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APPLICATION OF DMAIC AND TAGUCHI METHODS TO MINIMIZE THE DEFECTIVE PRODUCTS FLIP LIGHTSPEED CLIPBAR

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ABSTRACT

PT X is an industrial company that produces sandals including Lightspeed Clipbar, Lightspeed Clip sandals and Lightspeed Cross Bar sandals. The problem that occurs is that there is one sandal product with the highest level of disability, namely the Eiger Lightspeed Clipbar sandal product which reaches 9,101% per year. The purpose of this study was to identify the type of defect in the Lightspeed Clipbar sandal product through the DMAIC stages (Define, Measure, Analyze, Improve, and Control)) and make a proposed improvement in the assembling and buffing process at PT X. Based on the results of the study, identified factors causing defects between Other: open bonding, the sides of the sandals are not neat and the erosion of the Lightspeed Clip logo sandals. Factors that cause sandals are defects, glue, soles and benzene. The DPMO (Defect per Million Opportunities) value of the DMAIC results is 30376.12 with an average sigma score of 3.38. The sigma value does not meet the sigma process capability standards for industries in developed countries, which is 5-6 sigma. While the results of the Taguchi experimental calculations the value of the average quality characteristics for sandals defects amounted to 3.40 to 0.32 and the S / N quality characteristics of 10.67 to 0.24. The conclusion of this study resulted in corrective action on the Eiger Lightspeed Clipbar sandals product, which is obtained the optimal level setting of factors that affect the defects of Eiger Lightspeed Clipbar sandals, including the 28g glue factor, 15 mm rubber soles and 13 mm benzene. Confirmation results with an optimal setting level obtained values of 3.31 to 0.38, as well as S / N quality characteristics for the defects of the Lightspeed Clipbar sandals 10.54 to 0.

INTRODUCTION

The quality of the products produced well in addition to providing customer satisfaction, can also be a determinant of a product that has a high selling value.

According to Phil Crosby (2002) as quoted by Sudianto (2008) quality is a very important factor because it is a consumer consideration in selecting products. The quality of products produced by a company in fact there are always failures, one of which is disability in the product. Products that have defects certainly hinder the company's sales, because it can cause the selling price to decrease and result in customer dissatisfaction[1]

PT X is a company engaged in the manufacturing of sandals, which was founded in 1989. This company manufactures sandals with trademarks. Cat Stayle (own brand). PT X manufactures sandal products under the Eiger trademark, which has three models of mountain sandals namely the Eiger Lightspeed Clip Sandal, Eiger Lightspeed Cross Bar and Eiger Lightspeed Clipbar. Eiger sandals production process is divided into eight main stages, namely the process of sewing, embosing, scratching sol, assembling, buffing, quality control (QC), packaging to product delivery.

The quality of sandal products produced by PT X is divided into 3 categories, namely categories A, B and C. Category A is sandals that can be sold to the market without any defects, category B has disabilities and the selling price has decreased by 40%, category C is sandals which has a very large functional price reduction of 50%. Research on the Eiger sandal production process is focused on the assembling process and the buffing process, because there is a problem that is a defect in the Eiger Lightspeed Clipbar sandals model. The average defect in sandals produced is 9,101% and belongs to category B.

These defect problems can certainly be overcome by using the DMAIC method (Define, Measure, Analyze, Improve and Control) and the Taguchi method. According to the results of the study[2] shows that the DMAIC method and the Taguchi method can improve quality (minimize defects) in the casting process at the lowest possible cost. DMAIC method is a method that can identify and analyze the root causes of a product's disability optimally [3].

The DMAIC method has 5 stages that must be applied including the identification stage, the measurement which is the quality improvement stage, the analysis phase which is the stage of analyzing the DPMO value, improvement which is the stage of giving proposed corrective actions and analyzing corrective actions. And finally the control which is the stage to ensure that the corrective actions implemented will continue.[4].

Taguchi is a method that can improve the quality of products and processes at the same time can reduce costs,as well as minimal resources. The reason for choosing the Taguchi Method in applying DMAIC is because this method can make a product or process become robust against noise factors, this method is also called a robust design method [5]. Based on the background above, the purpose of this study is to identify the types of defects in the Lightspeed Clipbar sandal product through the stages of DMAIC (Define, Measure, Analyze, Improve, and Control)) and make suggestions for improvement in the assembling and buffing process at PT X.

LITERATURE REVIEW

The definition of quality according to the American Society for Quality is quoted by Heizer & Render in Gasperzs: "Quality is the Totality of features and characteristics of products or services that have the ability to meet the needs that appear expressed or hidden." [6]. Whereas according to[1] Quality is an attempt to meet or exceed the expectations of customers and quality is a condition that is always changing (for example when it is considered to have good quality, maybe in the future it is considered less qualified). In general, the stages in which the implementation of Six Sigma is carried out using the Measure, Analyze, Improve, and Control (DMAIC) approach which serves to improve the quality of the production process and reduce the level of defects in attribute quality and variable quality [7].

The DMAIC methodology is used when a company already has a finished product or product that is still in the process stage, but has not yet reached the specifications required by the customer. The following is an explanation of the DMAIC stages:

a. Define, determine project goals and customer expectations.

b. Measure, measure the process to be able to determine the performance now or before experiencing improvement with the key quality characteristics of Critical to Quality (CTQ). Measurement system with Defect per unit (DPU) is a defect that occurs. The measurement system uses Defects per Million Opportunities (DPMO) as a unit of measurement.

$$\text{DPU} = \frac{\text{Damage Total}}{\text{Production Total}} \quad (1)$$

Calculate the DPOM beforehand determine the probability of the amount of damage

$$\text{DPOM} = \frac{\text{DPU x 1 jam}}{\text{Damage Problem}} \quad (2)$$

Determination of sigma value

= normsinv ((1.000.000-DPMO)/1.000.000) + 1,5

c. Analyze, at this stage analyze and determine the root cause of a defect or failure by using brainstorming, brainstorming is a good way to generate as many good ideas as possible related to a given topic, which aims to make a list of problems that can be fixed and produce a cause which might be of a problem [8].

d. Improve, improve the process of eliminating or reducing the number of defects or failures using the Taguchi method. The Taguchi experimental design isdivided into three main stages that cover all experimental approaches.

The three stages include the following:

1. The planning stage is the stage of identifying the problems that arise, from these problems the next thing that is done is to look for what factors are influential and determine the value level required of these factors.
2. The implementation stage is the stage of implementing Taguchi's experimental research based on predetermined factors and levels, using the orthogonal matrix table aray in accordance with the calculation of degrees of freedom.
3. The analysis phase is the stage that is used to test the correctness of the factors that have been processed and get the results of the experiments, at this stage a hypothesis test is performed to find out whether the factors that have been determined have a significant effect on the problems that occur with the formulation as follows: Calculate the total square (ST) with the following formula:

$$ST = \sum y^2 \quad (3)$$

where:
y = Data obtained from experiments
Calculates the square of the mean (Sm) with the following formula:

$$Sm = n\bar{y}^2 \quad (4)$$

where:
n = Number of trials"
$\bar{y}$ = Average data obtained from experiments

Calculate the square of the factor (Sq) with the following formula

$$Sq_i = n_{i1}\,\overline{i1}^2 + n_{i2}\overline{i2}^2 + ...n_{ij}\overline{ij}^2 \quad (5)$$

where:
"n = Number of trials"
Calculate the square of error (Se) with the following formula:

$$Se = ST - Sm - \left(Sq_A + Sq_B + ... + Sq_i\right) \quad (6)$$

Calculate the average number of squares (Mq) with the following formula:

$$Mq_i = \frac{Sq_i}{v_i} \quad (7)$$

Calculate the F-ratio (Fi) using the following formula:

$$F_i = \frac{Mq_i}{Mq_e} \quad (8)$$

Calculate pure squares (Sq`) with the following formula:

$$Sq' = Sq_i - \left(v_i \text{ x } v_e\right) \quad (9)$$

Calculate the percent contribution (Pi) with the following formula:

$$P_i = \frac{Sq_i}{S_t} x100 \qquad (10)$$

The smaller, the better, the quality character with a value limit of 0 and non negative. The value is getting smaller (near zero is desired).

$$S/N_i = -10\log\left(\frac{1}{n}\sum_{i=1}^{r} Y_i^2\right) \qquad (11)$$

Confidence intervals are upper and lower limits where it is expected that the average value actually falls within that range. When expressing a trust value for a confidence interval, the true value will be within the specified limits, then the formula used is as follows:

$$\mu_{predicted} = \overline{y} + \left(D_1 - \overline{y}\right) + \left(B_1 - \overline{y}\right) + \left(F_1 - \overline{y}\right) \qquad (12)$$

Calculating the estimated confidence interval can be calculated with the following formula:

$$CI_i = \sqrt{F_{\alpha,v1,v2} \text{x}\ v_e \text{x} \left[\frac{1}{neff}\right]} \ (13)$$

with:
F_ (α, v1, v2) = F ratio table
α = risk. Trust level = 1 - risk
v_1 = degrees of freedom for the average and the value is always 1 confidence interval
v_2 = degrees of free pooled error variance
V_e= pooled error variance
n = number of observations So that the confidence interval is obtained by the following formula:

$$\mu_{predicted} - CI \le \mu_{predicted} \le \mu_{predicted} + CI \ (14)$$

Confirmation experiments aim at experiments conducted to check conclusions obtained. The purpose of the confirmation experiment is to verify [5]

1. Allegations made at the time of the performance model determining factors and their interactions.
2. Designing optimum parameters (factors) the results of the analysis of the experimental results on the expected performance.

The confirmation experiment steps are as follows:

1. Designing optimum conditions for significant factors and levels.
2. Compare the average variance of the results of the confirmation experiment with the expected average and variance.

A confirmation experiment is declared successful if:

1. There was an improvement in the results of the existing process (after the Taguchi experiment).

2. The results of the confirmation experiment are close to the predicted value.
3. Control, oversee the performance of the process that will come after experiencing improvement.

METODOLOGY

The research begins with direct observation to the company it aims to gain knowledge about the production process of Eiger Lightspeed Clipbar sandals conducted at CV Cat Style. The background of the problem is divided into two, namely a field study conducted aimed at identifying the problems that are happening in the company, these problems regarding the production process of Eiger Lightspeed Clipbar sandals. Field studies conducted were in the process of assembling and buffing that experienced problems with quality degradation, and literature studies. Literature study was conducted to find out the stages in resolving the current problem, one of the proposed improvements in the quality of Eiger sandals using the DMAIC method (Define, Measure, Analyze, Improve and Control) and Taguci. Data collection consists of two stages, namely primary data with direct observation to the production process being carried out, these observations include brainstorming, interviews and experiments. Interviews were conducted with several workers who were in the process of producing the EigerLightspeedClipbar sandals, and who had the authority and knowledge of the production process and the assembling and buffing process. experiments carried out to determine the number of defects that occur from a predetermined level. The following primen data have been obtained as follows:

a. Eiger Lightspeed Clipbar sandals defect data from experiments conducted from 15 June to 28 June 2019.
b. Eiger Lightspeed Clipbar sandals flaw data from confirmation experiments that have been conducted from 28 July to 10 August 2019.
c. Data on three types of defects in Eiger Lightspeed Clipbar sandals products from October to December 2019, three types of defects are open bonding, the sides of the sandals are not neat and the Lightspeed Clipbar logo is eroded.

Secondary data obtained in this study are data on the number of production and the number of defects in Eiger Lightspeed Clipbar sandals which are included in the B-Grade category in October to December 2019. Processing data in the research Proposal for Repairing the Lightspeed Clipbar Sandal Product Defects with the DMAIC and Taguchi methods, As for the explanation of the stages of the DMAIC and Taguchi methods, to provide suggestions for improvement in this study are as follows

A. DMAIC and Taguchi The stages for implementing DMAIC are as follows:

1. Define phase, namely identifying the types of defects that arise in research that will be carried out with the initial stages of defining Critical to Quality (CTQ).

2. The measure phase is a step to determine Critical to Quality (CTQ) and Defects per Million Opportunities (DPMO), aiming to determine the sigma value obtained from the calculation results produced by the company.
3. Analyze phase is a step to find out the factors that influence the emergence of types by using the brainstorming method by interviewing 3 speakers who are in the company.
4. Improve phase is the stage where improving the production process and eliminating the causes of defects that arise, this improve stage uses the Taguchi method. Taguchi experiments conducted on quality improvement that is by making the product or process "insensitive", by making adjustments to the average and reducing variance appropriately, then the loss / loss of product or process will be minimized Application of optimal settings is carried out so that quality degradation can be achieved

B. The steps for implementing the Taguchi method are as follows:

1. Determine what factors will be an improvement on the Taguchi experimental test, these factors can be seen at the Analyze stage.
2. Determine the level for each factor that will be examined, the level consists of one company standard and two as a proposed level.
3. Calculation of degrees of freedom, the function of calculating degrees of freedom is to determine the orthogonal matrix table in accordance with the calculation of degrees of freedom.
4. The experiment was carried out by direct observation to the production process of the Eiger Lightspeed Clipbar sandals, using orthogonal matrix tables, the elements of which are arranged according to rows and columns. Orthogonal matrix table aims to determine the defects that occur based on levels that have been determined.
5. Calculation of variance analysis and S / N Variance Analysis is a calculation to find out whether factors and levels that have been determined affect the decrease in the quality of the Eiger Lightspeed Clipbar sandals.
6. Confirmation calculation is the application or verification of the results of the Taguchi that has been done before, by applying the optimal level setting of the evidence becomes a determinant of whether the optimal settings that have been determined can be applied in the company or rejected by the company.

The control phase is carried out the calculation of process capability (Cp) and sigma level after the improve phase. This control stage is used to control at the level until process stability is achieved before the next DMAIC cycle is carried out (Gaspersz, 2002). The analysis is done after data processing is complete and find out the solution of the problem being investigated. The results of the analysis are used as proposed improvements aimed at reducing the number of Eiger Lightspeed Clipbar sandals defective products. The results of the research conducted as a solution to the proposed quality improvement, starting from identifying the types of defects, looking for the root causes of disability and providing suggestions for improvement to reduce the number of defects that refer to the research objectives, is the final result supported by the analysis. Conclusions and suggestions are given to the company and further researchers, namely, by providing what actions can reduce defects in the assembling and buffing process.

RESULTSANDDISCUSSION

Define

Define phase is the initial stage in working DMAIC, to define the problem. The aim is to determine the critical to quality (CTQ) target. A good sandal product must have characteristics and good quality including not open bonding, perfect buffing process, ie right and left sandals have the same shape, Lightspeed Clipbar writing on the sandals is not eroded, not dirty, stitching stitches on the sandal strap, no benzene lines, printing perfect sandals, cutting patterns of perfect sandals, in determining CTQ can be identified in advance on the types of defects that occur in the Pareto diagram (Figure 1)

Figure 1. pareto diagram of 11 types of defects in Lighspeed Clipbar sandals results that show there are 3 dominant defect characteristics in Eiger Lightspeed Clipbar sandals. The focus of research to be investigated is on the production process, in the process of assembling and buffing Eiger Lightspeed Clipbar sandals. defect product characteristics in both processes can be seen in table 1 as follows:

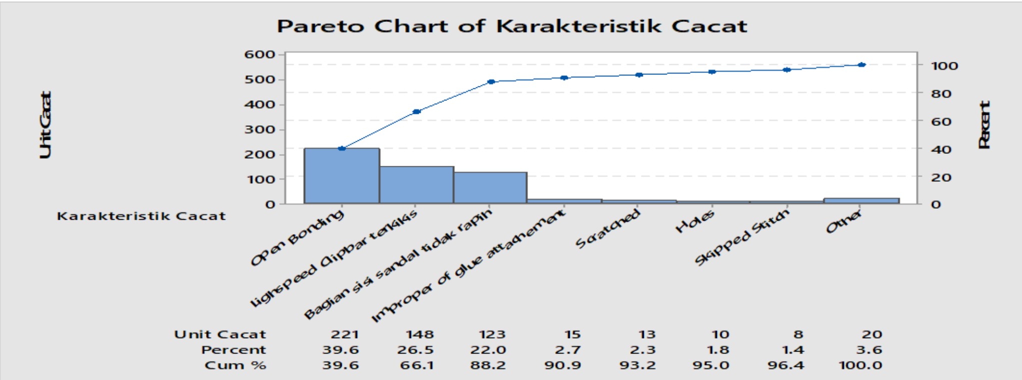

Figure 1 Pareto diagram of 11 types of defects

Table 1 Characteristic of Defects

No	Process	Process	Machine	Defect Characteristics
1	Assembling	Bonding: The union between sol and benzene.	Press	Open Bonding, that is, there are sol openings that are not open properly.
2	Buffing	Buffing: The process of	Gurinda	1. Less buffing process on the sides of the

		tidying the sides of the sandals.		sandals, so that the shape of the sandals is not flat.
				2. Eroded the Lightspeed Clipbar logo on the sanda Terkikis tulisanlogo Lightspeed Clipbar pada sandal.

Table2 Defect per Unit (DPU) Sandal Eiger

No	Month	Production Amount (Unit)	Type of Defect			Number of Defects	Percentage of Defects
			Open Bonding	The Side of the Sandals Is Not Neat	The erosion of the Lightspeed Clipbar logo		
1	Oct	6046	221	123	148	492	8,138%
2	Nov	4134	177	99	118	394	9,531%
3	Dec	7125	310	172	207	689	9,670%
Total		17305	708	394	473	1575	9,101%
Percentage of defects that occur			45%	25%	30%		

Table 3.Results Defect per Million Opportunity (DPMO)
Eiger Sandal

No	Month	Production Amount (*Unit*)	Number of Defects	CTQ Potensial	DPU	DPMO	DPMO Average	Sigma value	Sigma Average
1	Oct	6046	492	3	0,081	27125,37	30376,12	3,42	3,38
2	Nov	4134	394	3	0,095	31769,07		3,36	
3	Dec	7125	689	3	0,097	32233,92		3,35	
Jumlah Pemeriksaan						Dec		10,13	

The measure phase is the second stage in working on DMAIC, the measure stage includes the identification of critical to quality (CTQ). The data can be seen in the product capability and the number of units of goods that have disabilities the measure stage is carried out the calculation of the value of Defect per Unit (DPU) and Defects per Million Opportunities (DPMO), as well as the sigma value of defective products. DPU EigerLightspeedClipbar sandals data in 20169 can be seen in table 2.And the results of DPMO calculations (Defects Per Million Opportunities) and sigma values in October to December can be seen in Table 3.

Analyze

The results of the interviews conducted from the three sources that have been conducted, it can be concluded that of the three types of sandals produced by CV Cat Style there is one type of sandals with the highest level of defect found in the type of Eiger Lightspeed Clipbar sandals. The defect factor occurs because the raw material is not in accordance with company criteria, the raw material consists of glue, benzene and sol, the main raw material for making Eiger sandals. There are three types of the most dominant defects that often occur in the company. The results of these interviews can help identify problems that occur in the company to be processed and get positive results from defective problems that arise.

Improve

The improve phase of the DMAIC method is done by the Taguchi method which aims to provide quality improvements to the EigerLightspeedClipbar sandals so that the number of defects is reduced. The data obtained is data obtained from the company and obtained from the operator's experience. The data can be seen in table 4 as follow:

Table 4 Determination of Level and Value of Factor Levels

Code	Control Factor	Level 1	Level 2	Level 3
A	Glue	20g	28g	42g
B	Soles(Rubber)	14 mm	15 mm	16 mm
C	Benzol (Sponge)	11 mm	12 mm	13 mm

The Average Variance Analysis of TheEigerSandals LightspeedClipbar
The choice of the orthogonal matrix is $L_9(3^4)$ because the total of degrees of freedom is 8, greater than 6 degrees of freedom from the calculations, orthogonal matrix$L_9(3^4)$ can be seen in table 5 as follows:

Table 5 Data on Defect Experiment Results in the LightspeedClipbar Sandal

Orthogonal Matrix $L_9(3^4)$									
Experiment	Factors and Interactions				Replication			Amount	Mean
	A	B	C	e	1	2	3		
1	1	1	1	1	5	3	3	11	3
2	1	2	2	2	6	5	4	15	5
3	1	3	3	3	6	4	5	15	5

The above data obtained results of experiments conducted repetition (replication) three times. Experiments carried out for 9 working days, the average results obtained for experiments 9 times by 5 units.

Table 6 Response Table for Average Sandal Defects

	A	B	C
Level / Factor 1	4	5	6
Level / Factor 2	6	5	6
Level / Factor 3	6	6	5
Difference	2	1	1
Ranking	2	3	1

Through the combination of each level of factors, the data processing Anova can be seen in table 7 as follows:

Table7 Avg. Variance Analysis of Sandals Defect

Source	Sq	v	Mq	F-rasio	Sq'	p%	F_{table}
A	21	2	11	94	21	16%	3,40
B	7	2	4	34	7	5%	3,40
C	102	2	51	434	102	77%	3,40
Error	2,4	20	0,12	1	2	2%	3,40
St	132	26	5	-	132	100%	-
Sm	771	1	-	-	-	-	-
ST	903	27	-	-	-	-	-

Table 7 shows that the calculation of percent contribution to factor A has a percentage contribution of 16% against sandal defects the Eiger Lightspeed Clipbar, Factor B has a contribution of 5% to Sandals defects Eiger Lightspeed Clipbar and Factor C has a contribution of 77% against the Eiger sandals

Estimated optimal conditions and confidence interval

Based on the results of the analysis calculations for the average data, a significant factor influences the causes of the EigerLightspeedClipbar sandals as follows:
A1 = Glue 20g
B2 = Sol (rubber) 15mm
C3 = benzene (sponge) 13mm
The Intersection Model to predict the average quality of EigerLightspeedClipbar sandals with supporting factors using equation (12) as follows:

$\mu_{prediction} = \overline{Y} + (\overline{A_1} - \overline{Y}) + (\overline{B_2} - \overline{Y}) + (\overline{C_3} - \overline{Y})$
= 5 + (4 – 5) + (5 -5) + (5 – 5)
= 3,40

While the confidence interval of the average quality of EigerLightspeedClipbar sandals at a 95% confidence level is as follows:

$F_{(0,05;2;24)} = 3,40$
Mq = 0,12
Confidence Interval Calculation:

$$n_{eff} = \frac{27}{1 + (2 + 2 + 2)} = 3,86$$

$$n_{eff} = \frac{1}{3,86} = 0,26$$

Cl = $\pm \sqrt{3,4 \times 0,12 \times 0,26}$
= 0,32

$\mu_{prediction} - CI \leq \mu_{prediction} \leq \mu_{prediction} - CI$

$3{,}40 - 0{,}32 \leq 3{,}40 \leq 3{,}40 - 0{,}32$
$3{,}08 \leq 3.4 \leq 3{,}72$

The calculation results show that when using the optimal combination or selected factor level settings, the average EigerLightspeedClipbar flaw defect is around 3.08 ≈ 3 to 3.72 ≈ 4 or about 3 to 4.

Analysis of variance on eiger lightspeed clipbar sandal defect

To identify the influence of levels and factors on the defects of EigerLightspeedClipbar sandals, the response data of the number of defects in the EigerLightspeedClipbar sandals product processing can be seen in table 8 .The results of the S / N table response can be seen in table 9.The results of the analysis of S / N variance can be seen in table 10. The results of table 10 show that factor A has a 45% contribution to Eiger Lightspeed Clipbar sandals, factor B has a 32% contribution to Eiger Lightspeed Clipbar sandals and C has a 18% contribution to the Eiger Lightspeed Clipbar sandals

Table 8 Data on the Results of Light speed Clipbar Sandal Defect Trials

Orthogonal Matrix $L_9(3^4)$								
Experiment	Factors and Interactions				Replication			S/N
	A	B	C	e	1	2	3	
1	1	1	1	1	5	3	3	10
2	1	2	2	2	6	5	4	13
3	1	3	3	3	6	4	5	13
4	2	1	2	3	5	6	5	14
5	2	2	3	1	4	3	4	11
6	2	3	1	2	9	8	8	17
7	3	1	3	2	7	6	6	15
8	3	2	1	3	6	7	6	15
9	3	3	2	1	6	7	4	15
y								14

Table 9 Response Tables for S / N

	A	B	C
Level 1	12	13	14
Level 2	14	13	14
Level 3	15	15	13
Difference	1	2	0
Ranking	2	3	1

Table 10 S / N Variance Analysis

Source	v	Sq	Mq	F-rasio	Sq'	p%	Ftabel
A	2,0	20	10	150,9	20	45%	3,40
B	2,0	14	7	105,6	14	32%	3,40
C	2,0	8	4	60,3	8	18%	3,40

Error	20,0	1,3	0,1	1,0	1	3%	3,40
St	26,0	44,0	2,0	-	44	100%	-
Sm	1,0	1676,0	-	-	-	-	-
ST	27,0	1719,0	-	-	-	-	-

Estimated optimal conditions and s/n confidence interval

Based on the results of the analysis of variance analysis for S / N data, a significant factor influences the defects that arise in the EigerLightspeedClipbar sandals as follows: A1 = Glue 20g
B2 = Sol (rubber) 15mm
C3 = benzene (sponge) 13mm
Equation model to predict the average quality of EigerLightspeedClipbar sandals by applying influential factors using equation 12 as follows:
$\mu_{prediction} = \overline{Y} + (\overline{A_1} - \overline{Y}) + (\overline{B_2} - \overline{Y}) + (\overline{C_3} - \overline{Y})$
= 14 + (12 – 14) + (13 -14) + (13 – 14)
= 10,7

The S/N confidence intervals for the Eiger Lightspeed Clipbar sandals flaw at a 95% confidence level are as follows:

$F_{(0,05;2;24)} = 3,40$
Mq = 0,07
Convidence Interval calculation ::
$n_{eff} = \frac{27}{1+(2+2+2)} = 3,85$
$n_{eff} = \frac{1}{3,85} = 0,26$
Cl = $\pm\sqrt{3,4 \times 0,07 \times 0,26} = 0,24$

Then the confidence interval for the optimal process:
$\mu_{prediction} - CI \leq \mu_{prediction} \leq \mu_{prediction} - CI$
10,67 – 0,24 ≤ 10,67 ≤ 10,67 – 0,24
10,42 ≤ 10,67 ≤ 10,91
The calculation results show that when using the optimal combination or selected factor level settings, the S / N of the EigerLightspeedClipbar flawed sandals is around 10.67 ≈ 10 to 10.91 ≈ 11 or about 10 to 11.

Variance analysis confirmation experiments

Determination of optimal level settings that have been done in the previous Taguchi experiment can be seen in table 11 as follows:

Table11 Response confirmation table

Factor	Optimal Conditions	
	Level	Nilai

A	Glue	1	20g
B	Soles(Rubber)	2	15 mm
C	Benzol (Sponge)	3	13 mm

The optimal level setting applied to the confirmation experimental processing is known that for factor A level 1 (Glue, 20g), factor B level 2 (sol, 15mm) and factor C level 3 (benzene, 13mm). The optimal setting is data processing that has been done in the previous Taguchi experiment. The confirmation experiment stage is the implementation stage of the data from the previous Taguchi experiment by selecting the optimal factor and level settings, the data can be seen in table 12 as follows:

Table 12 Results of Confirmation of Sandal Defect Confirmation

Exsperiments	Production Sample	Experimentation Results	Defect Percentage
1	80	3	4%
2	80	3	4%
\`3\`	80	2	3%
4	80	3	4%
5	80	4	5%
6	80	4	5%
7	80	4	5%
8	80	3	4%
9	80	4	5%
10	80	3	4%
Amount	800	33	41%
Average	80	4	4%

Confirmation results can be seen in Table 12 is the data collection as much as 10 times the production with production samples taken are 80 samples Eiger Lightspeed Clipbar sandals with an average of 4% of defects that arise.Based on the results obtained in the previous analysis, it is known that a combination of factors influences the average and variance of Eiger Light speed Clip flaw defects, namely glue at level 1 of 20g, sol (rubber) at level 2 of 15 mm and benzene (sponge) at level 3 by 13 mm. The results of the 95% confidence interval calculation for the Taguchi experiment were then compared with the Taguchi experiment confidence interval. These results can be seen in table 13 as follows:

Table 13 Interpretation of Results of Eiger Lightspeed Clipbar Sandal Defect Measures

Response (flip Eiger Lightspeed Clipbar)		Prediction	Optimization
Taguchis Experiment	Average	3,40	3,40 ±0,32
	Variability (S/N)	10,67	10,67 ± 0,24
Confirmation Experiment	Average	3,31	3,31 ± 0,38
	Variability (S/N)	10,54	10,54 ± 0,28

Based on the interpretation of the results of the Eiger Lightspeed Clipbar sandals defect calculation shown in table 4.13, the results of the calculations show that the calculations using the Eiger Lightspeed Clipbar sandals defect experiment for an average of about 3.40 ≈ 3 to 0.32 ≈ 1 or about 3 to with 1, while for S / N calculations around 10.67 ≈ 11 to 0.24 ≈ 1 or about 11 to 1. The results of the confirmation experimental calculations show that when using the optimal combination or selected factor level settings the average defect Eiger Lightspeed Clipbar sandals around 3.31 ≈ 3 to 0.38 ≈ 1 or about 3 to 1, and for the calculation of experimental confirmation of S / N Eiger Lightspeed Clipbar sandals around 10.54 ≈ 11 to 0.28 ≈ 1 or around 11 to 1. The Taguchi experiment to a confirmation experiment has decreased in its mean and variability, thus it can be concluded that these factors and level can reduce the defects of EigerLightspeedClipbar sandals.

CONCLUSION

Based on research that has been done, the first stage of identifying the types of defects in EigerLightspeedClipbar sandals using the DMAIC method, looking for the root causes of EigerLightspeedClipbar sandals using DMAIC methods, while providing corrective action on EigerLightspeedClipbar sandals using the Taguchi method as follows:

1. Identifying the types of defects in Eiger Lightspeed Clipbar sandals which cause a decrease in quality, among others, open bonding, the sides of the sandals are not neat (different), the Lightspeed Clipbar logo on eroded sandals.
2. Finding the root cause of defects in Eiger Lightspeed Clipbar sandals which results in the reduction of defects in these factors, among others, glue, soles (rubber) and benzene (sponges).
3. Provide repair measures on sandals Eiger Lightspeed Clipbar using the Taguchi method with optimal settings including the dose of glue for sandals of 28g, soles (rubber) thickness for sandals of 15 mm and the thickness of sponges for sandals of 13 mm. Taguchi experimental results obtained after conducting experiments on average 3.40 to 0.32, while for the Taguchi S/N experiment 10.67 to 0.24, after conducting Confirmation experiments the results for an average value of 3, 31 up to 0.38, while for the calculation of experimental confirmation S / N 10.54 up to 0.28. These results indicate a decrease in defects, these results can meet the research objectives of improving the quality of the Eiger Lightspeed Clipbar sandals produce.

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