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Analysis Of Product Quality Of Rubber Production Using Six Sigma Method

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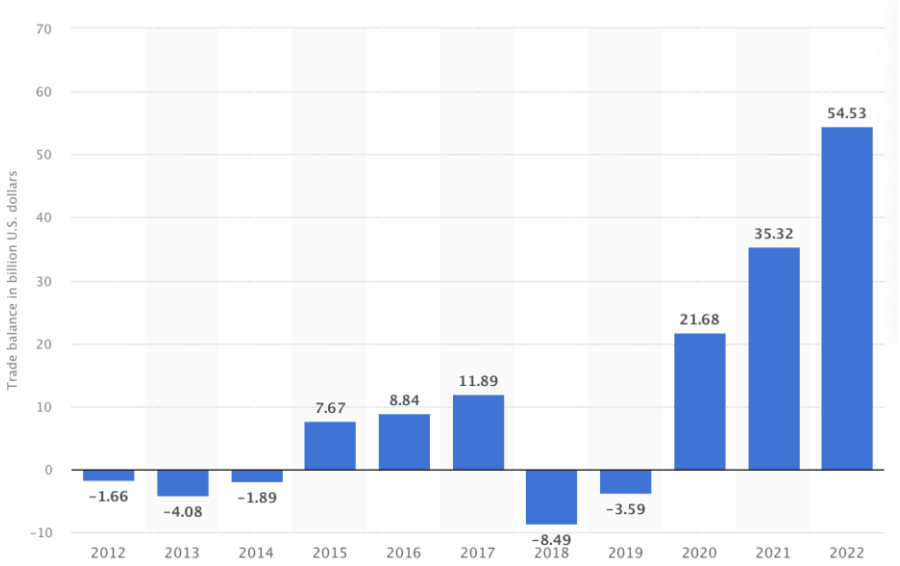
ABSTRACT. Contemporary companies function in a complex environment where opportunities are affordable, global markets are evolving faster than ever, and operational performance and organizational success are determined by customer-centric offerings. The motivation behind this study is to research what PT Surya's item quality means for the six sigma technique to distinguish factors that cause deformities and go to fitting lengths to work on the nature of their items. The assessment zeroed in only on the nature of elastic objects at PT Surya Teknologi Industri. Those expectations are called exceptional control. Inside the area of product development, the Six Sigma concept DMAIC (outline, measure, examine, improve and manipulate) is a method of approaches to enhance the technique that focuses on lowering operational changes and causes of failure. A non-public organisation referred to as PT. Surya Teknologi enterprise produces custom designs and plastic moulds. Consistent with the studies results, we are able to verify that the high-quality control done by way of the enterprise is good even above the sigma degree, however there are nonetheless many things that aren't true. We consider that the enterprise can improve the elements that cause defects and improve the great ofproducts produced.

Keyword: DMAIC; Product Defect; Quality Product; Six Sigma
JEL Classification: D2, L65, M11

INTRODUCTION

The stock market industry in Indonesia is very extensive and has the power of physical and computer resources. Indonesia's growth in the foreign exchange market underscores its flexibility and adaptability to the global financial crisis. Indonesia's strong computer economy combined with many unconventional ideas make Indonesia a unique player in both traditional and innovative fields. The implementation of G20 exchange rate measures reflects Indonesia's creation of a better environment for international exchange; which will enable this to be possible and the community to succeed. The G20 budget forecast provided during the audit period measured the exchange rate at US$691.9 billion (this increase from US$451.8 billion), further supporting the growth and strength of Indonesia's foreign exchange sector (WTO, 2022). News Figure 1, Indonesia's shows the 2012 trade balance. Till 2022, whilst the trade charge is the distinction between the value of traded goods and imported goods. A fine trade rate shows a surplus, while a tremendous value indicates a deficit. Indonesia will spend approximately $54.53 billion in 2022. Following prolonged economic recovery measures, there has been a significant increase in non-oil and gas sectors in general, and in the midst of these efforts, there has been a reaction to inflation and growth.



Source : By Author

Figure 1. From 2012 to 2022, Indonesia's goods trade balance (in billions of dollars)

In the production method, to produce the desired product and meet the predetermined high-quality requirements, good management is required. Convenient management is very beneficial for the manufacturing system so that excessive defects do not arise. Other than defects in a product, the product will revel in a lower in selling rate due to the fact the corporation does not recognize fine manipulation (Smętkowska, 2018). Six Sigma is a methodology focused on improving product and service quality, reducing variation, and driving cost savings. It is a structured approach that uses mathematical and statistical tools to increase productivity and business efficiency, requiring a broad knowledge of mathematics, management, and the relevant sector (Fersini, 2019). Variations of Six Sigma encourage organizations to gain aggressive profits through the over-provision of high-quality products and services, in conditions of increasingly fierce competition. Six sigma is a comprehensive and flexible framework for achieving, assisting, and maximizing business procedures. The objective of six sigma is to get ready, improve, and consistently confirm business ways to deal with accomplish no expense of disappointment.

Production methods starting from managing raw materials until they become marketable goods are very important in a production business. utilization of various resources, including

humans, machines, raw materials, etc., is part of this system. As a result, overall company performance can be improved through increasing production performance (Thomas et al., 2018). Contemporary companies function in a complex environment where opportunities are affordable, global markets are evolving faster than ever, and operational performance and organizational success are determined by customer-centric offerings. The general public of organizations that do not prioritize costs will now not be able to successfully compete with international organizations because of their expensive structure (Ahmed, 2019). Most commercial enterprise problems are caused by operational or methodical inefficiencies and a lack of efficient non-stop development techniques. Patron-directed operations no longer lose performance in achieving client desires. In addition to prioritizing buyer happiness, buyer-centric strategies must serve as a catalyst to achieve operational desires in reducing waste and improving performance (Yanamandra, 2022). The production industry frequently employs six sigma to lessen process and product variability. Six sigma can save costs of up to 25,000 USD by reducing equipment calibration costs from 78% to only 10.7% due to increased product variants (Marecek-Kolibisky & Kucerová, 2020). By intensely depending on measurements and critical thinking strategies, Six Sigma is an organized technique for process improvement that is focused on bringing down process varieties (process differences) while decreasing deformities (Omoush, 2020).

The process of implementing six sigma in innovation can deliver improvements in customer satisfaction and business performance through innovation for existing customers (Dagmar, 2021). The purpose of this research is to find six sigma at PT Surya Teknologi Industri more closely in reducing defective products and increasing the superiority of the products produced, as well as reading the extent of the DPMO (Defects per Million Opportunity) value to look for elements that can influence the product's capabilities so that it moves What is taken can be done more focused on major development. PT. Surya Teknologi Industri is a non-public organization participated underway produces merchandise as plastic injection shaped plastic parts and molds which are predominantly intended for unrefined components to help domestic and foreign creation.

METHODS

This study uses qualitative methods along with descriptive methods to explore the complexity of the research topic. Qualitative research focuses on understanding events in context, examining human behavioral patterns, beliefs, and experiences. This research emphasizes depth and clarity through a qualitative approach, aiming to explore meaning, perspective and context rather than relying solely on measured data. A qualitative analysis that accurately records and interprets the findings is carried out using descriptive methods. The study of a subject identifies and explains facts, characteristics, and relationships. This involves drawing a detailed and complete description of objects, showing the main features of objects, and showing the relationships between them. This study was conducted in PT. Surya Technology Industries is located in Bekasi Regency, West Java. In the research, primary data was obtained from interviews with the parties involved in the research, and secondary data were used to reveal the brief company structure, organizational structure, working methods, and supporting data in this research.

Data analysis used by researchers are DMAIC method and Six Sigma method. DMAIC is a five-pronged approach to research; that is, define, measure, analyze, improve, and control. **Define**; this stage decides the quantity of deformities and the primary drivers of harm that caused production errors. Methods applied include: 1) Identifying common quality problems in the production of company-specific products. 2) Define the action plan to be implemented in line with what needs to be done according to the research and analysis results. 3) Decide Six Sigma improvement objectives and targets in view of vision results.

Measure; the subsequent step in Six Sigma is to implement the size procedure. This step specializes in information the overall performance of the machine selected for development and accumulating all of the essential information for analysis. The purpose of measurement is to determine the quality of the product, the production process, and the efficiency of the process or production process. Commonly used criteria in this category are 1) Processing of production data and information on defective products. 2) Calculate the DPMO value (Defects per Million Opportunities). 3) Knowing the value of Sigma.

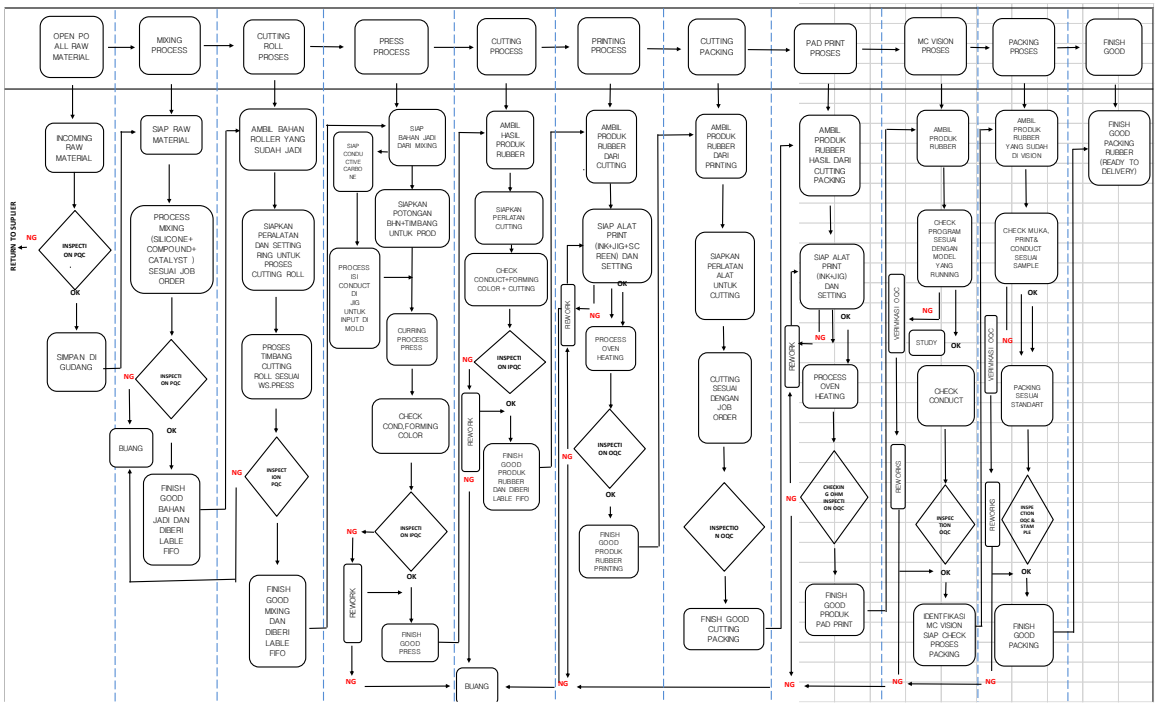
Analysis; in this phase, the data is analyzed for defects as described in the previous phase. The categories created in this category are as follows: 1) Analysis of common defects. After determining the different product types available in the product, the different types are analyzed. This analysis covers the frequency, cause, and impact of the type of defect that occurs. 2) Creation of RCA (root analysis). After the analysis is performed, a root cause analysis is performed to determine the causes of the most common defects. The output of this step could be used due to the next step, specifically creating a fault model and influencing analysis. developing FMEA (Failure Model and Risk Analysis) After studying the causes of defects, the outcomes are analyzed for every type of defect. 3) Optimization, at this stage the solution determined in the analysis phase is applied. To continually improve product quality, make improvements to processes that may degrade performance or cause product defects. 4) Results and comments. The closing stage is the tracking of the outcomes of the development. The conclusions already reached have been reached on the end of the research. suggestions are then made to relevant companies within the belief that future studies will fill the gaps left by present day studies.

RESULT AND DISCUSSION

In the industry, quality is particularly crucial, as it directly impacts the safety and sustainability of projects (Owusu, 2020). Bawane (2017) and More et al (2017), highlight the challenges in defining and managing quality in the industry, with Bawane specifically addressing the unique nature of customized quality assurance plans. Осипов (2016) emphasizes the importance of quality in meeting consumer needs and reducing production costs, the quality practices that best impact business results (Gremyr et al., 2019), and the capabilities that the quality experts need to have (Martin et al., 2019; Ponsignon et al., 2019). These inquiries connect with the meaning of value and its importance.

The introduction framework used by PT Surya Teknologi Industri is make-to-inventory (MTI) and make-to-order (MTO). Items which are created with the MTI framework will later be sold objects brought with the MTO framework will be presented to their standard client list. The progression of the rubber creation process at PT Surya Teknologi Industri is displayed in Figure 2. In six sigma projects information handling is by and large utilizing the pattern of DMAIC cycle. Information handling expects to decide the degree of deformities in the rubber creation process, sorts of imperfections, and factors causing deserts, and give important suggestions and as per the issue. give important proposals and as per existing issues. Juliani et al. (2020) expressed that the organization's capacity to carry out six Sigma would have the option to give manageability in the undertaking when the execution can affect the organization's monetary benefit.

Figure 2. Flow of Rubber Production Process



source: primary research data

Figure 2. Flow of Rubber Production Process

Define

The primary section of six sigma control is the definition section, which goals to discover the troubles and goals of the six sigma assignment. in addition, the satisfactory functions of the product that have an effect on the customer also are explained. Then the SIPOC diagram is made that's beneficial for figuring out crucial factors of the existing system.

An industrial corporation faces numerous troubles, from small to large, and these issues may be solved using the Six Sigma approach. however when enforcing a Six Sigma project, you need to prioritize which issues or satisfactory improvement possibilities might be addressed first. faulty rubber products are one of the most common issues inside the manufacturing technique of PT Surya technology industry. The following products and defects of PT Surya Technology Industri rubber from March to August 2023 are shown in Table 1.

Table 1 Defect Percentage Data of All rubber products PT Surya Technology Industry

Month	Total Production	Defect Amount	Defects Percentage
March	1,349,406	33,917	2.51%
April	930,218	25,510	2.74%
May	1,200,487	35,093	2.92%
June	1,499,036	29,715	1.98%
July	1,435,128	34,830	2.4 %
August	1,370,307	30,004	2.19%

Source: primary research data

Rubber processing is the procedure of processing rubber materials and remodeling them into preferred shapes. Rubber materials are to be had in distinct forms such as plates, tubes and blocks. The weak spot of rubber is that the material is easily damaged and it is tough to expect when it's going to break. As a countermeasure, anti-aging measures are taken in processed products. Various types of defects can occur during the processing of rubber. The probability of defects varies depending on the processing method. This causes level deviations and burr formation on the cutting surface during the cutting process. In addition, regardless of the processing method, if foreign substances are mixed into the rubber material, the quality of the final product will decrease. If a disruption occurs in the processing process, the product will lose its appearance and not work as it should. If the compost is not combined at the top and bottom, the quality of the product will be affected by its composition, causing faulty product, non-conformity and contamination. Examination of drawings should be done carefully to check for gaps.

Define Customer-Specific Needs

A Six Sigma project addresses customer needs, market changes, etc. There should be a Voice of the Customer (VOC) system that constantly monitors and updates. Therefore, it is important to understand the customer's needs, requirements and outcomes for a Six Sigma project. Output requirements for product features received by the customer are primarily application or product related. A quality plan was developed to identify or define specific customer requirements, as shown in Table 2. Information in the quality plan was obtained through interviews with product distribution personnel.

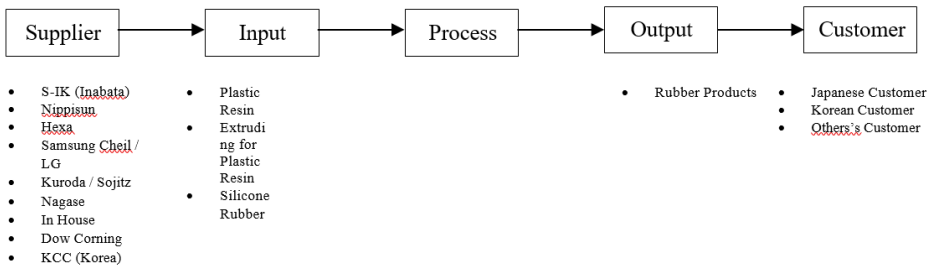
Table 2. Quality Plan Layout for Rubber Products

Customer Needs			
Primer	**Secondary**	**Tertiary**	**Technical Needs**
Good Physical Properties	Excellent ozone, chemical and aging resistance	Excellent resistance to heat and cold	ISO Approve

source: primary research data

SIPOC Diagram

The SIPOC diagram is used to pick out elements which could have an effect on the fine of the rubber manufacturing procedure, from the production stage (supplier) to the sales level (customer).



source: primary research data

Figure 3. SIPOC diagram of PT Surya Technology Industry Rubber

The rubber production process consists of 3 main stages: vacuum pressing, mixing, and printing/vulcanization. Auto vacuum cleaners are used to deliver perfect parts, reduce waste, and increase productivity. Leading heavy-duty machines include machines that perform operations

such as speed control, multi-zone temperature, position control, accident replacement, and rapid changes. The purpose of mixing is to incorporate elements simultaneously into the rubber matrix. They were mixing the quality of rubber materials, viscosity, hardening properties, etc. It depends on processing factors such as. Mixing equipment, general mixing methods, volcanic equipment, and methods should be identified to prevent product loss. Vulcanization completes the rubber manufacturing procedure. Vulcanization creates bonds among rubber polymers, and the procedure varies relying at the requirements of the final product. Low cross-linking of rubber polymers gives smooth, flexible rubber. increasing the wide variety of links reduces the power of the rubber and effects in a more potent rubber. If vulcanizations procedure not been completed properly, the rubber would remain hard when hot, crack when its been cold, and rot quicker.

Measure

The second one stage of the DMAIC cycle is measurement, which incorporates the method of figuring out the important thing characteristics of quality or critical to quality (CTQ) and the approach of measuring the fundamental overall performance of rubber manufacturing. The distinction between innate as well as predefined quality regarding a client's emotional feelings presents another problem (Martin, 2020). This phase is done to determine the current situation according to Six Sigma criteria such as DPMO level, sigma level, and existing capacity so that performance targets can be set and analyzed further.

Defining the key Critical to Quality (CTQ)

CTQ is a feature or characteristic of a product or method that is crucial due to the fact it is directly associated with customer desires and satisfaction. CTQ certification identifies the product in line with customer necessities and the frequency of defects that occur within the rubber manufacturing process. products from the manufacturing branch also play an crucial position in figuring out the most important CTQ of the products. There are 3 CTQ data points, Color (A), Dirt (B), and Mold (C), for rubber products that directly impact customers. The CTQ mentioned above is determined in consultation with the production department and based on samples of hazardous products taken during the investigation. The number of samples taken into account is 30 figures and the examination is carried out 30 times. The tracking of rubber products is shown in Table 3, and defect rate data is shown in Table 4. From table 3 and table 4, it is able to be seen that coloration defects are the highest contributor to product defects at 59%, accompanied by grimy defects at 27%, and brief mold defects at 14%.

Table 3. Results of Sampling Observations of the Number of Rubber Product Defects

No.	Observation Date	n	Number of Rubber Product Defects			Total
			Color Defect	Dirty	Shord Mold	
1	2-Jul	30	2	1	0	3
2	3-Jul	30	1	0	1	2
3	5-Jul	30	1	1	1	3
4	6-Jul	30	4	0	0	4
5	7-Jul	30	1	0	0	1
6	13-Jul	30	3	0	1	4
7	14-Jul	30	2	1	0	3
8	15-Jul	30	1	0	0	1
9	16-Jul	30	1	1	0	2
10	19-Jul	30	3	1	0	4
11	21-Jul	30	1	0	1	2
12	22-Jul	30	2	3	2	7

13	23-Jul	30	2	0	0	2
14	28-Jul	30	2	1	0	3
15	29-Jul	30	3	1	0	4
16	30-Jul	30	1	0	0	1
17	3-Aug	30	2	0	1	3
18	4-Aug	30	2	1	0	3
19	5-Aug	30	1	0	0	1
20	6-Aug	30	0	1	1	2

Source: primary research data

Table 4. Percentage of Attribute Data Defects

No.	CTQ	Total Defects	Percentage (%)	Cumulative (%)
1	Color Defect	47	59%	59%
2	Dirty	21	27%	86%
3	Shord Mold	11	14%	100%
	Total	79	100%	

Source: primary research data

Output Level Performance Baseline Measurement

As soon as the CTQ is determined, the following step is to measure baseline overall performance. organising a method for executing work in order that the progress and outcomes of the Six Sigma method may be defined and compared within the future. The output degree of the base layer is about using the DPMO (errors per million chances) parameter and the sigma capability. Measurements are made from all types of data. Predefined CTQs are required to measure the output level of data attributes. The calculation table of DPMO and Sigma values of the data structure is shown in Table 5.

Table 5. Calculation of DPMO and Sigma Value of Attribute Data

Organization: PT Surya Technology Industri	**Department:** Production
***Input/Output*:** *Output*	**Name *Output*:** Rubber
Proses: Rubber Production**Machine:** Auto Vacuum Press, Mixing roller, High Tempt Drying Conveyor	**CTQ Potential:** 1. Color Defect 2. Dirty Defect 3. Short Mold Defect

Observation Date : 2 Juli – 25 Agustus 2023

No.	Sample	Total Defect	CTQ Potensial	DPMO	Sigma
1	30	3	3	33.333,33	3,33
2	30	2	3	22.222,22	3,51
3	30	3	3	33.333,33	3,33
4	30	4	3	44.444,44	3,20
5	30	1	3	11.111,11	3,79
6	30	4	3	44.444,44	3,20
7	30	3	3	33.333,33	3,33
8	30	1	3	11.111,11	3,79
9	30	2	3	22.222,22	3,51
10	30	4	3	44.444,44	3,20
11	30	2	3	22.222,22	3,51
12	30	7	3	77.777,78	2,92
13	30	2	3	22.222,22	3,51

14	30	3	3	33.333,33	3,33
15	30	4	3	44.444,44	3,20
16	30	1	3	11.111,11	3,79
17	30	3	3	33.333,33	3,33
18	30	3	3	33.333,33	3,33
19	30	1	3	11.111,11	3,79
20	30	2	3	22.222,22	3,51
21	30	1	3	11.111,11	3,79
22	30	1	3	11.111,11	3,79
23	30	3	3	33.333,33	3,33
24	30	2	3	22.222,22	3,51
25	30	6	3	66.666,67	3,00
26	30	3	3	33.333,33	3,33
27	30	2	3	22.222,22	3,51
28	30	1	3	11.111,11	3,79
29	30	3	3	33.333,33	3,33
30	30	2	3	22.222,22	3,51
Jumlah	**900**	**79**	**Proses**	**29.259,25**	**3,39**

Source: primary research data

Table 6. How to Estimate Process Capability for Attribute Data

Steps	Action	Equation	Calculation
1	What process you want to know	-	Rubber Production Process
2	How many units are produced	-	900
3	How many defective products	-	79
4	Calculate the defect rate	Steps 3/Steps 2	0,087
5	Determine the CTQ that causes defective products	CTQ	3
6	defect	Steps 4/Steps 5	0,029
7	Calculate the probability of defect rate	Steps 6 x 1.000.000	29.259,26
8	CTQ characteristics	-	3,39
9	Calculate defect probability	-	The sigma esteem is 3.39 which implies it is over the normal industry execution in Indonesia

Source: primary research data

Table 5 shows that the obtained DPMO and Sigma values differ significantly, with the DPMO performance having a value of 29,259.25 and the performance sigma value being 3.39 sigma. The distribution of characteristic data sigma values is different and inconsistent, with a low value of 2.92 sigma and a high value of 3.79. The process DPMO value and performance sigma value obtained above will then be used as the basis for further development. The calculation steps to obtain the DPMO value and sigma value are shown in Table 6.

Analyze

The third step within the Six Sigma quality improvement process is analysis. At this stage, we want to do many stuff, which include figuring out the steadiness and capability of the method, figuring out the crucial quality feature (CTQ) target for improvement, figuring out the resources and reasons of defects, and prioritizing the sources of issues in the end with FMEA. Efforts to introduce a valid definition of quality must include a continuous review of customer needs (Escobar et al, 2022)

Production Data Stability

A systematic data analysis is performed to determine whether the number of defects in the rubber production process is within statistical control parameters. To create a control chart, the first step is to calculate the Center Line (CL), Upper Control Limit (UCL), and Lower Control Limit (LCL). The following is the calculation of CL, UCL, and LCL can be seen in Table 7.

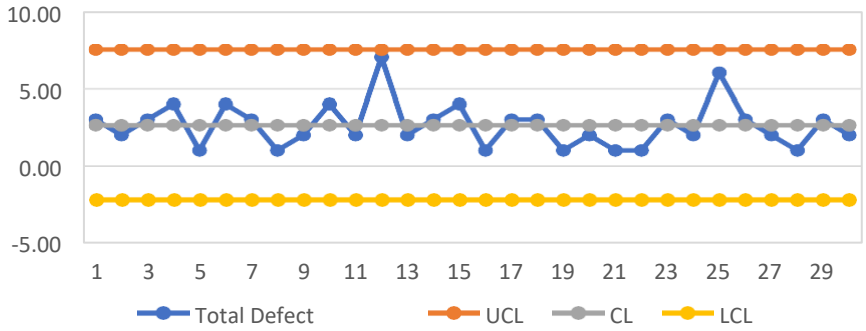
After CL, UCL, and LCL values are determined, the following C-chart control chart for the product inventory is created as shown in Figure 3. Based on Figure 3, we can confirm that the defect rate of gamis is still within limits. However, there are still some trends that are very high and some exceed the UCL value, so corrective measures need to be taken to make the performance difference stable or even equal. In general, quality control (QC) verifies that key components or specific features of the process are completed in the incoming process. Using appropriate quality control methods (designs, timelines, lists, etc.) before executing the process is a proven method of maintaining safety and quality (Amurao et al., 2023).

Table 7. Data on Number of Defective Products (C-chart)

No.	Total Sample	Total Defect	C-*chart* UCL	CL	LCL
1	30	3	7,49	2,63	2,23
2	30	2	7,49	2,63	2,23
3	30	3	7,49	2,63	2,23
4	30	4	7,49	2,63	2,23
5	30	1	7,49	2,63	2,23
6	30	4	7,49	2,63	2,23
7	30	3	7,49	2,63	2,23
8	30	1	7,49	2,63	2,23
9	30	2	7,49	2,63	2,23
10	30	4	7,49	2,63	2,23
11	30	2	7,49	2,63	2,23
12	30	7	7,49	2,63	2,23
13	30	2	7,49	2,63	2,23
14	30	3	7,49	2,63	2,23
15	30	4	7,49	2,63	2,23
16	30	1	7,49	2,63	2,23
17	30	3	7,49	2,63	2,23
18	30	3	7,49	2,63	2,23
19	30	1	7,49	2,63	2,23
20	30	2	7,49	2,63	2,23
21	30	1	7,49	2,63	2,23
22	30	1	7,49	2,63	2,23
23	30	3	7,49	2,63	2,23
24	30	2	7,49	2,63	2,23

25	30	6	7,49	2,63	2,23
26	30	3	7,49	2,63	2,23
27	30	2	7,49	2,63	2,23
28	30	1	7,49	2,63	2,23
29	30	3	7,49	2,63	2,23
30	30	2	7,49	2,63	2,23
Total	**900**	**79**			

Source: primary research data



Source: primary research data

Figure 4. Control Map Attribut Data

Identification Factors Causing Defects

According to the Pareto chart, faulty defect is known to be the defect with the highest percentage in other CTQs, making the seam defect the first problem to be solved. After being identified and discussed with the production department of the Rubber Production Department, it was determined that there were factors that could potentially cause defects, such as: 1) Human factors include: contractors cannot coordinate well in some processing activities, contractors are more Normally needs to be fulfilled, users are not careful. 2) Machine factor, machine setting does not match the characteristics of rubber, some machines are dirty. 3) Material content includes: The material used is old, the material used does not match the description.

Table 8. Worst Defect NG Rubber 2023

NO	Problem	QTY	PPM	Remarks
		January		
1	Dirty	5,381	5,745	0,57%
2	Short Mold	2,982	3,184	0,32%
3	Colour	2,652	2,832	0,28%
4	Printing	1,024	1,093	0,11%
5	Tear	841	898	0,09%
		February		
NO	Problem	QTY	PPM	Remarks
1	Dirty	6,817	5,878	0,59%
2	Short Mold	5,819	5,017	0,51%
3	Colour	3,739	3,224	0,33%
4	Printing	2,071	1,786	0,18%
5	Tear	1,26	1,086	0,12%
		March		
NO	Problem	QTY	PPM	Remarks

1	Short Mold	11,886	8,808	0,89%
2	Dirty	9,797	7,26	0,73%
3	Colour	6.106	4,525	0,46%
4	Printing	2,025	1,501	0,15%
5	Tear	1,484	1,1	0,10%

Source: primary research data

According to the data, while dirt, mold and color were the most important factors in January, Dirty led with 0.57% PPM, showing that cleanliness issues affected customer perception, followed by short defects and color. Persistent contamination with permanent defects and discoloration was seen at 0.59% PPM in February, highlighting ongoing challenges with hygiene standards and product quality. A change occurred in March when Short Pattern 0.89% PPM became an issue; This problem represents major industrial problems, followed by soil and color defects. Every month is a different process. Resolving these persistent dirt, short product, and color issues through quality control activities is critical to product fulfillment, customer satisfaction, and maintaining a popular product.

Improve

After the basis cause of the dimensions mismatch problem with specifications is diagnosed, a corrective action plan can be made to enhance the quality of rubber products.

Designing development recommendations is done according to the 5W + 1H method, due to the fact while developing development recommendations, it is crucial to recognize what (goal) desires to be accomplished (what), why the improvement plan is made (why), in which (where), whilst the improvement plan can be implemented (when), before the implementation of the improvement plan. who is accountable (who) and the way the improvement plan have to be carried out (how).

Table 9. Recommended Corrective Action

Type	5W+1H	Description/Action
Main Goals	*What?*	1. Prepare an SOP for the production department regarding the standard size or strength of rubber produced and how it should be cleaned. 2. Perform audits to ensure proper implementation of SOP. 3. Set tolerance limits for each element.
Reasoning	*Why?*	The materials used in the rubber production process are standardized to ensure that all rubber products comply with the required specifications and are durable.
Location	*Where?*	Rubber processing line Making
Sequence	*When?*	SOP outside the production period and using it in rubber production
People	*Who?*	Production manager
Method	*How?*	Establish detailed production procedures (SOP) and communicate with all employees.

Source: primary research data

Control

Within the control segment of the DMAIC method, the point of interest shifts to reinforcing the benefits carried out via quality improvement activities. This segment includes documenting overall performance, disseminating lessons learned, and setting up standard

operating procedures based totally on a success practices. Table 10 summarizes the nature and results of the internal classification process carried out between January and August 2023 in different rubber processing categories. During this period, developments were made in various departments including Mixing, Pressing, Cutting, Printing, and Packaging. QTR Status and Report Sortir Forward for the period January to August 2023 show that the mixing, media, cutting, printing, and packaging departments are well managed and are resolving quality-related issues within their responsibilities. Thanks to strict quality control measures and problem-solving methods, all problems arising in this period have been covered and solved; This underlines PT Surya Teknologi Industri's commitment to continuous improvement and product excellence.

Table 10. Status QTR & Report Sortir Internal Januari - Agustus 2023

BAGIAN	JANUARI			FEBRUARI			MARET		
	CLAIM QC	STATUS		CLAIM QC	STATUS		CLAIM QC	STATUS	
	QTR	OPEN	CLOSE	QTR	OPEN	CLOSE	QTR	OPEN	CLOSE
MIXING	-	-	-	-	-	-	-	-	-
PRESS	13	-	13	15	-	15	17	-	17
CUTTING	11	-	11	10	-	10	12	-	12
PRINTING	27	-	27	26	-	26	24	-	24
PACKING	9	-	9	12	-	12	14	-	14
TOTAL	60	-	60	63	-	63	67	-	67
BAGIAN	APRIL			MEI			JUNI		
	CLAIM QC	STATUS		CLAIM QC	STATUS		CLAIM QC	STATUS	
	QTR	OPEN	CLOSE	QTR	OPEN	CLOSE	QTR	OPEN	CLOSE
MIXING	-	-	-	-	-	-	-	-	-
PRESS	13	-	13	23	-	23	36	-	36
CUTTING	9	-	9	5	-	5	9	-	9
PRINTING	21	-	21	25	-	25	19	-	19
PACKING	11	-	11	8	-	8	9	-	9
TOTAL	54	-	54	61	-	61	73	-	73
BAGIAN	JULI			AGUSTUS					
	CLAIM QC	STATUS		CLAIM QC	STATUS				
	QTR	OPEN	CLOSE	QTR	OPEN	CLOSE			
MIXING	-	-	-	-	-	-			
PRESS	32	-	32	29	-	29			

CUTTING	12	-	12	10	-	10
PRINTING	21	-	21	28	-	28
PACKING	11	-	11	14	-	14
TOTAL	76	-	76	81	-	81

Source: primary research data

CONCLUSION

Findings include color defects, dirt, and storage, which represent common problems in the production process. These product defects can be attributed to several factors, primarily people, machines, and related factors. Human issues play a significant role in product defects, especially when it comes to inconsistent employee performance at different stages of production. variations in worker overall performance can bring about inconsistent product quality and increase the probability of defects. moreover, mechanical failures which includes the presence of contaminated components additionally cause severe issues in retaining product integrity. contamination in equipment can cause contamination of the final product, make a contribution to defects, and compromise general quality. additionally, variant in material quality additionally contributes to defects in rubber merchandise. adjustments to items can also have an effect on the characteristics of the final product, inflicting coloration errors, defects, and other quality problems. Addressing those material-related problems is important to making sure consistency and reliability in product quality. primarily based on evaluations, PT Surya Teknologi Industri has a commendable overall performance in quality management. The calculated DPMO fee, which shows the extent of defects, indicates the corporation's willingness to lessen defects and improve product quality. Additionally, the Six Sigma level achieved by the company exceeds industry standards and demonstrates operational capabilities and best practices to meet customer expectations. Criteria derived from DMAIC (Identification, Action, Analysis, Improvement, Control) provide a comprehensive overview of PT Surya Teknologi Industri's activities. the usage of the DMAIC technique, the corporation was capable of pick out areas for improvement, enforce targeted measures, and keep sturdy controls to make sure high-quality. PT Surya Teknologi Industri's performance above the industry standard in Six Sigma reinforces its commitment to continuous improvement and excellence in production. The findings of the study revealed the factors causing defects in rubber products at PT Surya Teknologi Industries. The research contributes to the understanding of how production processes can be effectively managed by identifying human, machine, and related issues as primary factors. Using the Six Sigma method to analyze product quality provides insight into its effectiveness in improving business operations. Studies demonstrate the importance of using problem-solving methods to improve product quality and reduce defects. Identifying the factors affecting PT Surya Teknologi Industri's production helps managers develop strategies to improve objectives. Management can implement measures to increase efficiency and effectiveness by addressing people-related issues such as operational inefficiencies and machine malfunctions. DPMO and Six Sigma assessments provide management insight into effective management practices. Managers can use this data to measure enterprise standards and decide how properly those standards are being accomplished. using Six Sigma concepts, PT Surya Teknologi Industri can set up effective quality control systems to make sure consistent product quality and consumer satisfaction. The study focused only at the quality of rubber products at PT Surya Teknologi Industri. even though those offer valuable insights into specific production techniques, the findings may not be generalizable to different industries or sectors. external factors beyond the researcher's control, which include adjustments in marketplace situations, regulatory necessities, or technological advances, can also affect the studies technique. these elements may additionally introduce biases or confounding variables that restrict the value of the analysis, so that they may be used as parameters in future research.

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