The Relationship between Perceived Managerial Coaching and Six Sigma Outcomes

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DEDICATION

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ABSTRACT

This study investigated the impact of coaching expertise on project outcomes within the Six Sigma context. Survey data were collected from 140 Black Belts and 176 Team Members at six organizations. Black Belts responded to the *Black Belt Project and Learning Instrument*, while Team Members responded to the *Project Team Coaching and Outcomes Assessment.* To determine whether any of the variables were related, independent variables: Project Characteristics, Coaching Expertise, Employee Focus, Years of Experience, Number of Projects Completed, Education Level, and Number of Projects in a Team (answered by Black Belts only) were related to the dependent variables Team Outcomes, Customer/Project Outcomes, Organizational Outcomes, and Bottom-line Dollar Outcomes linear regression was used. The data were analyzed for two groups: Black Belts, and Team Members, using descriptive statistics, principle component factor analysis, correlation, Moods Median, and regression analysis.

The results of the regression analyses showed that the independent variable Coaching Expertise explained most of the variance in the dependent variable Team Outcomes for Black Belts, and for Team Members. Coaching Expertise also explained most of the variance of Customer/Project Outcomes and Organizational Outcomes for Black Belts and for Team members.

The results of the regression analyses also showed that the independent variable Project Characteristics explained a portion of the variance in the dependent variables Team Outcomes for Black Belts, and for Team Members. Project Characteristics also explained a portion of the variance for the dependent variables Organizational Outcomes for Black Belts and for Team Members. Project Characteristics explained a small portion

of the variance for the dependent variable Bottom-line Dollars for Team Members. The results of the regression analyses showed that the demographic independent variable Number of Completed Projects explained a portion of the variance for dependent variables Customer/Project Outcomes and Organizational Outcomes for Black Belts.

Finally, the independent variable Employee Focus explained a small portion of the variance in the dependent variable Team Outcomes for Black Belts and for Team Members. Other independent variables: Education Level and Number of Projects as a Team Member (for Black Belts only), had no significant relationship to any of the dependent variables.

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CHAPTER 1

INTRODUCTION AND BACKGROUND

> *I cannot resist the temptation to say that I was well aware of the crucial importance of human relations in a corporate setting even in the early days of my business career.... My instinct, and perhaps my conscience, dictated to me that I should trust my employees if I expected them to trust me. I must have full confidence in their ability to learn and their potential for personal growth.*
> -Konosuke Matsushita, 1989, founder of Panasonic Electronics and quality visionary

Six Sigma is an organizational structure that resides outside of normal operations, and is developed in an attempt to reduce variation in business processes. The process improvements that take place within the Six Sigma structure are directed by improvement specialists who use a structured method and performance metrics with the aim of achieving strategic objectives for the organization (Schroeder, Linderman, Liedtke, & Choo, 2007). The practices employed within the Six Sigma structure help reduce variation and waste within an organization, through the use of the prescriptive DMAIC method, which is an acronym for the methodology used, and includes the interconnected phases of a process improvement project: Design, Measure, Analyze, Improve, and Control (Harry & Schroeder, 2000). Six Sigma was invented at Motorola during the late 1980s, further developed within other organizations such as GE and AlliedSignal in the mid to late 1990s, and is deployed through the training and development of specialists, called Black Belts, who lead process improvement efforts (Kaissi, 2005; Schroeder, et al., 2007).

At the time of Six Sigma's inception, increased competition, globalization, and complexity in the workplace were leading to the creation of organizations that were flatter and leaner in terms of their organizational structure, and more robust in terms of

their capacity for change and ability to cut costs (Douglas & Erwin, 2000; Hall & Torrington, 1998; Hiltrop, 1998; Thevnin, 2004). Thus, the Six Sigma methodology arose out of attempts to engage the workplace in new techniques to help managers forge through the more global, complex, and competitive landscape of business, while maintaining competitive advantage (Linderman, Schroeder, Zaheer, Liedtke, & Choo, 2004; McAdam & Lafferty, 2004). Businesses of today continue to work within the contexts of globalization, increased competition, and the need for creating competitive advantage, and Six Sigma continues to be seen as one technique to help organizations forge through these issues effectively, through process and quality improvement efforts (Schroeder, et al., 2007).

Coaching, meanwhile, is a process by which a manager, through guided discussion and guided activity, helps a member of his/her staff to solve a problem or carry out a task more efficiently and/or effectively. The focus is on practical improvement of performance and development of specific skills (Kalinauckas & King, 1994), and, while used to improve the performance of the individual worker, when used effectively, has the potential for improving the performance of the organization, overall (Ellinger, Ellinger & Keller, 2003a; Hunt & Weintraub, 2002). This is done through guidance, encouragement, and support of the learner (Redshaw, 2000).

There are specific skills and behaviors that, when applied during interactions with others within the organization, and employees specifically, help to encourage the development of a high-performance workplace through the valuation and support of learning (Ellinger, et al., 2003a). Thus, the implementation and development of coaching skills and behaviors of individuals charged with managing others within formal

organizations is rooted within the need to improve operational performance in today's business environ (Ellinger, et al., 2003a; Hall & Torrington, 1998; Hamlin, Ellinger & Beattie, 2006). Thus, managerial coaching and Six Sigma each arose out of attempts to engage the workplace in new techniques to help managers forge through the vastly different landscape of business, while maintaining competitive advantage (Douglas & Erwin, 2000; Ellinger, et al., 2003a; Hall & Torrington, 1998; Hamlin et al., 2006; Linderman, et al., 2004; McAdam & Lafferty, 2004; Schroeder, et al., 2007).

The literature purports that a relationship between coaching and process improvement, via Six Sigma efforts, does exist. The thread that links these topics is the repeated call for a closer focus on human resources, and the way that relationships within the workplace impact the learning and subsequent performance of an organization (Choo, Linderman & Schroeder, 2007a; Dahlgaard & Dahlgaard-Park, 2006; Ellinger, 1999; Ellinger, et al., 2003a; Graham, Wedman & Garvin-Kester, 1993; McAdam & Lafferty, 2004; Powell, 1995; Samson & Terziovski , 1999).

This chapter will bring the relationship between Six Sigma and coaching to light, as well as describe the intent of this dissertation by reviewing the following: (a) the link between coaching behaviors and improved employee and organizational performance, (b) the relationship between human factors, such as open communication, empowerment and management commitment; and organization performance, and (c) the relationship between human factors such as open communication, empowerment, and management commitment and Six Sigma performance. After these sections are examined, the Statement of the Problem, Need for the Study, Purpose of the Research, and Research

Questions will be covered. Finally, the organization of the paper and key definitions will be reviewed.

Linking Human Factors and Organization Performance

Ellinger, et al. (2003a) studied the coaching behaviors of line managers and their effects upon both employee satisfaction and performance. They found that not only did employees of managers who exhibited coaching behaviors have increased job satisfaction, but they also exhibited greater job commitment and better job performance. Ellinger (1999) also found a link between the coaching behaviors of individual managers and improved employee performance and increased cost saving practices, and thus improvements to an organization's financial performance.

Meanwhile, Graham, et al. (1993, 1994) revealed that managers who attended coaching training exhibited increased use of coaching in the following areas: (a) expressing performance expectations, (b) providing feedback, (c) providing relevant information, and (d) rewarding performance. The managers' increased use of coaching behaviors resulted in a direct correlation with increased sales by sales departments, thereby providing another example of how managerial coaching positively impacted organizational performance. Thus, there appears to be a link in the literature between the exhibited use of managerial coaching behaviors and organizational success.

The relationship between human factors (also referred to as soft skills) and organizational performance has been also been explored within the context of Total Quality Management (TQM) by Powell (1995), who found that the TQM methodology is only able to provide competitive advantage when the organization specifically focused on

the TQM processes related to open communication with employees, employee empowerment, and managerial commitment. Apparently, no amount of tactical deployment strategies, such as quality training and benchmarking, helped to improve organizational competitive advantage when the soft skills of open communication, empowerment, and management commitment were not in place. It is notable that many of the skills Powell described as *soft skills* are similar to, or fully match, those described within the coaching literature, such as empowerment and communication (Beattie, 2002; Ellinger & Bolstrom, 1999).

In similar research, Samson and Terziovski (1999) found that leadership skills, management of people, and customer focus each had a strong positive relationship with company performance; other elements, such as process management and information gathering, did not. The elements that are essential to managerial coaching are also positively related to successful quality improvement. Thus, the concepts of open communication, employee recognition, and employee involvement found in the coaching literature (Ellinger, et al., 2003a, 2003b; Mink, Owen, & Mink, 1993) are listed as elements that are positively related to company performance through specific quality improvement methodologies within the Quality and TQM literature (Powell, 1995; Samson & Terziovski, 1999).

Linking Human Factors and Six Sigma

The argument that improving business processes through the use of coaching is also made through an examination of the following Six Sigma literature. First, McAdam and Lafferty (2004) found that employee involvement and motivation are often lacking in Six Sigma implementation efforts, but are necessary for program success. Specifically,

in order for Six Sigma to be not only successful but also embedded as a structure and methodology within an organization, employees within the Six Sigma organization need to be empowered, rewarded, and provided with an opportunity for two-way communication, all of which play a role in the success or failure of the Six Sigma methodology within an organization.

Similarly, Dahlgaard and Dahlgaard-Park (2006) found that Six Sigma companies that did not focus on human factors were less likely to succeed. Through their extensive comparative analysis they found that Six Sigma, along with other quality management systems such as TQM or lean manufacturing, is only successful in organizations that have a culture prepared for implementing these enterprises successfully. The culture that is necessary for TQM and Six Sigma success requires that the organization (a) create and communicate the linkage between personal/employee tasks and values, and goals of the organization, (b) establish trust, and (c) engage in open communication (Dahlgaard & Dahlgaard-Park, 2006). Linking work to broader organizational goals, building trust, and establishing open communication are elements of coaching (Ellinger & Bolstrom, 1999).

In summary, the preceding three studies referred specifically to communicating openly with employees, involving them in the implementation process, building trust, and supporting their learning, all of which fit under the coaching umbrella.

Finally, the grounded theory framework developed by Choo, Linderman, and Schroeder (2007b), helped to build a bridge between the literature on coaching and Six Sigma. The authors demonstrated the essential elements of a successful Six Sigma quality management system. They discovered the conceptual frameworks that support the organizational contexts that guide Six Sigma implementation and the learning that

drives it, through the inclusion of such essential organizational elements as leadership support, providing challenging work, and developing trusting relationships. Each of the contexts Choo, et al. (2007b) call for, including leadership support, challenging work, and trusting relationships, are also essential elements of managerial coaching (Beattie, 2002; Ellinger & Bolstrom, 1999; Graham, et al., 1994; Hamlin, et al., 2006).

Thus, the thread that links coaching and Six Sigma, as exhibited in the literature, lies in the repeated call for managers to engage in behaviors that promote empowering, supportive, trusting relationships, as well as providing employees challenging work in which open communication exists, thereby driving greater learning processes within organizations (Choo, et al., 2007b; Dahlgaard & Dahlgaard-Park, 2006; Ellinger, 1999; Ellinger, et al., 2003a; Graham et al., 1993; McAdam & Lafferty, 2004; Powell, 1995; Samson & Terziovski, 1999).

The growing amount of evidence reviewed above has helped to establish coaching as contributory to overall organizational performance, as well as process improvement (Ellinger, 1999; Ellinger, et al., 2003a; Graham et al., 1993). This may have been a factor in the call for the integration of coaching into the Six Sigma context from writers in popular literature (Bertels, 2003; Harry & Schroeder, 2000; Pande, Neumann, & Cavanaugh, 2000). However, the issues noted within the popular literature have remained untested.

Six Sigma and Coaching: Learning Endeavors

Many managerial scholars and practitioners now see organizational learning as one avenue for pursuing competitive advantage (Ellinger & Bolstrom, 1999; Gherardi, 1999). Coaching, according to some, is a way for an organization's leaders to promote

and facilitate learning, and has become one of the major responsibilities of managers (Beattie, 2002; Ellinger, et al., 2003a; Evered & Selman, 1989; Gilley, 2000).

Six Sigma, too, is considered a way in which to increase the learning of organizational members (Choo, et al., 2007b). Thus, Six Sigma and coaching are related in that both are useful in helping to promote learning that is essential for sustained organizational performance (Sitkin, et al., 1994), which thereby helps to not only create competitive advantage for organizations (Probst, 1997) but helps to ensure the stability of society overall (Grant, 1996). Thus, while Six Sigma and coaching are clearly linked to each other through the call for greater focus on human factors within the Six Sigma context, as described in the previous section, they, too, are linked, as each is employed within organizations as a method for instituting learning by organization members.

Statement of the Problem

It has been suggested in the popular literature and other resources (e.g., Six Sigma Forum Magazine, T + D, papers published on the popular website isixsigma.com) that coaching be integrated within the Six Sigma context. However, to date there has been no scholarly research that has tested this relationship directly.

The problem addressed in the current research is derived from evidence suggesting that Black Belts receive little or no training in coaching skills specifically, as was highlighted by Brady (2005), who found that irrespective of the type of project led by Black Belts, his/her Six Sigma training focused on the Six Sigma tools, statistics, and prescriptive methodologies that are applied during Six Sigma implementation, rather than the soft skills necessary for leading groups of people (Antony, 2006; Bendell, 2005;

Hahn, Hill, Hoerl & Zinkgraf, 1999; Harry & Schroeder, 2000). Further, while there has been a call within popular literature suggesting that more focused attention be placed upon skills such as coaching that go beyond mechanistic learning (Bendell, 2005; Harry & Schroeder, 2000), it has not been emphasized. Thus, the problem is that while there have been calls for increased attention to providing Six Sigma training in skills that go beyond statistical knowledge, there is, to date, no scholarly research establishing a direct link between the expertise of a Six Sigma Black Belt's soft skills and the outcomes that Black Belt derives from his/her Six Sigma projects.

Need for the Study, Purpose, and Research Question

The deployment and implementation of a Six Sigma program is often quite costly. According to Dusharme (2007), while the cost of Six Sigma deployment for very small companies can be less than $10,000 per year, many large companies have invested over $10 million on the effort. The cost of Six Sigma implementation is important because a substantial portion of the total deployment cost is spent on the training and development of Black Belts and others (Dusharme, 2007), with about one third of companies investing over $1 million in Six Sigma training alone (Bryant, 2007). Even though the average return on investment for Six Sigma training has been reported at over 200 percent (Henderson & Evans, 2000), the importance of examining the cost of training and how training can be improved is still worth investigating. This is because, if coaching expertise does, indeed, have an have an impact upon the perceived outcomes of a Black Belt project, understanding the relationship between Black Belt coaching and perceived project outcomes may help to inform Six Sigma trainers about the importance of

integrating coaching training into Black Belt training. Further, an investigation of the impact that Black Belt coaching has on perceived Six Sigma outcomes could influence how training is conducted, ultimately encouraging improvements to Six Sigma. Finally, exploring this connection is important because the philosophy upon which process improvement strategies, including Six Sigma, have been built is the notion that all processes within an organization, no matter how effective they are already, can be improved upon, whether they are manufacturing processes, service processes, transactional processes such as billing or accounting, or design processes, including new product development.

The goal of process improvement is to reduce defects and waste, and to increase efficiency ad infintum, through the "re-creation of processes so that defects and errors never arise in the first place" (Harry & Schroeder, 2000, p.1). Philosophically, with such high standards of continuous improvement held to organizational processes, it seems natural that those standards would be applied to the Six Sigma methodology and Six Sigma training practices specifically. Based upon the high cost of training and development for Six Sigma Black Belts described above (Dusharme, 2007), and the potential benefits of improving their ability to coach individuals within project teams, there is a need to investigate how coaching impacts process improvement.

In summary, although there is an increasing competition in the marketplace that is forcing companies to make drastic changes to maintain competitive advantage (Bertels, 2003; Haikonen, Salolainen, & Jarvinen, 2004), Six Sigma seems to be providing many companies with the framework by which they can make significant gains in profit margin. Yet, there is a constant pressure to improve organizational processes in order to

maintain a leading edge (Halloway, Francis, & Hinton, 1999). This edge, according to Grant (1996), is necessary to ensure the survival of the broader society, through the concerted effort by individuals and organizations to show their legitimacy through profitability. That means organizations must continuously work to improve their internal processes and decrease defects in services and products, thus lowering the overall loss for society at large (Llorens-Montes & Molina, 2006) and helping to create a more stable society (Grant, 1996). Thus, Six Sigma should continue to be improved upon, even though it has been implemented at many companies with great success, in order to provide a means through which an organization can continually progress for the sake of both the individual organization and society as a whole.

The purpose of this research is to gather evidence to support or refute the call for training and development of Six Sigma Black Belts to include coaching skills. If coaching skills, indeed, have an impact on process improvement outcomes, then improvements to Six Sigma training, and thus the processes of Six Sigma deployment and implementation, can therefore be improved upon. Thus, the research question is: *What is the relationship between Black Belt coaching expertise and the perceived outcomes of their Six Sigma projects?*

Limitations

This research is limited in that it collected data only from Six Sigma Black Belts and their team members. Other members of the Six Sigma community were not included in the study. Further, this study is limited by the use of self-reported data, as will be described in Chapter 3.

Data were collected at six organizations, located in United States. Further, the organizations from which data were collected comprised a convenience sample, which precludes the generalizability of the research (Gall, Gall, & Borg, 2003).

Definitions

There are several key terms associated with this research on Six Sigma and coaching. Each is explained more thoroughly in Chapter 2, the Literature Review. These terms are:

Coaching: Coaching is a process by which a manager, through guided discussion and activity, helps a member of staff solve a problem or carry out a task more effectively. The focus is on practical improvement of performance and development of specific skills (Kalinauckas & King, 1994). This is done through guidance, encouragement, and support of the learner (Redshaw, 2000).

Managerial coach: One who encourages the development of a high-performance work environment through management practices that value and support the facilitation of learning (Ellinger, et al., 2003a).

Process improvement: A systematic approach to help organizations achieve significant changes in the way they do business, through the implementation of specific projects (Forster, 2006).

Project: A temporary organizational endeavor set to achieve a specified goal under the constraints of time, budget, and other resources (Shenhar & Dvir, 2007a).

Six Sigma: An organized parallel meso-structure (outside of normal operations) that reduces variation in organizational processes by using improvement specialists, a

structured method, and performance metrics with the aim of achieving strategic objectives (Schroeder, et al., 2007).

Six Sigma Black Belts (BB): A full-time human resource responsible for implementing the work of the Six Sigma structure through the execution of a project within an organization (Bertels, 2003). This person is a team leader, trained in Design, Measure, Analyze, Improve, Control (DMAIC) methodology and facilitation skills, responsible for guiding a Six Sigma improvement project to completion (Pande, et al., 2000).

Six Sigma Green Belt: An employee who is trained in Six Sigma methodologies, and works as a team member on specific projects as part of his/her regular work duties. Green Belts often work under Black Belts to complete a Six Sigma project (Kaissi, 2005).

Organization of the Thesis

This chapter included an introduction to the problem and identified the need for the study. It also provided the purpose of the research and the research question. Limitations of the study and key definitions which provide greater understanding of the intent, method, and results of the study were offered as well.

Chapter 2 will provide a detailed review of the existing literature on the topics of coaching and Six Sigma, as well as closely related topic areas. Chapter 3 will discuss the method employed in the study and the research design. Chapter 4 will provide a comprehensive description of data analysis and research results. Chapter 5 will discuss the key findings of the study, along with implications for research and practice.

CHAPTER 2

REVIEW OF LITERATURE

The purpose of this research was to gather evidence to support or refute the call within popular literature for training and development of Six Sigma Black Belts to include coaching skills. Thus, the research question was: *What is the relationship between Black Belt coaching expertise and the perceived outcomes of their Six Sigma projects?*

The purpose of this research was carried out by first identifying the process used to review the literature. Then, a discussion of the literature on coaching, process improvement, and project management in that order will follow. The literature review will conclude with information on Six Sigma and process improvement, and a summary of the literature.

Literature Review Process

While there is a limited amount of research and scholarly writing in the areas of Six Sigma, project management, and managerial coaching specifically, and literature on general coaching, process improvement, quality, TQM, and general project management is more prevalent. Thus, a review of the literature which examines each of these areas will be conducted.

The literature review was conducted using the EBSCO Academic Search Premier and Business Source Premier databases, Emerald, and Digital Dissertations, as well as doing forward searches using the Social Science Citation Index (SSCI) for the most

recently published articles. Older articles were uncovered searching through reference lists of more current literature.

Three specific sets of keywords were searched during the literature review. First, coaching literature was investigated using the following keywords: coach, coaching, managerial coaching, manager as coach, mentoring, executive coaching, and employee development. The Six Sigma and process improvement literature was searched using the following keywords: Six Sigma, Total Quality Management, TQM, quality, and quality management system. The project management literature was examined by searches using the following keywords: process improvement, performance improvement, project management, project execution, and project success. As each of these searches became broader, they yielded many pieces of literature outside the scope of this particular research. Only articles and books that specifically referenced managerial coaching and Six Sigma or TQM were included in the study.

The determination of whether the literature was useful was accomplished through a staged review system (Torroco, 2005) in which there was an initial review of the abstracts, followed by a full in-depth review of those articles that covered the topic areas of either Six Sigma or managerial coaching. Since there has been no published literature review to date on either topic, I found it appropriate to consider any literature that included models, examples, case studies, theories, and/or empirical studies in either topic area, as well as the broader topic areas listed above. Literature on topics such as Six Sigma or TQM methodologies, such as DMAIC, certification, and other unrelated subjects, were excluded from the review because they are outside of the scope of this research. The literature in the areas of coaching, business process improvement and

quality, project management, and Six Sigma each contributes to the body of knowledge for this research. Thus, these four major topic areas were examined thoroughly, with special care taken to study the historical roots, definitions and purposes, and empirical research in each area, as these help to identify the link between the four topical areas.

Coaching

The use of the word *coach* in reference to an individual has two distinct lineages, one in sports, the other in education. In sports the word was used to describe the individual in charge of training and directing a rowing crew, beginning in the 1880s (Evered & Selman, 1989; Wenzel, 2000). It was later used to describe any athletic leader or trainer who was charged with improving the performance of individuals and teams in sports (Wenzel, 2000). The word *coach* was first used in the educational sense in the 1840s, when it was adopted as a colloquial term at Oxford University to refer to a private tutor who prepared students for exams (Evered & Selman, 1989; Wenzel, 2000). However, its meaning was altered in the early 1900s by DeBower and Jones (as cited in Wenzel, 2000), who began to use the word *coach* as a way to describe a specific set of managerial activities. They recognized coaching as an activity by which a sales manager could motivate and direct a sales force in order to improve sales and profitability. DeBower and Jones' conception of coaching was based upon the philosophies of Scientific Management (Evered & Selman, 1989; Wenzel, 2000), as was the work of Mintzberg (1973) and Ferdinand Fournies, early management gurus who touted coaching as a way to bring out positive attributes in employees (Feldman & Lankau, 2005; Weisbord, 1987). The notion of using coaching simply as a tool for performance

management would hold for nearly 70 years. During that time, there was a divergence in the literature. While coaching continued to focus upon the notion of job performance through specific communication efforts, there became a distinction between the areas of *manager-as-coach* and *executive coaching*. In manager-as-coach (i.e., managerial coaching, or simply *coaching*, as it is used in this paper), the acting manager or supervisor plays the role of coaching an individual; in executive coaching a higher-level individual is being coached, usually by an external, professional coach in order to improve workplace performance (Joo, 2005).

While the area of managerial coaching has currently no published literature review, there have been two recently published literature reviews on executive coaching. One looks at executive coaching from a psychology and counseling perspective (Kampa-Kokesch & Anderson, 2001), the other looks at executive coaching from a consulting and Human Resource Development (HRD) perspective (Joo, 2005). While both touch briefly on the topic of managers acting as coach, neither delves into the topic fully. Although it is true that executive coaching and managerial coaching arose from similar roots, they are often looked at separately within the literature, citing executive coaching as a distinct intervention separate from managerial coaching and other possible human resource development interventions (Kampa-Kokesch & Anderson, 2001; Tobias, 1996). Thus, managerial coaching is most often related to the training, development, and retention of employees (Evered & Selman, 1989; Joo, 2005; Orth, Wilkinson, & Benefari, 1987), while executive coaching most often refers to the one-on-one relationship between a coach and an executive (Joo, 2005; Kampa-Kokesch & Anderson, 2001). Therefore,

while executive coaching is a vital part of management and HRD literature, it may not be appropriate for review within this context.

The notion of using coaching as a way to improve organizational performance through the facilitation of employee learning did not emerge until foundational work by Allenbaugh (1983) and Orth, Wilkinson, & Benefari, (1987). Each suggested that increasing the knowledge of individual employees, whether they had performance issues or not, was essential for the continuous improvement of organizational performance. This notion was echoed by Evered and Selman in 1989. They contended that managers who act as coaches — those who could shift from the command-control paradigm of management to that of knowledge and empowerment through coaching — would have the best business results.

Next, coaching will be reviewed within the context of organizational improvement. This includes how employee performance is related to the concept of coaching, including definitions and purposes of coaching, typologies of coaching, empirical research of coaching, coaching training transfer, and coaching case studies.

Definitions, Purposes and Typologies of Managerial Coaching

Table 1 represents several definitions of coaching as it relates to the managerial coach. The definitions are listed in chronological order, from most recent to least recent. Each of these definitions suggests that that the process of gaining new knowledge, or learning, will ultimately help either the individual worker (Orth, et al., 1987; Peterson & Hicks, 1996; Redshaw. 2000) or the individual and the organization (Ellinger, et al., 2003a; Hunt & Weintraub, 2002) perform better, and/or be more effective in some way.

Thus, the notion of coaching is inherently linked to performance improvement through learning.

Table 1

Definitions and Purposes of Managerial Coaching

Author	Year	Definition and Purpose
Ellinger, Ellinger & Keller	2003a	A coaching manager is one who encourages the development of a high-performance work environment through management practices that value and support the facilitation of learning.
Hunt & Weintraub	2002	The coaching manager is a business leader and manager who helps his/her employees learn and develop through coaching, who creates a workplace that makes learning, growth and adaptation possible, and who combines leadership with a genuine interest in helping those around him/her.
Redshaw	2000	Managerial coaching is the process of giving guidance, encouragement, and support to the learner.
Peterson & Hicks	1996	Coaching is the process of equipping people with the tools, knowledge and opportunities they need to develop themselves and become more effective.
Kalinauckas & King	1994	Coaching is a process by which a manager, through discussion and guided activity, helps a member of staff to solve a problem or carry out a task better. The focus is on practical improvement of performance and the development of specific skills.
Mink, Owen & Mink	1993	Coaching is the process by which one individual, the coach, creates a relationship with others that make it easier for them to learn.
Orth, Wilkinson & Benefari	1987	Coaching is a day-to-day, hands on process of helping employees recognize opportunities to improve their performance and capabilities.

Encouragement for the use of coaching as a way to improve performance is a reaction to the need for more empowered, motivated employees (Barry, 1994; Ellinger, 1999; Kanter, 1983; Mowday, 1978) who are able to perform in today's highly competitive workplace (Ellinger, et al., 2003b; Evered & Selman, 1989; Gilley, 2000). The call for coaching as a way to improve performance through empowerment and motivation echoes appeals from many scholars who would like to see coaching placed at the heart of management practice (Burdett, 1998; Hamlin, et al., 2006; Hunt &

Weintraub, 2002). And, while the notion of coaching as the heart of management activities seems to lend itself to positive results (some of which will be reviewed in the following section), there are still many scholars who criticize coaching pundits as lacking a sound and sufficient empirical base (Grant, 2003; Grant & Cavanaugh, 2004; Hamlin, et al., 2006; Kampa-Kokesch & Anderson, 2001, Lowman, 2005).

There has been considerable discussion among scholars regarding the differences between managerial coaching and other types of *helping* behaviors, such as mentoring and counseling. While these terms are often used interchangeably to describe the same concept (Ellinger, 1999), they are separately defined. Mentoring is seen as a long-term developmental process that is taken on voluntarily (Burdett, 1991; Ellinger, 1999). Counseling, meanwhile, focuses more closely on an individual's emotional state, as it impacts job performance (Burdett, 1998; Ellinger, 1999). Burdett (1991) first tried to resolve the issue of differentiating coaching from both counseling and mentoring by defining two coaching processes: individual performance and problem solving. He placed mentoring and counseling into the functions of coaching processes, along with tutoring and confronting. While Singer (1979) suggested that counseling is not, and should not be, a part of the coaching process, others such as Burdett (1991) and Kinlaw (1989) contended that separating coaching from mentoring and counseling is impossible, since they are often used concurrently to address one problem or situation. Next, the skills and behaviors of coaching will be reviewed. This will include how the skills of coaching are related to the exhibition of actual coaching behaviors.

A number of studies establish the specific skills and behaviors that encompass "coaching" (Ellinger, et al., 2003b). While the skills of coaching are different than the

actual coaching behaviors a manager may exhibit, they are related. Table 2 represents five key typologies that describe managerial coaching skills and behaviors. The typologies are listed in chronological order.

These typologies have helped to further define what it means to be a coaching manager, and the concomitant skills that are essential for positive leadership (Hamlin, et al., 2006). The results of Luthans, Hodgetts, and Rosenkantz (1988) found that managers who regularly exhibit behaviors traditionally attributed to human resource functions, of which coaching is one, are more likely to be seen as effective supervisors by bosses, peers, and employees, and more likely to be promoted, thus providing evidence that coaching is related to being perceived as a good leader.

Empirical Research on Coaching

As noted earlier, there is a paucity of research on the effectiveness of coaching as a strategy for improving performance, both individual and organizational. As a result, there has been some question as to whether managerial coaching actually works (Ellinger, 1999).

The limited published research that examines the relationship between managerial coaching and improved performance at the individual and organizational level is presented here, including how coaching relates to performance, the relationship between coaching and training transfer, and case studies on coaching.

Coaching and performance. Ellinger, et al. (2003a), using survey research, studied the coaching behaviors of line managers and their impact upon both employee satisfaction and performance using survey research. This research, performed within a distribution

center, used matched pairs for data analysis, and was the first to allow for self assessment of coaching skills by managers.

Table 2

Typologies of Coaching Skills and Behaviors

Author	Year	Definition and Purpose
Park, McLean, & Yang	2008	This typology resulted from qualitative research tested 5 dimensions of coaching skills, including valuing people over organization, open communication, appreciation of teamwork, acceptance of ambiguity, and facilitative development. There is some argument within scholarly literature whether coaching skills are sufficient in providing proof of the exhibition of actual coaching behaviors.
Hamlin, Ellinger & Beattie	2006	This typology used qualitative research to describe leadership and managerial coaching. The authors found that many of the skills and behaviors found to be desirable or 'good' managerial coaching behaviors were also used within the management literature to describe *good* leadership.
Beattie	2002	This typology resulted from a phenomenological approach in which field studies were conducted with line managers who worked in organizations that aspired to become learning organizations. The typology was created using grounded theory approach. It included caring, informing, advising, assessing, empowering, challenging, and developing others.
Ellinger Ellinger & Bolstrom	1999	This typology provided a qualitative research design that used interviews to identify how managers facilitate their employees' learning. It included the following behaviors: • Empowering Cluster: Questioning, being a resource, transferring ownership, and not providing answers. • Facilitating cluster: Providing feedback, soliciting feedback, setting and communicating expectations, broadening employee perspectives, using scenarios and examples, and promoting a learning environment.
Graham, Wedman & Garvin-Kester,	1994	This typology provided a taxonomy of what *good* and *bad* coaching behaviors looked like. The grouping of eight coaching skills categories included: communication skills, feedback, observation, and guidance. The authors then identified how a *good* coach may carry out these skills behaviorally, versus a *poor* coach.
Mumford	1993	This typology distinguished how managerial coaching would look within a formal development setting versus within the direct managerial context. Within the formal setting, coaching included: conducting performance appraisals, providing learning opportunities, and analyzing developmental needs. Within the direct managerial context, coaching: delegating to develop skills, providing learning opportunities, acting as a model, and offering help.

They found that not only did employees of managers who exhibited coaching behaviors have significantly increased job satisfaction, but they also exhibited greater job commitment and better job performance than did fellow employees. Ellinger (1999) had previously found a link between coaching from individual managers and increased employee performance, as well as increased cost saving practices, and thus organizational improvement.

A qualitative study by Graham, Wedman, & Garvin-Kester (1993), studied the impact of managerial coaching within a sales force. The researchers found that when coaching behaviors were exhibited by sales managers, it resulted in a direct correlation with increased sales by sales departments. That is, those salesmen and women who were coached by their managers were more likely to make sales than those sales people who were not exposed to coaching. Notably, the coaching behaviors of expressing performance expectations and providing feedback were the most effective for increased sales performance.

Within a team context, a qualitative study by Mulec and Roth (2005) found that specific coaching interventions by professional coaches who included the heavy usage of inquiry and questioning methods in their managerial behaviors helped to improve the effectiveness of team performance, which included outcomes such as the ability of the team to develop novel solutions. The teams that were coached via the use of guided questioning by managers were found to be more creative and efficient.

Coaching training transfer. There has been some question as to how managers can be influenced to display a coaching-type managerial style. Using qualitative research, Graham, et al. (1994), found that when individual sales managers were trained

in coaching skills and how to execute coaching behaviors, there was a significant increase in the number of coaching behaviors they exhibited toward their employees.

This research was further confirmed by Peterson and Hicks (1996), whose qualitative research found that administering a coaching training program for managers was an effective way to increase the number of managerial coaching behaviors he or she exhibited. According to Graham, et al. (1993), managers who attended coaching training exhibited increases in the areas of expressing performance expectations, providing feedback, providing relevant information, and rewarding performance.

Coaching case studies. Several case studies help to better explain the use of managerial coaching in the organizational context. First, a case study conducted at Coca-Cola Company helps to describe what organizations may expect when they implement a coaching program (Veale & Wachtel, 1996). Coca-Cola trains managers for specific coaching behaviors, including modeling, instructing, and problem solving. Human Resource managers at Coca-Cola use coaching as a way to "maximize the contribution of HRD to business success" (p. 23), and believe it is key to building competitive advantage within the organization.

A classic case study, conducted at Sears (Worthy, 1950), found that when coaching was instituted within the organization, employee morale increased significantly. This increase in morale led to an increase in customer satisfaction as well. The author found that when morale, based upon the increased use of coaching, increased by 5 percent, sales at that location increased by 5.5%. That is, as a marked increase in coaching behaviors was reported, the sales at each location also achieved a marked increase, which was, according to Worthy, partly the result of the organization's newly

flattened and decentralized structure, which created an environment in which coaching was more easily transferred.

In summary, coaching is seen as an important component of leadership and management of employees. Much has been written on the theory, model development, and empirical research, including case studies in the area of coaching and managerial coaching in particular. Each is important in understanding how coaching may impact employee performance, including performance within the Six Sigma context.

Business Process Improvement

The Business Process Improvement literature will be reviewed in the following categories: roots of process improvement and definitions, Total Quality Management (TQM), and measurement systems. Finally, the literature on quality, as it relates to business performance, including Baldrige Award criteria will be reviewed.

The notion of business process improvement has been a part of the human endeavor starting with documented quality standards set by Chinese craftsmen in the 21st Century BC (Juran, Bigliazzi, Spaans, & Dunaud, 1995). The first to study modern process improvement was Fredrick Taylor, whose work was used in the U.S., while also being translated and adopted in Japanese organizations before World War II (Kiassi, 2005). Following Taylor's initial investigation of how to improve processes within an organization, Dr. Walter Shewhart applied statistical analysis to Taylor's concepts in order to develop what is now known as statistical process control (SPC) (Kaissi, 2005; Brady, 2005) and process improvement.

Historically, the most often cited works in the area of process improvement are from W. Edwards Deming and Joseph Juran in the area of quality. While both men developed his own respective ideas on how to improve quality within manufacturing organizations, their bodies of work were met with enthusiasm in the U.S. that peaked during the war efforts but eventually waned after the end of World War II (Grant & Lang, 1991; Sherman, 1996).

However, just as U.S. quality initiatives seemed to fade, the notion of process improvement took hold and was strengthened by Juran and Deming's work overseas. The historical roots of quality and process improvement, including TQM and Six Sigma, have an indelible link to the quality movement that took place during the mid-twentieth century in Japan and focused on post-war reconstruction (Brady, 2005; Grayson & O'Dell, 1988; Imai, 1986; Toyoda, 2006). Statistical process control as a means for reducing defects and increasing quality was adopted by Japanese companies eager to try new techniques in order to help improve the Japanese economy (Juran, et al., 1995). The increased pressure upon U.S. business to perform to the standards of Japanese industry became apparent during the early 1980s as U.S. companies began to work to regain lost status (Grayson & O'Dell, 1988; Hayes & Abernathy, 1980; Powell, 1995). These same techniques were later adopted by some 93 per cent of U.S. companies (Powell, 1995), thus restoring American competitiveness (Juran, 1992). This technique for improving quality would eventually lead to such innovations as (a) the quality circle, (b) the Hoshin planning model, which helps to manage the quality function (Akao, 1993; Isikawa, 1985; King, 1998), (c) the Taguchi method for applying statistics to the design of experiments (DOE) (Kaissi, 2005; Taguchi, 1987) and, (d) concepts now known as the Toyota

Production System, or lean manufacturing (Ohno, 1988; Toyoda, 2006). Thus, the work of Deming, Juran, Feinbaugm, Crosby, and Japanese experts such as Ishikawa, Shingo, and Taguchi, represent the core of the quality improvement movement, or process improvement movement as it is known today (Brady, 2005; Dale, Wu, Zairi, Williams, & Van Der Weile, 2001; Powell, 1995). Deming, specifically, is often cited, due to his highly publicized management theories (Hillmer & Karney, 1997). His *Profound Knowledge* became the cornerstone of what is now known about management (Anderson, Rungtusanthum, & Schroeder, 1994; Braughton, 1999; Dahlgaard & Dahlgaard-Park, 2006; Deming, 1986, 1994). Much of what is acknowledged as true, and drives the conception of process improvement, and the concepts linked to that, such as quality improvement and Six Sigma, is theoretically linked to the initial teachings of Deming and Juran.

Definitions of Business Process Improvement

There has been some discussion in the literature about what a business process is, resulting in several definitions as to what constitutes *improvement* to those processes, as identified in Table 3. These definitions are listed in chronological order.

As can be seen, there are several different versions within the literature of not only what business process improvement is, but also how it takes place. Notably, there is a tension in the literature as to what constitutes business process improvement. While some believe it only describes practices such as business process redesign (Teng et al., 1996; Harrington, 1998) others believe it includes all types of process improvement measures (Bendell, 2005; Davenport, 1998; Forester, 2006; Chan & Roseman, 2001).

Table 3

Definitions of Business Process Improvement

Author	Year	Definition and Purpose
Forster	2006	Business process improvement is a systematic approach to help organizations achieve significant changes in the way they do business.
Chan & Roseman	2001	Business process improvement is the evaluation of alternative ideas and the movement of the organization toward a set goal.
Harrington	1998	Business process improvement is the product of business process reengineering, redesign, and benchmarking.
Teng, Grover & Fielder	1996	Business process improvement is the critical analysis and radical redesign of existing processes to achieve breakthrough improvements in performance measures, such as cost reduction, time reduction, or quality improvement.

Total Quality Management (TQM)

TQM as a management theory may still be in its theory-building and developmental stages (Dale, et al., 2001; Hanfield & Melnyks, 1998). However, it is clear that TQM has made some significant contributions to overall management theory (Dale, et al., 2001). As shown in Table 3, there are many definitions of what constitutes business process improvement. While there is agreement that TQM is an integrated management philosophy which emphasizes the use of continuous improvement of organizational processes (George, 1992; Juran, 1992; Powell, 1995; Ross, 1993), there is some question as to whether TQM constitutes a *business* process improvement initiative. While there seems to be no question in the literature regarding TQM's focus on process improvement, some argue that it does not fall under a business process improvement program because TQM involves incremental rather than radical change of work processes. Further, TQM takes place over an open-ended period of time rather than a bounded time frame (Davenport, 1993; Malhotra, 1998). Thus, the authors contend that

although TQM does do its work in process improvement, it is outside of the context of *business* process improvement circles. Others find that TQM is not only a business process improvement or redesign methodology, but that it is the program that largely put business process improvement strategies on the map within U.S. industry (Teng, Grover & Fielder, 1994). Whatever the case, TQM is now known as a leading force in business and industry.

Over the past several years there has been a great deal of research regarding whether TQM is actually helping companies to retain competitive advantage. The work of Hendricks and Singhal (1997) showed that those organizations that have won a quality awards outperform those firms that have not won quality awards. Those companies that have won awards have higher operating incomes, as well as improved sales growth when compared to non-award winners. This is reflected by Powell (1995) who said that most empirical studies conclude that TQM does produce value, including those studies that have reported on company-wide improvements in such areas as customer satisfaction, employee commitment, employee motivation, and reduction of waste, most notably Juran (1988), Schmidt and Finnegan (1992), and Spechler (1991). The most widely cited TQM research project was the International Quality Study, conducted by the American Quality Foundation (1991), whose research represented over 500 organizations that had implemented TQM efforts in many different corporate sectors and within several countries. This study concluded that TQM did, indeed, improve firm performance, although the levels of improvement were dependent upon the organization's maturation level in terms of the TQM implementation stage. The portions of TQM that related to

process improvement and supplier quality improvement were particularly important to overall firm performance (Juran, 1988; Schmidt & Finnegan, 1992; Spechler, 1991).

Another empirical study that examined TQM's impact on organizational competitive advantage measured performance in terms of quality improvement and financial gain. Powell (1995) found that although such things as quality training and benchmarking do not generally produce competitive advantage, other features interwoven into the TQM philosophy, such as open culture, employee empowerment, and executive commitment, do produce advantage. He explained that the tactical tools and techniques of TQM are not what drive success within an organization. Rather, the tacit features of TQM philosophy that drive success. Thus, he believes that although the retraining of many line workers in specific TQM practices many not be necessary, providing employees with the chance to learn the philosophies of TQM is an important endeavor.

Samson and Terziovski (1999) further confirmed Powell's earlier results in a study of 1200 manufacturing organizations in Australia and New Zealand that had implemented TQM practices. They found that the intensity with which TQM practices were implemented significantly impacted the level of performance success achieved by the organization. They also found that strong use of TQM principles in the areas of leadership, management of people, and customer focus were the most viable predictors of operational performance for these organizations. Further, those firms considered to be low performers within the study were less likely to exhibit good performance in the areas of leadership, management of people, and customer focus.

Although the American Quality Foundation (1991) study showed a significant relationship between TQM implementation and organizational success, there are those

who criticize TQM. They cite such problems as demanding unrealistic employee commitment, consuming too much management time, and failing to address the needs of small and non-profit firms (Naj, 1993; Schaffer & Thomson, 1993). Thus, although it has many adherents, TQM is not without its detractors.

Measurement Systems

While performance measurement is the *process* of quantifying the efficiency and effectiveness of an action, performance measures are the *metrics* to do so, and a performance measurement system is a *set of metrics* to measure a group of actions that are taking place within an organization (Kaplan, 1990; Neely, et al., 1995). Performance measurement is a key issue in business process improvement because it helps (or should help) to guide a business's strategy (Andrews, 1971; Ansoff, 1986; Skinner, 1969), from which business process improvement and Six Sigma are directed. Although there have been arguments that performance measures are not always derived from strategy (Neely, Mills, Platts, Gregory, & Richards, 1994; Neely, et al., 1995) the goal of an organization should be to align these two concepts.

The basic measurements that are used for the assessment of all business activities can be identified under the dimensions of time, quality, or cost (Baccarini, 1999). As depicted in Figure 1, the *Project Management Triad* of each of these dimensions can be discussed on several levels: individual, process, and organization (Neely, et al., 1995). Flexibility is also considered a dimension of project success (Forster, 2006), as are reliability (Neely, et al., 1995), and price (Leong, Snieder, & Ward, 1990). Still others have elucidated the quadrants of business process measurement in other ways (Garvin, 1987; Gerwin, 1987; Slack, 1987; Stalk, 1988; Wheelwright, 1994), leading to some

confusion within the literature as to what is, and is not, included in the time, cost, and quality/performance dimensions (Neely, et al., 1995). Soderlund's (2003) conception of *performance constraints* are equivalent, if not identical, to what some authors refer to as project management quality (Atkinson, 1999). These can further be extrapolated using the matrices of Neely, et al., (1995), which helps to refine the relationship between coaching and business process improvement, thus showing possible ways in which managerial coaching could impact the Six Sigma effort, as expressed in Figure 2.

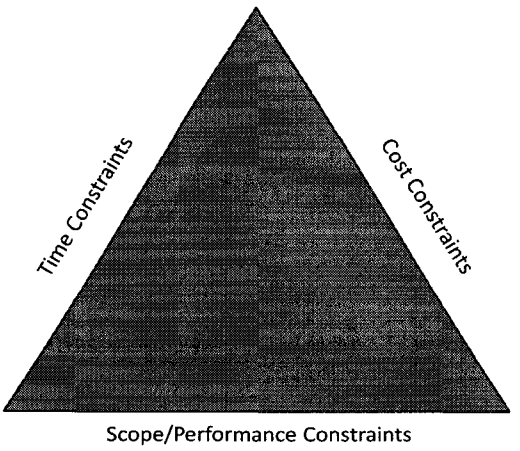


Figure 1. The *Project Management Triad of Triple Constraints,* a depiction of performance measures in business process improvement and project management measures (Soderlund, 2003).

Quality and Business Performance

There are conflicting reports about the importance of quality measures on overall business performance. Several studies have been conducted using the vast database developed by the Strategic Planning Institute, a non-profit organization that originated at

General Electric Company and is now carried out at the Harvard Business School. One significant study carried out using data available through the Strategic Planning Institute's database was conducted by Gale and Klavans (1985), who found that high quality products and services are among the most profitable. They also determined that improvement in product quality led to market share increases, and helped to increase profits by enhancing customer-perceived value.

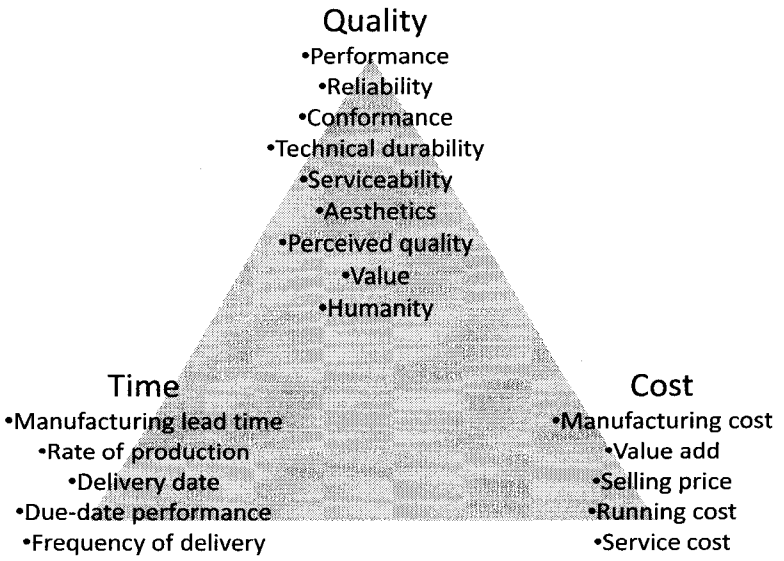


Figure 2. Dimensions of time, cost, and quality (Neely, et al., 1995).

Other researchers have also used the Strategic Planning Institutes data, and each, including the well-known Profit Impact of Market Strategy (PIMS) study, found a positive relationship between quality improvement within an organization and improved

organizational profitability (Buzzell & Gale, 1987; Craig, & Douglas, 1982; Schoeffler, Buzzell, & Heany, 1974).

Literature on the Malcolm Baldrige Award criteria will help to provide a further link on the impact of human resources on quality improvement, and thus Six Sigma. The criteria on which the award is based, is an exemplar of how one would measure the performance of an organization. A review of the Malcolm Baldrige lierature, along with empirical evidence in the areas of managerial coaching, will show how to integrate these two topics. The Malcolm Baldrige National Quality Award is one of the most well known sets of standards for measurement of business processes and the process of quality assurance in particular. Set up through legislation in the late 1980s, its objective was to create an awareness of quality issues with American industry (Wisner & Eakins, 1994). The award applicants are judged by a board of examiners in seven categories relating to quality: leadership, information and analysis, strategic quality planning, human resource development and management, process quality management, quality and operational results, customer focus, and satisfaction, the framework of which can be viewed in Figure 3 (Winn & Cameron, 1998; Wisner & Eakins, 1994). The Malcolm Baldrige framework was tested through path analysis, and found to be a valid way of measuring the dimensions of quality improvement (Flynn & Saladin, 2001).

More specifically, there are certain standards that require the development of an organization's human resources that fall within the Malcolm Baldrige criteria, as represented below (adapted from Neely, et al., 1995). Table 4 shows the scoring of the recent Malcolm Baldrige Award, and helps to illustrate what measures are important to organization performance. Of the 1000 possible points available in the Malcolm

Baldrige Award, 150 of those points measure the impact of human resources on an organization's overall quality, and therefore provide 15 percent of the score for an organization applying for the award.

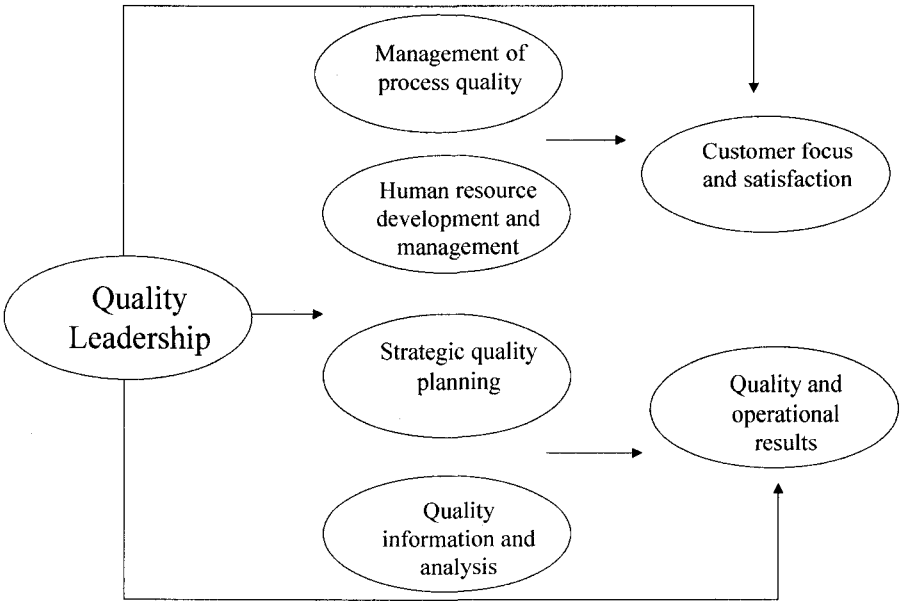


Figure 3. An illustration of the Malcolm Baldrige Quality Award theoretical framework, adapted from Winn and Cameron (1998).

Table 4

Malcolm Baldrige Award Criteria

Criteria No.	Criteria
4.0	Human resource utilization (150 points)
4.1	Human resource management (20)
4.2	Employee involvement (40)
4.3	Quality education and training (40)
4.4	Employee recognition and performance measurement (25)
4.5	Employee well-being and morale (25)

Project Management and Process Improvement

According to Juran (1989), quality improvement takes place on a project by project basis and "in no other way" (p.35). This can be said of Six Sigma as well, since much of the work of Six Sigma is accomplished through specific process improvement projects (Kaissi, 2005; Schroeder, et al., 2007).

Although project characteristics have not been examined through the Six Sigma lens, the impact of project characteristics on project outcomes has been well established within the Project Management literature. Many industries, including those outside of manufacturing such as banking and retail, find that they need to improve their organizational processes, and these improvements can only be achieved through the execution of projects (Shenhar & Dvir, 2007b). Much of the impetus for researching project success factors, and those factors that drive project success, is due to their widespread use within organizations today (Dvir, Lipovitsky, Shenhar & Tishler, 1998). Scholarly literature on project management will be reviewed in these two categories: a brief historical overview of project management and empirical research on project characteristics.

Perspectives of Project Management

Historically, project management as a field of study was formally established within the literature and the workplace during the 1950s. The newly constructed paradigm extended and expanded the use of the Gantt chart, a bar chart which visually describes the elemental parts of a multiple-tasked project, describing in detail how a large project can be broken down into smaller task structures (Drucker, 1973). Gantt Charts and other project management techniques were first widely used within military contexts.

During that time, *projects* became widely utilized in such industries as aerospace, and were employed as a way to deal with the complexities of such things as developing missile defense systems and other military applications during the Cold War (Levin & Kirkpatrick, 1966; Mulenburg, 1999). Within non-governmental organizations, the work of Elton Mayo and his Hawthorne studies, which were performed at Western Electric Company, helped to shine a light on teamwork and how teams may be utilized to work on important projects (Longbotham, 2000; Parker, 1990). Research on teamwork, and motivation in teams was further elaborated by Douglas McGregor and his X and Y theories of motivation, which helped to explain the attributes and motivations of effective and ineffective teams (Longbotham, 2000; Parker, 1990) and thus effective and ineffective projects. The field became formalized in 1969 after the development of the Project Management Institute, which helped to create standards for project management and its use (Longbotham, 2000; Parker, 1990). Since that time, scholarly interest in projects and project management, and their use within business and industry, has expanded greatly.

Critical Success Factors of Project Management

Research on critical project success factors help to demonstrate how those projects that are executed with certain specific factors in place have the greatest chance for successful completion, as suggested by Hyvari (2006). These success factors can be broken down into five key areas: (a) project characteristics, (b) project manager characteristics, (c) project team characteristics, (d) organizational characteristics, and (e) external environment factors. Most important to the current research are those factors described in the area of project characteristics which includes such topics as leadership,

competency, and complexity (Hyvari, 2006), each of which have been studied previously. For example, some of the most extensive research undertaken on critical success factors in project success was executed by Murphy, Baker, and Fisher (1974), using a sample of 650 projects in the areas of aerospace and construction. They found ten specific factors that were highly related to project success, and another 23 that were deemed necessary components to success, but not established as *adequate* for project success. Several other studies on critical success factors (or factors of failure) have been completed since. Many of these are reviewed in Table 5 below, which are listed in chronological order.

In the writing on critical success factors, Belassi and Tukel (1996), Cooke-Davies (2002), Dvir, et al. (2003), and Hyvari (2006) specifically refer to project characteristics that are considered factors critical to the success and/or successful completion of a project. However, of the eight scholarly reviews of critical project success factors listed below, all except Dvir, et al. (2003) were either based upon case study research or empirical results from self-reporting views of perceptual critical success factors. There are, however, several empirical reviews of specific subsets within the literature, that take a more substantive review of success factors from the perspective of actual project success. These are further reviewed above, as well.

Scholarly interest in how project characteristics may impact the outcomes of a project was articulated by Gerwin and Sussman (1996), who called for more research that investigated how task conditions, including project complexity and uncertainty, could impact the outcomes of a project. The inclusion of project specific areas covered within critical success factor literature helps to further develop project characteristics as an area

of importance in scholarly research. Yet to date only a limited number of empirical research studies have examined this topic.

Table 5

Critical Success Factors in Project Completion and Project Success

Author	Year	Definition and Purpose
Hyvari	2006	Critical success factors include project related factors or characteristics, factors related to the project manager/leadership, factors related to team members, factors related to the organization, factors related to the organizational and economic environment.
Dvir, Lipotvetsky, Shenhar & Tishler	2003	Critical success factors include work on project initiation activities including project definition, project need, project design and policy, technological infrastructure. Critical success factors also include control processes, such as project scheduling, following of milestones, and maintenance of organizational and managerial environment, such as personnel management, policy management.
Cooke-Davies	2002	Critical success factors include the ability to understand: Risk management, organizational processes, defined organizational responsibility, project duration, project scope, performance measurement, project metrics, and project practices.
White & Fortune	2002	Critical success factors include insuring that projects have clear goals and objectives. Projects must also have end-user commitment, adequate funding and resources, and the support from senior management.
Zimmerer & Yasin	1998	Critical success factors include project manager's leadership by example, vision, technical competence, communication, commitment, and technical experience.
Belassi & Tukel	1996	Critical success factors are separated into five groups, including project factors (project size, value of project, project scope, and project urgency), project management factors (project manager's commitment to the project, ability to coordinate the project, and competence in project management), organizational factors (organizational structure, top management support, functional management support), and leadership factors (communication skills, motivation, decision making, vision, technical competence).
Pinto & Slevin	1987	Critical success factors include the mission of the project, top management involvement in the project, effective communication by management, technical capabilities of the project manager, client involvement, consultation, and acceptance of the project, and effective monitoring and feedback throughout the project.
Murphy, Baker & Fisher	1974	Critical success factors include clear goals, goal commitment of project team, on-site project manager, adequate funding, project team capability, accurate initial cost estimates, minimum start-up difficulties, planning and control, task – social orientation, absence of bureaucracy.

Tatikonda and Rosenthal (2000) investigated how novelty and project complexity were related to the overall execution success of a product development project. They looked at the degree to which a new product was reliant upon new technologies, the newness of the project's objectives for the organization, and the difficulty of the project's objectives overall. They found that while the technological novelty of a product is negatively related to the overall cost of a project, project difficulty is highly negatively correlated with the time it takes for a project to be completed.

Larson and Gobeli (1996) found no relationship between a project's complexity and the performance of a project in the areas of cost, schedule, or overall success. However, the structure of a project was found to be a central factor.

The study revealed that those projects which were designed based upon a functional matrix (a matrix in which a project is divided into segments and assigned to relevant functional groups) is significantly less effective than those projects that are designed based upon a project team matrix (a matrix in which a designated person manages a group of select specialists to work outside of their normal boundaries in order to complete the project). Specifically, in the functional matrix design, the project leader has indirect authority over team members, while in the project team matrix, the project manager has direct authority to make decisions regarding personnel and work flow issues. This research is in some respects contrary to Liu (1999), who found that project complexity and project difficulty actually enhanced the outcomes of some projects. This, Liu contended, is because more complex projects are impacted by greater goal difficulty, which actually enhances project team commitment, and thus project outcomes. This relationship, however, was curvilinear. That is, when a project becomes overly-highly

complex, that relationship changes, and project difficulty and complexity relate negatively to its outcomes.

The level of technology available to project members and leaders was related to outcomes of a project. Keller (1986) found that technology had a direct impact on the performance of a group project within a research and development organization, while Gold (1987) found that technology directly influenced the speed at which projects could be completed.

Several other factors have been empirically tested and shown to have an impact on the outcomes of a project. First, the structure, characteristics, and learning orientation of project teams are each related to how well a project is executed and its level of success. While McDonough (1993) found that the educational level of a team had a positive relationship with the success of a project, the education level of the team leader or project manager had a *negative* relationship with project outcomes, especially when dealing with innovative projects. Jiang and Klein (2000), meanwhile, found that those project teams whose members had a higher level of expertise in the project area had a higher success rate than those teams made up of individuals with little or no content expertise. Finally, McDonough and Barczak (1991) found that there was a greater chance for success when team members were more autonomous and had greater clarity about the project's importance to organizational strategic objectives.

A project team's approach to preparing for the project also had an effect on the project's outcome. First, Schmitt, Lyytenen, Kiel and Cule (2003) examined project teams internal processes and found that those teams that prepared, examined, and analyzed the potential threats to the project's success had a greater chance of having a

positive outcome on the overall project. Lorance and Wendling (2001), meanwhile, found that those teams that took the time and were given the opportunity to present all of the possible resource requirements their project might necessitate had better project outcomes.

The characteristics of a project leader can have an impact on the outcomes of a project. Thite (1999) found that a project leader's exhibition of both transactional and transformational leadership style had a positive effect on the overall outcomes of a project. This was corroborated by Kaissi (2005), who found that the use of the rational persuasion style of leadership by project leaders was related to a positive outcome on projects. This was contrary to Keegan and den Hartog (2004), who found that while there was a significant relationship between the leadership style that a line manager exhibited and an employee's commitment and motivation, that relationship failed to exist between a project manager and project team members. Finally, there is research that shows how networks, especially social networks, impact the management of a project, and the outcomes of those projects (Hedberg, Dahlgren, Hansson, & Olve, 1997).

Six Sigma and Process Improvement

The literature on Six Sigma will be reviewed as follows: definitions and typologies describing Six Sigma will be examined, followed by the roles of a Six Sigma Black Belt. Next, empirical research and critiques of Six Sigma will be reviewed.

Six Sigma: Definitions, and Typologies

Several researchers and scholars have developed working definitions of Six Sigma (Table 6). These definitions are listed in chronological order, and provide a

general knowledge of the purposes of Six Sigma. They also provide information about the structure of Six Sigma within organizations.

Table 6

Definitions of Six Sigma

Author	Year	Definition
Schroeder, Linderman, Liedtke,& Choo	2007	Six Sigma is an organized parallel-meso structure to reduce variation in organizational processes by using improvement specialists, a structured method, and performance metrics with the aim of achieving strategic objectives.
Harry & Schroeder	2000	Six Sigma is a business process that allows companies to drastically improve their bottom line by designing and monitoring everyday business activities in ways that minimize waste and resources while increasing customer satisfaction.
Blakeslee	1999	Six Sigma is a high-performance, data-driven approach to analyzing the root causes of business problems and solving them.
Hahn, Hill, Hoerl, & Zinkgraf	1999	Six Sigma is a disciplined and statistically based approach for improving product and process quality.
White	1992	Six Sigma is a systematic approach to reducing variation to a defect rate of 3.4 per million opportunities.

Several writers have developed typologies on the critical success factors that are necessary for the successful implementation of Six Sigma (Coronado & Antony, 2002). The critical success factors of Six Sigma include such concepts as management involvement and commitment, careful selection of Six Sigma team members, strategic alignment customer focus, and precise use of data (Antony & Banduelas, 2001; Coronado & Antony, 2002; DeKonig & de Mast, 2006; Eckes, 2000; Haikonen, et al., 2004; Pande et al., 2000; Thevnin, 2004) Interestingly, while there have been attempts to *apply* the Six Sigma methodology to Human Resource management, such as using its methodology to secure and analyze data in order to provide information on development opportunities

(Grant, 2005) or to provide data for selecting more appropriate job candidates (Fleming, 2005), applying coaching to the Six Sigma context has yet to be tested.

The notion of critical success factors effecting implementation and the knowledge provided by case studies are helpful in gaining a more holistic understanding of Six Sigma in general. However, in order to gain a greater understanding of Six Sigma, empirical research of the topic is reviewed below.

Empirical Research on Six Sigma

The empirical research on Six Sigma is far less available than within the areas of project management or business process improvement. Empirical research can be divided into two areas: those studies showing theory and model development and those studies showing the results of Six Sigma implementation.

First, Hensley and Dobie (2005) linked Six Sigma with a customer service readiness scale in order to better explain how Six Sigma might be more effectively utilized within the service industry. They developed a model to show the relationships between service and Six Sigma. Bendell (2005) integrated the topics of Six Sigma and lean manufacturing (which is currently a popular variation of these two business methodologies) in order to explain a holistic model of business process improvement. Haikonen, et al., (2004) developed a model which explains the theoretical linkage between the Six Sigma model of improvement and the theoretical concepts of Continuous Improvement. Kaissi (2005), meanwhile, researched how different types of leadership styles exhibited by Six Sigma leaders, including Green Belts, Black Belts, and Champions, impact Six Sigma success.

McAdam and Lafferty (2004) studied Six Sigma at several organizations within different industries. They reviewed how Six Sigma implementation from a multiple-level perspective and considered how implementation impacted the organization at different levels ranging from individuals to organization wide. They found that often the implementation process relied too heavily on measurement and results, but lacked the appropriate actions in terms of focus on employee involvement and motivation. Further, they found that one failing of Six Sigma is its inability to empower employees, along with the reluctance of some managers to release power to subordinates. Thus, they concluded that those organizations that were most able to widen their conception of Six Sigma to include human perspective in include empowerment and two-way communication, would have the greatest chance of success.

Similar research was performed by Dahlgaard and Dahlgaard-Park (2006), who also found that when Six Sigma implementation was less likely to succeed when it focused more strongly on the tools and techniques and less on the human factors. According to the authors, there is no mechanism within the Six Sigma structure that is designed to incorporate the corporate culture changes necessary for Six Sigma success.

Finally, Choo, et al., (2007a) developed a framework for learning and knowledge creation within a quality Six Sigma. This framework included a model that described how both methodological and contextual elements from within an organization lead to better probabilities for improvement and competitive advantage within that organization. Methodological elements included those tools, techniques and organizational structures, such as the DMAIC methodology described in Chapter 1, that help to make Six Sigma successful. The contextual elements, meanwhile, were those enabling contexts or

organizational orientations that lent themselves to allowing creativity, learning, and knowledge to be created within an organization. The contextual elements that were most important include providing employees with leadership support, resource availability, challenging work, and trusting relationships, all of which are dimensions of good coaching skills, as defined in Table 2.

Another set of empirical research exists that provides information about the actual measurable result that Six Sigma has provided to specific companies and industries. This literature includes the work of Rucker (2000), who found an 80 percent reduction in callbacks and a 67 percent reduction in cycle times after the implementation of Six Sigma methodologies at Citigroup. Thomerson (2001) found a 33 percent increase in through-put yield within the healthcare industry. Likewise, Buck (2001) found an 18 percent reduction in medical and laboratory error in the healthcare industry. Motawani, Kumar, and Antony (2006) found an increase of earnings of $1.5 billion over the course of four years at Dow, while Lee and Choi (2006) found $16 billion in cost savings over 12 years at Motorola.

Critiques of Six Sigma

Six Sigma is not without its critics. First, Bendell (2005) cited a lack of customer focus as being the downfall of the Six Sigma methodology. While the "rhetoric of Six Sigma emphasized the customer as the most important focus, most projects have a cost down approach that does not impact or improve customer satisfaction" (p. 972).

Antony (2006) found that focusing on expensive data collection as a primary means for decision-making provides only a small portion of the totality of solutions to the problems that organizations face. Finally, the publication of a strong critique of Six

Sigma by Burns (2006) suggested that the methodology is built upon weak and sub-par statistical methods, thus rendering the program useless. His critique was based upon the rationale that Six Sigma is a variant of the Deming principles, with a different marketing scheme. To date, his comments have not been responded to in scholarly literature.

Literature Review: Summary and Conclusions

The purpose of this review was to review the literature in the topic areas of process improvement, managerial coaching and Six Sigma in order to (a) determine what has already been written in these topic areas, (b) determine whether there is a way to link these topic areas together based upon current literature, and (c) illustrate how these topic areas may be related to each other.

Several key pieces of literature help to codify the relationship between coaching and Six Sigma found in Chapter 1:

- Choo, A.S., Linderman, K., & Schroeder, R.D. (2007a).
- Dahlgaard, J.J., & Dahlgaard-Park, S.M. (2006).
- Ellinger, A.D., Ellinger, A.E., & Keller, S.B. (2003a, 2003b).
- Graham, S., Wedman, J. F., & Garvin-Kester, B. (1993, 1994).
- McAdam, R., & Lafferty, B. (2004).
- Samson, D., & Terziovski, M. (1999).
- Thevnin, C. (2004).

The repeated call for a closer focus on human resources and the way relationships within the workplace impact an organization, are the threads that link the reviewed topics of Six Sigma, coaching, and business process improvement and the empirical research on

them. The literature from each of the topic areas shows how such things as morale, motivation, and open communication within an organization positively impact overall organizational processes, while empirical work in the area of managerial coaching helps provide a linkage between managerial coaching and overall organizational success.

CHAPTER 3

METHODS

The purpose of this research was to gather evidence to support or refute the call within popular literature for training and development of Six Sigma Black Belts to include coaching skills. If coaching does, indeed, have an impact upon process improvement outcomes, then this research will provide a rationale for providing coaching training within the Six Sigma context. The research question was: *What is the relationship between Black Belts' coaching expertise and the perceived outcomes of their Six Sigma projects?*

This chapter describes the methods used to carry out the research. The documentation describes the following: (a) population and sample, (b) instrumentation and variable specification and (c) data analysis.

Correlational research was the most appropriate research method, given the research question. It can be used to provide information about the degree to which a relationship exists between variables (Gall, Gall & Borg, 2003). The resulting coefficient will provide information on the strength of the relationships, while Chronbach's alpha helps to establish reliability of the dimensions tested in the research. An important advantage associated with correlational research is that it can be used to provide information on the *degree* to which a relationship exists, rather than just examining *whether* a relationship exists (Gall, et al., 2003).

Population and Sample

Included in the following section is information regarding the population and sample used in the research. Recruitment procedures and response rates are identified.

Organization members from 13 organizations that apply the Six Sigma methodology were invited to take part in the study. Of those, six agreed. Organizations sampled were representative of several manufacturing organizations within the United States.

The six conveniently sampled organizations are herein referred to as Organizations A, B, C, D, E, and F. These organizations can be described as follows: (a) Organization A is a Fortune 500 company with over $14 billion in annual sales and 50,000 employees, (b) Organization B is a Fortune 100 company with $51 billion in sales and 79,000 employees, (c) Organization C is a Fortune 500 company with $4 billion in sales and 34,000 employees, (d) Organization D is a Fortune 100 company with $35 billion in sales and 122,000 employees, (e) Organization E is a Fortune 1000 company with $2 billion in sales and 9,000 employees, and (f) Organization F is a Fortune 500 company with $6 billion in sales and 26,000 employees. Each of these organizations requires Black Belt to have four weeks of training plus a minimum of one completed successful project in order to be certified. All of those within the sample held Black Belt certification, as defined by the organization.

From within the six organizations, information was drawn from two populations. The first population comprised Black Belts. The second population comprised those team members who had worked under a Black Belt on a specific Six Sigma project. There must be a minimum of 110 respondents, or 10 observations per predictor variable

(Long, 1997). Thus, at least 110 responses were sought, given the 11 predictor variables identified in the research.

Recruitment Procedures

Upon receipt of approval for the research from the Institutional Review Board (IRB) at the University of Minnesota, the research was conducted using the safeguards required in accordance with IRB policy, such as letters of consent that included information on the voluntary nature of the research and procedural safeguards to participant's anonymity (Institutional Review Board, 2007). The resulting IRB approval form can be found in Appendix A.

Recruitment at each organization took place in the following manner: I contacted Six Sigma or Quality executives via email, and invited them to have their organization participate. Upon communicating back their willingness to participate, I contacted each Six Sigma or Quality executive by phone and asked them to identify potential participants within the organization, along with their contact information. This process has been described by Creswell (1994) as single-stage participant sampling.

The executives within each organization identified Black Belts and Team Members through company records. Then, they provided initial information to employees to encourage participation.

Data Collection and Response Rates

As soon as Black Belts and Team Members had been informed of the study by the executives, I sent a cover letter to all potential participants via email. The cover letter included a link from which the survey could be entered. Each of the respondents was sent an initial survey, followed by one or two reminders. Organization A's initial launch

took place on March 12, 2008, followed by reminders on March 26 and April 12, 2008. Organization B's initial launch took place on March 26, 2008, followed by reminders on April 13 and April 23, 2008. Organization C's initial launch took place on April 20, 2008, followed by reminders on May 5 and May 14, 2008. Organization D's initial launch took place on May 22, 2008, followed by reminders on June 7 and June 15, 2008. Organization E's initial launch took place on June 12, 2008, followed by reminders on June 20 and June 27, 2008. Finally, Organization F's initial launch took place on June 18, followed by a single reminder on July 1, 2008. Survey response rates can be found in Table 7.

While the overall response rates may seem low, consideration must be taken for the use of online, rather than hard-copy, survey. Sheehan (2001) analyzed several electronically distributed academic surveys and found the average response rate of those surveys distributed online at 36.8%. While the response rates of Black Belts were close to this number, Team Members response rate was not. The difference between the groups may be related to the salience of the research issue to potential respondents; the importance of the survey to the respondents' daily life has a considerable impact upon response rates (Sheehan & McMillan, 1999). That is, Black Belts may find the issue of Six Sigma more important to their daily life and work than do Team Members, and therefore be more willing to participate in the research. Alternatively, Team Members could have been concerned with the confidentiality of the online survey, or could be afraid to indicate damaging assessments of Black Belts, and therefore were less willing to participate. Another issue that must be addressed is that of non-respondent bias. There is a risk that those individuals who were not been willing to participate in the study are not

statistically similar to those that were willing to participate. This issue could be resolved by a follow-up study that attempts to contact those who were non-responsive to the current research (Gall, Gall, & Borg, 2003).

Due to the low response rate at Organization B (only one response), the data that were collected at that site was removed from all statistical analyses. Thus, discussion regarding survey data from this point on will refer to Organizations A, C, D, E, and F.

Table 7

Response Rates

Org.	Total Sample	Total Respondents	Total Usable Responses	Response Rate*
A	Black Belt: 23 Team member: 66	Black Belt: 19 Team member: 41	Black Belt: 17 Team member: 30	Black Belt: 73.9% Team member: 45.4%
B	Black Belt: 2 Team member: 6	Black Belt: 1 Team member: 6	Black Belt: 1 Team member: 0	Black Belt: 50% Team member: 0%
C	Black Belt: 86 Team member:74	Black Belt: 48 Team member: 14	Black Belt: 33 Team member: 9	Black Belt: 38.3% Team member: 12.1%
D	Black Belt: 119 Team member: 442	Black Belt: 66 Team member: 115	Black Belt: 61 Team member: 109	Black Belt: 51.2% Team member: 24.6%
E	Black Belt: 52 Team member: 27	Black Belt: 49 Team member: 0	Black Belt: 6 Team member: 0	Black Belt: 11.5% Team member: 0%
F	Black Belt: 43 Team member: 103	Black Belt: 24 Team member: 36	Black Belt: 22 Team member: 32	Black Belt: 51.1% Team member:32.0%
Total	Black Belt: 435 Team member: 718	Black Belt: 167 Team member: 212	Black Belt: 140 Team member: 180	Black Belt: 32.2% Team member: 25.1%

**Note:* Response Rate is based upon Total Usable Responses

Instrumentation and Variable Specification

In this section, instrumentation will be described, including information on reliability and validity. Then the variables that were tested in the research will be reviewed.

Seven instruments were adapted to create the two instruments used in the research: (a) the *Black Belt Project and Learning Instrument* completed by Black Belts, and (b) the *Project Team Coaching and Outcomes Assessment* completed by Team Members. The instruments that were adapted for this research were as follows:

The *Coaching Skills Instrument* (Park, McLean, & Yang, 2008) is a 20 item instrument that measures the five dimensions of coaching on a 7-point Likert-type scale. Those dimension are Open Communication (alpha 0.81), Team Approach (alpha .88), Accept Ambiguity (alpha 0.73), Value People (alpha 0.0.83), and Facilitative Development (alpha .78). Validity was established through review by experts in coaching, as well as by performing factor analysis.

The *Black Belt Knowledge Outcomes* Instrument (Choo, Linderman, & Schroeder, 2007b) is a five item measure of the learning and knowledge outcomes of a Six Sigma project measured on a 7-point Likert-type scale. This scale tests the single dimension Knowledge Creation (alpha .78). Validity was established through review by experts who were University professors, and through pilot testing.

The *Project Difficulty/Challenge* measure (Choo, 2003) is a five item survey to test project difficulty, measured on a 7-point Likert-type scale. This scale tests the single dimension Project Difficulty/Challenge (alpha 0.84). Validity was established by content experts.

The *Supervisory/Line Manager Coaching Behavior Measure* (Ellinger, Ellinger, & Keller, 2003a) is an eight item survey measuring coaching behaviors on a 7-point Likert-type scale. This scale also tests only a single dimension, as they describe it:

Facilitation of Learning (alpha 0.90). Validity was established through factor analysis, field testing, and review by content experts.

The *Team Learning Instrument* (Sarin & McDermott, 2003) is a six item scale that tests the degree to which the processing of team experience changes the nature and range of potential team actions, measured on a 7-point Likert-type scale. This scale also tests only a single dimension Team Learning (alpha 0.83). Validity was established through pretesting and review by experts who were University professors.

The *Project Success Assessment Questionnaire* (Shenhar, Dvir, Levy, & Maltz, 2002) is a 60 item survey that tests the overall success of a project, measured on a 5-point Likert-type scale. This scale tests the dimensions Project Management, Customer Outcomes, Organizational Outcomes and Team Outcomes. Validity was established using factor analysis and review by content experts. Information on the reliability of this instrument was not available. Attempts to contact authors to retrieve reliability information were unsuccessful.

Finally, the *Project Complexity Scale* (Linderman & Choo, 2008), is a five item scale using a 5-point Likert-type scale, measuring a single dimension, Project Complexity. Information on the reliability and validity of this scale was not available. Attempts to retrieve this information were unsuccessful.

Of the seven instruments used for the research, two had no information available for reliability or validity. However, because each was appropriate to the study, they were used nonetheless. Upon including them in the survey developed for this study, validity and reliability were tested on each of the measures and found to be at acceptable levels.

Appendices B and C include each item of the original surveys and those adaptations made for the current survey. Some of the original test items remained the same, while others were changed for various reasons. For example, many of the original scale items began with the phrase "My manager..." (e.g., "My manager viewed difference of opinion as constructive."). Wording of the original item changed in the current survey for Black Belts to "I view differences of opinion as constructive." Similarly, in the Team Member survey, that same item was changed to "The Black Belt leader viewed differences of opinion as constructive."

Each of the modified items and the changes that were applied were reviewed by content experts at the University of Minnesota. These adaptations, as noted above, resulted in two nearly identical instruments: one for Black Belts and one for Team Members. Each is described below, along with variable specifications.

Black Belt Project and Learning Instrument

This survey was distributed to Black Belts. Its 72 items were placed on a 6-point Likert-type scale ranging from 1=strongly disagree to 6=strongly agree. Five independent variables were collected using the *Black Belt Project and Learning Instrument*: (a) Project Characteristics, which helps to identify the complexity and difficulty /challenge of a project, (b) Coaching Expertise, which measures the coaching skills and behaviors of Black Belts, and the demographic variables (c) Years with the Organization, (d) Education Level, (e) Number of Completed Projects, and (f) Number of Completed Project in a Team (not included as a variable with Team Members, because this data were collected in variable "Number of Completed Projects").

Project Characteristics included 13 items, and comprised the dimensions Project Complexity (alpha .77) and Project Difficulty/Challenge (alpha 0.80); combined, Project Characteristics revealed an alpha of 0.83, overall (see Appendix D). Coaching Expertise included 27 items, and comprised the dimensions Facilitation of Learning (alpha .78), Open Communication (alpha 0.78), Team Approach (alpha 0.67), Value of People (alpha .78), Ambiguity Acceptance (alpha 0.66), and Facilitative Development (alpha 0.72); Coaching Expertise revealed an alpha of 0.91, overall. Demographic variables included six items that collected information on Black Belts' project and organizational experience, and education level using continuous data (see Appendix H).

Four dependent variables were collected from Black Belts in the *Black Belt Project and Learning Instrument.* They included: (a) Team Outcomes, (b) Customer/Project Outcomes, (c) Organizational Outcomes, and (d) Bottom-line Savings.

Team Outcomes included 13 items, and comprised the dimensions Team Learning Outcomes (alpha 0.88), Knowledge Creation Outcomes (alpha 0.81), and Team Growth Outcomes (alpha 0.76), (alpha); Team Outcomes revealed an alpha of 0.91, overall (see Appendices E and G). Customer/Project Outcomes included seven items, and comprised the dimensions Project Management Outcomes (alpha 0.74) and Customer Outcomes (alpha .90); Customer/Project Outcomes revealed an alpha of 0.82, overall. Organizational Outcomes included six items, and comprised the dimension Organizational Outcomes (alpha 0.88); Organizational Outcomes reveled an alpha of 0.88, overall. Two questions that tested the bottom-line dollar impact of a project were also included in the dependent variables (See Appendix G).

Project Team Coaching and Outcomes Assessment

This survey was distributed to Team Members. Its 69 items were placed on a 6-point Likert-type scale ranging from 1=strongly disagree to 6=strongly agree. Four independent variables were collected from Team Members using the *Project Team Coaching and Outcomes Assessment:* (a) Project Characteristics, which helps to measure the complexity and difficulty/challenge of project, (b) Coaching Expertise, which measures the coaching skills and behaviors exhibited by Black Belts, and the demographic variables (c) Years within the Organization, (d) Education Level, and (e) Number of Completed Projects, which were collected using continuous data.

Project Characteristics included 13 items, and comprised the dimensions Project Complexity (alpha 0.82) and Project Difficulty/Challenge (alpha 0.79); Project Characteristics revealed an alpha of 0.86, overall (see Appendix J). Coaching Expertise included 27 items, and comprised the dimensions Facilitation of Learning (alpha 0.90), Open Communication (alpha .88), Team Approach (alpha 0.92), Value of People (alpha 0.90), Ambiguity Acceptance (alpha 0.83), and Facilitative Development (alpha 0.90); Coaching Expertise revealed an alpha of 0.91, overall (see Appendix I). Demographic variables included five items that collected information on Team Members' project and organizational experience as well as education level, using continuous data (see Appendix M).

Four dependent variables were collected from Team Members using the *Project Team Coaching and Outcomes Assessment*: (a) Team Outcomes, (b) Customer/Project Outcomes, (c) Organizational Outcomes, and (d) Bottom-line Saving.

Team Outcomes included 11 items, and comprised the dimensions Team Learning Outcomes (alpha 0.91), Team Knowledge Creation Outcomes (alpha 0.89), and Team Growth Outcomes (alpha 0.90); Team Outcomes revealed an alpha of 0.93, overall (see Appendix K). Customer/Project Outcomes included seven items and comprised the dimensions Project Management Outcomes (alpha 0.89), and Customer Outcomes (alpha 0.94); Customer/Project Outcomes revealed an alpha of 0.93, overall. Organizational Outcomes included six items and comprised the dimension Organizational Outcomes (alpha 0.91); Organizational Outcomes revealed an alpha of 0.91, overall. One question that tested the bottom-line dollar impact of the project was also included in the dependent variables (see Appendix L).

Summary of Variable Specifications

In order to conduct this research, seven independent and four dependent variables were examined. An illustration of the proposed relationships between independent and dependent variables can be found in Figure 4. Independent variables are found on the left side of the model, while dependent variables can be found on the right.

Data Analyses

The following section reviews the methods employed for data analyses. The research question *What is the relationship between Black Belts' coaching expertise and the perceived outcomes of their Six Sigma projects?* was answered using descriptive statistics, factor analysis, Moods Median, correlation, and regression analysis. Each is discussed below. Data were collected and analyzed on two sets of data: Black Belts, and Team Members.

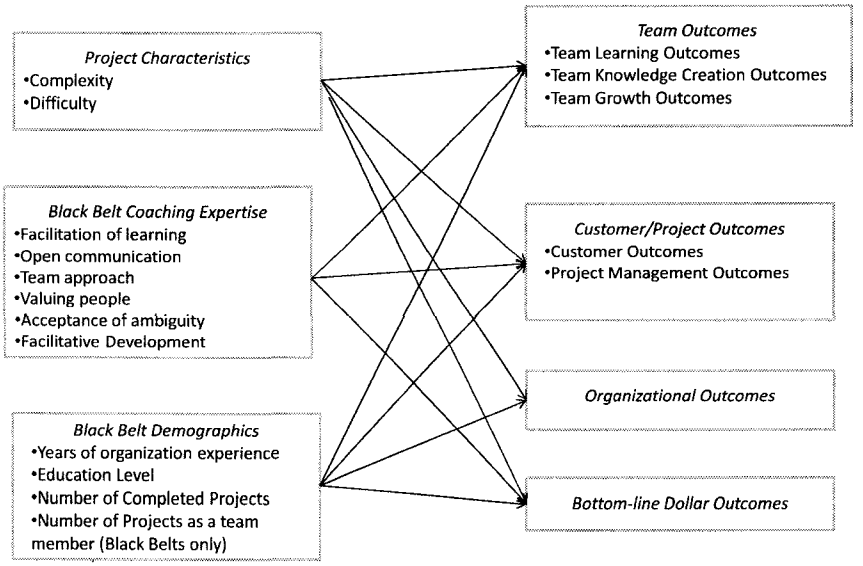


Figure 4. Variable identification.

Descriptive Statistics, Reliability, and Validity

Descriptive statistics were obtained for each of the research groups--Black Belts and Team Members. Central tendency measures, including mean and standard deviation were obtained. Validity was established through review by content experts at the University of Minnesota, both in the Human Resource Development Department, and the Operations and Management Sciences Department of the Carlson School of Management.

The survey was initially field tested to establish validity and reliability upon the receipt of 40 fully completed surveys from Black Belts and from Team Members. Alpha scores were calculated a second time after all survey responses were collected, to further confirm the reliability of survey dimensions. Nunnally, (1978) has indicated .70 to be an

acceptable reliability coefficient, but notes that this score may be as low as .60 in some instances. Alpha scores ranged from 0.81 to 0.93, as noted in the previous section.

Factor Analysis

Factor analysis, according to Yang (2005), is often used to validate an instrument through the identification of the factors that underlie that concept or construct. This is done by exploring the correlations of the factor in order to detect relationships between factors, which can ultimately be used to classify variables into clusters.

Principal component factor analysis, which was conducted as part of this research, uses factor analysis to test whether the items that are presumed to describe a construct actually do so, and are distinguishable from other constructs that are being tested (Gall, Gall, & Borg, 2007). Results of the principal component factor analyses can be found in Appendices N and O, and are discussed in Chapter 4.

Moods Median Test

In order to determine whether there was a significant difference between the respondent groups, Black Belts and Team Members, Mood's Median (sometimes referred to as the Median Test) test was performed for each of the variables.

Mood's Median, rather than ANOVA, was employed to test the differences between groups because of the non-normal nature of the data. Mood's Median, a non-parametric test, does not require normality of data (Gibbons & Chakrabarti, 2004), and thus is an appropriate measure given that the data collected were non-normal, for the most part skewed right. This statistic uses Pearson's Chi-square (x^2) as a test for independence between groups (Gall, et al., 2007).

Correlation Analysis

The data were also analyzed using correlation analysis. The purpose of calculating a correlation is to express in mathematical terms the degree and direction (positive or negative) of a relationship between two or more variables. Further, the correlation coefficient explains "how effectively individual's scores on one measure can be used to predict their score on another measure" (Gall, et al., 2007, p. 334).

One common measure of correlation is Pearson's correlation coefficient. Often symbolized as Pearson's *r*, it is constructed using the *line of best fit* which indicates that each of the data points on the *x* axis is also represented on the *y* axis (Gall et al., 2007). The resulting data set is represented by an *r* value of between -1 and +1. The closer the correlation coefficient to -1 and +1, the more accurately one can predict one variable based upon the results of the other. Conversely, the closer the r value to 0, the lower the actual correlation of the two values, with an *r* of 0 implying that no correlation exists, or there is no relationship between the two variables. Thus, a high correlation indicates that a high score on one variable is often paired with a high score on the other variable, while a low score on one variable is often paired with a low score on the other variable. Often, .0.01-0.09 is considered a negligible correlation, 0.10 – 0.29 is considered a slight correlation, 0.30 – 0.49 is considered a moderate correlation, while anything 0.50 and above is considered to be strongly correlated (Gall, et. al., 2003)

Linear regression is a form of correlation which tests the relationship between one or more independent variables, and one dependent variable. The purpose of a linear regression is to find a line or model that that best predicts the variance in the dependent variable (*y*) using one or more independent variables (*x*) (Gall, et al., 2003). Linear

regression was used in addition to simple correlation because, while correlation does not make a distinction between the independent and dependent variables, linear regression does make this distinction. More particularly, while correlation provides information as to the strength and direction of a relationship, linear regression attempts to create a model that represents the relationship, by fitting a line to the observed data. Further, regression helps provide predictive values of the relationship between two variables; when the x value is changed, the corresponding y value should change proportionately, as well (Zou, Tuncale, & Silverman, 2003).

CHAPTER 4

DATA ANALYSIS AND FINDINGS

The purpose of this research was to gather evidence to support or refute the call for training and development of Six Sigma Black Belts to include coaching skills. The aim of the research was to answer the research question: *What is the relationship between Black Belts' coaching expertise and the perceived outcomes of their Six Sigma projects?*

This chapter includes findings based on (a) preliminary data, (b) comparisons of Black Belts and Team Members, and (c) results of regression analysis identifying the research findings. Each of these will be reviewed separately.

Preliminary Data

Table 8 simply identifies descriptive statistics obtained for Black Belts and Team Members. Included are the mean and standard deviation for each of the groups.

Factor analyses were performed primarily to determine whether co-linearity existed between the dimensions of the survey, and secondarily to validate the instruments. The extraction method used was principal component factor analysis, while orthogonal and varimax rotations were performed on the data, no rotation was used for the final data analysis, since rotation made little or no difference in the results of the factor analysis.

Two factor analyses were performed on the data: one on items that collected information on independent variables, and another on items that collected information on dependent variables. Two factor analyses were performed because the assumption of this research is that there *is* a relationship between the independent variables and the

dependent variables. Thus, it was necessary to separate the factor analyses in order to avoid the co-linearity issues that would have likely arisen by performing a single factor analysis.

Table 8

Descriptive Statistics

Factor	*N*: Black Belt	*M*	SD	*N:* Team member	*M*	SD
Project characteristics	140	4.59	.84	176	4.48	0.83
Coaching Expertise	139	4.65	.57	179	4.38	0.98
Employee focus	137	3.88	1.30	171	3.89	1.31
Years of experience	139	9.92	7.10	173	10.45	8.71
No. of completed projects	139	2.99	.88	173	3.66	1.09
Education Level	139	4.43	.62	166	4.31	0.77
Number of projects in a team (Black Belt only)	137	14.34	23.48			
Team outcomes	139	4.70	.78	175	4.53	1.05
Customer/project outcomes	139	5.01	.87	168	4.64	1.08
Organizational outcomes	139	4.92	.97	174	4.41	1.10

A factor analysis was performed on each of the items representing the independent variables. Three factors emerged: (a) Project Characteristics, (b) Coaching Expertise and (c) Employee Focus.

a) Project Characteristics consisted of nine items, which came from the dimensions Project Complexity and Project Difficulty/Challenge.

b) Coaching Expertise consisted of 24 items from the dimensions Facilitation of Learning, Open Communication, Team Approach, Value of People, Ambiguity Acceptance, and Facilitative Development.

c) Employee Focus consisted of only one item: Value People 4. This item tested the following statement: "The Black Belt leader/I focused on the individual needs of team members."

Based upon the results of the factor analysis, the three emerging factors (Project Characteristics, Coaching Expertise, and Employee Focus) along with demographic variables, were used for data analysis (see Appendix N). A second principal component factor analysis was performed on each of the items representing the independent variables; again, three factors emerged: (a) Team Outcomes, (b) Customer/Project Outcomes, and (c) Organizational Outcomes.

- Team Outcomes consisted of eleven items from the dimensions Team Learning Outcomes, Team Knowledge Creation Outcomes, and Team Growth Outcomes.
- Customer/Project Outcomes consisted of seven items from the dimensions Project Management Outcomes and Customer Outcomes.
- Organizational Outcomes consisted of six items from the dimensions Organizational Outcomes and Knowledge Creation.

Based upon the results of the principle component factor analyses, correlation coefficients were calculated to determine whether or not co-linearity existed among the remaining six variables. The resulting correlation matrix showed highly significant, but low to moderate correlations among the variables (see Table 9). This result, together with the results of the factor analysis, suggests construct validity among the variables used in the research, and helps to establish that the variables being tested are not subject to co-linearity.

Table 9

Correlation Matrix of Variables

Factor	Project characteristics	Coaching	Employee focus	Team outcomes	Customer/project outcomes	Organizational outcomes
Project characteristics						
Coaching	.43					
Employee focus	.25	.57				
Team outcomes	.54	.62	.28			
Customer/project outcomes	.20	.41	.25	.38		
Organization outcomes	.45	.50	.26	.65	.62	

Note: All correlations were significant (p=0.000).

Comparisons between Black Belts and Team Members

Based upon the work of Cook and Campbell (1979), who found that self-respondents tend to assess themselves in ways that reflect positively upon them, it was appropriate to test whether differences existed between Black Belts and Team Members. Histograms depicting the variance and range (i.e., dispersion) of the data were used to determine the spread and shape of a set of data (i.e., normality). The variability and shape of the data help to determine the most appropriate type of statistics to apply in order to compare groups (Utts & Heckard, 2004). The histograms revealed that the data were non-normal, most of which was skewed right (see Appendix P). Moods Median, a non-parametric test, was employed because of the non-normal nature of the data (Gibbons & Chakrabarti, 2004). Thus, Moods Median was used to test whether differences existed between Black Belts and Team Members, in lieu of ANOVA. The results of the Moods Median test are found in Table 10.

Table 10

Between Group Comparison: Moods Median

Variable	Median: Black Belt	Median: Team Member	χ^2	*p*-value
Project characteristics	4.78	4.56	3.03	0.08
Coaching expertise	4.64	4.48	3.48	0.06
Employee focus	4.00	4.00	0.00	0.95
Years of experience	8.00	7.00	0.03	0.87
Number of completed projects	3.00	4.00	17.53	0.00***
Education level	4 (college degree)	4 (college degree)	0.10	0.75
Team outcomes	4.82	4.73	1.56	0.21
Customer/project outcomes	5.14	4.86	12.34	0.00***
Organizational outcomes	5.17	4.50	14.67	0.00***
Bottom-line dollars	200000	100000	8.54	0.00**

Note: * $p <$ .0.05; ** $p < 0.01$, ***$p = 0.000$

Based upon the results of the Moods Median test, there were no differences between the groups for the following variables: (a) Project Characteristics, (b) Coaching Expertise, (c) Employee Focus, (d) Years of Experience, (e) Education Level, and (f) Team Outcomes; however, there were differences between Black Belts and Team Members for the following variables: (a) Number of Projects Completed, (b) Customer/Project Outcomes, (c) Organizational Outcomes, and (d) Bottom-line Dollars. The results of the Moods Median test show that Team Members completed, on average, one more project than did Black Belts. Black Belts perceived Customer/Project Outcomes to be greater ($\tilde{x} = 5.14$) than did Team Members ($\tilde{x} = 4.86$). Black Belts perceived Organizational Outcomes to be greater ($\tilde{x} = 5.17$) than did Team Members ($\tilde{x}$

= 4.50). Finally, Black Belts perceived Bottom-line Dollars to be greater ($\tilde{x}$ = $200000) than did Team Members ($\tilde{x}$ = $100000), by double the amount.

Relationships

The research question of interest was: *What is the relationship between Black Belts' coaching expertise and the perceived outcomes of their Six Sigma projects?* Each of the independent variables (a) Project Characteristics, (b) Coaching Expertise, (c) Employee Focus, (d) Years of Experience, (e) Number of Completed Projects, (f) Education Level, and (g) Number of Projects in a Team (answered by Black Belts only) were entered into a regression analysis to determine the contribution each made in the variance of the dependent variables: (h) Team Outcomes, (i) Customer/Project Outcomes, (j) Organizational Outcomes, and (k) Bottom-line Dollar Outcomes. Regression analyses were performed for Black Belts and for Team Members, the results of which are found in Table 11.

The results of regression analysis showed that for Black Belts, 51.8 percent of the variance in Team Outcomes was explained overall. Coaching Expertise accounted for 38.7 percent of the variance in Team Outcomes, followed by Project Characteristics, which accounted for 9.4 percent of the variance, and Employee Focus, which accounted for 3.7 percent of the variance. For Black Belts, 12.6 percent of the variance in Customer/Project Outcomes was explained, overall. Coaching accounted for 9.2 percent of the variance in Customer/Project Outcomes, followed by Number of Completed Projects which accounted for 3.4 percent of the variance.

Table 11

Regression Analyses

By Dependent Variable	*B*	s.e.	Δ R^2 (adj.)	R^2 (adj.)
		Black Belts		
Team Outcomes				
Constant	0.432	0.383		
Coaching	0.687**	0.104	.387	.387
Project Characteristics	0.341**	0.065	.094	.481
Employee Focus	-0.128**	0.038	.037	.518
Customer/Project Outcomes				
Constant	2.250	0.608		
Coaching	0.465**	0.122	.092	.092
No. Completed Projects	0.199*	0.078	.034	.126
Organizational Outcomes				
Constant	0.185	0.519		
Coaching	0.548**	0.126	.286	.286
Project Characteristics	0.331**	0.084	.066	.352
No. Completed Projects	0.206**	0.066	.039	.391
Bottom-line Dollars				
None				

By Dependent Variable	*B*	s.e.	Δ R^2 (adj.)	R^2 (adj.)
		Team Members		
Team Outcomes				
Constant	0.330	0.36		
Coaching	0.545**	0.065	.378	.378
Project Characteristics	0.400**	0.077	.081	.459

Customer/Project Outcomes				
Constant	2.501	0.35		
Coaching	0.485**	0.077	.186	.186
Organizational Outcomes				
Constant	1.091	0.41		
Coaching	0.410**	0.075	.221	.221
Project Characteristics	0.333**	0.088	.055	.276
Bottom-line Dollars				
Constant	-290387	270204		
Project Characteristics	121072*	585533	.027	.027

Note. * $p < 0.05$; ** $p < 0.01$

For Black Belts, 39.1 percent of the variance in Organizational Outcomes was explained, overall. Coaching accounted for 28.6 percent of the variance in Organizational Outcomes, followed by Project Characteristics, which accounted for 6.6 percent of the variance, and Number of Completed Projects, which accounted for 3.9 percent of the variance. Finally, for Black Belts, none of the variance in Bottom-line Dollars was explained.

For Team Members, 45.9 percent of the variance in Team Outcomes was explained, overall. Coaching accounted for 37.8 percent of the variance in Team Outcomes, followed by Project Characteristics, which accounted for 8.1 percent of the variance. For Team Members, 18.6 percent of the variance in Customer/Project Outcomes was explained, overall. Coaching Expertise accounted for all 18.6 percent of the variance in Customer/Project Outcomes. For Team Members, 27.6 percent of the variance in Organizational Outcomes was explained, overall. Coaching accounted for 22.1 percent of the variance in Organizational Outcomes, followed by Project Characteristics which accounted for 5.5 percent of the variance. Finally, for Team

Members, 2.7 percent of the variance in Bottom-line Dollars was explained by only one variable: Project characteristics.

Summary of Main Findings and Limitations

The purpose of this study was to gather evidence to support or refute the call for the training and development of Six Sigma Black Belts to include coaching skills. To that end, the research question was: *What is the relationship between Black Belts' coaching expertise and the perceived outcomes of their Six Sigma projects?* The primary statistical procedure used to answer the research question was linear regression. The independent variables were: (a) Project Characteristics, (b) Coaching Expertise, (c) Employee Focus, (d) Years of Experience within the Organization, (e) Number of Completed Projects, (f) Education Level, and (g) Number of Project Completed in a Team (tested on Black Belts only). The dependent variables were: (a) Team Outcomes, (b) Customer/Project Outcomes, (c) Organizational Outcomes, and (d) Bottom-line Dollars. The data were analyzed for two groups: Black Belts and Team Members.

The results of the regression analyses showed that the independent variable Coaching Expertise explained most of the variance in the dependent variables (a) Team Outcomes, (b) Customer/Project Outcomes, and (c) Organizational Outcomes for Black Belts and for Team Members.

Secondarily, results of the regression analyses showed that the independent variable Project Characteristics explained a portion of the variance in the dependent variables (a) Team Outcomes and (b) Organizational Outcomes for Black Belts and for Team Members. Project Characteristics explained a negligible amount of the variance

for the dependent variable Bottom-line Dollars for Team Members, but not for Black Belts.

Finally, the results of the regression analyses showed that the demographic independent variable Number of Completed Projects explained a small portion of the variance for dependent variables Customer/Project Outcomes, Organizational Outcomes, for Black Belts.

This research is limited by a number of factors that impact its generalizability. The research results must be applied carefully, due to the following contexts that delimit its reach. First, there are many variables that are seen as critical to the success of a project. While some of these variables, such as project characteristics and demographic variables, were incorporated into the research, the research was not inclusive of all possible variables that can have an impact on project outcomes. Second, the use of self-reported coaching scores by Black Belts may affect the validity of the survey, as found in Cook and Campbell (1979). Third, there was a lack of cohesion in data collection, as many matched Black Belt and team member pairs did not respond to the survey. Finally, the results of this study can be generalized only to those organizations from which the data were gathered.

CHAPTER 5

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

This chapter discusses the contribution this research makes to the existing literature on coaching and Six Sigma. First, I will summarize the purpose and method of the study. Second, I will discuss the research results, including comparisons to the current literature. Third, I will explore the implications for future research. Finally, I will discuss recommendations for practice, and draw conclusions.

Increased competition, globalization, and complexity within the workplace have led organizations to become more robust in their capacity for change and ability to cut costs (Douglas & Erwin, 2000; Thevinin, 2004). The Six Sigma methodology arose out of organizations' attempts to improve profitability and competitive advantage through process and quality improvements. Coaching, meanwhile, focuses on the practice of improving individual employees' performance through the development of specific job skills (Redshaw, 2000) and guidance and support of employees' learning, for the purpose of creating a high performance workplace (Ellinger, 1999).

The notion of integrating coaching into the Six Sigma context has been suggested in the popular literature (Bertels, 2003; Harry & Schroeder, 2000; Pande, Neumann, & Cavanaugh, 2000); however, to date there has been no scholarly research to support this recommendation. Therefore, the purpose of this research was to gather evidence to support or refute the call for training and development of Black Belts to include coaching skills. The research question was: *What is the relationship between Black Belts' coaching expertise and the perceived outcomes of their Six Sigma projects?*

Data were collected from 140 Black Belts and 176 Team Members at six organizations. Black Belts responded to the *Black Belt Project and Learning Instrument*, while Team Members responded to the *Project Team Coaching and Outcomes Assessment.* The response rates of Black Belts and Team Members were 32.2% and 25.1% respectively. Data were analyzed using principle component factor analysis, correlation, Moods Median, and regression analysis. In the following section, I will summarize and discuss findings based upon each of the statistical procedures.

Discussion

I performed two principle component factor analyses (PCAs) on the data in order to determine whether co-linearity existed between the survey's original dimensions. One PCA was conducted on items from the study's original independent variables: Project Complexity, Project Difficulty/Challenge, Facilitation of Learning, Open Communication, Team Approach, Value of People, Ambiguity Acceptance, and Facilitative Development. The other PCA was conducted on items from the study's original dependent variables: Team Learning Outcomes, Knowledge Creation Outcomes, Team Growth Outcomes, Project Management Outcomes, Customer Outcomes, and Organizational Outcomes. The PCAs resulted in six factors; the three factors emerging from independent variables were (a) Project Characteristics, (b) Coaching Expertise, and (c) Employee Focus, and the three factors emerging from dependent variables were (d) Team Outcomes, (e) Customer/Project Outcomes, and (f) Organizational Outcomes. This result indicated that the original dimensions employed in the research showed signs of co-linearity, and may have been testing the same constructs. The factor Coaching

Expertise was the result of six dimensions that comprised 28 items, all of which loaded onto a single factor. This result is inconsistent with the results of Park, McLean, and Yang (2008), who found 20 items that loaded onto five separate factors. Further, Project Characteristics was the result of two dimensions that comprised nine questions, all of which loaded onto a single factor. This result is inconsistent with that of Tatikonda and Rosenthal (2000), who found Project Complexity and Project Difficulty as 11 items that loaded onto two separate factors.

After reducing the number of variables through PCA, I calculated correlation coefficients to determine whether or not co-linearity existed among the remaining variables. Correlation coefficients resulted in highly significant, but low to moderate correlations among the variables. It is reasonable that the low to moderate correlations among variables were due to the compression of dimensions by the PCAs, and confirms relative independence among variables.

Next, I made comparisons with the non-parametric Moods Median test between Black Belts and Team Members. This test was performed in order to determine whether significant differences existed between Black Belts and Team Members. The results of the Moods Median test revealed that no differences existed between the groups for the following variables: Project Characteristics, Coaching Expertise, Employee Focus, Years of Experience, Education Level, and Team Outcomes; however, there were differences between Black Belts and Team Members for the variables Number of Completed Projects, Customer/Project Outcomes, Organizational Outcomes, and Bottom-line Dollars.

Statistics revealed that Team Members, on average, have completed more projects than Black Belts. I believe this may be a result of Team Members being more likely to participate in two or more teams simultaneously, while Black Belts are likely to participate in a single project, finishing it before beginning the next.

Black Belts scored three of the dependent variables, Customer/Project Outcomes, Organizational Outcomes, and Bottom-line Dollars, significantly higher than did Team Members. Two plausible explanations exist for the differences found between Black Belts and Team Members. In the first explanation, the differences between the groups are due to score inflation related to the use of self-reported data, often referred to as common method bias. This hypothesis is consistent with the literature by Cook and Campbell (1979), who found that self-respondents tend to assess themselves in ways that reflect positively upon them. The second explanation may be that Black Belts could be privy to information regarding the outcomes of their projects that Team Members lack access to, such as personal communication with project customers. As a result, Black Belts may have received more positive feedback regarding the project than Team Members, thereby scoring project outcomes significantly higher than did Team Members. However, although Black Belts tended to rate Team Outcomes, Customer/Project Outcomes, Organizational Outcomes, and Bottom-line Dollars higher than did Team Members, the results of the research are trustworthy nonetheless because the linear regression showed that for *both* groups, Black Belts *and* Team Members, significant relationships existed between Coaching Expertise and Team Outcomes, Customer/Project Outcomes, and Organizational Outcomes. Thus, even though Black Belts tended to rate

these project outcomes higher than did Team Members, the conclusions of the significant impact of Coaching Expertise remained the same.

Last, I performed linear regression in order to determine whether a relationship existed between the seven independent variables (a) Project Characteristics, (b) Coaching Expertise, (c) Employee Focus, (d) Years of Experience, (e) Number of Completed Projects, (f) Education Level, and (g) Number of Projects Completed in a Team (from Black Belts only) and the four dependent variables (h) Team Outcomes, (i) Customer/Project Outcomes, (j) Organizational Outcomes, and (k) Bottom-line Dollars. Results from two groups were analyzed: Black Belts and Team Members. I found several significant relationships in the results of the regression analyses:

(a) Results indicated that Coaching Expertise was the most powerful variable within the study, and explained the greatest proportion of variance for Team Outcomes (R^2 adj. = 38.7%), Customer/Project (R^2 adj. = 9.2) Organizational Outcomes (R^2 adj. = 28.6%) for Black Belts. Coaching Expertise also explained the greatest proportion of variance for Team Outcomes (R^2 adj. = 37.8%), Customer/Project (R^2 adj. = 18.6%) Organizational Outcomes (R^2 adj. = 22.1%) for Team Members. These significant results indicate that coaching does indeed impact Six Sigma project outcomes within participating organizations. If these findings are the result of the significant impact that coaching expertise has on team learning and knowledge creation processes (as indicated by Team Outcomes), this is consistent with Choo, Linderman, and Schroeder (2007a), who found that the learning and knowledge creation that take place within Six Sigma teams are related to the behaviors of the Black Belt leading the team. This would also be consistent with

the work of Dahlgaard and Dahlgaard-Park (2006) who found that open, two-way communication (which are core skills and behaviors of coaching expertise, and tested within this research by items Facilitation of Learning 3, Facilitation of Learning 4, and Facilitative Development 4; see Appendices F and I) are essential for Six Sigma success. The significant relationship between Coaching Expertise and Team Outcomes, Customer/Project Outcomes, and Organizational Outcomes helps to support the call within popular literature for the inclusion of coaching in Black Belt training.

(b) Results indicated that Project Characteristics was the second most powerful variable within the study, and explained a portion of the variance for Team Outcomes (R^2 adj. = 9.4%), and Organizational Outcomes (R^2 adj. = 6.6%) for Black Belts. Project Characteristics also explained a portion of the variance in Team Outcomes (R^2 adj. = 8.1), Organizational Outcomes (R^2 adj. = 6.6%), and Bottom-line Dollars (R^2 adj. = 2.7%) for Team Members.

This result is interesting in that it both confirms and contradicts current literature. First, the relationship between Project Characteristics (which measured the original dimensions Project Complexity and Project Difficulty/Challenge) and Bottom-line Dollars Outcomes helps to confirm that the difficulty and complexity of a project are, indeed, critical success factors to project outcomes, as was reported by Belassi and Tukel (1996), Cooke-Davies (2002), Dvir, et al. (2003), and Hyvari (2006). However, each of the significant results indicates a *positive* relationship between Project Characteristics and the dependent variables. This is in contrast to Larson and Gobeli (1996) and Tatikonda and Rosenthal (2000), who

found no relationship between project complexity and project outcomes (note that Project Characteristics comprises the dimensions Project Difficulty and Project Complexity). Meanwhile, Griffin (1997), found a significantly *negative* relationship between project complexity and Project Management Outcomes. I am unsure why the current Project Characteristics results provided significantly *positive* results while other research indicated there was either no relationship, or a significantly negative relationship; however, the result does provide a rationale for further study in this area.

(c) Results indicated that Number of Completed Projects explained a small portion of the variance for Customer/Project Outcomes (R^2 adj. = 3.4%) and Organizational Outcomes (R^2 adj. = 3.9%) for Black Belts, but accounted for none of the variance in Team Member responses. These results indicate that the Number of Completed Projects of a Black Belt has a significantly positive impact upon the results of their Six Sigma project. Based upon this result, the more experience a Black Belt has, the greater chance he or she has for obtaining better project outcomes. This finding means that, as one may expect, experience is important to outcomes. This finding is consistent with the critical success factor research of Hyvari (2006) and Zimmerer and Yasin (1998), each of which indicated that the level of experience a project leader has is critical to the success of a project.

While there were other significant variables, their impact was negligible. Based upon the results of this research, the model that was initially developed for this research Figure 4 (replicated here) has been changed to reflect the actual findings of the study,

represented by Figure 5. Several changes can be found when the original model is compared with the revised model.

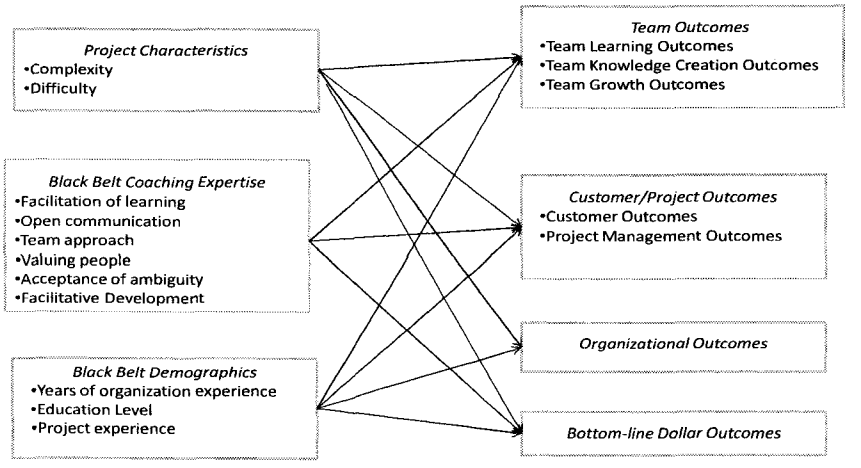
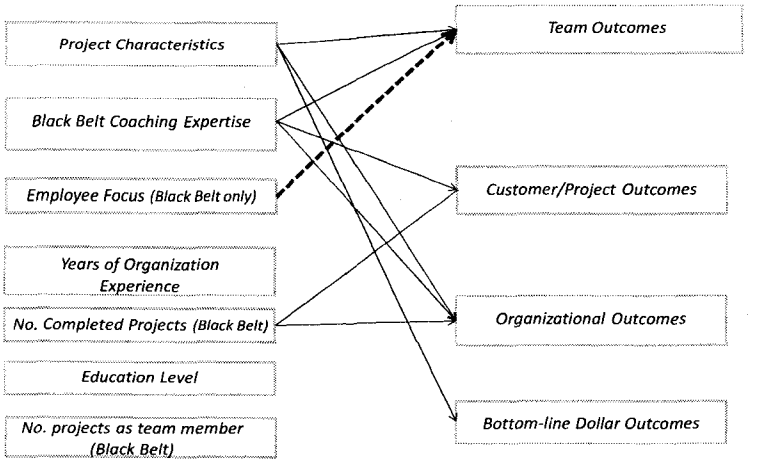


Figure 4. Model identifying original research approach



Note: Dashed line indicates a negative relationship between Employee Focus and Team Outcomes

Figure 5. Revised model, based upon research results

(a) The original model (Figure 3) assumed that Project Characteristics was a two factor model, made up of the constructs Project Complexity and Project Difficulty/Challenge. However, based upon the results of the factor analysis, Project Characteristics, as depicted in Figure 5, is a single construct.

(b) The original model assumed that Coaching Expertise was a six factor model. However, based upon the results of the factor analysis, Coaching Expertise, as depicted in Figure 5, is a single construct.

(c) The factor Employee Focus, which was not included in the original model, emerged as a factor based upon the results of the factor analysis.

(d) The original model assumed that Team Outcomes was a three factor model. However, based upon the results of the factor analysis, Team outcomes, as depicted in Figure 5, is a single construct.

(e) The original model assumed that Customer/Project Outcomes was a two factor model. However, based upon the results of the factor analysis, Customer/Project Outcomes, as depicted in Figure 5, is a single construct.

(f) The original model assumed that Coaching Expertise would account for some portion of the variance in each of the dependent variables. However, the results of this research did not indicate Coaching Expertise to be related to Bottom-line Dollars.

(g) The original model assumed, based upon the literature, that each of the demographic independent variables would be significantly related to each of the dependent variables. However, only Number of Completed Projects accounted

for the variance in two of the dependent variables: Customer/Project Outcomes and Organizational Outcomes.

Implications for Future Research

This research provides a starting point from which other researchers can further the scholarly knowledge base of coaching. Several findings within this study can be the basis for further research.

(a) The significant relationship between Coaching Expertise and Team Outcomes, Customer/Project Management Outcomes, and Organizational Outcomes within the Six Sigma context is important. However, this finding could be extended by examining coaching through the lens of another quality initiative, such as Total Quality Management (TQM) or Lean manufacturing. Looking at coaching through an alternative lens would help to further establish the importance of coaching within the broader frameworks of quality and project management.

(b) This study provides information as to the relationships that exist between the independent variables Coaching Expertise, Project Characteristics, Employee Focus, Years of Experience, Number of Completed Projects, Education Level, and Number of Projects in a Team (answered by Black Belts only), and the dependent variables Team Outcomes, Customer/Project Outcomes, Organizational Outcomes, and Bottom-line Dollar Outcomes. However, it does not provide information about the *effect* that the independent variables have on the dependent variables. Therefore, a next step for future research could be to employ an experimental research design testing the effects that independent

variables have upon the dependent variables. Providing coaching training to a set of randomly selected Black Belts, and not to others, researchers could study the *effects* of coaching training upon project outcomes, rather than just the relationships.

(c) This research has found a significant positive relationship between the independent variables Coaching Expertise, Project Characteristics, Employee Focus, and Number of Project Completed and the dependent variables Team Outcomes, Customer/Project Outcomes, Organizational Outcomes, and Bottom-line Dollar Outcomes by respondents primarily within the United States. Yet, Six Sigma implementation has taken place in organizations in South America, Europe, Asia, the Middle East, and Africa. However, it is not yet known how coaching, as it is defined in the United States, can be applied within those cultures. Therefore, research into coaching, and how it impacts project outcomes within other cultures, would be an asset to those interested in coaching from a more global perspective.

(d) Finally, while this research provides information as to the relationship between variables from the perspective of both Black Belts and Team Members, a matched-pair research design, as initially proposed, was not employed due to lack of adequate response. The use of matched-pair research design would help provide information about how Black Belts and Team Members perceive the relationship between coaching and project outcomes *specifically* for individuals and individual projects. This would help to further verify the relationship

between coaching and project outcomes within the Six Sigma context, as well as reduce the effects of common method bias on the analysis.

Recommendations for Practice

The results of this study have implications for the selection, training, and development of Six Sigma Black Belts, as well as implications for others involved in the Six Sigma community, including Team Members and organizational leaders. The statistically significant results provide a rationale for Six Sigma trainers and managers within participating organizations to look more closely at coaching as an essential component of project success. While causality cannot be established by the results of this study, the research provided predictive evidence that projects within the participating organizations that are led by Black Belts who have greater coaching expertise were perceived by themselves and Team Members as being able to execute project outcomes in the following areas: Team Outcomes, Customer/Project Outcomes, and Organizational Outcomes. These outcomes include such phenomena as (a) the production of learning and knowledge creation by team members, (b) the completion of projects that meet customer expectations, budget, scheduling, and quality goals, and (c) the creation of significant financial and strategic impact for the organization.

With this in mind, it may be appropriate for participating Six Sigma organizations to implement several changes or additions to their Six Sigma deployment and training initiatives. These changes, based upon the results of this study, could help to promote better project outcomes in several ways. First, assessing the coaching expertise of those individuals identified as potential Black Belts may be appropriate. This assessment could

help identify individuals within the organization who may already possess coaching skills. For those who have fewer skills, training in coaching skills would be appropriate for increasing coaching behaviors, as suggested by Graham, Wedman, Garvin-Kester (1993). The selection of appropriate Black Belt candidates is critical to the success of a project (Zimmerer & Yasin, 1998; Belassi & Tukel, 1996), and by using coaching expertise as a criterion for Black Belt selection, organizations may be better able to choose Black Belt candidates who can produce good project outcomes. Coaching training is not traditionally a part of Black Belt training; rather, there is often leadership training that includes the facets of project management, with little inclusion of coaching skills. Thus, introducing a coaching component into Black Belt training will be an asset to Black Belts, Team Members, and the organization leaders by providing a greater probability of success. Coaching training, too, could also help provide Black Belts with the soft skills necessary to lead groups of people (Antony, 2006; Bendell, 2005; Brady, 2005; Hahn, Hill, Hoerl & Zinkgraf, 1999; Harry & Schroeder, 2000).

The results of this research also have implications for Team Members working with Black Belts on Six Sigma projects. Specifically, the relationship between Coaching Expertise and Team Outcomes provides evidence that those Black Belts who are better able to coach their teams are more likely to provide Team Members with better Team learning and knowledge creation outcomes. Specifically, Team Members working under *coaching* Black Belts are more likely to work on a team that generates more ideas and better prepares Team Members for future projects (as tested by items Team Learning 2; Team Learning 3; Team Learning 4; Team Knowledge Creation 1; Team Knowledge Creation 5; see Appendices E and K).

Based upon the significant relationship between Coaching Expertise and Customer/Project Outcomes, and Organizational Outcomes, Team Members working with Black Belts who have a higher level of coaching expertise are afforded the experience of working on a team that may be seen as more successful by project customers and organizational leaders. This could provide Team Members with the potential for career advancement that they would not have otherwise had. Thus, the results of this research illustrate some practical implications for Team Members who work under Black Belts with higher levels of coaching expertise.

Finally, this research has implications for organization leaders, as well. The significant positive relationship between Coaching Expertise and Organizational Outcomes provides evidence that Black Belts who coach are better able to provide significant return on investment, financial and strategic outcomes from their projects. This research has several implications for practitioners who are interested in applying the results of the study to Six Sigma deployment and implementation within his or her organization. The research reveals that the use of coaching as a means to select, train, and develop Black Belts may be beneficial for all involved.

Conclusions

This research has found a significant relationship between the coaching expertise of Black Belts and the Team Outcomes, Customer/Project Outcomes, and Organizational Outcomes of their projects. Although the research was completed using a convenience sampling, it provides evidence that those Black Belts within participating organizations who apply coaching as a method for developing Team Members are able to obtain more

fruitful project results. This research is a springboard from which the extent of coaching's impact upon Six Sigma outcomes can be further explored.

Coaching as a field of study has historical roots that go back over a century (Evered & Selman, 1989; Wenzel, 2000). However, scholarly inquiry into the topic is relatively new, and is limited to a few key studies. The work of Hamlin, Ellinger, and Beattie (2006) helps to connect the notion of coaching to leadership and managerial leadership in general by showing that much of what is considered the *work* of a managerial leader, such as developing employees and encouraging their learning, is the key to good leadership. In this sense, coaching is not a separate entity from leadership, but an essential piece of it. That is, in order to be an effective manager or leader, one must be an effective coach (Hamlin, et al., 2006). Applied to the Six Sigma context, although a Black Belt is rarely the direct manager or boss of those individuals who make up the Six Sigma project team, it is important that Black Belts be effective at coaching, in order to lead their project to completion with positive outcomes.

The use of several factors to explore the outcomes of a Six Sigma project is, as described by Shenhar, Dvir, Levy, and Maltz, (2002), relevant to organizations in varying ways. While Six Sigma projects are most often associated with process improvement, and the dollar savings that result, there are many projects do not, for any number of reasons, supply the organization with bottom-line monies. To illustrate this point, of the 127 Black Belts who answered the item *Bottom-line Dollars 1* in the survey ("Approximately how much was the project worth, in terms of bottom line savings?"), 25 percent reported none. This indicates to me that, even though bottom-line dollar savings

are seen as important to Six Sigma results, there are other grounds for initiating a Six Sigma project.

The independent variable Coaching Expertise had a significant positive relationship to Team Outcomes in each of the regression analyses performed (Black Belts and Team Members). This factor was made up of three dimensions: Team Learning Outcomes, Team Knowledge Creation Outcomes, and Team Growth Outcomes. While Team Growth Outcomes are related to the personal and professional growth of Team Members, Team Learning and Team Knowledge Creation Outcomes are critical to the organization itself. That is, the Team Learning and Team Knowledge Creation dimensions measured the learning and knowledge that were created within the team environment. According to Ellinger and Bostrom (1999), the coaching of individual employees is an attempt to build learning capacity within an organization. Based upon the significant positive relationship between Coaching Expertise and Team Outcomes for Black Belts, and for Team Members, my research suggests that those Black Belts who are better at coaching may improve the learning capacity within the organization. Thus, like the organizations that participated in the Ellinger and Bostrom (1999) study, those participating Six Sigma organizations that seek to improve the level of learning and knowledge creation taking place within the Six Sigma structure do so by improving coaching skills and resulting behaviors in their Black Belts, especially if that organization strives to become a Learning Organization.

A Black Belt's role as trainer and developer of Team Members could be enhanced if coaching skills and behaviors were integrated into regular managerial activities, based upon the need for open communication, trust building, and employee involvement, all of

which, according to the literature, provide a significant impact on project performance and Six Sigma success. Open communication, trust building, and employee involvement are essential to coaching as it is defined in this research. The integration of coaching into Black Belt training, development, and selection may help provide greater opportunity for incorporating communication, involvement, and trust into the Six Sigma structure (Choo, Linderman & Schroeder, 2007a; McAdam & Lafferty, 2004; Dahlgaard & Dahlgaard-Park, 2006; Powell, 1995; Samson & Terziovski, 1999; Ellinger, Ellinger & Keller, 2003a; Ellinger, 1999; Graham et al., 1993). The relationship between Coaching Expertise and Team Outcomes, Customer/Project Outcomes, and Organizational Outcomes helps to establish that coaching does, indeed, have an impact upon the success of Black Belt's Six Sigma project.

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Appendix A

IRB Approval

Request for IRB Approval for Change in Protocol

IRB Study Number: 0711P20201
Principal Investigator: Marcia (Toberman) Hagen
Primary Title: The Relationship between Black Belt Coaching and Perceived Six Sigma Project Outcome

Indicate the type of change/addition and attach all applicable documents:

☐ Protocol Amendment: Version , Dated
☐ Revised Investigator Brochure: Version , Dated
☒ Recruitment Changes/Advertisements
☐ Notice of Closure to Accrual
☐ Change(s) to Study Procedures
☒ Other: Changes to consent form

Briefly summarize the change(s). For protocol amendments, do not say "See summary of changes provided with amendment". Rather, summarize the nature of the significant revisions.

- I have received contact information for a larger group of employees than I had originally anticipated, from an organizational sponsor [redacted]. Because of the unexpectedly low response rates within other participating organizations, I need to include all of the potential [redacted] participants, in order to get the data necessary to perform expected statistical analyses. Thus, I want to increase the total number of participant invitations to 1000. You have previously agreed to allow the distribution/invitation of the survey to 600 participants. OK

- I need to increase the number of winners in the random drawing from:

1-$200.00		2- $200.00
5- $50.00	to	8-$50.00
10- $20.00		25-$20.00

The committee has, in the past, approved the random drawing for this research at the rates listed in column 1. Because of the higher than anticipated number of potential participants, I would like to increase the number of drawing recipients. OK

Describe the rationale for the change(s):

- Due to low response rates, I need to increase the number of people who will be invited to participate in the study. I have been provided with a larger number of potential participants (as described above) than expected, and would like to be able to include those individuals in the study. The increased potential compensation is in response to the higher than expected number of potential participants.

IRB - APPROVED BY EXPEDITED REVIEW
IRB 5-23-08

Appendix B

Adaptations to Black Belt Project and Learning Instruments

Dimension	Original Item	Change to Item	Basis for Change
Open communication	Park, et al. (2008).		
	When I share my feelings with my manager, my manager appears to be comfortable.	I was comfortable when team members shared their feelings.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	When a situation needs my manager's experiences, he/she willingly discusses them.	I was willing to discuss my experiences when the situation warranted.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	In facing new problems, my manager would rather listen to my opinion first.	I listened to team members opinions when we faced new problems, rather than consulting resources outside of the team.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	When I work with my manager, he/she discusses his/her expectations with me.	I discussed my expectations with the team members.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
Team approach	My manager would rather work with others to complete tasks.	I prefer to work with a team, rather than by myself, when completing tasks.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	As a part of a workplace group, my manager prefers to work for group consensus.	I contribute to creating team consensus.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
	When a decision is to be made, my manager prefers to participate with others to determine the outcome	I solicit team member's opinions when a decision is to be made.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.

Dimension	Original Item	Change to Item	Basis for Change
	When analyzing a problem, my manager tends to rely on group ideas.	I rely on group ideas when analyzing a problem.	1. Changes made the series of questions parallel.
Value people	In discussion with me, my manager focuses on my individual needs.	I focus on the individual needs of team members.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	When facilitating business meetings, my manager leaves time for relationship building.	When facilitating meetings, I leave time for relationship building.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	In facing conflict between individual needs and tasks, my manager puts priority on meeting people's needs.	I put priority on meeting team member's needs, when facing a conflict between individual needs and work tasks.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
	In daily work, my manager considers people's needs outside the workplace.	I consider team member's needs outside the workplace, in my daily work.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
Accept ambiguity	My manager views differences of opinion as constructive.	I view difference of opinion as constructive.	1. Changes made the question applicable to the respondent.
	When I am making career decisions, my manager stresses risk-taking.	I stress risk-taking when helping team members make decisions.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
	When my manager seeks solutions to problems, he/she tends to try new solutions.	I seek new solutions, when I seek out solutions to problems.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
	My manager views disagreement in the workplace exhilarating.	Omitted	1. Changes improved question clarity.

Dimension	Original Item	Change to Item	Basis for Change
Facilitative development	My manager appears to view learning and development as one of his/her major responsibilities.	I view learning and development as one of my major responsibilities.	1. Changes made the series of questions parallel.
	In order to improve my performance, my manager serves as a role model.	I serve as a role model in order to improve the performance of employees.	1. Changes made the series of questions parallel.
	My manager actively provides opportunities for me to take more responsibility.	I actively provide opportunities for team members to take more responsibility.	1. Changes made the series of questions parallel.
	To improve work performance, my manager constantly provides feedback.	I constantly provide team members feedback in order to improve their performance.	1. Changes made the series of questions parallel.
Knowledge creation	Choo, et al. (2007b).		
	Doing this project enhanced the team's abilities and knowledge to perform future work.	Team member's overall ability and knowledge to perform future work was enhanced by taking part in this project.	1. Changes made the series of questions parallel.
	Solutions found in doing this project were clearly unique and innovative to the company.	The solutions this project generated were unique and innovative.	1. Changes improved question clarity.
	This team generated many ideas while doing the project.	Team members generated many ideas while doing this project.	1. Changes made the series of questions parallel.
Project complexity	Linderman & Choo (2008).		
	The project required a lot of different skills and knowledge from team members.	The project required a considerable amount of skill and knowledge from team members.	1. Changes improved question clarity.
	It took time to understand necessary the project's tasks and objectives.	It took an extensive amount of time to understand the project's necessary tasks and objectives.	1. Changes improved question clarity.

Dimension	Original Item	Change to Item	Basis for Change
.	The project required a lot of analysis.	The project required a considerable amount of analysis.	1. Changes improved question clarity.
	The project required a lot of detail work.	The project required a considerable amount of detail work.	1. Changes improved question clarity.
	The project was relatively simple (reverse).	Omitted	1. No reverse coded questions were included.
Project difficulty/ challenge	Choo (2003).		
	The tasks in this project were challenging.	The tasks involved in this project were challenging.	1. Changes improved question clarity.
	The team found this project to be difficult.	The project, in general, was difficult.	1. Changes improved question clarity. 2. Changes made the series of questions parallel.
	There was a sense of urgency in this project.	Completion of the project was considered urgent.	1. Changes improved question clarity.
	This project was easy and not challenging to the team.	The project deadlines were reasonable.	1. Revised question to remove reverse coding.
Facilitation of learning	Ellinger, et al., (2003a).		
	I use analogies, scenarios and examples to help my employees learn.	I used analogies, scenarios, and/or examples to help team members learn.	1. Changes made the question applicable to the respondent.
	I encourage my employees to broaden their perspectives by helping them to see the big picture.	I helped make team members aware of how the project fits into the big picture of the organization.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	I provide constructive feedback to my employees	I provided constructive feedback to team members.	1. Changes made the question applicable to the respondent.
	I solicit feedback from my employees to ensure that my interactions are helpful to them.	I solicited feedback from team members.	1. Changes made the question applicable to the respondent.

Dimension	Original Item	Change to Item	Basis for Change
	I provide my employees with resources to they can perform their jobs more effectively.	I helped team members by providing necessary or additional resources to help them perform more effectively.	1. Changes made the question applicable to the respondent.
	To help my employees think through issues, I ask questions, rather than provide solutions.	I helped team members think through issues by asking questions, rather than providing answers.	1. Changes made the question applicable to the respondent.
	I set expectations and communicate the importance of those expectations to the broader goals of the organization.	I set project expectations and communicated the importance of those expectations to the broader goals of the organization.	1. Changes made the question applicable to the respondent.
	To help them see different perspectives, I role-play with my employees.	I used role-play as a way to help team member better understand, and learn from, the project experience.	1. Changes made the question applicable to the respondent.
Team learning	Sarin & McDermott (2003).		
	Member's experience with the team is likely to help them perform better in cross-functional teams in the future.	Team member's experiences within the team are likely to help them perform in a cross-functional team environment in the future.	1. Changes improved question clarity.
	Member's experience with the project is likely to help them perform better on product development projects in the future.	Omitted	1. Question does not apply to many Six Sigma projects.
	Team members are likely to repeat the mistakes made here on other projects.	Omitted	1. Reverse coded items were not included in the survey.
	Due to their experience on this project, team members will be better prepared to handle similar situations.	Team members who worked on this project will be better prepared to handle similar projects.	1. Changes made the series of questions parallel.
	Members are likely to apply the lessons learned on this project to other areas in the organization	Team members are likely to use lessons learned in this project on similar projects.	1. Changes improved question clarity.

Dimension	Original Item	Change to Item	Basis for Change
Project management	Shenhar, Dvir, Levy, & Maltz (2003).		
	The project was completed on time or earlier.	The project was completed on-schedule/on-time.	1. Changes improved question clarity.
	The project was completed within or below budget.	The project was completed within budget.	1. Changes improved question clarity.
	The project has only minor changes.	The project was successful in improving the intended process or product	1. Changes improved question clarity.
	Other efficiency measures were achieved.	The project achieved its quality or dpm goals.	1. Changes made the question applicable to the respondent.
	Project was successful in following: Meeting customer expectations.	Project customer's expectations were met.	1. Changes improved question clarity.
Customer outcome	Project was successful in following: Customer satisfaction with the team project.	The projects customers' appeared to be satisfied with the overall results.	1. Changes improved question clarity.
	Project was successful in following: Customer uses the project.	Project customers provided positive feedback on the outcomes of this project.	1. Changes improved question clarity.
	Project was successful in following: The project was considered a success.	The project met customer expectations.	1. Changes improved question clarity.
Organization outcome	The project increased the organization's profitability	The project saved the company a significant amount of money	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	The project contributed to shareholder value.	The project contributed to broader organizational goals.	1. Changes improved question clarity.
	The project contributed to the organization's direct performance.	The project had a strategic impact for the organization.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	The team was highly satisfied.	Overall, I found the project to be a valuable experience.	1. Changes improved question clarity.

Dimension	Original Item	Change to Item	Basis for Change
Team outcomes	The project team had high morale and energy.	Omitted	1. Omitted due to question clarity.
	The team members experienced personal growth.	I grew personally as a result of the project.	1. Changes made the series of questions parallel.
	Team members wanted to stay in the organization.	I grew professionally as a result of working on the project.	1. Changes made the series of questions parallel. 2. Changes improved question clarity.

Appendix C

Adaptations to Project Team Coaching and Outcomes Assessment

Dimension	Original Item	Change to Item	Basis for Change
Open communication	Park, et al. (2008).		
	When I share my feelings with my manager, my manager appears to be comfortable.	When sharing my feelings, the Black Belt leader appeared to feel comfortable.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	When a situation needs my manager's experiences, he/she willingly discusses them.	The Black Belt leader was willing to discuss his/her pertinent experiences when the situation warranted.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	In facing new problems, my manager would rather listen to my opinion first.	The Black Belt leader listened to team members' opinions when we faced new problems, before consulting resources outside of the team.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	When I work with my manager, he/she discusses his/her expectations with me.	The Black Belt leader discussed his/her expectations with the team.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
Team approach	My manager would rather work with others to complete tasks.	The Black Belt leader preferred to work with a team, rather than by his or her self when completing tasks.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	As a part of a workplace group, my manager prefers to work for group consensus.	The Black Belt leader contributed to creating team consensus.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
	When a decision is to be made, my manager prefers to participate with others to determine the outcome.	The Black Belt leader solicited team member's opinions when a decision was to be made.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.

Dimension	Original Item	Change to Item	Basis for Change
	When analyzing a problem, my manager tends to rely on group ideas.	The Black Belt leader relied on group ideas when analyzing a problem.	1. Changes made the series of questions parallel.
Value people	In discussion with me, my manager focuses on my individual needs.	The Black Belt leader focused on the individual needs of team members.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	When facilitating business meetings, my manager leaves time for relationship building.	When facilitating meetings, the Black Belt leader left time for relationship-building.	1. Changes made the question applicable to the respondent. 2. Changes improved question clarity.
	In facing conflict between individual needs and tasks, my manager puts priority on meeting people's needs.	The Black Belt leader put priority on meeting team member's needs, when facing a conflict between individual needs and work tasks.	1 Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
	In daily work, my manager considers people's needs outside the workplace.	The Black Belt leader considered team member's needs outside the workplace, in daily work.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
Accept ambiguity	My manager views differences of opinion as constructive.	The Black Belt leader viewed difference of opinion as constructive.	1. Changes made the question applicable to the respondents.
	When I am making career decisions, my manager stresses risk-taking.	The Black Belt leader stressed risk-taking when helping team members make decisions.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
	When my manager seeks solutions to problems, he/she tends to try new solutions.	The Black Belt leader sought new solutions to problems.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
	My manager views disagreement in the workplace exhilarating.	Omitted	1. Omitted due to question clarity.

Dimension	Original Item	Change to Item	Basis for Change
Facilitative development	My manager appears to view learning and development as one of his/her major responsibilities.	The Black Belt leader viewed learning and development as one of his/her major responsibilities.	1. Changes made the series of questions parallel.
	In order to improve my performance, my manager serves as a role model.	The Black Belt leader served as a role model in order to improve the performance of employees.	1. Changes made the series of questions parallel.
	My manager actively provides opportunities for me to take more responsibility.	The Black Belt leader actively provided opportunities for team members to take more responsibility.	1. Changes made the series of questions parallel.
	To improve work performance, my manager constantly provides feedback.	The Black Belt leader constantly provided team members feedback in order to improve their performance.	1. Changes made the series of questions parallel.
	Choo, et al. (2007b)		
Knowledge creation	Doing this project enhanced the team's abilities and knowledge to perform future work.	Team member's overall ability and knowledge to perform future work was enhanced by taking part in this project.	1. Changes made the series of questions parallel.
	Solutions found in doing this project were clearly unique and innovative to the company.	The solutions this project generated were unique and innovative.	1. Changes improved question clarity.
	This team generated many ideas while doing the project.	Team members generated many ideas while doing this project.	1. Changes made the series of questions parallel.
	Linderman (2008).		
Project complexity	The project required a lot of different skills and knowledge from team members.	The project required a considerable amount of skill and knowledge from team members.	1. Changes made the series of questions parallel.
	It took time to understand necessary the project's tasks and objectives.	It took an extensive amount of time to understand the project's necessary tasks and objectives.	1. Changes improved question clarity.
	The project required a lot of analysis.	The project required a considerable amount of analysis.	1. Changes improved question clarity.

Dimension	Original Item	Change to Item	Basis for Change
	The project required a lot of detail work.	The project required a considerable amount of detail work.	1. Changes improved question clarity.
	The project was relatively simple (reverse).	Omitted	1. Reverse coded questions were not included in the survey.
Project difficulty/ challenge	Choo (2003).		
	The project was easy and not challenging to the team.	The project deadlines were reasonable.	1. Question was revised to remove reverse coding.
	The tasks in this project were challenging.	The tasks involved in this project were challenging.	1. Changes improved question clarity.
	The team found this project to be difficult.	The project, in general, was difficult.	1. Changes improved question clarity. 2. Changes made the series of questions parallel.
	There was a sense of urgency in this project.	Completion of the project was considered urgent.	1. Changes improved question clarity.
Facilitation of learning	Ellinger, et al. (2003a).		
	I use analogies, scenarios and examples to help my employees learn.	My Black Belt leader used analogies, scenarios, and/or examples to help team members learn.	1. Changes made the question applicable to the respondent.
	I encourage my employees to broaden their perspectives by helping them to see the big picture.	My Black Belt leader helped make team members aware of how the project fit into the big picture of the organization.	1. Changes made the question applicable to the respondent. 2. Changes made the series of questions parallel.
	I provide constructive feedback to my employees.	The Black Belt leader provided constructive feedback to team members.	1. Changes made the question applicable to the respondent.
	I solicit feedback from my employees to ensure that my interactions are helpful to them.	The Black Belt leader solicited feedback from team members.	1. Changes made the question applicable to the respondent.

Dimension	Original Item	Change to Item	Basis for Change
	I provide my employees with resources to they can perform their jobs more effectively.	The Black Belt leader helped team members by providing necessary or additional resources to help them perform more effectively.	1. Changes made the question applicable to the respondent.
	To help my employees think through issues, I ask questions, rather than provide solutions.	The Black Belt leader helped team members think through issues by asking questions, rather than providing answers.	1. Changes made the question applicable to the respondent.
	I set expectations and communicate the importance of those expectations to the broader goals of the organization.	The Black Belt leader set project expectations and communicated the importance of those expectations to the broader goals of the organization.	1. Changes made the question applicable to the respondent.
	To help them see different perspectives, I role-play with my employees.	The Black Belt leader used role-play as a way to help team members learn during the project.	1. Changes made the question applicable to the respondent.
Team learning	Sarin & McDermott, (2003).		
	Member's experience with the team is likely to help them perform better in cross-functional teams in the future.	Team member's experiences within the team are likely to help them perform in a cross-functional team environment in the future.	1. Changes improved question clarity.
	Member's experience with the project is likely to help them perform better on product development projects in the future.	Omitted	1. The question does not apply to many Six Sigma projects.
	Team members are likely to repeat the mistakes made here on other projects.	Omitted	1. Reverse coded items were not used in the survey.
	Due to their experience on this project, team members will be better prepared to handle similar situations.	Team members who worked on this project will be better prepared to handle similar projects.	1. Changes made the series of questions parallel.
	Members are likely to apply the lessons learned on this project to other areas in the organization.	Team members are likely to use lessons learned in this project on similar projects.	1. Changes improved question clarity.

Dimension	Original Item	Change to Item	Basis for Change
	The project was completed on time or earlier.	The project was completed on-schedule/on-time.	1. Changes improved question clarity.
Project management	Shenhar, Dvir, Levy, & Maltz (2007).		
	The project was completed within or below budget.	The project was completed within budget.	1. Changes improved question clarity.
	The project has only minor changes.	The project was successful in improving the intended process or product.	1. Changes improved question clarity.
	Other efficiency measures were achieved.	The project achieved its quality or dpm goals.	1. Changes made the question applicable to the respondent.
	Project was successful in following: Meeting customer expectations.	Project customer's expectations were met.	1. Changes improved question clarity.
Customer outcome	Project was successful in following: Customer satisfaction with the team project.	The projects customers' appeared to be satisfied with the overall results.	1. Changes improved question clarity.
	Project was successful in following: Customer uses the project.	Omitted	1. Changes improved question clarity.
	Project was successful in following: The project was considered a success.	The project met customer expectations.	1. Changes improved question clarity.
Organization outcome	The project increased the organization's profitability.	The project saved the company a significant amount of money.	1. Changes made the question applicable to the respondent 2. Changes improved question clarity.
	The project contributed to shareholder value.	The project contributed to broader organizational goals.	1. Changes improved question clarity.
	The project contributed to the organization's direct performance.	The project had a strategic impact for the organization.	1. Changes made the question applicable to the respondent 2. Changes improved question clarity.

Dimension	Original Item	Change to Item	Basis for Change
	The team was highly satisfied.	Overall, I found the project to be a valuable experience.	1. Changes improved question clarity.
Team outcomes	The project team had high morale and energy.	Omitted	1. Omitted due to question clarity.
	The team members experienced personal growth.	I grew personally as a result of the project.	1. Changes made the series of questions parallel.
	Team members wanted to stay in the organization.	I grew professionally as a result of working on the project.	1. Changes made the series of questions parallel. 2. Changes improved question clarity.

Appendix D

Black Belt Project and Learning Instrument: Project Characteristics

Dimension	Question
Introductory question1	1a. Please name or describe your most recently completed Six Sigma project in which you worked with a team (Organization A and Organization D).
	1b. Please describe the project listed above (Organization C, D, E, and F).
Introductory question 2	2. When was this project completed?
Project complexity 1	1. The project required a considerable amount of skill and knowledge from team members.
Project complexity 2	2. It took an extensive amount of time to understand the project's necessary tasks and objectives.
Project complexity 3	3. The project required a considerable amount of analysis.
Project complexity 4	4. The project required a considerable amount of detail work.
Project complexity 5	5. The project required extensive search for various solutions.
Project difficulty/challenge 1	6. The project deadlines were reasonable.
Project difficulty/challenge 2	7. The tasks required for this project were challenging.
Project difficulty/challenge 3	8. The team was challenged by the project.
Project difficulty/challenge 4	9. The project, in general, was difficult.
Project difficulty/challenge 5	10. Completion of the project was considered urgent.

Appendix E

Black Belt Project and Learning Instrument: Your Perceptions of the Project

Dimension	Question
Team learning 1	11. Being a part of the project team was a good learning experience for team members.
Team learning 2	12. Team member's experiences within the team are likely to help them perform in a cross-functional team environment in the future.
Team learning 3	13. Team members who worked on this project will be better prepared to handle similar projects.
Team learning 4	14. Team members are likely to use lessons learning in this project on similar projects.
Team knowledge creation 1	15. Team members generated many ideas while doing this project.
Team knowledge creation 2	16. The solutions this project generated were unique and innovative.
Team knowledge creation 3	17. Team member's overall ability and knowledge to perform future work was enhanced by taking part in the project.
Team knowledge creation 4	18. Major changes were implemented as a result of the project.
Team knowledge creation 5	19. Team members learned a great deal during the project.

Appendix F

Black Belt Project and Learning Instrument: Your Contributions to the Project

Dimension	Question
Facilitation of learning 1	20. I used analogies and/or examples to help team members learn.
Facilitation of learning 2	21. I helped make team members aware of how the project fits into the big picture of the organization.
Facilitation of learning 3	22. I provided constructive feedback to team members.
Facilitation of learning 4	23. I solicited feedback from team members.
Facilitation of learning 5	24. I helped team members by providing necessary or additional resources to help them perform more effectively.
Facilitation of learning 6	25. I helped team members think through issues by asking questions, rather than providing answers.
Facilitation of learning 7	26. I set project expectations and communicated the importance of those expectations to the broader goals of the organization.
Facilitation of learning 8	27. I used role-play as a way to help team members better understand, and learn from the project experience.
Open communication 1	28. I was comfortable when team members shared their feelings.
Open communication 2	29. I was willing to discuss my experiences when the situation warranted..
Open communication 3	30. I listened to team members' opinions when we faced new problems, rather than consulting resources outside of the team.
Open communication 4	31. I discussed my expectations with the team members.
Team approach 1	32. I prefer to work with a team, rather than by myself, when completing tasks.
Team approach 2	33. I contribute to creating team consensus.
Team approach 3	34. I solicit team member's opinions when a decision is to be made.
Team approach 4	35. I rely on group ideas when analyzing a problem.

Dimension	Question
Value people 1	36. I focus on the individual needs of team members.
Value people 2	37. When facilitating meetings, I leave time for relationship-building.
Value people 3	38. I put priority on meeting team member's needs, when facing a conflict between individual needs and work tasks.
Value people 4	39. I consider team member's needs outside the workplace, in my daily work.
Acceptance of ambiguity 1	40. I view difference of opinion as constructive.
Acceptance of ambiguity 2	41. I stress risk-taking when helping team members make decisions.
Acceptance of ambiguity 3	42. I seek new solutions, when I seek out solutions to problems.
Facilitative development 1	43. I view learning and development as one of my major responsibilities.
Facilitative development 2	44. I serve as a role model in order to improve the performance of employees.
Facilitative development 3	45. I actively provide opportunities for team members to take more responsibility.
Facilitative development 4	46. I constantly provide team members feedback in order to improve their performance.

Appendix G

Black Belt Project and Learning Instrument: Project Outcomes

Dimension	Question
Customer outcomes 1	47. The project met customer's expectations.
Customer outcomes 2	48. The project customers were satisfied with the overall results.
Customer outcomes 3	49. Project customers provided positive feedback on the outcomes of this project.
Project management outcomes 1	50. The project was completed within budget.
Project Management Outcomes 2	51. The project was successful in improving the intended process or product.
Project management outcomes 3	52. The project was completed within its original set schedule/on-time.
Project management outcomes 4	53. The project achieved its original quality or dpm goals.
Project management outcomes 5	54. Overall, the project achieved its original goals.
Team growth outcomes 1	55. Team members grew professionally as a result of working on the project.
Team growth outcomes 2	56. Team members grew personally as a result of the project.
Team growth outcomes 3	57. Overall, team members found the project to be a valuable experience.
Organizational outcomes 1	58. The project outcomes were financially significant.
Organizational outcomes 2	59. The project contributed positively to overall organizational performance.
Organizational outcomes 3	60. The project had a strategic impact for the organization.
Organizational outcomes 4	61. The project had a positive return on investment.
Organizational outcomes 5	62. The project contributed to broader organizational goals.
Bottom-line dollars 1	63. Approximately how much was the project worth, in terms of the bottom line?
Bottom-line dollars 2	64. If applicable, what was/will be the projected savings of the project one year after completion?

Appendix H

Black Belt Project and Learning Instrument: Project and Demographic Information

Dimension	Question
Demographic information 1	65. How many years have you been with the organization?
Demographic information 2	66. How many projects have you completed, as a Black Belt at this organization?
Demographic information 3	67. What is your highest level of education?
Demographic information 4	68. How many projects have you completed as a team member (not leader) both within and outside of this organization.
Demographic information 5	69. How many projects have completed as a Black Belt at another organization?
Demographic information 6	70. If you have any comments, questions, or concerns, please let me know!

Appendix I

Project Team Coaching and Outcomes Assessment: Leader Contributions to the Project

Dimension	Question
Introductory question 1	1. Please name or describe your most recently completed Six Sigma project in which you worked with a team.
Introductory question 2	2. When was this project completed?
Facilitation of learning 1	3. The Black Belt leader used analogies and/or examples to help team members learn.
Facilitation of learning 2	4. The Black Belt leader helped make team members aware of how the project fits into the big picture of the organization.
Facilitation of learning 3	5. The Black Belt leader provided constructive feedback to team members.
Facilitation of learning 4	6. The Black Belt leader solicited feedback from team members.
Facilitation of learning 5	7. The Black Belt leader helped team members by providing necessary or additional resources to help them perform more effectively.
Facilitation of learning 6	8. Te Black Belt leader helped team members think through issues by asking questions, rather than providing answers.
Facilitation of learning 7	9. The Black Belt leader set project expectations and communicated the importance of those expectations to the broader goals of the organization.
Facilitation of learning 8	10. The Black Belt leader used role-play as a way to help team members learn during the project.
Open communication 1	11. When sharing my feelings, the Black Belt leader appeared to feel comfortable .
Open communication 2	12. The Black Belt leader was willing to discuss his/her pertinent experiences when the situation warranted .
Open communication 3	13. The Black Belt leader listened to team members' opinions when we faced new problems, before consulting resources outside of the team.
Open communication 4	14. The Black Belt leader discussed his/her expectations with the team.
Team approach 1	15. The Black Belt leader preferred to work with a team, rather than by his or her self when completing tasks .
Team approach 2	16. The Black Belt leader contributed to creating team consensus.
Team approach 3	17. The Black Belt leader solicited team member's opinions when a decision was to be made.

Dimension	Question
Team approach 4	18. The Black Belt leader relied on group ideas when analyzing a problem.
Value people 1	19. When facilitating meetings, the Black Belt leader left time for relationship-building.
Value people 2	20. The Black Belt leader put priority on meeting team member's needs, when facing a conflict between individual needs and work tasks.
Value people 3	21. The Black Belt leader considered team member's needs outside the workplace, in daily work.
Value people 4	22. The Black Belt leader focused on the individual needs of team members.
Acceptance of ambiguity 1	23. The Black Belt leader viewed difference of opinion as constructive.
Acceptance of ambiguity 2	24. The Black Belt leader stressed risk-taking when helping team members make decisions.
Acceptance of ambiguity 3	25. The Black Belt leader sought new solutions to problems.
Facilitative development 1	26. The Black Belt leader viewed learning and development as one of his/her major responsibilities.
Facilitative development 2	27. The Black Belt leader served as a role model in order to improve the performance of employees .
Facilitative development 3	28. The Black Belt leader actively provided opportunities for team members to take more responsibility.
Facilitative development 4	29. The Black Belt leader constantly provided team members feedback in order to improve their performance.

Appendix J

Project Team Coaching and Outcomes Assessment: Project Characteristics

Dimension	Question
Project complexity 1	30. The project required a considerable amount of skill and knowledge from team members.
Project complexity 2	31. It took an extensive amount of time to understand the project's necessary tasks and objectives.
Project complexity 3	32. The project required a considerable amount of analysis.
Project complexity 4	33. The project required extensive search for various solutions.
Project complexity 5	34. The project required a considerable amount of detail work.
Project difficulty/challenge 1	35. The project deadlines were reasonable.
Project difficulty/challenge 2	36. The tasks required for this project were challenging.
Project difficulty/challenge 3	37. The team was challenged by the project.
Project difficulty/challenge 4	38. The project, in general, was difficult.
Project difficulty/challenge 5	39. Completion of the project was considered urgent.

Appendix K

Project Team Coaching and Outcomes Assessment: Your Perceptions of the Project

Dimension	Question
Team learning 1	40. Being a part of the project team was a good learning experience for me.
Team learning 2	41. My experiences within the team are likely to help them perform in a cross-functional team environment in the future.
Team learning 3	42. I feel better prepared to handle similar projects, after working on this project.
Team learning 4	43. I am likely to use lessons learning in this project on similar projects.
Team knowledge creation 1	44. We generated many ideas while doing this project.
Team knowledge creation 2	45. The solutions this project generated were unique and innovative.
Team knowledge creation 3	46. My overall ability and knowledge to perform future work was enhanced by taking part in the project.
Team knowledge creation 4	47. Major changes were implemented as a result of the project
Team knowledge creation 5	48. I learned a great deal during the project.

Appendix L

Project Team Coaching and Outcomes Assessment: Project Outcomes

Dimension	Question
Team growth outcomes 1	49. Team members grew professionally as a result of working on the project.
Team growth outcomes 2	50. Team members grew personally as a result of the project .
Team growth outcomes 3	51. Overall, team members found the project to be a valuable experience.
Customer outcomes 1	52. The project customer's expectations were met.
Customer outcomes 2	53. The project customers appeared to be satisfied with the overall results.
Project management outcomes 1	54. The project was completed within budget.
Project Management Outcomes 2	55. .The project was completed within its original set schedule/on-time.
Project management outcomes 3	56. .The project was successful in improving the intended process or product.
Project management outcomes 4	57. The project achieved its original quality or dpm goals.
Project management outcomes 5	58. The project achieved its overall goals.
Organization outcomes 1	59. The project outcomes were financially significant.
Organization outcomes 2	60. The project had a strategic impact for the organization.
Organization outcomes 3	61. The project contributed to broader organizational goals.
Organization outcomes 4	62. The project had a positive return on investment.
Organization outcomes 5	63. The project saved the company a significant amount of money.
Bottom-line dollars 1	64. Approximately how much was the project worth, in terms of bottom line savings?

Appendix M

Project Team Coaching and Outcomes Assessment: Project and Demographic Information

Dimension	Question
Demographic information 1	65. How many years have you been with the organization?
Demographic information 2	66. How many projects have you completed, as a team member at this organization?
Demographic information 3	67. How many projects have you completed as a team member outside of this organization?
Demographic information 4	68. What is your highest level of education?
Demographic information 5	69. If you have any questions, comments, or concerns, please let me know!

Appendix N

Principal Component Factor Analysis: Independent Variables

Item	Project Characteristic	Coaching	Employee Focus
Project difficulty/challenge 4	0.688 (2)		
Project complexity 3	0.662 (1)		
Project complexity 2	0.651 (1)		
Project complexity 5	0.641 (1)		
Project difficulty/challenge 2	0.626 (2)		
Project difficulty/challenge 3	0.573 (2)		
Project complexity 4	0.553 (1)		
Project complexity 1	0.518 (1)		
Project difficulty/challenge 5	0.309 (2)		
Team approach 2		0.769 (5)	
Facilitative development 3		0.733 (8)	
Facilitative development 2		0.727 (8)	
Facilitation of learning 6		0.714 (3)	
Facilitation of learning 5		0.704 (3)	
Open communication 4		0.704 (4)	
Open communication 2		0.700 (4)	
Accept ambiguity 1		0.698 (7)	
Team approach 3		0.697 (5)	
Facilitative development 4		0.696 (8)	
Facilitation of learning 7		0.687 (3)	
Facilitation of learning 4		0.681 (3)	
Facilitation of learning 3		0.677 (3)	
Facilitation of learning 2		0.675 (3)	
Value people 2		0.665 (6)	0.443 (6)
Accept ambiguity 2		0.665 (7)	

Item	Project Characteristic	Coaching	Employee Focus
Facilitative development 1		0.660 (8)	
Team approach 4		0.653 (5)	
Facilitation of learning 1		0.648 (3)	
Accept ambiguity 3		0.644 (7)	
Value people 1		0.621 (6)	0.370 (6)
Open communication 1		0.592 (4)	
Team approach 1		0.592 (5)	
Value people 3		0.585 (6)	0.457 (6)
Facilitation of learning 8		0.455 (3)	
Value people 4		0.550 (6)	0.557 (6)

Note. Items are referred to descriptively, rather than numerically. For actual question, see Appendices D – M. The numbers in parentheses refer to the dimension in which the item belongs.

Appendix O

Principal Component Factor Analysis: Dependent Variables

Item	Team Outcomes	Customer/Project Outcomes	Organizational Outcomes
Knowledge creation 3	0.853 (10)		
Team learning 3	0.845 (9)		
Knowledge creation 5	0.845 (10)		
Team learning 1	0.84 (9)		
Team learning 5	0.837 (9)		
Team learning 4	0.817 (9)		
Knowledge creation 1	0.769 (10)		
Team growth 1	0.759 (13)		
Team growth 3	0.745 (13)		
Team growth 2	0.721 (13)		
Knowledge creation 2	0.602 (10)		
Organizational outcomes 2			0.828 (14)
Organizational outcomes 5			0.814 (14)
Organizational outcomes 4			0.807 (14)
Organizational outcomes 3			0.805 (14)
Organizational outcomes 1			0.791 (14)
Knowledge creation 4		0.409 (10)	0.516 (10)
Project management 4		0.759 (12)	0.440 (12)
Project management 5		0.758 (12)	0.427 (12)
Customer outcomes 1		0.746 (11)	
Customer outcomes 2		0.735 (11)	
Project management 1		0.728 (12)	
Project management 3		0.675 (12)	
Project management 2		0.501 (12)	0.446 (12)

Note. Items are referred to descriptively, rather than numerically. For actual question, see Appendices D - M . The numbers in parentheses refer to the dimension in which the item belongs.

Appendix P

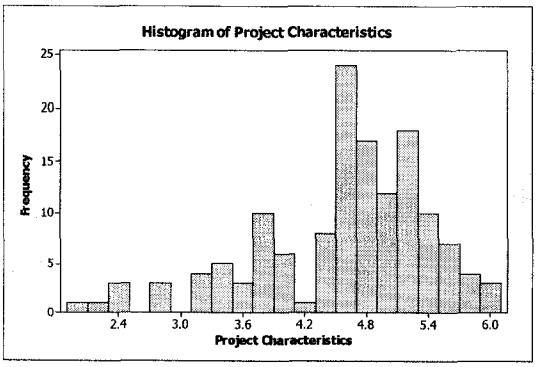

Figure 1. Black Belts Project Characteristics Histogram

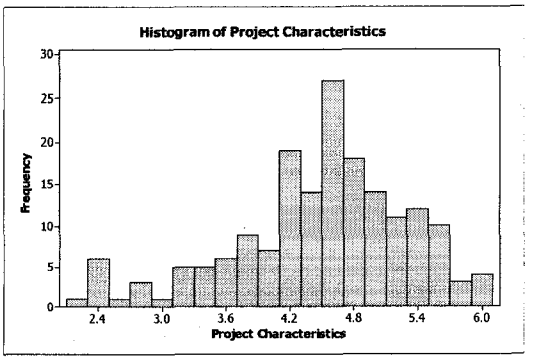

Figure 2. Team Members Project Characteristics Histogram

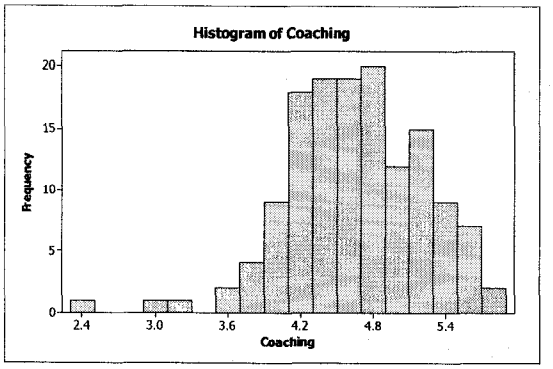

Figure3. Black Belts Coaching Expertise Histogram

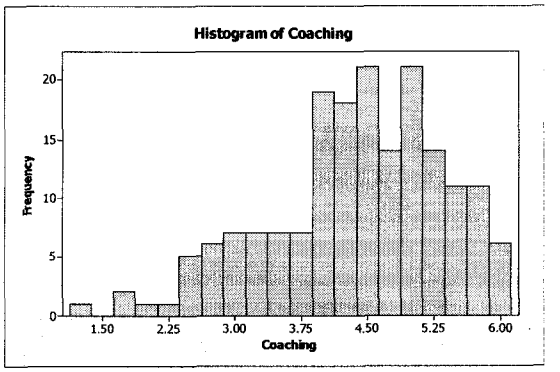

Figure 4. Team Members Coaching Expertise Histogram

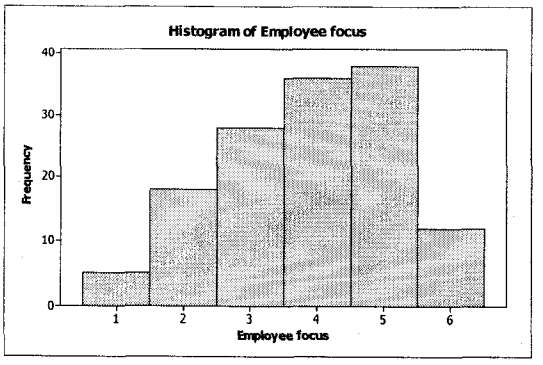

Figure5. Black Belts Employee Focus Histogram

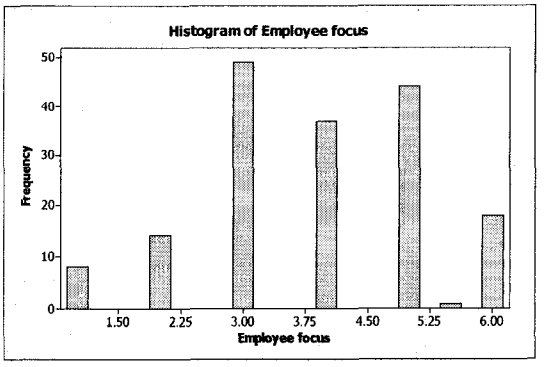

Figure 6. Team Members Employee Focus Histogram

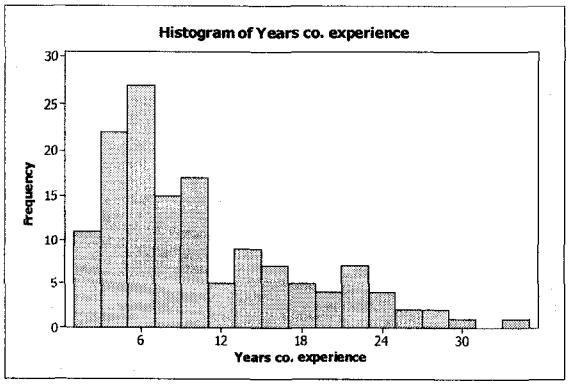

Figure 7. Black Belts Years of Experience Projects Histogram

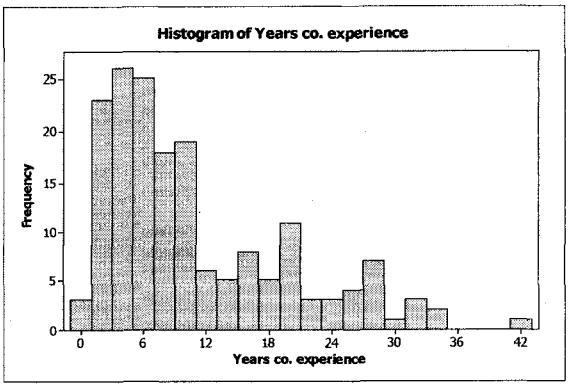

Figure 8. Team Members Years of Experience Histogram

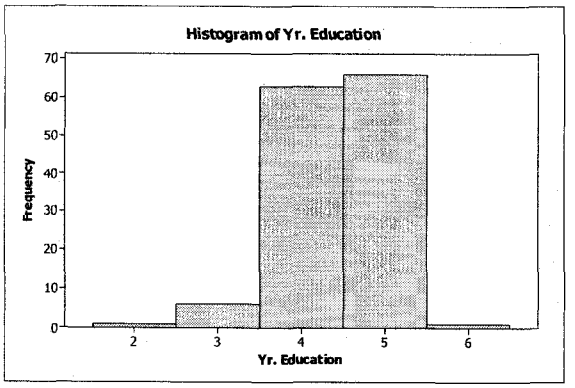

Figure 9. Black Belts Education Level Histogram

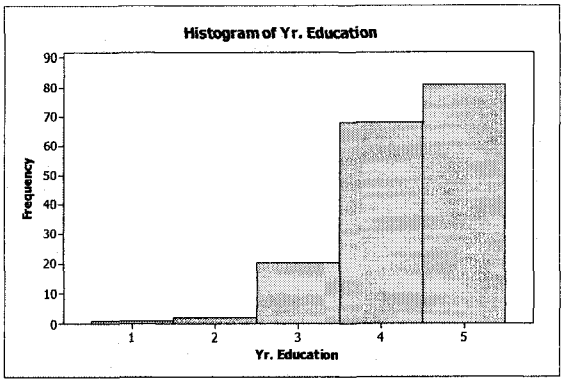

Figure 10. Team Members Education Level Histogram

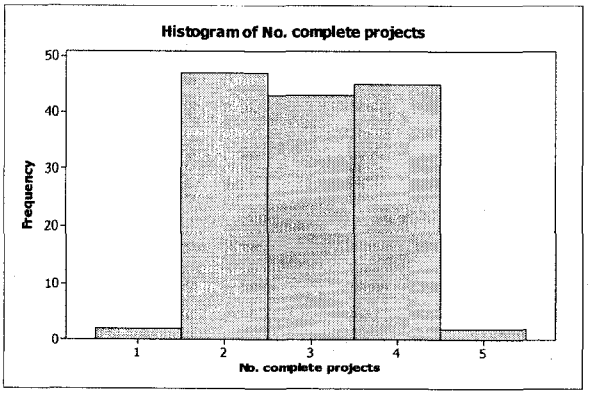

Figure 11. Black Belts Number of Completed Projects Histogram

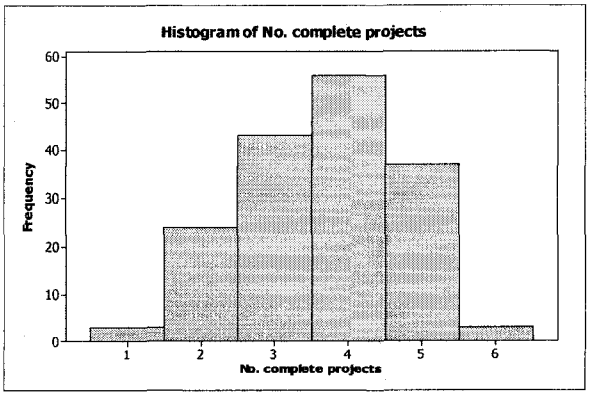

Figure 12. Team Members Number of Completed Projects Histogram

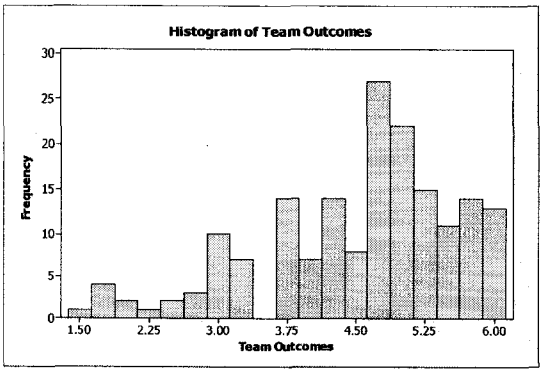

Figure 13. Black Belts Team Outcomes Histogram

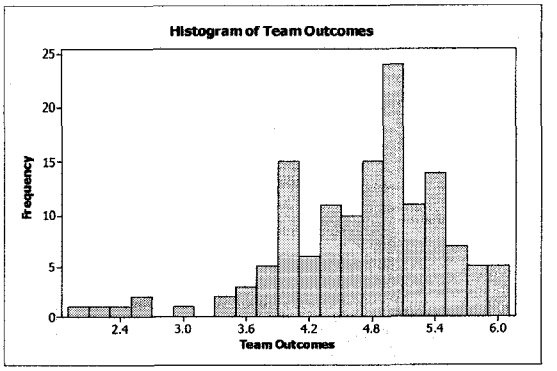

Figure 14. Team Members Team Outcomes Histogram

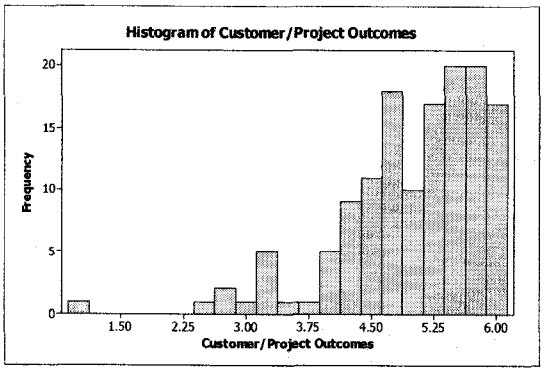

Figure 15. Black Belts Customer/Project Outcomes Histogram

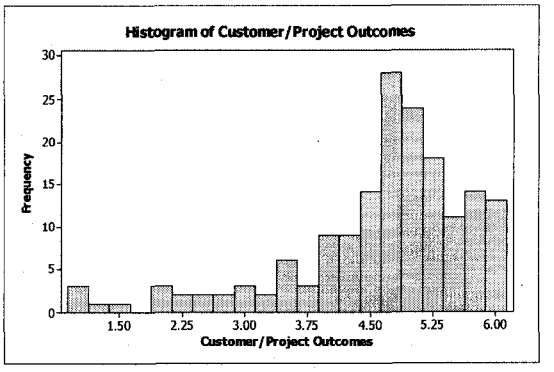

Figure 16. Team Members Customer/Project Outcomes Histogram

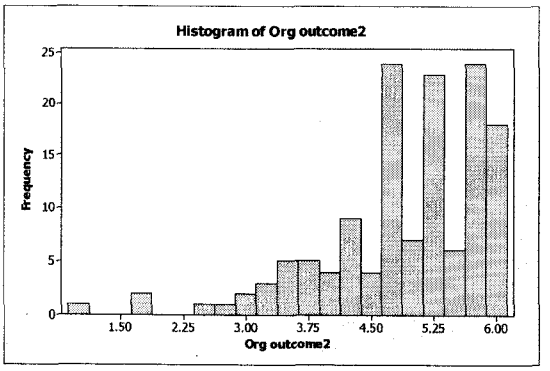

Figure 17. Black Belts Organizational Outcomes Histogram

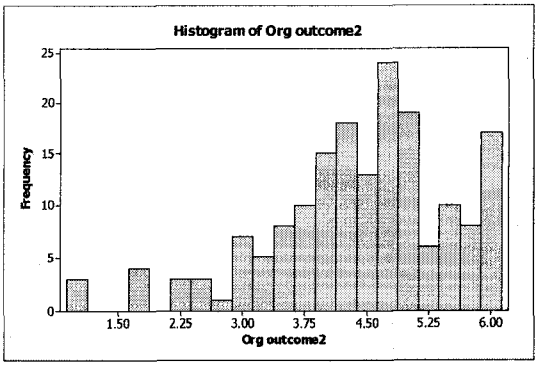

Figure 18. Team Members Organizational Outcomes Histogram

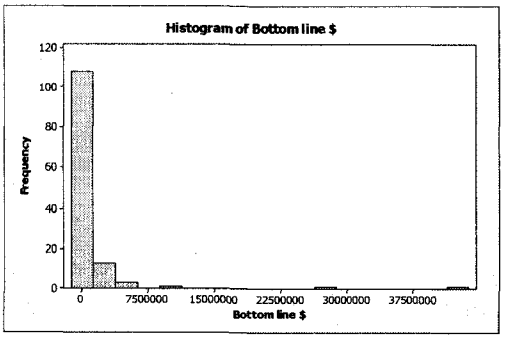

Figure 19. Black Belts Bottom-line Dollars Histogram

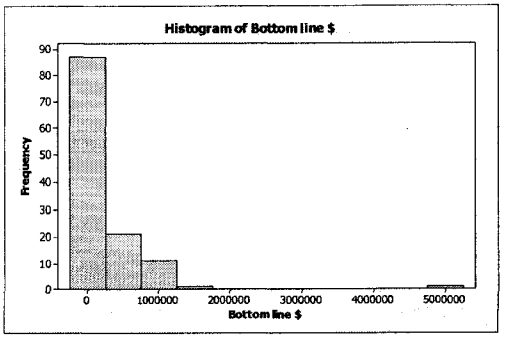

Figure 20. Team Members Bottom-line Dollars Histogram