ANALYSIS OF CAUSES OF DEFECTS AND REPAIR SOLUTIONS ON JERRY CAN PRODUCTS USING ROOT CAUSE ANALYSIS (RCA) AND CAUSE EFFECT DIAGRAMS

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ABSTRACT

PT. ABC is a enterprise engaged inside the manufacturing of price-delivered palm oil based totally merchandise together with ghee and margarine. PT. ABC produces packaging in the form of a jerrycan. In producing jerrycans there are usually faulty products found at the manufacturing ground of PT. ABC. Jerrycan products that do not healthy the characteristics in which elements consisting of materials or materials motive the product to be faulty. If this circumstance maintains, it'll purpose losses for the agency. This examine goals to identify the causes and provide guidelines for best improvement the use of the foundation reason analysis technique and purpose effect diagrams by way of being attentive to components, particularly fabric, human, system and approach. and provide enhancements using the 5W+1H technique and answer tree diagram. based on the root of the trouble discovered, there are three defects, specifically blackspot, broken, and inappropriate colour.

Keywords: jerrycan, root cause analysis, cause effect diagram, Tree diagram, 5W+1H

1. INTRODUCTION

The general concept of productivity is a comparison between output and input in units of time. Productivity can be said to be good if the amount of production or output increases with the same amount of input or resources, the amount of production or output is the same or increases with a smaller number of inputs or resources and increased production or output is obtained with the addition of relatively small resources. In increasing its productivity, the company strives to always make improvements in every activity and minimize waste that occurs in the process of making its products.

Quality is one of the critical factors determining the success of a organisation in mastering the competition. The company truly maintains product satisfactory to maintain purchasers from shifting far from the product. every product that has been made will always be re-examined earlier than being despatched to purchasers to keep the excellent of the product so that patron delight and loyalty is maintained. The success of a product is decided by way of how the company unearths out what the patron desires. The organisation's assignment is to create a strategy so that you can decide customer dreams and degree the extent of satisfaction based totally on best standards.

Product quality is a determining factor for the level of satisfaction obtained by consumers after making a purchase and use of a product. In producing jerrycans there will always be defective products where the jerrycans do not conform to the existing standard characteristics. Factors such as materials or materials cause the product to be defective.

PT.ABC uses visual inspection to determine defective products in jerrycans. Defective products found in the production of jerrycans are blackspots or inappropriate indentations, broken jerrycans and colors on jerrycans that do not match.

Primarily based at the evaluation that has been described, the method of the trouble from the analysis of the state of affairs on this field is

the way to lessen defects in jerrycan merchandise. This analysis is centered on figuring out the elements that purpose product defects and determining the best solution steps taken to overcome the causes of product defects. each category has causes that want to be defined thru a brainstorming session.

These categories, amongst others, are based at the 6M category usually used within the manufacturing industry:
1. Machine (equipment or technology),
2. Method (method or technique).
3. Material, (comsumption, and information)
4. Man, (labor)
5. Measurement (inspection),
6. Milieu (environment)

Based totally at the information at the range of manufacturing and defects inside the jerrycan, it could be visible that the proportion of defective jerrycan products produced is around 0.51% of the overall production every day. A high percentage for defects that occur, it is necessary to analyze the deviations that occur in production and look for the causes of product defects caused and provide suggestions for improvement as an effort to minimize product defects.

Within the measure and examine steps, the team focused on identifying which Key process input Variables (KPIV) and Key Output Variables (KPOV) to check, what information to collect, how to research and display the statistics, understand potential assets of variability, and determine how to interpret the information. the records they get. In growing the tempo, they turn to creative considering the specific changes the method can make and different matters that may be done to have the favored effect on technique performance.

Root cause analysis (RCA) is used to recognize the problem occurred within the first vicinity. identifying the starting place of the trouble the use of a specific set of steps, with related tools, to find the basis purpose of the trouble the primary reason of this technique is to pick out factors expressed in herbal shape,

importance, vicinity and time because of positive conduct, actions and conditions that ought to be changed to keep away from needless errors. Then it will be analyzed using the cause effect diagram method.

Root cause analysis diagram as a problem-solving tool, namely a fishbone diagram or fishbone diagram. A fishbone diagram is used to find the causal factors of a characteristic deviation and clearly illustrates the various sources of nonconformities in related products. The principle used to make a cause-and-effect diagram is brainstorming. Cause and effect diagram, the cause of problems in here to put into consideration were human, material, working method, and machine, which could be seen in fishbone diagram.

5W+1H analysis is an analytical method used to address each root cause. The method includes questions:
1. What, what defects occur and what improvement moves will be taken to remove blackspot defects, breakages and beside the point shades.
2. Where, where the improvement movement to eliminate the illness can be accomplished.
3. Why, why the defect can arise in order that a manner to fix the disorder is found.
4. Who, who might be answerable for the improvment movements to eliminate the defects carried out.
5. When, when is the time to perform repairs to do away with defects.
6. How, how the improvment movement to take away the disorder is completed.

2. METHODS

This research was conducted at PT. ABC is located at KIM 1 Deli Serdang Regency, North Sumatra. to manipulate or improve a process, we want information, or statistics. data can be gathered in numerous ways. Research activities are carried out in several ways, namely:

1. Interview
Researchers conducted a question and solution approach with personnel and managers, regarding the input, process and output of the jerrycan production.

2. Observation
Researchers evaluation actions associated activities in conjunction with the issues raised. The outcomes of these observations are at once recorded by way of the researcher and from the observation activities, errors or techniques and activities may be recognized

3. Literature Study
The researcher also conducts a literature study through existing literatures or references.

3. FINDINGS AND DISCUSSION

3.1. Root Cause Analysis (RCA)

Root Cause Analysis (RCA) or The 5 Whys uses "countermeasures," rather than solutions. Countermeasures are actions or series of actions that are seeking for to prevent the problem from springing up again, whereas answers are virtually looking to deal with the scenario. for that reason, countermeasures are stronger, and much more likely to prevent the trouble from reoccurring.

Table 1. Root Cause Analysis Blackspot

Why	Why	Why	Why	Why
Defect	Blackspot	Operator didn't have time to check	Too much workload	Lack of operator skills
		Lack of equipment check	There are tools that cannot be used	Lack of additional equipment
		Heat engine	Lack of observation on the machine	Lack of equipment technician
		Slippery floors impede operator movement	The injection blow is not clean and the black crust is formed	Other materials fall into the material bucket

Table 2. Root Cause Analysis Jerrycan Broke

Why	Why	Why	Why	Why
Defect	Jerrycan Broke	Operator didn't check carefully	Operator workload is too much	Lack of operator skills
		Late Jerrycan check	Less attention paid to elasticity may be thin	When vacuuming the ingredients in the bucket, the ingredients are not mixed evenly
		Wrong recipe when blending	Lack of attention to machines	Wrong Proparameter
		Engine Overheat/overheat exceeds 1800C	The number of recycled materials compared to pure materials	Excessive raw materials

Table 3. Root Cause Analysis Incorrect Color

Why	Why	Why	Why	Why
Defect	Incorrect Color	Operator didn't check carefully	Beban tugas operator terlalu banyak	Skill operator yang kurang
		Color check is late	Jauhnya posisi peralatan ketika dibutuhkan	Lokasi penyimpanan peralatan tidak sesuai
		The process is hampered when the machine breaks down	Kurangnya perhatian terhadap mesin	Jauhnya posisi operator ketika mesin terkendala
		Engine overheats overheats over 1800C. temperature limit	The amount of filler/material percentage doesn't match	Raw materials that

3.2. Fishbone Diagram / Cause Effect Diagram / Ishikawa

If we want to use a fishbone diagram / Cause and Effect / Ishikawa, we must first see, in what department, division and type of business this diagram is used. Differences in departments, divisions and types of business will also affect the causes that have a significant effect on problems that affect quality which will later be used. The steps in making a fishbone diagram are as follows:

1. Problem Statement
In the first step, the problem to be analyzed is defined which is interpreted as an effect. Visually in fishbone, this problem will be the "fish head". The problems determined based on the previous description are product defects in the form of blackspots, breakages and inappropriate colors.

2. Identifying Problem Categories
After knowing the problems that have been determined, namely product defects in the form of blackspot defects, breakages and colors that do not match, then the problem category is identified. The causes of problems can be grouped into 6 groups, namely materials, machines and equipment, man, methods, environment, and measurement. The group that causes this problem is placed in the fishbone diagram on the fish fin. based totally at the effects of brainstorming and interview, the recognized categories of blackspot defects on Jerrychan are:

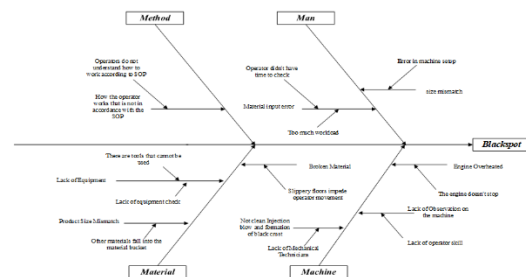a. Man
b. Material
c. Machine
d. Method

Figure 1. Fishbone Diagram Broken

Meanwhile, the categories of broken defects in jerrycan are:
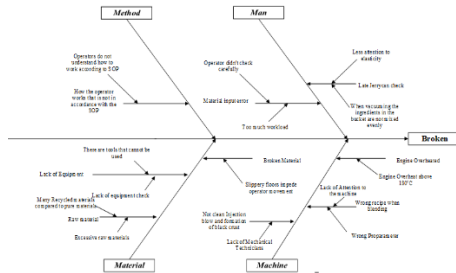a. Man
b. Material
c. Machine
d. Method

Figure 2. Fishbone Diagram Jerrycan Broken

While the categories of color defects that do not match the Jerrycan are:
a. Man
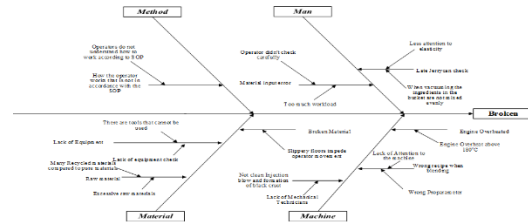b. Material
c. Machine
d. Method

Figure 3. Fishbone Diagram Incorrect Color

3. Determine potential causes by way of brainstorming and interviews.

Each category of problems has causes that need to be described. The reasons for this

category were determined based on the results of interviews and brainstorming. those capability causes will be positioned in the fishbone diagram, namely below the category in which the concept ought to be located..

4. Evaluate and agree at the most probable reasons

After every category is crammed in, the most probable reason is searched for amongst all of the reasons Then do a re-examination of the causes that have been made and determine the causes that seem most likely on the fishbone diagram

Table 4. Improve

Problem				Failure Mode	Failure Mode Potential Effect	Potential Cause Potential Effect	Control
Blackspot ,Broken and Incorrect Color	Operator works not in accordance with SOP	Mistakes and errors in process	Operator doesn't understand SOP	Training for new operator			
	Material input error	Problems and jamming machine	Too much workload	Raw material selection according to criteria and standard			
	Size missmatch	Jamming machine	Machine setup error				
	Lack of equipment	Waiting in process	Lack of equipment check	Regular equipment maintanance			
	Broken material	Defect product	Slippery floor	Regular cleaning inspection and maintenance			
	Dirty injection blow		Lack of mechanical technician				
	Engine overheated	Engine error	Engine doesn't stop	Regular machine maintanance			
	Lack of observation on the machine		Lack of operator skill				

Alternative improvements are compiled to correct the errors that have been identified. Alternative actions are made using the 5W+1H method. 5W+1H stands for what, why, who, while, wherein, and how. 5W+1H is essentially a way used to do investigation and research on problems that arise within the manufacturing system. The corrective actions taken to lessen defects are as follows

Table 5. Improvement Actions with the 5W+1H Method Blackspot

what (Defects that occur)	where (Source of Defect)	Why (Source of Problems)		Who (Person responsible)	when (When Happens)	How (Proposed Improvements)
		Causative factor	Occurrence factor			
Blackspot	Production Floor	Man	Operator shifts that are too busy can cause operators to easily get tired and not concentrate	Operator	During the production process	Operator shift rescheduling
		Material	Put other ingredients into the mix	Raw Material Operator		Selection and laying of raw materials in accordance with the criteria or standards.
		Machine	Not clean Injection blow and formation of black crust	Operators & Maintenance Experts		Carry out regular maintenance and inspection of machines
		Method	How the operator works that is not in accordance with the SOP	HR & Production Head		Implement the workings of SOPs and audit systems

Table 6. Improvement Action with 5W+1H Method Jerrycan Broken

what (Defects that occur)	where (Source of Defect)	Why (Source of Problems)		Why (Source of Problems))	when (When Happens)	How (Proposed Improvements)
		Causative factor	Occurrence factor			
Broken	Production Floor	Man	Operators are not skilled and conscientious in carrying out their duties	Operator	During the production process	Provide special training to operators
		Material	Lots of recycled raw materials compared to pure raw materials	Raw Material Operator		The use of pure materials in accordance with quality criteria
		Machine	Error setting when Blending	Operators and Experts Maintainence		Training and socialization of the use of machines to operators

Table 7. Improvement Actions with 5W+1H Method Incorrect Color

what (Defects that occur)	where (Source of Defect)	Why (Source of Problems)		Who (Person responsible)	when (When Happens)	How (Proposed Improvements)
		Causative factor	Occurrence factor			
Color doesn't match	Production Floor	Man	Operators are not careful in carrying out their duties	Operator	During the production process	Provide special training to operators
		Material	Invalid color	Raw Material Operator		The use of pure materials in accordance with quality criteria
		Machine	The process is hampered due to a broken machine	Operators and Experts Maintainence		Training and socialization of the use of machines to operators and periodic checks on machines
		Method	The method used is not according to the SOP	HR & Production Head		Implement the workings of SOPs and audit systems

3.3. Discussion

From the analysis that has been done above, the solution is obtained using a tree diagram. It can also be called a diagram in the form of a network where every possibility that exists is connected to each other to find a possibility in detail. The tree diagram can be seen below.
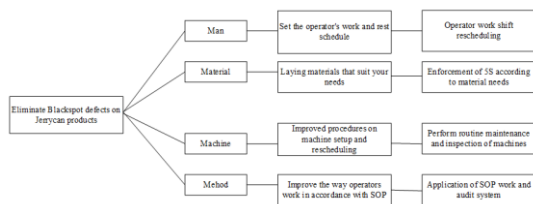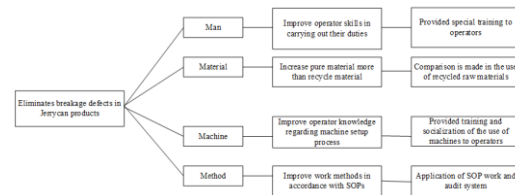
Figure 4. Blackspot defect diagram tree

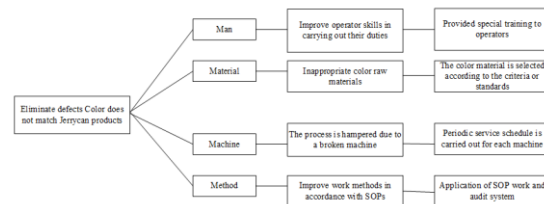Figure 5. Broken Jerrycan Defects Tree Diagram

Figure 6. Incorrect Color Tree Diagram

4.CONCLUSION AND SUGGESTION

The conclusions obtained from the above dialogue are as follows :

• Analysis of the causes of defects in packaging sacks is used with a causal diagram where the root causes can be identified such as methods,

jerrycan materials, humans, and jerrycan making machines.

• Based totally at the approach of Fishbone Diagram acquired the elements that cause defects in jerrycan products at PT. ABC is the occurrence of raw substances used now not according to requirements, broken machines, operators who lack know-how concerning machines and manufacturing and the absence of an audit team inside the production method.

• Based on the 5W + 1H method, problems occur during the production process.

• The recommended corrective actions are to provide special training to operators, use of pure materials in accordance with product standards, training and socialization of machine use, to operators and periodic checks on machines, and implementing SOP and audit systems.

The suggestions obtained from the above discussion are as follows:

• Organizations should apply the 5S method (Seiri, Seiton, Seiso, Seiketsu, Shitsuke).

• It is advisable for the company to establish socialization of work procedures prior to the implementation of the production process.

• The company should carry out routine maintenance on each machine.

• The company should balance the working time before and after the break in each of the existing work shifts.

• The company should add employees to audit the production process

ACKNOLEDGEMENT

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