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IMPLEMENTATION OF STATISTICAL PROCESS CONTROL (SPC) METHODS IN MAXIMIZING THE QUALITY OF RATTAN CRAFT PRODUCTS (CASE STUDY OF MULIA ROTAN SHOP MEDAN)

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Abstract

Toko Mulia Rattan is a service company in Medan City that focuses on rattan crafts. They often experience quality problems in their production process. To overcome this, they use the Statistical Process Control (SPC) Method to analyze the causes of defects in products and production processes. The goal of SPC is to find the root cause of defects in order to improve product quality. They carry out quality control analysis using statistical tools such as Check Sheets, Control Charts, Pareto Diagrams, and Cause and Effect Diagrams. The research results show that the use of SPC has met quality standards and significantly reduced damage or rejected products. In 2023, there will be a significant reduction in the types of damage which are dominated by Easily Detached Leather, Rattan Thickness, Wrong Color, and Broken Books. This indicates improvements in the production process that produce better results. The first steps in improving quality are statistical analysis of production quality control, starting with creating check sheets, control charts using Microsoft Excel, Pareto diagrams based on primary data, and cause and effect diagrams based on interviews to identify causal factors such as human factors, machines, materials and work methods. Next, they provide recommendations or proposed actions to improve quality.

Keywords:Product Quality, Quality Control, Statistical Process Control (SPC)

INTRODUCTION

Rattan products are one of the most popular forest commodities in Indonesia after wood products. Rattan has unique properties that make it easy to process, strong, and has an attractive appearance, so it is widely used in the furniture industry. Even though Indonesia supplies almost 80% of the world's rattan needs, the rattan processing industry has not developed in line with its potential. Rattan craftsmen are individuals who have high hand skills and produce art items with a sense of beauty, but product defects often occur in the production process.

Rattan is a vine from the Palmae family with a fibrous root system and compound flowers. The economic potential of rattan has been recognized by the Indonesian government, which aims to increase the added value of rattan raw materials and produce finished rattan products to increase exports and state income.

Toko Mulia Rattan is one of the rattan producers in Medan which is experiencing problems with the quality of its products. They faced a significant number of product defects every month in 2019, causing financial losses and delays in order delivery.

To correct this problem, the Statistical Process Control (SPC) method is used. SPC is an analytical method for monitoring production processes by collecting data, arranging data in graphs, and interpreting data to control and reduce variations in the production process. This

method has various techniques, including Pareto diagrams, histograms, check sheets, cause and effect diagrams, scatter diagrams, flow diagrams, and control charts.

By implementing SPC, rattan manufacturers can improve their production processes, minimize product defects, and improve the quality of the final product. The implementation of SPC in the rattan industry is expected to bring significant operational and financial benefits.

Thus, implementing the Statistical Process Control (SPC) method is the right step to maximize the quality of rattan craft products, ensuring that the raw materials, production process and final results comply with the expected standards.

RESEARCH METHODS

This research implements the Statistical Process Control (SPC) method, which is a type of quantitative descriptive research. Quantitative descriptive research is a type of research that systematically, factually and accurately describes the facts and characteristics of a particular population, and also describes phenomena in detail (Musfirah et al., 2022). This type of research is widely used by researchers because the expected final results are values that can be obtained and observed using real numerical results. Thus, researchers can conclude that quantitative descriptive research is a type of method that is very suitable for implementing Statistical Process Control, where the test results are in the form of data (numbers).

TIME AND PLACE

In processing the data obtained, the method is used Statistical Process Control (SPC) with analysis steps within the following time period:

Table 4.1 Statistical Process Control (SPC)

Year	Month	Total Production	Type of defect				Amount Defective Products
			KMM	KR	SW	PB	
	Jan						
	Feb						
	Mar						
	April						

Toko Mulia Rattan is a service SME that has been engaged in rattan furniture craftsman services since 1997, located at Jl. Gatot Subroto No. 350, Sei Sikambing D, Kec. Medan Petisah, Medan City, North Sumatra 20114. We not only offer an exclusive collection of high quality rattan furniture, but also provide custom and repair services to meet the unique needs of homes, cafes and restaurants. With our dedication to detail and creativity, we are committed to presenting furniture solutions that suit the style and space needs of business premises to create a beautiful and comfortable atmosphere in every room.

RESEARCH PROCEDURE

In data processing, the Statistical Process Control (SPC) method is used with the following analysis steps:

1. Check Sheet

This sheet is used to record production data and types of defects every month. These defects include Easily Detached Skin (KMM), Rattan Thickness (KR), Wrong Color (SW), and Book Breaks (PB).

2. Control Chart
   A control chart is a graphical tool for monitoring whether an activity or process is under statistical quality control. The steps for making a control chart include calculating the percentage of damage, center line, upper control limit, and lower control limit.
3. Pareto Chart
   This diagram is used to identify the most dominant types of product damage. This helps in knowing priorities for making quality improvements.
4. Cause and Effect Diagram
   After knowing the main type of damage, a cause and effect diagram is used to analyze the factors causing the damage. This helps in identifying the root cause and planning corrective action.
5. Quality Improvement Recommendations
   The final step is to provide recommendations or proposed actions to improve the quality of defective products. This is done based on the results of causal factor analysis, so that companies can improve product control processes and reduce defective products.

RESEARCH RESULT

The results of this research use statistical methods to analyze production quality control. The analysis steps include making a check sheet, a control chart with the help of Microsoft Excel, a Pareto diagram based on processed primary data, and a cause and effect diagram based on interview results.

The first step is to create a check sheet to make data collection and analysis easier. The check sheet records the date, total defects per day, total production, and type of damage. This data helps in identifying the causes of production defects and pinpointing problem areas. By using a check sheet, data is obtained regarding the factors that cause production defects and the severity of defects in the production process.

Next, the data from these check sheets is used to create control charts, Pareto diagrams, and cause-effect diagrams, which will provide further insight into the factors that influence product quality.

Table 4.2 Checking Sheet / Check Sheet)

Year	Month	Production Amount	KMM	KR	SW	PB	Number of Defective Products	Total Production Amount
2022	January	90	3	4	4	5	16	106
	February	42	2	4	4	6	16	58
	March	56	3	5	12	2	22	78
	April	83	2	3	4	1	10	93
	May	101	4	6	17	5	32	133
	June	90	3	4	5	5	17	107
	July	87	3	12	3	3	21	108
	August	98	3	9	9	6	27	125
	September	95	23	3	4	5	35	130
	October	121	2	4	5	6	17	138

	November	98	21	3	8	3	35	133
	December	96	2	4	3	2	11	107
Total		**1057**	**71**	**61**	**78**	**49**	**259**	**1316**
2023	January	102	4	5	5	6	20	122
	February	105	3	5	6	7	21	126
	March	110	2	4	5	4	15	125
	April	121	2	3	4	4	13	134
	May	101	4	5	4	2	15	116
	June	109	5	5	7	2	19	128
	July	119	3	3	6	6	18	137
	August	102	8	3	2	1	14	116
	September	100	15	9	7	8	39	139
	October	105	2	5	8	4	19	124
	November							
	December							
Total		**1074**	**48**	**47**	**54**	**44**	**193**	**1267**

Source; Mulia Rattan Store 2023
KMM: Easy Peel Off Skin
KR: Rattan Thickness
SW: Wrong Color
PB: Broken Book

Scatter diagrams or scatter diagrams are graphs that show the relationship between two variables, whether positive, negative or no relationship. The SPSS output shows the points scattered around the normal line, indicating a normal distribution in the 2022 and 2023 data.

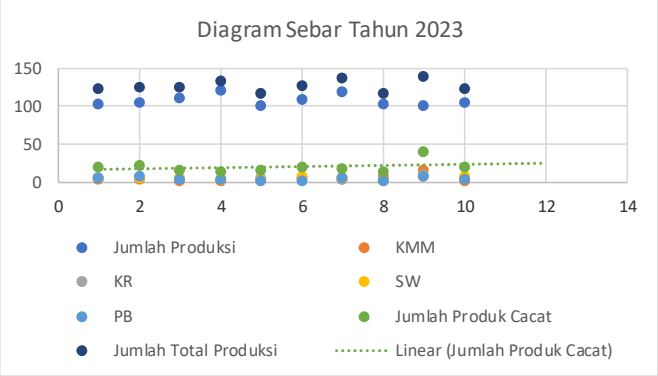

Figure 1. Scatter Diagram for 2023

A histogram is a graph that shows the characteristics of data divided into classes.

Histograms can be normal or skewed, showing the distribution of data. Histogram analysis shows that the number of defects in 2022 is still high and will decrease significantly in 2023, but still needs improvement.

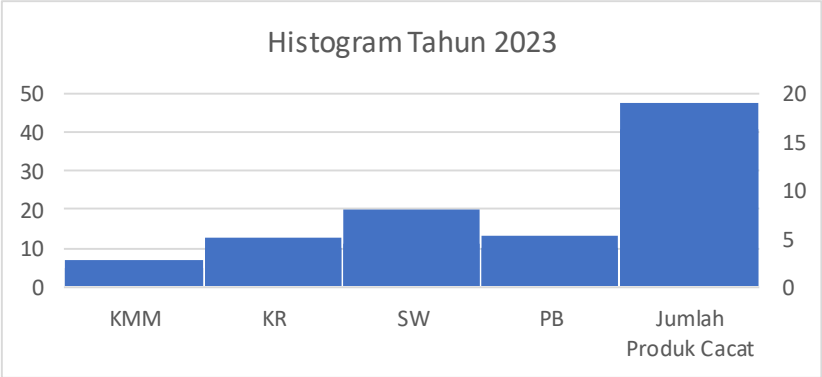

Figure 2. Histogram for 2023

The second step is to create a control chart, a graphical tool for monitoring whether an activity or process is under statistical quality control. Control charts are used to determine the percentage of damage, tolerance limits, and upper and lower control limits. This method helps in solving problems that affect product quality and determining necessary improvements.

Control charts are used to determine the percentage level of damage, damage tolerance limits and upper limits, lower limits of damage. The following are the results of data processing on the control chart :

Table 4.3 Control Map Calculation Results

Year	Month	Production Amount	Number of Rejects	P	CL	UCL	LCL
2022	January	106	16	1%	117.41	178.39	56.42671
	February	58	16	1%	117.41	178.39	-40.6549
	March	78	22	1%	117.41	178.39	-60.9824
	April	93	10	0%	117.41	178.39	-60.9824
	May	133	32	1%	117.41	178.39	-60.9824
	June	107	17	1%	117.41	178.39	-60.9824
	July	108	21	1%	117.41	178.39	-60.9824
	August	125	27	1%	117.41	178.39	-60.9824
	September	130	35	1%	117.41	178.39	-60.9824
	October	138	17	1%	117.41	178.39	-60.9824
	November	133	35	1%	117.41	178.39	-60.9824
	December	107	11	0%	117.41	178.39	-60.9824
Amount		**1316**	**259**				
2023	January	122	20	1%	117.41	178.39	-60.9824
	February	126	21	1%	117.41	178.39	-60.9824
	March	125	15	1%	117.41	178.39	-60.9824

	April	134	13	1%	117.41	178.39	-60.9824
	May	116	15	1%	117.41	178.39	-60.9824
	June	128	19	1%	117.41	178.39	-60.9824
	July	137	18	1%	117.41	178.39	-60.9824
	August	116	14	1%	117.41	178.39	-60.9824
	September	139	39	2%	117.41	178.39	-60.9824
	October	124	19	1%	117.41	178.39	-60.9824
	November						
	December						
Amount		**1267**	**193**				

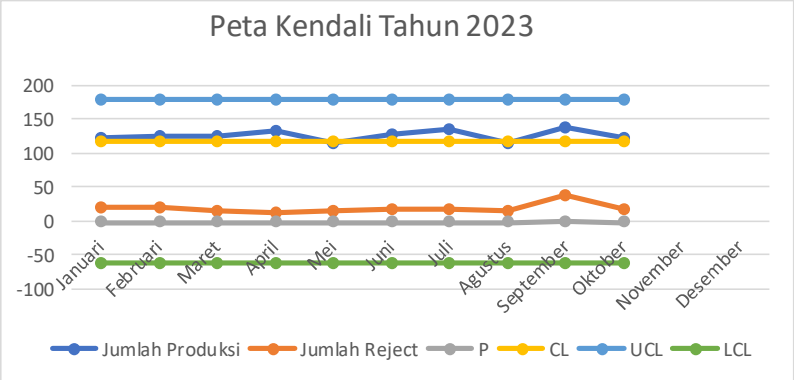

Figure 3. Chart Control Map for 2023

Based on the results of the control chart analysis, in 2023 there is still a line above the Center Limit but still below the UCL (Upper Control Limit) line, indicating that quality control during that year is still within safe production limits. However, further improvements are still needed to overcome deviations that occur and prevent further deviations.

The next step is to identify the dominant type of damage to rattan products. From the results of the check sheet data, a Pareto diagram is used to identify, sort and resolve product damage permanently. Based on the Pareto diagram, production damage in 2022 is dominated by types of damage, including Easily Removable Leather at 71, Rattan Thickness at 61, Wrong Color at 78, and Book Breaks at 49.

The analysis presented includes the types of defects KMM (Leather Easily Removes), KR (Thickness of Rattan), SW (Wrong Color), and PB (Broken Book) for the years 2022 and 2023. For each type of defect, the proportion of defects and the upper control limit are calculated. (UCL), lower limit (LCL), and control chart analysis. The following is a summary of the analysis results:

KMM Analysis (Easy Peel Off Skin):

- Disability proportion for 2022: 5%
- Disability proportion for 2023: 4%

- Based on the control chart, the proportion of KMM defects is still below the safe control limit.

KR (Rattan Thickness) Analysis:

- Disability proportion for 2022: 5%
- Disability proportion for 2023: 4%
- Based on the control chart, the proportion of KR defects is still below the safe control limit.

SW (False Color) Analysis:

- Disability proportion for 2022: 5.9%
- Disability proportion for 2023: 4.2%
- Based on the control chart, the proportion of SW defects is still below the safe control limit.

PB Analysis (Book Break):

- Disability proportion for 2022: 3.4%
- Disability proportion for 2023: 3.4%
- Based on the control chart, the proportion of PB defects is still below the safe control limit.

Identify Cause and Effect (Fishbone Diagram):

- Cause and effect diagrams are used to identify the root cause of a problem.
- The causal factors analyzed include humans, machines, methods, materials and the environment.
- This diagram helps in generating solution ideas for identified problems.

Analysis shows that the proportion of defects for all types of defects is below safe control limits based on the control chart. This shows that the production process is still in a controlled condition and does not require significant improvements. Cause and effect diagrams can be used to more deeply identify the causal factors of defects that occur in the production process.

CONCLUSION

The implementation of the Statistical Process Control (SPC) method at Toko Mulia Rattan has had a positive impact in maximizing the quality of rattan craft products. Quality standards have been met and excessive damage or rejected items have been successfully reduced. In 2022, the dominant types of damage include Easily Detached Leather, Rattan Thickness, Wrong Color, and Book Breaks with each a significant number of cases. However, in 2023, there was a significant decrease in the number of defects, although Easy Shedding Skin was still the most dominant damage type. Improvements in the production process have succeeded in reducing damage, but further improvements and improvements in the production process are still needed to prevent further damage from occurring.

The steps for statistical analysis of production quality control, in accordance with the SPC method, involve several stages. First, a check sheet is created to monitor product quality. Next, create a control chart using Microsoft Excel and create a Pareto diagram based on primary data that has been processed. Finally, a cause and effect diagram is created based on the results of the interview to identify the factors that cause damage, such as human factors, machines, materials and work methods. Recommendations or proposed actions are then given to make quality improvements based on the results of the analysis that has been carried out. Thus, the implementation of SPC at Toko Mulia Rattan has made a positive contribution in improving product quality and minimizing damage during the production process.

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