EFFECTIVE ROOT CAUSE ANALYSIS AND CORRECTIVE ACTION PROCESS

Branislav TOMIĆ[1], Vesna SPASOJEVIĆ BRKIĆ[2]

[1]Bombardier Aerospace, Toronto, Canada.
[2]University in Belgrade, Faculty of Mechanical Engineering, 11000 Belgrade, Kraljice Marije 16, Republic of Serbia.
Corresponding author. E-mail: vspasojevic@mas.bg.ac.rs

Root Cause Analysis and Corrective Action process are absolutely essential for the improvement of the quality management system and increasing the quality of the final product or service. This article has intention to briefly highlights the major steps that should be taken in the right sequence in order to successfully and permanently resolve any problem from problematic process. It has two major areas which are mutually interrelated and cannot function without each other – root cause analysis and corrective action process. The first one serves the purpose to detect the right root cause of the problem which is the source of the issues and the other one is a set of actions to permanently eliminate the root cause with the proposed solutions that directly attack it in order to completely remove it from the process.

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INTRODUCTION

Root Cause Analysis and Corrective Action Process is a set of steps, in certain sequence, to identify, detect the cause and successfully rectify the issues that have been experienced in any field of manufacturing or servicing systems.

Root cause analysis (RCA) is a process designed for use in investigating and categorizing the root causes of events with safety, health, environmental, quality, reliability and production impacts. The term "event" is used to generically identify occurrences that produce or have the potential to produce these types of consequences. Simply stated, RCA is a tool designed to help identify not only what and how an event occurred, but also why it happened. Only when investigators are able to determine why an event or failure occurred will they be able to specify workable corrective measures that prevent future events of the type observed. Understanding why an event occurred is the key to developing effective recommendations. Usually RCA has got mixed with the accurate description of what happened and how it happened. However, if the analysts stop there, it is not probed deeply enough to understand the reasons for the problem. Therefore, it is not known what to do to prevent it from occurring again.

Identifying root causes is the key to preventing similar recurrences. An added benefit of an effective RCA is that, over time, the root causes identified across the population of occurrences can be used to target major opportunities for improvement. If, for example, a significant number of analyses point to procurement inadequacies, then resources can be focused on improvement of this management system. Trending of root causes allows development of systematic improvements and assessment of the impact of corrective programs. Effective RCA process serves the purpose to find the root causes of unwanted event and facilitating effective corrective actions to prevent recurrence.

Corrective Action (CA) is an action that organization should take to eliminate the root cause of nonconformities in order to prevent recurrence. Corrective actions have to be appropriate to the effects of the nonconformities encountered. Corrective action process should review nonconformities, determine the causes of nonconformities, evaluate the need for action to ensure that nonconformities do not occur, determine and implement action needed, record the results of taken action, review taken corrective action, flowdown the corrective action requirements if required to the place of problem's origin, and take specific actions where timely and/or effective

corrective actions are not achieved. In other words, CA is a process of identification and elimination of the root causes of a problem, thus preventing its re-occurrence.

Establishing a corrective action process includes also steps how to effectively determine where action is needed, how to quickly assemble a knowledgeable and capable team to work on the case, and predictably produce results and improvements within the imposed or acceptable time frame (Ingram, 1997)

ROOT CAUSE ANALYSIS

It's very hard to precisely define the term root cause. There is a substantial debate on the definition of the root cause, but these four cover all aspects of this phenomenon (Rooney and Heuvel, 2004):
1. Root causes are specific underlying causes of observed problem;
2. Root causes are those that can reasonably be identified and therefore fixed;
3. Root causes are those states that depend on management and management has control to fix them;
4. Root causes are those for which effective recommendations for preventing recurrences can be generated and hence eliminate the effect that they produce.

1. Root causes are underlying causes of observed problem. The investigator's goal should be to identify specific underlying causes called root cause(s). The more specific the investigator can be about why an event occurred, the easier it will be to arrive at recommendations that will prevent re-occurrence.

2. Root causes are those that can reasonably be identified and therefore fixed. Occurrence investigations must be cost beneficial. It is not practical to keep valuable manpower occupied indefinitely searching for the root causes of occurrences. Structured RCA helps analysts get the most out of the time they have invested in the investigation. The good representative of this approach is Kepner-Tregoe's technique, when not the best but optimal root cause is sufficient and the most economical way to resolve the problem.

3. Root causes are those states that depend on management and management has control to fix them. Analysts should avoid using general cause classifications such as operator error, equipment failure or external factor. Such causes are not specific enough to allow management to make effective changes. Management needs to know exactly why a failure occurred before action can be taken to prevent recurrence. It is also important to be identified a root cause that management can influence.

4. Root causes are those for which effective recommendations can be generated. Recommendations should directly address the root causes identified during the investigation. If the analysts arrive at vague recommendations such as, "Improve adherence to written policies and procedures," then they probably have not found a basic and specific enough cause and need to expend more effort in the analysis process.

The RCA is a four-step process involving the following:
1. Data collection.
2. Causal factor charting.
3. Root cause identification.
4. Recommendation generation and implementation.

1. Step one - Data collection. The first step in the analysis is to gather data. Without complete information and an understanding of the event, the causal factors and root causes associated with the event cannot be identified. The majority of time spent analyzing an event is spent in gathering data.

2. Step two - Causal factor charting. Causal factor charting provides a structure for investigators to organize and analyze the information gathered during the investigation and identify gaps and deficiencies in knowledge as the investigation progresses. The causal factor chart is simply a sequence diagram with logic tests that describes the events leading up to an occurrence, plus the conditions surrounding these events. Preparation of the causal factor chart should begin as soon as investigators start to collect information about the occurrence. They begin with a fishbone chart that is modified as more relevant facts are uncovered. The causal factor chart should drive the data collection process by identifying data needs. Data collection continues until the investigators are satisfied with the thoroughness of the chart (and hence are satisfied with the thoroughness of the investigation). When the entire occurrence has been charted out, the investigators are in a good position to identify the major contributors to the incident, called causal factors. Causal factors are those contributors (human errors and component failures) that, if eliminated, would have either prevented the occurrence or

reduced its severity. In many traditional analyses, the most visible causal factor is given all the attention. Rarely, however, is there just one causal factor; events are usually the result of a combination of contributors. When only one obvious causal factor is addressed, the list of recommendations will likely not be complete. Consequently, the occurrence may repeat itself because the organization did not learn all that it could from the event.

3. Step three - Root cause identification. After all the causal factors have been identified, the investigators begin root cause identification. This step involves the use of a decision diagram to identify the underlying reason or reasons for each causal factor. The diagram structures the reasoning process of the investigators by helping them answer questions about why particular causal factors exist or occurred. The identification of root causes helps the investigator determine the reasons the event occurred so the problems surrounding the occurrence can be addressed.

4. Step four - Recommendation generation and implementation. The next step is the generation of recommendations. Following identification of the root causes for a particular causal factor, achievable recommendations for preventing its recurrence are then generated. The root cause analyst is often not responsible for the implementation of recommendations generated by the analysis. However, if the recommendations are not implemented, the effort expended in performing the analysis is wasted. In addition, the events that triggered the analysis should be expected to recur. Organizations need to ensure that recommendations are tracked to completion. The important step in resolving any issue is assembling appropriate team of specialist that will with synergetic effect contribute to the final resolution. According to Lee et al. (2010), in the team shouldn't be the individuals who have one or more the following characteristics:
1. People too close to the incident
2. People who do not have sufficient time to participate in the RCA process
3. People who "already know the answer"
4. People positioned too high up in the management

Andersen and Fagerhaug (2009) state that beneath every problems lies a cause for that problem. Therefore, when trying to resolve the problem, the simple approach should be taken:
1. Identification of the root cause(s) of the problem and

2. Implement effective corrective action that will eliminate identified root cause(s) of the problem.

This two-step approach may appear deceptively simple but people frequently underestimate the effort that is needed to find the real root cause of the problem. This is the major obstacle in successful root cause analysis and corrective action process since the incorrect root cause(s) may mislead the team to implement inadequate corrective action(s) and not to achieve the effect that is needed, so the problem will appear again and again.

According to Performance Review Institute (2006) the Root cause analysis represents the squared part of the following flow chart for the entire root cause corrective action process (Figure 1).

CORRECTIVE ACTION

Corrective action (CA) is a simply solution meant to reduce or eliminate an identified problem. Corrective Action is defined as an action that organization should take to eliminate the root cause of nonconformities in order to prevent recurrence.

Corrective Action can also be thought of as sustaining, as you can not prevent the event at this juncture, it has already happened. Actions taken now are to prevent recurrence of the event. They focus on breaking the cause chain completely by fixing the contributing causes and the root cause. A contributing cause, if not addressed, could be a future root cause. Corrective Action is a series of actions that positively change or modify system performance. It focuses on the systemic change and the places in the process where the potential for failure exists. Corrective Action does not focus on individual mistakes or personnel shortcomings.

In determining solutions it is necessary to consider the following:
1. Feasibility: The solutions need to be within the company's resources and schedule;
2. Effectiveness: The solutions need to have a reasonable probability of solving the problem;
3. Budget: Solution costs must be within the budget of the company and appropriate for the extent of the problem;
4. Employee Involvement: The departments and personnel affected by the problem need to be involved in creating the solution;
5. Focus on Systems: The solutions should be focused on systemic issues;
6. Contingency Planning: All solutions are developed with a certain expectation of success.

Effective corrective action according to Beecroft et al. (2003) includes the selection of one solution until several alternatives have been proposed. Having a standard with which to compare the characteristics of the final solution is not the same as defining the desired result. A standard allows evaluating the different intended results offered by alternatives. When it's tried to build toward desired results, it's very difficult to collect good information about the process. Considering multiple alternatives can significantly enhance the value of final solution. Once the team has decided the "what should be" model, this target standard becomes the basis for developing a road map for investigating alternatives. Brainstorming and team problem-solving techniques are both useful tools in this stage of problem solving. Many alternative solutions should be generated before evaluating any of them. A common mistake in problem solving is that alternatives are evaluated as they are proposed, so the first acceptable solution is chosen, even if it's not the best fit. If we focus on trying to get the wanted results it is missed the potential for learning something new that will allow for real improvement. Skilled problem solvers use a series of

considerations when selecting the best alternative. They consider the extent to which:
− A particular alternative will solve the problem without causing other unanticipated problems;
− All the individuals involved will accept the alternative;
− Implementation of the alternative is likely;
− The alternative fits within the organizational constraints.

Managers or team leaders may be called upon to order the solution to be implemented by others, "sell" the solution to others or facilitate the implementation by involving the efforts of others. The most effective approach, by far, has been to involve others in the implementation as a way of minimizing resistance to subsequent changes. Feedback channels must be built into the implementation of the solution, to produce continuous monitoring and testing of actual events against expectations. Problem solving, and the techniques used to derive elucidation, can only be effective in an organization if the solution remains in place and is updated to respond to future changes.
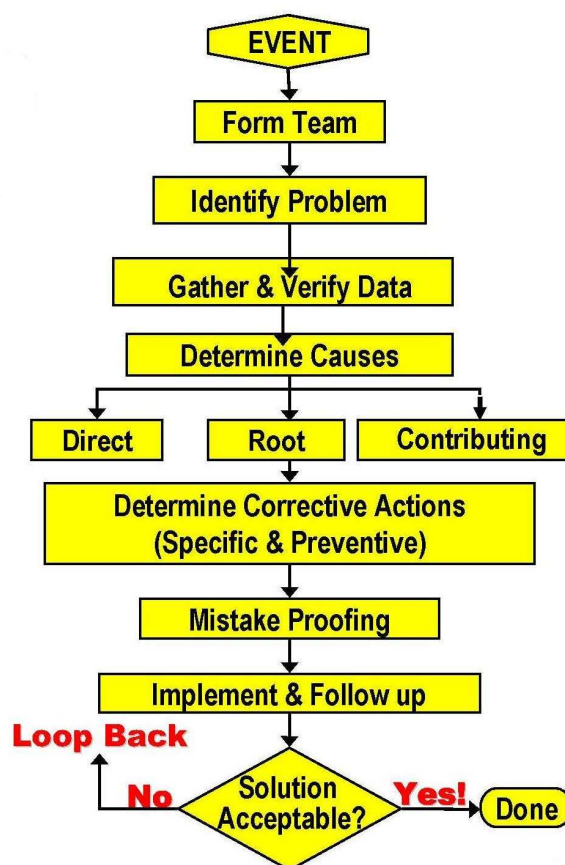

Figure 1: Flow Chart of the Root Cause Analysis and Corrective Action process (Performance Review Institute, 2006)

CONCLUSION

Root cause corrective action for non-conformances has long been a requirement in any industry. It is a process of determining the causes that led to a nonconformance or event, and implementing corrective actions to prevent a recurrence of the event. The requirements for corrective action have been imposed by industry standards for decades and while not new, may not have been aggressively enforced. In order to be successful in this process, it is necessary to implement the following steps:

– Establishment and maintenance of documented procedures for implementing corrective and preventive action;
– Corrective or preventive action taken to eliminate the causes of actual or potential nonconformities to a degree appropriate to the magnitude of the problems and commensurate with the risks encountered;
– Implementation and recording of changes to the documented procedures resulting from corrective and preventive action;
– Effective handling of customer complaints and reports of product nonconformities.
– Investigation of the cause of nonconformities relating to product, process and quality system, and recording the results of the investigation;
– Determination of the corrective action needed to eliminate the cause of nonconformities;
– Application of controls to ensure that corrective action is taken and that it is effective.

Effectiveness of RCCA process must demonstrate compliance with each of these requirements. Following the process described herein and documenting these steps will allow demonstrating this compliance. All of these requirements are met within a root cause corrective action process that addresses:
– Containment actions;
– Problem definition;
– Root Cause Analysis;
– Possible Solutions and the selection of the right one(s);
– Assessment and Effectiveness of the RCCA process.

Root Cause Analysis and Corrective Action process are absolutely essential for the improvement of the quality management system and increasing the quality of the final product or service.

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