A Best Practice Process for Collaboration Based on Knowledge Created by Internal Coaches and Six Sigma Green Belts

Steven R. Pollock

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DEDICATION

This dissertation is dedicated to the following people who never stopped believing in me. My parents, Dick and Sue Pollock, inspired a love of life-long learning many years ago. My wife, Betsy Pollock, honored my educational goals and dreams. My children, Emily, Sarah, Erica, Diane, and Charlotte, urged me to finish what I started a long time ago.
I want to thank the many people who contributed to the successful outcome of this study. My committee: Drs. Chavez (chair), Patrick, and Spangenberg. The following associates at my employer, Humana, Inc.: my peer, Dr. Jason Kell, Ph.D., provided insightful advice about the dissertation process, and my supervisor and kindred Black Belt, Mrs. Maria Hughes, encouraged this professional development endeavor.
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CHAPTER 1

INTRODUCTION

A Six Sigma program is a collaborative problem-solving approach for satisfying customers and developing associates. This methodology seeks the sustainable improvement of product and service processes. An effective Six Sigma program understands how to improve quality, decrease cost, and engage associates. Six Sigma improvement teams use projects to reduce waste and eliminate defects. The methodology employed by these teams is called DMAIC: Define, Measure, Analyze, Improve, and Control (Jones & George, 2011; Pande, Neuman, & Cavanagh, 2002). The methodology originated in the United States in the late 1980s at the Motorola Corporation, was strengthened by its deployment in the 1990s at General Electric (GE) and Allied Signal, and continues to evolve through its application in healthcare, education, non-profit, and governmental settings. A Six Sigma program may include approaches for the improvement of design (called Design for Six Sigma) and for the realization of process efficiency (called Lean). This dissertation will hereafter refer to these improvement approaches as DMAIC since the approaches share common tools, objectives, and challenges.

There are special roles within the Six Sigma infrastructure for DMAIC experts, project team participants, operational leaders, and associates. DMAIC is facilitated by Black Belt and Master Black Belt subject matter experts (Pande et al., 2002). Hereafter, these two skill-level designations will be referred to as internal coach. The internal coach seeks to build an organization’s culture whereby continuous improvement is the norm. The internal coach helps participants learn through DMAIC training and project guidance. Most of the coaching effort occurs after the initial classroom training during the application of concepts and tools to real-world problems. Project team participants are called Green Belts. Operational leaders participate as project sponsors (sometimes called champions) or project stakeholders. Associates engage as project team members or adopters of project solutions. This is how it works in the organization.
studied. Many experts recommend that the internal coach be dedicated to the program on a full-time basis since there are a myriad of tools, concepts, and challenges to overcome when applying classroom learning to real workplace problems (Breyfogle, 2003; Chakravorty, 2010; Pyzdek & Keller, 2009).

However, there is limited information regarding how to sustain a Six Sigma program through the use of knowledge (Goh, 2010; Van Iwaarden, Van der Wiele, Dale, Williams, & Bertsch, 2008). The learning process deployed by the internal coach is a requirement of knowledge creation (Choo, Linderman, & Schroeder, 2007). However, very little is known about how the learning process works. Project team failure appears to occur when insufficient resources are provided to help participants learn about Six Sigma tools (Moosa & Sajid, 2010). Feedback to the internal coach about DMAIC implementation barriers may raise awareness about correct coaching behavior (Jacobsen, 2008). Thus, project teams benefit from access to a well-informed internal coach.

An example of the importance of the project team’s access to an internal coach is discussed by Bourg et al. (2010). Agilent Corporation developed and applied a coaching model for working with its Green Belt teams after the initial Green Belt teams failed to achieve expected results. According to the experience at Agilent, a skilled coach uses a defined process in a proactive manner. A contract is discussed at the start of the project by the coach and team members. Then during the project and at the project’s conclusion, feedback is provided to the coach and project team members about their performance. This is not a general practice based on data from a major Six Sigma survey in the United States.

The Benchmarking Exchange (2011) survey reports about the current state of Six Sigma practices in the United States. Internal Black Belts or Green Belts deliver initial training according to 61% of the respondents, and the learning process occurs 36% of the time within an internal classroom. Other forms of training appear to be self-service (web, self-study, CD) for 33% of respondents. However, the survey does not reveal how organizations are supporting project teams after the initial training experience through coaching. This dissertation asserts that most learning occurs after the initial training in the context of the Six Sigma project. For example, over twenty-six process improvement tools are identified by survey respondents in the survey results (2011). This dissertation takes the position that internal coaches strengthen learning and collaboration. It is not
likely these process improvement tools will be learned effectively without direct application on the job under the guidance of an experienced internal coach.

Internal coaches also provide help with overcoming implementation barriers through their work with project teams and organizational leaders. The American Productivity and Quality Center (APQC) reports there are known barriers to continuous improvement (Gunnarsdottir, 2012). Many of these barriers involve collaboration issues within a project team and outside of the team with stakeholders and other associates. Gunnarsdottier (2012) cites a study by Chakravorty (2010) indicating a high level of implementation failure for Six Sigma programs. The lessons learned reported by Chakravorty (2010) for overcoming failure include the engagement of a process expert for each project team. Availability of an internal coach is necessary for resolving challenges and teaching the project team how to deal with the issue in the future. Thus, there is a great deal of value in understanding the actions of the internal coach when supporting a project team. Learning contributes to knowledge. Best practices may result from knowledge.

The interaction between the internal coach and project team creates knowledge. However, it is unclear how the interaction occurs. A practical body of knowledge is needed. Learning occurs when a structured DMAIC approach is used, but DMAIC does not deliver knowledge in the absence of other program practices (Choo et al., 2007). The practices include the alignment of projects with organizational strategy and the formalization of a learning process. A formalized learning process helps an organization compete. Cost cutting is easier to duplicate than accumulated process improvement knowledge (De Mast, 2006). Engagement of organizational members in the learning process is a key element of a learning organization (Davison & Al-Shaghana, 2007; De Mast, 2006; Gobeille, 2009; Hagen, 2010; Pollock, 2010). Development of Six Sigma management theory is needed for developing a greater understanding about efficacious human resource policies and practices (Zhang et al., 2011). This dissertation contributes to the body of knowledge about formalizing the learning process used by an internal coach and Green Belt project teams in a Six Sigma program.

This chapter will discuss the following. The Statement of the Problem describes the limited understanding about how an internal coach provides support to Green Belt project teams. The Purpose of the Study is to identify the key factors internal coaches and Green Belts perceive to be important to project outcomes. The Research Question is to examine the relationship between internal coaches and Six Sigma Green Belt
project teams for creating project outcomes. The Definitions define the key terms of the study. The Limitations identify the scope of the study as one organization in the United States using a validated test instrument. The Study Benefits are the development of the best practice tool for collaboration using insights from the collected data and the use of nonmanufacturing data for the study. The Organization of the Dissertation identifies and briefly describes the five chapters of the study. The social implications for conducting this study are discussed next.

**Social Implications of the Study**

This study addresses a primary leadership challenge faced by any organization adopting a Six Sigma program. The challenge is to identify and then to adopt the most appropriate Six Sigma processes and practices for sustainable success. The creation of knowledge helps organizational leaders face this challenge. Six Sigma programs are expensive to implement, and most programs in the United States are immature. Best practices help organizations avoid common implementation mistakes. Internal coaches need to understand how to guide their Green Belt teams based on objective data.

Green Belt is the foundational skill level in Six Sigma. Success at the Green Belt level provides opportunities for the participants to mature to more complex problem solving skills. These advanced skills empower an organization to tackle persistent quality and service issues. Thus, the extent of correct guidance at the Green Belt level provides greater assurance of sustainability for a Six Sigma program. A best practice tool for collaboration in a Six Sigma program encourages a culture of continuous improvement. This type of culture is harder to imitate than a business model dependent exclusively or primarily on cost cutting. The statement of the problem is discussed next.

**Statement of the Problem**

The literature about Six Sigma adoption acknowledges the value of training participants. However, the literature largely ignores the role of the internal coach. The problem is the literature does not provide a great deal of insight about what the internal coach should do to support Green Belts. Current practice suggests organizations give too much reliance on the initial training course to guide participants (The Benchmarking Exchange, 2011). The literature does not offer substantive examples of what Green Belts say they want from their coaches after the initial training course. Most Fortune 500 firms have implemented Six Sigma to compete globally (Zhang, Hill, & Gilbreath, 2011). These programs are relatively immature. The Benchmarking Exchange (TBE) reports
results from 1,271 respondents in the United States that over 61% of the reporting organizations’ Six Sigma programs are less than 3 years old (2011). However, the TBE survey does not examine the relationship between the internal coach and project teams after the initial training course. Six Sigma programs would benefit from guidance about best practices for internal coaches and project teams. The purpose of the study is discussed next.

**Purpose of the Study**

This study will examine how to make the collaborative problem-solving process for Six Sigma Green Belt project teams more effective by collecting data from internal coaches and Green Belts using a validated instrument. There is a significant investment in implementing a Six Sigma program. The potential risk of failure has been recently estimated to be as high as 60% (Chakravorty, 2010). The high failure rate of Six Sigma programs suggests that internal coaching is needed even if some associates possess natural, intrinsic ability to perform DMAIC tasks. Self-reported figures from the Six Sigma community in the United States show a wide range of annual training program cost, with small firms reporting annual spending less than $10,000 to large firms spending over a $1,000,000 (The Benchmarking Exchange, 2011). Estimates vary, but large firms such as GE spend a range between $4,000 and $25,000 per associate for each Belt (Zhang et al., 2011). The largest two costs for a Six Sigma program are (a) Wages of the internal coach and (b) Training and development of the participants. A typical Black Belt annual salary is at least $89,000. A Master Black Belt annual salary is at least $117,000 (Hansen, Wilde, & Kinch, 2011). Benefits add to this total. Training and development of participants is the largest cost, however.

An examination of how to make the process of coaching Green Belts more effective is worth undertaking given a Six Sigma program’s risk and investment factors. The perceptions of the internal coaches and Green Belts about the key drivers of effective project outcomes will be evaluated using correlational analysis. The perceptions that explain the major portion of the variance for the dependent variables will be identified. The independent variables are Project Characteristics, Coaching Expertise, Employee Focus, Years of Experience, Completed Projects, Education Level, and Projects completed in a team (internal coach only). The dependent variables are Team Outcomes, Customer Outcomes, Organizational Outcomes, and Savings. The research question is discussed next.
Research Question

The purpose of this study is to examine the relationship between internal coaches and Six Sigma Green Belt project teams. Associates typically begin their Six Sigma engagement at the Green Belt level. The Green Belts often rely on support from Six Sigma experts called internal coaches. While some Green Belts may be intrinsically gifted and able to apply process improvement tools in a collaborative manner, most participants require assistance from an internal coach. If knowledge is created during this collaboration, it is necessary to understand how this occurs. This research will support the development of best practices. The research question is: What is the relationship between internal coaching of Green Belts and the perception of their results for knowledge creation in the United States? The key definitions are discussed next.

Definitions

The key terms are discussed in Chapter 2. Internal coaching supports Six Sigma Green Belts about continuous improvement practices, and this support is an ongoing, formal role in the Six Sigma program (Gobeille, 2006; Hagen, 2008; and Pande et al., 2002). Knowledge creation processes and outcomes are learning created from process design, and repetition of this process encourages stability of learning (Choo et al., 2007; Nold III, 2011; and Zhang et al., 2011). Six Sigma Green Belt project team development requirements are the skills necessary for effective problem solving and project success (Pande et al., 2002; Stevenson & Mergen, 2006). The limitations of the study are discussed next.

Limitations

The study will be limited to projects using Six Sigma DMAIC for Green Belt projects in the United States. External coaches are excluded because they lack understanding of company culture and relationships held by an internal coach. The study will not validate the adoption of the best-practice model. The study will use a representative sample by surveying internal coaches and certified Green Belt associates of a large healthcare corporation with a mature Six Sigma program. This study accepts Gobeille’s (2006) recommendation for selecting a host organization and using a representative sample: the study results are generalizable to other organizations when those organizations use similar Six Sigma training and certification rules. Six Sigma training and certification rules are fairly consistent in the United States. The study will
use an existing survey instrument (Hagen, 2008) to collect data. The survey instrument is adequate for examining the research question. The study benefits are discussed next.

**Study Benefits**

The primary benefit of the study is the potential for developing a body of knowledge for internal coaching of Green Belt project teams. If knowledge is created during this collaboration, it is necessary to understand how this occurs. The study will address a gap in the published literature about how internal coaches and Green Belts collaborate. Details about the collaboration may strengthen understanding about how to improve Six Sigma program sustainability. Another benefit is its use of nonmanufacturing source data. The other dissertations examining this topic used manufacturing sources of data (DeRuntz, 2005; Gobeille, 2006; Hagen, 2008). The organization of the dissertation is discussed next.

**Organization of the Dissertation**

This chapter introduces the problem and the need for the study. Discussion has been provided about the relationship between Six Sigma sustainability and application of knowledge. Chapter 1 also described the Statement of the Problem, Purpose of the Study, Research Question, Definitions, Limitations, and Study Benefit. Chapter 2 will discuss a comprehensive literature review on internal coaches and Six Sigma Green Belt project teams, as well as other related topics. Chapter 3 will discuss the method for the study. Chapter 4 will discuss data analysis and results. Chapter 5 will discuss key findings of this study, as well future research, and practical implications.

The next chapter will discuss the literature review.
CHAPTER 2

REVIEW OF THE LITERATURE

The purpose of this study is to examine the relationship between internal coaches and Six Sigma Green Belt project teams. Associates typically begin their Six Sigma association at the Green Belt level. This level is the starting point for learning how to apply Six Sigma methodology and tools to solve quality problems. Green Belts may receive support from other associates trained in Six Sigma, external consulting resources or internal coaches whose job is to focus on building competency and culture (DeRuntz, 2005; Gobeille, 2009; Hagen, 2010; Pande et al., 2002). This study only considers internal coaches whose main task is support of Six Sigma participants, including Green Belts. These resources receive training to equip them for their support tasks. These resources also understand the organization’s culture, unlike external resources. These qualified resources guide Green Belts through the Six Sigma methodology. The learning curve for many Green Belts is daunting. Six Sigma terminology, processes, and tools require effort to understand. Many Green Belts benefit from a learning guide or internal coach. Even those few Green Belts, who possess inherent, natural ability to apply Six Sigma, benefit from an internal coach. Naturally bright Green Belts can learn additional skills from an experienced coach and progress rapidly to the higher skill of Black Belt. However, the majority of associates require training and coaching to learn Six Sigma Green Belt skills. This is how it works in the organization studied. Yet there is very little published information on this topic.

The literature does not provide insight about what internal coaches should do to support Green Belts. If collaboration produces knowledge, it is necessary to understand how this occurs. This research will support the development of best practices for helping Green Belts. The research question is: What is the relationship between internal coaching of Green Belts and the perception of their results for knowledge creation in the United States? International implications of the research question are beyond the scope of this study.
The purpose of this research will be accomplished by creating a process for reviewing the relevant literature. Next, the literature will be discussed in terms of Six Sigma evolution, importance of knowledge creation and behaviors for knowledge creation. Since Six Sigma is a disruptive intervention into how an organization solves quality problems, it is necessary to understand how to preserve Six Sigma over time to reap the benefits. Knowledge creation about what works is essential. The literature review will be concluded by summarizing what the literature says – and does not show – about internal coaches and Green Belt knowledge creation. The literature review process will be discussed next.

Literature Review Process

The majority of Six Sigma research focuses on Black Belt topics (Zhang, Hill, & Gilbreath, 2011). This research creates awareness about the mature stage of a Six Sigma intervention. However, the analysis typically does not consider the challenges and opportunities at the Green Belt level of intervention. Thus, a review of literature will be conducted to understand the direction of research at the Black Belt level and how that direction might be applied to Green Belts. The review of literature supports the expansion of the body of knowledge to Green Belts. This understanding addresses the research question about the relationship between internal coaching of Green Belts and the perception of their results for knowledge creation in the United States.

The literature review will focus on assessment of recently published articles, dissertations, and books. The literature review will be accomplished using Columbia Southern University’s (CSU) Online Library, Google search queries, American Society for Quality (ASQ) Online archives, and the researcher’s personal library for quality management. The CSU Online Library will be the primary source of information, and this library uses databases for Academic OneFile, Business Source Complete, Dissertations & Theses Database, and Online Books ebrary. The CSU and ASQ databases are available to members. However, the articles, dissertations, and books are typically available through Google Online searches or other institutional libraries.

Online search queries will use sets of keywords. The keywords are: Six Sigma Green Belt, quality management, coaching, internal coaching, development, mentoring, and Six Sigma. Combinations of these keywords will be used to identify potential literature sources. The search timeframe priority will be 2006 – 2011 since this represents the most recent period of research. Landmark literature occurring outside of
this timeframe will be included in the review of the literature. The Online search may offer many references outside of the scope of this research study. Only articles, dissertations, and books that examine the research question will be included in the study.

The process for determining if literature is useful will involve a series of critical steps: (a) Identify key questions and assumptions, (b) Use key questions and assumptions to conduct Online searches using keywords, (c) Scan abstracts, (d) Create detailed review of literature that discusses internal coaching or Green Belt knowledge creation, and (e) Conduct note taking to make an annotated bibliography. The annotated bibliography will be organized in Microsoft Excel so sorting is enhanced. Recognizing there is limited literature published about internal coaches and Green Belts, and noting that the published literature tends to focus on Black Belt issues (Zhang et al., 2011), it will be relevant to find any case studies, literature reviews, or empirical studies that explore the conditions of knowledge creation in the context of a Six Sigma process improvement project or a Six Sigma organizational development initiative. It will also be appropriate to capture best practices regarding internal coaches and knowledge creation. To this point, recent recipients of the Baldrige National Quality Award will be reviewed using the winners’ reports for possible insights. Finally, it will be relevant to identify any research instruments which may be appropriate for data collection.

The key questions and assumptions to manage the On-line searches are as follows: (a) How do internal coaches influence knowledge creation? (b) What behaviors for coach and team members are prominent? (c) What insights may contribute to the best practice model? (d) Does coaching of projects create better knowledge compared to projects without a coach? (e) Is behavior different in a knowledge-creating team? (f) Is there a knowledge creation, best-practice model? The review of the literature will be limited in the following way. Literature will be limited to projects using Six Sigma basic problem solving approach at the Green Belt project level. External coaches will be excluded because they lack understanding of company culture and relationships held by an internal coach. The study will not validate the adoption of the best-practice model. The literature will focus on experiences in the United States. While reviewing the literature, the following assumptions will be made: (a) The need for internal coaches will continue for Green Belt projects, (b) Knowledge creation through Green Belt activity is beneficial, (c) Internal coach and team behavior influence knowledge quality, (d) A best-practice model strengthens Six Sigma Body of Knowledge, and (e) Research is needed.
to understand Green Belt knowledge creation. The importance of performing a literature review about internal coaching will be discussed next. Internal coaching will be considered within the context of the Six Sigma quality improvement methodology in terms of its history, challenges, and opportunities.

**Importance of Performing a Review of the Literature about Internal Coaching**

The value of Six Sigma quality improvement methodology for financial outcomes is well documented (Breyfogle, 2003; Bhanushali, 2010; Chase, Jacobs, & Aquilano, 2004; De Mast, 2006; Gitlow & Levine, 2005; Goh, 2010; Maguad, 2006; Pande, Neuman, & Cavanagh, 2002; Pyzdek & Keller, 2009; Jones & George, 2011). By comparison, the value of Six Sigma for development of knowledge is less understood (DeRuntz, 2005; Eckes, 2001; Gobeille, 2006; Choo, Linderman, & Schroeder, 2007; Hagen, 2010). Recent research outlines opportunities for development of a Six Sigma management theory including greater understanding about how human resource policies and practices support the improvement approach (Zhang, Hill, & Gilbreath, 2011).

This study contributes to the Six Sigma Green Belt body of knowledge by examining how internal coaches support project teams to create knowledge. The study aims to recommend a best-practice model. Organizations cannot sustain their improvement with cost reduction by itself as a strategy because this is easily imitated in the market (Shane, 2009). A more holistic strategy that includes knowledge creation provides potential for competitive advantage. It is difficult to imitate. It is also more engaging for organizational members as a learning organization (Davison & Al-Shaghana, 2007; De Mast, 2006; Gobeille, 2009; Hagen, 2010; Pollock, 2010).

The literature review process yields a body of recent research largely published since 2006, including (a) 52 peer-reviewed studies from 34 journals, (b) 3 dissertations, and (c) 35 books. This comprehensive literature review indicates an opportunity to expand the Six Sigma body of knowledge by focusing on Green Belts. This is useful since Six Sigma programs empower Green Belts, so the Green Belts may then influence other associates through successive improvement projects. Knowledge creation at the Green Belt level is critical for the maturity of a Six Sigma program.

The source materials, when grouped into common themes based on analysis of the source materials, reveal relevant research categories. Figure 1 shows a Pareto Chart in which the research studies are grouped into common thematic categories, and the categories are ranked in descending order by count of research studies. The research studies are listed in the Reference section. Figure 1 indicates there is
significant research about coaching (although not necessarily internal coaching relative to Six Sigma Green Belts), some research about Green Belt team development (i.e., training), and no research about knowledge creation at the Green Belt level. The coaching studies review Six Sigma around one-third of the time (5/16 studies) without regard to Green or Black Belt levels (Bourg, Stoltzfus, McManus, & Fry, 2010; Box, 2006; Gobeille, 2006; Hagen, 2010). The other coaching studies examine executive or other development coaching applications. Figure 1 and three recent dissertations by DeRuntz (2005), Gobeille (2006), and Hagen (2008) resulted in the three themes of interest for this study. The themes are the following: internal coaching actions, Six Sigma Green Belt project team developmental requirements, and knowledge creation processes and outcomes.

The Six Sigma literature is provided by a small research group. Figure 2 shows the direction of published studies reviewed. The studies originated from 34 different peer-reviewed journals suggesting the broad academic discipline interest in Six Sigma as a research area. The research study will contribute to the Six Sigma body of knowledge. Approximately one-third of all studies use statistical analysis. Research continues to emphasize qualitative studies. The goal of the qualitative research is to create a common language for understanding Six Sigma.

Approximately one-third (19/55) of the qualitative studies originated from traditional quality management journals, including Total Quality Management, Total Quality Management & Business Excellence, The Journal for Quality & Participation, and Quality Management Journal. There remains a significant amount of research opportunity to understand Six Sigma (Zhang et al., 2011) in general and this study’s research question in particular: What is the relationship between internal coaching of Green Belts and the perception of their results for knowledge creation in the United States? The summary of the literature review process is discussed next.

Summary of the Literature Review Process

Thus, the literature about the themes of interest for internal coaching actions, Six Sigma Green Belt project team developmental requirements, and knowledge creation processes and outcomes will contribute to the body of knowledge for Six Sigma intervention. These themes will be considered in a comprehensive manner. Attention will be paid to thematic definitions, history, objectives, and empirical research. This will provide potential links between the themes. The linkage will allow consideration about the research question of the relationship between internal coaching of Green Belts and
FIGURE 1

Focus of Studies Reviewed 2006-2011

SOURCES: Literature Reviewed for dissertation. Totals include 3 dissertations which researched coaching (2) and training (1).
FIGURE 2

Trend of Annual Published Studies

NOTE: Based on 52 studies from 34 peer-reviewed journals and 3 dissertations (1 dissertation published in 2005 but added to 2006 totals). 35 books identified but excluded from graph since their publication dates were prior to 2006. The books did provide invaluable reference information.