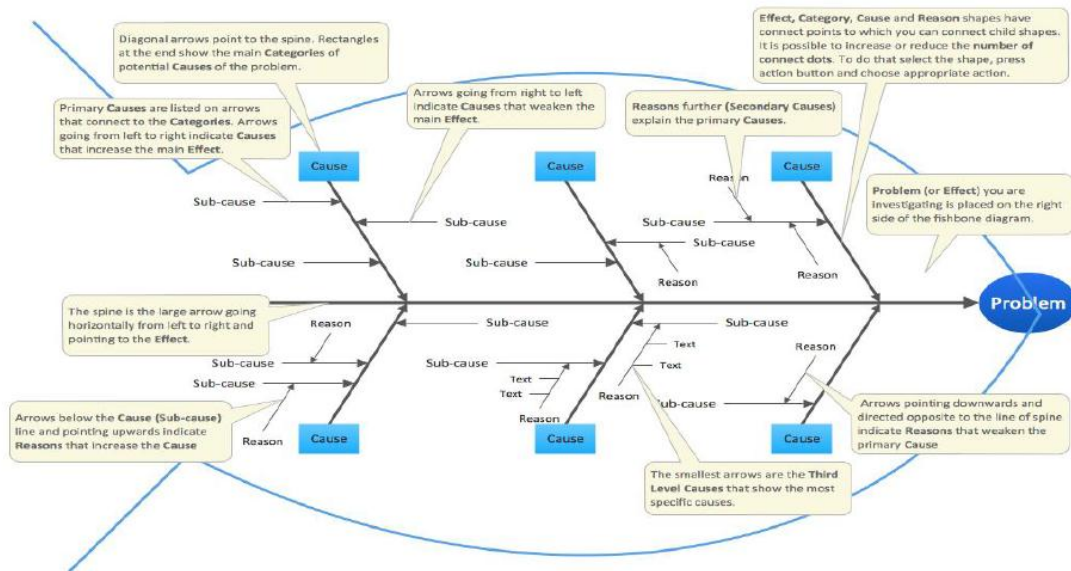
Figure 2.3 Structure of Fish Bone Diagram
Source: http://www.mindtools.com

2.4 What is PDCA

PDCA is based on the "Shewhart cycle," and was made popular by Dr. W. Edwards Deming, considered by many to be the father of modern quality control.3 During his lectures in Japan in the early 1950s, Deming noted that the Japanese participants shortened the cycle's steps to the now traditional plan, do, check and act. It is interesting to note that Deming preferred plan, do, study, and act because the translation of "study" from Japanese to English has connotations closer to Shewhart's intent than does "check."4 This model has been around for 60 years and it is relevant

in today's public health world, providing a defined and well tested process to achieve lasting improvement to the problems and challenges public health is now facing.
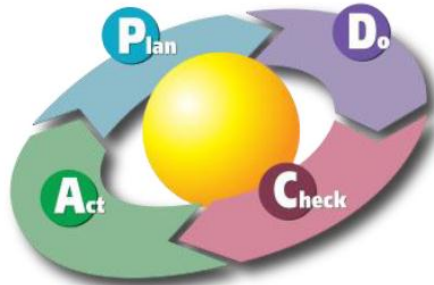
Figure 2.4 PDCA Cycle
Source: mindtool.com

Spending adequate time in each phase of the PDCA cycle is imperative to having a smooth and meaningful quality improvement process. The elements put forth here comprise a deliberate process based on the scientific method, and help ensure that improvement efforts are conducted in a way that will maximize the degree of success achieved.

2.4.1 Phase of the PDCA Model

The phases of the PDSA model below assume that just one underlying, or root cause will be addressed by testing just one intervention. When undertaking the PDCA process, the team may decide to address more than one root cause, and/or to test more than one intervention to address a root cause. In such instances, it will be important to measure the effect of each intervention on the root because it is intended to address.

Plan: The purpose of this phase is to investigate the current situation, fully understand the nature of any problem to be solved, and to develop potential solutions to the problem that will be tested.

1. **Identify and prioritize quality improvement opportunities**. Usually a team will find that there are several problems, or quality improvement opportunities, that arise when programs or processes are investigated. A prioritization matrix8 may help in determining which one to select. Once the quality improvement opportunity has been decided, articulate a problem statement. Revisit and, as appropriate, revise the problem statement as you move through the planning process.

2. **Develop an AIM statement** that answers the following questions:

   a. What are you seeking to accomplish?

   b. Who is the target population?

   c. What is the specific, numeric measure(s) you are seeking to achieve?

   d. The measurable improvement objective is a key component of the entire quality improvement process. It's critical to quantify the improvement you are seeking to achieve. Moreover, the entire aim statement also will need to be revisited and refined as you move through the planning phase.

3. **Describe the current process** surrounding the problem in order to understand the process and identify areas for improvements. Flow charts and value stream mapping are two examples of methods to accomplish this.

4. **Collect data on the current process**. Baseline data that describe the current state are critical to further understanding the process and establishing a foundation for measuring improvements. The data may address, for example, time, people, space, cost, number of steps, adverse events, and customer satisfaction. A host of tools are available to collect and interpret data on the process, such as Pareto charts, histograms, run charts, scatter plots and control charts. The data collected must be aligned with the measures listed in the aim statement.

5. **Identify all possible causes** of the problem and determine the root cause. While numerous causes will emerge when examining the quality improvement opportunity, it is critical to delve in and carefully identify the underlying, or root, cause of the problem, in order to ensure that an improvement or intervention with the greatest chance of success is selected. Brainstorming is a useful way to identify

possible causes and a cause and effect/fishbone diagram and the 5 Whys are useful for determining the actual root cause.

6. **Identify potential improvements** to address the root cause, and agree on which one to test. Once the improvement has been determined, carefully consider any unintended consequences that may emerge as a result of the implementing improvement. This step provides an opportunity to alter the improvement and/or develop countermeasures as needed to address any potential unintended consequences. Revisiting the aim statement and revising the measurable improvement objectives are important steps at this point.

7. **Develop an improvement theory**. An improvement theory10 is a statement that articulates the effect that you expect the improvement to have on the problem. Writing an improvement theory crystallizes what you expect to achieve as a result of your intervention, and documents the connection between the improvement you plan to test and the measurable improvement objective.

8. **Develop an action plan** indicating what needs to be done, who is responsible, and when it should be completed. The details of this plan should include all aspects of the method to test the improvements – what data will be collected, how frequently data are collected, who collects the data, how they are documented, the timeline, and how results will be analyzed.

*Do***:** The purpose of this phase is to implement the action plan.
    1. **Implement the improvement.**
    2. **Collect and document the data.**
    3. **Document problems, unexpected observations, lessons learned and knowledge gained.**

*Check/Study***:** This phase involves analyzing the effect of the intervention. Compare the new data to the baseline data to determine whether an improvement was achieved, and whether the measures in the aim statement were met. Pareto charts, histograms,

run charts, scatter plots, control charts and radar charts are all tools that can assist with this analysis.

1. Reflect on the analysis, and consider any additional information that emerged as well. Compare the results of your test against the measurable objective.
2. Document lessons learned, knowledge gained, and any surprising results that emerged.

Act: This phase marks the culmination of the planning, testing, and analysis regarding whether the desired improvement was achieved as articulated in the aim statement, and the purpose is to act upon what has been learned. Options include:

1. **Adopt**: Standardize the improvement if the measurable objective in the aim statement has been met. This involves establishing a mechanism for those performing the new process to measure and monitor benchmarks on a regular basis to ensure that improvements are maintained. Run charts or control charts are two examples of tools to monitor performance.

2. **Adapt**: The team may decide to repeat the test, gather different data, revise the intervention, or otherwise adjust the test methodology. This might occur, for example, if sufficient data weren't gathered, circumstances have changed (e.g., staffing, resources, policy, environment, etc.), or if the test results fell somewhat short of the measurable improvement goal. In this case, adapt the action plan as needed and repeat the "Do" phase.

3. **Abandon**: If the changes made to the process did not result in an improvement, consider lessons learned from the initial test, and return to the "Plan" phase. At this point the team might revisit potential solutions that were not initially selected, or delve back into a root cause analysis to see if additional underlying causes can be uncovered, or even reconsider the aim statement to see if it's realistic. Whatever the starting point, the team will then need to engage in the Plan cycle to develop a new action plan, and move through the remaining phases.

PDCA offers a data-based framework based on the scientific method. This simple yet powerful format drives continuous and ongoing efforts to achieve measurable improvements in the efficiency, effectiveness, performance, accountability, outcomes, and other indicators of quality in services or processes which achieve equity and improve the health of the community.

CHAPTER III
RESEARCH METHODOLOGY

This Chapter informs the reader how the project was conducted by describing the detail steps in conducting the research. The steps should be set systematically to help the researcher solve the initial problems. By constructing the suitable research methodology, the research and analysis can be done accurately. Hereby the steps performed to solve the initial problems in this research as follow:

Initial Observation

- To understand the most problem faced at PT. MEAINA
- To determine the area of problem
- To understand the product process at PT. MEAINA

Problem Identification

- To observe the effect of current effect of NG product
- To define the objectie of project
- To define the scope, limitations, and assumptions used in the project.

Literature Study

- To explain how PDCA method works
- To explain the definition of QC 7 tools
- To explain how the gauge works
- To describe the to use the method to solve the problems

Data Collection and Analysis

- To explain the current condition of PT. MEAINA
- To obtain the data of highest type of NG existed
- To obtain the data of the most defective lines
- To obtain the main cause of the problem

Conclusion and Recommendation

- To make a conclusion which answer the research questions.
- To give recommendations for the company and for future purposes.

3.1 Initial Observation

Initial observation is the first step to start the project of PT MEAINA. This step is done to figure out the overview of the company and deeply knowing the product process at PT MEAINA together with the NG exitence.

3.2 Problem Identification

The purpose of problem identification is as the continuation of initial observation. The focus is on the problem existed at PT MEAINA. The first step done at problem identification is to define the problem statement as the fundamental of the project that will lead the project to the main purpose of conducting the project.

In this project, the main problem is the existence of NG bracket that still flow to the machinig process and the high exitence of NG product at the product process. Thus, it needs to be minimized by firtly starting from the type of NG that contribute most to the total number of NG.

3.3 Literature Study

After constrating the detail of problem identification, the next important thing to do is collecting the literature study to support the project with reliable and relevant references to guide the process of solving the problem. Literature study is the sources to review the material relevant to the study to provide a clear theoretical background of the research. Study literature can also help the researchers to understand more the field that is trying to be researched and analyzed since the research is universal.

In this project, there are several important points that need to be elaborated and the sources related to the topic need to be collected. The use Plan Do Check Act approach in improving output. The use of QC 7 tools has also been widely used to identify problem and make the priority for which problem that must forstly be started. The use of the method to solve the problem must be excellently understood and clearly explained.

3.4 Data Collection and Analysis

In this step, the continuation of privious step is began again. This is one of essential step as the collection of data must be done then the data obtained must be analyzed toward the solution of the problem.

In this project, the data collection is done through collecting the total number of NG product together with the type of NG product. It is done through each production line to then find the most defective line. The analyisis is also done to find the root cause of the problem through usage of QC 7 tools. At the end, the result is obtained through the analysis to find the best solution for the problem. The analysis will also be done through the cost-benefit analysis to find how much cost is saved by the execution of this project

3.5 Conclusion and Recommendation

Once the data collection and analysis is finished, a conclusion related to the to research must be stated to depict the result of the research as it has been successfully conducted and telling the reader that the project has been coming to an end. The conclusion will determine how significance the project was. The result of the project must determine whether it can answer the research objectives or not. Since the purpose of the project is for real implementation, some recommendations for the company may be delivered and applied for the benefits in the future.

3.6 Detail Framework

Begin the project

Initial Obseration

PROBLEM IDENTIFICATION

LITERATURE STUDY

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                    ▼
        ┌───────────────────────┐
        │    DATA COLLECTION    │
        └───────────────────────┘
                    │
                    ▼
        ┌───────────────────────┐
        │    Find existence of  │
        │    defective product  │
        └───────────────────────┘
                    │
                    ▼
        ┌───────────────────────┐
        │  Determine the NG type│
        │  that contribute the most│
        └───────────────────────┘
                    │
                    ▼
        ┌───────────────────────┐
        │  Determine    the    most│
        │  defective  line  for  the│
        │  related NG type      │
        └───────────────────────┘
                    │
                    ▼
        ┌───────────────────────┐
        │  Determine    the    root│
        │  cause   of   the   most│
        │  existing NG type     │
        └───────────────────────┘
                    │
                    ▼
        ┌───────────────────────┐
        │  ANALYZE AND FIND     │
        │  THE BEST SOLUTION    │
        └───────────────────────┘
                    │
                    ▼
        ┌───────────────────────┐
        │  Comparing and calculate│
        │  the cost saving after│
        │  improvement          │
        └───────────────────────┘
                    │
                    ▼
        ┌───────────────────────┐
        │  Conclusion and       │
        │  Recommendiation      │
        └───────────────────────┘
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CHAPTER IV
COMPANY PROFILE

4.1 Description of Mitsubishi Electric

Mitsubishi Electric Automotive Indonesia is located at Bekasi International Industrial Estate Block C 11 No. 1 Cikarang-Selatan, Bekasi 17550. PT. Mitsubishi Electric Automotive Indonesia is subsidiary of Mitsubishi Electric Corporation (MELCO) located at Himeji, Japan.

Melco itself was built by Yataro Iwasaki in 1870. Mitsubishi was built by promoting the business difference growing as modern company. In 1917, Mitsubishi Goshi Kaisha became mother company called Mitsubishi Headquarter. In 1921, MELCO was born and in 1946, Mitsubishi Headquarter was separated and every Mitsubishi company started to run the business independently.

Figure 4.1 PT. Mitsubishi Electric Automotive Indonesia

4.2 Rules and Programs of the Company

PT. Mitsubishi Electric Automotive Indonesia usually called MEAINA has some programs related to its acronym.

M = Motivation

E = Environment and enthusiasm

A = Attitude

I = Innovative and initiative

N = No fat for health

A = Always smile and greetings.

Those are the foundation of the company in the daily activity of all employees. The employee are expected to have high motivation to complete the job, take care of environment, keep a good attitude, keep the body health, and always greet each other by giving smile. The company believes that this will support the development of company to the future.

4.3 Subsidiaries of Mitsubishi Electric in Asia-Pacific

There are 26 subsidiaries of Mitsubishi Electric in Asia-Pacific and employed around 17,000 employees for the total. The Asia-Pacific subsidiaries are located in eight countries. They are India, Thailand, Singapore, Indonesia, Australia, Malaysia, Philippines and Vietnam.
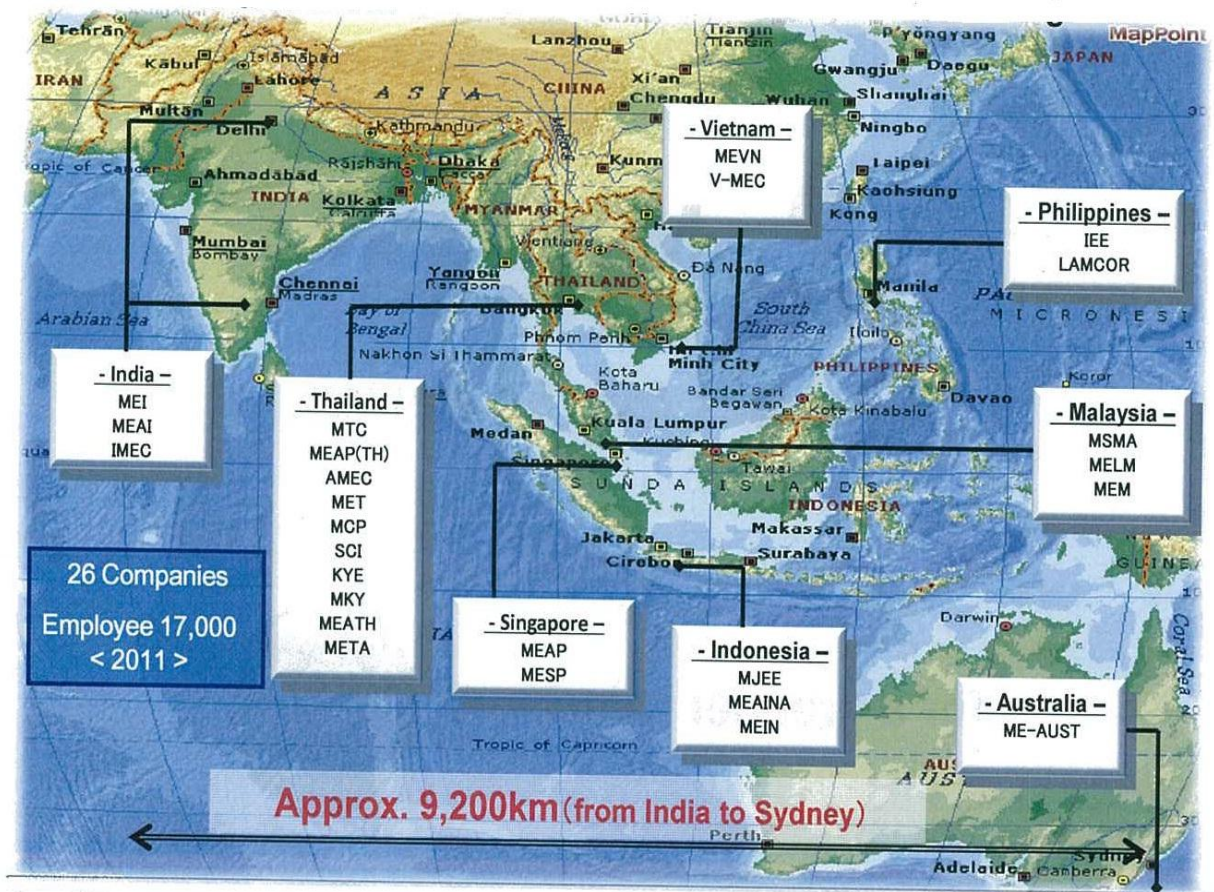
Figure 4.2 Separation of Mitsubishi Electric in Asia-Pacific

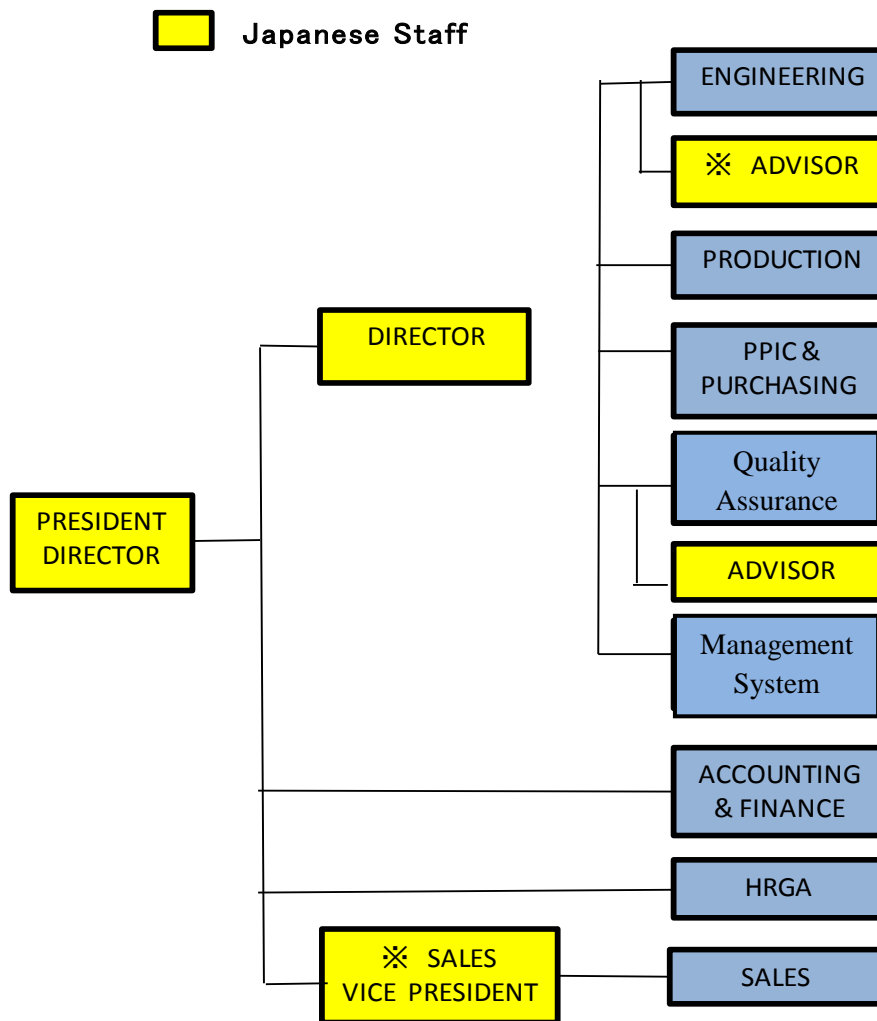**4.4 Structure of PT. Mitsubishi Electric Automotive Indonesia**

Figure 4.3 Organization Structure of PT. Mitsubishi Electric Automotive Indonesia

The yellow signed is the Board of Director of PT. MEAINA. The Board of Directors are sent directly from MELCO, Japan together with Quality and Engineering Advisor. There are eight departments in PT MEAINA and each department is led by one manager

For the detail of the job, President Director is responsible for the whole system, accounting, HRGA and Sales. The Director is responsible for Engineering, Production, PPIC and Purchasing, QA, and MS department activities. Quality advisor

is responsible for Technical Support and Local Manpower Development. Sales advisor is responsible for Strengthening Customer Relation and engineering advisor is responsible for stator Technical Support. The rest of departments are responsible for their own job description based on the name of department.

There are two categories of employee at PT MEAINA; contract and permanent. For detail, there are 181 contracted employees and 401 permanent employee of PT MEAINA.

4.5 Product of PT. MEAINA

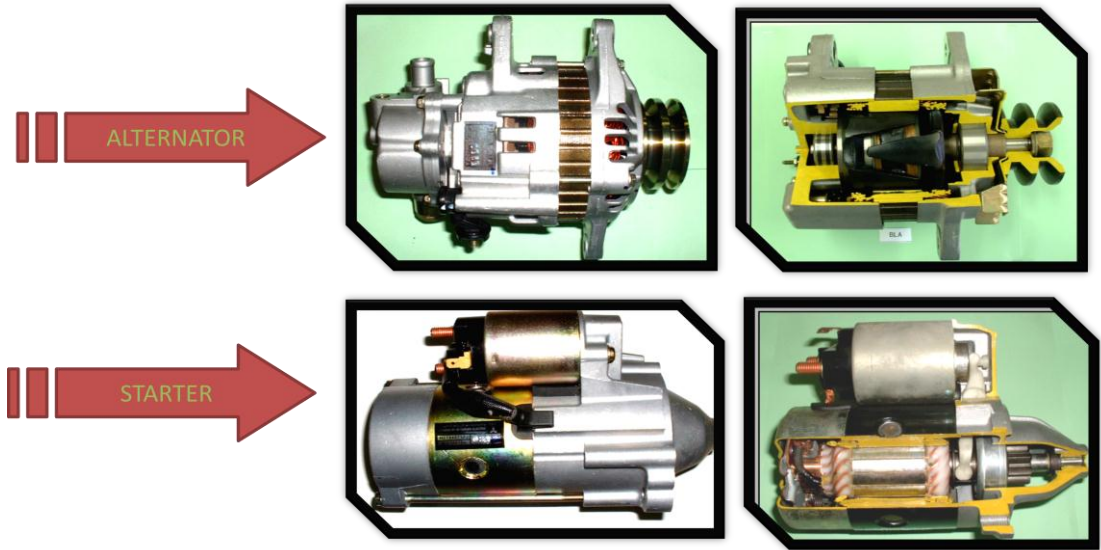### 4.5.1 Assembly Product

Figure 4.4 Assembly Product of PT. MEAINA

Above is the assembly product produced by PT. Mitsubishi Electric Automotive Indonesia. There are two assembly lines at PT. Mitsubishi Electric Automotive Indonesia; Starter assy and Alternator assy. Rotor is used as the source of electricity

of automobile and starter is used to start the engine of automobile. This product is usually mounted at the car which registered as MEAINA's customer.
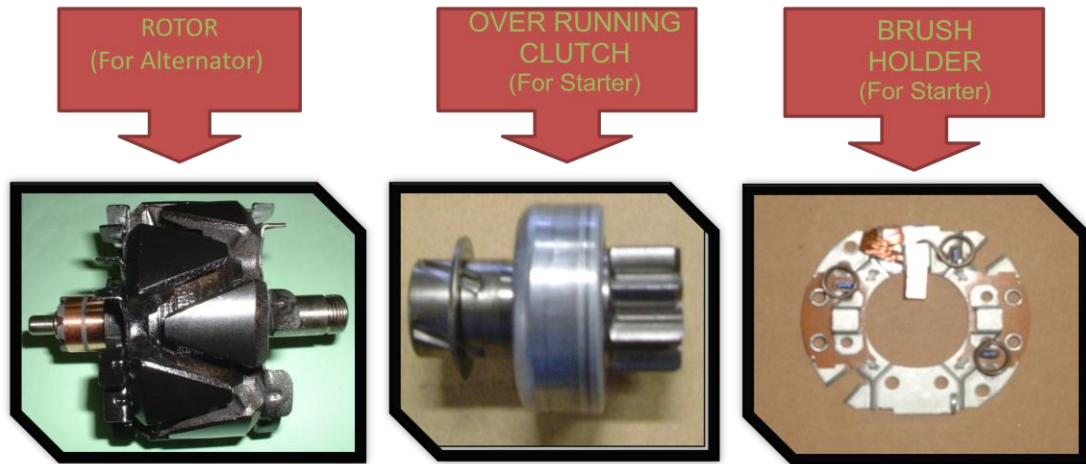
4.5.2 Part Manufacture Product

Figure 4.5 Part Manufacture Product of MEAINA

Above is the parts manufacture produced by PT. Mitsubishi Electric Automotive Indonesia consisting of Rotor for alternator, over running clutch for starter, and brush holder for starter.
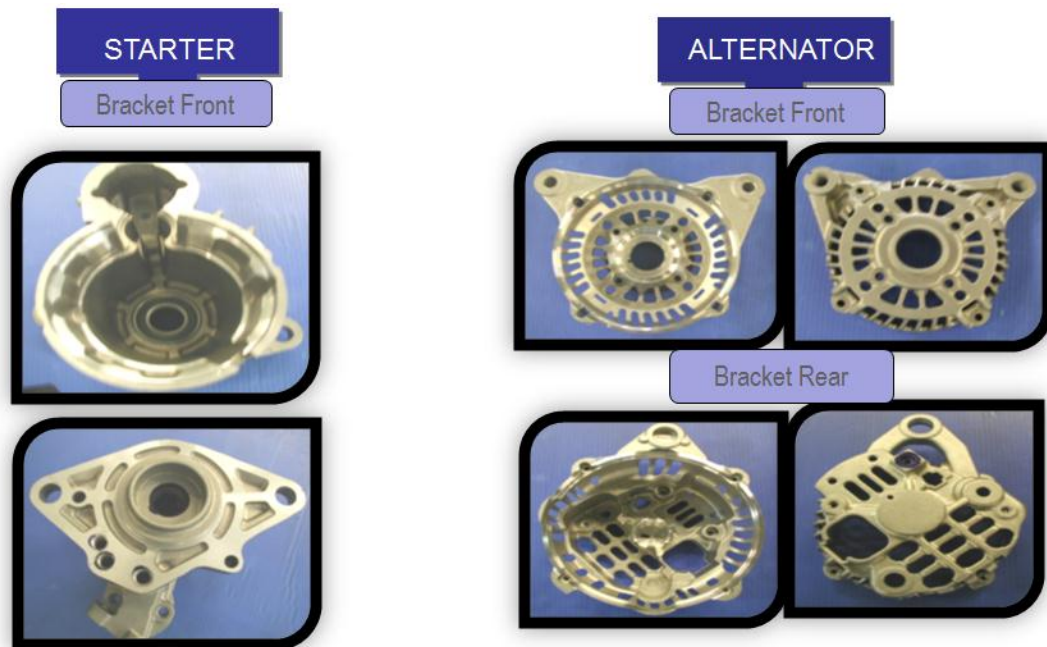
Figure 4.6 Part Manufacture of PT. MEAINA

PT. Mitsubishi Electric Automotive Indonesia also produce brackets categorized as bracket front and bracket rear. The brackets itself is made for Starter and Alternator.

4.6 MEAINA Customers

There are two categories of MEAINA customers, the first one is domestic customers and second is export customers. The domestic customers are;

1. MKM / KTB (Mitsubishi)
2. SIM (Suzuki)
3. HPM (Honda)
4. NMI (Nissan)
5. ADM (Daihatsu)

Not only domestic customer, the foreign customers of MEAINA are:

1. MELCO   (Japan)
2. META   (Thailand)
3. LAMCOR   (Philippines)
4. MEAA   (USA)

5. MEAC   (Czech Rep.)
6. APM-AE   (Malaysia)
7. MESAC   (China)
8. MEAI   (India)
9. MEAB   (Brazil)
10. MEUF   (France)

Figure 4.7 Customer of MEAINA

4.7 Certification of MEAINA

PT. Mitsubishi Electric Automotive Indonesia has fulfilled the certification for ISO/TS 16949 and recertified in 2012. It is standardization for technical specification aimed at the development of a quality management system that provides continual improvement, emphasizing defect prevention and reduction of variation and waste in the supply chain.

PT. MEAINA is also certified for ISO 14001 and recertified in 2010. This certification concern on the criteria for environmental management, meaning that MEAINA has put an effort to be environmentally-friendly.

Figure 4.8 Certification Obtained by MEAINA

CHAPTER V
DATA COLLECTION AND ANALYSIS

5.1 Plan

In this step, several collections of data are done to plan and identify the type of NG that must be improved later. This step is necessary before as the initial step of running the project. In the beginning, there will be brief explanation of flow process of daily production at PT. MEAINA to depict the product process of PT. MEAINA. Then, problem main cause analysis will be decided, continued by main course and together with the improvement plan.

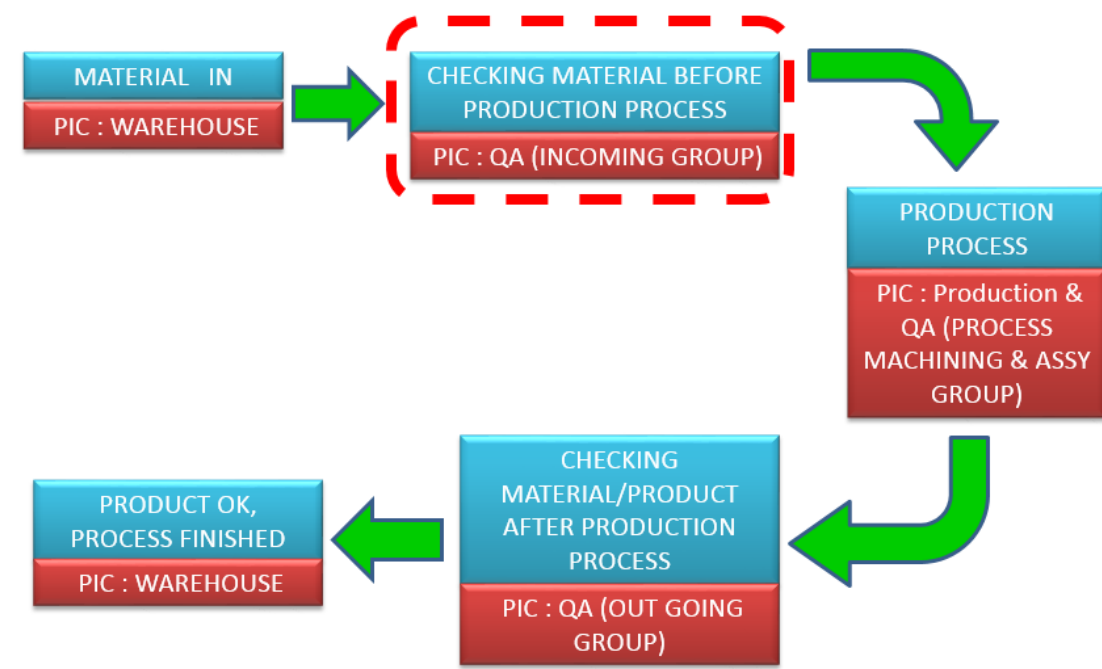**5.1.1Flow Process of Daily Production at MEAINA**

Figure 5.1 Flow Process of Daily Production

The figure above shows flow process of daily production at PT. Mitsubishi Electric Automotive Indonesia (MEAINA). Since the topic of this study is to prevent the flow of defective bracket at incoming area to machining process, then the analysis must be began from the very first time blank bracket arrive to PT. Mitsubishi Electric Automotive Indonesia until those blank brackets are machined. As this study focuses on the NG blank bracket caused by supplier and have been the concern of quality incoming section, the area of study will only the stuffs that involve quality incoming section and anything related with it to analyze the NG caused by supplier.

When the blank brackets produced by suppliers arrive in PT. Mitsubishi Electric Automotive Indonesia, that brackets will be taken care by warehouse. Warehouse section itself has responsibility to keep the incoming blank bracket before the brackets are further processed. After the brackets are kept by them, there will be another section responsible for that blank bracket before it comes to machining process. It is quality incoming team.

As explained above, quality incoming group will handle the bracket before it comes to machining process. This is a very essential part of this study since this process has started to involve quality assurance team, so the quality assurance process at PT. Mitsubishi electric Indonesia begin here. Basically, the quality incoming inspector will check the blank bracket produced by supplier visually. The inspectors usually take some samples of bracket on the surface and check the abnormality visually. The sample taken by quality incoming inspector is usually the bracket placed on the surface of rack because one rack consist of hundreds bracket. In case the inspector finds abnormality at the samples they inspect, so one lot of blank bracket will be rejected and supplier will have to repair it. Once the quality incoming team finished inspecting the blank bracket, the blank bracket that pass the incoming quality inspection will be proceed to the next process which is machining process and is considered as work in process.

After finish with the incoming quality process, the next process is off course machining process. The brackets that have passed the incoming quality inspection will be machined using TC and NCLA machine. In this process, there will be drilling process and etc. During the machining process, quality assurance team will not take their hands out of this process. The machining section of quality assurance team will be assigned to inspect and watch the machining process at production lines. In case abnormalities are found during the machining process, that lot of production can be rejected by quality assurance team. The inspection process usually involves the dimension of bracket after the machining process. The dimension of bracket can somehow be changed after the machining process. It can be caused by the machine activities or other external factors such as problem with measuring devices and etc. The machining process of quality assurance team will also work using Coordinate Measuring Machine (CMM) to ensure the dimension of bracket still within its tolerance and specification established before. Basically, the department in charge for this process is production department. But, to ensure the quality of products produced, the quality team must also be involved since the quality assurance must be applied in every single step of manufacturing process. Thus, the cooperation between Quality Assurance department and Production department is essential to support the production process.

After done with the machining process, there is still a further process of ensuring quality of product. The next quality team assigned is outgoing quality team as the next process is called quality outgoing inspection. This outgoing team is responsible for inspecting and checking the bracket after machining process by visual. Since the visual NG can sometimes be existed after machining process, it is the responsibility of outgoing team for ensuring the quality of product free of visual NG. The difference between machining section and outgoing section is the types of NG they inspect. When machining section focus on dimension NG, outgoing section will focus on visual NG. Outgoing quality inspection is the last process of quality assurance as it's

named outgoing, this process is to ensure the quality of product before it is shipped to customers.

After finish with the quality assurance process, the products are ready to be delivered to customers and located at the warehouse as the product is considered good. The warehouse department will take care of the storage of product before it is shipped to customers. Based on the figure above, the focus of this study is only at checking material before production process done by quality incoming section.

5.1.2 Monitoring Process

To find what kind of NG types usually happen at incoming area, the monitoring is done together with the data collection about the defect. The first, analysis is tried to be done to find whether the NGs are mostly caused by Supplier or mostly caused by MEAINA's machining process.

Table 5.1 Data Claim

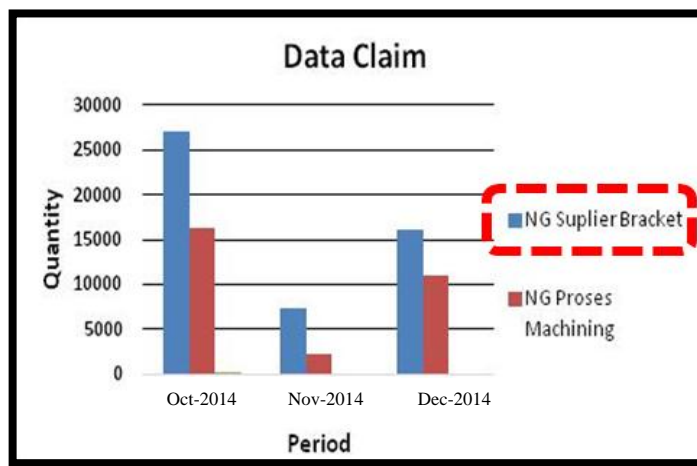| No	Data claim of bracket	Period			Total
		Oct-14	Nov-14	Dec-14	
1	NG supplier bracket	26,984	7,341	16,163	**50,488**
2	NG machining process	16,335	2,141	11,028	**29,504**

Figure 5.2 Data Claim Report at the End Of 2014

At first, the monitoring process is done through figuring out which NG is more dominant, whether it is NG caused by supplier or NG caused by machining process of PT. Mitsubishi Electric Automotive Indonesia. The data collection is done for the NG data at the end of 2014 because for that period, the Scrap Production Report (SPR) has been closed so the data can be easily utilized.

Looking at the data, there are fluctuations of amount of NG for NG caused by supplier. For three last month at the end of 2014, October shows the highest rate of NG, then significantly decrease on November and increase again on December. The pattern happens at NG data caused by machining process. But, the increasing and decreasing are not really significant as shown at the table and figure.

Looking at the data again, it is clearly proved that the NG caused by supplier is way bigger than the NG caused by machining process of MEAINA. The total NG caused by supplier for last three months of 2014 is 50,488 pieces and it is only 29,504 pieces of defective bracket caused by machining process. The difference of 20,984 pieces shows a very significant difference for those two kinds of NG. Thus, that is why the focus of this project is to minimize NG caused by supplier as it gives the biggest impact and it causes the biggest loss.

5.1.3 Finding the Most Defective Line

Table 5.2 NG Existence for the Last Semester of 2014

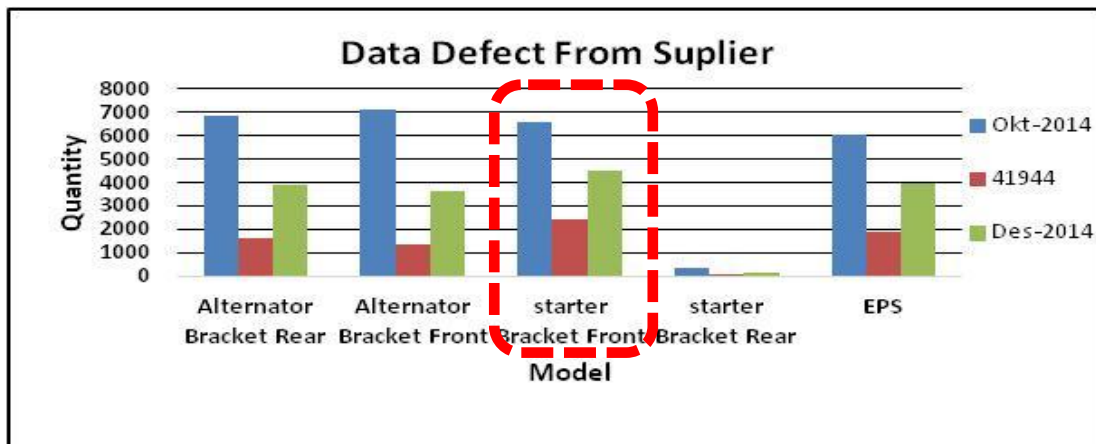| No	Model	Period			TOTAL
		Oct-14	Nov-2014	Dec-14	
1	Alternator Bracket Rear	6,879	1,609	3,887	12,375
2	Alternator Bracket Front	7,119	1,355	3,624	12,098
3	Starter Bracket Front	6,593	2,398	4,521	13,512
4	Starter Bracket Rear	331	80	135	546
5	EPS	6,062	1,899	3,996	11,957

Figure 5.3 Data Defect from Supplier for Each Line Model

The data above shows the NG brackets flow to lines, meaning that mistake happen at incoming quality inspection so that the defective bracket can flow to machining process. In general, there are five categories of machining line at PT. MEAINA. They are Alternator Bracket Rear, Alternator Bracket Front, Starter Bracket Front, Starter Bracket Rear, and Electric Power Steering (EPS).

Based on the data recorded still on the same period (the end of 2014) among those lines category, the highest number of defective bracket exist at Starter Bracket Front (SBF) line and the lowest is at Starter Bracket Rear (SBR) line. Based on the table, it can be seen that Starter Bracket Front always contributes the highest number of NG existence on October until December 2014, even the 1st highest on November and December 2014. The data also shows that the NG is really minimized on the November, meaning that the incoming quality inspector did a really good job during that period.

Regarding to the recorded data above, so it can be concluded that the most defective lines caused by NG's supplier is Starter Bracket Front. Thus, the focus of this project is at Starter Bracket Front line because it is known that the biggest loss caused by supplier's NG happen at this line.

Since the most defective line has been established, the collection of data for the next step is done at Starter Bracket Front line and the next job is to find the data about

what type of defect does mostly happen at Starter Bracket Front Line by analyzing and collecting the data of defect caused by supplier then establish what kind of defect that have to be minimized or even removed at this stage before continuing to the next stage of removing or minimizing defect. This step is done based on the continuous process of improvement in purpose to minimizing defect as the root of loss at PT. Mitsubishi Electric Automotive Indonesia.

5.1.4 Finding the Highest Type of NG Existence

Table 5.3 Number of NG Based On NG Type

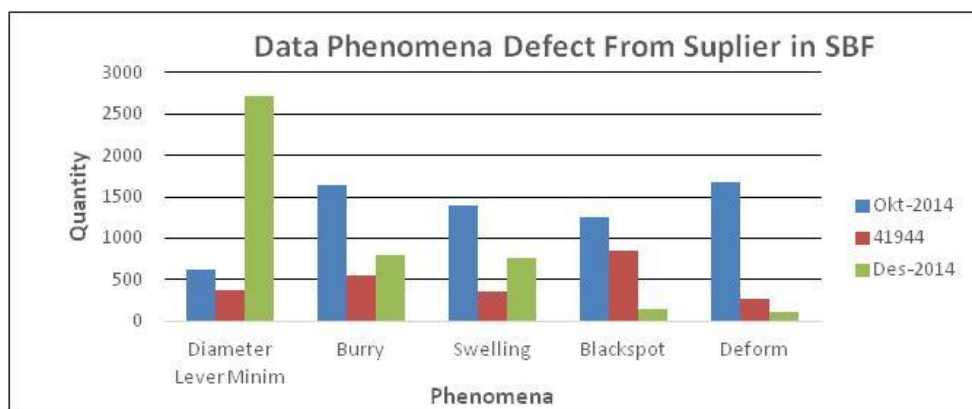| No	Phenomena	Period			TOTAL
		Oct-14	Nov-2014	Dec-14	
1	**Small diameter lever**	621	381	2,709	3,711
2	**Burry**	1,650	543	801	2,994
3	**Swelling**	1,396	352	757	2,505
4	**Blackspot**	1,251	849	149	2,249
5	**Deform**	1,675	273	105	2,053

Figure 5.4 Data Phenomena Defect From Supplier at Line SBF

After getting the information whether the NGs are mostly caused by suppliers or caused by process at PT. Mitsubishi Electric Indonesia and based on the data it is proved that NGs caused by supplier are much bigger in comparison with NG caused

45

by MEIANA Process. The next step that should be done is figuring out what type of NG that mostly caused by suppliers.

As the concept of continuous improvement, the type of NG caused by supplies that must be overcome must go to the highest type of NG existed recently. Observation through data of NG product recorded is done. Recording data of NG product is done on the period of the end of 2014 as what have been done at the observations before.

There are five common phenomena observed as these phenomena mostly happen and flow to line Starter Bracket Front. The type of NG that usually happen at Starter Bracket Front line are diameter lever minim, burry, swelling, black spot, and deform. As shown at the data on the period October until December 2014, the difference between one type of NG to the other type of NG is not really significant each other. The numbers are around 2,000 pieces of each NG type except, there is one type of NG shows a little bit more significant, it is small lever diameter. The number of small diameter lever happen at Starter Bracket Front line on the period October 2014 until December 2014 is 3,711 pieces. It is simply higher among the other types of NG at Starter Bracket Front line.

Based on the data above, it is clear that the next focus of this project is to eliminate the existence of small diameter lever caused by suppliers that flow to Starter Bracket Front line as this type of defect contribute the highest type of NG to Starter Bracket Front line.

Small diameter lever is type of NG that can cause many problems to MEAINA's products. Mostly, the problem will start to arise when the process have reached the assembly line. In the assembly process, the brackets that have been machined will be assembled in the assembly line together with the other components of starter because this problem observed happen at Starter Bracket Front. If the diameter lever considered small and is not based on the specification established, the bracket will not be able to be assembled and together with the other components so that the bracket will be considered NG.
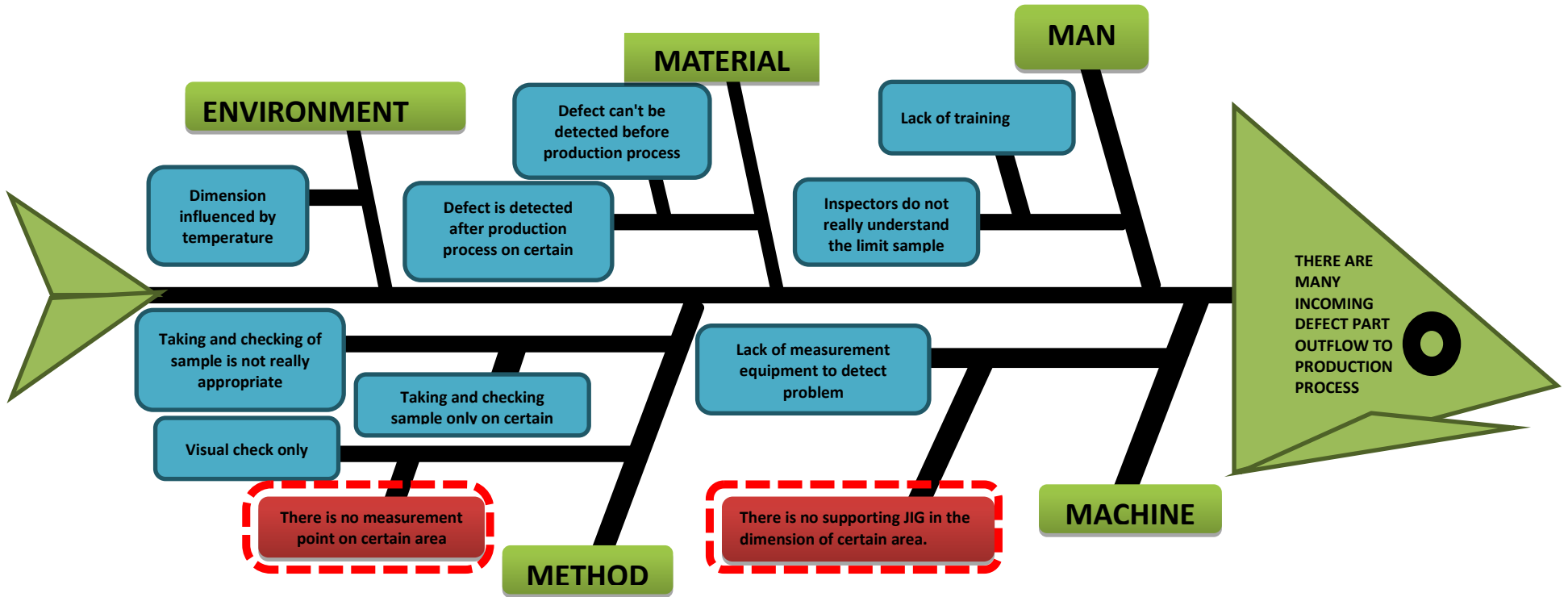
5.1.5 Problem Factor Analysis

Figure 5.5 Fish Bone Diagram

The diagram contains the following elements:

ENVIRONMENT
- Dimension influenced by temperature

MATERIAL
- Defect can't be detected before production process
- Defect is detected after production process on certain

MAN
- Lack of training
- Inspectors do not really understand the limit sample

METHOD
- Taking and checking of sample is not really appropriate
- Taking and checking sample only on certain
- Visual check only
- There is no measurement point on certain area

MACHINE
- Lack of measurement equipment to detect problem
- There is no supporting JIG in the dimension of certain area.

Head: THERE ARE MANY INCOMING DEFECT PART OUTFLOW TO PRODUCTION PROCESS

Figure above shows the fishbone diagram involving the 4M + 1E analysis; Man, Machine, Material, Method, and Environment. This tool is part of Quality Control 7 tools and usually uses to analyze the effect of one main cause as being done through this project. The analysis to find the root cause of this problem is done through analyzing those five important aspects. Maachine, material, method, and environment have played an important role on this project. The purpose of this fishbone diagram is actually only to see and analyze how far those suspected factors on this cause and then will be anlyzed and the effect of each factors to this main cause of incoming defects that flows to machining process.

5.1.5.1 Man

As it shown in the fish bone diagram, man factor has been one of the caused of this problem. There are some branches of the bone as it shows the cause that is considered as man factor. As it called man factor, of course any cause of the problem will refer to Human whether activity or ability to the related job.

The very first problem suspected refer to the inspector. The quality incoming inspector is the man behind the mask as they are the first one who deal with the incoming bracket before going to the machining process. As they are the first team who face the bracket, they might have known well the procedure of inspecting the incoming bracket, in this case, it is limit sample that really matters in this case.

Some of the inspector may not really understand about the application of the limit sample. Some of the inspector may be the new inspector since the turnover of this a quiet high, so the inspectors may change oftenly. This has been a quiet big trouble for the quality incoming section. Moreover, limit sample is changing document that sometimes can be changed based on the updated rules and procedure after conisdering the needs of customer and establishment from Mitsubisihi Electric Corporation as the mother of Mitsbusihi Electric Automotive Indonesia.

For this problem, training must be really needed by the inspectors. The inspectors must given a training about the application of limit sample moreover if the limit sample has changed for several reason. Here, again the application of Horenso is really needed when as the main factor of a successfull flow of communication. The training must be done as immediate as possible to the new inspector when the limit sample is updated to ensure the understanding of inpector in letting the bracket go through the machining process.

5.1.5.2 Machine

The next important aspect is machine. Machine has been a very important tool that support the human's activities. Since the application of measurement have instensly been done at PT. Mitsubishi Electric Automotive Indonesia, then the needs of machine is really necessary. The high usage machine ability have been one aspect why this aspect must be really considered.

The product produced by PT. Mitsubishi Electric Automotive Indonesia needs precision a lot. To ensure the precison, the usage of measurement devices is really needed especially for the quality inpectors. In current condition, there is no measuring devices used by quality incoming inspectors. This measurement tools such as Coordinate Measuring Machine, calipers, or dial are mostly used by quality machining process team.

Moreover, the current condition shows that there is no such supporting measurement devices to detect the diameter lever problem which is considered minim. Thus, to detect the small diameter lever, the inspector must do something with the measurement tools to check whether diameter lever is match the specifiction as stated at the limit sample or not. By the help of this too, it is expected that the small diameter lever can as soon as possible be detected by the incoming quality inspector to prevent the NG bracket flow to the machining process.

For this case, the new supporting jig is necessary to overcome this problem. The jig can be designed based on the area will be measured and the inspector can utilize the jig to check the accuracy of certain area.

5.1.5.3 Method

The next important is the apllied method. In inspecting the blank bracket, some method have been done to ensure the quality of blank bracket in inspection process. So the existing method must now be a little bit improved.

For the case of diameter lever which is considered minim, it is really dimentional. It is known that the existing method of checking is only by visual. It is also known that the method of visual checking only utilize the ability of human eyes. Human eyes of course can not detect the difference of inches, it is even still hard to differ between 1 cm and 2 cm without any support from supporting tools. Thus, to detect the problem of small diameter lever, it can not be done only by visual check. The measurement point on certain area must also be done to ensure the diemeter is match to the limit sample. Any kind of supporting tools considered as measuring devices must be utilized to solve this problem. So, the lever area must checked using measuring devices.

The next problem related to the method is the sample taking process. It is about how the sample are chosen by inspector. This sample will later be inspected whether by visual or by measuring devices. The method of taking the sample may not be really appropriate. The fact is the sample taken by operator is only a small amount of the whole sample in one rack consisted of hundreds bracket. Moreover, the sample taken by inspector is only the blank bracket located on the surface because that is the only part that can be reached by quality incoming inspector. Since the inspectors have only taken several blank bracket located on the surface in one rack, it is wondered whether the quality of blank bracket inspected by operator can wholely depict the quality of blank bracket in one rack. This has been a very big question and this problem has

been suspected to be one of the cause of the flow defective bracket to the machining process.

5.1.5.4 Material

In terms of material, the NG is sometimes can not be detected before the machining process when it is supposed to be detected before the machining process. As the material of bracket is casted iron, so it is a little hard to inspect the NG using eyes only especially for the NG categorized as dimension. Another example of NG that is usually detected after machining process is blow hole. This has been a problem since those defects are supposed to be detected before machining process by quality incoming inspector, not after or while machining process by quality machining process inspector.

5.1.5.5 Environment

The last factor considered to be the cause of defective bracket flow to the machining process is the environment. This factor appears to be external factor that may have affected the quality of bracket especially the dimension of the bracket.

It is known that the material that the bracket made of is a casted iron. It is known that iron may be swelled as the effect of temperature. This swelling process is caused by the temperature around at the environment of the bracket. The swelling process can change the dimension of bracket as well. How far the dimension change is based on the swelling coefficient of the material. The temperature around the bracket can sometimes be extremely hot, or sometimes become extremely cold because the saving treatment of the blank brancket is not really exclusive as it is only located in the warehouse area. This what makes the environment of the blank bracket especially the temperature can effect the dimension of bracket as the swelling effect. The swelling

may lead the dimension of bracket out of the dimension soecification as stated in the limit sample.

5.1.6 Finding the Dominant Cause of NG

Table 5.4 Quantity of NG Caused by Determined Factor

No	Main Problem	Quantity	Percentage	Qty Cummulative	Percantage Cummulative
1	There is no supporting jig in the dimension of certain area	1856	50%	1856	50%
2	There is no measurement point on certain area	928	25%	2784	75%
3	Defect is detected after production process on certain area	451	12%	3235	87%
4	Lack of training	311	8%	3546	95%
5	Temperture affect dimension	165	5%	3711	100%

Afer finish with the fish bone diagram analyzsis, some of the branch of the bone as the causes of the problem are further anlyzed. This project appear to analyze the NG bracket caused by small diameter lever through the cause of the NG itself. The points taken are how many small diameter lever caused by unavailability of supporting jig in the dimension of certain area, how many Small diameter lever of bracket caused by unavailability of measurement point on certain area, how many Small diameter lever of bracket is detected after production process, how many Small diameter lever of bracket caused by unoptimized training for inspector, and how many Small diameter lever of bracket caused by the influence of temperature to the dimension of bracket.

The result is quantity of Small diameter lever of bracket together with the cause can be obtained. As the result, some of the dominant causes can be found. As it is shown at the data, the cause of Small diameter lever of brackets mosly come from unavailability of supporting jig in the dimension of certain area, in this case it is the diameter lever. Then, it is followed by the unavailability of measurement point on certain area. Then followed by the defect detected after production process, unoptimized training, and the lowest cause of NG is the change of dimension affected

by temperature. The cummulative of the NG is 100% meaning that the whole tested NG bracket are inspected and the cause of NG is analyzed and judged. This is the NG bracket that are machined by Starter Bracket Front line as found as the most defective line through the execution of this project. After finding the dominant cause the main problem, so the next focus of this project is to improve and minimize the NG bracket at diameter lever area through providing dimension jig on certain area and add the measurement point on certain area, in this case it refers to the diameter lever area.
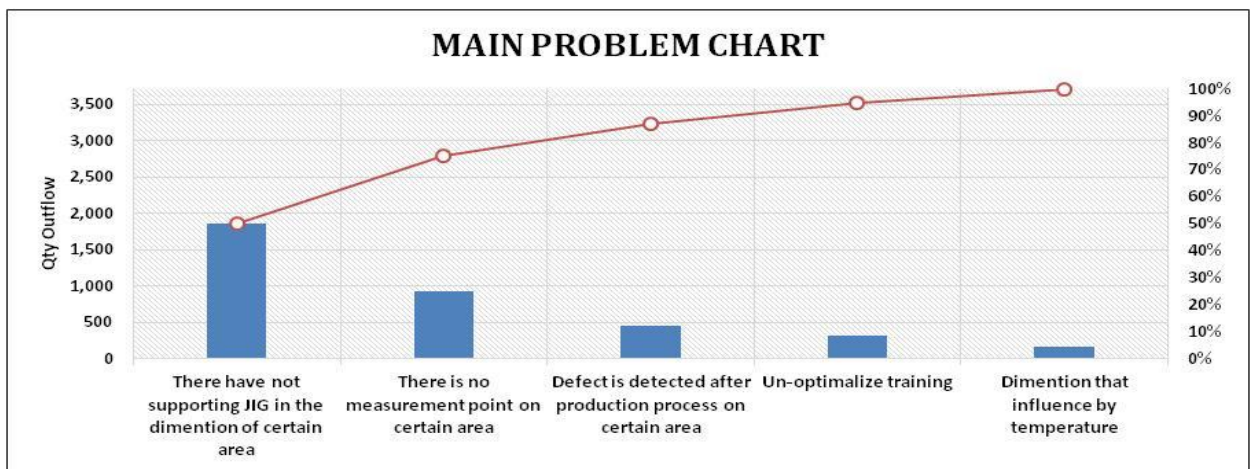
Figure 5.6 Main Problem Chart

5.1.7 Improvement Plan

After determining what kind of NG that will be focused on, and what is the defective line together with the cause analysis using fish bone diagram, the next step is the improvement plan. This step has been very essential as this is the main action of the project to eliminate the NG bracket.

Before going the improvement action, it is better to prepare the action using 5W + 1H analysis first involving what, who, where, when, why, and how.

Table 5.5 5W + 1h Analysis

What	Optimizing inspection process at incoming area
Who	Inspector QA
Where	Incoming area and measurement room
When	March 10, 2015 – June 10, 215
Why	Many defect categorized small diameter lever flow to Starter Bracket Front line
How	Optimize inspection process at Strater Bracket Front Line 1. Adding check point at diameter lever area to inspection report 2. Using pin gauge for checking the diameter lever area 3. Verification using Coordinate Measuring Machine when the abnormality is found at three measurement points ; upper, center,bottom

Talking about what, it is surely about what is the focus of this project. It is determined already before that the focus is to optimizing inspection process at incoming area to reduce the number of NG bracket caused by suppliers to machining process. The "who" is the one who will apply the improvement action later. In this case, QA inspector will be responsible to apply the improvement plan. The location of improvement is at incoming area and measurement room. The improvement is done from March 10 until June 10, 2015. The last is how does the team do the improvement. After looking at existing NG bracket data, it is determined that the focus will be on eliminating NG at diameter lever area. The, it will be done by adding check point at diameter lever area to inspection report, utilizing designed pin gauge for checking the diameter lever area, and running the verification using Coordinate Measuring Machine (CMM) when the abnormality is found at three measurement points; upper, center, and bottom

5.2 Do

As the planning processes are finished, the next step to do is the "do" step. Here, the implementation of project is done through the solution of the main problem found at planning processes. The "do" process is of course the improvement action.

5.2.1 Improvement Action

5.2.1.1 Inspection Process before Improvement
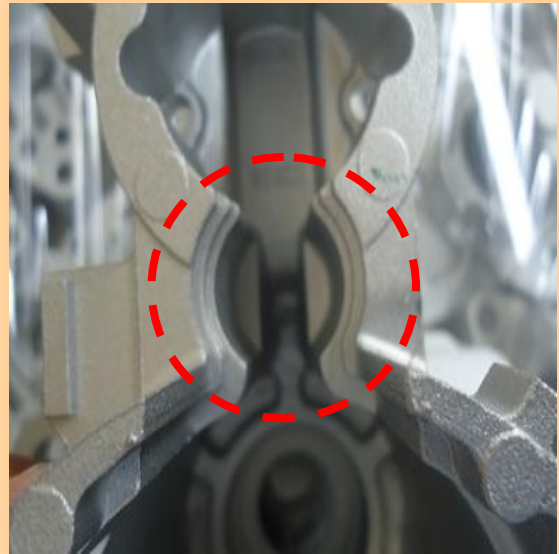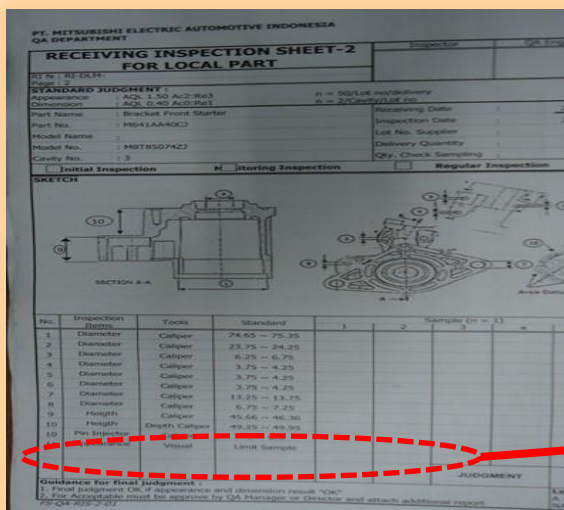

Figure 5.7 Visual Checking

Figure 5.8 Position Checking

Figure 5.9 Check sheet before

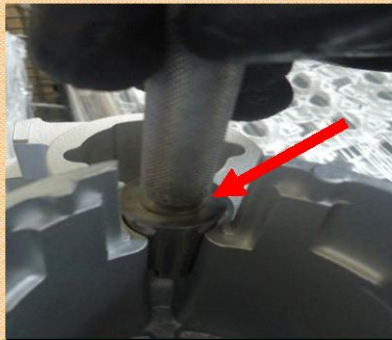There is no check point for diameter lever area

The pictures above shows the inspection process before improvement. At the beginning, the quality incoming inspector check the incoming bracket only by visual using eyes. This is the common inspection method that have usually been doing by the quality incoming inspectors. For the position checking, the diameter lever is only inspected by visual by the quality inspectors. The existing check sheet showing that there is no point for diameter lever checking.

Based on the fact above, it is clear that the diameter lever is something impossible to be inspected by visual only since it is categorized as dimension and need to be measured. Human eyes has a very limited ability to play with dimension especially in inches or mili meter. So, it is impossible to check on the diameter lever by visual only. After that, one point of diamter lever area must be put on the checksheet.

5.2.1.2 Inspection Process after Improvement

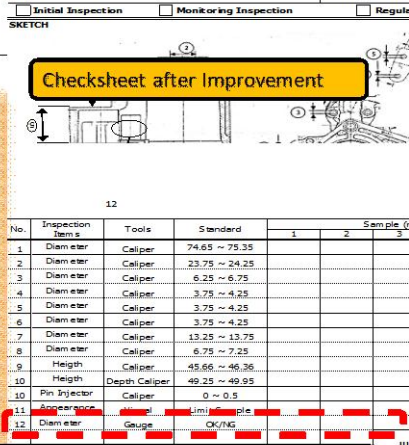Figure 5.10 Inspection Process after Improvement

Looking at the weaknesses at the before improvement process, some aspects must be improved. There are three actions done through this project to eliminate the NG at diameter lever area.

The first thing is at the check point of diameter lever. The conditionn before improvement shows that the diameter lever is out of inspector's checking because it is only checked by visual only. Because of the limited ability of human eyes, there must be supporting tools to check the diameter lever. So, gauge is utilized to check this diameter lever point. The specification of the gauge is based on the model of bracket itself. So, the gauge will be designed to macth with the diameter lever. If the gauge is go, so the blank bracket can pass through the machining process.
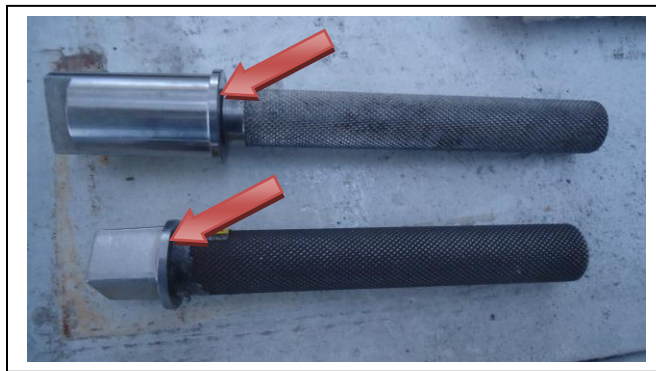
Figure 5.11 Picture of the Gauge Used

Above is the specification of the gauge used to check the diameter lever area. By using this gauge that is matched with the spesification of the drawing, it is expected that diameter area of bracket that pass through machining process will always be suitable with the specification stated on the drawing.

The gauge itself is consisted of two side, Go side and No Go side. The diameter lever is considered go if the the gauge can fit smoothly into the diameter lever without any obstacle and properly touched the insertion limit (look at the arrow). In case the gauge is not properly fit and does not touch the insertion limit, so the bracket is considered NG.s

The next process is verification using Coordinate Measuring Machine (CMM). The purpose of verifiying the dimeter lever using Central Measuring Machine (CMM) is to ensure the diameter of lever area is match with the specification because sometimes, the abnormality can happen. When the abnormality on diameter lever happen, the inspector will directly bring the bracket to measurememnt room for verification using Coordinate Measuring Machine (CMM).

Figure 5.12 Picture of Coordinate Measuring Machine (CMM)

The last is improving the check sheet. Since the point for diameter lever has not yet been put on the check sheet, so the improved check sheet must provide this point. The effect of this is to ensure that when the inspectors do the inspection, they must inspect and ensure this diameter lever point also before letting the blank bracket pass through to the machining process.

PT. MITSUBISHI ELECTRIC AUTOMOTIVE INDONESIA
QA DEPARTMENT

RECEIVING INSPECTION SHEET-2 FOR LOCAL PART			Inspector	QA Engineer	QA Manager
RI No : RI-DLM-2-RV51					
Page : 2					

STANDARD JUDGMENT :
Appearance : AQL 1.50 Ac2:Rc3   n = 50/Lot no/delivery
Dimension : AQL 0.40 Ac0:Rc1   n = 2/Cavity/Lot no

Part Name	: Bracket Front Starter	Receiving Date	:
Part No.	: M641AA40CJ	Inspection Date	:
Model Name	:	Lot No. Supplier	:
Model No.	: MST850742J	Delivery Quantity	:
Cavity No.	:	Qty. Check Sampling	:

☐ Initial Inspection   ☐ Monitoring Inspection   ☐ Regular Inspection   ☐ Others

SKETCH

No.	Inspection Items	Tools	Standard	Sample (n = 1)					$\bar{\bar{x}}$	Judge
				1	2	3	4	5		
1	Diameter	Caliper	74.65 ~ 75.35							
2	Diameter	Caliper	23.75 ~ 24.25							
3	Diameter	Caliper	6.25 ~ 6.75							
4	Diameter	Caliper	3.75 ~ 4.25							
5	Diameter	Caliper	3.75 ~ 4.25							
6	Diameter	Caliper	3.75 ~ 4.25							
7	Diameter	Caliper	13.25 ~ 13.75							
8	Diameter	Caliper	6.75 ~ 7.25							
9	Height	Caliper	45.65 ~ 46.35							
10	Height	Depth Caliper	49.25 ~ 49.95							
10	Pin Injector	Caliper	0 ~ 0.5							
11	Appearance	Visual	Limit Sample							
12	Diameter	Gauge	OK/NG							
						JUDGMENT		ACC	OK	NG

Guidance for final judgment :
1. Final judgment OK if appearance and dimension result "OK"
2. For Acceptable must be approve by QA Manager or Director and attach additional report

Legend :
A : Applicable
NA : Not applicable

Figure 5.11 Picture of New Check Sheet used by Inspector

1 Inspector Checking by Visual for appearance on all position
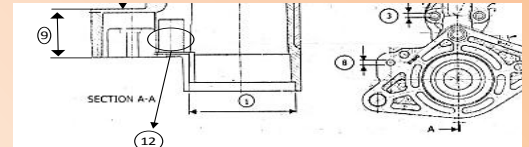
No.	Inspection Items	Tools	Standard	Sample		
				1	2	
1	Diameter	Caliper	74.65 ~ 75.35			
2	Diameter	Caliper	23.75 ~ 24.25			
3	Diameter	Caliper	6.25 ~ 6.75			
4	Diameter	Caliper	3.75 ~ 4.25			
5	Diameter	Caliper	3.75 ~ 4.25			
6	Diameter	Caliper	3.75 ~ 4.25			
7	Diameter	Caliper	13.25 ~ 13.75			
8	Diameter	Caliper	6.75 ~ 7.25			
9	Heigth	Caliper	45.66 ~ 46.36			
10	Heigth	Depth Caliper	49.25 ~ 49.95			
10	Pin Injector	Caliper	0 ~ 0.5			
11	Appearance	Visual	Limit Sample			
12	Diameter	Gauge	OK/NG			

3 Write the result of checking Diameter Lever on new check sheet (OK / NG)

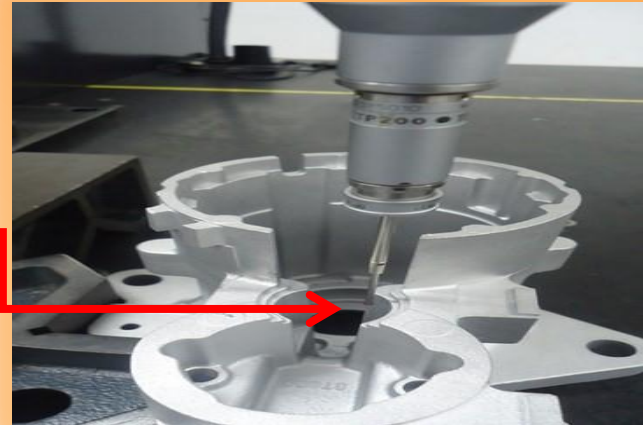**2** Inspector Checking by Pin Gauge at Diameter Lever area.

Detail Point Checking

Position checking by Pin Gauge

Figure 5.12 New Inspection Process after Improvement

Inspector Measuring By CMM at Diameter Lever area for verification when found abnormality condition.

Position measurement by CMM

Result of measuring by CMM at Upper, Center and Bottom position. (Speck 21± 0.4 Upper position, 20+0.3/0 Bottom position)

Figure 5.13 New Inspection Process by using Coordinate Measuring Machine

5.3 Check

Finish with the "do", the next step is check as the evaluation of the improvement result. Below is the evaluation of the improvement result.

5.3.1 Evaluation

Table 5.6 NG Quantity before Improvement

No	Phenomena	Qty	Qty Cummulatif	Percentage	Percentage Cummulatif
1	Diameter Lever Minim	3,711	3,711	27%	27%
2	Burry	2,994	6,705	22%	49%
3	Swelling	2,505	9,210	19%	68%
4	Blackspot	2,249	11,459	17%	85%
5	Deform	2,053	13,512	15%	100%

Table 5.7 NG Quantity after Improvement

No	Phenomena	Qty	Qty Cummulatif	Percentage	Percentage Cummulatif
1	Burry	1.992	1.992	32%	32%
2	Swelling	1.789	3.781	29%	61%
3	Deform	1.221	5.002	20%	81%
4	Blackspot	1.211	6.213	19%	100%
5	Diameter Lever Minim	0	6.213	0%	100%

After doing the improvement process, the next step is to compare the NG data before improvement and the NG data after improvement. It can clearly be seen that the improvement action works in eliminating the NG brackets that flow to machining process at Starter Bracket Front Line for NG categorized as small diameter lever.

The before improvement data shows that small diameter lever is the highest type of NG that exist and flow to machining process with the contribution of 27% of total NG of blank bracket. After improvement, it is shown clearly on the data that the improvement has been successfully done. The after improvement data shows that the small diameter lever can be overcame. From contributing 27% of defect, the after improvement data state that the small diameter lever contribute "0" pcs or 0%. It changes from the highest percentage of NG to the lowest percentage of NG.
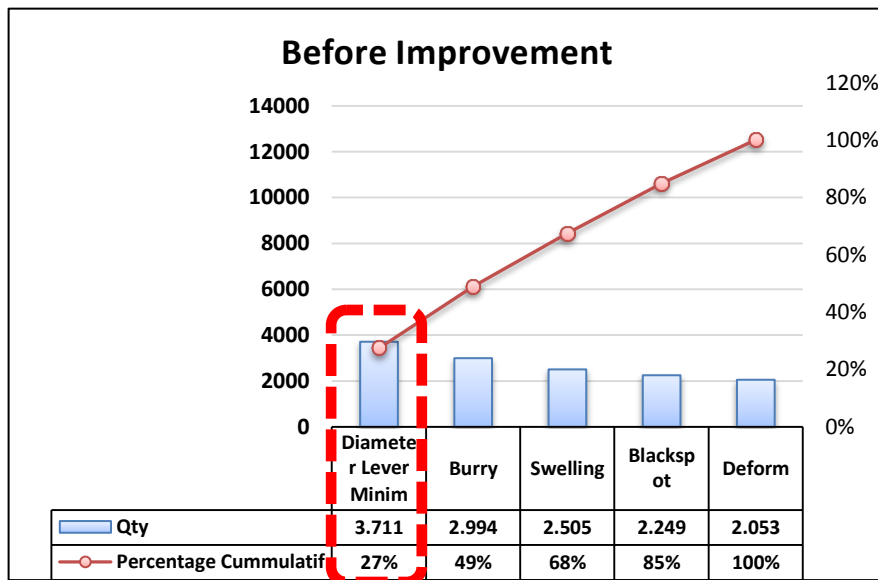

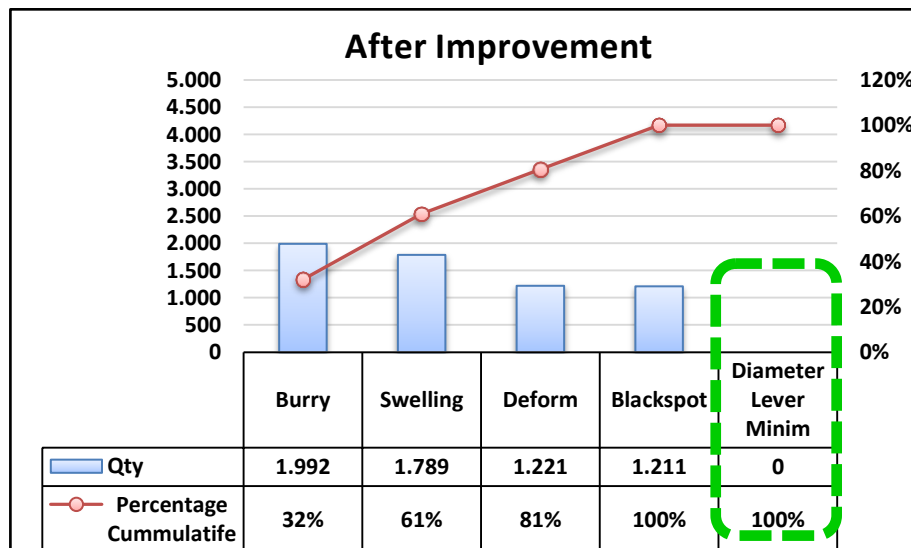Figure 5.14 Pareto Chat of NG Quantity before Improvement

Figure 5.15 NG Quantity after Improvement

Above is the Pareto diagram of the condition before improvement and condition after improvement. Small diameter lever initially appears as the highest, then after improvement process, small diameter lever suddenly does not appear anymore, or it can be said as zero diameter lever defects.

Looking at the result shown at the Pareto diagram, it can be concluded that the problem of small diameter lever can be overcame as there will be no more complaint from customer or assembly line of PT. Mitsubishi Electric Automotive Indonesia and the machining process can successfully be done without any problem of small diameter lever anymore.

Table 5.8 Comparison of NG Quantity before and after Improvement

NG Type	Qty before improvement	Qty after improvement
Small diameter lever	3711	0

Putting the comparison into one table as shown above, it is clearly compared how the condition of NG at diameter lever before improvement and after improvement. Small diameter lever has became the most "no problem" type of NG in comparison with burry, sweling, blackspot, and deform.
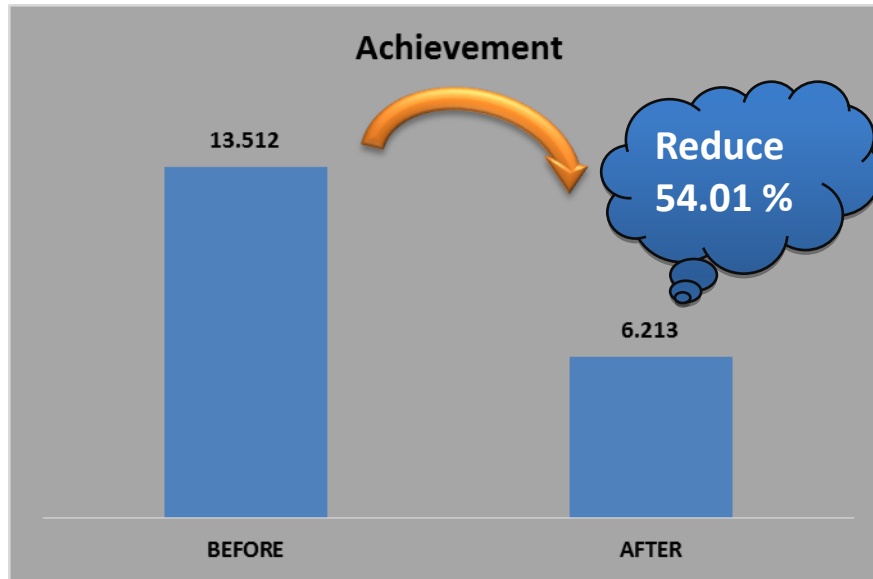
Figure 5.16 Comparison of NG Quantity before and after Improvement

Putting the comparison into histogram, it is also clear that the project has successfully reduce the NG bracket form the beginning NG bracket quantity of 13,521 pcs to 6,213 pcs only. This the the acheivement of reducing 54.01% amount of NG bracket flowing to machining process.

5.4 Act

Finish with the check process, the next process is act as it is purposed in order that the improvement can be continuously applied. The implementation of act is done through the standardization process.

5.4.1 Standardization

Standarization here is the action of establishing the improvement to be able to be applied continously in the company. Standarization process here must involve those who have strategic position in the company such as Manager of Board of Director.

For the standarization of this project, the standarization is done to the check sheet. It is known the existing check sheet for quality incoming inspector Report Model M645DH40BJ does not state check point for diameter lever. Thus, for the standarization, the check sheet is revised to document number Doc.No RI-DLM-2-RVS1 which has check point for diameter lever.

As the purpose of standarization to apply this improvement continuously, it is expected that by revising the check sheet the quality incoming inspector can from right now start to utilize the revised check sheet which has point check for diameter lever. By applying this standarization, it surely is expected that the NG bracket of small diameter lever will again not flow to machining process and it is really expected that the NG bracket can maximally be minimized after machining process whether it is sent to customer or assembly process at PT. Mitsubishi Electric Automotive Indonesia itself.
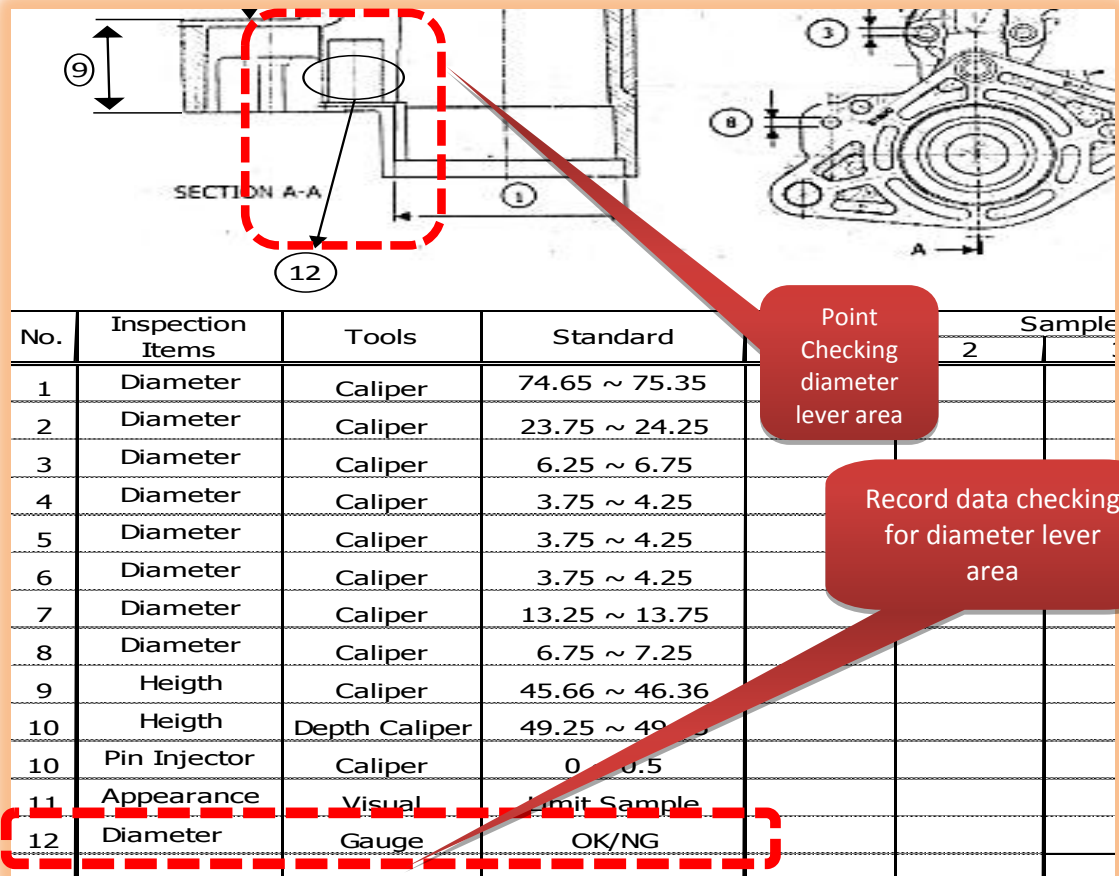
No.	Inspection Items	Tools	Standard	Point Checking diameter lever area	Sample		
					2		
1	Diameter	Caliper	74.65 ~ 75.35				
2	Diameter	Caliper	23.75 ~ 24.25				
3	Diameter	Caliper	6.25 ~ 6.75				
4	Diameter	Caliper	3.75 ~ 4.25				
5	Diameter	Caliper	3.75 ~ 4.25				
6	Diameter	Caliper	3.75 ~ 4.25				
7	Diameter	Caliper	13.25 ~ 13.75				
8	Diameter	Caliper	6.75 ~ 7.25				
9	Heigth	Caliper	45.66 ~ 46.36				
10	Heigth	Depth Caliper	49.25 ~ 49.				
10	Pin Injector	Caliper	0 ~ 0.5				
11	Appearance	Visual	Limit Sample				
12	Diameter	Gauge	OK/NG				

Figure 5.17 Check Sheet Content after Improvement

5.5 Benefits

There are a lot of benefits for the company through realization of this project. There two kinds of benefit obtained through the realization of this project; tangible benefits and intangible benefits. The intangible benefits is related to the prevention of NG blank bracket at diameter lever area passing through machining process. The tangible benefits is like the cost saving as follows.

5.5.1 Cost Saving

The calculation of cost saving is done as follows:

Price of Starter Bracket Front after process	IDR 70,000 (A)
Price of Starter Bracket Front before process	IDR 40,000 (B)
Process Cost (A-B)	IDR 30,000

The process cost has included electricity usage, small part and man power

The data obtained form PPIC Department

Through the improvement, the number of NG bracket reduced is 54.01 %. Based on the achievement, the total production cost than can be saved is:

NG Quantity reduced $= \dfrac{54.01}{100} \, (13,512) = 7,299 \; pcs$

Total cost saved = 72,999 pcs x IDR 30,000/pcs = IDR 218,970,000 per 3 months period.

Total cost saved per month : IDR 218,970,000 / 3 = IDR **72,990,000** per month.

Based on the calculation, the total cost that can be saved through the realization of this project is <u>IDR 72,990,000</u> per month including cost of electricity usage, man power, and supporting part.

CHAPTER VI
CONCLUSION AND RECOMMENDATION

6.1 Conclusion

- Type NG that mostly happen is caused by supplier as supplier contribute up to 63% of total defect.

- There are several type of NG caused by supplier and the type of NG that mostly happen is small diameter lever. This contribute up to 27% in comparison with the other

- To overcome the small diameter lever problem, a new jig developed to check the lever area by incoming inspector

- New checksheet has been developed by adding one dimeter lever item check to make quality incoming inspector easier in doing the inspection at diameter lever

- The result of implementing those method lead to the decreasing number of NG categorized as small diameter lever up to 0%

- For overall NG, this project can reduce NG rate up to 54.01%

- The total cost saved by omitting small diameter bracket is up to IDR 218,970,000 per 3 months or IDR 72,990,000 per month.

- The real result has successfully been obtained through the execution of the project. The Plan, Do, Check, Act approach has been applied through this project and has run smoothly.

6.2 Recommendation

To realize the improvement continuity leading to minimizing NG product and approaching zero defect action, the next NG type that is mostly existed based on the histogram can next be improved.
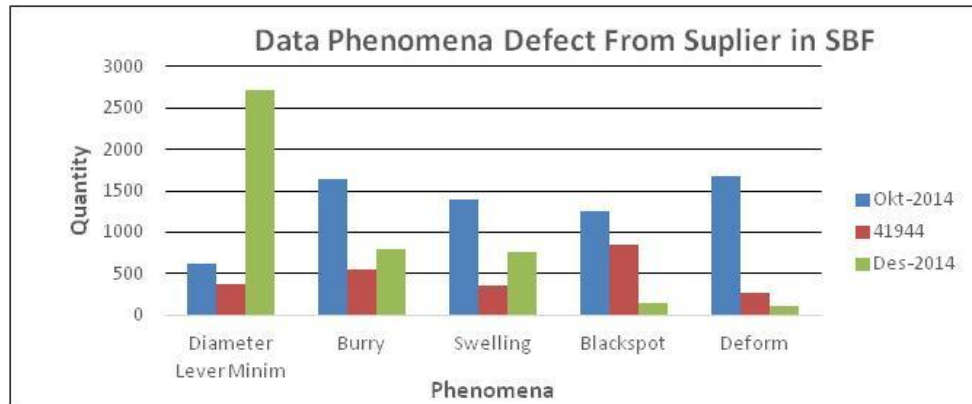

Figure 6.1 NG Phenomena at SBF Line

Based on data above, the next NG that must be eliminated is burry as it is the second largest NG after small diameter lever, then, continued by the third largest and so on. Then, the improvement can be continued to the NG caused by machining process also and take concern to eliminate them. By acting this way, it is expected that NG product produced by PT. MEAINA can be really minimized.

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