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Analysis of Quality Control of Suitcases to Minimize Defects Using the Control Map Method and FMECA (Failure Mode Effect and Criticality Analysis) PT. Mitra Mutu Abadi

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ABSTRACT

Objective: *So that the purpose of this research is to determine the level of disability a product by identifying the highest levels of risk a failure that arise and do the proposed fixes.* ***Method:*** *The Method employed is that This study using of qualitative and quantitative methods with those maps control p used to see the control over control and a lower. If the data is still within the limits of control, control data will be declared. A method of FMECA (failure mode effect criticality and Analysis) knows the value of an RPN (Risk Priority Number) analysis and the critical of any potential failure products, as for tools help the pareto seventools includes diagrams, check sheet, diagrams and effect, histogram, stratification, control a chart and fishbone diagrams.* ***Results:*** *The key Results achieved are that The results of this study show the value on the hinge control map, known UCL with a value of 0.066, LCL with a value of 0.045, CL with a value of 0.055. On the casing control map, it is known that UCL with a value of 0.049, LCL with a value of 0.031, CL with a value of 0.040. On the handle defect control map, it is known that UCL with a value of 0.042, LCL with a value of 0.025, CL with a value of 0.033. In the hinge defect with the cause of failure, namely the production operator is not careful or less focused with an RPN value of 168 included in the high category. For the second on casing defects with the cause of failure, namely the provision of glue is uneven with an RPN value of 126 included in the high category. To get the best quality results, improvements can be made, namely the need to evaluate the comfort at work, because the more comfortable the workplace the concentration of workers is increasing, must choose materials that are strong, durable and have been tested for quality. need to update machines or tools with the latest technology. increase air circulation in the room and do greening around the company. before starting work activities the supervisor must brief the SOP, in the room given the SOP board. These improvements can minimize defects and can increase company productivity so that it can achieve the desired target.* ***Novelty:*** *The Novelty is derived from the specific application and detailed findings of the Control Chart and FMECA methods in addressing the rising defect rate at PT. Mitra Mutu Abadi.*

INTRODUCTION

PT. Mitra Mutu Abadi develops moving industry in field industry manufacturing special suitcase located in Ds, Candipari, Porong District, Sidoarjo. Industry moment This is make manufactured products quality high and deep same time price affordable for all over community. PT Mitra's production process quality eternal produce product as big as 300-420 product in a month.

However, In process production moment This Still there is deviation from standard Which has set on momentprocessing material standard become product So. In other words the product the it is said experience damage or disability products, in the company This Still Not yet apply analysis quality product in accordance standard. So that experience increase disability every the year from 7.3% to 12.8%. There is product defects

that Which enter in QC stage of which there are 3 types defects that occur in the production process suitcase that is disabled on hinges, disabled handle And disabled casing Which caused by by a number of factor like factor man, machine, methods, materials, and environment. Then from That with existence disability the very influence high booking from 55% to 30%. This is can result in occurrence level competition growing business tight [1].

Because of the purpose A company can achieved if customer feel fast to something product or services [2]. There are many aspects that can be help reach satisfaction customers, one of them is quality product Which Good. Besides on satisfaction customer ability produce product Which quality can become somethingsuperiority company [3]. In effort increase Power competition something product, quality can be one of factors that can help reach Therefore, control over the quality product felt important Because become something aspect in determine position in the era of competition business. Then from that, in the production process must done supervision And fulfillment aspect quality Which support so that Can reduce amount disabilityon product Which produced And Can increase quality product [4].

For realize repair quality product so study This aim For analyze How implementation control quality of suitcases at PT Mitra Mutu Abadi with use p control chart method (*Control p Chart*) control quality product can identify quality products outside limit control. Benefits that can be obtained with do control quality that is No Lots damaged products, so that productivity still awake [5]. and stage analysis use FMECA method (*Failure Mode, Effect and Criticality Analysis*) can produce A a reliable system that can minimize to failure, and also capable guard components and functions Can controlled with easy. FMECA is applied For do identification factors that can cause failure, and do identification impact to results process production, And do identification action *preventive* For avoid occurrence failure [6]. As forthe tools are *seventools* includes Pareto diagrams, *check sheets,* cause diagrams consequences, histogram, stratification, *control charts,* and scatter diagrams. Tools This very help in develop repair product. Purpose from study This is For find factors reason disability suitcase in a way comprehensive And find solutions and improvements best For data processing. Furthermore, research This will using maps control And FMECA, which will make more in analyze factors reason disability on product.

RESEARCH METHOD

Implementation research in the village Candipari Subdistrict Porong Regency Sidoarjo, East Java. Research This focused on controlling the production process suitcase For minimize defects that occur use method map control For identify quality product in outside limit control. Then, reference For doaction correct identify point critical product in the production process with use FMECA method (*Failure Mode and Effect Criticality Analysis*) [7].

1. Control Quality

Control quality is control quality product during in process manufacturing until

product

So For prevent existence product Which No fulfil quality after product finished [8]. Activity control quality is field very job vast and complex Because all influencing variables quality must noticed.

2. Map Control

Wrong One tool statistics Which can functioned For evaluate whether something process production whether is atin control quality in a way statistics or No is map control (control chart) in a way general, there istwo category in the control chart, namely the control chart attribute and control charts variables [9]. The following is formula calculation on the control chart :

a. *Upper Control Limit*

$$UCL = \bar{p} + 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}} \quad (10)$$

b. *Lower Control Limit*

$$LCL = \bar{p} - 3\sqrt{\frac{\bar{p}(1-\bar{p})}{n}} \quad (10)$$

c. *Center Limit*

$$CL = \bar{p} = \frac{\Sigma np}{\Sigma n} \quad (10)$$

3. *FMECA*

Failure Mode Effect Critically Analysis is methods used For determine level failure from each components and for identify problem in a way the whole thing in the end can be minimized or remove factors that influence the production process [11]. Point failure assessed with count mark *Risk Priority Number* (RPN). Mark RPN is results multiplication between *severity*(S), *occurrence* (O) and *detection* (D), the SOD level is at level 1 to with 10. Assessment done by 4 head division that is *Supervisor* PPIC, *Supervisor* Production, *Supervisor Purchasing* And *Supervisor Maintenance* Whichunderstand function operational company and has Work more from 5 years, following shown RPN formula in lower This.

RPN = *Severity* x *Occurrence* x *Detectio* (11)

4. *Diagram Fishbone*

This diagram show consequence or consequence from something problem with highlight various cause, effect, or effect. It is called Because Consequence Because connection between cause and effect represented in a way graphics. In connection with control process statistics, diagram cause and effect used For identify cause (causes) And condition quality (consequence) Which caused by by reason said [12].

5. Diagram Histogram

Histogram is one of the tools that help For determine variation in process. Diagram form the stem show tabulation from data that arranged based on size [13].

6. Diagram Pareto

Pareto diagram is Wrong One tool control quality (tool QC 7) can help For analyze databased on impact category data And pattern data (causality) on impact or problem in

a way overall [14].

7. Level Analysis

Analysis is distribution system complete information become parts components. Purpose from analysis This is For find problems, obstacles, and expected needs For repair [15]. Stage This done analysis to factors reason problem with observation direct to field plus interview parties related company. Results identification This visualized with use diagram *fishbone.*

8. Stage Repair

At the stage This done search action repair For solution on causes the problem that appears. Cause problems that have been identified become a failure mode potential which then searching for effect failure its potential And reason its potential use method FMECA [16].

9. Level Control

Objective stage This is control improvements that have been made proposed at the stage previously. In the future expected with implementation process production Which Already repaired, product disabled Which produced becomereduce And quality process production company the more increased [16]

Picture following show diagram flow study :

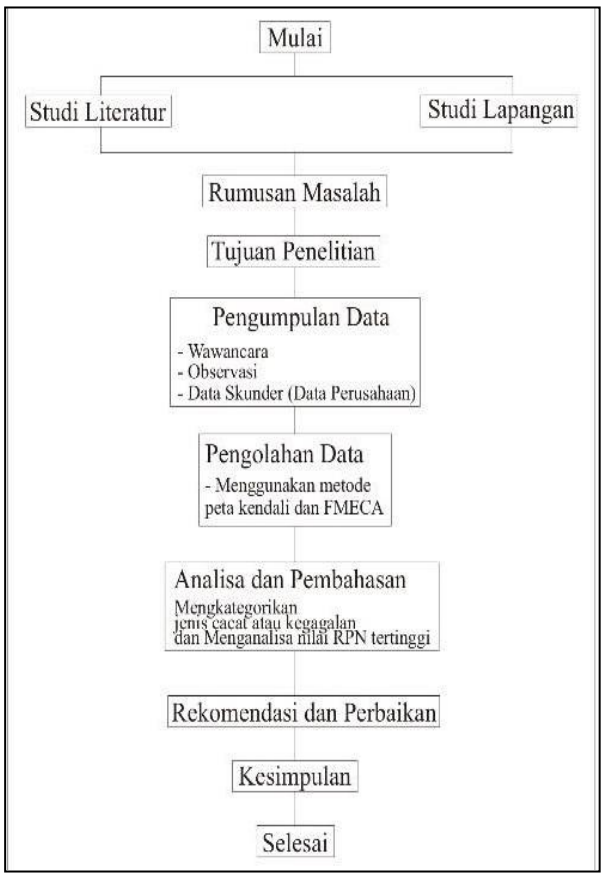


Figure 1. Diagram Flow Study.

In figure 1 the flow diagram study explain the ongoing process study that is done studies field and study literature, then formulate problems and goals research, after That gather data with interview, observation And request data company on permission

supervisor, stage next processing the first data namely the control chart For calculation limit control top and bottom control below the second FMECA For determine level failure assessed with count mark *Risk Priority Number* (RPN). Fromresults calculation can analyzed level risk disability or failure with determine mark *severity*, *occurrence* and *detection* using *Failure Mode Effect Critical Analysis* (FMECA) so obtained proposal repair Which Can made into consideration in a way Keep going continuously For increase quality product.

RESULTS AND DISCUSSION

Collection Data

Study This using secondary data acquired company from results interviews and observations to the production supervisor. Research This carried out at PT Mitra Mutu Abadi, as follows is data that obtained.

Table 1. Data Disabled

Month	Results Production	Type Disabled			Amount Product Disabled	percentage disability
		Hinge	Handle	Casing		
1	390	23	14	15	53	10%
2	326	20	13	15	48	9%
3	350	17	14	7	39	7%
4	315	5	11	12	34	6%
5	410	25	11	15	50	9%
6	305	15	12	17	44	8%
7	320	17	13	15	39	7%
8	420	27	11	18	55	10%
9	396	23	12	15	50	9%
10	337	20	10	14	44	8%
11	379	21	11	17	49	9%
12	321	23	11	10	44	8%
Total	4269	236	143	170	549	100%
Percentage		43%	26%	31%	100%	

In table 1 you can known Type product frequent defects happened is found on the hinge as many as 236 product with percentage total disability 43%. Meanwhile second is there is on handle as much as 143 productwith percentage of total disability 26%. Then the third is There are 170 products in the casing with total percentage of disability 31%.

Processing Data

Diagram Histogram

Diagram following is Wrong One tool Which help For determine variation in process. On dataTable 1, can concluded that disability highest is on the type disabled hinge. And the data can depicted in A diagram histogram like picture following This :

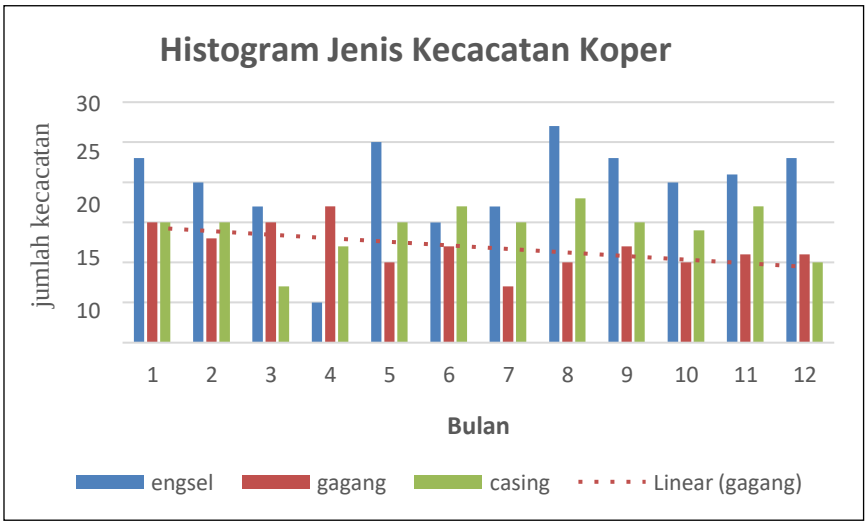


Figure 2. Histogram Type Disabled Suitcase.

Based on Figure 2, it can be seen that type damage that occurred is the first hinge colored blue happens every month (month 1-12) by 43%. Then the second one casing damage colored green happen on every month (month 1-12) as big as 31%. Which final damage handle colored redhappen on every month (month 1-12) as much as 26%.

Diagram Pareto

Pareto diagram is one of the tool control quality (QC tool 7) can help For analyze data based on impact data categories and data patterns (causality) on impact or problem in a way overall, so from That he did calculation percentage data product disabled on suitcase.

Table 2. Data Presentation Priority Type Disabled.

No	Type Disabled	Amount Disabled	Presentation	cumulative	Priority
1	Hinge	236	43%	43%	1
2	Handle	143	26%	69%	3
3	Casing	170	31%	100%	2
	Total	549	100%		

Table 2 explains that calculation table on can known that, type disabled product suitcase that is, type disabled hinge priority First with presentation as big as 43%, type disabled casing priority second withpresentation by 31% and priority third that is type disabled handle with presentation by 26%. In the table above, can concluded that disability highest is on the type disabled hinge. The data above the can depicted in diagram Pareto like on picture following :

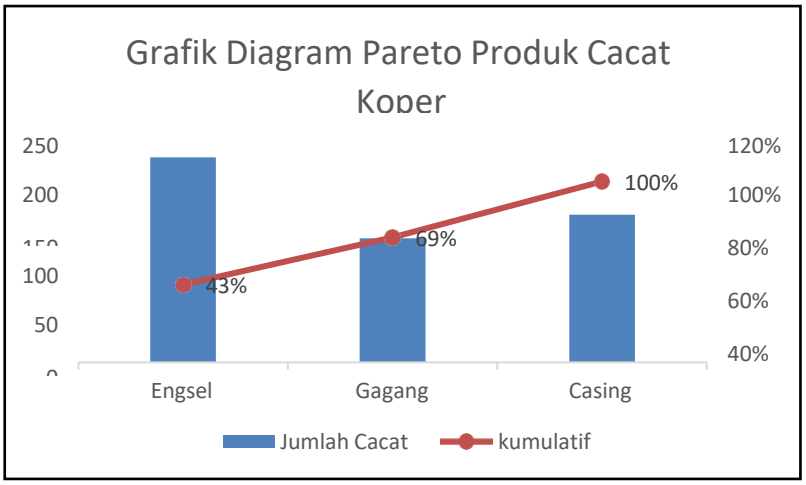


Figure 3. Chart Diagram Pareto Product Disabled Suitcase.

Figure 3 explains that Pareto diagram above can known damage that occurred to production year 2021 month January – December dominated by 3 types damage that is Hinge with percentage 43%, damage because the Casing with percentage 31%, and Handle with percentage of 26% of amount sample production, at the stage furthermore will known limit control on And limit control lower.

Map Control

Control chart used For see limit control top and bottom more control low. If the data is still in limit control, data stated controlled. In figure 3 there are 3 types disabled that is, disability hinge, defective handle And disabled casing. On stage This For measure control quality whether Already under control or Not yet, with do calculation use map control. Following is calculation map control on disabled product suitcase.

Table 3. Map Control Type Disabled Hinge Suitcase.

Month	Results Production	Type Disabled Hinge	P (Proportion Disabled)	CL	UCL	LCL
1	390	23	0,06	0,055	0,066	0,045
2	326	20	0,06	0,055	0,066	0,045
3	350	17	0,05	0,055	0,066	0,045
4	315	5	0,02	0,055	0,066	0,045
5	410	25	0,06	0,055	0,066	0,045
6	305	15	0,05	0,055	0,066	0,045
7	320	17	0,05	0,055	0,066	0,045
8	420	27	0,06	0,055	0,066	0,045
9	396	23	0,06	0,055	0,066	0,045
10	337	20	0,06	0,055	0,066	0,045
11	379	21	0,06	0,055	0,066	0,045
12	321	23	0,07	0,055	0,066	0,045
Amount	4269	236	0,66	0,055	0,066	0,045

following This is data processing types disabled hinge For find CL, UCL and LCL in production year2021 as following.

a. Menghitung Proporsi kesalahan:

$$P = \frac{x}{n}$$

P = proporsi kesalahan
x = cacat pada sampel
n = banyak sampel pengamatan

$$\bar{p} = \frac{23}{390} = 0{,}06$$

b. Menghitung rata rata atau CL:

$$P = \frac{jumlah\ produk\ cacat}{jumlah\ sampel\ pemeriksaan}$$

$$P = \frac{236}{4269} = 0{,}055$$

c. Menghitung UCL (*Upper Control Limit*)

$$UCL = P + 3\sqrt{\frac{p(1-p)}{n}}$$

$$= 0{,}055 + 3 \times 0{,}003$$
$$= 0{,}066$$

d. Menghitung LCL (*Lower Control Limit*)

$$LCL = P - 3\sqrt{\frac{p(1-p)}{n}}$$

$$= 0{,}055 - 3 \times 0{,}003$$
$$= 0{,}045$$

After know results from calculation CL, UCL And LCL type disabled hinge can seen on picturefollowing :

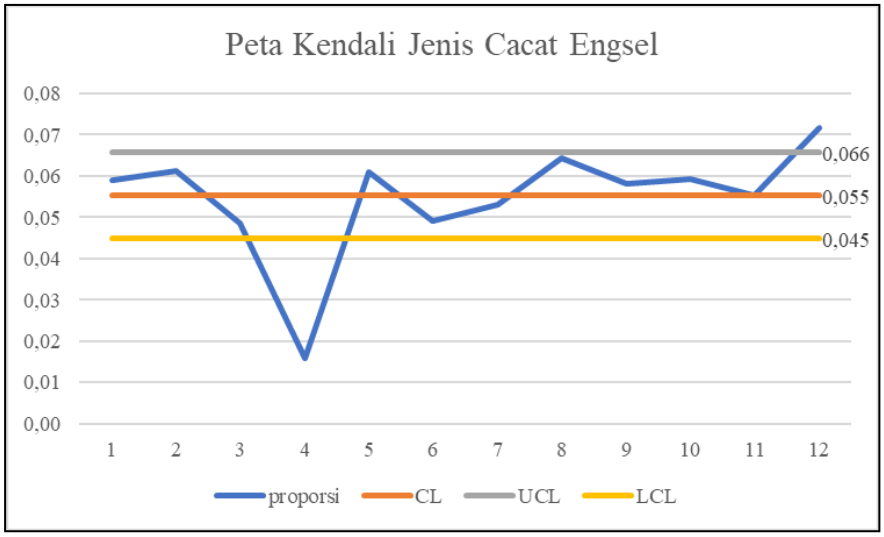


Figure 4. Map Control Type Disabled Hinge Suitcase.

Based on Figure 4 control chart type disabled hinge suitcase the known There is two extreme data which occurs in the 4th and 12th months, and is necessary done control in the month the that is, that is with do revision data, with throw away data observation on month 4th And the 12th do analysis returnuntil all data is under control. Data that has been revised return made in the control chart new and can seen on Figure 5.

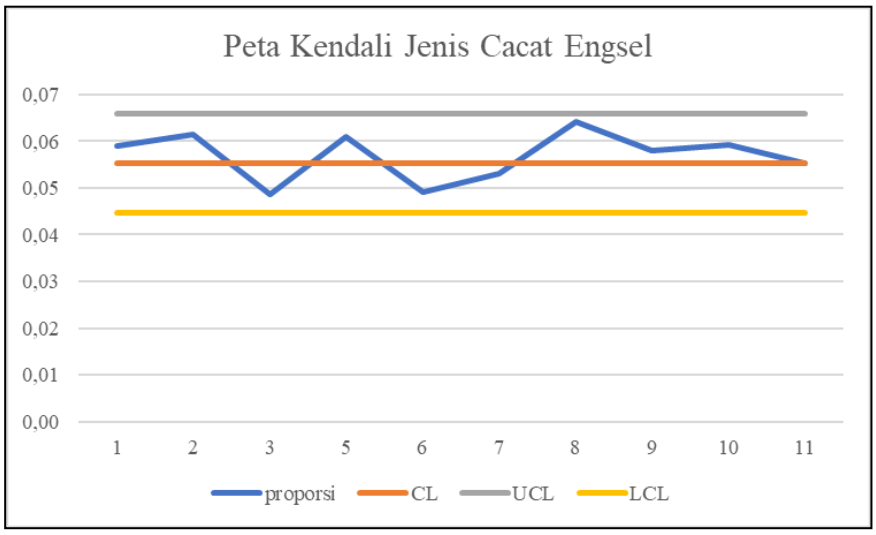


Figure 5. Revision Map Control Disabled Hinge Suitcase.

From picture 5 can concluded that map control disabled hinge results revision known that all dataWhich analyzed has under control.

Table 4. Map Control Type Disabled Casing Suitcase

Month	Production Output	Number of Defective Casings	*p* (Defect Proportion)	CL	UCL	LCL
1	390	15	0.04	0.040	0.049	0.031
2	326	15	0.05	0.040	0.049	0.031
3	350	7	0.02	0.040	0.049	0.031
4	315	12	0.04	0.040	0.049	0.031
5	410	15	0.04	0.040	0.049	0.031
6	305	17	0.06	0.040	0.049	0.031
7	320	15	0.05	0.040	0.049	0.031
8	420	18	0.04	0.040	0.049	0.031
9	396	15	0.04	0.040	0.049	0.031
10	337	14	0.04	0.040	0.049	0.031
11	379	17	0.04	0.040	0.049	0.031
12	321	10	0.03	0.040	0.049	0.031
Total	4269	170	0.48			

Following This is data processing types casing defect for find CL, UCL and LCL in production year2021 as following.

e. Menghitung Proporsi kesalahan:

$P = \frac{x}{n}$

P = proporsi kesalahan

x = cacat pada sampel

n = banyak sampel pengamatan

$p = \frac{15}{390} = 0{,}04$

f. Menghitung rata rata atau CL:

$$P = \frac{jumlah\ produk\ cacat}{jumlah\ sampel\ pemeriksaan}$$

$$P = \frac{170}{4269} = 0{,}040$$

g. Menghitung UCL (*Upper Control Limit*)

$$UCL = P + 3\sqrt{\frac{p(1-p)}{n}}$$

$$= 0{,}040 + 3 \times 0{,}003$$

$$= 0{,}049$$

h. Menghitung LCL (*Lower Control Limit*)

$$LCL = P - 3\sqrt{\frac{p(1-p)}{n}}$$

$$= 0{,}040 - 3 \times 0{,}003$$

$$= 0{,}031$$

After know results from calculation CL, UCL And LCL type disabled casing can seen on picturefollowing :

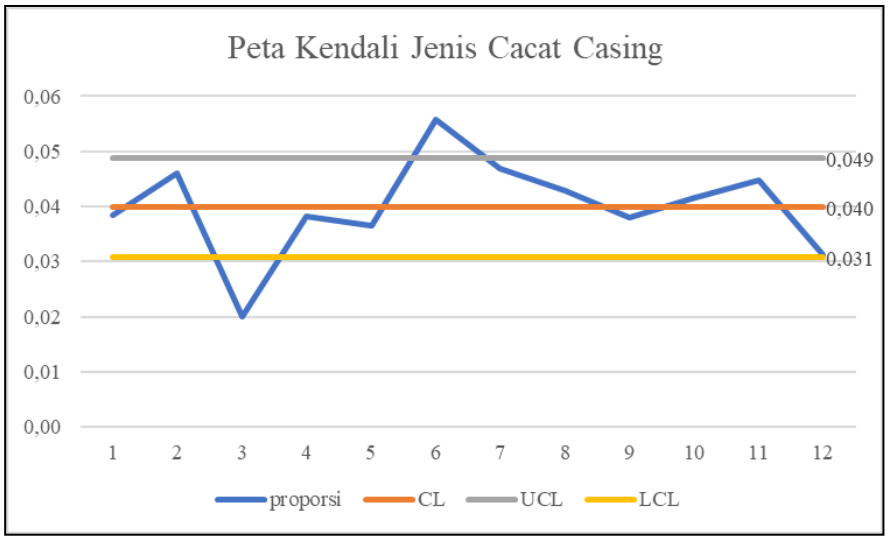
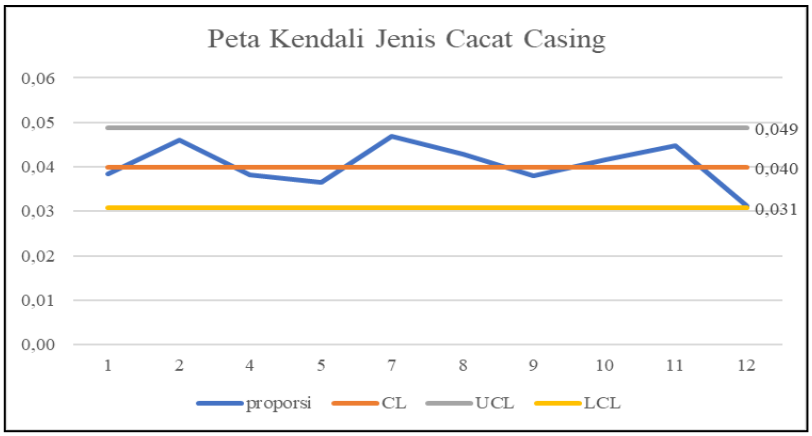


Figure 6. Map Control Type Disabled Casing Suitcase.

Based on Figure 6 control chart type disabled hinge suitcase the known There is two extreme data which occurs in the 3rd and 6th months, and is necessary done control in the month the that is, that is with do data revision, with discarding observation data in the 3rd and 6th months of doing analysis returnuntil all data is under control. Data that has been revised return made in the control chart new and can seen on picture 7.



Picture 7. Revision Map Control Type Casing Defect Suitcase.

From figure 7 we can see concluded that the control chart casing defect results revision known that all data Which analyzed has under control.

Table 5. Control Map Type Disabled Handle Suitcase.

Month	Production Output	Number of Defective Casings	*p* (Defect Proportion)	CL	UCL	LCL
1	390	14	0.04	0.033	0.042	0.025
2	326	13	0.04	0.033	0.042	0.025
3	350	14	0.04	0.033	0.042	0.025
4	315	11	0.03	0.033	0.042	0.025
5	410	11	0.03	0.033	0.042	0.025
6	305	12	0.04	0.033	0.042	0.025
7	320	13	0.04	0.033	0.042	0.025
8	420	11	0.03	0.033	0.042	0.025
9	396	12	0.03	0.033	0.042	0.025
10	337	10	0.03	0.033	0.042	0.025
11	379	11	0.03	0.033	0.042	0.025
12	321	11	0.03	0.033	0.042	0.025
Total	4269	143	0.41			

Following This is data processing types disabled handle For find CL, UCL and LCL in production year2021 as following.

i. Menghitung Proporsi kesalahan:

$$P = \frac{x}{n}$$

P = proporsi kesalahan

x = cacat pada sampel

n = banyak sampel pengamatan

$$p = \frac{15}{390} = 0{,}04$$

j. Menghitung rata rata atau CL:

$$P = \frac{jumlah\ produk\ cacat}{jumlah\ sampel\ pemeriksaan}$$

$$P = \frac{143}{4269} = 0{,}033$$

k. Menghitung UCL (*Upper Control Limit*)

$$UCL = P + 3\sqrt{\frac{p(1-p)}{n}}$$

$$= 0{,}033 + 3 \times 0{,}002$$

$$= 0{,}042$$

l. Menghitung LCL (*Lower Control Limit*)

$$LCL = P - 3\sqrt{\frac{p(1-p)}{n}}$$

$$= 0{,}033 - 3 \times 0{,}002$$

$$= 0{,}025$$

After know results from calculation CL, UCL And LCL type disabled handle can seen on picturefollowing :

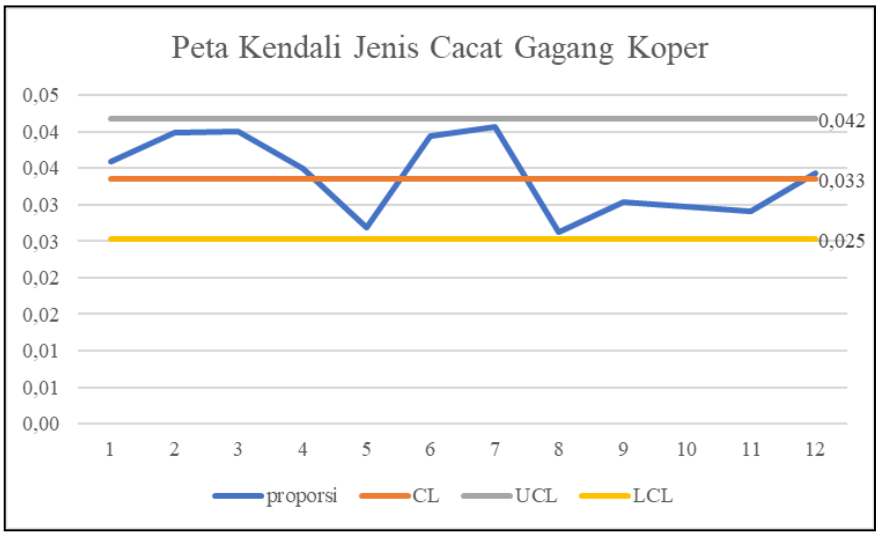


Figure 8. Map Control Type Disabled Handle Suitcase.

Based on on figure 8 map control type disabled handle suitcase the, can concluded that No There isproportion defects that come out from limit control upper (UCL) and limit control below (LCL) so that No foundvariations of the existing process outside control *(out of control*). After done control chart stage the there are 2 type defects that become priority main that is, disability hinges, and casing defects, so that can done stage furthermore.

***Failure Mode Effect and Critically Analysis* (FMECA)**

Critical Analysis is the process of assessment and classification risk failure. Analysis critical usematrix critical, following table 5 Which used in determination priority analysis critical.

Table 6. Critically.

No.	Critical Degree	Value Range	Risk Level
1	Minor	0–30	Acceptable
2	Medium	31–100	Tolerable
3	High	101–180	Unacceptable
4	Very High	181–252	Unacceptable
5	Critical	>252	Unacceptable

Based on table 5 there are 5 assessments For evaluate score failure with use *Risk Priority Number* (RPN). Determination RPN value is carried out with multiply between mark *Severity*, *Occurrence*, and*Detection* Where mark the results from identification after do observation And interview with supervisor production. As for calculation from *Risk Priority Number* (RPN) intended on table 6 following This.

Table 7. Results Calculation RPN

Defect Type	Failure Mode	Failure Effect	Cause of Failure	S	O	D	RPN
Hinge	Casing	Improper installation	Difficult to close	Operator is not careful or lacks focus	7	7	4
		Adhesive does not bond properly to the casing	Adhesive easily detaches or peels off	Uneven application of adhesive	6	6	3

In table 7 it is known that risk highest First that is type disabled hinge with installation failure No precision, the effect So difficult For close suitcase, caused by production operator not enough thorough and less focus with RPN value 168. After that, the risk highest second that is type casing defect with lather failure glue with casing, the effect is lather so easy off or peeling and caused giving the glue not enough evenly with RPN value 126. Then at stage next obtained RPN value of calculation *Failure Mode Effect and Analysis* (FMEA), so done analysis more carry on based on table *Critically*, whether enter in category (*acceptable*) no existence constraints, (*Tolerable*) no made into priority repair as well as (*Unacceptable*) necessary done repair, The results of the FMECA calculations and analysis are shown in the following table 8 This.

Table 8. Results FMECA Calculation On Production Suitcase.

Defect Type	Failure Mode	Failure Effect	Cause of Failure	RPN	Critical Degree	Risk
Hinge	Casing	Improper hinge installation	Difficult to close	Operator is not careful or lacks focus	168	High
		Adhesive does not properly bond to the casing	Adhesive easily detaches or peels off	Uneven adhesive application	126	High

Based on table 8 above explain that calculation RPN value is present two mark highest including in category *high,* the first obtained mark highest in disability hinge with reason failure that is operator production No thorough or not enough focus with mark RPN 168, including in degrees critical *high*, so thatneed done repair (*unacceptable*). For the second on the casing defect with reason failure that is giving glue not enough evenly with RPN value 126 included in degrees critical *high,* so that need donerepair (*unacceptable*).

Stage furthermore is stage analysis that is identification and analysis about factors

reason occurrence product defects at PT Mitra Mutu Abadi. Analysis performed on defects hinges and casing as disabled Which So priority repair with diagram *fishbone* like in the picture 6 And Figure 7.

Diagram *Fishbone*

Fishbone diagram or cause diagram consequence show connection between current problem faced with reason potential And factors Which influence it. Carelessness in process manufacturing suitcasewood can cause damage or defective. This is caused by from factors : human, environment, machine, method, and material For hinge suitcase.

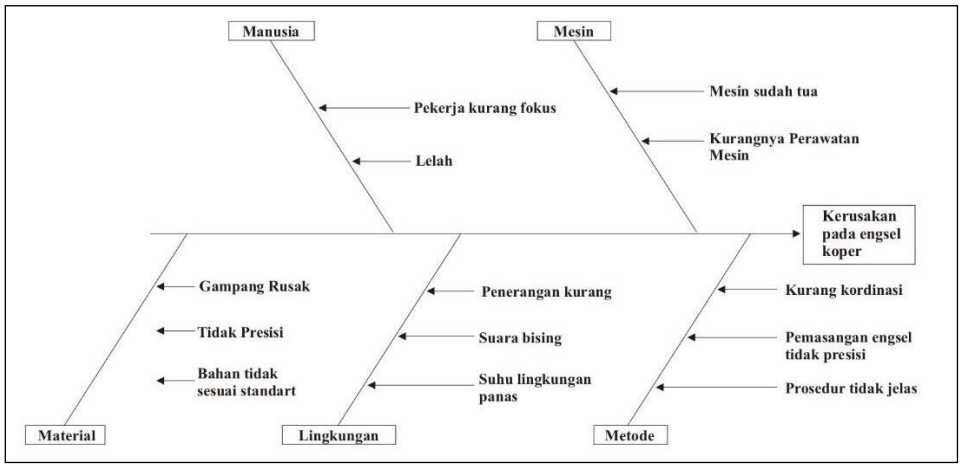


Figure 9. Diagram *Fishbone* For Hinge Suitcase.

For factor damage to the suitcase casing, thing This caused by from factors : humans, materials, environment andmethod.

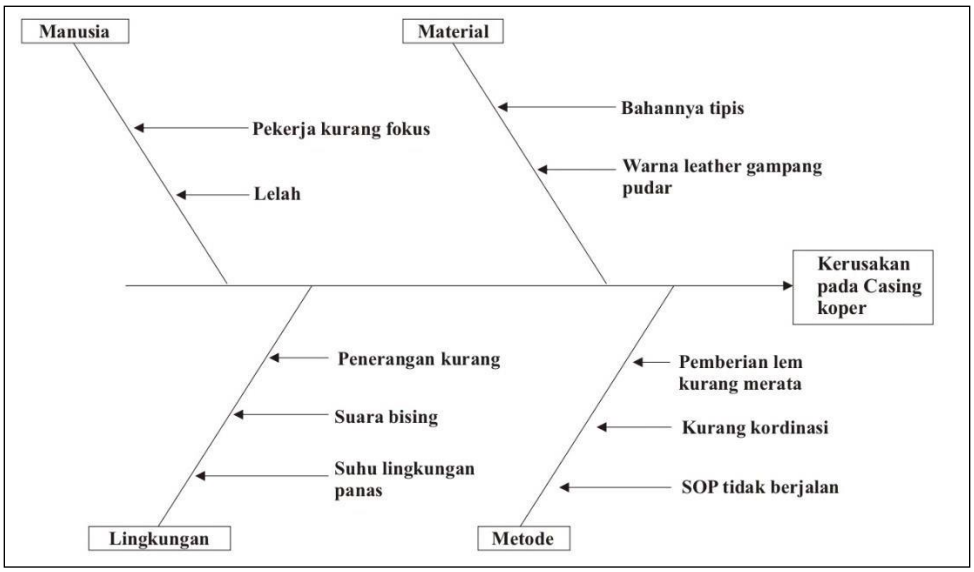


Figure 10. Diagram *Fishbone* For Casing Suitcase.

On figure 10 there is a number of factor on disabled hinge that is, factor machine, machine Already old, turtle maintenancemachine. Factor human, no do checking in a way detailed, workers not enough focus and fatigue. Factors method, not enough coordination, marketing = dream hinge No precision, procedure No clear. Factor

environment, lightingless, sound noise, temperature environment heat. Material factors, easy broken, no precision, materials No in accordance standard. Then For factor on disabled casing that is, factor material, material thin, color leather easy faded. Factor human, worker not enough focus, tired. Factors method, administration glue not enough even, less coordination, SOPNo walk. Factor environment, lighting not enough, voice noisy, temperature environment hot.

Stage furthermore is stage give usual repair on problem Which faced. Factor reason defects that have been obtained in the previous fishbone diagram become a failure mode potential that will analyzed effect failure potential And reason potential use method FMECA (table 6 And 7). Evaluation risk This consider three factor that is *severity* (S), *occurrence* (O) and *detection* (D) then carried out search proposal improvements on each factor reason failure. Made table For determine proposal repair from factor occurrence failure like in the table 8.

Stages Proposal Repair

After know reason occurrence damage on suitcase, so from That arranged A recommendation or proposal action repair in a way general in effort pressing level disability product suitcase as following.

Table 9. Proposal Action For Damage Hinge Suitcase.

Factor	Cause	Proposed Corrective Action
Human	Workers lack focus; fatigue	The company needs to evaluate workplace comfort, because a more comfortable working environment increases worker concentration. The company should provide rest breaks of 5–10 minutes every 2 hours.
Machine	Old machines; lack of machine maintenance	The company should update machines or equipment using the latest technology. More frequent machine or equipment maintenance is required to reduce machine damage.
Material	Easily damaged; lack of precision; materials not meeting standards	Materials of good quality should be selected. Inspection of materials before ordering is required. The company must establish specific standards or quality requirements for material procurement.
Environment	Insufficient lighting; noisy environment; hot working temperature	Additional lighting should be installed in each division. The distance between the assembly area and cutting/smoothing machines should be increased. Air circulation should be improved and greenery added around the company area.
Method	Lack of coordination; imprecise hinge	Training on teamwork between workers and supervisors should be conducted so that errors can be easily identified. The production supervisor

Factor	Cause	Proposed Corrective Action
	installation; unclear procedures	should continuously remind workers that hinge installation requires accuracy and must not be done carelessly. Existing procedures must be clearly communicated among employees to ensure proper understanding.

Table 10. Proposal Action For Casing Damage Suitcase.

Factor	Cause	Proposed Corrective Action
Human	Workers lack focus; fatigue	The company needs to evaluate workplace comfort, because a more comfortable working environment increases worker concentration. The company should provide rest breaks of 5–10 minutes every 2 hours.
Material	Thin material; leather color fades easily	The company must select strong, durable materials with proven quality. The drying process should not be excessively long, and workers should be educated about the weaknesses of leather materials.
Environment	Insufficient lighting; noisy environment; hot working temperature	Additional lighting should be installed in each division. The distance between the assembly area and cutting/smoothing machines should be increased. Air circulation should be improved, and greenery should be added around the company area.

CONCLUSION

Fundamental Finding : The analysis shows that the prioritized failure modes are the hinge and the casing, where the hinge control chart has a UCL of 0.066, an LCL of 0.045, and a CL of 0.055, while the casing control chart has a UCL of 0.049, an LCL of 0.031, and a CL of 0.040, indicating their dominant contribution to product defects. **Implication :** Among the three identified defect types—hinge, handle, and casing—the hinge and casing have the highest risk priority numbers, with the hinge reaching an RPN of 168 and the casing an RPN of 126, both classified as high criticality, implying that improvement efforts should be focused primarily on these two components. **Limitation :** The findings are limited to the identified human, material, machine, environmental, and method factors within the observed production conditions, meaning that other unexamined variables may also influence defect occurrence but were not captured in this analysis. **Future Research :** Future studies should focus on implementing and evaluating corrective actions such as improving workplace comfort to enhance worker concentration, selecting stronger and more durable tested materials, upgrading machines

with newer technology, enhancing air circulation and greenery around the company, and strengthening work methods through consistent supervision and clear SOP briefings supported by visible SOP boards.

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