Utilizing Project Management Principles for Successful Six Sigma Project Execution

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ABSTRACT

This paper reviews the American Society for Quality (ASQ) Certified Six Sigma Black Belt Body of Knowledge (CSSBBBOK) and prescribed areas of the Project Management Body of Knowledge (PMBOK) along with industry accepted deliverables deployed in the Six Sigma methodology of Define, Measure, Analyze, Improve, and Control (DMAIC). Each DMAIC phase is compared to the applicable project management process knowledge area of the PMBOK and the CSSBBOK. This paper proposes utilizing project management deliverables to the typical DMAIC tool set to resolve some of the root causes of Six Sigma project failure and to ensure successful Six Sigma project execution.

1.0 INTRODUCTION

Many companies deploy Six Sigma methodologies through selection of improvement projects that are related directly to customer dissatisfaction (warranty) -- things that have gone wrong (Stamatis, 2001).This is typically accomplished by training employees in Six Sigma Define, Measure, Analyze, Improve, and Control (DMAIC) methodology and completing the improvement projects with an emphasis on analytical rigor. However, according to Bertels (2003), Dussharmi (2003), and Goldstein (2003) successful Six Sigma projects also depend upon making sure that all levels of management play an active role in the deployment of the project by actively engaging them in the planning and project review process. In addition, Kowalski (2006) suggests that "90% of Six Sigma practitioners rate the addition of tools for engaging frontline managers and employees as a top priority for improving project results."

Upon examination of the ASQ-CSSBBBOK the Project Management section which describes the project charter and plan, team leadership and team dynamics, performance, change agents and management and planning tools, constitutes less than 10% of the overall ASQ-CSSBBBOK. Could the prescribed areas of the PMBOK offer tools that can be added to the DMAIC methodology that will successfully engage managers and employees? This paper proposes adding project management deliverables to the existing list of Six Sigma DMAIC tool set to resolve some of the root causes of Six Sigma project failure and ensure successful Six Sigma project execution.

2.0 PROJECT MANAGEMENT

Project Management (PM) is the application of knowledge, skills, tools and techniques to project activities to meet project requirements which is accomplished through the application and integration of the PM processes of initiating, planning, executing, monitoring and controlling, and closing. The term "project management" is sometimes used to describe an organizational or managerial approach to the management of projects and some ongoing operations, which can be redefined as projects that is also referred to as "management by projects."(A Guide to the PMBOK, 2004).

This standard describes the nature of PM processes in terms of the integration between the processes, the interactions within them, and the purposes they serve. These processes are aggregated into five groups, defined as the:

PM Process Groups:

- Initiating
- Planning
- Executing
- Monitoring and Controlling
- Closing

The PM knowledge areas are:

- Project Integration Management describes the processes and activities that integrate the various elements of project management, which are identified, defined, combined, unified and coordinated within the PM Process Groups.
- Project Scope Management describes the processes involved in ascertaining that the project includes all the work required, and only the work required, to complete the project successfully.
- Project Time Management describes the processes concerning the timely completion of the project.
- Project Cost Management describes the processes involved in planning, estimating, budgeting, and controlling costs so that the project is completed within the approved budget.
- Project Quality Management describes the processes involved in assuring that the project will satisfy the objectives for which it was undertaken.
- Project Human Resource Management describes the processes that organize and manage the project team.
- Project Communications Management describes the processes concerning the timely and appropriate generation, collection, dissemination, storage and ultimate disposition of project information.
- Project Risk Management describes the processes concerned with conducting risk management on a project.
- Project Procurement Management describes the processes that purchase or acquire products, services or results, as well as contract management processes.

3.0 SIX SIGMA DEFINED

Six Sigma was conceptualized as quality goal in mid—1980's at Motorola. There have been many versions of the Six Sigma definition since it was first coined in Motorola in the year 1987. ASQ defines Six Sigma as a fact-based, data-driven philosophy of quality improvement that values defect prevention over defect detection. It drives customer satisfaction and bottom-line results by reducing variation and waste, thereby promoting a competitive advantage. It applies anywhere variation and waste exist, and every employee should be involved. In simple terms, Six Sigma quality performance means no more than 3.4 defects per million opportunities. Benbow et. al, (2005) discuss differing opinions on the definition of Six Sigma by defining Six Sigma as philosophy , or as a set

of tools and or as a methodology. We will consider the methodology definition which is shown below.

The Six Sigma methodology recognizes the underlying and rigorous approach known as DMAIC. DMAIC defines the steps a Six Sigma practitioner is expected to follow, starting with identifying the problem and ending with the implementation of long-lasting solutions. While DMAIC is not the only Six Sigma methodology in use, it is certainly the most widely adopted and recognized (www.asq.org). Methodologies other than DMAIC are beyond the scope of this paper.

Irrespective of the choice of definition one may make, Six Sigma is always deployed through execution of a series of projects selected by management and driven by black belts. Six Sigma Black Belt leads, inspires, manages, delegates, coaches and "baby-sits" colleagues and becomes almost expert in tools for assessing problems and fixing or designing processes and products. Usually the Black Belts work alongside a team assigned to a specific, Six Sigma project (Pande, Holpp, 2002).

The fact that implementations of Six Sigma are always done through projects raises the logical question of how well is typical Six Sigma practitioner equipped with PM skills?

The criteria for selection of a black belt person vary considerably. Organizations may consider the organizational hierarchy of an employee before selection of the candidate for Six Sigma practitioner role (Revelle, 2001). Bertels, (2003) emphasizes that comfort and proficiency with numerical analysis and computer literacy are "must haves" for Six Sigma black belt roles. Pande et.al (2002) suggest that the black belt must possess strong problem solving, the ability to collect and analyze data, organizational savvy, leadership and coaching experience, and good administrative sense. They also suggest that the black belts must be adept at project management. Organizations assume delivery of these skills through the six sigma training; however this assumption has not been evaluated. The paper evaluates the fulfillment of PM skills by assessing the ASQ Six Sigma Black Belt Body of Knowledge.

Table 1. Knowledge areas prescribed by ASQ

KNOWLEDGE AREA	Specific Topics
I. Enterprise-Wide Deployment	A. Enterprise view B. Leadership C. Organizational goals and objectives D. History of organizational improvement/foundations of six sigma
II. Business Process Management	A. Process vs. functional view B. Voice of the customer C. Business results
III. Project Management	A. Project charter and plan B. Team leadership C. Team dynamics and performance D. Change agent E. Management and planning Tools
IV. Six Sigma Improvement Methodology and Tools – Define A	A. Project scope B. Metrics C. Problem statement
V. Six Sigma Improvement Methodology and Tools – Measure	A. Process analysis and documentation B. Probability and statistics C. Collecting and summarizing data D. Properties and applications of probability distributions E. Measurement systems F. Analyzing process capability
VI. Six Sigma Improvement Methodology and Tools – Analyze	A. Exploratory data analysis B. Hypothesis testing
VII. Six Sigma Improvement Methodology and Tools – Improve	A. Design of experiments (DOE) B. Response surface methodology C. Evolutionary operations (EVOP)
VIII. Six Sigma Improvement Methodology and Tools – Control	A. Statistical process control (SPC) B. Advanced statistical process control C. Lean tools for control D. Measurement system re-analysis
IX. Lean Enterprise	A. Lean concepts B. Lean tools C. Total productive maintenance (TPM)
X. Design for Six Sigma (DFSS)	A. Quality function deployment (QFD) B. Robust design and process C. Failure mode and effects analysis (FMEA) D. Design for X (DFX) E. Special design tools

4.0 ASQ SIX SIGMA BLACK BELT BODY OF KNOWLEDGE

The American Society for Quality (ASQ) has developed a Six Sigma Black Belt Body of Knowledge to use as a basis for certification of individuals as the Black Belts level of performance in applying the Six Sigma methodology. The knowledge areas prescribed by the ASQ are shown in Table 1.

Table 1 shows that 10% (one knowledge area out of ten) of the curriculum is devoted to project management. The question is that of adequacy and if these skills are well embedded within DMAIC phases. In order to assess this we evaluate the tools applied in each of the DMAIC phase and their relevance to project management.

5.0 THE RELEVANCE OF SIX SIGMA BLACK BELT TOOLS TO PROJECT MANAGMENT

The similarities between PM and Six Sigma have been discussed in the past. Tye (2005) suggests using Six Sigma to aid PM when developing a new process or product. Pyzdek (2003) discusses PM requirements for a successful Six Sigma program execution but the discussion is focused at the program level and not at the project level. Stamatis (2001) also discusses PM integration for the Design for Six Sigma (DFSS) methodology (beyond the scope of this paper).

Figure 1. PM knowledge level of integration in DMAIC phases

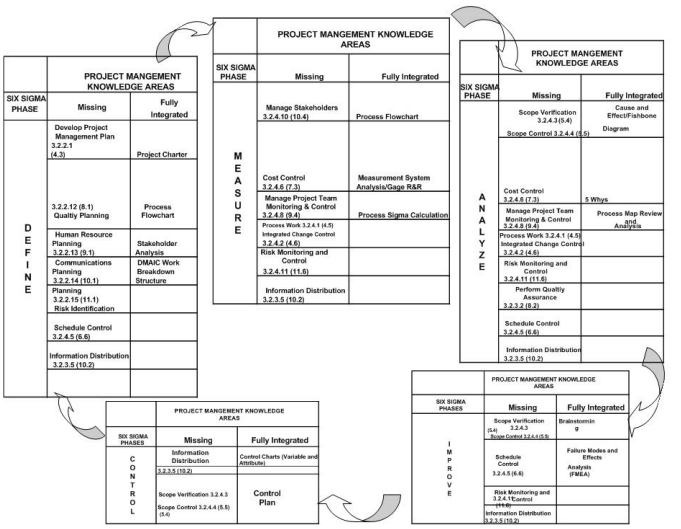
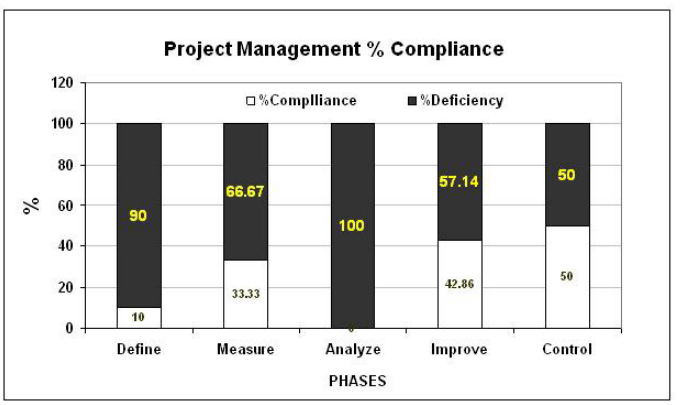


Figure 2. PM gap analysis for each six sigma DMAIC phase



*(% Gap = (missing PM knowledge areas) ÷ (missing PM knowledge areas + fully integrated PM areas) * 100)*

Figure 1 evaluates the tools within DMAIC Phases against PM knowledge areas to determine which Knowledge areas are missing from the DMAIC phases.

Figure 2 displays quantitatively the PM knowledge areas of deficiency within each DMAIC phase as discussed earlier in Figure 1.

The gaps shown in Figure 2 are an indication of the void spaces for PM knowledge areas within DMAIC phases which may adversely affect the project execution and the project success.

6.0 REASONS FOR ADDRESSING THE GAPS

The primary reason for addressing the gaps using PM knowledge areas can found in the root causes of Six Sigma project failures discussed by Goldstein (2001), Underdown (2006), Nilanatasrinivasan (2005) and are summarized in Figure 3: Cause and Effect Diagram: Six Sigma Success Factors. This is in no way a comprehensive list but nevertheless, gives us a glimpse of important root causes of Six Sigma project failures.

Solutions to mitigate the root causes discussed in figure 3 are shown in Table 2.

7.0 PROPOSED SOLUTION

All the root causes listed in Table 2 may be successfully addressed or mitigated by adhering to sound PM principles as prescribed in the PMBOK. Table 2 each specific PM knowledge area that may address or mitigate root causes for each of the Six Sigma project failures. For example, details of the Deployment plan can be addressed or mitigated by adhering to Project Integration Management which defines inputs and outputs, along with standards for developing a sound project charter and developing a preliminary scope statement.

Likewise, the root cause related to communication may be mitigated if the Six Sigma practitioner implementation of Project Communication Management as defined by the PMBOK.

It is important to note that there may be more than one PM knowledge area to addressing or mitigating root causes, but this paper is limited to discussion of the most applicable PM knowledge area.

8.0 CONCLUSION

Root causes of Six Sigma project failures were discussed and it was determined that Six Sigma practitioners rated the addition of tools for engaging frontline managers and employees as a top priority for improving the success of Six Sigma projects. In addition, upon examination of the current ASQ CSSBBBOK it was determined that even though it provides a solid foundation for establishing standards for analytical tools and methodologies used in the DMAIC process, the knowledge area of PM appear to be lacking and does not provide enough tools to ensure successful implementation of projects with the engagement of frontline managers and employees. Integrating PMBOK areas into the DMAIC process may address or mitigate this issue. Further research will be required to evaluate the effects of integrating PMBOK areas into Six Sigma methodology on the success of Six Sigma Projects. The next steps in the research will be to develop a training model that will better address the PM knowledge areas and study the effects of the same on the successful execution of Six Sigma projects.

Figure 3. Cause and effect diagram: Six sigma success factors

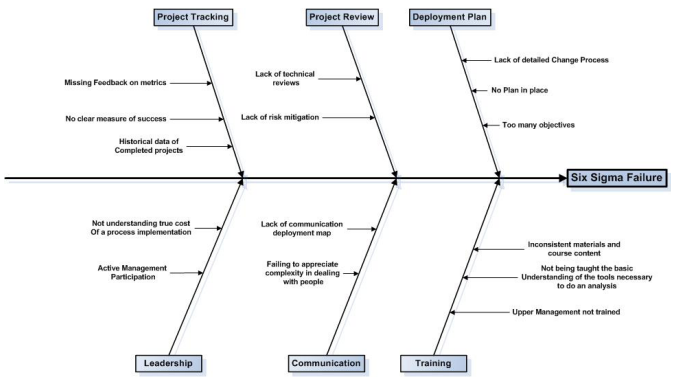


Table 2. Proposed PM knowledge areas for mitigating root causes

Root Causes	Proposed Project Management Knowledge Areas for Mitigating Root causes
1. Deployment plan.	Project Integration Management
2. Active participation of the senior executives.	Project Communications Management
3. Project reviews.	Project Integration Management
5. Full-time vs. part-time resources.	Project Human Rescource Management
6. Training.	Project Human Rescource Management
7. Communications.	Project Communications Management
8. Project selection.	Project Integration Management
9. Project tracking.	Project Time Management

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