DEFECT ANALYSIS PRODUCTION PROCESS SOLAR STREET LIGHT WITH APPROACH ROOT CAUSE ANALYSIS

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ABSTRACTS

PT. Santinilestari Energi Indonesia is a company engaged in renewable energy in the core business of producing street light based on solar cell and smart system. The company's main focus is to meet the needs of consumers by producing products that have good quality. However, various obstacles encountered make the light production quality down, during the period January 2016 to April 2016 there have been recorded Work Order (WO) is done by the production department. For WO Assembly Controller there is a defect by 8.85%, WO Assembly Solar Cell Cable is defect amounted to 8.04%, WO Assembly Reflectors are a defect amounting to 6,23%, and WO Assembly Armature contained 4.79% defect. In order to find and understand the main cause of defects in production there are many methods that can apply, one of the methods is Root Cause Analysis. This research designed to 5 stages that is The Data Collection, The Definition Problems, Finishing Phase Problems, and The Conclusion and Recommendations. The data collection was done by taking secondary data, an interview with the manager production or manager operational, and observation field. Data processing uses method Cause Effect Diagram and FMEA. The purpose of this research is to find and provide solutions the causes of defects in street light product.

***Keywords**:* Root Cause Analysis, SIPOC, FMEA.

INTRODUCTION

PT. SEI is a company engaged in renewable energy with the core business of producing street light based on solar cell and smart system. The company's main focus is to meet the needs of consumers by producing products that have good quality. However, various obstacles encountered make the lights production quality down, during the period January 2016 to April 2016 there have been recorded Work Order (WO) is done by the production department. For WO Assembly Controller there is a defect by 8.85%, WO Assembly Solar Cell Cable are defect amounted to 8.04%, WO Assembly Reflectors are defect amounting to 6,23%, and WO Assembly Armature contained 4.79% defect.

Any business in highly competitive always competes with industry of which a kind of. In order to win the competition, business owners have to pay full attention on the quality of the product. Attention on the quality of giving positive impacts to businesses through two ways namely the effect on production costs and the effect on income. If at the process of production is there are defects due to negligence operators and skill that is not of particular importance for the operators itself, then it obviously will increase production costs.

To find and understand the root cause defect in the production area there are many the methods that can apply, one of method is root cause analysis. Root cause analysis (RCA) is a tool problem solving to help the company find and understand the root of the problem, with the purpose of removing the root cause and prevent problems were back. Basically, RCA

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aimed at identifying the origin of a time. With the defective product is required to improve quality by knowing the root cause of problems that arise so as to reduce defects in the production process.

METHODOLOGY

Root Cause Analysis

Defects can be defined as a characteristic that does not meet quality standards. Besides the severity of one or more damage to the product can make the product is rejected or disabled (Gaspersz, 2002). Root cause analysis (RCA) used to identify the root cause a time. RCA is a comprehensive evaluation methods structured to identify the root cause (root cause) events that was not expected (undesired outcome) and measures necessary to prevent such back to the that was not expected.

a. SIPOC Diagram

To identify the process that is being studied , in-out and the output of the process, as well as suppliers and customers, it takes a map illustrating the process flow. Tools commonly used is a diagram of SIPOC. SIPOC (Supplier, Input, Process, Output, Customer) used to indicate mainly activity or subprocess in a of business process, together with the framework of the process, which are presented in Supplier, Input, Process, Output, Costumer. SIPOC Model is the most widely used in the management process improvement.

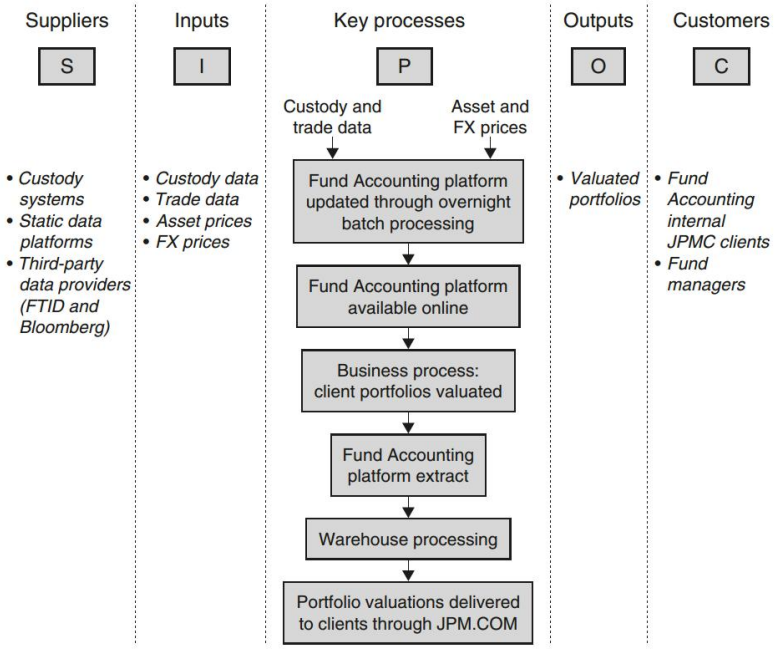

Fig. 1. *Portfolio valuation SIPOC*
(Source: Antony, 2006)

b. Pareto Chart

Diagram Pareto is a tool that used to identify and prioritize based on the order of many problems of a chart stems. Diagram Pareto very useful in determining and identify priorities of the problems that will be completed. The problem most often and often happens is the main priority to do the act of repairing. Diagram Pareto created based on statistics and principle that 20 percent cause, responsible for 80% problems that arise or otherwise.

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c. Cause and Effect Diagram

Cause and effect diagram is used to analyze the problem and the factors that cause the problem. Thus the diagram can be used to explain the causes of a problem. The figure also called Fishbone diagram because it is shaped like a fish skeleton. The ideas gained from a meeting brainstrorming owned by a group written in a fishbone diagram and then one by one the factors causing that does not become the root causes and eventually started to remove the remaining factors that actually approached the expected goals.

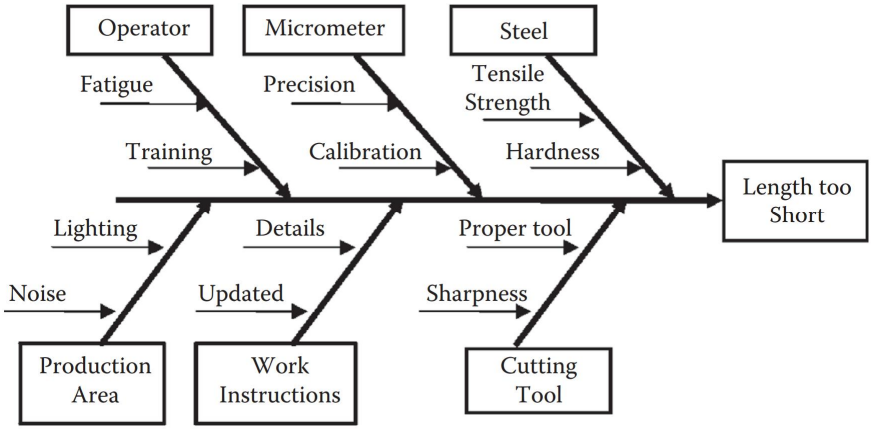

Fig. 2. Example Fishbone
(Source: Barsalou, 2015)

d. Failure Mode Effect Analysis

Failure Mode and Effect Analysis (FMEA) is a systematic approach that implements a table method to help the thought process used by engineers to identify potential failure modes and effects. FMEA (Failure Mode and Effect Analysis) is an engineering technique used to identify, prioritize, and dispose of the potential problems of a system, design or process before the failure identified by consumers (Stamatis, 2003).

According to Kennedy (1998), the purpose of the FMEA is as follows:

1. Identify potential process failure occurs.
2. Finding the impact of a variety of failures.
3. Finding the root cause of a failure.
4. Prioritize actions to be taken according to the failure rate indicated by the Risk Priority Number (RPN).
5. Identify and document recommendations for improvements

Control Plan

The purpose of the Control Plan is to assist in the manufacturing of quality products according to customer requirements. This is done by providing a structured approach to the design, selection and application of control methods for the value-added system in total. Control Plans provide a written summary description of the system used in the process and minimize product variation.

Control Plan does not replace the information contained in detailed operator instructions. The methodology is applicable to a variety of manufacturing processes and technologies. Control Plan is an integral part of the overall quality and to be used as a living document. Therefore, this section should be used in conjunction with other relevant documents. An important phase of the process for quality planning is the development control plan.

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Control Plan is a written description of the system for controlling parts and processes. Single Control Plan may apply to a group or family of products produced by the same process to the same source. In supporting the control plan, process monitoring instructions should be defined and used continuously. Consequently, Control Plan describes the actions required at each stage of the process including receiving, on-process, out-going, and periodic requirements to assure that all process outputs will be in controlled circumstances.

RESULTS AND DISCUSSION

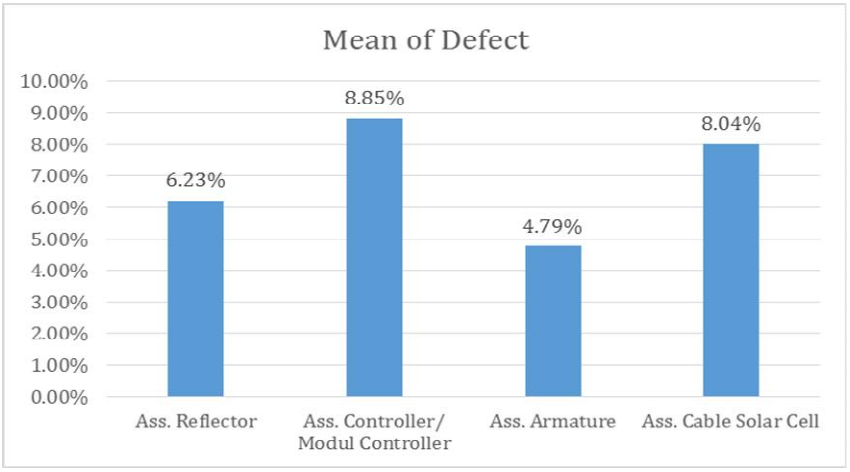

Fig. 1. Mean of Defect

In Figure 1 shows that the first dominant defect in the assembly of the controller or controller module with the presentation of 8.85%, the second flaw is the cable assembly solar cell with a value of 8.04%, the third flaw is a reflector assembly with a value of 6.23%, and disability the fourth is the armature assembly with a value of 4.79%.

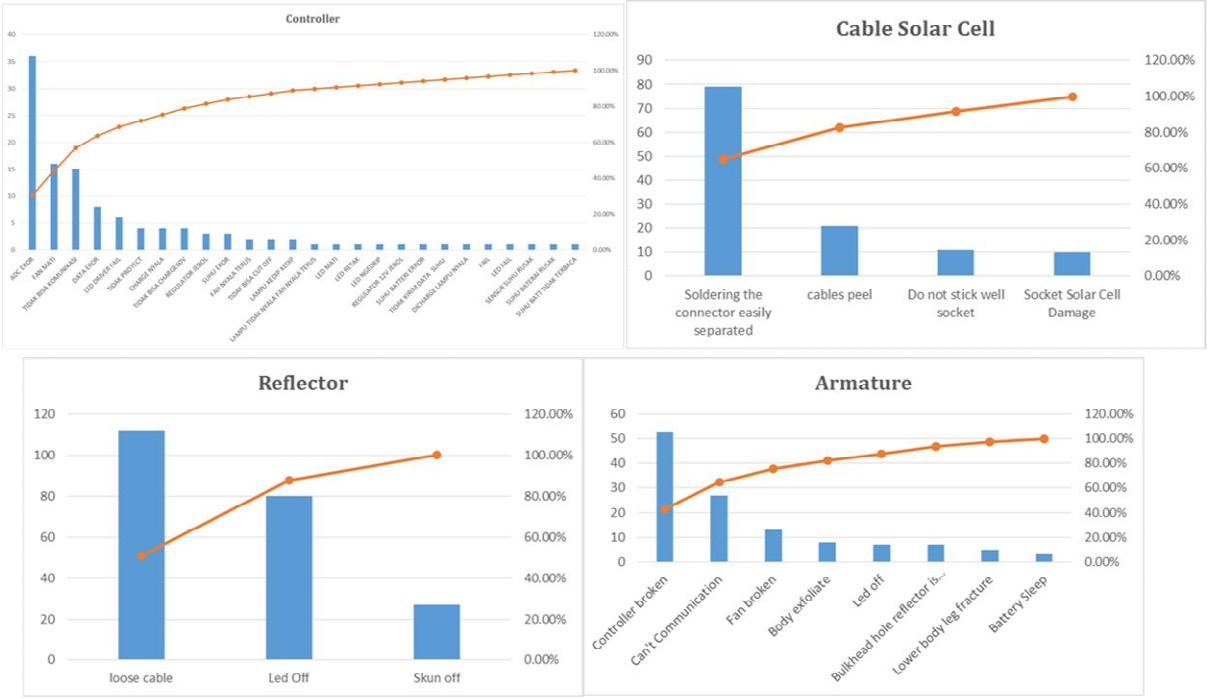

Fig. 2. Pareto Defect of Process Ass. Street Lamp

In this study, there are limitations that the experiment in taking corrective action, so that recommendations for improvement are only shown in the table control plan.

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Table 1. FMEA for Process Ass. Street Lamp.

Proses Funtion/ Requirement	Potential Failure Mode	Potential Effects of Failure	Sev	Potential Cause(s)/ Mechanism(s) of Failure	Occur	Current Process Controls (Prevention)	Current Process Controls (Detection)	Detect	RPN
Ass. Controller	ADC error	Kontroller can't Cut-off, and regulator controller fail	8	Elco C1&C10 Crack	8	N/A	The initial inspection process	3	192
				ADC component tolerances	9	N/A	Comparison of the data controller to the data AVO	2	144
				AVO uncalibrated	9	Ensuring tool has been calibrated before use	See the calibration label on each appliance during the setup process	1	72
	Fan off	Controller will not be commanded, the batteries will swell, the battery will catch fire, damage controller	9	Negligent operator to program the controller	9	N/A	Inspeksi 100% on proses	3	243
				Soket Crack	7	N/A	The initial inspection process	3	189
				Mosfet Q10 broken leg	6	Do not stack too high the controller module	Inspeksi 100% on proses	3	162
				Fan curved pin socket	6	When plug socket ascertained in completely	Inspeksi 100% on proses	3	162
	Could not communicatio n	Controller is not monitored, so it will lose an intelligent system that is owned by the controller	7	Soket Crack	8	N/A	The initial inspection process	3	168
Ass. Cable Solar Cell	Soldering the socket easily separated	Battery will not charge the next lights turn off after 3 days	8	Solder results underdone	6	N/A	Inspeksi 100% on proses	3	144
				Solder less heat	5	Supplied solder reserve	The initial inspection process	3	120
				Tin quality is not good	2	N/A	The initial inspection process	3	48
				Cable quality is not good	3	N/A	The initial inspection process	3	72
				The skill of the operator less	6	N/A	Inspeksi 100% on proses	3	144
				Less scrupulous operators	6	N/A	Inspeksi 100% on proses	3	162
	cables peel	Cause a surge in the controller module	9	Operator haste	6	N/A	Inspeksi 100% on proses	3	162
				The tools used are not appropriate	5	Provide appropriate tools	The initial inspection process	3	135
				Sanding wrong way	6	Learn WI before starting the process	Inspeksi 100% on proses	3	162
Ass. Reflector	loose cable	Lamp off	8	Solder results underdone	6	N/A	Inspeksi 100% on proses	3	144
				Solder kurang panas	5	Supplied solder reserve	The initial inspection process	3	120
				Pad on the PCB corrosion	7	Extra cleaning process with PCB pad	The initial inspection process	3	168
				Pad on the PCB is too small	7	N/A	The initial inspection process	3	168
				Tin quality is not good	2	N/A	The initial inspection process	3	48
				Handling Modul PCB LED	6	Do not stack too high LED module	Sampling on proses	2	96
	LED off	Lamp off	8	Former tensile test conducted by the supplier	5	N/A	The initial inspection process	3	120
				Solder the LED underdone	5	N/A	Inspeksi 100% on proses	3	120
Ass. Armature	Controller fail	Lamp off	8	Solder results underdone	6	N/A	Inspeksi 100% on proses	3	144
				Not yet a Zener Diode soldered	6	N/A	Inspeksi 100% on proses	3	144
				Terminal 6 pin not yet soldered	6	N/A	Inspeksi 100% on proses	3	144
				Quallity of part regulator not good	9	N/A	Inspeksi 100% on proses	3	216
				Missing setting RF	6	When setting a table reading RF Channel RF	Inspeksi 100% on proses	3	126
				Missing setting RF and Base station	6	When setting the controller carries a map of the installation	Inspeksi 100% on proses	3	126
	Could not communicati on	Controller is not monitored, so it will lose an intelligent system that is owned by the controller	7	Interference between RF	9	Channel divide between Checker order not simultaneously while checking	Inspeksi 100% on proses	3	189
				RF fail	5	Before ignited supply in the first check pin-pin RF	Inspeksi 100% on proses	3	105
	Fan fail	The battery will swell, the battery will catch fire, damage controller	9	Missed assembly Resistor	4	N/A	Inspeksi 100% on proses	3	108
				When mounting resistor foot shot with other components	3	The accuracy when mounting Resistor	Inspeksi 100% on proses	3	81
				The quality of Fan Ugly	6	N/A	Inspeksi 100% on proses	3	162
				The quality of the Regulator Ugly	6	N/A	Inspeksi 100% on proses	3	162

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CONCLUSIONS AND RECOMMENDATIONS

Recommended improvements gained by doing brainstorming with better understand the issues section Production and Quality Control in the field. Based on the results of FMEA and priorities known risk, then in order to maximize the reduction in the number of defects in the product up to zero defect level to do some proposals as follows:

a. Personnel: Conduct training about basic electronics (Soldering, reading electronic components). Selection at recruitment provider with which own Basic electronics.
b. Machines: Doing eye replacement of solder or heater Solder itself.
c. Methods: Make changes by checking (division RF channel) are previous 1 RF channel is done by some inspector, became one RF channel is held by 1 Inspector check.
d. Material: Selecting and evaluating the performance of suppliers so obtained a supplier with a good performance.
e. Measurement: Buying a calibration tool for calibrating AVO meter.

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