Implementing Six Sigma - Part II

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*In the part I of this article (*Breyfogle 1999b*) Six Sigma techniques were described and some of the background of Six Sigma was provided.*

A good Six Sigma implementation plan defines Six Sigma projects in critical areas of the business. A road map, or visual description, is useful in developing a sound deployment. The phases of deployment are: measure, analyze, improve, and control. These four phases, referred to as S^4 (Smarter Six Sigma Solutions: Breyfogle 1999a) can be cast in the form of a project. [Smarter Six Sigma Solutions and S^4 are service marks of Forrest W. Breyfogle III]

A visual description of this project-based implementation of S^4 within an organization is shown in Figures 1- 3 for a key process output variable (KPOV) that has direct monetary implications. The following elaborates more on these figures and this strategy.

Deployment of Six Sigma: Projects with Bottom-line Benefits

Often organizations do not look at "their" problems as the result of current process conditions. However, if they did, their situation might be described by Figure 1. They might also have a variety of key process output variables (KPOV's). A KPOV could be a critical dimension, overall cycle time, a DPMO rate (i.e., a defects per million opportunities metric could expose a "hidden factory" that has much rework that is not currently being reported), customer satisfaction, and so on.

For this type of situation, organizations often react over time to the up and down movements of the KPOV level in a "fire fighting" mode, "fixing" the problems of the day. Practitioners and management might even think that this type of activity is making improvements to the system. However, in reality they are often spending a lot of resources without making any process improvements. Unless process changes are made the proportion of non-compliance, as shown in the figure, will remain approximately the same. Arbitrary tweaks made frequently in an attempt to control process variability and "noise" (e.g., material differences, operator-to-operator differences, machine-to-machine differences, and measurement imprecision) can impact a KPOV to a level that results in a large non-conforming proportion. Organizations who frequently encounter this type of situation have much to gain from the implementing an S^4 program. They can better appreciate this potential gain when they consider all the direct and indirect costs associated with their current level of non-conformance.

The suggested S^4 methodology is not only a statistical methodology but also a deployment system of statistical techniques, as described in Figure 2. For a S^4 program to be successful it must have upper level management commitment and the infrastructure that supports this commitment. Deployment of the S^4 techniques is most effective through practitioners, sometimes called black belts, change agents, top guns, or another term given by a company within its deployment approach. These practitioners are to work full time on the implementation of the techniques through S^4 projects selected on business needs (i.e., have a very beneficial return on investment). Direct support needs to be given by an executive management committee who has high level managers champion S^4 projects.

When a practitioner utilizes the steps summarized in Figure 2 either during a workshop or as a project after a workshop, the type of process improvement described in Figure 3 can result, where the process has been simplified, designed to require less testing, and/or become more robust (i.e., indifferent) to the noise variables of the process. This effort can result in an improvement shift of the mean along with reduced variability that leads to quantifiable bottom-line monetary benefits.

References

- Breyfogle III, Forrest W. (1999a) *Implementing Six Sigma: Smarter Solutions using Statistical Methods*, Wiley, New York, NY.
- Breyfogle III, Forrest W. (1999b) "Implementing Six Sigma," ASQ *The Quality Management Forum*, Summer 1999, Volume 25, Number 2 (see http://www.smartersolutions.com/html/impl_six_sigma_i.htm)

Author

Forrest W. Breyfogle III founded Smarter Solutions, Inc. in 1992 after a 24 year career with IBM. Smarter Solutions, Inc. specializes in the training and coaching of "Smarter Six Sigma Solutions." His second book, *Implementing Six Sigma: Smarter Solutions using Statistical Methods,* was published in 1999 by John Wiley & Sons, New York, NY. Forewords within this book were written by the president of Motorola University, a principal at IBM Consulting, and the statistical methods manager at SEMATECH. Described benefits of the 800 page book include the wide scope and integration road map of the tools. The author can be reached at 1779 Wells Branch Pkwy., #110B-281, Austin, TX 78728,   (512) 996-8288, forrest@smartersolutions.com, or www.smartersolutions.com.

Figure 1. Example process with a key process output variable (Reproduced *from Implementing Six Sigma: Smarter Solutions using Statistical Methods*, Forrest W. Breyfogle III, Wiley, copyright 1999)
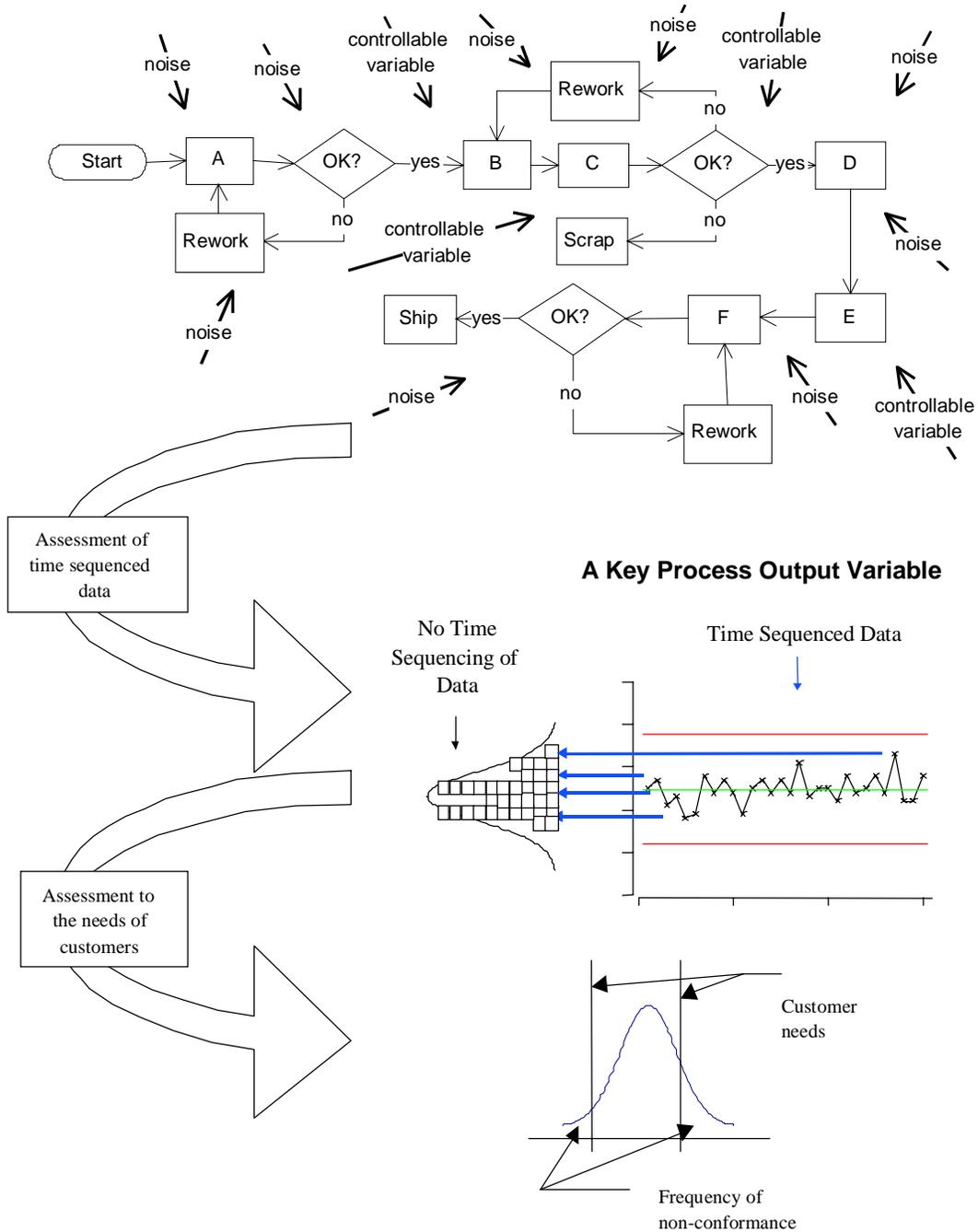
Figure 2. Pictorial representation of the implementation an S[4] business strategy. (Reproduced from *Implementing Six Sigma: Smarter Solutions using Statistical Methods*, Forrest W. Breyfogle III, Wiley, copyright 1999)

S[4] Executive Vision

Phase 0 - S[4] Assessment and Kickoff

| Select exemplary projects for S[4] assessment workshop | Conduct executive assessment workshop | Select champions | Develop implementation plan |

Phase 0 - S[4] Deployment Strategy Phase

| Conduct S[4] executive training | Conduct S[4] champion training | Select S[4] black belt candidates | Define projects | Create intra-support structure |

Project Implementation

Phase 1 - S[4] Measurement Phase

| Flow chart total process | Create C&E Diagram | Control chart project metrics | Estimate capability/performance of project metrics | Create Pareto charts | Conduct MSA | Identify potential KPIV's & KPOV's/FMEA |

Phase 2 - S[4] Analysis Phase

| Create multi-vari charts | Determine confidence intervals for key metrics | Conduct hypothesis tests | Determine variance components | Assess correlation of variables | Conduct regression analysis | Conduct ANOVA |

Phase 3 - S[4] Improvement Phase

| Select DOE factors and levels | Plan DOE execution | Conduct DOE | Implement variability reduction designs/assessments | Consider response surface methods |

Phase 4 - S[4] Control Phase

| Determine control plan | Implement control charts for KPIV's | Consider short run and three-way control charts | Consider CUSUM, EWMA & EPC | Consider pre-control charts | Mistake-proof processes |

Fig. 3. Example process improvement and impact to a key process output variable. (Reproduced from *Implementing Six Sigma: Smarter Solutions using Statistical Methods*, Forrest W. Breyfogle III, Wiley, copyright 1999)
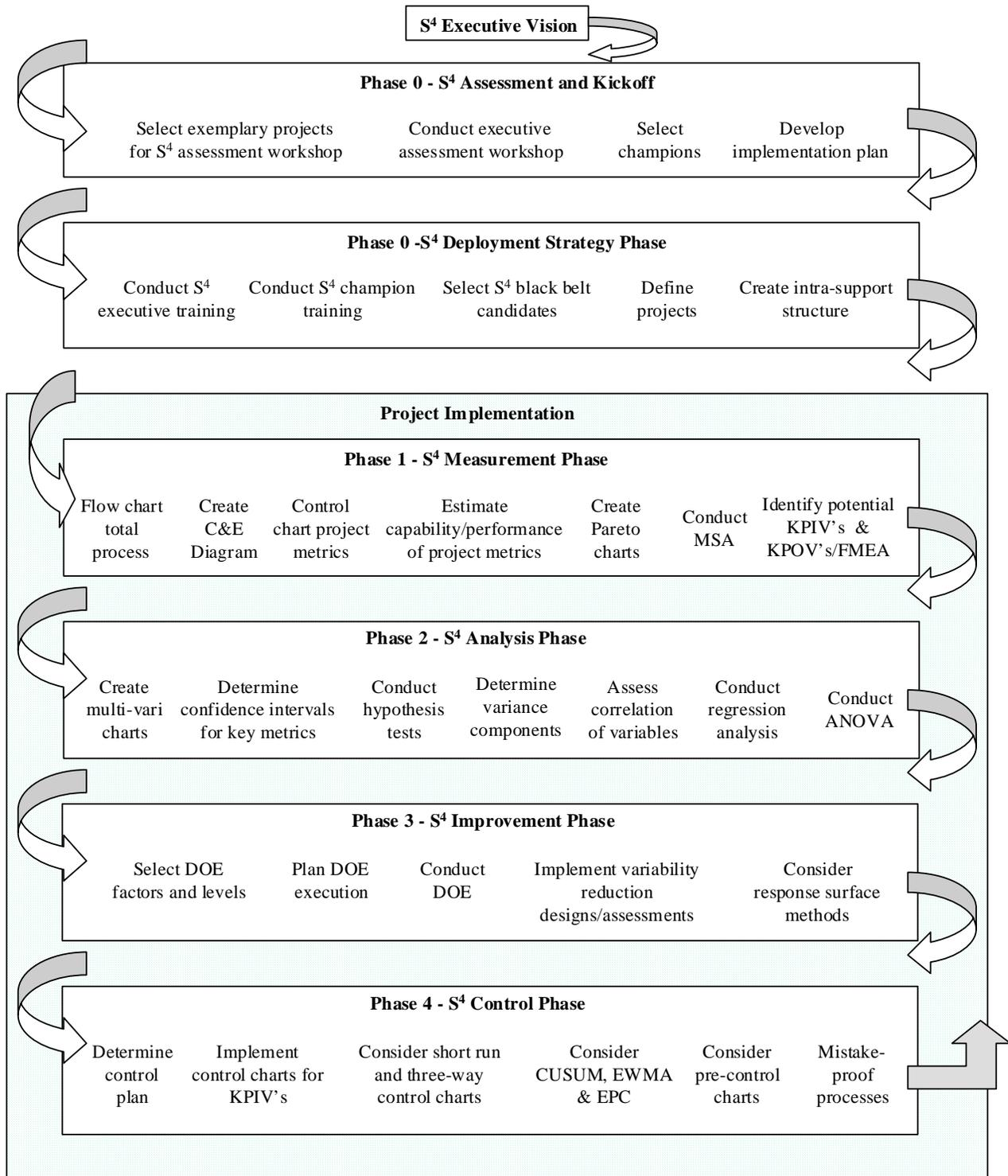

A Key Process Output Variable

Process changes shifted mean and reduced common cause variability

Process changes reduced the frequency of non-conformance

Customer needs

Frequency of non-conformance

Reduced non-conformance translates to tangible benefits

$$$$
Bottom-line Benefits