Productivity Methodologies, Tools, and Techniques

Part II: Understanding Six Sigma and DMAIC methodology

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The foundation of Six Sigma initiatives lies in the rigorous application of the "define, measure, analyze, improve, and control" (DMAIC) methodology. This methodology works well in a wide variety of situations, but it has been confirmed to be one of the best problem-solving tools, especially in uncharted areas where no solution has been suggested previously. The details of activities that generally occur when the DMAIC methodology is applied are outlined below.

Define is the first phase of the DMAIC methodology of Six Sigma. The purpose is to define the project team's understanding of the problem to be addressed and the output is stated in the project charter. In the charter, the team normally indicates the objectives of the project, expected timeline, scope, and members of the team. Also created during this phase is a suppliers, inputs, process, outputs, customers (SIPOC) diagram that identifies the process being examined, the inputs to and outputs of the process, and the relevant suppliers and customers to ensure that team members acquire a bird's-eye view of the project. Another important aspect of the define phase is the gathering of voice of the customer data. The Six Sigma project team is focused on finding out directly from customers what they want and how well the current process meets their needs.

The measure phase establishes techniques for collecting data on the current performance of the process identified in the define phase. This phase is used to determine sources of variation and serves as a benchmark to validate improvements. A detailed process map is also created in this phase together with indications of possible variations existing within the process. With a clear measurable Y (output), the process is studied to determine the key inputs (X) for each process (Figure 1). After the key input list is drafted, the team considers the potential impact that each input has with respect to the defects currently generated in the process. Key inputs are prioritized to establish a shortlist to be evaluated in detail later. Process capabilities can also be calculated once the performance data are available.
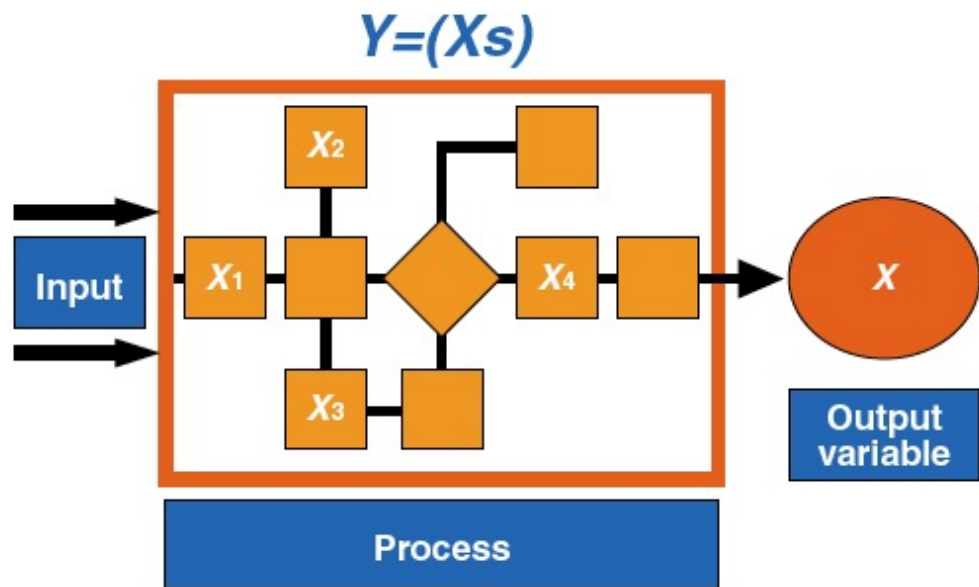
$$Y=(Xs)$$

Figure 1. Input, process, and output relationship

The purpose of the analyze phase is to allow the project team to target improvement opportunities by taking a closer look at the data to determine the root causes of the process problems and inefficiencies. This involves discovering why defects are generated by further probing into the key variables (identified in the previous measure phase) that are most likely to cause process variation. Statistical analysis is a key component of this phase and used to demonstrate and confirm these relationships.

In the improve phase, the team develops, implements, and validates alternative methods that will lead to improved performance. Once the root causes have been determined and confirmed in the analyze phase, the team can easily find solutions for the problems. As part of the normal Six Sigma methodology, there must also be a check to ensure that the desired results are being achieved before total adoption can be carried out. Some experiments and trials may be required to find the best solutions.

The final phase is the control phase. The control phase of the methodology focuses on continuous measurement to ensure that the process continues to achieve the intended results of the improve phase. Performance tracking mechanisms and measurements are put in place to prevent the gains from being lost over a period of time. Once all team members are confident that the achievements will continue in place, the team normally begins to transfer control of the process back to the original process owner(s).

Six Sigma teams are generally assigned to work on complex problems. The cause-and-effect relationships and therefore the solutions are not immediately obvious. To find the root causes of such problems, the DMAIC cycle must be followed painstakingly without skipping any phase or suggesting ad-hoc solutions. A team that ventures into the measure and analyze phases before gaining an overall understanding of their project in the define phase is likely doomed to significant reworking or even project failure from the outset.

Organizations that rely on Six Sigma realize that the methodology is most successful when integrated into the overall business strategy and not deployed merely as an occasional off-the-shelf tool kit. Six Sigma requires a corporate

culture shift. The ultimate measure of success is when the methodology becomes embedded and is applied throughout the organization.