Six Sigma Leadership:

A Study of Six Sigma Black Belts in Conjunction with Transactional and Transformational Leadership

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Dissertation.com
Boca Raton, Florida
USA • 2008

ISBN-10: 1-59942-690-0
ISBN-13: 978-1-59942-690-7

Abstract

Six Sigma is a quality improvement initiative that has evolved over 20 years and is utilized in organizations around the world. The initiative is deployed by a variety of personnel, with Six Sigma Black Belts facilitating the individual projects that serve to reduce waste and enhance customer value throughout all departments within organizations. Extensive education and training is required to become a Six Sigma Black Belt; however, this training rarely, if ever, contains leadership training. As leadership is important to the overall success of the Six Sigma projects and thus, the overall initiative, it is important to know if Six Sigma Black Belts have adequate leadership skills to facilitate Six Sigma project teams. This study serves to quantify Six Sigma Black Belts' leadership abilities through Bass and Avolio's Multifactor Leadership Questionnaire.

Dedication

This dissertation is dedicated to my friends, family, and co-workers who provided a wealth of encouragement and patience while I finished this project. This is specifically for my grandmother from whom I inherited my drive and determination, as well as her daughter, whose words, “Do not start something you are not going to finish,” continually haunt me, and to my closest friend who would not let me give up.

Acknowledgements

The author would like to express sincere gratitude to committee members Dr. Nigel Searle, Dr. Kathleen Roth, and Dr. Andrew Ghillyer, as well as many other faculty and students at Argosy University for their support and guidance in the planning and implementation of this research project. The deepest appreciation is further offered to the managers and employees of Quality Digest, American Society for Quality, and other organizations for their participation in the research study. Without their contributions of time and resources, this study would not have been possible.

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CHAPTER I: THE PROBLEM

Introduction

For organizations to remain successful there must be continual adaptation and improvement of products and services in order to stay ahead of the competition while meeting all stakeholders' needs. This requires effective leadership throughout the organization. As many have realized this necessity, for decades there has been much discussion and research on both leadership and quality improvement initiatives used in U.S. organizations.

The search for methods to improve the way organizations work extends back over a century. It includes Frederick Taylor's fatigued assembly-line worker study in 1919 and its resulting productivity and quality improvement, which helped establish management philosophies that are still in operation today. Flora Ayeni's research conducted in May 2003 tied Taylor's work to Total Quality Management (TQM), where "management is seen as providing the impetus for making total quality the guiding process of the organization" (p. 22). The cost of quality and the problems that plagued U.S. organizations were later highlighted by the works of W. Edwards Deming, Philip B. Crosby, and Joseph M. Juran (Bremer et al., 2005). Juran and Deming brought their ideas of improving quality and reducing variability to Japan, a country that consequently named one of its quality awards the Deming Prize. "Crosby defined quality as 'meets requirements,'" while Juran "promoted the use of team activities for improvement" and authored the "Quality Handbook" (p. 150). Their contributions allowed management to better understand how an investment in quality improvements ultimately costs less than the waste created by poor quality, including the loss of the customer; however, it failed to focus on the overall profitability of the organization (Keller, 2005). At the same time, without their pioneering work in quality initiatives combined with contributions from other fields,

organizations would not have the ability to continue making advancements in productivity and customer satisfaction. Furthermore, while TQM is still practiced today, Ayeni's research shows that firms changing from TQM to Six Sigma report greater profitability under Six Sigma.

Background

"Sigma (σ) is the Greek letter used by statisticians to denote the standard deviation for a set of data" and "is used to describe how well the process variation meets the customer's requirements" (Keller, 2005, p. 3). This measurement focuses on defects per million opportunities (DPMO). Most companies operate between a four and three sigma level, allowing 6,210 to 66,807 DMPO (Lucier & Seshaadri, 2001), whereas six sigma level processes only allow 3.4 defects, bringing the quality level of that process to 99.9997%.

During the 1980s, Motorola joined the quality movement seeking to reduce product defects on the manufacturing floor and received help from engineers Bill Smith and Mikel Harry (Eckes, 2005) who are credited with developing Six Sigma. In 1988, Motorola won the Malcom Baldrige Quality Award and published its results along with its use of Six Sigma. Six Sigma was different from quality initiatives of the past in that it became about "helping the organization make more money by improving customer value and efficiency" with the benefits going "straight to the bottom line" (Pyzdek, 2003, p. 5). While this may have been the origin of the Six Sigma initiative, its popularity was primarily due to other large organizations' utilization of the initiative and their successes with it. Specifically, Allied Signal and General Electric (GE) became pioneers in the Six Sigma quality initiative, reporting significant benefits. Allied Signal reported productivity gains of 6% in the first two years using Six Sigma (DeFeo, 2000), and GE Medical Systems reporting $91.2 million in customer benefits on more than 466 projects in one

year (Lucier & Seshadri, 2001). Many other companies have since adopted Six Sigma and reported similar results.

It has been almost two decades since Motorola won the Malcom Baldrige Quality Award, and unlike quality initiatives of the past, Six Sigma's use continues to expand throughout corporate America. With later developments and specifications of Design for Six Sigma (DFSS) and Lean processes, Six Sigma continues to mark successes that should silence its worst critics. The many reasons for Six Sigma's success include its focus on an organization's processes and customers. Another key element is the Six Sigma projects, as they are primarily focused on organization objectives through the reduction of defects and variation. Further, many of its achievements have been attributed to senior management support and the leaders that carry out Six Sigma initiatives because they tend to provide clear values and objectives while following fact-based management concepts (Caulcutt, 2001).

As stated in the *Six Sigma for Dummies* handbook, "no matter how hard you try to accomplish anything, it's always easier when you follow a proven methodology" (DeCarlo et al., 2005, p. 42). When undertaking a new Six Sigma project, the key format to follow is Define-Measure-Analyze-Improve-Control (DMAIC). "In DMAIC, business processes are improved by following a structured method with set steps" (p. 42). During the Define stage, the problem is identified with clear goals and objectives set for the project. The Measure stage is where the project team uncovers and understands the baseline of "performance and capability of the process or system being improved" (p. 42). The Analyze stage is when Six Sigma tools and data analysis are used to better understand the relationships between the processes and areas of concern. In the Improve stage, the modifications are developed, leading the project team to the ultimate objectives previously outlined. Finally, in the Control stage the team implements the

changes, including methods to monitor performance to sustain results. This important methodology is "a proven solution for process problems and improving business performance" (p. 42) that allows the project team to clearly define its mission and find areas in need of improvement, bringing Six Sigma projects to life. DMAIC is the key to running a Six Sigma project and is the main focus during the project team's assignment.

With such great importance placed on the actual Six Sigma projects and following the DMAIC methodology, the initiative deployment depends heavily on the people involved, including upper management's top-down approach and support, as well as the Six Sigma Champions and Master Black Belts who act as support and project managers. Other key participants include the Black Belts who facilitate the individual Six Sigma projects, as well as the Green Belts and team members who assist. As such, people are the key to Six Sigma success and longevity in organizations today. As Thomas Pyzdek states in *The Six Sigma Handbook* (2003):

> One doesn't achieve objectives by directly manipulating results, but by changing the way things are done. The driving force behind this change is the 'belts,' who are highly trained full- and part-time change agents. These people lead and support projects, and it is the projects that drive change. (p. xvii)

The belt terminology was coined by Dr. Mikel Harry, one of Six Sigma's founders from Motorola, while working to train others Unisys in the late 1980s. Specifically, "like a person skilled in the Oriental sport of karate, the Six Sigma Black Belt is self-assured and knowledgeable, the result of intensive training and real-world experience" (Chadwick, 2007, p. 1). In addition, while some Six Sigma organizations use different terms, the "Green Belt/Black Belt/Master Black Belt designations have emerged as generally accepted business terminology"

(p. 1). Regardless of the designation, leadership is crucial to the success of Six Sigma projects. Thus, it seems that strong leadership training and/or finding experienced leaders would be critical to the deployment of any organization's Six Sigma effort.

Although Black Belts are required to endure extensive training to earn their certifications, many of the training courses do not specifically address leadership issues or techniques and do not have prerequisites of such. Rather, Black Belt training provides an extensive, comprehensive training in statistics, namely statistical process control (SPC), so that Black Belts can assist their team members and build the case for change around each project. The training typically takes four weeks to six months and costs $900 to $15,000. The Black Belt must also pass a test and/or successfully complete a project before earning certification. As previously suggested, Black Belts are critical in leading their teams to find and initiate the changes required for Six Sigma projects. While Black Belt training does not always contain the soft skills necessary for leading these teams, Six Sigma projects continue to be immensely successful.

Research suggests that Six Sigma "follows both the transformational leadership type and transactional style by setting goals, communicating, encouraging, training, rewarding for compliance and maximizing external resources to increase company's bottom line" (Ayeni, 2003, p. 1). Since the mid-1970s, Bernard Bass has been writing about the differences between transformational and transactional leaders and has developed the full-range model of leadership "to broaden the range of leadership styles typically investigated in the field" (Avolio & Bass, 2004, p. 1). Bass' work identified that "whereas transformational leaders uplift the morale, motivation, and morals of their followers, transactional leaders cater to their followers' immediate self-interests" and what the organization can do for them (Bass, 1999, p. 9). Bass' work with Bruce Avolio also led to the development of the Multifactor Leadership Questionnaire

(MLQ), which measures the candidate's degree of transformational or transactional leadership style. In 1991, Bass and Avolio found that "leaders who are more satisfying to their followers and who are more effective as leaders are more transformational and less transactional" (p. 11). Additional research discussed in Chapter 2 shows that transformational leadership is tied to higher levels of performance within organizations. Though validated by research discussed herein, the MLQ continues to be refined by its authors, with the MLQ Form 5X currently being used. Bass and his colleagues continue to engage in extensive research, working to prove that the effective styles of leadership exist, thereby giving the survey tool more practical use in today's search for quality leaders.

Purpose of the Study

Research shows that leadership is crucial to the overall success of a Six Sigma initiative. It is also evident that a Six Sigma initiative is heavily dependent upon individual projects' successes, which Black Belts facilitate. With so much weight placed on these key factors, organizations must be assured that Six Sigma project team facilitators (i.e., Black Belts) have adequate skills to lead projects.

Research Question

Do Six Sigma Black Belts have enhanced leadership skills?

Hypotheses

$H1_0$ = Six Sigma Black Belts do not have higher scores on the MLQ transformational leadership component, Idealized Influence – Attributed (IIA), than non-Six Sigma Black Belts.

$H2_0$ = Six Sigma Black Belts do not have higher scores on the MLQ transformational leadership component, Idealized Influence – Behavioral (IIB), than non-Six Sigma Black Belts.

$H3_0$ = Six Sigma Black Belts do not have higher scores on the MLQ transformational leadership component, Inspirational Motivation (IM), than non-Six Sigma Black Belts.

$H4_0$ = Six Sigma Black Belts do not have higher scores on the MLQ transformational leadership component, Intellectual Stimulation (IS), than non-Six Sigma Black Belts.

$H5_0$ = Six Sigma Black Belts do not have higher scores on the MLQ transformational leadership component, Individual Consideration (IC), than non-Six Sigma Black Belts.

$H6_0$ = Six Sigma Black Belts do not have higher scores on the MLQ transactional leadership component, Contingent Reward (CR), than non-Six Sigma Black Belts.

$H7_0$ = Six Sigma Black Belts do not have higher scores on the MLQ transactional leadership component, Management by Exception – Active (MBEA), than non-Six Sigma Black Belts.

In order to conduct research on the above hypotheses, MLQ scores from a sample of Six Sigma Black Belts were compared to a Control Group of published normative samples by this author who is also a Six Sigma Black Belt. A significance test, namely the z-test, was conducted on each component in order to determine if the difference in the mean from the Six Sigma sample was statistically significant as stated in the hypotheses.

Definition of Terms

Six Sigma Roles: The personnel who are directly responsible for the Six Sigma program itself include Six Sigma Champions, Master Black Belts, Black Belts, and Green Belts, listed in hierarchical order.

Six Sigma Champions are those who are ultimately responsible for the identified Six Sigma project and need to serve as liaisons between the Six Sigma team and upper management.

Six Sigma Master Black Belts serve as trainers and coaches for Black Belts and the rest of the organization.

Six Sigma Black Belts work as team facilitators on Six Sigma projects.

Six Sigma Green Belts are lower in the hierarchical chain than Black Belts. They are trained in the basics of Six Sigma and serve on project teams, while continuing to operate in their everyday jobs.

Training: The coursework and education necessary for someone to become a Six Sigma Black Belt.

Leadership Skills and/or Attributes: Traits of a person in charge of a team and/or group of people that is responsible for accomplishing certain goals and objectives.

Transformational Leadership: While there is no universal definition for the purpose of this study, transformational leadership is a leadership style where the leader engages and motivates followers while also assisting with the followers' leadership development.

Transformational Leadership Scores: Results from MLQ testing components called Idealized Influence-Attributed (IIA), Idealized Influence-Behavioral (IIB), Inspirational Motivation (IM), Intellectual Stimulation (IS), and Individualized Consideration (IC).

Transactional Leadership: While there is no universal definition for the purpose of this study, transactional leadership is a leadership style where leaders clarify what their followers need to do for their reward.

Transactional Leadership Scores: Results from MLQ testing components of Continent Reward (CR) and Management by Exception – Active (MBEA) factors.

Control Group: International normative samples Avolio and Bass previously collected and published in 2004 on other self-rated scores from the MLQ. (There are 7,268 total reporting on the self-rated scales.)

Limitations and Delimitations of the Study

The proposed study is limited in that the MLQ is self-reported. While the survey tool also offers 360-degree methodologies, it is not appropriate for this study. Though the tool is a self-assessment, it has been validated by internal and external examinations. (The validity and reliability of the survey tool are investigated within the following chapters.) The results will also be compared to the Control Group, which consists of other self-reported data; however, the raw data from the Control Group is unavailable. This poses another limitation as the demographics of the Control Group (outside of the geographic location) are unknown. As the sample size is larger (i.e., 3,755), it can be assumed that it is normally distributed and representative of the population being tested.

There is also criticism of the proposed questionnaire in that the various types of leadership (transactional, transformational, and passive/avoidant) are not easily determined in the survey results. The MLQ is in its third edition and has been evolving over the past 25 years. It has been tested internally as well as externally and is widely used as a leadership determinant within organizations and fields of research. Furthermore, as the research project is not looking to define the type of leader, that specific limitation is acknowledged but deemed irrelevant. This study will attempt to compare Six Sigma Black Belts and their scores to the Control Group to determine if a difference exists.

In comparing non-Six Sigma Black Belts to the Control Group, it is possible that Six Sigma Black Belts are included in the results used as the Control Group. If the same respondent

is in both groups, it will prove more difficult to reject the null hypotheses, as the difference between the scores will be lower.

Additional limitations are similar to those in other studies, such as the number of respondents, the demographics may not be representative of the overall population, and the use of specific statistical analysis tools. It should be noted that limitations related to the analysis of the data are discussed in detail in Chapter 3.

Significance of the Study

Showing that Six Sigma Black Belts have enhanced leadership skills provides the assurance necessary to continue using trained Six Sigma Black Belts for the facilitation of the critical independent projects. It also allows organizations to recruit future organizational leaders from their population of Six Sigma Black Belts, knowing the long-term benefits the individuals may bring to the organization.

If the null hypotheses are accepted, however, it provides insight for Six Sigma Black Belt training organizations to enhance leadership training within their programs. It also suggests that Black Belts should work to enhance their leadership skills prior to assuming the role of project team facilitators to provide a greater likelihood of success for the Six Sigma projects and overall initiative.

Study Overview

A survey consisting of qualifying demographic questions as well as the self-reporting, 45-question MLQ survey was given to Six Sigma Black Belts. Candidates were sought through two online Black Belt communities and a single Six Sigma public corporation. This data was analyzed using statistical processing software to answer the proposed hypotheses stated above.

CHAPTER II: LITERATURE REVIEW

Introduction

Organizational and self-improvement continue to evolve, with many practitioners finding new ways to achieve each. Although many quality improvement programs have come and gone over the past century, Six Sigma has continued to be enhanced and utilized for the past two decades. Similarly, leadership is a topic that many have analyzed and researched. Six Sigma and leadership both have deep roots but continue to be topical today. While many can attend workshops or read popular media outlets' reviews on each subject, including Fortune Magazine's October 2007 *Special Leadership Report* with the front cover advertising Geoff Colvin's article, *How To Be A Great Leader: Secrets from GE, P&G, American Express and More*, the literature review herein will focus on academic research. This will include textbooks and peer-reviewed journals to provide a background of Six Sigma and leadership. Regardless of the medium, both Six Sigma and leadership continue to be discussed frequently, suggesting the business population continues to search for answers.

Literature Review: Six Sigma

Six Sigma, which was developed by engineers at Motorola in the 1980s in order to improve product quality, has many similarities to other quality improvement initiatives used in the past. For instance, the turn of the 20th century brought Frederick Taylor's Scientific Management Theory, which identified standards and measures for work products and tasks (Bremer et al., 2005). Taylor's theory enhanced productivity and was utilized in the automotive industry in the 1950s and continues to be used today. Also, in the 1950s, Toyota's lean production system used Just-in-Time and the Kanban flow system to eliminate wasteful activities that used resources without creating value (Albright & Lam, 2006). Around the same time, the

American statistician W. Edwards Deming "pioneered the use of statistical techniques to understand and improve processes" (p. 159). Utilizing the work of Bell Laboratory's Walter Shewart, Deming improved upon Statistical Process Control (SPC), suggesting that variation was not random or by chance and should be located and eliminated (Pyzdek, 2003, p. 324). SPC and Quality Circles, where groups of employees worked to continuously improve the processes within their control for the betterment of the organization (p. 169), were also successfully used by the Japanese. Many of these theories and systems have evolved into quality improvement initiatives and continue to be used today on a global scale.

It was not until the U.S.'s economic climate started to change in the late 1970s and early 1980s, including decreased inflation and a strong dollar, that U.S. firms began to experience intense foreign competition. This "resulted in a need for revisiting expenditures and cost calculations, and developing management initiatives" (p. 162). During the same period, the International Organization for Standardization (ISO) standards were being developed and adopted throughout the world. As organizations looked to become more competitive and meet ISO standards, quality improvement initiatives were heavily sought. It should also be noted that "military standards played a significant role improving manufacturing in the United States because contractors had to meet certain quality standards to earn military contracts" (Albright & Lam, 2006, p. 160). The U.S. Congress also got involved in the quality movement by establishing the Malcolm Baldrige National Quality Award in 1987 to encourage U.S. organizations to improve their quality. Twenty years later, the quality movement continues.

One of the many initiatives used is Total Quality Management (TQM). TQM was developed as a holistic approach to quality, driving it throughout all levels of an organization through training, empowerment, and ownership of processes (Cummings & Worley, 2005).

TQM strives toward continuous improvement through all activities of an organization, while looking to control costs and meet customer requirements; however, at one point, "there were over 400 TQM tools and techniques" (Pyzdek, 2003, p. 4). This, alone, made it difficult to sustain results in many organizations. Thus, TQM's popularity has faded among many U.S. firms. Several U.S. organizations also had difficulty adopting Quality Circles, which were working well for Japanese organizations. Therefore, new quality initiatives needed to be developed to resolve the quality dilemma.

With continuous improvement goals, similar to TQM and Quality Circles, two new developments emerged, the Theory of Constraints and Process Reengineering. Both focused on process improvement. The Theory of Constraints (TOC), developed by Goldratt and Cox in 1986, primarily sought to identify and maximize constraints in any given process. Once the identified constraint was maximized and controlled, it would theoretically no longer be a bottleneck. Afterwards, a new bottleneck would emerge and TOC would be applied to the new constraint. Next, Process Reengineering was developed later in the 1990s to enhance process productivity and efficiency. Eventually, the new processes created through the reengineering program typically led to workforce reduction, which caused Process Reengineering to lose its popularity (Pyzdek, 2003).

As U.S. organizations worked to regain or hold onto their competitive advantages through lower costs and better technology and/or superior quality, quality improvement initiatives were brought to the forefront of many organizations at a strategic level. As previously mentioned, the U.S. Congress created the annual Malcolm Baldrige Award to encourage organizations to improve. The award required the winner to publish its success story, including the background and systems that were recognized in winning the award. The Motorola