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Analysis of quality control issues in lakop sapu ijuk using Root Cause Analysis (RCA)

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Abstract
UD Cibinong Indah Plastik is engaged in the production of cleaning tools. Still, the proportion of defective lakop sapu ijuk production is 6.2%, whereas the company's set standard for faulty products is 5%, resulting in financial losses. This study employed the Root Cause Analysis method to identify the root causes and propose improvements. Fault Tree Analysis found that the most significant root cause is the lack of maintenance and replacement of machines. The suggested solutions through the Process Decision Program Chart are to improve the care and replacement schedule, provide additional training for workers and operators, and enhance the supervision system and SOP socialization for better production outcomes in the future.

Keywords: *Improvement; Root Cause Analysis; Process Decision Program Chart*

INTRODUCTION

The current development of technology will continue to drive the creation of new opportunities through the utilization of technology and innovation. This urges existing businesses to adapt to these changes to survive. However, such progress is limited by the infrastructure and human resources constraints in various regions that are not evenly distributed across Indonesia.

Usaha mikro, kecil, dan menengah (UMKM) have become crucial because their presence is not limited to urban areas but can also be found in remote regions. In this way, UMKM can influence regional economic equity and create job opportunities (Halim, 2020). Technological advancements also drive the growth and development of UMKM, making them accessible to a wider audience through the internet and social media. Hence, UMKM plays a significant role in developing and progressing a prosperous society's economy (Kadeni, 2020).

Meanwhile, quality control is vital in every industry and business to ensure that the products or services produced meet established standards (Sari & Purnawati, 2018). Sound quality is one of the critical factors in an organization's success in meeting all customer needs, thereby providing maximum satisfaction (Adriant & Siswanto, 2017). Quality also refers to a product's physical, functional, and characteristic state that meets consumer preferences and needs, satisfying the value or money given (Prawirosentono, 2007).

Therefore, it is crucial to be able to carry out quality management, which is a part of the company's efforts to continuously enhance its performance with continuous performance improvement at both the operational and process levels, as well as in every

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functional area within the company, by utilizing available human resources and capital (Gasperz, 2005).

There are at least seven tools that can be used to assist the improvement process and overall quality management activities (Heizer & Render, 2006) as follows:

1. Histogram
2. Pareto Chart
3. Fishbone Analysis
4. Check Sheet
5. Control Chart
6. Scatter Plot
7. Flow Chart

However, in some cases, low-quality control issues can occur, negatively impacting the company. Low-quality control can refer to a situation where the products or services provided by the company do not meet the expected quality standards. This can be caused by various factors, including a lack of understanding of quality requirements, failure to implement effective quality control processes, or inadequate supervision and control during production or service delivery.

Therefore, it becomes essential to pursue continuous improvement to improve quality as it can enhance overall performance. The results can be seen in various aspects, such as schedule adherence, time management, duration, task allocation, and the utilization of available resources (Siswanto et al., 2018).

One of them is UD Cibinong Indah Plastik, a UMKM engaged in the manufacturing of cleaning tools, with one of its main products being the coconut broom, locally known as "Sapu Ijuk" UD Cibinong Indah Plastik is a company that manufactures plastic components, particularly "lakop" or the plastic part sapu ijuk. However, there is an issue where UD Cibinong Indah Plastik produced 761,200 pieces of lakop sapu ijuk from January to August 2022. Among this quantity, 47,835 pieces were found to be below the standard quality.

Out of the total production of 761,200 lakop sapu ijuk, 6.2% of them did not meet the established quality standard, and this quantity significantly exceeded the expected defective products, which should have been less than 5% of the total production. Undoubtedly, this situation causes significant losses for UD Cibinong Indah Plastik, as without proper quality control, the number of unsatisfactory presentations will continue to increase, resulting in losses for the company.

Another impact of low-quality control issues, apart from financial losses, is the possibility of dissatisfying customers with the received products, leading to a decline in customer loyalty, decreased sales, and a tarnished reputation. These are undesirable consequences for any company, including UD Cibinong Indah Plastik, which aims to avoid disappointing its customers with their products. Therefore, it is crucial to maintain quality throughout the entire process of producing lakop sapu ijuk, including quality inputs for raw materials, production processes, and distribution to end consumers (Ariffien et al., 2021).

To overcome the issue of low-quality control, UD Cibinong Indah Plastik must promptly adopt a systematic and continuous approach to quality management. An effective quality control process should involve clear identification and understanding of quality requirements, accurate and regular measurement of the products or services produced, and swift corrective actions to address deviations from the established quality standards.

From the explanation above, a problem statement can be formulated, consisting of identifying the root causes that hinder the quality control of lakop sapu ijuk production at UD Cibinong Indah Plastik and proposing improvement measures to enhance quality control.

Meanwhile, based on the problem statement, the research objective is to identify the root causes of quality control issues in the lakop sapu ijuk production and to determine the necessary improvement steps that UD Cibinong Indah Plastik should undertake to enhance the level of quality control in the production of lakop sapu ijuk.

METHOD

In conducting this research, data collection involved direct observation at the premises where UD Cibinong Indah Plastik manufactures lakop sapu ijuk and interviews with several workers and representatives from UD Cibinong Indah Plastik. The collected data includes information on the types and quantities of defects in the lakop sapu ijuk production, raw material data, and the processing of lakop sapu ijuk. In addition to gathering field data, this research also conducted a literature review by examining relevant theories, references, and information related to the subject matter, which was necessary throughout the research process.

To resolve the quality control issues at UD Cibinong Indah Plastik, the Root Cause Analysis method was used. Root Cause Analysis is a structured approach aimed at identifying the factors influencing events that lead to problems and can be used to improve the quality of work (Corcoran & Nichols-Casebolt, 2004). Therefore, it is necessary to identify and delve deeper into the issues using Fishbone Analysis to determine the factors causing the quality control problems at UD Cibinong Indah Plastik.

Then, after identifying the root causes, a further in-depth investigation of the issues is conducted using Fault Tree Analysis, which is an analytical method used to identify and analyze the causes and consequences of a failure in a system by tracing the problems in a process where an undesired event occurs within the system. This analysis involves a thorough examination of the conditions and situations that led to the occurrence of the problem, to identify the factors contributing to the emergence of the said issue (Vesely & et all, 1981).

From the Fault Tree Analysis results, the root causes that lead to the low-quality control at UD Cibinong Indah Plastik, which deviates from the established standards, are identified. After identifying the root causes, possible improvement solutions are sought through the Program Decision Chart Diagram, which aims to assist in formulating contingency plans for activities with high risks or uncertainties, selecting the best corrective or improvement actions to resolve existing issues, and preparing improvement plans if system changes are needed in an ongoing planning process (Michalski, 1997).

All these steps are carried out systematically to identify potential improvement solutions and prioritize realistic and feasible solutions over those that might be more challenging to implement. With this approach, it is hoped that the outcomes from the Program Decision Chart Diagram, representing improvement solutions, can be utilized to enhance the existing system at UD Cibinong Indah Plastik and reduce the production rate below the quality standards. Consequently, UD Cibinong Indah Plastik can minimize losses and meet customer expectations.

RESULT AND DISCUSSION

It is necessary to conduct relevant analysis to identify the factors that may be causing the issues. Therefore, a cause and effect analysis, commonly known as fishbone analysis, was carried out based on interviews and observations. The investigation revealed that human factors, material or raw materials, methods, and machinery contribute to the problem.

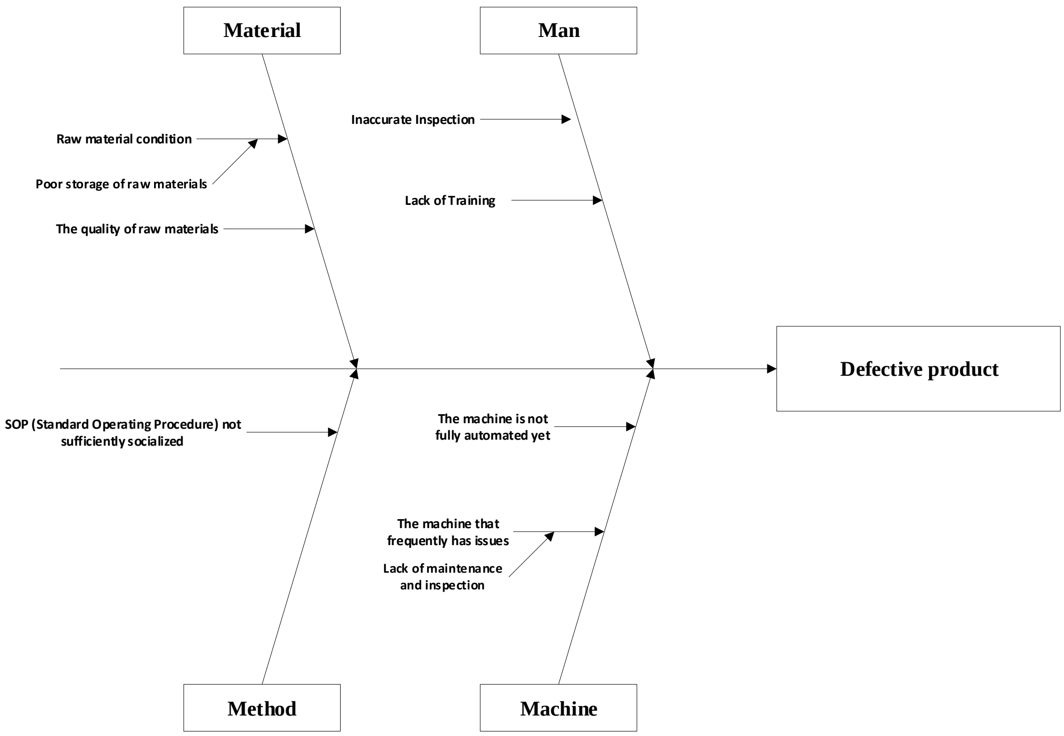

Fig. 1 Fishbone Analysis

Based on the results of the fishbone analysis, it is found that there are issues involving the machines used in the production process. These machines lack proper maintenance, leading to frequent problems during production. Another problem is that the devices are not fully automated yet, causing manual finishing processes that often result in errors. Additionally, there are issues with the methods used due to insufficient socialization of Standard Operating Procedures (SOPs), resulting in many mistakes made by machine operators and workers who do not follow the established operational steps.

Moreover, there are problems with the raw materials used, as they do not meet the required standards or have subpar conditions due to improper storage. Lastly, the human factor contributes to the problem, caused by inadequate training and a need for improvement in the precision of the workers.

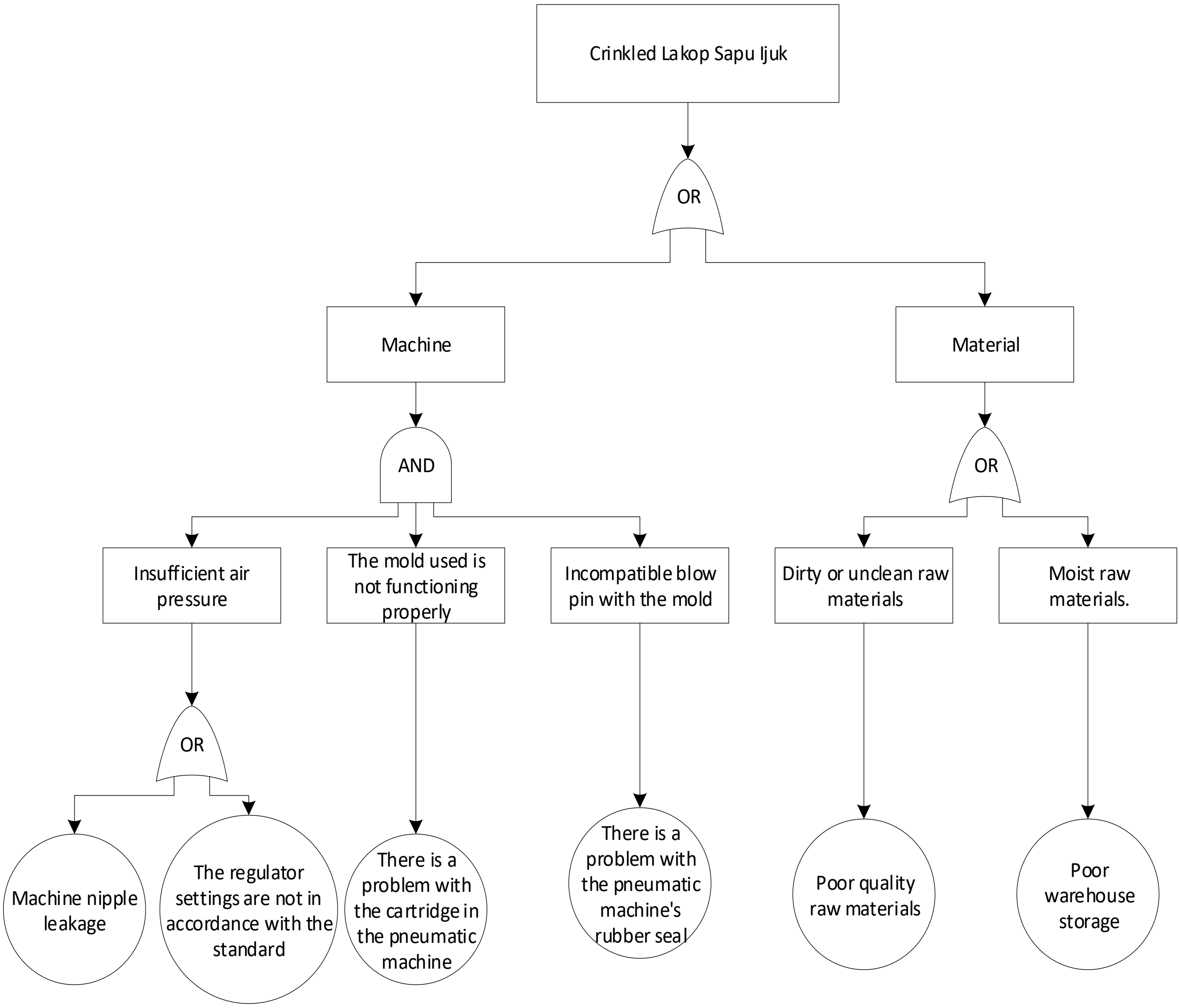

Fig. 2 Fault Tree Analysis of Crinkled Lakop Sapu Ijuk

The results obtained from the fishbone analysis only scratched the surface, as they did not delve into the actual root causes of the problems. Therefore, a further search for the root causes was conducted using fault tree analysis based on each occurring defect. Two contributing factors were identified for the issue of crinkled lakop sapu ijuk: machine-related factors and the raw materials used. Firstly, concerning the machine-related factors, several root causes were found. Leakage in the Nepel, improper regulator settings leading to the crinkling of the lakop sapu ijuk, cartridge machine problems affecting the moulding process, and issues with the rubber seal used in the malfunctioning machine, leading to pneumatic inefficiency. Secondly, regarding the raw material factors, the root cause of the problem was twofold. It involved using raw materials that did not meet the required quality standards and subpar storage conditions in the warehouse.

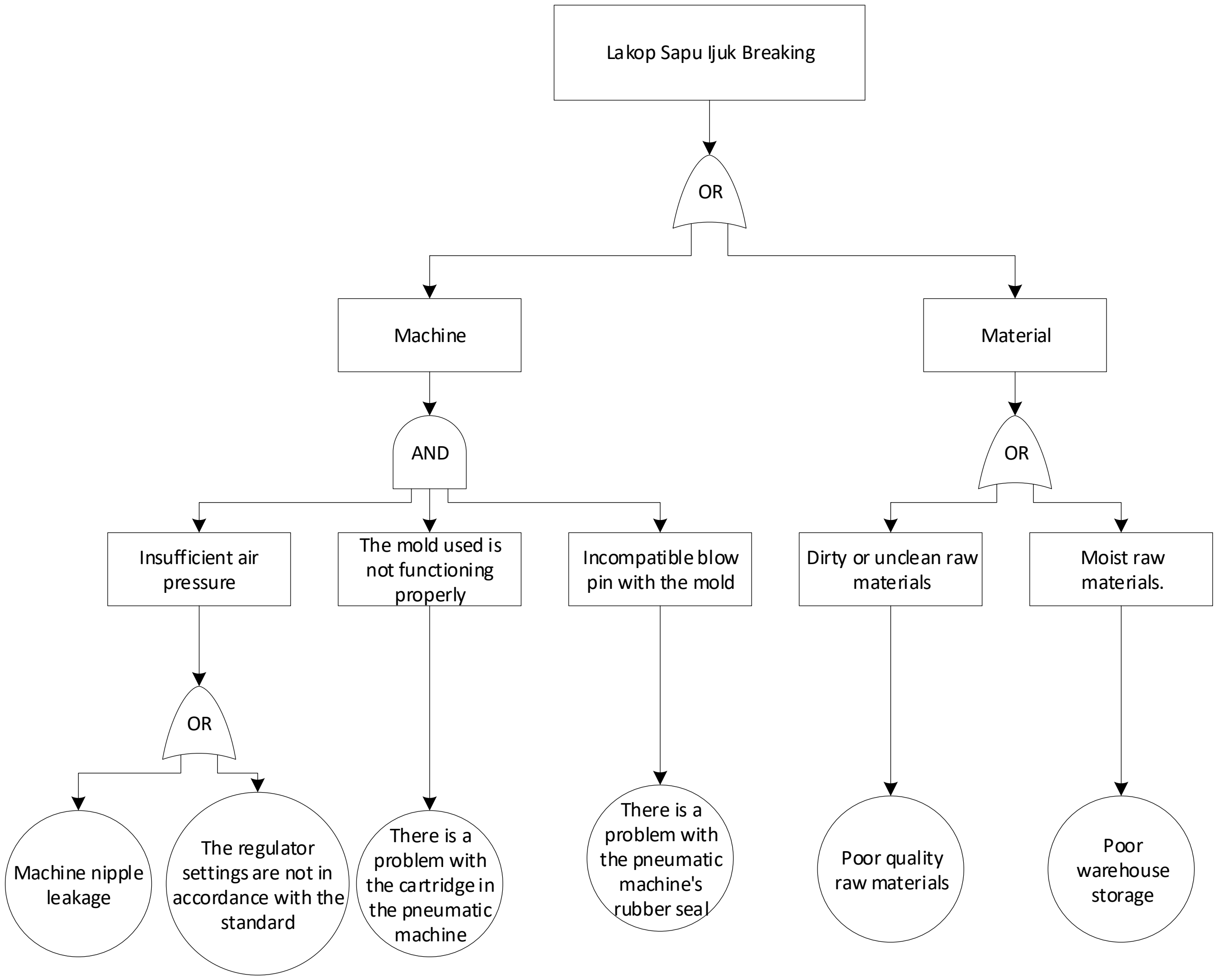

Fig. 3 Fault Tree Analysis of Lakop Sapu Ijuk Breaking

Regarding the issue of lakop sapu breaking during the moulding process, based on the findings from the fault tree analysis, several problems are identified, involving two factors: the machine factor related to issues with the used machine and the raw material factor used during the production process. Under the machine factor, the root cause of the problem is traced back to improper air regulator and heater settings, which do not comply with the standard operating procedures (SOP), leading to complications. Additionally, the problem with the pneumatic machine's rubber seal causes issues during the moulding process, and blockages in the stopper section of the device contribute to the problem. On the other hand, the raw material factor presents issues related to inadequate warehouse storage, resulting in using natural materials that do not meet the required standards. Consequently, this leads to the breaking of lakop sapu ijuk during the moulding process.

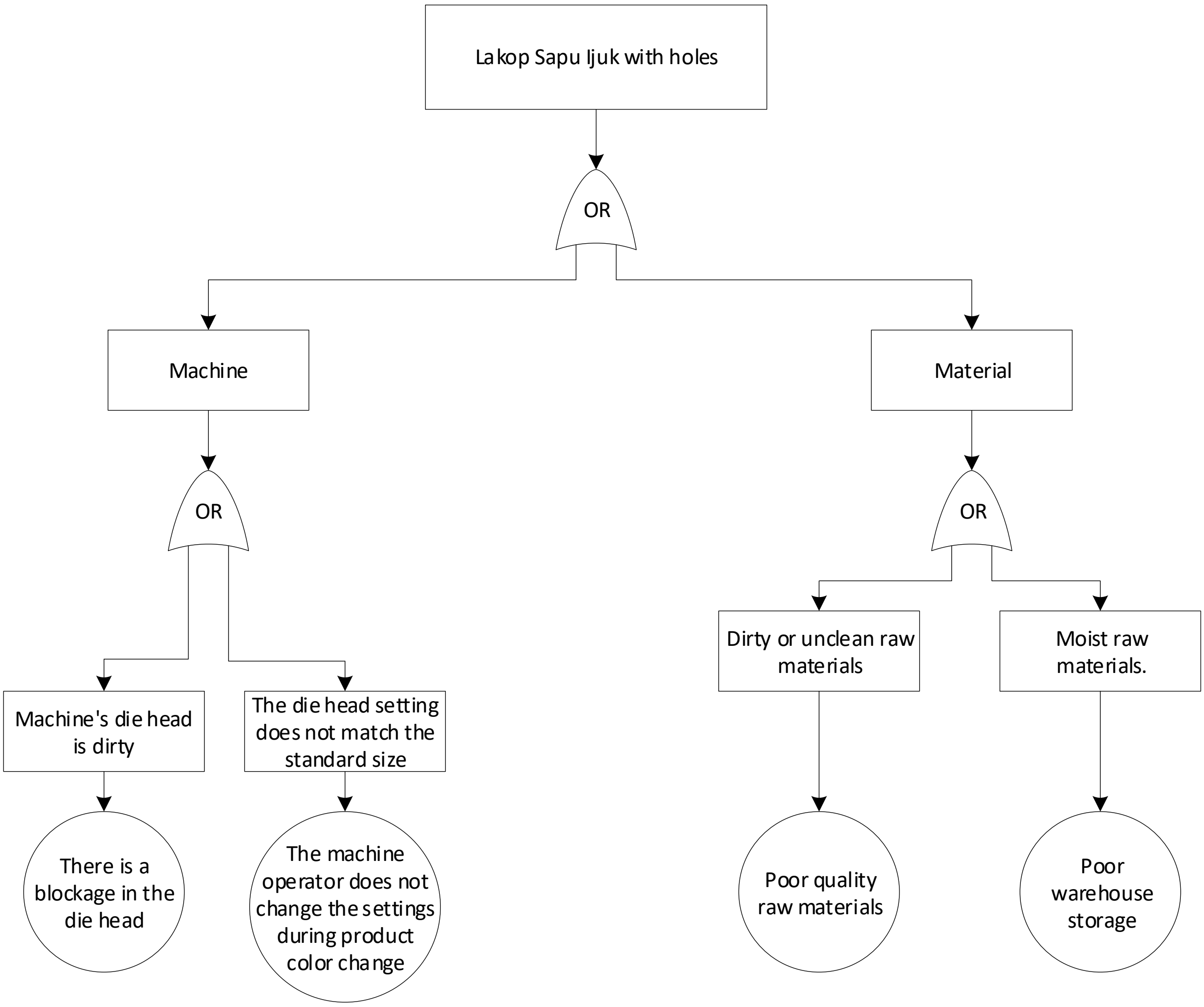

Fig. 4 Fault Tree Analysis Lakop Sapu Ijuk With Holes

Furthermore, there is an issue where the lakop sapu ijuk comes out with holes during the moulding process, resulting in an imperfect shape. Based on the findings from the fault tree analysis for the holed lakop sapu ijuk issue, two contributing factors were identified: machine-related factors and raw material factors used during the production process.

Regarding the machine-related factors, the root causes were identified as blockage occurring in the die head of the machine, leading to the problem. Additionally, it was found that the machine operators did not adjust the die head settings when changing the colour of the lakop sapu ijuk. This caused issues because each colour requires different die head settings. Next, a search for the root causes was conducted regarding the raw material factors, and it was discovered that the root cause was the use of poor-quality raw materials, specifically dirty or unclean raw materials, causing problems during the moulding process. Additionally, improper warehouse storage contributed to the issue.

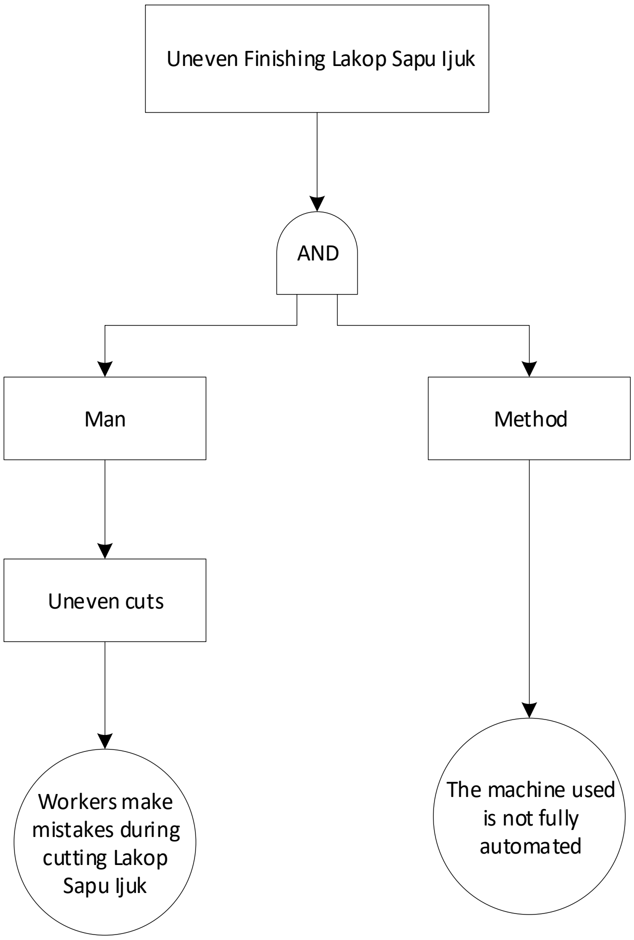

Fig. 5 Fault Tree Analysis Uneven Finishing Lakop Sapu Ijuk

Lastly, two contributing factors were identified for the lakop sapu ijuk with uneven finishing after conducting a root cause analysis using fault tree analysis: human factors and the method used. Regarding the human factors, the root cause was found to be errors made by workers during the cutting process of the lakop sapu ijuk. As for the method factor, the root cause was the lack of full automation in the existing machine.

After identifying each root cause, the next step is to search for solutions using the Program Decision Chart Diagram based on the results of the conducted Fault Tree Analysis. Several improvement solutions were found, represented by cloud-shaped symbols, to enhance the quality control of lakop sapu ijuk production.

Firstly, for Crinkled Lakop Sapu Ijuk there are two key factors to consider: machine and raw materials. For the machine factor, several improvement solutions were identified. Firstly, to address the issue of leaking *nepel*, regular nepel replacements should be conducted every month. Secondly, for the problem of inappropriate air pressure regulators, scheduled weekly checks should be implemented. Thirdly, maintenance should be performed on the machine cartridge every month. Lastly, to address the problem with pneumatic machine rubber seals, regular replacements of rubber seals should be carried out every week. These four improvement suggestions are depicted by circles below the cloud-shaped symbols, indicating that they are viable solutions for the company to implement.

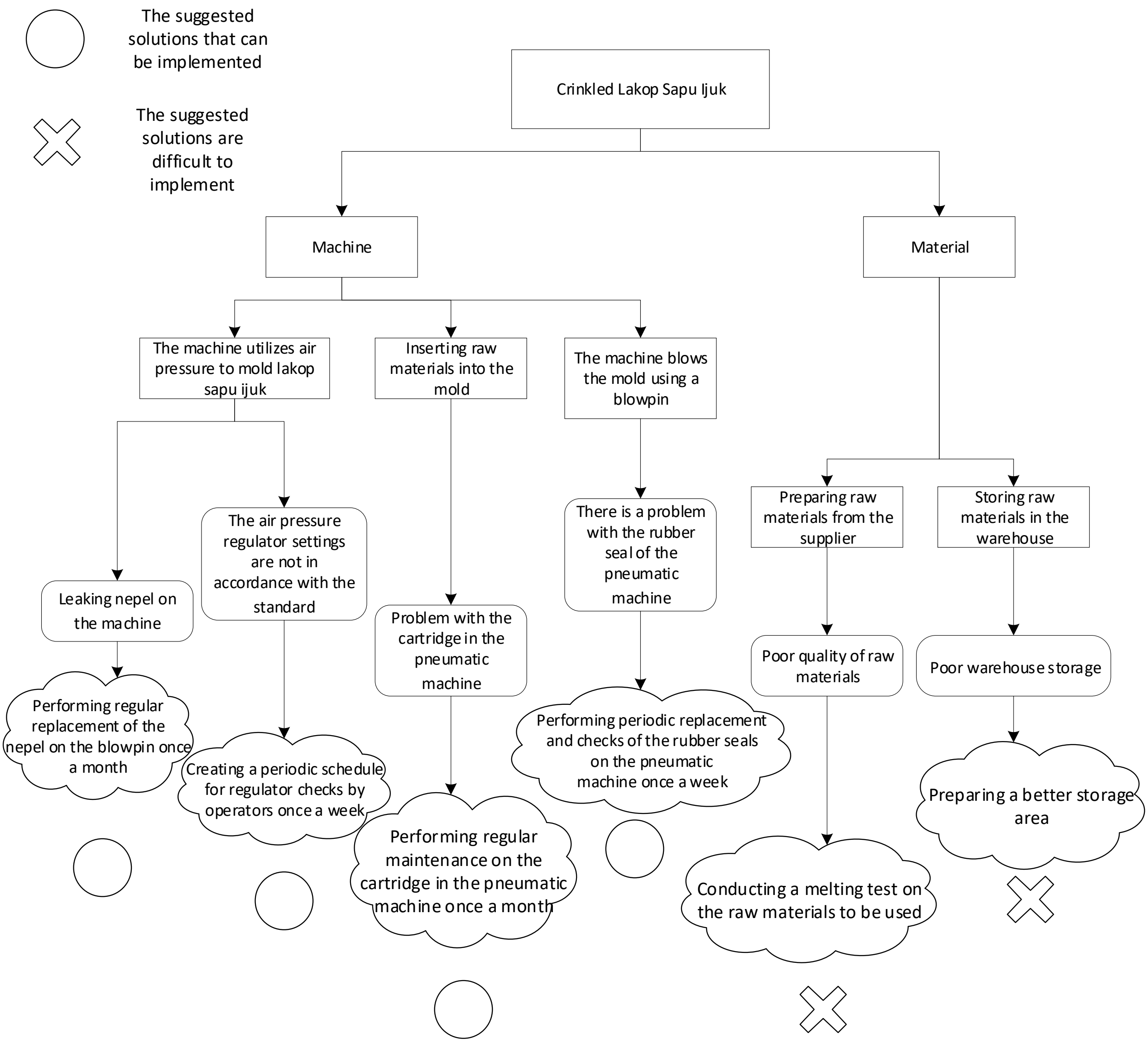

Fig. 6 Process Decision Program Chart Crinkled Lakop Sapu Ijuk

Next, there are improvement solutions for the issue of poor-quality raw materials for the raw material factor. Conducting a melting test on the raw materials before the moulding process can help determine their quality beforehand. This way, the company can assess the suitability of the raw materials for the moulding process.

As for the problem of inadequate warehouse storage, the proposed solution involves preparing a more suitable storage area to prevent the raw materials from being damaged due to temperature and humidity, which can cause the fabrics to become damp or mouldy. However, both of these suggestions are considered impractical due to the company's limitations in providing appropriate storage space and a melting machine. Therefore, these two proposed solutions are not feasible for the company to implement.

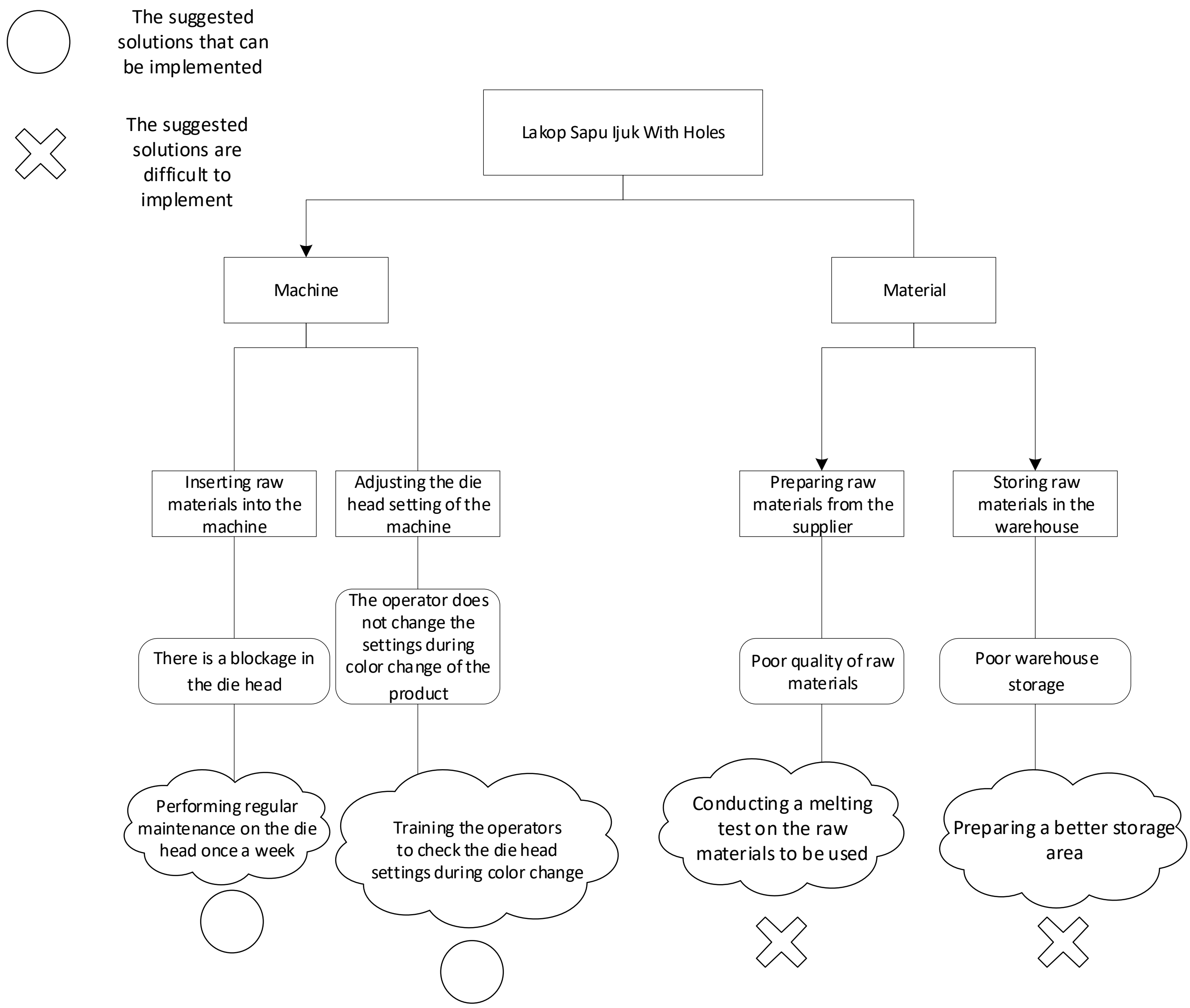

Fig. 7 Process Decision Program Chart Lakop Sapu Ijuk With Holes

Furthermore, the results from the Program Decision Chart Diagram for the issue of lakop sapu ijuk with holes found several improvement solutions for the machine and raw material factors. Regarding the machine factor, regarding the die head blockage issue, it is suggested to conduct regular maintenance once a week and provide additional training for the operators to adjust the die head settings properly. Similarly, the same issue persists for the raw material factor, leading to the same recommended solution: to perform molten material testing. Also, to address the problem of inadequate raw material storage, the suggested solution remains the same: to prepare a more suitable storage area. However, these proposed improvement solutions are currently not feasible to implement.

Moreover, for the issue of lakop sapu ijuk that breaks, the Program Decision Chart Diagram reveals two contributing factors: the machine and raw material. Regarding the machine factor, addressing the problem of improper air regulator settings, improvement efforts include implementing a regular schedule for operator checks on the air regulator and conducting routine checks on the heater settings once a week. Additionally, to tackle the problem with the pneumatic machine's rubber seal, a solution involves replacing the rubber seal regularly once a week. Furthermore, the suggested improvement is to conduct weekly checks on the machine's stopper for the issue of stopper blockages. However, the proposed solution for the raw material factor, which entails preparing a better storage area, is currently not feasible.

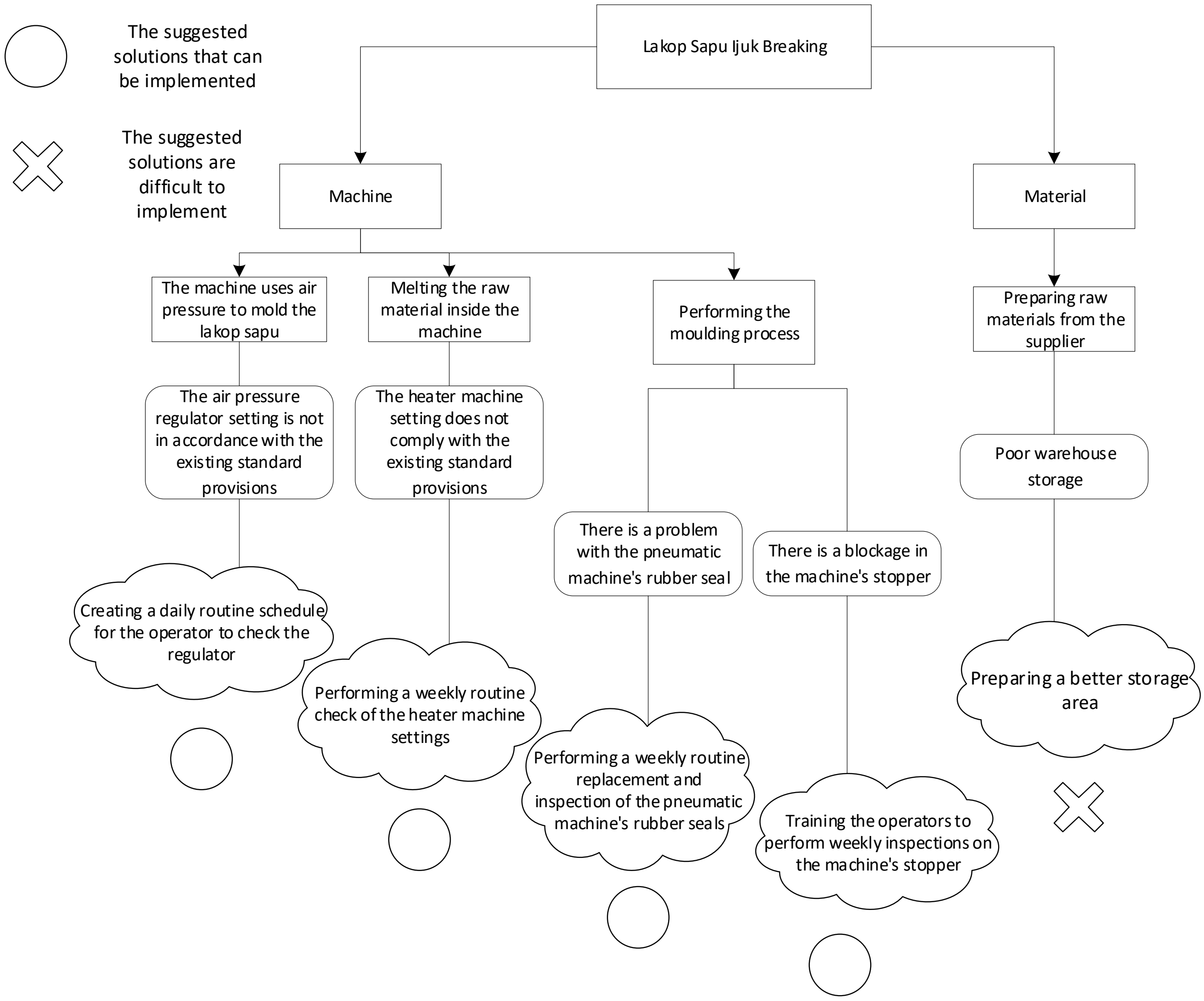

Fig. 8 Process Decision Program Chart Lakop Sapu Ijuk Breaking

Finally, based on the Program Decision Chart Diagram findings, the issue of the lakop sapu finishing being uneven is attributed to human and method factors. The proposed solution for the human element is to conduct a more intensive retraining to enhance the workers' skills in the finishing process. This training aims to minimize cutting errors, and this proposal has been accepted and can be implemented. Regarding the method factor, it has been identified that the current machine used is not fully automated. The suggested solution is to replace the device with a more automated one. However, implementing this improvement is currently not possible due to existing limitations.

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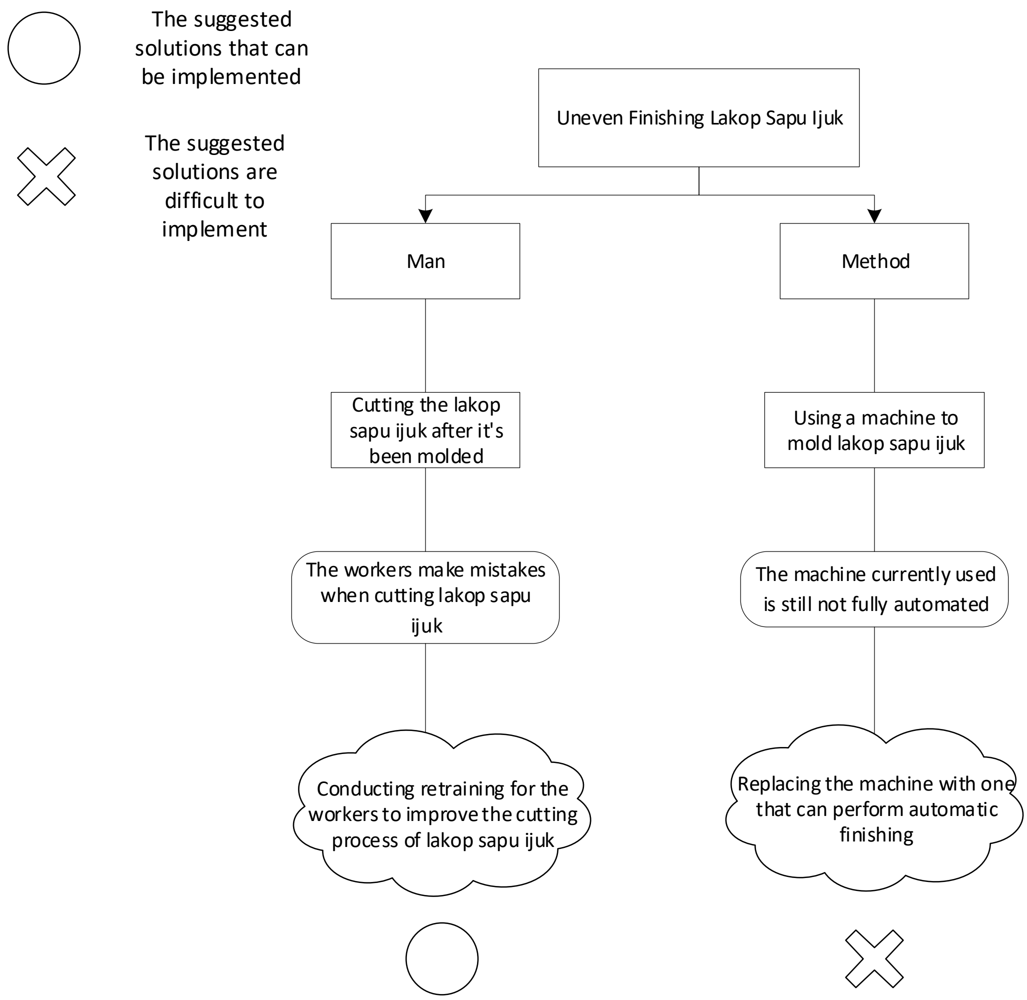

Fig. 9 Process Decision Program Chart Uneven Finishing Lakop Sapu Ijuk

CONCLUSION

The Root Cause Analysis approach is highly beneficial in identifying the underlying issues, especially in quality control. It helps find solutions by addressing the root causes of the problems that arise. In this case, the root causes identified in the production process of lakop sapu ijuk have resulted in losses due to many defective products. Where the root causes identified include issues such as;

1. Firstly, the crumpling issue of the lakop sapu ijuk can occur due to several root causes, including leakage in the machine's nepel, improper regulator settings, problems with the pneumatic seal and cartridge, poor quality of raw materials, and inadequate storage conditions.
2. The occurrence of holes in the lakop sapu ijuk is attributed to several root causes: blockage in the machine's die head, improper die head settings, poor quality of raw materials, and inadequate storage conditions.
3. The breaking of lakop sapu ijuk is caused by several root causes, including improper regulator air settings, incorrect heater machine settings, issues with the pneumatic machine's seal rubber, and inadequate storage conditions.

4. The issue of lakop sapu ijuk with uneven finishing occurs due to several root causes, including errors in the cutting process during finishing and the incomplete automation of the machine used.

Meanwhile, several improvement solutions have been obtained using the Program Decision Chart Diagram, some of which can be directly utilized or implemented. However, there are others that cannot be carried out due to current limitations. The offered solutions are as follows:

1. The recommended improvement solution for the issue of wrinkling in the lakop sapu ijuk is to conduct periodic replacement of the blow pin's nepel on the machine once a month, perform weekly checks on the air regulator, conduct monthly maintenance on the machine's cartridge, check and replace pneumatic machine's rubber seals every week, conduct melting tests on the raw materials to be used, and finally, prepare a better storage facility than the current one.
2. The recommended solution to address the issue of lakop sapu ijuk with holes is to perform weekly maintenance on the machine's die head, train operators to check the die head settings whenever changing colors, conduct melting tests on the raw materials to be used, and finally, prepare a better storage facility than the current one.
3. The recommended solution to address the issue of lakop sapu ijuk breaking is to create a daily schedule for checking the air regulator, conduct weekly inspections of the heater settings, perform weekly checks and replacements of pneumatic machine's rubber seals, train operators to inspect machine stoppers every week, and improve the storage facility for better organization.
4. The final recommended solution to address the issue of uneven finishing lakop sapu ijuk is to conduct retraining for workers in the finishing department and replace the current machine with a fully automated one capable of carrying out the moulding to finishing process entirely.

The proposed improvement solutions that are currently not feasible to implement include machine replacement, preparing a better storage facility, and acquiring a machine for conducting material melting tests. Meanwhile, the suggested solutions mainly focus on training, regular inspections, and similar measures, indicating a lack of attention to the existing Standard Operating Procedures (SOP). Therefore, there is a need for clear SOP socialization and an improved supervision system to ensure that similar issues will not occur in future production processes.

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