Review Article: Methods of Root Cause Analysis

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Abstract **- Root Cause Analysis is a systematic approach through the use of set tools and investigative techniques to get to the true root cause of the Engineering and other Quality system issues. In order to solve the problem permanently from the system it is important look for the exact root cause of the problem. There are various methods for root cause analysis which will help to find the root cause so that appropriate measures are taken to solve the problem. This review article will give brief guidance on various methods that can be used for the root cause analysis.**

Index Terms **- Root Cause Analysis, Methods of Root Cause Analysis, Problem solving for Engineering and Pharmaceutical issues.**

INTRODUCTION

In Science and Engineering, root cause analysis (RCA) is a method of problem solving used for identifying the root causes of faults or problems. It is widely used in field of telecommunication, IT, accidental issues, industrial process issues and medicinal & healthcare industry.

Root cause analysis is part of a more general problem-solving process and an integral part of continuous improvement. Because of this, root cause analysis is one of the core building blocks in an organization's continuous improvement efforts. It's important to note that root cause analysis in itself will not produce any results; it must be made part of a larger problem-solving effort for quality improvement.

This review article gives guidance on various Root Cause Analysis methods used to find the root cause and implement appropriate corrective and preventive methods to prevent the recurrence of the issue.

BASIC STEPS FOR ROOT CAUSE ANALYSIS

Root cause analysis can play an important role in continuous improvement, following steps are involved in Root Cause Analysis:

1. Define Problem: This is very important to identify the problem and describe it in in simple language so that anyone can understand the issue.
2. Gather Data: Each and every data related to the issue should be collected. One needs to go to the depth of the issue by gathering the data
3. Find the Cause: This is very important step to find the exact cause of the problem. This is done by various methods like 5 Whys technique, Brainstorming, Fishbone diagram etc.
4. Find the Solution: After finding the cause of the issue comes an important step to find the solution of the issue.
5. Develop Strategies to correct/ prevent: Strategies are to be developed in order to find the corrective and preventive actions of the issue to eradicate the problem from the roots.
6. Report Out: The findings of root cause and solutions to be discussed with the concerned and relevant personnel. This is very important step or else the findings may not be fruitful.
7. Monitor the Solution and close the loops if any: The solutions led out to correct and prevent the issue should be closely monitored for its effectiveness and gaps if any. If gaps found, then same shall be addressed appropriately and the issue to be closed.

METHODS OF ROOT CAUSE ANALYSIS

1. Brainstorming

Brainstorming is a group creativity technique by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas spontaneously contributed by its members. There are many versions of brainstorming, including round-robin brainstorming, wildest-idea brainstorming, double reversal, star bursting, and the charette procedure.

Following factors needs to be employed during a brainstorming session:

- Defer Judgement: This rule suggests that the problem requires the generation of ideas which could go wrong rather than judging a particular point as the root cause.
- Go for quantity: This rule is a means that the greater the number of ideas the bigger the chance of generating a radical and effective solution.
- Withhold criticism: In brainstorming, criticism of ideas generated shall be put 'on hold'. Instead, participants shall focus on extending or adding to ideas, reserving criticism for a later 'critical stage' of the process. Reduce social inhibition among the group members
- Welcome wild ideas: To get a good long list of suggestions, wild ideas are encouraged. They can be generated by looking from new perspectives and suspending assumptions. These new ways of / out of the box thinking might give you better solutions.
- Combine and improve ideas: All ideas shall be weighed, combined to determine the effect and finding out a probable root cause.

2. Affinity Diagram

The Affinity diagram is a business tool used to organize ideas and data. The tool allows large numbers of ideas stemming from brainstorming to be sorted into groups, based on their natural relationships, for review and analysis. It may be used in contextual inquiry as a way to organize notes and insights from interviews.

The affinity diagram organizes ideas with following steps:

- Each idea shall be recorded on as notes/ cards.
- Look for ideas that seem to be related.
- Sort notes/ cards into groups until all cards have been used.
- Once the notes/ cards have been sorted into groups the team shall sort large clusters into subgroups for easier management and analysis.
- Once completed, the affinity diagram shall be used to create a cause and effect diagram. The activity shall be carried out by a cross-functional team, including key stakeholders. The process requires becoming deeply immersed in the data, which has benefits beyond the tangible deliverables.

3. Control Charts

Control charts, also known as Shewhart charts or process-behavior charts, are a statistical process control tool used to determine if a manufacturing or business process is in a state of control. If analysis of the control chart indicates that the process is currently under control (i.e.,

is stable, with variation only coming from sources common to the process), then no corrections or changes to process control parameters are needed or desired. In addition, data from the process can be used to predict the future performance of the process. If the chart indicates that the monitored process is not in control, analysis of the chart can help determine the sources of variation, as this will result in degraded process performance. A process that is stable but operating outside of desired (specification) limits (e.g., scrap rates may be in statistical control but above desired limits) needs to be improved through a deliberate effort to understand the causes of current performance and fundamentally improve the process.

4. Flow Charts

Flowchart is a type of diagram that represents an algorithm, workflow or process showing the steps as boxes of various kinds, and their order by connecting them with arrows. This diagrammatic representation illustrates a solution model to a given problem. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields.

Flowcharts are used in designing and documenting simple processes or programs. Like other types of diagrams, they help visualize what is going on and thereby help understand a process, and perhaps also find flaws, bottlenecks, and other less-obvious features within it. There are many different types of flowcharts, and each type has its own repertoire of boxes and notational conventions.

5. Pareto Charts

A Pareto chart is a type of chart that contains both bars and a line graph, where individual values are represented in descending order by bars, and the cumulative total is represented by the line. The left vertical axis is the frequency of occurrence, but it can

alternatively represent cost or another important unit of measure. The right vertical axis is the cumulative percentage of the total number of occurrences, total cost, or total of the particular unit of measure. Because the reasons are in decreasing order, the cumulative function is a concave function.
The purpose of the Pareto chart is to highlight the most important among a (typically large) set of factors. In quality control, it often represents the most common sources of defects, the highest occurring type of defect, or the most frequent reasons for customer complaints, and so on.

The Pareto Chart shall be used in the following events:

- When analyzing data about the frequency of problems or causes in a process.
- When there are many problems or causes and the most significant cause needs to be focused
- When analyzing broad causes by looking at their specific components.
- When communicating with others about the given data.

6. 5 Whys
The 5 Whys is a method that uses a series of questions to drill down into successive layers of a problem. The basic idea is that each time you ask why, the answer becomes the basis of the next why. It's a simple tool useful for problems where you don't need advanced statistics, so you don't necessarily want to use it for complex problems.

7. Fishbone Diagram
A fishbone diagram sorts possible causes into various categories that branch off from the original problem. Also called a cause-and-effect or Ishakawa diagram, a fishbone diagram may have multiple sub-causes branching off of each identified category.

8. Fault Tree Diagram
Fault tree analysis (FTA) is a top down, deductive failure analysis in which an undesired state of a system is analyzed using Boolean logic to combine a series of lower-level events. It's a graphic model of the pathways within a system that can lead to a foreseeable, undesirable loss event. The pathways interconnect contributory events and conditions, using standard logic symbols. The Fault Tree Diagram shall be presented left to right or top to bottom.

CONCLUSION

The main benefit of RCA is that it finds the fundamental errors in the development process, enables teams to enact right measures to fix the problems and stop them from recurring ahead. Hence, there is lesser rework and fewer defects in the final product.

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