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Product Quality Control Analysis Using the Six Sigma Method with Statistical Process Control [SPC] Data Presentation

[Case Study PT. XNI]

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Abstract:- PT. XNI is a company that operates in the automotive manufacturing sector, especially in the production of motorbikes. Motorcycle products from PT. XNI is the one that dominates the motorbike sales marketing market with the most users currently in Indonesia. This research aims to reduce NG [Not Good] products in engines, as well as research controlling the quality of engine products from motorbikes so that they continue to improve and of course have quality. The method used is using the SIX SIGMA method, namely by Define, Measure, Analyze, Improve, Control and presenting data using Statistical Process Control (SPC). Month 1 The first week produced 5925 units, while the second, third, and fourth weeks saw slightly lower production, 5909, 5903, and 5911 engines respectively. seen from the significant decrease in the number of rejected products, namely from 5% in the first week to 3.91% in the fourth week and the 2nd month, first week 1.075%, second week 0.874%, third week 0.807%, fourth week 0.536 with respective production results - 5956, 5948, 5952 and 5968 engines respectively. The results of the analysis from week 1 to week 4 between months 1 and 2 show that the large number of reject products is caused by several factors, namely the quality of raw materials, namely motorbike parts, errors in the production process, errors from operators, problems with machines or work equipment. By minimizing or managing the factors above, companies can reduce the number of rejected products and improve overall production quality.

***Keywords:-** Manufacturing, Quality Control, SIX SIGMA, DMAIC, SPC.*

I. INTRODUCTION

In the current era, motorbikes have become an important necessity which is really needed for near and far activities because they are easier, their use is varied, some are for daily activities, some are used to earn a living, of course users want to use motorbikes. with good quality and can be used for the long term. PT. XNI is a company which is a manufacturing industry operating in the automotive sector. In this research, PT. XNI wants to control the quality of engine products on its motorbikes using Statistical Process Control (SPC), a method for controlling or processing quality which is a technique to ensure that every process used so that the products sent to consumers meet quality standards. The SPC method is a collection of quality tools used for problem solving to achieve process stability and increased capability with reduced variation. The SPC method provides basic methods for product sampling, testing, and evaluation and the information in the data is used to control and improve the manufacturing process. To ensure that the production process is in good and stable condition and that the products produced are always up to standard, it is necessary to carry out inspections of related matters in order to maintain and improve product quality in accordance with expectations so that the products produced are of high quality and quality. Quality is an important part of getting serious attention from customers, therefore PT. XNI tries to provide quality so that customers are satisfied with the products they make. There must be improvements made so that product quality meets expectations, starting from the need for cooperation between production operators and superiors on the line, because cooperation is what creates a good work environment so that when there is a problem on the work line, the operator can ask the check man for help, namely someone who leads at every post in the line, in order to minimize the occurrence of market claims which impact the motorbike engine becoming defective.

PT. XNI must check the machine every few days or every week on a regular basis and assess the operator so that anything that can affect the product's finished product can be prevented through routine checks, whether on the machine or the operator. The parts you want to install must also be checked first so that there are no damaged parts installed on the motorbike engine because this really affects the quality of the product, affects the appearance and the engine won't start. Therefore, the Six Sigma Method needs to be carried out effectively so that production runs well, with minimal product rejects and high quality. It needs to be emphasized that in order to avoid product rejects/defects which can cause waste of company resources, this method uses several methods, namely by Define, Measure, Analyze, Improve, Control. It's just a matter of consistency from the company and operators until it finally becomes a reality (zero claim market) or zero engine rejects/defects.

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II. THEORITICAL BASIS

➢ *Quality Control*

Quality control is a very useful method for companies to determine the suitability of product quality before selling it to consumers. Conceptually, quality control is a tool that is tendential in relation to aspects of maintenance, maintenance, repair, and maintaining the quality of a product for production management according to agreed standardization. In a company, the company can be said to be of quality if the production system in the company is good and controlled. Quality control within the company is carried out with the hope that production within the company will become more effective, namely that the defective products produced by the company will be reduced, thereby reducing waste of materials and labor used so that productivity will increase. Quality assessment is divided into 8 dimensions, namely performance, durability, aesthetics, perceived quality, reliability, serviceability, features, and conformance to standards.

➢ *Six Sigma Concept – DMAIC*

According to Gasperz (2005:310) Six Sigma is a vision of improving quality towards the goal of 3.4 errors per million opportunities in every product and service transaction. Six Sigma is a method or technique related to product management and improvement, a very comprehensive and flexible system, as well as new breakthroughs in quality control to achieve, maintain and maximize company success. Representing Six Sigma has 5 program levels that need to be carried out. Six Sigma with DMAIC stages, namely Define, Measure, Analyze, Improve, Control. Namely as follows:

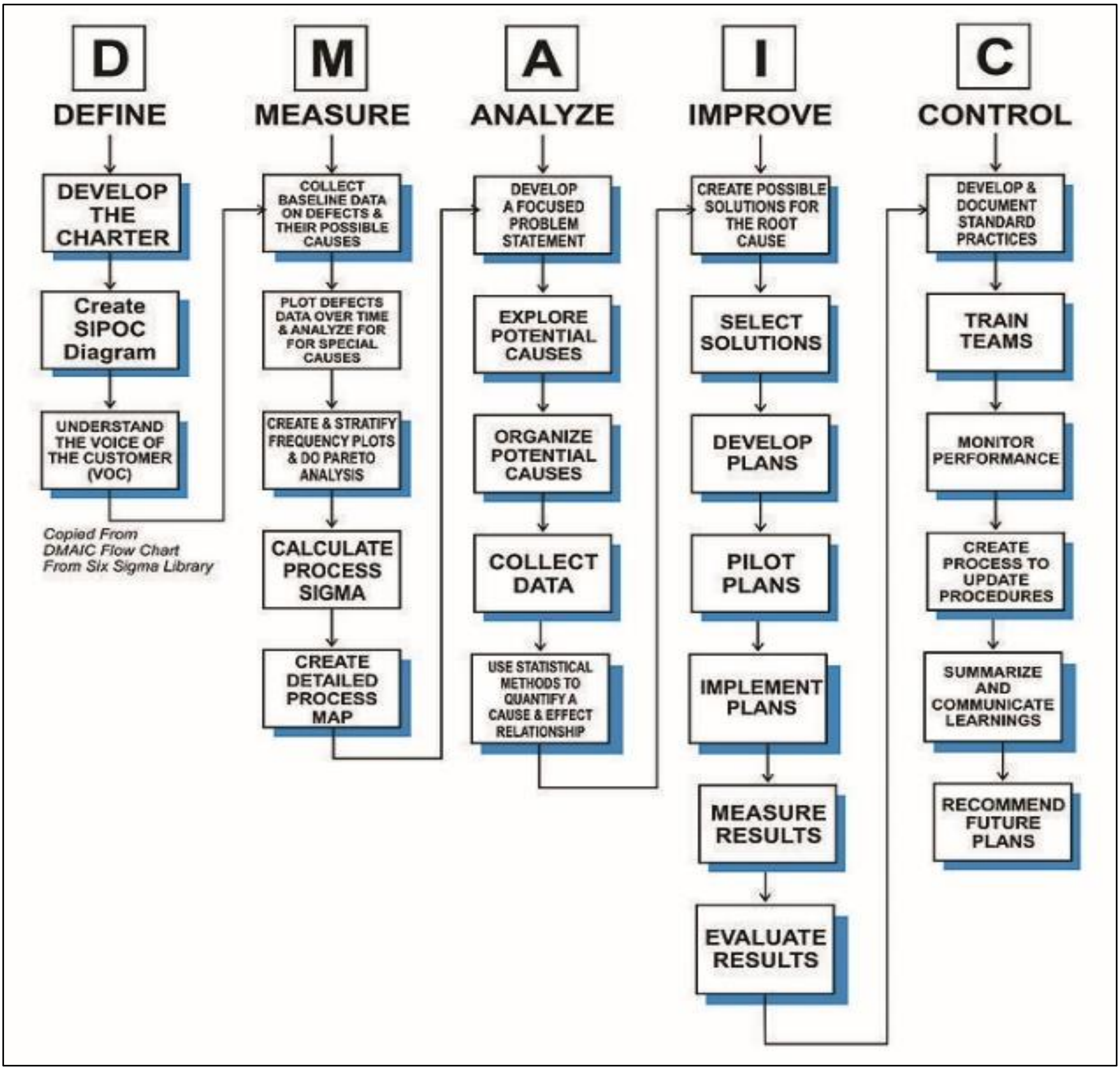

Fig 1 Process Flow In DMAIC

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- **Define**: The first stage in DMAIC is Define. This stage aims to define problems that occur in the production process, especially those related to rejected products and the low quality produced.
- **Measure**: At this stage, measurements are made of the amount of production and the number of rejects every week. Data is collected using check sheets to monitor machine conditions, raw materials and operator performance.
- **Analyze**: The data that has been collected is analyzed to identify the root cause of the problem that occurs. In this stage, statistical analysis is used to see patterns of problems in the production process, whether caused by operator error, machine damage, or poor quality of raw materials.
- **Improve**: Based on the results of the analysis, improvements are made to aspects found to be problematic. These improvements include increasing operator training, strengthening raw material quality checks, and more routine machine maintenance.
- **Control**: After improvements have been made, a control stage is implemented to ensure that the improvements that have been implemented remain effective and sustainable.

The cause of engine failure is the raw material factor, namely defective engine parts, the factor of operators who are less disciplined and not using Standard Operating Procedure (SOP) when working, so there are many incidents of engine repair coming down from the conveyor machine because there are parts that are not installed, factors from production machines can also be a factor. The engine product becomes defective due to trouble. This incident often occurs almost every day so it is necessary to take significant quality control measures so that products from PT. XNI produces quality products in the engine section, especially because this research focuses on motorbike engine quality.

III. RESEARCH METHODS

A. Research Location

The research was conducted at PT. XNI is a company that operates in the automotive manufacturing sector, especially in terms of motorbike production, and the research was carried out for 2 months (October – November 2024).

B. Research Flow and Methods

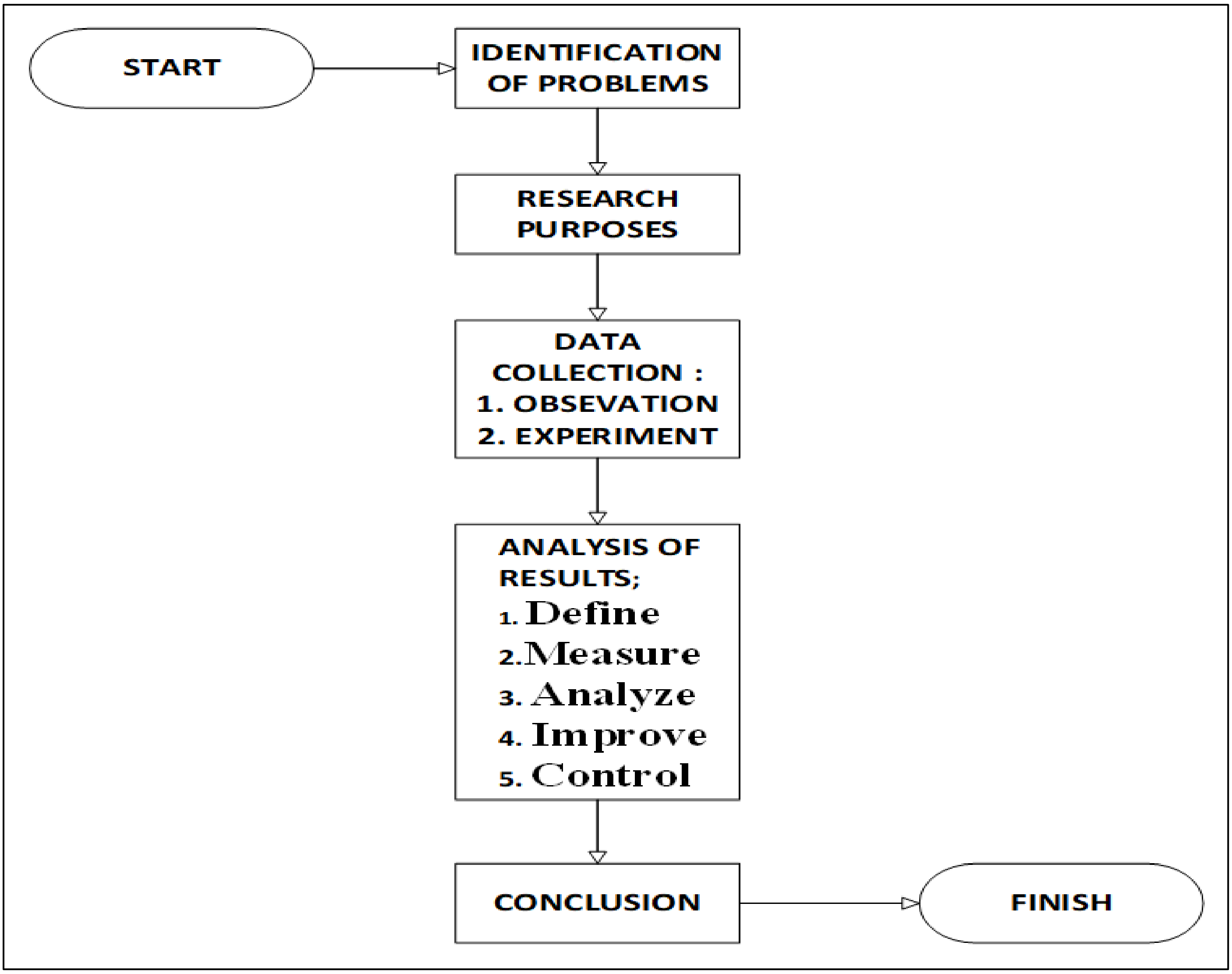

Fig 2 Flow of Research Methods

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This research uses the SIX SIGMA method with the presentation of Statistical Process Control (SPC) data to analyze and control the quality of motorbike engine production at PT. XNI. By using SPC tools, companies can monitor product quality in real-time and make improvements if there are undesirable variations. This research focuses on quality control and reducing the reject rate.

Figures **3** and **4** show the differences after the research results were carried out using DMAIC.

Table 1 DMAIC Stage Application

Step	Activity
Define	This stage aims to define problems that occur in the production process. From the total number of defects and types of defective products that occurred in the 1st and 2nd month period in this study.
Measure	At this stage, what is done is: using check sheets to monitor the condition of machines, raw materials and operator performance, p-charts, measuring the total DPMO value and sigma level.
Analyze	In this stage, statistical analysis is used to see patterns of problems in the production process, what causes them and how they can occur.
Improve	Using the DMAIC stages as a basis for analyzing the potential causes of a crash and determining a repair plan.
Control	This stage is to control the process of repairing rejected parts. This control can be carried out using tools such as SOPs, Work Instructions, Check Sheets, etc.

The expected quality target in implementing the Six Sigma Methodology in Production is to increase Process Capability by achieving 3.4 DPMO in the production process. The abbreviation DPMO is Defects per million Opportunities, namely Disabilities per one million Opportunities. 3.4 DPMO means 3.4 Defects in 1 (one) million chances. DPMO is a Process Capability assessment to measure how good a production process is. Defect Per Million Opportunities (DPMO) is a process performance measurement other than Cpk, PPM, Ppk, and COPQ. In a business context to make improvements in a process, **DPMO** is a performance measurement of a process which is calculated using the following formula. To calculate **Six Sigma** from month 1 and 2 data, we follow several steps, namely calculating DPMO first, then converting DPMO to **Z-Score**, and finally determining the Six Sigma level.

➢ *Data Provided:*

Table 2 Production Data and Reject before Research

Production Quantity	***Number of Reject (Defact)***
5925	95
5909	91
5903	97
5911	89
23648	372

- *Step 1: Calculating The Opportunity and Total Defacts*

✓ *Total Opportunity = Total number of productions for all products:*

Total Chance = 5925 + 5909 + 5903 + 5911 + 23648 = 50,296

✓ *Total Defact = Total number of defective products:*

Total Defact = 95 + 91 + 97 + 89 + 372 = 744

- *Step 2: Calculate DPMO (Defact Per Million Opportunities)*

With the Total Opportunity and Total Defact already calculated, we can calculate the DPMO using the following formula:

$$\text{DPMO} = \frac{Total\ Defact\ x\ 1.000.000}{Total\ Chance}$$

$$\text{DPMO} = \frac{744 \times 1{,}000{,}000}{50{,}296} = 14{,}801.53$$

So, DPMO = 14,801.53**.**

- *Step 3: Calculate The Z-Score of the DPMO*

Next, we calculate the Z-Score using the formula of inverted normal distribution. Z-Score can be calculated using the following formula:

$$Z = \Phi{-}1(\ = 1 - \frac{DPMO}{1.000.000})$$

Where

$$\text{DPMO} = (1 - \frac{14{,}801.53}{1.000.000}) = \Phi - 1(0.985198)$$

From the normal distribution table or the inverted normal distribution calculator, we get a Z-Score of around 2.05.

- *Step 4: Determining the Six Sigma Level*

After getting the Z-Score, we can convert it to the Six Sigma level. Based on the calculated Z-Score: $Z \approx 2.05$ means level 4 Sigma Conclusion:

With **DPMO = 14,801.53** and **Z-Score ≈ 2.05**, then the Six Sigma Level for this data is about 4 Sigma. So, the quality level of this process is at **Level 4 Sigma**.

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➢ *Data Provided:*

Table 3 Production Data and Reject After Research

Production Quantity	Number of Reject (Defact)
5956	64
5948	52
5952	48
5968	32
23824	192

- *Step 1: Calculating The Opportunity and Total Defacts*

✓ *Total Opportunity is the total amount of production for all products:*

Total Opportunities = 5956+5948+5952+5968+23824 = 50,648

✓ *Total Defact is the total number of defective products:*

Total Defact = 64+52+48+32+192 = 388

- *Step 2: Calculate DPMO (Defects Per Million Opportunities)*

With the Total Opportunity and Total Defact already calculated, we can calculate the DPMO using the following formula:

DPMO = (Total Defact x 1.000.000)/(Total Opportunity)

DPMO = (388×1,000,000)/50,648 = 7,664.79

So, DPMO = 7,664.79.

- *Step 3: Calculate the Z-Score of the DPMO*

Next, we calculate the Z-Score using the formula of inverted normal distribution. Z-Score can be calculated using the following formula:

Z=Φ−1 (= 1 - 7,664.79/1.000.000)

Where

DPMO = (1 - 7,664.79/1.000.000) = Φ−1(0.992335)

From the normal distribution table or the inverted normal distribution calculator, we get a Z-Score of around 2.41.

- *Step 4: Determining the Six Sigma Level*

After getting the Z-Score, we can convert it to the Six Sigma level. Based on the calculated Z-Score:

• **Z ≈ 2.41** means level 4 Sigma.

Conclusion: With **DPMO** = 7,664.79 and Z-Score ≈ 2.41, then the Six Sigma Level for this data is about 4 Sigma. So, the quality level of this process is at **Level 4 Sigma** .

IV. RESULT AND DISCUSSION

The following are the results of the data analysis conducted over the last four weeks:

Table 4 Number of Production and Reject per Week (Month 1)

Week	Production Quantity	Number of Rejects
Week 1	5925	95
Week 2	5909	91
Week 3	5903	97
Week 4	5911	89
TOTAL	23648	372

From the recorded data, it can be seen that the production amount is almost consistent with slight fluctuations from week to week. The first week produced 5925 units, while the second, third and fourth weeks showed slightly lower production, 5909, 5903 and 5911 units, respectively.

However, what is interesting to observe is the trend in the number of rejects. Although the production volume is relatively stable, the number of rejections shows significant fluctuations. In the first week, the number of rejected products was recorded at 95 units, and then decreased in the second week to 91 units. However, the third week experienced a fairly high spike in rejections, namely 97 units, before decreasing again in the fourth week to 89 units.

In this section, the results obtained from the application of the Statistical Process Control (SPC) and Six Sigma methods will be discussed in detail, by explaining each stage of Define, Measure, Analyze, Improve, and Control (DMAIC). This approach is used to analyze and improve the quality control of motorcycle products, especially in the motorcycle engine section so that it is of high quality at PT. XNI, with the aim of reducing the number of rejected products and improving the overall quality.

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A. *Define*

The first stage in DMAIC is Define is carried out by defining the business process flow that is currently happening at PT Okantara. SIPOC (as-is) diagrams are used to present the process flow from suppliers to consumers. SIPOC diagram (as-is) in the production of PT. XNI can be seen in Figure 1. The following SIPOC (Suppliers, Inputs, Process, Outputs, Customers) diagram is a tool used to map the overall business process, by highlighting the main elements in a system. The following is an example of a SIPOC diagram for the **production process of a motor engine** under **As-Is** conditions (currently).

➢ *Suppliers*

A supplier is a party that provides the materials, components, or information needed for the production process. In the case of motor engine production, suppliers can be:

- Raw material suppliers: Steel, aluminum, plastic, fuel, oil.
- Component suppliers: Spare parts such as pistons, camshafts, cylinders, clutches.
- Suppliers of machines or production tools: CNC machines, assembly tools, etc.
- Labor suppliers: Trained labor for various stages of production.

➢ *Inputs*

Input is all the materials, information, or resources needed to get the production process up and running. Some examples of inputs in motor engine production are:

- Raw materials: Steel, aluminum, plastic, etc.
- Components: Piston, engine, wheel, transmission.
- Equipment: Production machinery, measuring instruments, assembly equipment.
- Workforce: Machine operators, technicians, and assembly workers.
- Production instructions: Engineering drawings, assembly procedures.

➢ *Process*

Processes are the steps that are taken to convert inputs into outputs. Processes in the production of motor engines can include:

- Raw material processing: Cutting, forming, and processing of raw materials.
- Assembly of engine components: Assembling engine parts such as cylinder blocks, cylinder heads, pistons, etc.
- Quality checking: Testing the quality of materials and components to ensure there are no defects.
- Final assembly: Assemble the whole motor engine unit.
- Final checking and testing: Conducting machine testing to ensure all parts are working properly.

➢ *Outputs*

Output is the final result of the production process, i.e. a product that is ready to be shipped or marketed. The output of the motor engine production process is:

- Motorcycle engine that is installed and ready to use.
- Quality report: Records of tests and quality checks performed.

➢ *Customers*

The customer is the party that receives and uses the output from the production process. Customers in the context of motor engine production can be:

- Motorcycle dealership: A place that sells motorcycles to consumers.
- Individual customers: End consumers who purchase the motorcycle.
- Vehicle manufacturer: If the motor engine is manufactured for a specific purpose, such as for a specific motor vehicle.
- Service center: A place for motorcycle maintenance and repair.

➢ *Sipoc Diagram Table (as-is) Motor Engine Production:*

Table 5 Sipoc Diagram Table (as-is) Motor Engine Production

Suppliers	**Inputs**	**Process**	**Outputs**	**Customers**
Raw material suppliers	Raw materials (steel, plastic, aluminum)	1. Raw material processing (cutting, forming)	Ready-to-produce motor engines	Motorcycle dealers
Component suppliers	Components (pistons, camshafts, cylinders)	2. Assembly of machine components	Quality report (machine test)	Individual customers
Suppliers of production machinery/tools	Equipment (production machinery, measuring instruments)	3. Quality testing	A machine that works well	Vehicle manufacturer (if applicable)
Labor supplier	Trained workforce	4. Final assembly (assemble all components)		Service center
	Production instructions (drawings, procedures)	5. Final checking and testing		

This SIPOC diagram provides an overview of how the motor engine production process takes place, focusing on key elements in the supply chain, inputs, processes, outputs, and customers. The first stage in the Six Sigma method is Define, where problems encountered in the motorcycle production process are identified. Based on existing data, PT. XNI has

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seen an increase in the number of rejected products in recent weeks, which can affect customer satisfaction and increase production costs. The main problems identified were:

- **High number of rejected products**: Rejected or defective products that do not comply with quality standards are increasing.
- **Variation in the production process**: Uncontrolled production processes lead to large variations in product output.
- **Quality of raw materials**: The use of inconsistent raw materials causes the final product to not meet quality standards.

Using data from the Check Sheet and observations of production conditions, the main problem that needs to be fixed is the variation in product quality caused by raw material problems, human error, and machine damage.

B. Measure

In the Measure stage, the next step is to collect data to monitor the performance of the production process and measure the impact of the identified problems. In this case, the data used for measurement includes:

- The number of rejected products that occur every week.
- Machine performance and condition of raw materials used in production.
- Operator performance in carrying out the production process.

A control map *p chart* that serves to see whether quality control at PT. Is this XNI under control or not. The creation of the *P control* map is as follows:

- Calculating the proportion of defective products.
- Defect proportion is used to see the percentage of defects in each observation of the production process.

The DPU (defect per unit) formula as a counter to the proportion of product defects and DPMO (defect per million opportunity) as a counter to defective products in one million opportunities to then find the location of the company's sigma level based on its production results.

Table 6 PT XNI Defective Production Data Month 1 - Month 2

Total per Week	Production Quantity	Number of Defects
4 Week	47.472	564

$$\text{DPU} = \frac{\text{Number of Defects}}{\text{Production Quantity}}$$

DPU = $\frac{564}{47.472}$ = 0.0119

➢ *Month 1*

- *First Week:*

✓ Production Amount: 5925
✓ Number of Rejects: 95

Reject percentage = $(\frac{5925}{95}) \times 100 = 1.60\%$

- *Second Week:*

✓ Production Amount: 5909
✓ Number of Rejects: 91

Reject percentage = $(\frac{5909}{91}) \times 100 = 1.54\%$

- *Third Week:*

✓ Production Amount: 5903
✓ Number of Rejects: 97

Reject percentage = $(\frac{5903}{97}) \times 100 = 1.64\%$

- *Fourth Week:*

✓ Production Amount: 5911
✓ Number of Rejects: 89

Reject percentage = $(\frac{5911}{89}) \times 100 = 1.50\%$

➢ *Month 2*

- *First Week:*

✓ Production Amount: 5956
✓ Number of Rejects: 64

Reject percentage = $(\frac{5956}{64}) \times 100 = 1.075\%$

- *Second Week:*

✓ Production Amount: 5948
✓ Number of Rejects: 52

Reject percentage = $(\frac{5948}{52}) \times 100 = 0.874\%$

- *Third Week:*

✓ Production Amount: 5952
✓ Number of Rejects: 48

Reject percentage = $(\frac{5952}{48}) \times 100 = 0.807\%$

- *Fourth Week:*

✓ Production Amount: 5968
✓ Number of Rejects: 32

Reject percentage = $(\frac{5968}{32}) \times 100 = 0.5\%$

ISSN No:-2456-2165 https://doi.org/10.5281/zenodo.14621474

Table 7 Number of Month Percentages 1

Per Week	Number of Percentages
Week 1	1.60%
Week 2	1.54%
Week 3	1.64%
Week 4	1.50%

Table 8 Number of Month Percentages 2

Per Week	Number of Percentages
Week 1	1.075%
Week 2	0.874%
Week 3	0.807%
Week 4	0.536%

C. Analyze

In the Analyze stage, an analysis is carried out to determine the root cause of the existing problem. Some of the tools used in this analysis are:

➢ *Root Cause Analysis (RCA):*

To analyze the factors that cause.

➢ *Reject Products, found Several main root causes:*

- **Quality of Raw Materials**: Some of the raw materials used in production do not conform to predetermined specifications, thus affecting the quality of the final product.
- **Operator Error**: Operators who are poorly trained or inconsistent in following production procedures, leading to errors in product assembly and processing.
- **Machinery Breakdown**: Machines that are not properly maintained often suffer from breakdowns and failures, which has an impact on product quality.
- **Working Environment Conditions**: Environmental factors such as poor lighting and cleanliness of the production area can affect the performance of operators and production processes.

➢ *Control Chart and Pareto Analysis:*

Using the Control Chart, it was found that the production process experienced greater variation in the first and second weeks, but began to be controlled in the third and fourth weeks. Pareto Analysis also shows that most defect problems are caused by several major factors, such as engine breakdown and operator error.

➢ *Fishbone Diagram:*

A management tool used to analyze and identify the cause of a problem. This diagram is also known as the Ishikawa Diagram or Cause-and-Effect Diagram. Fishbone Diagram has several functions, including: identifying the root cause of a problem, getting ideas to solve the problem, assisting in further fact-finding, and visualizing the relationships between various causes. Here are some examples of interconnected causes that can be found in a foshbone diagram:

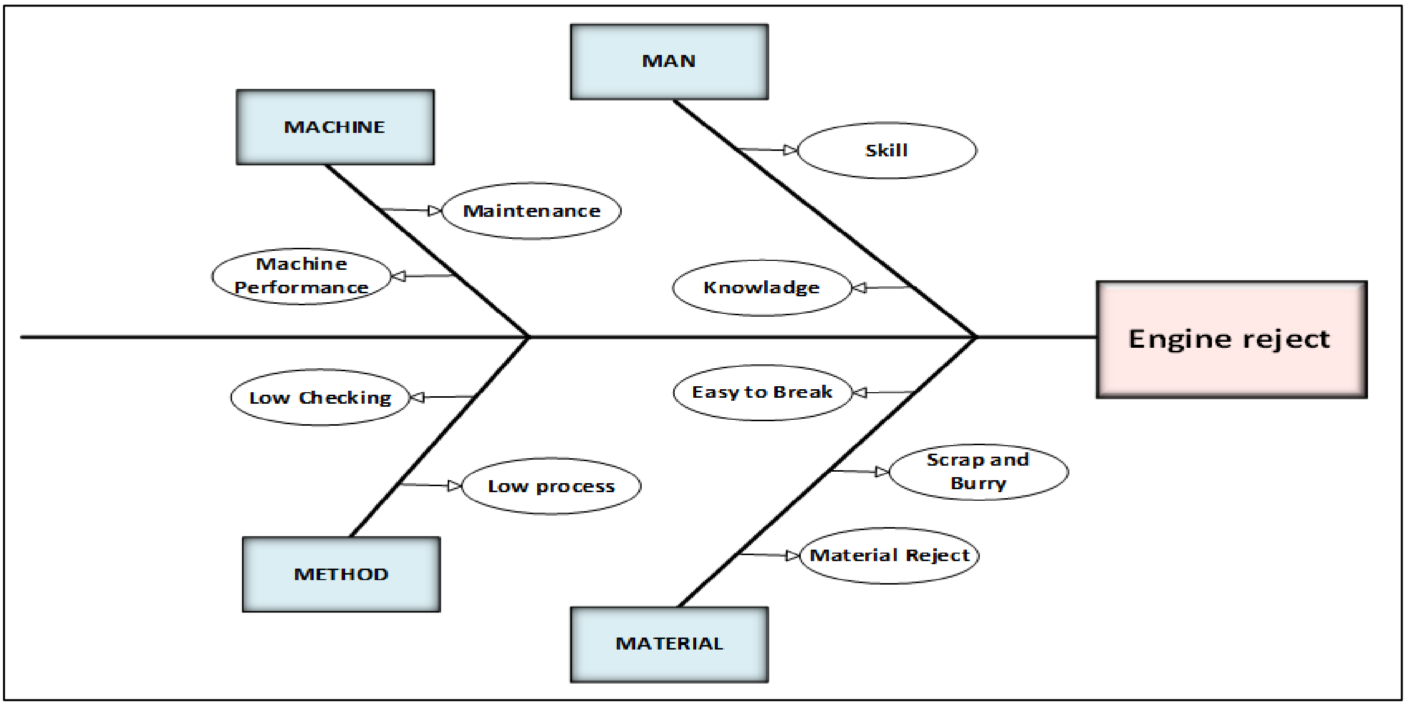

Fig 3 Fishbone Diagram

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➢ *Human*

- Lack of discipline in filling out the check sheet from the operator at the beginning before work, leading to a lack of control regarding the completeness of work tools.
- The factor of a hot workplace and standing for a long time, causing the operator to be tired and unfocused while working.
- Operators who sometimes change jobs during work because they want to learn in other jobs, causing some engine parts not to be installed which due to negligence eventually causes a market claim.
- Operators who are tired and panicked while working due to the lack of training and knowledge in the job, causing market claims because parts are not right in installation or even not installed.

➢ *Method*

- The sequence of the process starts from preparation to finishing
- Lack of discipline in checking parts or materials (such as 10x16 dowel pins, Tensioner cam chains, Guide cam chains, Cam chains, Gaskets)

➢ *Machine*

- The work machine is not optimal because sometimes there are often problems during the work process.

➢ *Material*

- Engine parts from suppliers/vendors are sometimes still found to be defective.
- There are several parts that still have scrup and buryy as well as parts that are easy to break.

D. Improve

After identifying the root cause, the next step is Improve, which is to make improvements to reduce the number of rejections and improve product quality. Some of the improvements implemented are:

➢ *Operator Training:*

Improving the skills of operators through more intensive training, so that they are more competent in carrying out the production process without making mistakes.

➢ *Production Procedure Improvement:*

Improvement of production procedures to ensure that operators follow the correct standard operating procedures (SOPs).

➢ *Routine Machine Maintenance:*

Implementation of stricter machine maintenance schedules and preventive maintenance to prevent machine breakdowns that can interfere with product quality.

➢ *Raw Material Control:*

Increases inspection of the raw materials used, ensuring that only raw materials meet accepted specifications.

After the improvements are implemented, re-monitoring is carried out on the data on the number of rejected products and production performance. The results showed a significant decrease in the number of rejected products, from 5% to 3.91% in the fourth week of month 1. Meanwhile, after using the six sigma method method in the 2nd month or later with the DMAIC stage, the results are very significant, which can be seen from the number of rejections that began to decrease. If this method continues to be carried out consistently and regularly, it is possible that the hope of zero rejection/Zero claim market will be more feasible if everyone works together and always follows the SOPs that have been made and carried out in conjunction with this method.

Tabel 9 Trend of Production and Reject Volume Week to Week (2 months)

Week	**Production Amount**	**Number of Reject**
Week 1	5956	64
Week 2	5948	52
Week 3	5952	48
Week 4	5968	32
Total	23824	192

From the recorded data, after using the Six sigma method, it can be seen that the production amount is almost consistent with slight fluctuations from week to week. The first week produced 5956 units, while the second, third, and fourth weeks showed production of 5948, 5952, and 5968 units, respectively. However, what is interesting to observe is the trend in the number of rejects. Although the production volume is relatively stable, the number of rejections shows significant fluctuations. In the first week, the number of rejected products was recorded at 64 units, while the second, third, and fourth weeks showed a slightly lower number of rejected products, 52,48,32 units, respectively.

$$\text{Reject percentage} = \frac{\text{Production Amount}}{\text{Number of Refects}} \text{ X } 100 = \text{....\%}$$

- *First Week:*

✓ Production Amount: 5956
✓ Number of Rejects: 64

Reject percentage = $(\frac{5956}{64}) \times 100 = 1.075\%$

- *Second Week:*

✓ Production Amount: 5948
✓ Number of Rejects: 52

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Reject percentage = $(\frac{5948}{52}) \times 100 = 0.874\%$

- *Thrid Week:*

✓ Production Amount: 5952
✓ Number of Rejects: 48

Reject percentage = $(\frac{5952}{48}) \times 100 = 0.807\%$

- *Fourth Week:*

✓ Production Amount: 5968
✓ Number of Rejects: 32

Reject percentage = $(\frac{5968}{32}) \times 100 = 0.536\%$

E. Control (Pengendalian)

In the Control stage, the final step is to ensure that the improvements that have been made remain continuous and that there are no deviations from the established standards. Some of the control measures implemented are:

➢ *Periodic Monitoring:*

Conduct regular monitoring of machine condition, raw material quality, and operator performance to ensure that the production process remains under control.

➢ *Quality Audit:*

Conduct periodic quality audits to ensure that the products produced always meet the standards that have been set.

➢ *Consistent SPC Implementation:*

Continue to use Control Charts and Check Sheets to monitor variations in the production process and detect problems early.

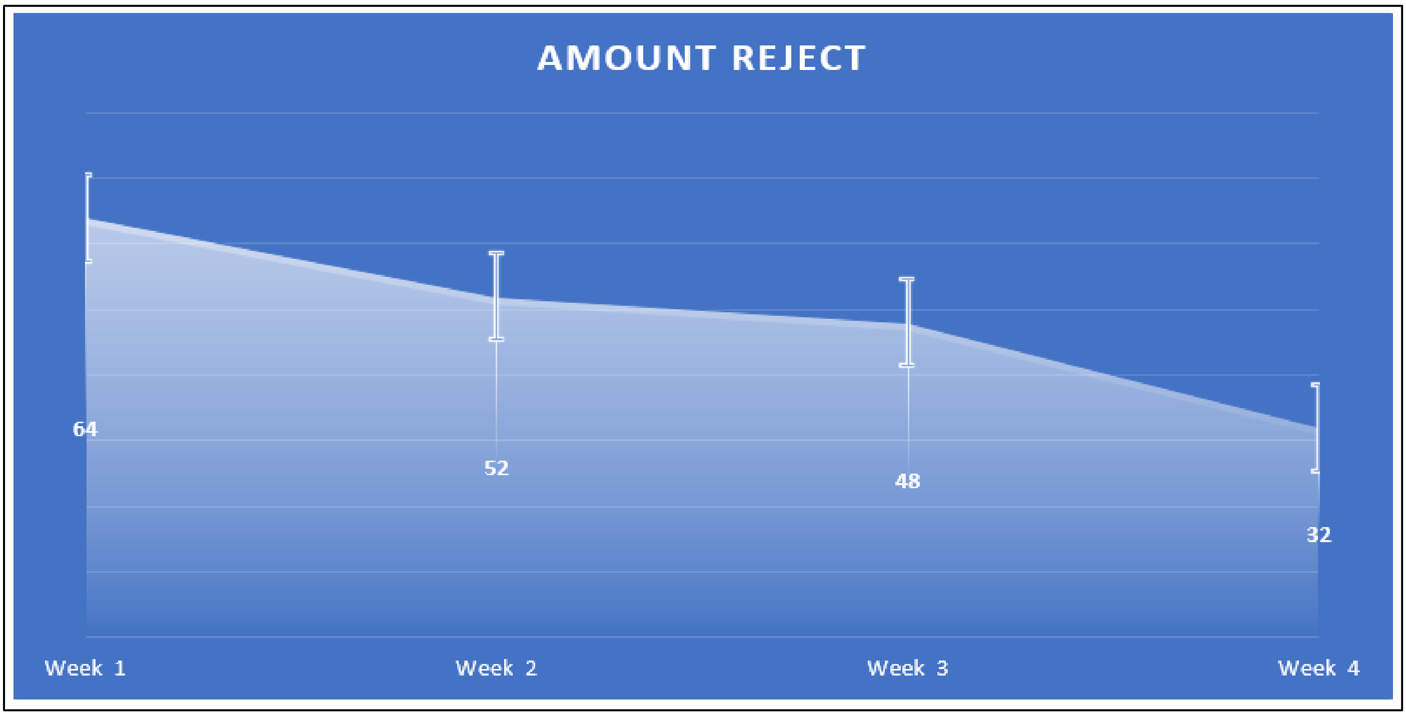

Fig 4 Impact of DMAIC Implementation on Production Quality

The impact of the application of the DMAIC method in quality control at PT. XNI can be seen from the significant decrease in the number of rejected products. In the 1st month of the first week it was 5% and then it decreased to 3.91% in the fourth week. In addition, there is an increase in production efficiency and a reduction in costs associated with reject products.

In the table above, the stages of using the DMAIC method in the 2nd month have very significant results, in the first week of the 2nd month, i.e., 1.75% then reduced to 0.536%. This shows that the Six Sigma method has a great influence on production control, therefore consistency in the application of SPC and Six Sigma is expected to continue, and the company can continue to improve the production process to achieve even better quality. Thus, the company can achieve the goal of achieving zero defect or zero defective products, which in turn will improve customer satisfaction and the company's competitiveness.

V. CONCLUSION

Based on the results of the processing and data analysis that has been carried out, the following conclusions can be drawn: In this study, the value of the factors that cause the product to become defective is due to poor raw materials, less than optimal operators and several factors such as inefficient or damaged work tools, and troublesome production machines, so that they inhibit and make parts reject. The

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proposed defect/reject product repair design is to make improvements to all sources of rejected products found.

The application of the DMAIC (Define, Measure, Analyze, Improve, Control) method supported by Statistical Process Control (SPC) and Six Sigma has proven to be effective in improving the quality control of motorcycle products at PT. XNI. Through systematic analysis and precise improvement, the company has successfully reduced the number of rejected products, improved production efficiency, and reduced variations in the process, with continuous control steps.

VI. SUGGESTION

PT. XNI is expected to control more from the factors of raw materials, employees and also machine maintenance by checking every week so that there are no problems during production time so that the factors causing engine rejection can be overcome if it is really done consistently and routinely. by maintaining high product quality and achieving goals in a long period of time, PT. XNI is also expected to reduce consumer claims and increase customer satisfaction, in order to strengthen its position in the Indonesian automotive market.

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