Getting to the Root of the Problem

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By the time many team members have completed the task of developing hypotheses regarding the root causes of a problem and collecting supporting data on the as-is performance of those factors, a sense of frustration—and possibly even exhaustion—may appear. The measure phase in the define, measure, analyze, improve and control (DMAIC) method often is associated with the storming stage of Bruce Tuckman's well-recognized model describing the stages of group development (Figure 1). Just mentioning that the next phase in the DMAIC method is analyze may be sufficient to create rebellion and divert a team from moving toward the norming stage of Tuckman's model.

Studies of the American cultural archetype have shown that most team members would rather skip over the analysis and head straight into creating solutions. Creativity is highly valued in American culture, and patience is not always perceived as a virtue. The phrase "analysis paralysis" is used to criticize teams that don't make quick and deliberate progress toward solving the problems. Amazingly, despite the growing emphasis on lean techniques and the elimination of waste in all forms, many teams still prefer to use the age-old trial-and-error method of quickly guessing the root causes and investing the bulk of their efforts on trying popular solutions. Keeping a team engaged in a thorough analysis process is not always an easy task under these circumstances.

Symptoms and root causes

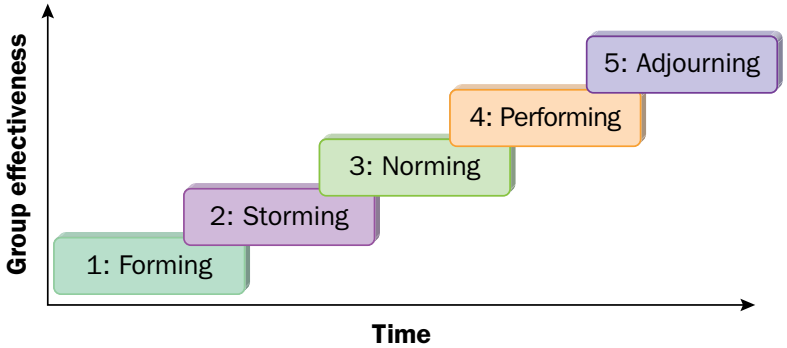
Let's take a moment to ensure the terms "symptom" and "root cause" are defined clearly. It's interesting to note that there is substantial debate on the differentiation of these terms and the differentiation is important. Although team members may not care about this difference, lean Six Sigma (LSS) practitioners are well aware that treating a symptom is not the same as eliminating a root cause.

Webster's dictionary defines a symptom as "a sign or token; that which indicates the existence of something else."[1] Indeed, the "something else" is the cause, which is defined as "that which produces or affects a result; that from which anything proceeds, and without which it would not exist."[2]

For this article, we'll define the root cause as the specific, underlying cause that must be prevented to avoid recurrence of the problem. We'll also recognize that a team may not always have the capability or authority to address the true root cause of a problem and, therefore, may be forced to address symptoms in the system. So for most DMAIC teams, the analyze phase involves determining the deepest cause that can be resolved practically and reliably.

In the workplace, however, it may not be easy to separate symptoms from causes. The tendency for team members to have preconceived solutions in mind and, therefore, to want to rush through the root cause analysis step so they can design creative fixes exacerbates this issue. Studies of successful problem solving have shown

Figure 1. **Tuckman model of the stages of team development**



Note: Developed by Bruce Tuckman in 1965 and revised in 1977.

that identifying true root causes—and later implementing solutions that permanently eliminate those root causes—is the single most important factor in generating enduring change and improved results.

There are many tools available to help team members move from hypothesized root causes to proven ones. Some of these tools rely primarily on instinct and expertise while others incorporate more data-driven analyses. Striking the right balance between the selection of the appropriate tools and the tendency for the team to be trying to push forward is the key to success, and that balance is best guided by an understanding of the risks associated with an incorrect identification of the root cause and the team's tolerance for cycles of validation experimentation.

Table 1 provides a list of some of the tools used for root cause analysis, and categorizes them based on their use of instinct and experience versus data-based analysis. It also includes a high-level description of their use and how risk affects the application of the tool. As this information indicates, the instinct-based tools can be supplemented with data to increase their reliability when the risk of an incorrect decision is high.

No matter how much the team wants to skip the root cause analysis process, it is absolutely essential that an orderly determination of the root cause occurs. When team dynamics favor instinct-based approaches, the quickest road to success may be to accept the brainstormed analysis as being directionally correct and to refocus the team on validation experiments to prove or disprove those suspected causes. LSS practitioners are well aware that experimentation also is a data-driven approach, so at first this may seem like a trade-off that adds little or no value; however, the experimentation process has some advantages from a human-factors perspective that can create a higher level of engagement.

Mining versus exploring

The process of gathering data to support the root cause analysis tends to be a passive experience for team members. They spend their time mining data that were collected previously and for which they had no input in the selection of the metrics, the way the data were collected, how they were analyzed or the display of results. This might be compared to the work of a person sitting by a stream, filtering water through a screen in search of gold. Much time can pass before anything truly exciting happens.

On the other hand, designing

Table 1. **Root cause analysis tools**

Tool	Primary categorization	Use and effect of risk on use
Fishbone (Ishikawa) diagram	Instinct	**Captures brainstormed ideas into cause system that reflect progressively deeper causes.** Useful for initial analysis. Should be supplemented with data-driven tools when risk of an incorrect solution is high.
Five whys analysis	Instinct	**Guides brainstorming through progressively deeper causes.** Often used in conjunction with the fishbone diagram. Useful for initial analysis. Should be supplemented with data-driven tools when risk of an incorrect solution is high.
Fault tree/ cause and effect tree analysis	Data	**Models the combinations of human errors, equipment failures and external factors that can produce the problem being evaluated in a structured manner.** Useful for analyzing equipment and software problems as well as chronic problems; also can be used as a troubleshooting or a structured guessing approach.
Causal factor chart/ timeline	Data	**Arranges building blocks to graphically depict the timing of events and the cause-and-effect relationships among events and conditions.** Useful when timing of events is important—particularly incidents with safety and environmental impacts.
Failure mode and effects analysis	Data	**Identifies the most significant areas (such as equipment, operations, processes and safeguards) of an actual or potential incident.** Useful for analyzing downtime, spare parts, repair work, equipment damage, reputation impacts and loss of future orders.

and conducting an experiment involves active participation by team members. Participative decisions are made on what factors must be analyzed and at what levels set during the experiment. A hands-on approach usually occurs during the experiment as data are collected and analyzed by the team, and that effort leads to collaboratively determined conclusions about the results. Furthermore, this process is much more social than data collection, which usually is done by individuals with separate assignments. At the beginning of an experiment, team members may feel as if they are onboard the Starship Enterprise as it explores the unknown territories of the universe.

Here's an interesting reality associated with this approach—it aligns completely with the DMAIC principles. Even if the team does an intensive analysis of the potential root causes using the tools, the analyze and improve phases still require that the root cause and proposed solutions be verified through experimentation. In this case, the experiment may be designed and conducted with a less-solid foundation of information related to the factors and treatments. Obviously, this may require multiple cycles of experimentation, which does have some negative consequences, but it also has the positive effect of keeping team members totally engaged.

Successfully using this approach requires attention to many areas including:

- **Cost of mining versus exploration.** The cost of mining existing data usually is negligible compared to the cost of experimentation—particularly when multiple experiments are required. This reality supports a blended approach that balances more in-depth analysis of the root cause using available data versus experiments that get team members actively involved. Although it is difficult to quantify, the loss of team members' focus and energy also has a cost that undermines project effectiveness.
- **Time of mining versus exploration.** Whether the time to do a thorough data analysis first and then conduct a designed experiment based on that assessment is shorter or longer than the alternative of using an instinct-based analysis and multiple experimental cycles depends on the specific process and root cause. It's reasonable, however, to assume that the first approach is likely to actually take less time than the second one when measured on the clock. As the adage says, however, "Time flies when you're having fun," and that may make team members' awareness of the time that is passing quite different than what is measured by the clock.
- **Stakeholder pressure.** Unless the project champion and other key stakeholders are well-versed in the DMAIC method, they are unlikely to support having the team invest much effort in either mining or exploration. The pressure—sometimes enormous pressure—will be on rushing to implement change and make the problem magically disappear. Letting the team decide which mixture of root cause analysis and validation will best simultaneously determine the correct root cause and build a compelling case for stakeholder support transfers this issue for the contextual surroundings of the team's work to the practical realm of its decision-based control, which in turn reduces its effect.

As always is the case when seeking high team member engagement and overall team performance—and at the same time conforming to the DMAIC process—the greatest success is attained when the issues are openly expressed and discussed. Letting team members decide how to tackle the DMAIC requirements without cutting corners enhances their experience as long as they understand and adhere to those constraints. This approach optimizes the human factors and the problem-solving process.

REFERENCES

1. "Symptom," *Webster's Revised Unabridged Dictionary*, C. & G. Merriam Co., 1913.
2. "Cause," *Webster's Revised Unabridged Dictionary*, C. & G. Merriam Co., 1913.

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