

Getting Root Cause Analysis to Work for You

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Summary

This paper provides several tips regarding how to make the most of Root Cause Analysis to progressively eliminate failures. Specific topics that are covered include:

- The need for training – why Root Cause Analysis is not just “common sense”
- The benefits of a team-based approach to Root Cause Analysis
- RCA Software – is it necessary for effective Root Cause Analysis?
- Creating the organisational environment for RCA success

The paper is based on the author’s experience in providing RCA training and consulting assistance at several mining organisations in Australia and overseas

Keywords

Root Cause Analysis, RCA, Software, Organisational Culture, Implementation, Team-based Problem Solving

1 INTRODUCTION

Root Cause Analysis (RCA) is rapidly becoming another one of those “flavour of the month” TLAs (Three Letter Acronyms). Like all TLAs, it is easy to get carried away with the hype surrounding the approach. Inevitably, then, the reality doesn’t live up to the expectations created by the hype. But nevertheless, the appropriate application of Root Cause Analysis techniques can yield significant organisational and individual benefits. This paper discusses some of the practical issues surrounding the implementation of Root Cause Analysis processes within organisations, and in doing so, attempts to give some guidance to those wishing to obtain success from their Root Cause Analysis program.

2 WHY ROOT CAUSE ANALYSIS IS NOT JUST “COMMON SENSE”

Two common misperceptions about Root Cause Analysis (RCA) are either that:

- Applying RCA successfully requires the application of some radically new or different skills, or alternatively
- RCA is simply “common sense” problem solving

Neither of these is the case.

Most people who undertake a Root Cause Analysis training course are somewhat disappointed to discover that, while RCA includes a few new tools, tips and techniques, these are all reasonably easily learnt, and not represent a radical departure from what most people are capable of applying. This often leads rapidly to the second misconception – that effective problem solving is simply “common sense”, and that, therefore, there is no need for people to be trained in Root Cause Analysis principles.

The experience of many who have participated in effective implementation of Root Cause Analysis principles within their organisations, however, clearly indicate that:

- “Common sense” is not particularly common
- Effective implementation of Root Cause Analysis, rather than requiring application of some rote-learned rules, actually requires a fundamental **shift in attitudes and mindset**, along with a **supportive organisational culture**.

We will deal with the second of these points later in this paper, but first let’s deal with the concept of Root Cause Analysis as “common sense”.

I would argue that, not only is common sense not particularly common – but in fact, **there is no such thing as “common sense”**.

Gano (1) in his book “Apollo Root Cause Analysis” argues that each individual is unique, with our own perceptions, beliefs and values, and that this leads each of us to arrive at quite different conclusions – even when presented with the same “facts”.

A generic problem-solving process can be considered to consist of the following key elements:

1. Recognition that a problem exists that should be solved (and allocation of an appropriate priority to the solution of this problem)
2. Identification of possible causes of the problem
3. Identification of alternative solutions to the problem
4. Selection of a solution (or solutions) to be applied to resolve the problem, and
5. Monitoring of the situation to determine whether the solution has been effective in solving the problem

The first phase of this process strongly correlates with the Behavioural Psychological field of “Situational Awareness”. A commonly accepted definition for this field is “the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future“ (2).

Numerous studies have shown that there are significant differences between individuals in all of these three areas.

Some of these differences are as a result of physical differences between individuals in terms of their sensory capabilities (there are differences between individuals in terms of their ability to hear, see, feel, smell and taste).

Some of these differences are as a result of differences in our backgrounds, attitudes and behaviours. For example, even presented with the same facts, different people will have different perceptions regarding the significance of those facts. In particular, we are more ready to ignore those facts that do not correlate with our current perceptions, and accept those that do fit with our current views. In other words, we see what we want to see.

- A car driver looks left down a footpath and pulls forward into a driveway. She hears a thud, looks down and sees a bicyclist on the ground near her car. The bicyclist is seriously injured
- A submarine commander looks through his periscope and sees no ships nearby. He orders the ballast blown and the submarine to surface. He then hears the clank of a ship hitting his deck and realizes that he has surfaced with another ship directly overhead. The ship overturns, killing 9 people aboard.
- A ship carrying 1500 people ran aground because the GPS was in the wrong mode, and the crew, for 34 hours, failed to notice that the screen contained the wrong information. Moreover, they simply ignored the presence of lights and buoys located in the wrong places. One crew member appears to have imagined a buoy being in the “right place” even though it wasn’t really there - just because he expected it to be there.

So right at the very earliest stages of the problem solving process, there are differences between what is “common sense” to one individual, in comparison with common sense to another person.

In terms of our ability to identify and assess alternative causes of, and solutions to, the problem, once again we run into differences between individuals. Gano (3) quotes a study by Stoutenburg which revealed that, when trying to prevent unacceptable events from happening again, 10% of participants immediately sought to place blame, 26% immediately expressed an opinion of the causes and offered an opinion without investigating the problem, and only 20% of participants examined the problem in sufficient detail to be able to identify an effective solution. From these statistics, it is clear that effective problem solving is far from “common sense”.

Finally, how often do we implement a “solution” to a problem, only to discover that the problem has not, in fact, been solved. Few organisations have adequate processes in place to monitor the effectiveness of solutions. Instead, all solutions are assumed to be effective, unless proven otherwise – which proof, of course, usually occurs at the most inopportune moments.

So clearly, effective problem solving is more than “common sense”. However **effective problem solving is a skill that can be learnt**.

The first step in this learning should be to “unfreeze” the misconception that effective problem solving is just “common sense”, and should cover:

- the need for better problem-solving,
- where their current problem-solving skills may be lacking, and
- allow participants to realise that the shortage of these skills is widespread – not just limited to a few individuals

Second, the training should cover a process for effective problem solving which:

- Emphasises the need for identification of a broad range of contributing causes to problems
- Ensures that problem solving is more than just a hunt for the “guilty”
- Ensures that both causes and solutions have strong factual supporting evidence
- Allows a structured approach to problem solving

There are a number of Root Cause Analysis training courses that satisfy these requirements. However, it has been our experience that, for most organisations, training their workforce in Root Cause Analysis is necessary, but not sufficient, to ensure that more effective problem solving practices are implemented.

3 THE BENEFITS OF A TEAM-BASED APPROACH TO ROOT CAUSE ANALYSIS

There is a school of thought, particularly among more highly qualified engineering personnel, that problem solving and Root Cause Analysis is best performed by “experts” in their fields. This school of thought discounts the potential contribution of lesser qualified personnel in being able to identify and implement effective permanent solutions to maintenance and reliability problems.

I believe this viewpoint to be fundamentally flawed, for a number of reasons.

First, if every problem that is to be solved requires the involvement of a few, highly skilled specialists, then these specialists quickly become the bottleneck in the problem solving process. Any individual is limited in terms of their capability to work on several projects simultaneously. In addition, these specialists frequently have other demands on their time, in addition to performing Root Cause analysis, and so the number of Root Cause Analysis projects that are in progress is severely limited by relying on only a few skilled personnel to perform these analyses.

Second, every individual brings their own knowledge, and biases, to the problem solving process. If the process is performed by a single individual, then the solutions invariably are coloured by the biases of the person performing the analysis. This is normal. For example, if problems were to be solved by a process engineer, then it is likely that the types of solutions recommended will tend to favour those that involve changes in process design or process parameters. If the problems were analysed by someone with an Information Technology background, then the solutions are likely to have something of an IT or systems flavour to them. These solutions may work, but there may be other, more cost-effective solutions that are overlooked because of the limitations of having only a single specialist work on developing the solutions.

Latino and Latino (4) consider that causes of problems can be divided into three categories:

- **Physical Causes** are the tangible causes of failures – “the bearing seized”, for example.
- **Human Causes** almost always trigger a physical cause of failure – these could be errors of commission (we did something we shouldn’t do) or omission (we didn’t do something we should have done) – “the bearing was not properly lubricated” would be an example of a human cause.
- **Latent Causes** (or Organisational Causes) are the organisational systems that people used to make their decisions – “there is no system in place to ensure that the lubricator’s duties are performed when he is on annual leave”, for example.

Latino and Latino argue persuasively that the most effective, sustainable solutions are those that address the Latent Causes of problems. Yet we often see “experts” – especially Reliability Engineers – focus almost exclusively on addressing the Physical Causes of problems. This is not surprising – it is due to their specialist knowledge in this area, and the biases that this brings to the problem solving process.

This does not mean that there is no role in effective Root Cause Analysis processes for expert knowledge – far from it – but the most efficient way of making use of specialists is to involve them only in those problems which require their specialist expertise. This is generally a fairly small subset of all of the problems that exist to be solved within most organisations.

A far more effective way of ensuring that Root Cause Analysis is effectively implemented within organisations is by:

- Empowering the workforce to solve problems within their area of operations, and
- Encourage the use of team based problem-solving approaches for more complex problems.

“Empowerment” is one of those buzz phrases of the 1990s that seems to have fallen from grace in recent years. Let us be clear what empowerment is, and is not. Empowerment **is** the granting of authority to make decisions and take action for a **predefined range of situations** without prior approval. Empowerment **is not** the abrogation of responsibility by management for all decision-making.

Birren (5) states that effective empowerment rests on three basic concepts: direction, freedom and support. If one is removed, the other two lose their meaning and empowerment no longer exists.

- **Direction** is the charge or mission, the statement that tells the workers what is needed. It includes definitions of desired outcomes, quality specifications, and enough other information to make it clear what is desired.
- **Freedom** is the ability of the workers to do the job they have been given. It includes the latitude to make operational decisions within the boundaries of the charge, without being second-guessed or undercut by the managers.
- **Support** is providing the resources necessary to do the job. It includes managers accepting work products and implementing decisions that are consistent with the direction provided, even if they disagree with the details.

Too often, in organisations, one or more of these three supporting concepts is missing, and so “empowerment” fails.

However, while true empowerment brings greater freedom on the part of those that are empowered, many are often reluctant to fully embrace this freedom. As stated by Mitsifer (6), “autonomy has not become a universally comfortable behaviour”. Mitsifer continues, “Our own dependency grows out of a reluctance to risk or to take responsibility for the future. We are conditioned from childhood to treat people (bosses or colleagues with more experience) with respect and attention. And dependency is increased by the fact that, realistically, our survival is often in someone else’s hands. But as organizations change to becoming more participative, more responsibility has not always been welcomed. In a sense, we keep ourselves in bondage to dependency.” So effective empowerment requires a high level of management supporting behaviours, particularly in those organisations that have had strongly hierarchical management structures and “top down” management decision-making styles.

Once again, this hints at the requirement for creation of an effective organisational environment for effective implementation of Root Cause Analysis processes – something we will discuss again in the last section of this paper.

Team-based problem solving processes are generally the most effective way of solving most problems – especially those that are more complex (in other words, those problems that you are most likely to want to subject to some form of Root Cause Analysis in the first place). The advantages of team-based problem-solving processes include:

- Those closest to the work know best how to perform and improve their jobs.
- Application of a broader range of knowledge from multiple disciplines
- Broader, more creative solutions to difficult problems.
- Greater chance of risk-taking and challenge to the status quo
- Teams tend to be more successful in implementing complex plans.
- Higher level of ownership of results

4 RCA SOFTWARE – IS IT NECESSARY FOR EFFECTIVE ROOT CAUSE ANALYSIS

A growing number of Root Cause Analysis processes are being supported by RCA software. We need to be careful not to oversell the benefits of software in effective problem solving – and in many cases, RCA software actually has some disadvantages and drawbacks.

The first thing we need to realise is that effective problem-solving through Root Cause Analysis techniques represents, for most organisations, a significant change in their way of thinking, and also represents a significant cultural shift. These fundamental changes cannot be effectively brought about simply by purchasing a software package, and yet many technocratic organisations are tempted to believe that a technological solution (such as a piece of software) will solve their problems.

Second, if conducting Root Cause Analysis requires the presence of software (and associated access to a PC or terminal), then you are probably missing out on a large number of opportunities for problem solving that could be applied by your tradesmen/technicians/mechanics and supervisors while they are in the field. There are generally many smaller problems that can be solved more or less immediately, simply through the use of a simple, but effective Root Cause Analysis problems solving process and a pocket notebook.

Shopfloor personnel are unlikely to use a process that requires them to log on to a terminal – and if they do use this process, it is likely to be some time after the event, rather than at the most appropriate time – when the problem has arisen.

Third, many software-based RCA tools involve some form of “Categorisation” problem solving process. The software prompts the user to think about problem causes using some form of hierarchical outline or “pick list” which users use to identify problem causes (and solutions). The problem here is that causes are not categories, and that there are an infinite number (and number of levels) of causes. A predefined hierarchy is likely to represent the biases of whoever created the categorisation scheme, and this may not reflect, or include, the causes that are relevant to the problem being solved. Even worse, these predefined hierarchies or “pick lists” often focus almost exclusively on the Physical Causes of failures (because these are the easiest to categorise), yet as we discussed earlier, the most effective solutions are those which deal with Organisational or Latent Causes (which are much harder to categorise without being overly generic). Finally, because this categorisation scheme is contained in a computer program, it frequently carries a higher level of “authority” than it deserves. Certainly, most of these computer programs provide the capability to add additional causes to their lists, but experience says that most people will restrict their thinking to those causes that are contained in the software. As a result, the solutions being developed will be suboptimal, while simultaneously giving the illusion of precision, as a result of having been developed using a computer.

Having said that, there is value in recording the results of past RCA analyses for future reference – but this can generally be achieved using readily available software tools, such as Microsoft Word, PowerPoint or Visio without having to resort to specialist RCA software.

5 CREATING THE ORGANISATIONAL ENVIRONMENT FOR RCA SUCCESS

Experience tells us that, in practice, there are several barriers that inhibit the success of implementation of Root Cause Analysis practices. Among these are:

- This is great, but I don't have time for this....
- Inability or unwillingness to tackle the bigger issues
- Fear of being “blamed” for making an error

All of these barriers must be overcome if implementation of RCA is to be successful. Let's deal with each of these barriers one at a time.

5.1 This is great, but I don't have time for this....

There is not a working person on this planet that does not have more things that they must (or would like to) do than they have time to perform. Whether this is in our private lives or our working lives, we are constantly having to make decisions and compromises about what we will do now, and what we will do later (or not at all). So when somebody says “I haven't got time to do this”, what they are really saying is “what you are asking me to do is lower priority than the things that I am currently doing”. Changing this sense of priorities is one of the imperatives for successful RCA implementation.

There is a poster that is occasionally seen on project office walls that says “If you haven't got time to do it right the first time, how are you going to find the time to do it again?” In dealing with RCA and failure elimination activities, this could be rephrased as:

“If you haven't got time to stop these failures from recurring, how are you going to find the time to keep fixing them?”

Management of the organisation needs to create a culture that encourages proactive use of RCA techniques, and ensures that these activities are given sufficient priority. The fundamental tool that is most effective in achieving this is by modifying the organisational reward system. Consider the situation in your organisation – do people get rewarded (either tangibly, through pay rises, or intangibly, through praise and positive reinforcement) for repairing broken equipment, or for stopping it from breaking in the first place? Personnel at all levels need to be rewarded for the effective implementation of failure elimination recommendations. This could be done formally, through performance appraisal systems, and with potential flow-on to salaries and benefits, or less formally, through individual encouragement and praise, notices on noticeboards, charts showing failure elimination activities completed and so on.

This is easily said, but requires courage on the part of senior managers – when the plant is falling down around your ears, it is hard to stay focused on longer term improvement activities – and there will always be a need to be flexible and sensible in calling the day-to-day priorities, but senior managers should never lose sight of the long term objectives of Root Cause Analysis and failure elimination, and behave accordingly.

5.2 Inability or unwillingness to tackle the bigger issues

As mentioned earlier, the most effective, sustainable solutions are those that address the Latent (or Organisational) Causes of problems. These are typically solutions that require changes to underlying organisational systems, processes and beliefs. Accordingly, they require more time, effort, and management

clout to implement. Frequently, when dealing with small RCA teams primarily consisting of shop floor and front line supervisory personnel, these people are reluctant or unable to identify these issues as potential causes. This may be partly because of their personal terms of reference (they assume that these issues are outside the scope of the analysis they have been asked to perform), it may be because they are, being essentially practical people, less able to think conceptually about these issues, or it may be because they believe that, even if they raise these as causes, they do not have the capability to initiate improvements in these areas. Regardless of the reasons for this, it is essential that any underlying organisational issues are identified, appropriate recommendations are made in these areas, and that the recommendations are acted upon. There are a few things that will assist in allowing this to happen. These include:

- **Using a skilled facilitator to facilitate the RCA sessions.** A skilled facilitator will ensure that sufficient depth of analysis is conducted. In particular, the facilitator needs to encourage the development of causes and recommendations back to Latent or Organisational cause level. Nevertheless, this may not be an easy task, and may require the facilitator to suggest possible organisational causes for discussion by the group.
- **Ensuring that recommendations dealing with Organisational Causes are not too general.** If the recommendations that are proposed for dealing with Organisational Causes are too generic in nature, then it becomes more difficult to implement them. For example, a recommendation that recommends a complete overhaul of the leave rostering system may be time-consuming and hard to implement. However, putting in place a process that ensures that when the lubricator is on leave, somebody else is allocated to perform his duties, may be much easier to implement, and may successfully address the causes of the failure. Appropriate team member training, a structured process for developing preferred recommendations, and a skilled facilitator will all assist in ensuring that recommendations are appropriately specific, and therefore easier to implement.
- **Making sure that Senior Management supports the implementation of recommendations dealing with Organisational Causes.** Many organisations are littered with recommendations from Safety Investigations that are never implemented, simply because there is not the management will, or the management processes to deal with these. There is a tendency on the part of senior managers to assume that, when dealing with isolated events, the organisational causes that led to that event occurring are unusual or exceptional – and therefore there is no need to tinker with the underlying organisational processes, beliefs or systems that led to these unfortunate consequences. This is simply an extension of the problems associated with Situational Awareness that we discussed in the first section of this paper, as applied at a management level. In other words, most managers see what they want to see, and ignore any “evidence” that does not correlate with their own view of the world. There are numerous examples of catastrophic failures that have occurred as a result of this selective blindness on the part of senior management personnel. The explosion at Esso Longford is one, such example. The loss of both the Columbia and Challenger space shuttles are two more. So-called “High Reliability Organisations” on the other hand, show a preoccupation with failure (7). They constantly encourage the reporting of errors, and treat any failure, no matter how small, as a symptom that something is wrong with their system – something that could eventually have catastrophic consequences if sufficient of these “small” failures happen to coincide at one point in time. This preoccupation with error, and the continual focus on refining processes and systems in order to eliminate error, is something that needs to be promoted and encouraged at all levels in the organisation, starting from the very top, if the full potential of Root Cause Analysis processes are to be realised.

5.3 Fear of being “blamed” for making an error

As mentioned on a couple of occasions earlier in this paper, there is very often a hierarchy of causes associated with most failures – Physical Causes are often caused by Human Causes, which are, in turn, usually caused by Organisational Causes. In order to successfully identify and address the underlying organisational causes of failures, it is necessary, usually, to identify the errors of omission or commission that were committed by individuals, which led to the ensuing failure. This can be a daunting, and event terrifying experience for those who committed the errors. This terror can be compounded even further if there is a reluctance or inability to progress beyond the Human causes of failures and identify the Organisational causes, as it leaves “human error”, with all of its negative connotations for the person committing the error, as being the “root” cause of the failure. Very quickly, in this environment, it is easy to slip into the “blame game”, Root Cause Analysis acquires a reputation as being a way of seeking and reprimanding individuals who “caused” the failure, and, not unsurprisingly, people then either refuse to participate, or refuse to provide sufficient, accurate information in order to prevent recurrence of the problem.

Many organisations are quick to allocate blame for failures, and then seek to prevent recurrence either through disciplinary or “retraining” actions. However, in the vast majority of situations this is either ineffective, or even counter-productive. Our current beliefs regarding human error are generally that:

- Human error is infrequent

- Human error is intrinsically bad
- A few people are responsible for most of the human errors, and
- The most effective way of preventing human error is through disciplinary actions

On the other hand, most behavioural psychologists – among them Reason and Hobbs (8) – are now showing, through quantitative research, that

- **Human error is inevitable.** Reason and Hobbs identified a number of physiological and psychological factors which contribute to the inevitability of human error, these include:
 - Differences between the capabilities of our long-term memory and our conscious workspace
 - The “Vigilance Decrement” - it is more common for inspectors to miss obvious faults the longer that they have been performing the inspection
 - The impact of fatigue
 - The level of arousal - too much or too little arousal impairs work performance, and
 - Biases in thinking and decision making, as discussed earlier in this paper
- **Human error is not intrinsically bad.** Success and failure spring from the same roots. Our desire to experiment and try new things (and learn from our mistakes) is the primary reason that the human race has progressed to its current stage of development. Fundamentally, we are error-guided creatures, and errors mark the boundaries of the path to successful action
- **Everybody commits errors.** No one is immune to error – if only a few people were responsible for most of the errors, then the solution would be simple, but some of the worst mistakes are made by the most experienced people.
- **Blame and punishment is almost always inappropriate.** People cannot easily avoid those actions they did not intend to commit. Blame and punishment is not appropriate when peoples’ intentions were good, but their actions did not go as planned. This does not mean, however, that people should not be accountable for their actions, and be given the opportunity to learn from their mistakes.

Reason and Hobbs reinforce the view that, in their words “You cannot change the human condition, but you can change the conditions in which humans work” – in other words, address the underlying Organisational Causes that led to the error being committed. They argue that successfully eliminating the natural fears that people have about being “blamed” for having made a mistake requires the proactive establishment of an organisational culture that has three components (9):

- **A Just Culture** – one in which there is agreement and understanding regarding the distinction between blame-free and culpable acts. Some actions undertaken by individuals will still warrant disciplinary action. They will be few in number, but cannot be ignored.
- **A Reporting Culture** – one which proactively seeks to overcome people’s natural tendencies not to admit their own mistakes, their suspicions that reporting their errors may count against them in future, and their scepticism that any improvements will result from reporting the error. This can be achieved a number of ways, such as by de-identifying individuals in reports, guaranteeing protection from disciplinary action, providing feedback and so on.
- **A Learning Culture** – one in which both reactive and proactive activities are performed in order to prevent future errors and failures.

Overcoming these natural fears is neither easy nor quick, but is essential if the full benefits of RCA are to be realised.

6 CONCLUSION

With an increasing number of organisations adopting some form of Root Cause Analysis processes, this paper has tried to outline some of the practical considerations involved in implementing RCA, and given a few tips, based on experience, to assist you to make full use of the power contained in an effective RCA process. Any comments or questions may be directed to the author at sandy.dunn@assetivity.com.au or via phone at +61 8 9474 4044.

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