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Implementation of House of Risk (Hor) Model for Mitigating Raw Material Supply Chain Risk at PT. Raja Indonesia Perkasa

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ABSTRACT

Supply chain activities always carry the potential for risk, which is why risk management is essential for addressing these risks. In companies that manufacture mattresses, such as PT Raja Indonesia Perkasa Suwayuwo, the supply chain activities related to leather raw materials are susceptible to various risks. Therefore, it is necessary to conduct a risk analysis and design mitigation actions to address or reduce the likelihood of risks or disruptions in the leather raw material supply chain. This study employs the House of Risk (HoR) model, which consists of two phases. The first phase involves identifying risks and risk agents, followed by measuring the severity and occurrence levels, as well as calculating the Aggregate Risk Priority (ARP) values. The second phase focuses on risk treatment. The results of the study show that there are 27 risk events and 52 risk agents identified. Furthermore, six mitigation actions have been proposed, which are expected to effectively mitigate the risks in the leather raw material supply chain.

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1. Introduction

The rapid growth of industry in Indonesia encourages companies, both newly established and long-established, to continue to innovate and adapt in order to maintain their existence amidst tight market competition. Small to large companies compete to improve their performance and productivity through various strategic and operational approaches. In this context, good company performance is not only measured by the output produced, but also by its ability to carry out management functions effectively. Terry (2010) states that management functions include four main aspects, namely planning, organizing, actuating, and controlling. These four aspects are important foundations in managing complex business processes, including supply chain management.

Supply chain is a network system involving various business entities such as suppliers, manufacturers, distributors, and retailers that directly or indirectly contribute to meeting customer demand. In this supply chain, there are important activities that include procurement of raw materials , the transformation process into semi-finished and finished products, and distribution of products to end consumers (Bayu Rizki Kristanto, 2014). The complexity of activities in the supply chain makes it vulnerable to various risks, both internal and external. Therefore, risk management is an absolute necessity in modern business processes. According to Hanafi (2006), risk management aims to identify, analyze, and control risks in order to minimize the possibility of disruption and the impact on company performance.

PT Raja Indonesia Perkasa, located in Suwayuwo, is a manufacturing company engaged in the production of various types of mattresses, such as sleeping mattresses, Palembang mattresses, and rastfur in various sizes. The products of this company have a wide appeal and have reached markets across regions, even outside Java such as Sumatra, Kalimantan, and Papua. The high market demand is certainly a big business opportunity, but on the other hand it also presents quite a few challenges in terms of supply chain management.

The problems faced by the company include the emergence of an imbalance between demand and production capacity, which is often responded to excessively, resulting in operational inefficiency. In addition , the process of selecting raw material suppliers is still not optimal, which causes various risks such as late delivery, inconsistent material quality, and uncontrolled increases in production costs. These risks, if not managed properly, can disrupt the stability and continuity of the production and distribution process.

Given this complexity, a systematic approach is needed in identifying and handling risks in the company's supply chain. One relevant and effective method is the House of Risk (HoR) model , which allows companies to not only identify risk sources (risk agents) and risk events, but also design a prioritized mitigation strategy based on the calculation of Aggregate Risk Priority (ARP) . By implementing this method, it is expected that companies can formulate appropriate actions to reduce potential disruptions to the supply chain, improve operational efficiency, and ultimately support the achievement of more competitive performance in the national market.

2. Literature review

Risk is defined as the probability of an event causing a loss and the potential magnitude of the event. $Risk = Eventlikeli\ h\ ood \times Eventconsequence$ (1) Risk management is the art of making decisions in a world full of uncertainty. House of Risk is a development of the QFD (Quality Function Deployment) and FMEA (Failure Modes and Effect Analysis) methods used to develop a framework for managing risk.

This method aims not only to mitigate risk but also to mitigate the cause of risk or risk agent. HOR has two phases, namely the first is risk identification, the output is in the form of a risk agent priority ranking. The second phase is risk handling, the output is in the form of a preventive action plan for the occurrence of risk agents.

In order for the implementation of the development of the raw material supply chain for products to run well and as expected, it is necessary to pay attention to the stages in implementing the mitigation of the raw material supply *chain* for products.

1. *House of risk (HOR) phase 1* mapping Mapping in this model is done by entering the results of measuring the severity level of risk events (table 3) and the occurrence of risk agents (table 4) and measuring their correlation. More clearly the mapping of the HOR phase 1 model.

a. Identification of risk events (Ei) and risk agents (Aj)

Table 1. *House of Risk*

Business process	Risk event Ei	Risk agents (Aj)							Severity of risk event i (Si)
		A 1	$A2$	A3	A4	A5	$A6$	$A7$	
Plan	$E1$								S1
Source	E2								S2
Make Deliver	E3								S3
Return	E4								S4
Occurrence of agent j	O1	O2	O3	O4	O5	O6	O7	O8	S5
Aggregate risk potential j	ARP 1	ARP 2	ARP 3	ARP 4	ARP 5	ARP 6	ARP 7	ARP 8	S6
Priority rank of agent j									

b. Calculation of occurrence and severity of variables Ei and Aj

a. Build a correlation matrix of Ei and Aj with the following conditions: 0: no correlation, 1: weak correlation, 3: moderate correlation and 9: strong correlation.

d. Calculation of ARP value from Aj using the formula:

$ARP\ j = Oj \cdot \sum Si \cdot Rij$ (2)

c. ARP rating of each Aj .

d. Making a Pareto diagram Aj (priority selection Aj).

2. House of risk mapping phase 2

a. Preparation of mitigation or preventive action (PAk) is based on Aj priorities .

b. Correlation relationship between Aj and PAk with the provisions of 0, 1, 3 and 9.

c. Calculation of the total effectiveness value of each PAk using the formula:

$TEk = \sum(ARP\ j \cdot Ejk)$ (3)

d. Measurement of the degree of difficulty of implementing PAk with a scale of application difficulty of 3: low, 4: medium and 5: high. e . Calculation of Effectiveness to difficulty ratio with the formula:

$ETDk =$ (4)

f. Priority ranking of PAk based on $ETDk$ value . This mitigation action mapping is carried out with the aim of seeing the effect of mitigation actions on risk agents. By mapping mitigation action options with selected risk agents. The first step that must be taken is to measure the correlation value between mitigation actions (table 6) and selected risk agents (table 5). The second step is to measure the degree of difficulty (Dk). The purpose of this measurement is to determine the degree of difficulty of implementing mitigation actions.

3. Methodology

raw material supply chain . To achieve this objective, the initial step taken was to examine various factors that influence the company's considerations in selecting raw material suppliers through a comprehensive literature study. This literature study is used as a basis for formulating initial variables that will be used as references in the data collection and analysis process. Through this approach, a number of main factors can be identified that play an important role in the company's decision making regarding supplier selection.

The research approach used is a quantitative approach with a survey method as the main method of data collection. The survey was conducted by distributing questionnaires to respondents selected based on certain criteria, and supplemented with structured interviews to dig deeper information and validate the variables of the literature study results. The questionnaire was compiled based on factors obtained from previous literature, then tested for validity through discussions with experts and interviews with company personnel who have experience in raw material procurement .

The next stage is distributing questionnaires to respondents representing various strategic positions in the company, such as purchasing, logistics, and operational management. The data obtained from the questionnaire is used to determine the priority of supplier selection criteria through priority scale analysis. Thus, a mapping is obtained regarding which factors are considered most important in the decision-making process by the company.

To identify potential risks and design appropriate mitigation strategies, this study uses the House of Risk (HoR) approach . The House of Risk model is a framework developed by Geraldin (2007) as a result of the combination and development of two quality management methods, namely Failure Mode and Effect Analysis (FMEA) and Quality Function Deployment (QFD) . This model allows the identification of the relationship between risk events and risk agents, as well as the preparation of mitigation actions based on the calculation of the Aggregate Risk Priority (ARP) value . By implementing the HoR model, companies can determine targeted and efficient mitigation strategies to minimize the impact of risks in raw material supply chain activities .

4. Results and Discussion

The results of the research that has been done, the first is the mapping of supply chain activities using the SCOR model, this mapping process is done by brainstorming . Referring to the model, the description of raw material supply chain activities is shown in table 5. From the results of the mapping process with the SCOR model in table 5, the next step is to identify and measure risk events and risk agents. This measurement is carried out to determine the severity scale of the results of the identification of risk events and to determine the occurrence scale of risk agents. This measurement is carried out by distributing questionnaires.

Table 2. *Occurrence* Rating Scale

Degre	Description	Probability of Event (%)	Rating
Remote	Rare	<5%	1
Low	It is unlikely to happen (*unlikly*)	5-15%	2
		15-25%	3
Moderate	It might happen (*possible*)	25-35%	4
		35-45%	5
		45-55%	6

High	It is very likely to happen (*likely*)	55-65%	7
		65-75%	8
Very High	almost certain to happen (*almost certain*)	75-80%	9
		>80%	10

Source: Anityasari & Wessiani (2011)

House of risk (HOR) mapping phase 1

Mapping in this model is done by entering the results of measuring the severity level of risk events (table 6) and the occurrence of risk agents (table 7) and measuring their correlation. More clearly the mapping of the HOR phase 1 model is listed in attachment 1. The purpose of this mapping is to find the ARP (aggregate risk priority) value. The ARP value is obtained from the multiplication of the severity value, occurrence value and correlation value of the risk event and risk agent, with the following calculation example :

$ARP\ j = Oj \cdot \sum Si \cdot Rij$

$ARP\ j$ 13= O13. S8. R7

=728

$ARP\ j = Oj \cdot \sum Si \cdot Rij$

ARP 17 = O17. S4. R7

=476

$ARP\ j = Oj \cdot \sum Si \cdot Rij$

ARP 15 = 15. S4. R7

=616

$ARP\ j = Oj \cdot \sum Si \cdot Rij$

ARP 22 = O22. S3. R7

=468

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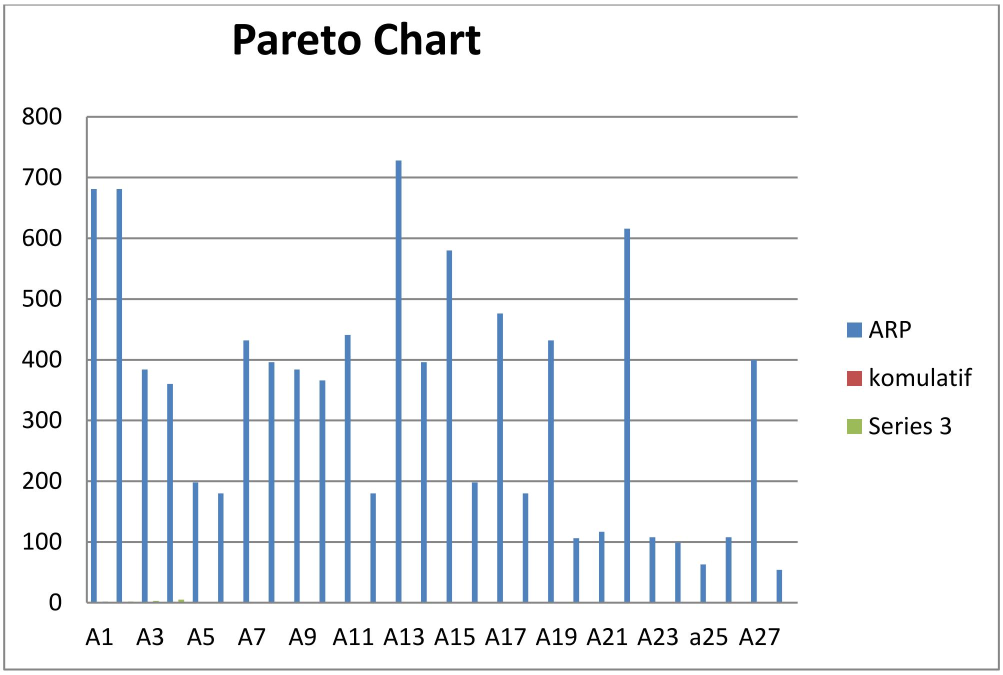

Figure 1. Pareto diagram

From Figure 1 and by using the Pareto 80/20 principle, the selected risk agents that will be taken into consideration in preparing risk mitigation actions are shown.

Table 2. Selected risk agents based on Pareto diagram

No	Oh	Risk Agent	ARP	%	% Cumulative
1	A13	Supplier unable to fulfill order	728	5.85	42.58
2	A13	Supplier does not fulfill contract	476	5.34	5.34
3	A14	Labor negligence	616	4.87	29.99
4	A22	Production machine failure	468	4.80	23.03

These risk agents will then be entered into the HOR phase 2 model for designing mitigation actions. The mitigation actions in question are actions to reduce the impact of a risk agent before the risk occurs. Alternative mitigation actions are obtained from brainstorming. The focus of designing this mitigation action is based on the selected risk agent.

Table 3. Risk mitigation action options from selected risk agents

	Risk Agent	Mitigation Action
	Supplier unable to fulfill order	Conduct supplier performance evaluation
	Supplier does not fulfill contract	Counter review

		Conduct supplier performance evaluation
	Labor negligence	Conducting work measurements Conduct regular training Internal quality audits related to workforce
	Production machine failure	

House of risk mapping phase 2

This mitigation action mapping is carried out with the aim of seeing the influence of mitigation actions on risk agents. By mapping mitigation action options with selected risk agents. The first step that must be taken is to measure the correlation value between mitigation actions (table 6) and selected risk agents (table 5). The second step is to measure the degree of difficulty (Dk). The purpose of this measurement is to determine the degree of difficulty of implementing mitigation actions. The scale of values in terms of degree of difficulty is shown in table 7. The results of this mitigation action mapping are shown in Figure 2. The third step is to measure the total effectiveness, by multiplying the correlation value between risk agents (j) and preventive actions (k). The calculation of total effectiveness aims to assess the effectiveness of mitigation actions, with the following calculation example:

TE =∑ARPE ∀ k TE =ARPE; +ARPE;

=(728×9)+(612×9) =3613

Table 7. Difficulty Degree Value Scale (Dk)

612×9) =12501

Table 4. Difficulty Degree Value Scale (Dk)

No	Weight	Information
1	3	Mitigation actions are easy to implement
2	4	Mitigation actions are somewhat difficult to implement
3	5	Mitigation actions are difficult to implement

The fourth step is to measure the effectiveness of the degree of difficulty (effectiveness to difficulty ratio), by dividing the total value of effectiveness (TEk) by the degree of difficulty of performing the action (table 7). The calculation of the effectiveness of the degree of difficulty aims to determine the priority ranking of all actions, with the following calculation example:

ETD = TE/Dk

ETD1=3613/3=1203

	Preventive Action (P Ak)

		PA1	PA2	PA3	PA4	PA5	PA6	Aggregate Risk Potential (ARPj)
Risk Agent	Supplier unable to fulfill order	9						
	Supplier unable to fulfill contract	9	9					
	Kelalaian tenaga kerja			9				
	Kerusakan mesin produksi				9	3	9	
	Total efectiveness of action -k	3613	9828	9776	8496	4212	5220	
	Degree of difficulty perfoming action –k	3	3	3	5	4	3	
	Effectiveness tu difficulty ratio	1203	3276	3258	72832	1053	1740	
	Rank of priority							

PA1 = Conduct supplier performance evaluation
PA2 = Contract review
PA3 = Conduct regular training
PA4 = Internal quality audits (internal quality audits)
PA5 = Preventive machine maintenance PA6 = Carrying out work measurements

Table 5. Priority ranking of mitigation actions

No	Mitigation Action	ETDk	Priority Ranking
1	Conduct supplier performance evaluation	1203	1
2	Contract review	3276	2
3	Conduct regular training	3258	3
4	Internal quality audits (internal quality audits)	72832	4
5	Preventive machine maintenance PA6 = Carrying out work measurements	1053	5

Conducting supplier performance evaluation (PA-1)

The highest ranking risk mitigation action is to evaluate the performance of suppliers who have a total effectiveness value (TEk) of 3613, a degree of difficulty effectiveness value (ETDk) of 1203 and a degree of difficulty value (Dk) of 3 which means this action is easy to implement. In evaluating and selecting suppliers must be based on their capabilities, namely the ability to meet the requirements of the quality system and certain quality assurance. In the process

This supplier is evaluated based on supplier performance which includes criteria for selecting leather raw material suppliers such as leather raw material quality, cost, delivery accuracy, service, supplier relationships. From this process all quality records are stored and maintained in such a way as to avoid damage and loss.

Conduct training (PA-3)

The second highest ranking risk mitigation action is conducting periodic training which has a total effectiveness value (TEk) of 3258, a degree of difficulty effectiveness value (ETDk) of 1740 and a degree of difficulty value (Dk) of 3 which means this action is easy to implement. The company must establish and maintain written procedures for identifying training needs that carry out activities that affect quality. Workers must be qualified on the basis of appropriate education, training or experience according to needs. This training is specifically applied to employees in the Purchasing and Warehouse Departments. Because from the results of data processing that has been carried out, this training is proposed because of employee negligence which has the potential to cause risks such as production planning errors, material calculation errors, errors in taking and placing leather.

Conducting work measurements (PA-6)

The next highest ranking risk mitigation action is to conduct work measurement which has a total effectiveness value (TEk) of 5220, a degree of difficulty effectiveness value (ETDk) of 1740 and a degree of difficulty value (Dk) of 3 which means this action is easy to implement. Work measurement is used as a basis for intensive planning to maintain process balance, especially in determining the level of labor usage for the warehouse.

Contract review (PA-2)

The third highest ranking risk mitigation action is conducting a contract review which has a total effectiveness value (TEk) of 5508, a degree of difficulty effectiveness value (ETDk) of 1377 and a degree of difficulty value (Dk) of 4 which means this action is rather difficult to implement. The company must establish and maintain written procedures for conducting contract reviews and for coordinating these activities.

Preventive machine maintenance (PA-5)

The fourth highest ranking risk mitigation action is to perform preventive machine maintenance which has a total effectiveness value (TEk) of 4212, a degree of difficulty effectiveness value (ETDk) of 1053 and a degree of difficulty value (Dk) of 4 which means this action is rather difficult to implement. The proposed or possible preventive maintenance is: 1. Performing maintenance at different time periods, namely conducting routine check-ups every month. Especially on sewing machines (stitching), cutting machines, conveyors, healast and toelast machines. 2. Maintenance is carried out after operating hours or a certain volume. The operating hours applied are 3 work shifts, each of which is 8 hours. The process of checking or setting up the machine can be done during work shifts.

Checksheet is a sheet of observation frequency and defect frequency in which the number of defective *sheets is recorded each month. Frequency sheet data for Pucuk Harum tea products can be seen in table 4.2*

Table 6. Number of Product Defects Date December 01, 2022 – December 12, 2022

No	Production result	Defective product (pcs)	Product is not defective	Close the Nangking	Volume Not enough	Dented Bottle
1	277409	157	277252	117	20	20
2	184195	250	183945	180	35	35
3	227219	249	226970	164	55	30
4	255794	261	255533	205	46	10
5	231948	336	231612	221	34	81
6	203686	268	203418	134	41	93
7	179655	247	179408	125	81	41
8	265786	366	265420	259	95	12
9	234123	357	233766	208	82	67
10	247005	531	246474	410	65	56
11	239675	291	239384	178	60	53
12	251230	245	250985	172	22	51
TOTAL				**2373**	**636**	**549**

Source: Data Processing , 2022

Stratification is the process of grouping defect data that occurs in the production area. In addition to grouping defect data, stratification also records the number of defects that occur in each type of defect. The stratification of defects in Pucuk Harum tea products can be seen in the following table.

Table 7. Product Defect Stratification Date December 01, 2022 – December 12, 2022

Date	Production result	Types of defects			Defective product (pcs)	Total defects (%)
		Close the Nangking	Volume Not enough	Dented Bottle		
1	277409	117	20	20	157	0.05
2	184195	180	35	35	250	0.13
3	227219	164	55	30	249	0.1
4	255794	205	46	10	261	0.1
5	231948	221	34	81	336	0.14
6	203686	134	41	93	268	0.13
7	179655	125	81	41	247	0.01
8	265786	259	95	12	366	0.13
9	234123	208	82	67	357	0.15
10	247005	410	65	56	531	0.21
11	239675	178	60	53	291	0.12
12	251230	172	22	51	245	0.09
TOTAL		**2373**	**636**	**549**	**3558**	

Source: Data Processing , 2022

Histogram is a bar chart that shows a tabulation of the entire data arranged based on its defects. Data collected from observations will be made into a histogram that provides an overview of the frequency of each type of defect, namely, perched lid, insufficient volume and dented bottles. The histogram of total defects can be seen in table 3.

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Table 8. Number of Product Defects Date 01 December 2022 – 12 December 2022

No	Types of defects		
	Close the Nangking	**Volume Less**	**Bottle Dent**
1	117	20	20
2	180	35	35
3	164	55	30
4	205	46	10
5	221	34	81
6	134	41	93
7	125	81	41
8	259	95	12
9	208	82	67
10	410	65	56
11	178	60	53
12	172	22	51
TOTAL	**2373**	**636**	**549**

Source: Data Processing

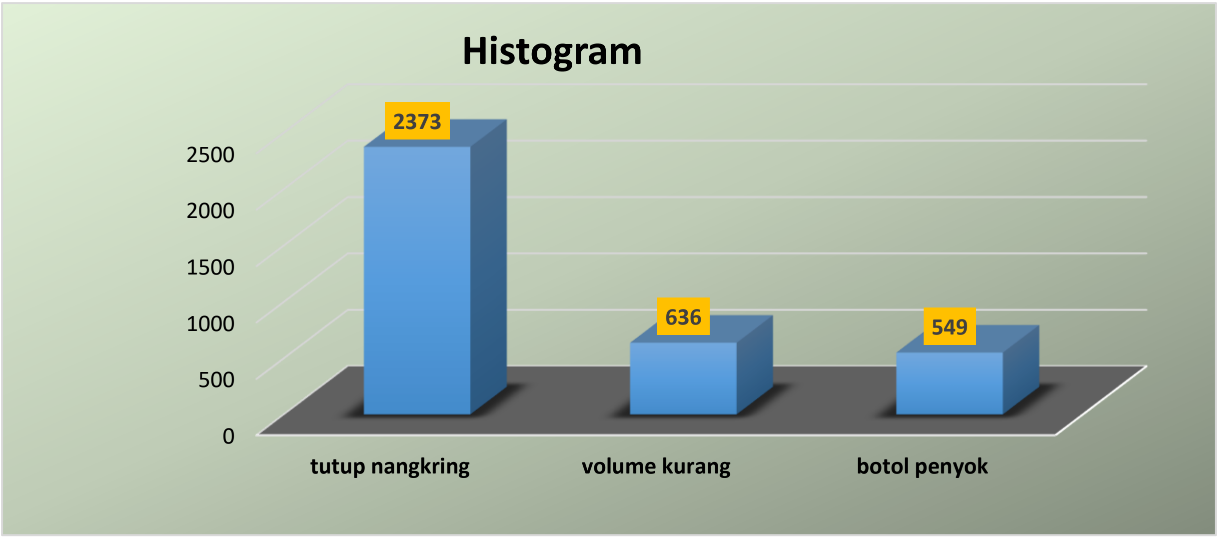


Figure 2. Histogram of Defective Products

The histogram graph in Figure 2 shows that the largest number of product defects is caused by perched lid defects with a total of 2373 defects and the smallest number of defects is caused by dented bottles with a total of 549 defects.

Pareto diagram is a diagram that describes the comparison between defective products with perched lids, insufficient volume and dented bottles, to the total defective products that occur which are sorted based on the largest number of defective products and then the percentage and cumulative percentage are calculated. The comparison of percentages can be seen in the following table.

Table 9. Percentage of Defective Products

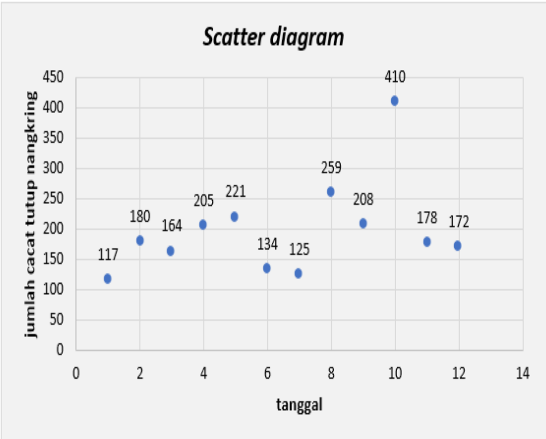
Types of defects	Number of defects (pcs)	Percentage of defects (%)	Cumulative percentage (%)
Close the perch	**2373**	**66.69**	**67**
Volume is low	**636**	**17.87**	**85**

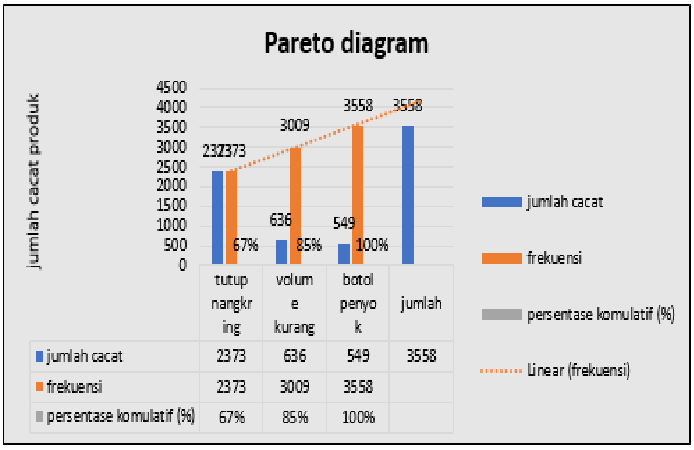
Dented bottle	**549**	**15.43**	**100**
Amount	**3558**	**100.00**	

Source: Data Processing , 2022

The following Pareto diagram is used to identify defects that need to be prioritized to be addressed. Based on the Pareto diagram in Figure 4.23, the defects that are prioritized for repair are the perched lid 67 % and the volume is lacking 85% with a total percentage of 100%.

A scatter diagram shows the possible relationship (correlation) between pairs of two types of variables, usually explaining the existence of a relationship between the two variables and showing the closeness of the relationship which is manifested as a correlation coefficient.





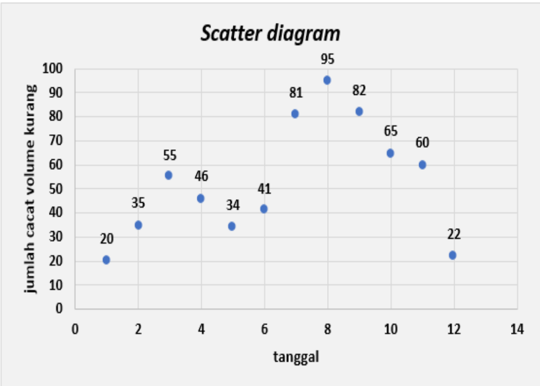


Figure 3. Pareto Diagram and Scatter Diagram of Defective Products

Table 10. Calculation of Correlation of Production Amount with Less Volume

Date	Production result (pcs) (X)	Volume is low (pcs) (Y)	X²	Y²	XY
1	277409	20	76955753281	400	5548180
2	184195	35	33927798025	1225	6446825
3	227219	55	51628473961	3025	12497045
4	255794	46	65430570436	2116	11766524
5	231948	34	53799874704	1156	7886232
6	203686	41	41487986596	1681	8351126
7	179655	81	32275919025	6561	14552055
8	265786	95	70642197796	9025	25249670

9	234123	82	54813579129	6724	19198086
10	247005	65	61011470025	4225	16055325
11	239675	60	57444105625	3600	14380500
12	251230	22	63116512900	484	5527060
Total	**2797725**	**636**	**662534281503**	**40222**	**147458628**

Source: Data Processing , 2022

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2}}$$

$$r = \frac{12(147458628) - (2797725)(636)}{\sqrt{[12(662534281503) - (2797725)^2][12(40222) - (636)^2}}$$

$$r = -0{,}1$$

Table 11. Results of Calculation of Product Defect Proportion, UCL, and LCL

SUBGROUP	Production result (pcs) (n)	Close the perch (np)	Proportion of perched lid defects (p)	p	UCL	LCL
1	277409	117	0.000422	0.000848	0.00101	0.000682
2	184195	180	0.000977	0.000848	0.00105	0.000645
3	227219	164	0.000722	0.000848	0.00103	0.000665
4	255794	205	0.000801	0.000848	0.00102	0.000675
5	231948	221	0.000953	0.000848	0.00103	0.000665
6	203686	134	0.000658	0.000848	0.00104	0.000653
7	179655	125	0.000696	0.000848	0.00105	0.000642
8	265786	259	0.000974	0.000848	0.00102	0.000679
9	234123	208	0.000888	0.000848	0.00103	0.000668
10	247005	410	0.000166	0.000848	0.00102	0.000673
11	239675	178	0.000743	0.000848	0.00103	0.000670
12	251230	172	0.000685	0.000848	0.00102	0.000674
Total	**2797725**	**2373**				

Source: Data Processing , 2022

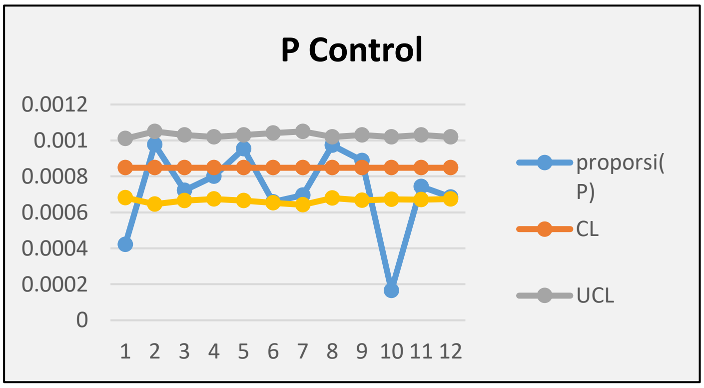


Figure 4. P Control Map for Perched Cover Defects

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From the results of the control map, it can be seen that the defects that occurred were still within the control limits (nothing was *out of control*) .

Table 12. Results of Calculation of Product Defect Proportion, UCL, and LCL

SUBGROUP	Production result (pcs) (n)	Volume is low (np)	Proportion of perched lid defects (p)	p	UCL	LCL
1	277409	20	0.000072	0.000227	0.000311	0.000142
2	184195	35	0.000190	0.000227	0.000332	0.000122
3	227219	55	0.000242	0.000227	0.000322	0.000132
4	255794	46	0.000179	0.000227	0.000317	0.000137
5	231948	34	0.000146	0.000227	0.000322	0.000132
6	203686	41	0.00201	0.000227	0.000327	0.000127
7	179655	81	0.000451	0.000227	0.000334	0.000120
8	265786	95	0.000357	0.000227	0.000317	0.000137
9	234123	82	0.000350	0.000227	0.000322	0.000132
10	247005	65	0.000263	0.000227	0.000317	0.000137
11	239675	60	0.000250	0.000227	0.000317	0.000137
12	251230	22	0.000087	0.000227	0.000317	0.000137
Total	**2797725**	**636**				

Source: Data Processing , 2022

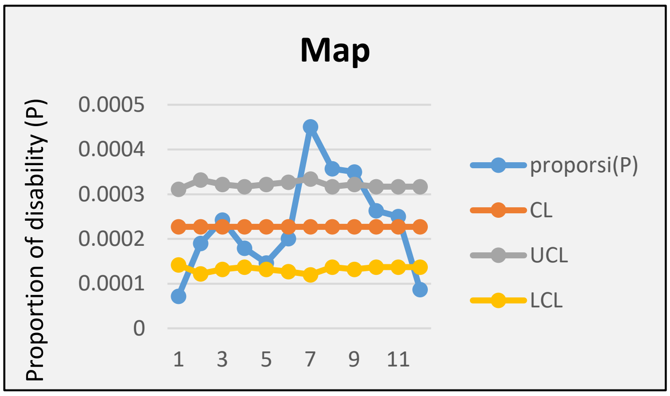

Figure 5. P Control Map for Perched Cover Defects

From the results of the control map, it can be seen that the defects that occurred were still within the control limits (nothing was *out of control*).

At this stage, an analysis of the causes of the perched lid defects and insufficient volume is carried out using *fish bone*. In this case, the cause of the problem is reviewed from human, method, machine and material. Here is a description of each cause of the problem:

a. Man

   In this case, there is a lack of operator accuracy regarding proper machine operation and a lack of operator understanding regarding machine settings and machine parameters.

b. Method

   The absence of standard machine parameters in determining machine settings, resulting in errors in producing Pucuk Harum tea.

c. Machine

In this case, there is no standard time for replacing parts on the Pucuk Harum tea filling machine.

d. Material

The lack of cleanliness of raw materials results in sticking dirt, resulting in defects in fragrant tea products.

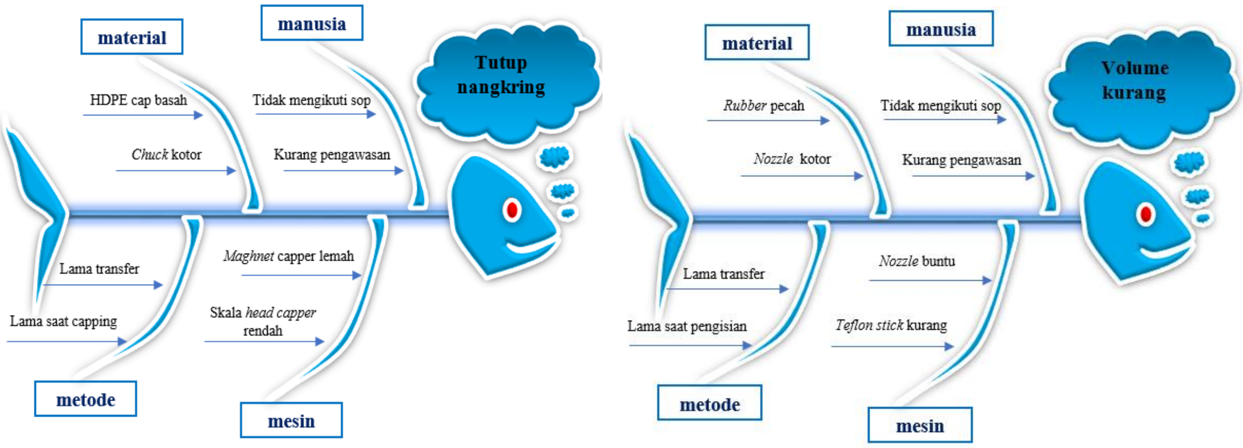

Figure 5. Cause and Effect Diagram of Defects

5. Conclusion

Based on the results of the processing and discussion that have been carried out, several conclusions were obtained, namely the number of defects in the Pucuk Harum tea product with a nangkring lid is 2373 pcs (66.69%) and for defects in the Pucuk Harum tea product with a low volume of 636 pcs (17.87%). The factors causing defects in the nangkring lid and low volume are caused by human factors, namely the operator does not follow the SOP, material factors, namely the chuck is dirty, machine factors, namely the capper magnet is starting to weaken, method factors, namely the length of time during transfer. The proposed improvements are to check and replace the magnet periodically so that the machine remains in normal condition, provide briefings to operators when they first start work and provide training for operators in order to provide additional knowledge about the machine, add a more practical and faster transfer path so that it does not take long or is late in the transfer process, conduct trials of new materials for rubber nozzles so that the rubber nozzle has good quality.

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