



## Structure Problem Solving

By Ken Myers

### A Different Approach to Problem Analysis and Corrective Action

Many organizations today use at least one approach for solving business problems. At present count, there are over 100 ways of solving business problems that range from the **8D** approach originally developed by FORD and used across the automotive industry to the **Corrective and Preventative Action (CAPA)** approach that was adapted for use by the regulated medical device, vaccines, and pharmaceutical industries. Both of these approaches were developed from the US Mil-Standard 1520, *Corrective Action and Disposition System for Non-Conforming Material*. If you don't have a problem solving approach, then many generalized approaches are available off-the-shelf which include: Deming's *PDCA*, Toyota's *A3*, Edward De Bono's *Six Thinking Hats*, Eli Goldratt's *Theory of Constraints*, and there is even a Russian developed approach known as *TRIZ*, (translated as the *Theory of Inventive Problem Solving*).

Every problem-solving approach used today provides basic guidelines for developing understanding of the observed problem, which is better termed the *problem-symptom*. By following these guidelines we are given the belief that the causes of a problem can be identified with reasonable certainty. However, in practice most problem-solving approaches do not always yield such results. Instead, teams often miss the true causes or identify many false causes of the problem under study. These two errors result in lost time and additional costs to the business as the team implements corrective actions that do not effectively solve the problem they addressed. Why does this happen? What aspects of the problem-solving method produce such undesirable results? To answer these questions, let's look at the generalized **CAPA** approach that uses a six step problem-solving methodology shown in Table 1:

**Table 1.** Typical Corrective and Preventative Action Problem Solving

Step	Description	Action(s)
1	Identify/Describe Problem	State the problem in clear and simple words.
2	Contain the Problem	If the problem results in producing defects that reach the customer, then a method of containing the defective products shall be established until the problem is solved.
3	Establish/Determine Cause	The cause of the problem shall be identified. Many methods may be employed to identify the cause such as field, plant and supplier investigations. The investigator should be careful to identify the true cause, and not a symptom of the cause.
4	Implement Corrective Action	Propose a corrective action that effectively eliminates the chance of the cause occurring. The results of the corrective action shall be monitored.
5	Evaluate Corrective Action	The corrective action shall be evaluated to insure the problem has been solved. The duration of this evaluation should provide sufficient time to assure the problem does not reoccur.
6	Document Changes	Any changes to processes, procedures, or work instructions shall be documented and approved by the management team.

Step 3 of Table 1 requires that the cause(s) be identified. The author notes that the primary purpose of a CAPA activity is to understand the cause of the problem, and yet there is a step that calls out this goal... There is no guidance how step 3 will be met. It is up to the team to develop the method of cause analysis and determine how it will be used during the problem-solving effort. Many problem-solving approaches used today provide similar guidance. The typical approach to cause analysis usually consists of:

- (1) **inspecting** the areas affected by the problem,
- (2) **interviewing** the personnel that touched the affected product or service,
- (3) **evaluating** the process, material, and/or product inspection data

All of these actions are useful when the problem is due to a limited number of single-point causes. Unfortunately, in complex situations involving multiple causes with interactions the utility of a conventional problem-solving approach diminishes quickly.

In 1965 Rand Corporation researchers Dr. Charles Kepner and Dr. Benjamin Tregoe developed the **Rational Process** technique, and together wrote the book entitled, *The Rational Manager*. Methods contained in this book, and later in their 1981 update entitled, *The New Rational Manager* provided effective ways of logically determining the causal mechanisms of business problems. Today, with the use of high performance computing tools and advances in problem analysis we can employ a new generation of causal analysis and corrective action methods that exceed those originally developed from Mil-STD 1520.

### Our Approach to Problem Analysis and Corrective Action

Our approach to Problem Analysis and Corrective Action builds upon the development of many effective methods created over the last 35 years. However, instead of configuring the problem-solving event as a **causal search** process, we use verified business data to logically **eliminate** all causes that are inconsistent with the observed facts and/or symptoms of the problem. Any inconsistencies or contradictions between the suspected causes and the observed facts render them, (the suspected causes), unlikely. Thus, we use verified observations and facts as a basis for removing many likely causes from further consideration. We often refer to this method of cause analysis as the *Sherlock Holmes* approach to problem-solving.

**Figure 1. A Structured Problem Solving Storyboard for Business**

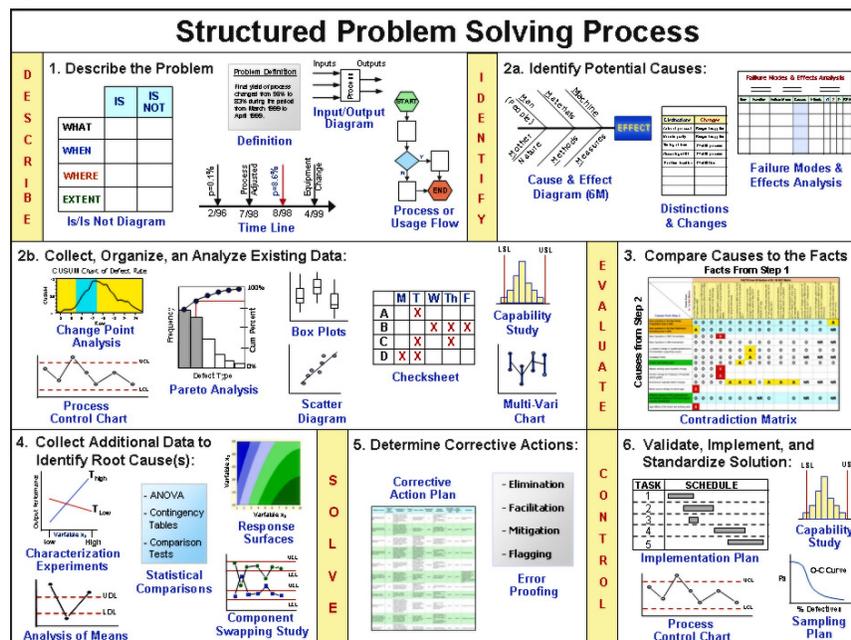


Figure 1 shows a storyboard of our approach starting with a problem description using a few Kepner & Tregoe’s problem-solving tools and then moving on to the **Identify** step where we posit all the possible causes of the problem. Next, we move to the **Evaluate and Solve** steps where we determine the likely causes that remain and evaluate new data to narrow our focus for cause identification. The final step of this process provides guidance for developing a **Standardize Solution** that should eliminate future occurrences of the problem. This problem-solving approach guides a team through the cause identification stage using a core-tool called the **Contradiction Matrix** (or C-Matrix). Using a *C-Matrix* the team can identify the causes having the **greatest** likelihood of producing the problem-symptoms. Figure 2 shows a generalized Contradiction Matrix with the causes eliminated by verified inconsistencies with known facts, data, and/or theories:

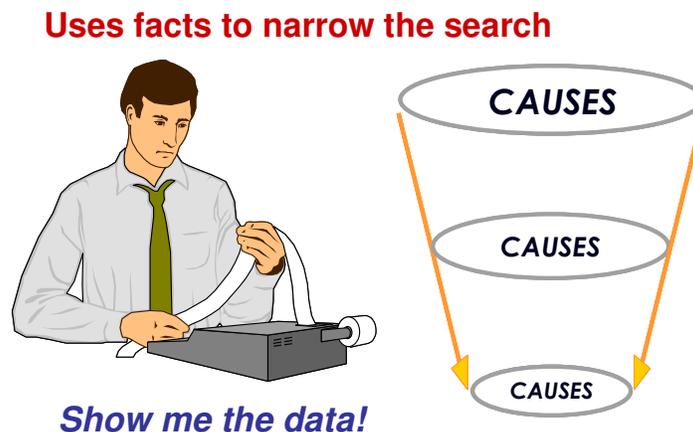
**Figure 2.** The Contradiction Matrix – a core root-cause analysis tool

Facts \ Causes	Facts						
	Fact #1	Fact #2	Fact #3	Fact #4	Fact #5	Fact #6	Fact #7
Cause #1	O		O	A	O	O	O
Cause #2	X						
Cause #3	O	O		O	A	X	
Cause #4	A	O	O	A		O	O
Cause #5	O	O	X				

**X** - FACT contradicts CAUSE      **A** - Assumptions made; need data to verify  
**O** - FACT supports CAUSE      **BLANK**- Need more data

The *Contradiction Matrix* is an effective tool that allows a team to screen out the **many unlikely** causes while leaving the **few likely** causes of the problem. With this knowledge the team is better able to determine the true causal mechanism(s) that produced the problem. All good problem-solving approaches effectively identify the array of likely causes using verified facts, observations, and established theory as a basis. With a limited array of possibilities a team is able to focus their attention and energy on the causes that remain, as illustrated in Figure 3.

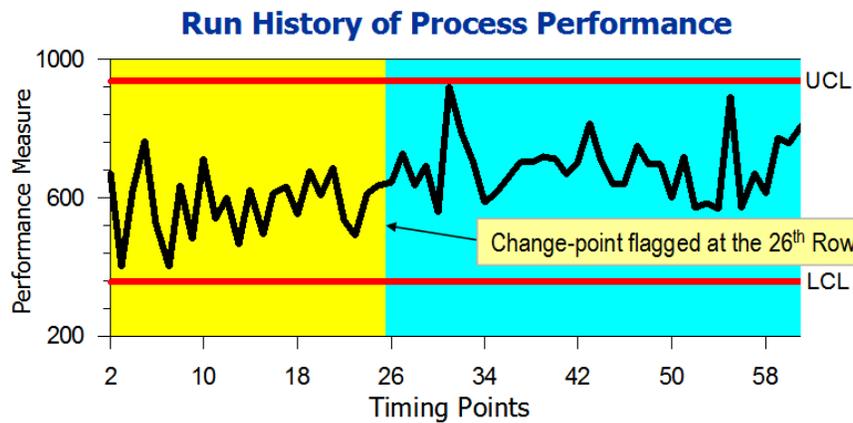
**Figure 3.** Primary Characteristic of all Good Problem-Solving Approaches



## Narrowing the Causal Focus

Suppose the observed problem was the result of multiple changes in the service or production systems, operating policies, and raw material suppliers. Narrowing our search within these systems would require us to first estimate the timing of change in process performance. By comparing the timing of change in process performance to the timing of changes with the service and production areas, operating policies and raw material suppliers we gain insight into the cause(s) of the problem. Using this supporting strategy, we have much greater confidence in making claims about the identified causes of the problem. We can use many powerful tools to perform this evaluation. But, one tool allows us to both estimate the timing of performance change and gain insight into the nature of how the system actually changed. This method is called **Change-Point Analysis**. Figure 4 illustrates a typical output from a Change-Point analysis showing the trend-wise changes as a difference in background colors. The table of significant changes provides the confidence level and interval estimates for the observed change shown in the plot.

**Figure 4.** Change-Point Analysis showing the Change-state and Estimates of Change



### Table of Significant Performance Changes

Confidence Level = 90%, Confidence Interval = 95%, Bootstraps = 1000, Sampling Without Replacement

Row	Confidence Interval	Conf. Level	From	To	Level
26	(16, 34)	100%	584.04	691.25	1 <span style="background-color: red; color: red;"> </span>

If you have a challenging problem that never seems to go away no matter how hard you try to eliminate it we would like to hear from you. Please [contact us](#) if you would like to know more about this novel approach to solving challenging business problems.