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# Root Cause Analysis:

## A Course Designed to Identify the Fundamental, Underlying Reasons for Performance Problems

**by Sal Ganino**

**Wikipedia defines "Root Cause Analysis"** (**RCA**) as "a class of problem solving methods aimed at identifying the root causes of problems or events."

> "Root Cause Analysis is any structured approach to identifying the factors that resulted in the nature, the magnitude, the location, and the timing of the harmful outcomes (consequences) of one or more past events in order to identify what behaviors, actions, inactions, or conditions need to be changed to prevent recurrence of similar harmful outcomes and to identify the lessons to be learned to promote the achievement of better consequences.
>
> The practice of RCA is predicated on the belief that problems are best solved by attempting to address, correct or eliminate root causes, as opposed to merely addressing the immediately obvious symptoms. By directing corrective measures at root causes, it is more probable that problem recurrence will be prevented. However, it is recognized that complete prevention of recurrence by one corrective action is not always possible."

***Root Cause Analysis*** (RCA) is a methodology for finding and correcting the most important reasons for performance problems. It differs from troubleshooting and problem-solving in that these disciplines typically seek solutions to specific difficulties, whereas RCA is directed at underlying issues.

- As a business process improvement tool, RCA seeks out unnecessary constraints as well as inadequate controls.
- In safety and risk management, it looks for both unrecognized hazards and broken or missing barriers.
- It helps target CAPA (corrective action and preventive action) efforts at the points of most leverage.
- RCA is an essential ingredient in pointing organizational change efforts in the right direction.
- Finally, it is probably the only way to find the core issues contributing to your toughest problems.

***Root Cause Analysis*** is not a single, sharply defined methodology; there are many different tools, processes, and philosophies for performing RCA. In this article, we will be considering:

- Production-based RCA; had its beginning in quality control for industrial manufacturing.
- Process-based RCA; basically a follow-on to production-based RCA, but with a scope that has been expanded to include the business processes.
- Failure-based RCA; rooted in failure analysis, engineering, and maintenance.
- Systems-based RCA; has emerged as an amalgamation of the preceding schools, along with ideas taken from fields such as change management, risk management, and systems analysis.

Taking some liberty, and using the letters in the acronym DMAIC from the Five Step Process of Six Sigma, this white paper will identify the steps involved with Root Cause Analysis:

### 1. Define

The first thing that must be done is to define or describe the problem that is causing concern to the organization. "Shipments are down," may well be a problem, but that is usually the symptom and not the problem itself. Before we can begin increase the number of shipments being made, we must first understand the reason for the diminished shipments. Too often we rush out and try to resolve the symptom, without knowing what the actual issue is that we must correct, solve, or improve. And after making some changes, we never really know whether we improved or made the situation worst.

This article summarizes this point:

**A Short Story for Engineers**

A toothpaste factory had a problem: they sometimes shipped empty boxes without the tube inside. This was due to the way the production line was set up; people with experience in designing production lines will tell you how difficult it is to have everything happen perfectly, where timing must be so precise. Small variations in the environment (which can't be controlled in a cost-effective fashion) mean you must have quality assurance checks smartly distributed across the line so that customers all the way down to the supermarket don't get upset and buy another product instead.

Understanding how important that was, the CEO of the toothpaste factory got the top people in the company together and they decided to start a new project to address this problem. They decided to hire an external engineering company to solve their empty boxes problem, as their engineering department was already too stretched to take on any extra effort.

The project followed the usual process: budget and project sponsor allocated, RFP, third-parties selected. Six months (and $8 million) later they had a fantastic solution - on time, on budget, high quality and everyone in the project had a great time. They solved the problem by using high-tech precision scales that would sound a bell and flash lights whenever a toothpaste box would weigh less than it should. The line would stop, and someone had to walk over and yank the defective box off the line, pressing another button when done to re-start the line.

A while later, the CEO decided to have a look at the return on investment of the project: amazing results! No empty boxes ever shipped out of the factory after the scales were put in place. Very few customer complaints, and they were gaining market share. "That's money well spent!" he said before looking closely at the other statistics in the report.

It turns out the number of defects picked up by the scales was 0 after three weeks of production use. It should've been picking up at least a dozen a day, so there was reason to believe there was something wrong with the report. The CEO filed a bug against it, and after some investigation, the engineers came back saying the report was actually correct. The scales weren't picking up any defects because all boxes that got to that point in the conveyor belt were good.

Puzzled, the CEO traveled down to the factory, and walked up to the part of the line where the precision scales were installed. A few feet before the scale, there was a $20 desk fan, blowing the empty boxes off of the belt and into a bin.

When asked about the fan, one of the workers said, "Oh, that. One of the guys put it there because he was tired of walking over every time the bell rang."

**Two basic errors occurred in the preceeding:**

1. They did not develop an accurate understanding of the actual problem to be addressed. The problem was not that the customer was getting empty toothpaste boxes, the problem that needed to be resolved was "***why were there empty toothpaste boxes in the first place?"***

2. The placement of the inexpensive fan was quite ingenious, however it did not resolve the problem. As is commonly done, they fixed the **symptom**, not the source.

### 2. Measure

Once we have defined the problem and developed a concise statement of what the actual problem is, we must then measure the problem. It is imperative that we know what the process is doing currently so that we can later measure the results of any corrective action we have taken to determine whether there is improvement or not. But, before we can measure, we must describe the current process, that is, we must map out the process from beginning to end.

This was summarized very nicely in the familiar statement, "You can't manage what you don't measure," wrongly attributed to Dr. W. Edward Deming. The basic significance of the statement is: "*You can't manage for improvement if you don't measure to see what is getting better and what isn't*."

During my early years as an Industrial Engineer for a major, multi-plant corporation, the departmental manager, Keith, was given a promotion and transferred to a larger plant. Each plant location was charged with operational and process improvements. To this end, each plant would circulate a copy of their internal newsletter so that all the other plants could see if any of the cost savings actions would be applicable for implementation at their plant. The first year, Keith reported that his department had implemented a computer-based program, eliminating a manual process, which would save $100,000 per year.

The next year, Keith's plant reported that annual savings of $100,000, reported the previous year, had to be withdrawn because they had to re-instate the old, manual system. If it were not for our finance department requiring verification of all cost saving programs, the company would have actually ended up **spending** $100,000 per year and not saving it.

### 3. Analyze

Einstein reportedly said, "If I had one hour to save the world, I would spend 55 minutes defining the problem and only five minutes finding the solution." So far, we have developed a concise problem statement and measured the existing results of having this problem; now it is time to truly **define** the problem:

**What is the real problem**, under all of the layers and complexities, what is the ***actual root cause of the performance problem***? Spending time and effort on treating the *symptoms* is wasteful because the problem will only recur:

***Eliminating the problem puts an end to the problem.***

Some years ago, I had the pleasure of living across the street from Jack and Kit, both Doctors of Osteopathy. Kit was very upset one afternoon when she came home and found that her daughter had taken a couple of aspirins to alleviate a headache she was suffering. Since this was such a common thing to do, I asked Kit why she was so concerned. She informed me that one of the symptoms of an aspirin overdose was a very severe headache; a rebound headache can occur when one takes too much aspirin; in other words, which came first: the chicken or the egg? Here begins the downward spiral of treating the symptom and seeing the problem only get worse.

The basic techniques used for finding the root cause are the "Five Whys" technique and the Cause and Effect, or Ichikawa, Diagram. The Five Whys technique was originally developed by Sakichi Toyoda, the founder of Toyota Industries. It became a critical component of problem solving training delivered as part of the induction into Taiichi Ohno's Toyota Production System

Peter Senge, in his "*The Fifth Discipline Field Book*," uses the example of a friend of his being taken on a tour of a factory by the Production Manager:

The two came upon a puddle of oil on the floor with a barricade over it. The friend asked the Manager, "Why is there oil on the floor?"

The manager, at a loss, calls the department foreman over and asked him, "Why is there oil on the floor?" The foreman replied, "Because maintenance hasn't cleaned it up yet."

The Manager turns to Peter's friend and says, "Because maintenance has not yet cleaned it up." Now the friend asks, "Why hasn't maintenance gotten around to cleaning it up yet?"

Again the manager asks the foreman, "Why hasn't maintenance gotten around to cleaning it?" The foreman replies, "Because this happens so often they'd end up spending all day here."

Once again the manager turns to the friend to repeat the response he just received, and the friend interrupts to say, "And why does this happen that often?"

The manager once again turns to the foreman, who says, "Because they have the wrong seal in the unit and it only lasts a few hours before it begins to leak."

Now the manager is catching on, and before the friend could say anything, he turns to the foreman and asks, "Why do we have the wrong seals?"

The foreman replied, "Purchasing got a deal on these cheap seals and bought 1,000 of them at 40% of the cost of the better seals."

Now it was time to talk with the folks in Purchasing. Peter's friend asked the Purchasing Manager why the decision was made to purchase this cheaper seal. The answer was, "Because Top Management gave us an edict to cut the cost of purchased goods by at least 15% or else."

The true cause of the problem is not always out on the production floor. Decisions made at the management level, albeit well intentioned, sometimes are taken quite literally and can, unknowingly, cause great problems.

### 4. Improve

Now that we know the real, root cause of the performance problem, we can begin to address the issue of solving, eliminating, or improving.

Another acronym that is quite useful is ***KISS: Keep It Simple, Stupid***. Many years ago, I designed a simple device for placing a short, cylindrical part on an anodizing rack, called a "tine-rack." The device allowed for pre-oriented cylinders to *free fall* down a chute; at the bottom of the chute was a centering structure that guided and spread the tines apart and centered them to receive the cylinders. The spreading device ended just prior to engaging the cylinders, allowing the tines to grip the cylinder and remove it from the chute. It worked fine in theory, or so said the mechanical engineers, who proceeded to redesign the unit to incorporate a "star wheel" large enough to hold one cylinder for each tine on the rack, 13 in total. The wheel mechanism was powered by pulling the rack through the device so that each tine engaged a spoke of the wheel, advancing one cylinder at a time.

Before the mechanical engineers could have the unit built and placed in production, I was transferred to another plant and lost sight of the project. A year or so later, a friend from the old location was transferred to my new plant. I found out, the ME's redesign failed, and they ended using my original, simpler design. Here again the $20 fan worked better than the $8 million scale.

### 5. Control

ISO 9001 is fond of the word "monitor," and here we are talking about the verb and not the noun.

> **To monitor:** "to watch closely for purposes of control, surveillance, etc.; keep track of; check continually" (very often; at regular or frequent intervals; habitually)".

This is where we do some more measuring; we measure the new process and compare the results against those obtained from the old process. Success can be claimed only when the results are better under the new process than under the old. If it is not going in the right direction, take a page from Coca Cola, when they tried coming out with "New Coke." It was disastrous, so they immediately pulled it from the market, licked their wounds, and went back to the "Original Coke."

Remember, not all attempts to solve the problem are going to work. One of Victor Borge's routines was to talk about his grandfather who was a bit of an inventor; he invented a soft drink he called "4-UP." However, it was a colossal failure. Victor's grandfather went back the drawing board and invented "5-UP." This too failed quite badly. Undaunted, he again went to the board and invented "6-UP." As with the previous two drinks, this also was not a hit. The grandfather died, and as Victor Borge puts it, he never really knew how close he came.





### What You Will Learn:

- Enhanced problem solving effectiveness by providing a model for more deeply analyzing problem situations;
- To clarify the difference between analytical and creative thinking, and when each is most useful;
- To promote the ability to provide problem-solving support in situations where one is not an expert in the process or technology involved;
- To expand the range of tools available for analysis of problem situations.

### Who Should Attend?

The **Root Cause Analysis Training** is valuable for anyone who wants to improve their ability to solve recurring problems. This may include, but not be limited to:

- Quality, safety, risk, and reliability managers
- Process Engineers
- Technicians
- Operations Supervisors and Personnel
- Process Owners
- Occurrence Investigators
- Analysts
- Maintenance Directors
- Reliability Professionals

**Root Cause Analysis Training** is appropriate for most manufacturing markets, including, but not limited to, core manufacturing markets in:

- Machinery and Computer Equipment
- Chemical and Allied Products
- Fuel Cell Industry
- Fabricated Metals
- Health Care Industry
- Electronics
- Transportation
- Measurement/Controlling Industries

Service markets that could effectively benefit from **Root Cause Analysis Training** would include, but not be limited to:

- Consulting/Business Services
- Federal, State and Local Government Agencies
- Financial Services
- Wholesale & Retail Companies
- Transportation
- Utilities

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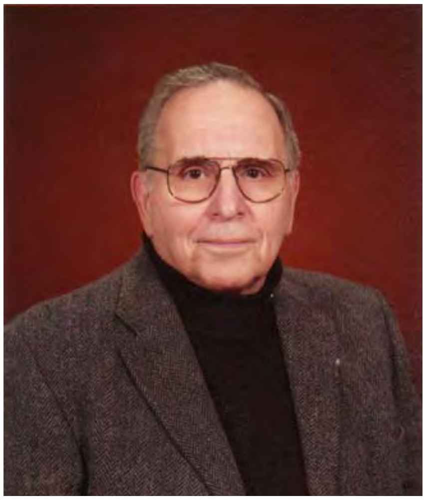
## Meet the Author & Facilitator

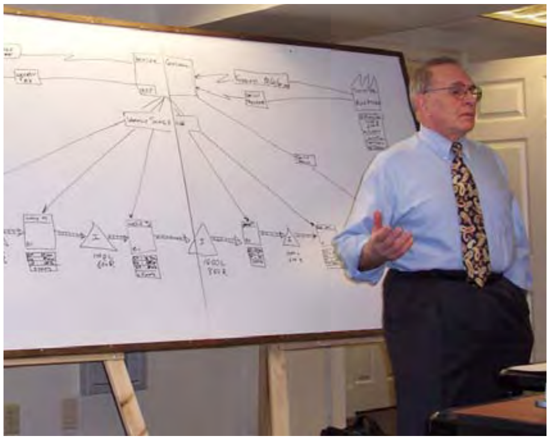
**Sal Ganino**
BSIE, CFPIM, CQA, CQE, CQMgr., CSCP



The list of initials following Sal Ganino's name represent a vast background in manufacturing, and represent important certifications:

- **BSIE** - Bachelor of Science in Industrial Engineering
- **CFPIM** - Certified Fellow in Production and Inventory Management
- **CQA** - Certified Quality Auditor
- **CQE** - Certified Quality Engineer
- **CQMgr.** - Certified Quality Manager
- **CSCP** - Certified Supply Chain Professional

Sal has worked in a wide variety of industries, serving as an Industrial Engineer, Production Superintendent, Materials Manager, Plant Manager, Operations Manager and Director of Manufacturing.



Sal Ganino is involved with the following organizations:

- International Organization for Standardization
- APICS - The Association for Operations Management
- Lean Enterprise Institute
- American Society for Quality

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