Walden University

COLLEGE OF MANAGEMENT AND TECHNOLOGY

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Herzl Marouni

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2010

Abstract

Analysis of Perceived Value of International Organization for Standardization 10006 Standard and Total Quality Management on Project Success

by

Herzl Marouni

M.S., University of Houston, 1985

B.S., University of Houston, 1982

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Applied Management and Decision Sciences

Walden University

May 2010

Abstract

The problem under study was that although many organizations involved in project management (PM) have adopted total quality management (TQM) to improve business performance, most do not utilize the guidelines within the International Organization for Standardization (ISO) 10006 Standard in the management of projects to ensure success. The purpose of the study was to gain further knowledge of the perceived value of TQM on project success and to identify potential reasons for the limited use of ISO 10006 in improving project success. The theory of constraints and systems theory framework were applied to address factors that prevent organizations from taking advantage of TQM and from utilizing the benefits of ISO 10006. A survey-based quantitative comparative approach of selected members of the Project Management Institute and American Society for Quality, along with the multivariate analysis of variance method, was used to test the differing impact of TQM tenets and quality management principles of ISO 10006 on measures of project success. Results of this study revealed that cooperation among internal and external stakeholders of the originating and the project organizations and employee involvement have a significant positive impact on project success. In addition, it was found that when individuals involved with projects focus their efforts on satisfying internal and external customers while taking a factual approach to decision making throughout the project cycle, improvement in project success follows. Organizations with a recognized TQM program that have not realized its full potential and that of the ISO 10006 Standard can use the results of the study to improve various PM processes to improve their PM practices and project success.

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Dedication

This study is dedicated to my family whose continued support through each endeavor enabled me to arrive at this, and all, milestones in my life. To my children, Dr. Amir Marouni and Oren Marouni, I hope I have shown that learning never ends. From them I have reaped joy and pride and the knowledge that they will make amazing contributions to humanity and that the world is, and will be, a better place for their being part of it.

Additionally, I dedicate this study to my mother, Moluk Marouni-Saadat, and to the memory of my late father, Yadollah Marouni, who instilled in me the seed of learning.

Acknowledgments

I would like to acknowledge the following people whose guidance enabled me to reach this milestone:

First, I would like to recognize Dr. Walter McCollum, my dissertation committee chair and faculty mentor, for his continued support and guidance since I met him more than three years ago. I will be forever indebted to him.

Second, I would like to thank Drs. Marilyn Simon and Robert Levasseur for their guidance and valuable suggestions in assisting me in developing a scholarly work.

I also offer my sincere thanks and appreciation:

To my dissertation editor, Toni Williams, and statistician, Dr. Tom Granoff, for their genuine interest in helping me to complete this study.

To the management at American Bureau of Shipping (ABS), where I have been employed for more than 16 years for their financial and moral support.

To the 2009-2010 American Society for Quality (ASQ) Greater Houston Section President, Mr. Greg Soap, the 2009-2010 ASQ Dallas Section President, Mr. Frederick Martin, the 2009 Project Management Institute (PMI) Houston Chapter President, Mr. John Gorman III, and the 2009 PMI Dallas Chapter President, Mr. Dwarala Iyengar, for agreeing to inform their respective memberships about the opportunity to participate in my study.

This acknowledgment would not be complete without thanking all individuals who participated in my study.

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Chapter 1: Introduction to the Study

The adoption of various management philosophies and business improvement initiatives by organizational leaders to improve an organization's performance in an increasingly competitive market has been a topic of discussion in boardrooms as well on productions floors for many years. The discussions intensified after more organizational leaders changed their mode of operations from managing the quality of products and services by the application of solely traditional quality control techniques to a more comprehensive quality assurance approach. The quality assurance approach includes an emphasis on preventing defects, continuous improvement, and building quality into products. Such an approach requires a change from old quality management to new quality management that is based on competition, and driven by a need in the financial marketplace's need for improvement in results (Williams, Wiele, Iwaarden, Bertsch & Dale, 2006).

Project-focused companies that excel in project management (PM) surpass their competitors in six areas: integrated processes, culture, management support, training and education, informal PM, and behavioral excellence (Kerzner, 2004). Kerzner also identified total quality management (TQM), PM, concurrent engineering, risk management, and change management, as the five management processes that excellent companies integrate in the 21st century. The holistic view of quality within TQM enables organizational leaders to manage changes through a systematic and multidisciplinary approach. The emphasis of the TQM culture on the involvement of all employees and their contributions to the development of a PM framework can lead to a consistent and continually improved performance (Bryde, 1997).

The plan-do-check-act (PDCA) cycle, also known as the Shewhart cycle or the Deming cycle, is one of the more recognized models for the TQM principle of continuous improvement and is the "underlying concept for the integration among project management processes" (Project Management Institute [PMI], 2004, p. 39). The identification of TQM as one of the nonproprietary approaches to quality management and its compatibility with project quality management processes (PMI, 2004) validates the need to integrate TQM into PM. The objective of integrating TQM and PM is to enable project-focused organizational leaders to take advantage of the synergy for improving project success that such integration brings about.

A number of barriers prevent the effective implementation of TQM and thus preclude obtaining the maximum benefits that TQM can bring to an organization. One such barrier is a result of the fact that the results in improvements in an organization from implementation of TQM are disproportionately small relative to the amount of effort expended to achieve the improvements (Gardiner, Blackstone, & Gardiner, 1994). Other barriers include the delegation of quality to quality experts rather than to real people, loss of entrepreneurship and innovation in corporate culture (Harari, 1997), lack of incentive for involvement, and leadership failures (R. M. Miller & Cangemi, 1993).

Zadry and Yusof (2006) noted that those barriers that result in the failure to take full advantage of TQM can be overcome. One approach to overcoming the barriers that received a lot of attention since the conception of TQM in the 1970s in the manufacturing environment as a scheduling algorithm (Mabin & Balderstone, 2003) and its subsequent development and introduction by Goldratt and Cox (1984) as a management theory is the theory of constraints (TOC). According to Mabin and Balderstone**,** the theory of

constraints is a multi-faceted approach developed over time to aid people and organizations in reviewing problems, finding creative solutions to them and enabling those solutions to be implemented successfully.

Zadry and Yusof (2006) defined TOC as an amalgam of philosophy, principles and tools conceived to ensure optimal performance of any organization by enabling the members of that organization to identify, control and ultimately eliminate any problem that prevents that organization from operating at peak performance**.** One of the factors associated with the unsuccessful implementation of TQM is its inherent conceptual requirements that leaders must apply quality efforts everywhere in an organization. The application of TOC to TQM offers a way of moving from a hit-or-miss implementation of TQM to a more focused effort that provides rapid results (Gardiner et al., 1994).

By characterizing every system as a chain of interrelated operations or processes, TOC helps organizations achieve rapid results through its two major components, the five focusing steps and the thinking process, and by providing answers to the fundamental questions of what to change, what to change to, and how to cause the change. The theory of constraints further helps organizations maximize performance through a better understanding of the cause-and-effect relationships that exist between interrelated processes in the system. The theory of constraints provides a structured approach that allows organizational leaders to implement TQM successfully while focusing their continual improvement efforts on individual constraints one at a time rather than through a wide-ranging approach. According to Reid (2007), the weakest link in a chain of activities will impact on the ultimate outcome of the process, it is of paramount

importance to administer all interconnected activities in the system to ensure that all goals are met and that they are met at optimal performance.

As noted in *A Guide to the Project Management Body of Knowledge* (PMI, 2004), or *PMBOK*, a PM system is "the aggregation of the processes, tools, techniques, methodologies, resources, and procedures to manage a project" (p. 369). Researchers at PMI identified project quality management as one of the nine knowledge areas that comprise the PM system, and quality planning, quality assurance, and quality control as its overarching processes (PMI, 2004). Researchers at PMI indicated quality control processes include monitoring project results, determining whether the results comply with the established quality standards and meet the project objectives, and mitigating the conditions that prevent project success (PMI, 2004).

Another tool that organizational leaders might find helpful in their efforts to increase the success of their projects is the ISO 10006:2003 (Quality Management Systems: Guidance for Quality Management in Projects) Standard, released originally in 1997 by the International Organization for Standardization (ISO) and subsequently revised in 2003. ISO 10006:2003 is developing the newest trend in the way we approach project management and can be beneficial to consider when planning a project (Stanleigh, 2004a). An examination of the standard and the *PMBOK* (PMI, 2004) provides a clear indication that duplications and differences exist between the two documents. In tandem, however, they expand the PM body of knowledge (Stanleigh, 2004a). The focus of the quantitative comparative study supported by systems theory and the focusing steps approach of the TOC framework was to investigate the potential positive impact of the critical factors of TQM and the eight quality management

principles of the ISO 10006:2003 Standard on project success in PM-focused organizations.

Background of the Problem

Project management as a formal endeavor began to evolve during the middle of the 20th century as a result of the development of PERT, the first program evaluation and review technique which signaled the birth of a new discipline (Shenhar & Dvir, 2007). Project management has also changed from its traditional configuration with a flood of sizeable and cumbersome projects that ended up being years behind completion schedule and considerably over-budget, often as a result of changes made to the original scope (Kerzner, 2004) through a renaissance to its current modern format. The change was in response to the demand experienced by not only the project-focused leaders of organizations but also a wide spectrum of organizational leaders competing in the rapidly changing business environment.

Achieving quality requires more than the application of inspection and of the tools of quality assurance (Zink, 2007). To achieve quality requires a change from detection to prevention that necessitates a change in the way organizational leaders manage their businesses through a new operating philosophy (Hafeez, Malak, & Abdelmeguid, 2006) leading to the widespread use of TQM. Many authors of scientific studies (Green, 2006; Harari, 1997; Meegan & Taylor, 1997; R. L. Miller & Cangemi, 1993; D. Miller & Hartwick, 2002; Sebastianelli & Tamimi, 2003) have pointed to the failure of TQM in meeting various perceived expectations. However, a large volume of studies (Beer, 2003; Deming, 1986; Escrig-Tena, 2004; Hendricks & Singhal, 1997, 2001; Juran, 1988; Shenawy, Baker, & Lemak, 2007) show that when implemented properly, TQM, with its

basic tenets of customer focus, elevated employee involvement, continuous improvement, enlightened leadership, and management by fact (Green, 2006), can be a powerful management tool that allows organizational leaders to improve organizations' operations and meet their stakeholders' needs and expectations.

One of the lessons learned during the transition from the renaissance to modern PM was the "importance of total quality management and shortening product development time" (Kerzner, 2004, p. 217). The introduction of TQM in 1985 (Kerzner, 2004) to the PM discipline was an attempt to improve project success by helping employees attain the planned objectives of a project. However, indications pointed to TQM's failure to deliver as expected. Although the timeline of the Standish Group's 7 years of CHAOS research showed some improvements in information technology PM and the project success rate, this rate had reached only 28% in 2000 (Standish Group International, 2001).

According to the KPMG Global IT Project Management Survey of over 600 international organizations in 2005, in the preceding 12 months, 49% of participants had experienced at least one project failure. In the same period, only 2% of organizations achieved target benefits all the time and 86% of organizations lost up to 25% of target benefits across their entire project portfolio. Recent figures from the 2009 Standish Group's CHAOS report indicated a significant increase in overruns in both cost and time. Time overruns increased from 72% in 2006 to 79% in 2008, whereas the change in cost overruns went from 47% in 2006 to 54% in 2008 (Standish Group International, 2009). Shenhar and Dvir (2007) noted that because

> most projects [are] failing to meet time and budget goals, and many projects are not fulfilling their business objectives, there seems to be an alarming gap between the needs of the discipline and what we know in order to fix them. (p. 93)

Such dismal results have led organizational leaders to reach for other alternatives to improve project success. One of the six areas comprising the hexagon of excellence that allows organizational leaders to excel in their PM-related activities beyond their competitors is integrated processes (Kerzner, 2004). Total quality management is the first in a series of management processes that have supported the acceptance of PM since 1985 (Kerzner, 2004). Kerzner (2004) also noted, "Companies that reach excellence are the quickest to recognize the synergy among the many management options available today. Companies that reach maturity and excellence the quickest are those that recognize that certain processes feed on one another" (p. 329). The focus of the current study was the benefits of quality improvement tools and techniques such as TQM and the ISO 10006:2003 Standard that, when applied, will enable organizations to maximize their PM capabilities, improve project success, and achieve business objectives.

Statement of the Problem

The problem examined in the study was that although organizations involved in PM have adopted TQM to improve business performance (Bryde & Robinson, 2007; Joiner, 2007; Shenawy et al., 2007; Sila & Ebrahimpour, 2005; Yusuf, Gunasekaran, & Dan, 2007), most are not utilizing the guidelines within the ISO 10006:2003 Standard that will enhance the management of projects and improve the quality and success of projects that are critical to improved business performance (Stanleigh, 2005). The results of the 2009 Standish Group's CHAOS report indicated an overall decrease in project

success rates. The statistics showed that 32% of projects succeeded, with the measures for success being on-time delivery, on budget, and within specified features and functions. Of the challenged projects that did not completely meet their intended goals, 44% and 24% of the projects either were cancelled or were delivered and never put into service and thereby considered failures (Standish Group International, 2009).

Purpose of the Study

The quantitative comparative study involved the application of a Likert-type scale survey-based approach in assessing the perception of members of two selected PMI chapters and two selected American Society for Quality (ASQ) sections in Texas to gain further knowledge of the positive impact of TQM critical factors and the use of guidelines within ISO 10006:2003 on project success. The findings might provide organizational leaders with results they can use to (a) improve various PM practices throughout the project life, (b) improve project success, and (c) experience positive results in the areas of employee morale, organizational profitability, and customer satisfaction. The results of the study might also stimulate further interest in PM research and fill the gap that exists in the research literature in the area of the application of quality management in projects.

Significance of the Study

Project failures are more behavioral than quantitative in nature, as PM has evolved from its traditional to its current modern configuration (Kerzner, 2004). To address the shift, organizational leaders need to utilize tools that can help them effectively determine the causes of project failures and prevent the same failures from recurring in future projects. The Project Quality Management Process Flow Diagram

depicted in the *PMBOK* (PMI, 2004, p. 183) identified various interactions between other PM processes and the project quality management processes that are compatible with approaches such as TQM, pointing to the fact that integration between TQM and PM is necessary for PM to be effective. Total quality management is one of the tools that, when effectively implemented and integrated with PM practices, can fulfill these objectives.

Organizations involved with PM and whose leaders have implemented TQM, but do not realize the full potential of its implementation, could use the results of the quantitative comparative study to improve the interaction between various entities and processes throughout the project life cycle. The results of the study might increase the level of knowledge among organizational leaders of the benefits that the ISO 10006:2003 Standard can bring into their PM practices. From a research perspective, the study could stimulate further interest in PM research.

Nature of the Study

Although several research methodologies received consideration as potential strategies of inquiry for the study, including case study, quantitative descriptive, explanatory, and comparative research designs, the research included a quantitative comparative methodology. Case study is

> a well-established research strategy where the focus is on a case (which is interpreted very widely to include the study of an individual person, a group, a setting, and organization, etc.) in its own right, and taking its context into account. Typically involves multiple methods of data collection. Can include quantitative data, though qualitative data are almost invariably collected. (Robson, 2002, p. 178)

Data collection in case study research requires planning for access arrangements, availability of resources, scheduling of data collection activities, and specification of the periods of time involved (Robson, 2002). Although the leaders of the PMI chapters and ASQ sections contacted by the researcher agreed to send the survey designed for the study to their members, the organizations controlled access to the respondents. The selection of a case study methodology for the research would have required in-depth interviews or observations of the respondents that were not feasible due to the scope of research covering a large number of individuals employed in many organizations spread throughout the two largest cities in Texas and only one researcher.

According to Singleton and Straits (2005), all research involves a descriptive factor, but the basic difference between the descriptive study and the explanatory study is in the range or extent of the description. Descriptive research involves a search for information about individual variables, whereas explanatory research involves a search to describe the relationship between variables (Singleton & Straits, 2005). The descriptive study is a fact-finding enterprise that concentrates on a select and limited number of dimensions of a specific unit with the intention of measuring the identified dimensions in a precise and methodical manner, generally in a mathematical or statistical fashion (Singleton & Straits, 2005). Descriptive research involves an attempt to accurately portray people, events, and situations (Robson, 2002). However, since the goal of the study was to examine, by way of comparison, the differences that exist in project success measures based on TQM critical factors and the quality principles of the ISO 10006:2003 Standard as documented in the two research questions below, the researcher determined that the most appropriate research design would be a quantitative comparative approach.

A comparative approach, in its most basic format, involves an attempt to compare two or more items with the intention of discerning the differences between them.

The study involved comparing the impact each of the TQM critical factors and the quality management principles within the ISO 10006:2003 Standard has on the measures of project success by providing an accurate description and systematic analysis of two sets of variables: (a) project success measures such as on-time completion, within budget, to specification, and customer satisfaction as the dependent variables and (b) the eight quality management principles (customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making, and mutually beneficial supplier relationships) that form the basis of the ISO 10006:2003 Standard (ISO, 2003, p. 5) and the following critical factors of TQM as the independent variables: leadership, continuous improvement, internal/external cooperation, customer focus, learning company, employee fulfillment, and process management. The variables noted (the project success measures, the eight quality management principles that form the basis of ISO 10006:2003, and the critical factors of TQM) have several indicators that can be utilized to identify them and are listed in Chapter 3.

Research Questions and Hypotheses

The data obtained in the quantitative comparative study addressed the following research questions through the use of a survey of individuals involved in PM:

1. What differences exist in project success based on TQM critical factors?
2. What differences exist in project success based on the use of guidelines within the ISO 10006:2003 Standard?

Based on the above research questions, a quantitative comparative approach was used in testing the following hypotheses:

$H1_0$: No significant differences exist among the seven TQM critical factors for the on-time-completion project success rating.

$H1_A$: Significant differences exist among the seven TQM critical factors for the on-time-completion project success rating.

$H2_0$: No significant differences exist among the seven TQM critical factors for the within-budget project success rating.

$H2_A$: Significant differences exist among the seven TQM critical factors for the within-budget project success rating.

$H3_0$: No significant differences exist among the seven TQM critical factors for the to-specification project success rating.

$H3_A$: Significant differences exist among the seven TQM critical factors for the to-specification project success rating.

$H4_0$: No significant differences exist among the seven TQM critical factors for the customer satisfaction project success rating.

$H4_A$: Significant differences exist among the seven TQM critical factors for the customer satisfaction project success rating.

$H5_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the on-time-completion project success rating.

$H5_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the on-time-completion project success rating.

$H6_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the within-budget project success rating.

$H6_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the within-budget project success rating.

$H7_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the to-specification project success rating.

$H7_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the to-specification project success rating.

$H8_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the customer satisfaction project success rating.

$H8_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the customer satisfaction project success rating.

To test the hypotheses, the quantitative comparative study involved a purposive sampling using a Likert-type scale survey-based approach to receive responses from participants who are members of the PMI and ASQ in the two largest cities in Texas. Based on the information received from the Greater Houston ASQ section in the city where the researcher resides, more than 90% of the section members would have an e-mail address available for survey purposes. An assumption was that a similar ratio would apply to other ASQ sections and the PMI chapters surveyed. Therefore, based on this assumption and the available information on the membership of the selected PMI chapters and ASQ sections, the sample frame included approximately 8,500 individuals.

Theoretical Framework

Theories play a major role in the validity and acceptance of research. A theoretical framework enables a researcher to position a proposed study in relation to other studies in the field and to rationalize asking individual to participate in the study (Simon, 2006). Dale, Wu, Zairi, Williams, and Van Der Wiele (2001) noted that a theory provides the framework within which researchers can analyze a problem and determine which specific issues are important enough on which to direct their focus and highlight in the study. Selecting an appropriate theory or theories for research enables a researcher to add new dimensions to the existing relevant field of study. The basis of the theoretical framework for the study was systems theory and TOC.

General systems theory, developed more than 4 decades ago, has been defined as an approach to management that endeavors to assimilate and fuse information across a broad spectrum of scientific disciplines (Kerzner, 2009). In PM, which is an application of systems theory and knowledge (PMI, 2004), the unification of information occurs across the initiating, planning, executing, monitoring, controlling, and closing of integrated processes required for the effective management and implementation of projects. Systems theory indicates the need for a management approach that addresses issues across the entire spectrum of organizational disciplines while at the same time fulfilling the role of management (Kerzner, 2009). The integrative nature of PM necessitates the application of techniques that will ensure various functions within an organization work in harmony in a team environment with the aim of a positive contribution to project success. Shenhar and Dvir (2007) proposed that researchers should view PM from three different perspectives: operational/process, team/leadership,

and strategic/business. Although the views are completely different, Shenhar and Dvir noted that although the views are completely different, the only way to achieve project management success is by viewing the project as a complete and integrated process or system.

As reported by researchers at PMI (2004), the PDCA cycle, which was developed by Shewhart and later modified and popularized by Deming in the ASQ Handbook, pages 13-14, is a fundamental thread which pulls together and integrates the myriad of processes in project management (American Society for Quality, 1999). The PDCA cycle is one of the most important tools associated with continuous improvement methodology, which is one of the characteristics of TQM. Customer focus, another tenet of TQM, has a close association with the responsibilities of the PM team to those invested in project success including customers, the project organizations, and the public (PMI, 2004). Shenhar and Dvir (2007) observed that there is a dearth of theories in the field of project management and that the entire discipline is adversely affected by the deficiency of concepts and framework. At the same time, theories may be developed as a result of trying to solve problems faced in daily situations. One of the theories on which the current study was grounded and that could address the gap was TOC. The theory of constraints addresses which thinking processes enable people to invent simple solutions to seemingly complicated situations and how organizational leaders can use the psychological aspects of individuals and organizations to implement the solutions.

Shenhar and Dvir (2007), in supporting the notion that theories could emerge from practical questions, offered a list of practical PM problems that could be addressed by theories such as TOC. Citing the work of Goldratt, Shenhar and Dvir (2007)

suggested that TOC could address PM problems such as time overruns and escalating resources. Through systems thinking, a system can be viewed from a broad perspective that involves recognizing the overall structure, patterns, and cycles rather than concentrating on specific events. A broad view of the system can lead to the quick identification of the real causes of problems (i.e., constraints) that prevent organizational leaders from reaching their goals.

One of the eight quality management principles that form the basis of the ISO 10006:2003 Standard (ISO, 2003) is a systems approach to management. Clause 5.2.6 of the ISO 10006:2003 Standard states, "In general, the system approach to management allows for the coordination and compatibility of an organization's planned processes and a clear definition of their interfaces" (ISO, 2003, p.. 8). The clause also emphasizes the utility of a system approach in managing the interaction between various project processes in a coordinated and controlled manner. To control the project processes according to Clause 5.2.6 of the ISO 10006:2003 Standard, "it is necessary to define and link the processes needed, to integrate them and manage them as a system aligned with the originating organization's overall system" (ISO, 2003, P. 8). The ISO 10006:2003 Standard places great emphasis on a system approach in managing PM processes and systematic continual improvement, which closely align with the tenets of TQM. The ISO 10006:2003 Standard can be a strong candidate as a tool that organizational leaders can utilize to take advantage of the integration of TQM and PM, the goal of which is improving their PM processes and stakeholders' satisfaction.

According to Cooper and Schindler (2003), the explanatory study is based on theories or at a minimum, hypotheses proposed by the research to explain and look for

the causes of specific phenomena. The proposed survey-based quantitative comparative study involved empirically testing the impact of successful implementation of TQM and the eight quality management principles of the ISO 10006:2003 Standard on the success of projects in organizations involved in PM.

Assumptions

Assumptions of the study were as follows:

1. Participants in the survey are or have been employed by organizations involved with PM processes. Because participants in the survey were members of either a PMI chapter or an ASQ section, there was a strong reason to believe that they were knowledgeable about topics covered in the study and therefore this assumption was likely met.

2. Participants in the study would provide honest answers to survey questions, reflecting their genuine perception of the value of TQM and the ISO 10006:2003 Standard in PM and the subsequent impact on project success. Due to the fact that surveyors rely almost exclusively on reports of behavior rather than on observable behavior, "measurement error may be produced by respondent's lack of truthfulness, misunderstanding of questions, and inability to recall past events accurately and by the instability of their opinions and attitudes" (Singleton & Straits, 2005, p. 227). To increase the probability of receiving honest answers to survey questions, the survey letter emphasized the benefits that results of the study could bring to survey participants and their organizations.

3. The presidents of the Dallas and Houston ASQ sections and PMI chapters confirmed to the researcher through e-mail and verbal confirmation that they would

ensure that their respective memberships would have access to the electronic survey via a portal on each organization's website. Due to the commitments from the presidents of the selected PMI chapters and ASQ sections, the assumption was met.

4. The link to two documents summarizing the content of the ISO 10006:2003 Standard and its close relationship with the *PMBOK* (PMI, 2004) provided adequate information and allowed the respondents who had no prior or limited knowledge of the standard to respond to Research Question 2.

Scope and Delimitations

The scope of the study was limited to a survey of individuals who were members of ASQ sections and PMI chapters, thereby excluding participation by those individuals whose organizational leaders have not supported ASQ or PMI membership. The individuals selected to participate in the study work in one of the two largest cities in Texas, which excluded individuals employed in smaller organizations, located in smaller cities, and having fewer employees. Some participants might have been involved with more projects than other participants, which might have allowed them to provide more accurate responses pertaining to an organization's success in integrating TQM and PM to achieve a higher rate of project success.

Limitations

Kerzner (2004) noted that the use of surveys in explanatory research poses a major disadvantage. While a connection between variables may be easily inferred with a survey, it is not as easy to establish a cause-and-effect relationship in research based on a survey as it is in research based on experiments. Highlighted in the survey study was the association between critical factors of TQM and quality management principles of the

ISO 10006:2003 Standard and variables that measure project success. Further investigation will be necessary should one seek the cause-and-effect relationships between the variables. Participants' responses to the survey questionnaire reflected a subjective perspective and might have indicated a lack of knowledge of accurate information related to project success or failure. Since no objective measurements in terms of the four project success indicators were collected in the study, the results shown relied solely on self reporting which was an additional limitation of the study. In addition, the exclusion of certain employees due to the circumstances listed above could introduce coverage error as a result of limiting the types of individuals allowed to participate (Singleton & Straits, 2005).

Definition of Terms

The following were key terms used throughout the study.

Constraint: Anything that prevents an organization from achieving its goals (Goldratt, 1990).

Integrated: A group of activities or components combined to function as a unified whole (PMI, 2004).

Originating organization: The organization that decides to undertake a project, which might be a single organization, joint venture, or consortium. The originating organization assigns the project to a project organization. The originating entity could assume responsibilities for multiple projects, which could each be delegated to different project organizations (ISO, 2003).

Process: A group of related activities or actions undertaken to accomplish a specific set of project requirements (PMI, 2004).

Project: A temporary series of tasks designed to create a special product or service (PMI, 2004).

Project management: The coordination of tasks such as planning, scheduling, and controlling to ensure that project objectives reach fruition and reflect the best interests of those invested in the project (Kerzner, 2004).

Project organization: An entity responsible for executing the project and that can be independent of the originating organization (ISO, 2003).

Project schedule: Target dates scheduled to perform activities and meet milestones (PMI, 2004).

Project scope: Work undertaken to deliver a product or service with agreed upon features and functions (PMI, 2004).

Project team: All individuals who contribute to the project, including the PM team, the project manager, and, for some projects, the project sponsor (PMI, 2004).

Summary

This chapter contained the fundamental concepts surrounding the use of TQM critical factors and the guidelines within the ISO 10006:2003 Standard followed by organizational leaders to achieve excellence in their PM processes. The chapter also contained a discussion on the problem statement, significance, purpose, assumptions, scope, and limitations of the study. The chapter included a description of the pivotal role that theories play in research in general and the TOC and systems theory in the study. The chapter also showed that the researcher should approach the positive impact of critical factors of TQM and guidelines within the ISO 10006:2003 Standard on project

success measures from a system perspective where PM processes and their interaction are continuously improved.

The organization of the subsequent chapters is as follows. Chapter 2 includes a review of the literature on the topics of TQM, PM, and the ISO 10006:2003 Standard and the application and impact of TOC and systems theory in the effective implementation of TQM and PM in organizations with the aim of improving project success. Also included is a review of literature discussing the merits of ISO 9001 Standard, Six Sigma, CMMI and their application in the field of PM. Chapter 3 includes a detailed description of the quantitative research, the conceptual framework of the study, the survey methodology, the survey instrument and its reliability and validity, the population and sample size, the operationalization of dependent and independent variables, the data collection and analysis process, ethical considerations, and implications for social change.

Chapter 2: Literature Review

The first of the 14 principles of management introduced by Deming (1986), recognized as the father of the modern quality improvement and the total quality movement, is as follows: "Create constancy of purpose towards improvement of product and service, with the aim to become competitive, stay in business and to provide jobs" (p. 23). The notion of creating constancy of purpose was an invaluable guide in developing an effective strategy through which a comprehensive and exhaustive literature review was performed. Regardless of the topic of research, the exposure to a variety of points of view, ideas, and conclusions is inherent in the literature review process. To manage the process, which includes effectively and efficiently sorting through a large volume of studies conducted on relevant topics, it is imperative to have a clear strategy and to focus only on the studies that address questions raised and on the research methodology.

The literature review is the foundation of any research project. Furthermore, the literature review should accomplish the following important objectives such as setting a broad framework for the study and in justifying the decisions which determine what will or will not be included in the scope of the research. All empirical studies, whether qualitative, quantitative, or mixed methods, must be grounded in existing literature or concepts that demonstrate a need for the study, must be related to the study's purpose statement, and must show the study's relationship to previous work (Rocco & Plakhotnik, 2009). Creswell (2009) indicated that the literature review serves different purposes for each research method. In quantitative research, the role played by the literature is not only to help in validating the problem to be studied but also to point out to the researcher

to additional problems that might require attention. Considering these points of view, the purpose of the literature review was to examine, analyze, and synthesize the previous theoretical and empirical studies on the topics of TQM, PM, and the ISO 10006:2003 Standard and the application and impact of TOC and systems theory on the effective integration and implementation of TQM and PM in organizations with the goal of improving project success. The literature review substantiated the reasons for the research questions addressed in the study. The main goal of the literature review was to provide an unbiased, comprehensive, and up-to-date view and analysis of the current literature relevant to the study. According to Boote and Beile (2005), the purpose of research is to advance our general knowledge and understanding. In order to do so, a researcher needs to be fully aware of what research was conducted in the past, be knowledgeable about the weaknesses as well as the strengths of previous studies and their impact on the field of study. Rocco and Plakhotnik (2009) noted that the literature review is a way to honor what was done before and provide guidance to present work allowing current research to impact the future. The following sections might provide new knowledge to other scholars interested in pursuing further research on the topic of the current study.

Organization of the Review

This chapter includes a discussion on the current research for TQM, PM, and the ISO 10006:2003 Standard; the results that advance the research questions addressed in the study; and the related deficiencies in the literature. A literature review places existing literature in the framework of historical context. A review of literature review should

report on what exists, the claims made within existing literature and scrutinize the methodology used to determine whether the studies can be substantiated. The review also included the relationships among TQM, PM, and the ISO 10006:2003 Standard, their impact on project success, and the role of TOC and systems theory on the effective integration and implementation of TQM and PM. In addition, a comparative analysis of the relationship between the ISO 9001 Standard, Six-Sigma, and Capability Maturity Model Integration (CMMI), three quality or business improvement initiatives with widespread application in project-oriented organizations, and TQM is presented. The analysis could provide valuable insight for future empirical research on their application in organizations to improve project success.

Strategy for Searching the Literature

Visually depicting where a research study is positioned in comparison with a larger literature involves developing a figure, or a research map of studies that exist, the topics covered in the literature and depicting where and how the proposed study advances the research. Figure 1 depicts the general flow of the literature research for the study. The first step was to search for literature covering the topics of TQM, PM, and the ISO 10006:2003 Standard and the application of TOC and systems theory on their integration and implementation. The next step of the literature search was limited to examining the literature that covers the relationship between TQM and PM and the impact of TQM on PM, as well as the relationship between the ISO 10006:2003 Standard and PM and the impact of the ISO 10006:2003 Standard on PM. The next step was to search the literature on all three topics of TQM, PM, and the ISO 10006:2003 Standard and on the

application of TOC and systems theory on their integration and implementation. The search also included key words on the topics of ISO 9001, Sig Sigma, and CMMI.

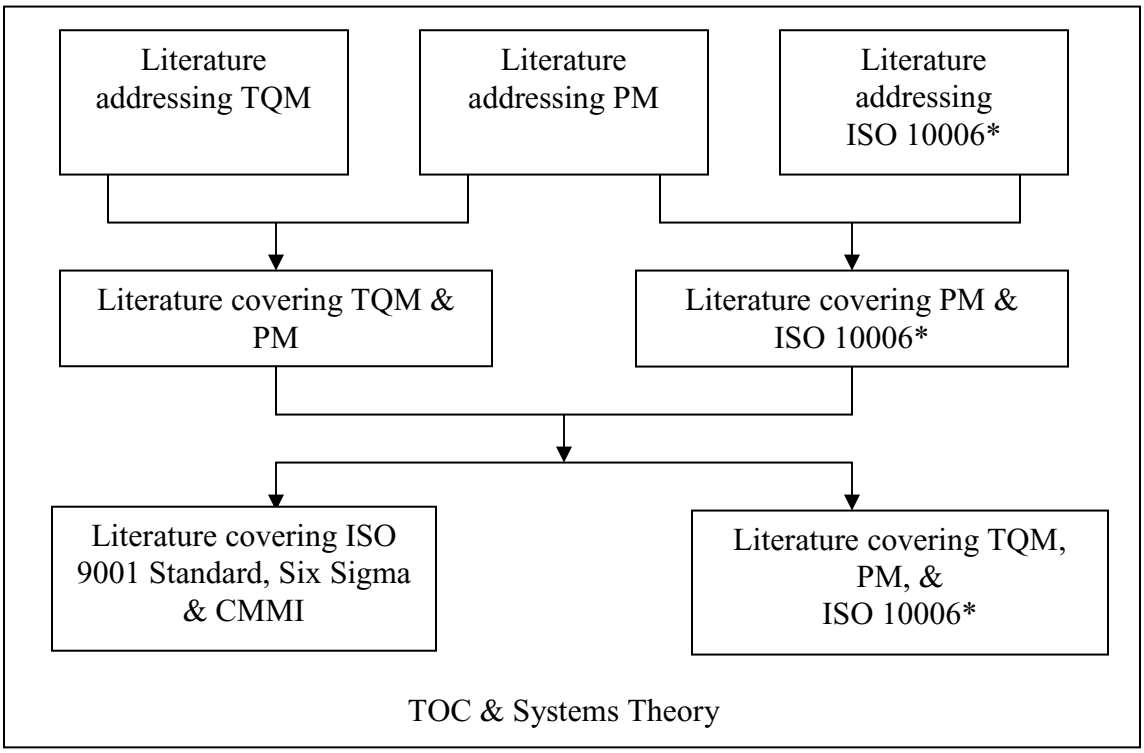

Figure 1. Research map. An asterisk (*) denotes where the current research extends the existing literature.

The time frame for the literature search was the period between 2002, when Sila and Ebrahimpur published their comprehensive investigation of TQM survey-based research, and early 2009. The key terms for the search were TQM, PM, and ISO 10006:2003. The search included literature covering the application of TOC and systems theory in the effective integration and implementation of TQM and PM for the same period. The strategy for searching literature within the said time frame was based on the

use of a wide range of sources including scholarly books; refereed journals retrieved from Academic Search Premier, Business Source Premier, Emerald, and Sage Journals Online databases; the ASQ website, and other Internet sources.

Total Quality Management (TQM)

To understand the role of TQM in organizations as a philosophy of improving performance in general, and project success in particular, requires an appreciation of the evolution of quality and the field of quality management. According to Maguad (2006), human beings have pursued quality since the beginning of civilization, but the methods used to manage problems relating to quality have changed from period to period. The transition from the quest for a certain level of product and service quality in primitive societies to higher levels in preindustrial, industrial, and postindustrial eras (Maguad, 2006) provides important insight into the evolution of quality throughout the history of humankind. This insight highlights the need for an improvement in performance necessary to meet increasing customer expectations for quality products and services and the need to face the challenges for financial survival and growth in an expanded global economy. According to Khanna, Vrat, Shankar, and Sahay (2004), quality is the premier factor that enables an organization not only to survive but also to grow its business.

Hafeez et al. (2006) described the evolution of the quality movement through the four stages of inspection-based system, quality control, quality assurance, and TQM from the 1940s through the 1970s. The focus of the inspection-based system was to separate conforming products from defective and nonconforming products. The next stage of the evolution was marked by the introduction of quality control into the process in ensuring

the production of conforming products only. This stage was followed by steps that placed greater emphasis on quality assurance rather than quality control through the design of quality into products. According to (Hafeez et al., 2006),.interface between all facets of an organization as well as within each separate mechanism.

One stage in the evolution of TQM was the transition from what Maguad (2006) called compliance oriented to improvement oriented, which involved focusing on issues such as compliance to specifications, procedure development, and supplying documentation to ensure consistency rather than an emphasis on a process of continual improvement in order to satisfy the customer and achieve success for the organization in the long term.. This stage coincides with the transition from the pre-World War II years to the post-World War II and postwar Japan years that have more relevance to the management of quality in the 21st century. According to Williams et al. (2006), one of the key learning points affecting quality improvement in management and production in the West was the influence of Japanese competition, especially in the automotive and electronics industries. In the 1980s, the Japanese auto industry surpassed its American counterpart in sales as a result, according to Khanna et al. (2004), of an emphasis on quality and the implementation of a number of well-known quality improvement methods including TQM.

The search for literature on the topic of TQM and its impact on business results in financial or operational performance revealed the following studies: Hendricks and Singhal (1997), Eriksson and Hansson (2003), Prajogo and Sohal (2003), Escrig-Teana (2004), Sila and Ebrahimpour (2005), Lakhal, Pason, and Limam (2006), and Subedi and

Maheshwari (2007). Regarding the impact of TQM on financial performance, Hendricks and Singhal (1997) reported that statistical tests conducted in their study showed clear-cut evidence that companies that were recipients of quality awards outperformed their control counterparts in measures based on operating income, indicating that winning these awards was a result of effective TQM implementation. Hendricks and Singhal (1997) reached the conclusion above by conducting an exploratory comparative study testing the hypotheses that implementation of TQM programs would improve profitability, increase revenues, and reduce costs.

Subedi and Maheshwari (2007) compared a total of 15 Baldridge Award winners against 30 companies in the control group where the control group was comprised of two companies for each of the award winners from the same industry type as defined by the four-digit standard industrial classification code. Subedi and Maheshwari's quantitative comparative study on the impact of TQM on the profitability and efficiency of Baldridge Award winners showed that the increase in profits and growth exhibited by the award winners was greater than that exhibited by the control group which is a clear signal that the bottom line can be impacted in a positive manner by total quality management.. The noted increase in earnings should provide an incentive for leaders in organizations involved with PM to incorporate TQM principles into their projects.

By employing a quantitative comparative study, Eriksson and Hansson (2003) reviewed the financial accomplishments of award winners in comparison to that of their competitors. Their study based on a Swedish quality award reported that financial performance of the award winners surpassed that of their competitors on a majority of the

study's indicators. The strategy was chosen because the ideal, a comparison between each company's performance with the implementation of TQM versus its performance without the implementation of TQM, was not feasible. As a result, two different comparisons were made. The first separated each award-winning company based on manufacturing and service industry sectors. The second comparison performed was between an award-winning company and one of its stated competitors. The development of the companies' performance was studied using the following indicators, some of which were similar to those selected in the study conducted by Hendricks and Singhal (1997): percentage change in sales, return on assets, return on sales, percentage change in total assets, and percentage change in number of employees. One important conclusion reached by Eriksson and Hansson was that during the period when TQM was being implemented, the companies that later won the quality award did not necessarily outperform their competitors in their particular industries. However, in the post implementation period, the companies winning the quality award did outperform their competitors and branch indices on all indicators evaluated. This is an important conclusion for organizational leaders to recognize because the effective integration of TQM principles into PM activities is an ongoing process, the results of which might not be visible for some time before resulting in increased project success.

Critical Factors of Total Quality Management

From the impact of TQM on the operational performance perspective, results of new research on the relationship between TQM practices, quality performance, and innovation performance conducted by Prajogo and Sohal (2003) indicated that "TQM

significantly and positively relates to both product quality and product innovation performance although it appears that the magnitude of the relationship is greater against product quality" (p. 901). Lakhal et al. (2006) reported that the results of their study indicated that quality management practices have a positive impact on an organization's performance. In discussing the relationship between TQM factors and business results using an integrated TQM framework, Sila and Ebrahimpur (2005) concluded that critical factors of TQM such as leadership, planning, customers, and suppliers should be viewed as a whole system and the synergies that develop among them ensure successful results in a business. Sila and Ebrahimpur determined that leadership and information analysis were the two important aspects that function as the foundation of the system interface.

Sila and Ebrahimpur (2005) utilized a 7-point Likert-type scale survey-based instrument to test 23 hypotheses developed through an extensive review of literature to investigate the relationship between TQM factors and results in business. After an initial pilot study and subsequent modification and review by quality experts of their instrument, Sila and Ebrahimpur's survey was mailed to a sample of manufacturing firms across the United States. The completed and returned surveys were divided into two groups based on timely response and were statistically tested for nonresponse bias using the *t* test. Results indicated no difference between the groups.

Data preparation by Sila and Ebrahimpur (2002) included eight constructs with 27 indicators. Several of the eight constructs (leadership, customer focus, process management and supplier management) were used in this study, albeit under different names. In this study, for the eight quality management principles of the ISO 10006:2003

Standard, there are 20 indicators and for the seven critical factors of TQM, there are 12 indicators. In Chapter 3, these constructs are defined and operationalized.

Shenawy et al. (2007) employed a meta-analysis statistical procedure to integrate the results of a sample of 51 empirical and independent studies into a single database with the goal of building a theoretical model of TQM. The results of the study indicated that an effective TQM model should include the following five components: top management commitment and leadership, teamwork, culture, training and education, and process efficiency. The use of a random-effects meta-analysis rather than a fixed-effects methodology allowed Shenawy et al. to overcome the impact of unknown studies. By employing a random-effects methodology rather than the fixed-effects methodology, the higher external validity allowed for support of generalizability of the results.

The five TQM components noted above are among the 25 TQM factors identified by Sila and Ebrahimpur (2002) in their research. The identification of the TQM critical factors was one of the objectives categorized by their examination of 347 studies published in various journals from 1989 through 2000. The selection by the researcher of top management commitment, teamwork, and training as several of the indicators related to the critical factors of TQM for this study was facilitated by the statistical generalizability of research performed by Sila and Ebrahimpur and Shenawy et al. (2007).

While the above studies pointed to the positive impact of TQM on organizational financial and performance results, the literature research also identified several studies on obstacles to TQM success (Beer, 2003; Green, 2006; Harari, 1997; Miller & Cangemi,

1993; Sebastianelli & Tamimi, 2003). Miller and Cangemi (1993) attributed TQM failure to leadership failure, not measuring the effects of TQM, poorly developed vision, unwillingness to follow that vision, a poor ability to communicate with the workforce, prior history of workforce resistance, union opposition, short-term profitability overriding long-term plans, an underdeveloped relationship with suppliers, a lack of worker empowerment, and a lack of support for the team concept. Harari (1997) noted that TQM programs can often be unsuccessful even in business atmospheres that are desperate for quality improvement due to the following reasons:

1. TQM focuses people's attention on internal processes rather than on external results.
2. TQM focuses on minimum standards.
3. TQM develops its own cumbersome bureaucracy.
4. TQM delegates TQM to quality czars and experts rather than to real people.
5. TQM does not demand radical organizational reform.
6. TQM does not demand changes in management compensation.
7. TQM does not demand entirely new relationships with outside partners.
8. TQM appeals to faddism, egotism, and quick-fixism.
9. TQM drains entrepreneurship and innovation from corporate culture.
10. TQM has no place for love. (p. 38)

The results of a national survey of quality managers on their ratings of frequent barriers to TQM revealed the following five underlying constructs: (a) inadequate human resource development, (b) lack of planning for quality, (c) lack of leadership for quality,

(d) inadequate resources for TQM, and (e) lack of customer focus (Sebastianelli & Tamimi, 2003). Beer (2003) noted that the failure to establish TQM as an organizational standard practice can be a result of the gap between how top management expresses its intentions regarding TQM and the actual realty of implementing TQM within the various components of the organization. Green (2006) explained that commonly perceived failures of TQM could be attributed to poor or incorrect implementation of the principles of TQM and unrealistic organizational expectations.

A close examination of factors influencing the failure of TQM as evident by the theoretical and empirical studies listed clearly showed valid reasons for concern regarding the ability of TQM to deliver promised results as perceived by those who have been unsuccessful in implementing TQM in their organizations. One potential reason for the failure of effective implementation of TQM is the differences that exist in the perception of what TQM is capable of and what it can deliver, which closely relates to the definition of TQM. The review of literature on TQM revealed that quality experts and researchers have presented different definitions since its inception.

Karuppusami and Gandhinathan (2006) characterize TQM as a method of management guided by an integrative approach with the goal of continual quality improvement with the aim of achieving customer satisfaction. In the ISO 8402 Standard, the definition of TQM is "a management approach of an organization, centered on quality, based on the participation of all its members and aiming at long-term success through customer satisfaction, and benefits to all members of the organization and to society" (Ljungström & Klefsjö, 2002, p. 622). Nelson and Daniels (2007a) provided the

following alternative definition for TQM: "Simply put, it is a management approach to long-term success through customer satisfaction" (p. 58). Besterfield et al. (as cited in Vouzas & Psychogios, 2007) analyzed the three words that constitute the acronym TQM as *total*, referring to the makeup of the whole; *quality*, referring to excellence of a product or service; and *management*, as the manner of handling, controlling, leading, and planning. Together these terms define TQM as the "art of managing the whole to achieve excellence" (Besterfield et al., as cited in Vouzas & Psychogios, 2007, p. 64).

The definitions listed above to some extent share certain core ideas such as managing quality to reach excellence, customer satisfaction, and continuous improvement. However, they each also include unique concepts such as integrative management, the need for participation of all members of the organization, and benefits to all members of the organization and to society. Organizational leaders can utilize the core ideas and unique concepts of TQM to help them overcome the barriers to achieving project success, which is critical in reaching their operational and financial goals.

Project Critical Success Factors

Success means different things to different people and is often dependent on the context of the situation (Jugdev & Müller, 2005). Jugdev and Müller (2005) explained that their views and definitions of project success have evolved over the years. Originally limited to the project implementation phase, success can now be defined across the entire spectrum of the project life cycle and reflects achievement over all the phases of the project that meet the needs of all organizations involved in the project. The

following definition for product life cycle and its relation to project life cycle is also from PMI (2004):

> A collection of generally sequential, non-overlapping product phases whose name and number are determined by the manufacturing and control needs of the organization. The last product life cycle phase for a product is generally the product's deterioration and death. Generally, a project life cycle is contained within one or more product life cycle. (pp. 367-368)

Although organizational leaders can establish unique success factors for each phase of their projects, the triple constraint factors (time, cost, and specifications/ performance) remain the common measures of project success (Anderson, Birchall, Jessen, & Money, 2006; Dvir, Sadeh, & Malch-Pines, 2006; Milis, 2008; Peterson, 2007). According to Milis (2008), a project is a failure if it does not meet its completion date or budget or if the end result does not conform to the original specification. Anderson et al. (2006) noted that while the goal of every project is success, each project is special in its own right and is subject to strict guidelines relating to time and money. Meeting the strict guidelines involves a series of complex operations and the modern tumultuous economy often makes project success a goal that is difficult to reach (Anderson et al., 2006). However, through a quantitative cross-cultural research methodology and the application of two separate but sequentially related analyses, exploratory factor and regression, Anderson et al. (2006) identified relationships between project success factors that are within the control or direct influence of PM. As a result, the barriers that impede PM and successful project execution can be recognized and removed.

In their research, Anderson et al. (2006) sought to answer which success factors within direct control of PM contribute to project success and how these factors contribute to project success. Anderson et al. (2006) investigated the relationship between specific factors that contribute to project success. In contrast, the current study, through the use of a comparative methodology, involved a search for answers to what differences exist in project success based on TQM critical factors and what differences exist in project success based on the use of guidelines within the ISO 10006:2003 Standard.

Considering the triple constraints as the only indicators of project success ignores project stakeholders' needs and expectations, including those of internal and external customers and members of the project team. According to Kerzner (2004), the familiar definition of project success as one that is completed in a timely fashion, under budget and with a quality project is problematic as it is an internal definition. The customer or end user might have a different perspective and define success differently. Organizational leaders who consider stakeholders' satisfaction as a project success factor will have a greater chance of applying TQM principles to identify the gaps that prevent them from reaching their organizational operational and financial goals.

Organizations reach their operational and financial goals through ongoing and repetitive work or projects. According to Kerzner (2004), the familiar definition of project success as one that is completed in a timely fashion, under budget and with a quality project is problematic as it is an internal definition. The customer or end user might have a different perspective and define success differently. To ensure that leaders manage projects in an environment conducive to their success, organizations utilize PM

discipline. As stated in the *PMBOK* (PMI, 2004), project management applies a specific set of knowledge, skills and tools throughout a project life cycle to ensure that project requirements are met. The integration of management processes that include initiating, planning, executing and monitoring ensures project success. Managing and closing a project involves identifying requirements; establishing clear and achievable objectives; balancing competing demands for quality, scope, time, and cost; and adapting the specifications, plans, and approach to the different concerns and expectations of the various stakeholders.

Each of the steps has a unique contribution to project success. Without a clear definition of project requirements, the initiating and planning processes, including the allocation of adequate resources, might not materialize. The establishment of clear and achievable project objectives provides the necessary framework within which the implementation of proper and adequate monitoring can take place. Another critical contribution of the PM discipline to project success is the achievement of delivering a quality product or service on time, under budget and that meets project specifications. Considering various stakeholders' requirements, demands, and expectations extends the contribution of PM to project success beyond just managing competing project demands. When all the above steps are taken holistically, PM could play an effective and decisive role in helping organizational leaders achieve their business objectives through successful projects.

Project Management (PM)

According to Shenhar and Dvir (2007), humanity has always organized creative activities to influence lives and societies. Society currently labels such activities projects. However, the development of PM as a formal discipline and a key business process with the intent of managing and delivering successful projects is new. A review of the literature on the success of PM in meeting the goal of project success revealed conflicting observations. Although demonstrable PM values are pursued, little evidence of its actual and measured value exists (Thomas & Mullaly, 2007). Shenhar and Dvir indicated that despite a long history of expansive projects and fifty years of developing and refining the PM discipline, project success rates are very low. Koskela and Howell (2002) used empirical evidence and suggested that there are serious issues with the theoretical base of current project management. Koskela and Howell summarized the deficiencies into the following three classes of problems:

> Firstly, project management has not achieved the goals set to it: it does not perform in a satisfactory way. In small, simple and slow projects, the theory-associated problems could be solved informally and without wider penalties. However, in present big, complex and speedy projects, traditional project management is simply counterproductive; it creates self-inflicted problems that seriously undermine performance.
>
> Secondly, the lack of theory has rendered education and training more difficult and has hampered effective professionalization of project management. Lacking theory, project management cannot claim, and will not be granted, a

> permanent and respected place in higher education institutions. Also, the lack of an explanation of project management, to be provided by a theory, has slowed down the diffusion of project management methods in practice.
>
> Thirdly, the renewal of project management has been hampered by the lack of theory. Anomalies, deviations from theory-predicted outcomes, have been observed long since in project management, but their cause has been misinterpreted and the project management community has not acted on them. The important functions of a theory, regarding continual validity testing and giving direction for further progress, have neither from the viewpoint of research or practice been realized. (para. 12-14)

Ample evidence also indicates that PM has become one of the fastest growing disciplines in organizations. Such growth is a result of the fact that projects are not only for developing new products or services, but also for initiating improvements in existing products and services, developing new processes or systems, and often in marketing (Shenhar & Dvir, 2007). Srivannaboon (2006) provided an insight into the increasing interest in PM and business strategy, which is that business leaders perceive that their alignment will improve the potential to achieve organizational goals. Angelides (1999) described a framework "for integrating Good Technical Practices and Good Business Practices through good project management to achieve better product/service delivery" (p. 79). The proposed integrated framework with PM, good technical practices, and good business practices as its three linked spheres of influence could eradicate the contradictions between time, budget and quality and ensure that all objectives can be met.

Besner and Hobbs (2006) presented the result of their large-scale survey of 753 PM practitioners regarding the perceived value and potential contribution of PM practices to project success. According to Besner and Hobbs, projects that are successful are very valuable to organizations and the PM practices add worthwhile assets to an organization. The added value is a result of good PM practices and good measurement tools that improve project success. Responding to the question of which tools, techniques and practices have the greatest and lowest value, and the greatest and lowest potential for improvement, the results of the study showed that the tools and techniques that improved organizational learning and memory also possessed the greatest potential for improving project success.

The study also revealed while PM tools currently in use for larger projects for outside customers have a high value, the same cannot be said for smaller, internal-customer-focused projects (Besner & Hobbs, 2006). Efforts should be made to develop PM tools for smaller, internal projects. Of course, the development of any tools and techniques will need to take into account the specifics of each project and organizational characteristics (Besner & Hobbs, 2006). Besner and Hobbs' (2006) study results provided valuable information that allowed the inclusion of appropriate questions in the survey used to assess PM practices in the surveyed organizations and to assess the impact of PM tools also supported by the TQM principles applied in these organizations.

Another study whose results applied to the current study was a cross-country study of the software industry in Japan, Israel, and New Zealand conducted by Zwikael (2008b). Zwikael (2008b) focused his study on the impact of top management support

for projects in the software arena. The objective of the study was to determine which specific processes employed by top management have the most influence on project success in the field of software development and then to compare the processes with the actual support provided within the organization. Citing several research studies in PM literature, Zwikael (2008b) concluded that "the more top management processes are practiced in organizations, the higher the level of project success. However, with executive limited time and resources, it is also important to identify the most effective support processes for different project scenarios" (p. 499).

Although the subject of Zwikael's (2008b) study was the software sector, the results indicated that support from top management is a primary need across all sectors. The findings of another study also conducted by Zwikael in the same three countries where data were collected from 700 project managers and their supervisors in seven industries (engineering, software, production, construction, communications, services, and government) showed that "top management support is significantly correlated with project success" (Zwikael, 2008a, p. 387). Kerzner (2004) noted that the contribution of top management, specifically its ability to provide high-level decisions in the planning stages, is critical for the success of all types of projects in any sector.

An examination of the following 10 critical top management support processes identified by Zwikael (2008b, pp. 505-506) indicated that some of the concepts such as the involvement of people, communication among those involved in the project, and the establishment of measurements are very similar to several concepts required for the successful implementation of TQM.

1. Appropriate project manager assignments.
2. Refreshing project procedures.
3. Involvement of the project manager during initiation stage.
4. Communication between the project manager and the organization.
5. Existence of project success measurements.
6. Supportive project organization structure.
7. Existence of interactive interdepartmental project groups.
8. Organization project resources planning.
9. Program management office involvement.
10. Use of standard PM software.

The 10 critical top management support processes were utilized to investigate the role of top management support in addressing the following research question: What differences exist in project success based on TQM critical factors?

Researchers of every study on the topic of PM should recognize and consider the influence of the PMI on the PM community, the contribution of its 11 global standards, and the publication of the *PMBOK* on project success. Founded in 1969 and with more than half a million members in over 170 countries, PMI's primary goal is to proactively expand and enhance the discipline of project management globally in order that organizations everywhere will institute its processes and practices and recognize that business success is a result of its implementation (PMI, n.d.). According to PMI (2004), "The Project Management Body of Knowledge is the sum of knowledge within the profession of project management" (p. 3).

The purpose of the *PMBOK* is "to identify that subset of the Project Management Body of Knowledge that is generally recognized as good practice" (p. 3). The *PMBOK* contains the following three sections:

Section I: The Project Management Framework

Section II: The Standard for Project Management of a Project

Section III: The Project Management Knowledge Areas

Section III organizes 44 PM processes identified in Section II into nine knowledge areas, including project integration management and project quality management, which had relevance to the current study and are further analyzed in subsequent sections of this chapter. Project integration management identifies and details the processes that coordinate the myriad activities of project management which are then unified across all project management groups (PMI, 2004).

A subsequent section of this chapter includes the information contained in the project integration management knowledge area of the *PMBOK* to review literature that addresses the application of systems theory in the implementation of PM in organizations. The project quality management knowledge area "describes the processes involved in assuring that the project will satisfy the objectives for which it was undertaken. It consists of the Quality Planning, Perform Quality Assurance, and Perform Quality Control project management processes" (PMI, 2004, p. 10). In the following section, the concepts common to both TQM and PM that are covered in the project quality management knowledge area of the *PMBOK* and are addressed in related literature are analyzed and synthesized to gain further knowledge of the integration of

TQM and PM and its impact on project success. The results of this review are used in further development of the survey instrument for the study.

Integration of TQM and PM

In 1985 organizational leaders began "using the principles of project management for the implementation of TQM. The first ally for project management surfaces with the 'marriage' of project management and TQM" (Kerzner, 2004, p. 6). The notion of PM as an enabler for TQM implementation is echoed by one of the perspectives provided by Bryde (1997) regarding the link between TQM and PM that indicates PM should be used as the vehicle to successfully introduce a TQM program into the workplace because it is the most effective. Beginning in the late 1990s, company leaders realized that PM principles and systems and TQM programs were mutually beneficial and could be used to support each other (Kerzner, 2004). Excellent companies understood and made full use of these complementary systems.

Although the importance of the role that PM has played in the creation of a TQM culture in organizations should not be undermined, the current study involved an investigation into the role that TQM principles play in providing an environment conducive to the successful implementation of PM principles. According to Masters and Frazier (2007), organizations investigate different options for a very basic reason and that reason is to increase output and profitability. The project environment is not exempt from this driving force. One approach to understanding the potential reasons that result in organizations adopting TQM and the transition of PM as the enabler of TQM culture to

the use of TQM as a tool in the successful implementation of PM is to search for the common principles between the two philosophies.

In total quality management, according to Kerzner (2004), the paramount issue is addressing issues of quality from a total system perspective. Quality alone is not the ultimate goal. Total quality management functions constantly and simultaneously in facet of a company's operations. From an organizational perspective, an analysis of Kerzner's statement reveals two critical concepts: (a) quality should be a contributing and not a standalone factor that differentiates an organization or parts of it and (b) TQM provides a framework conducive for the achievement and the continual improvement of quality in any aspect of an organization deemed relevant to its business activities. The PDCA management cycle, a method to direct quality efforts in a well-organized and orderly fashion as seen in Figure 2, is the foundation for such a framework (Dale et al., 2001).as seen in Figure 2, is the foundation for such a framework.

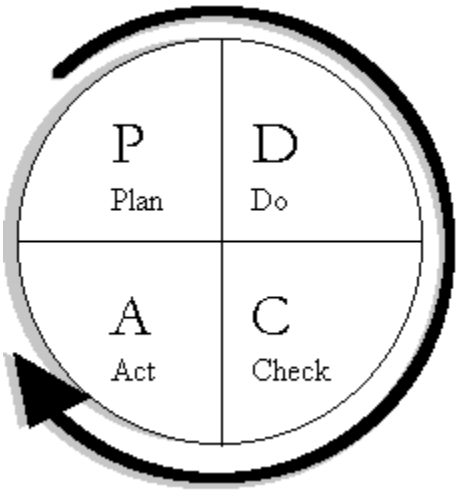

Figure 2. The plan-do-check-act management cycle.

The PDCA is a four-step procedure that can lead to quality improvement. The plan step is the manner in which the improvement to be implemented is developed. In the do step, the plan is executed. During the check step, the effects of the plan implementation are observed. Finally, in the act step the results of the plan are reviewed to establish what has been learned and what can be predicted. The PDCA cycle is frequently called the Shewhart cycle because the concept was first discussed by Walter A. Shewhart in his book *Statistical Method From the Viewpoint of Quality Control*. The cycle is also called the Deming cycle because the concept was introduced in Japan by W. Edwards Deming (Nelson & Daniels, 2007b). The PDCA cycle is in complete alignment with PM principles (Kerzner, 2004). At the beginning of any project, one establishes project goals, then executes the plan, and checks on the results. Steps that did not work are revised and the process begins again (Kerzner, 2004).

From the PM perspective, according to PMI (2004), project quality management processes incorporate all the actions undertaken by an organization to ensure that a project meets the requirements under which it was conceived, including the determination of all policies, goals and responsibilities related to quality issues. The processes are divided into five PM process groups that are interdependent and are always executed in the same sequence irrespective of the type of project or application in which they are performed. The process groups and their purpose are as follows (PMI, 2004):

1. Initiating Process Group: Defines and authorizes the project or a project phase.

2. Planning Process Group: Defines and refines objectives, and plans the course of action required to attain the objectives and scope that the project was undertaken to address.

3. Executing Process Group: Integrates people and other resources to carry out the project management plan for the project.

4. Monitoring and Controlling Process Group: Regularly measures and monitors progress to identify variances from the project management plan so that corrective action can be taken when necessary to meet project objectives.

5. Closing Process Group: Formalizes acceptance of the product, service or result and brings the project or a project phase to an orderly end. (p. 41)

Figure 3 depicts the mapping of the five process groups to the PDCA cycle. "The Planning Process Group corresponds to the 'plan' component of plan-do-check-act cycle. The Executing Process Group corresponds to the 'do' component and the Monitoring and Controlling Process Group corresponds to the 'check and act' components" (PMI, 2004, p. 40).

Kerzner (2004) identified the PDCA cycle as a continuous improvement system in the context of PM where when a project is completed, managers review what has been learned throughout its planning and execution. The lessons are then incorporated into the process and the plan-do-check-act cycle begins again for a new project. Application of the PDCA cycle in both TQM and PM practices creates a synergy that should enable organizations to manage their projects in a controlled and continuous improvement

system with a positive impact on project success factors such as time, cost, performance, and stakeholders' satisfaction.

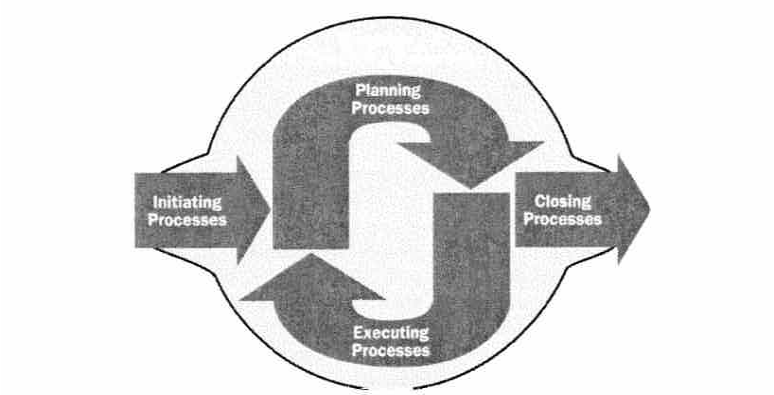

Figure 3. Project management process groups mapped to the plan-do-check-act cycle. *Note*. From *A Guide to the Project Management Body of Knowledge* (3rd ed., p. 40), by PMI, 2004, Newtown Square, PA: Author. Copyright 2004 by the Project Management Institute, Inc. Reprinted with permission.

The findings from Bryde and Robinson's (2007) study formulated to determine the effect of a TQM program on the concentration of focus in PM practices showed results that support the notion of the close relationship related to customer focus but dispute the positive impact of the synergy between TQM and PM relating to time, cost, performance, and other stakeholders' satisfaction. The results of the study showed that employees in companies with an established TQM program demonstrated more customer focus in their PM practices than employees in companies with no TQM program in place did, and no comparable relationship was found between time, cost performance, and other stakeholder focus and an established TQM program.

Bryde and Robinson (2007) noted that while no obvious relationship was found between the iron/golden triangle (time, cost, performance) and TQM in a particular environment, this might be because the relationship already exists in a business atmosphere. Bryde and Robinson cited Maylor, who suggested that managing stakeholders' interests is not a well-understood process and is often ignored. There is a need to identify and understand the barriers to management of project stakeholders and what required removing these barriers and establishing an effective process to manage their interests (Bryde & Robinson, 2007). One of the focus areas of the current study was to identify the TQM critical factors that could break down the barriers to project success by analyzing the results of a survey to ascertain responses to the following research question: What differences exist in project success based on TQM critical factors?

ISO 10006:2003 Standard

Background

According to the ISO (n.d.-a),

> ISO (International Organization for Standardization) is the world's largest developer and publisher of International Standards.
>
> ISO is a network of the national standards institutes of 161 countries, one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system.
>
> ISO is a non-governmental organization that forms a bridge between the public and private sectors. On the one hand, many of its member institutes are part of the governmental structure of their countries, or are mandated by

> their government. On the other hand, other members have their roots uniquely in the private sector, having been set up by national partnerships of industry associations.
>
> Therefore, ISO enables a consensus to be reached on solutions that meet both the requirements of business and the broader needs of society. (¶ 1-4http://www.iso.org/iso/about.htm)

The work of preparing international standards normally involves ISO technical committees. The ISO 10006 Standard was developed by Technical Committee ISO/TC 176, Quality Management and Quality Assurance, Subcommittee SC 2, Quality Systems (ISO, 2003, p. iv).

ISO 10006 Standard Development

Dr. J. H. Gordon, the convener of Working Group 8, which was responsible for the development of the ISO 10006 Standard, provided the following historical perspective (personal communication, March 18, 2009):

> At the 1988 meeting of TC176 SC2 [Technical Committee 176, Subcommittee 2] in Portugal the French delegation proposed that a new Working Group should be set up to prepare a standard guideline for the management of quality in projects. The Secretariat of SC2 was instructed to contact the P [participating] member nations who send delegates to the TC176 SC2 meetings to request nominations for experts to attend the meeting in 1989 at Interlaken, and to invite a Convenor to undertake the work.

> The first meeting of WG [Working Group] 8 at Interlaken was attended by some 15 experts the majority of whom were inevitably QM [quality management] orientated but fortunately some had PM experience. There were many discussions then and at later meetings on the content and structure we were expected to provide in the standard. At that time there were few National Standards on PM other than the UK 6046 and all were more concerned with project planning rather than PM which caused the WG many problems. However we started and over the next 3-4 years produced a number of working drafts without being satisfied with any of them as we found we were effectively writing a PM standard which, useful as it would have been, was not the requirement and a new start was undertaken.
>
> With the new start a process view of PM and the interaction of QM with the processes emerged and after several working drafts was issued as a CD [Committee Draft] for comment—which it got!! However it finally emerged as the first standard in 1997.

Eight Quality Management Principles of the ISO 10006:2003 Standard

The current edition of ISO 10006 (ISO 10006:2003, Quality Management Systems—Guidelines for Quality Management in Projects), which replaced the first edition (ISO 10006:1997), was published on June 15, 2003. The standard "provides guidance on quality management in projects. The ISO 10006:2003 Standard outlines quality management principles and practices, the implementation of which are important to, and have an impact on, the achievement of quality objectives in projects" (ISO, 2003,

p. v). The following eight quality management principles are the basis for ISO 10006:2003 (ISO 9000:2000, Introduction) that according to the ISO 10006:2003 Standard "should form the basis for quality management systems for the originating and project organizations (ISO, 2003a, p. 5): customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making, and mutually beneficial supplier relationships.

Stanleigh (2004b) proposed that the overall purpose of the ISO 10006:2003 Standard is the creation and maintenance of process and product quality in a project requiring a systematic approach to ensure the following:

1. Stated and implied customer needs are understood and met.
2. Interested stakeholders needs are understood and evaluated.
3. Quality policy is incorporated into the organization's management.

As stated in ISO (2003a), in order to meet the goals of a project, it is necessary to manage project activities within a quality management system. The quality management system of the operating organization should parallel that of the originating organization as much as possible. By applying the ISO 10006:2003 guidelines outlined in the following key elements, organizations can achieve this alignment: (a) quality management system in projects, (b) management responsibility, (c) resource management, (d) product realization, and (e) measurements, analysis, and improvement.

A close review of the key elements noted above also revealed a close alignment between the ISO 10006:2003 Standard and critical factors of TQM such as leadership, involvement of people, planning, customers, and suppliers. Concerning the role of

leaders in both the originating and the project organizations to promote these factors, the ISO 10006:2003 Standard states that one of the roles of the leader is to determine the purpose and direction to be taken by the organization. Leaders establish and ensure continuity of the atmosphere in which employees can become engaged in attaining the company's goals (ISO, 2003a).

Both TQM and the ISO 10006:2003 Standard emphasize the important role leaders should play in creating a culture of quality. Total quality management was identified earlier as a management approach centered on quality. The ISO 10006:2003 Standard provides the following guidelines for leaders to assume in their role in creating a culture of quality in their organizations:

1. Set the quality policy and identifying the objectives (including the quality objectives) for the project.
2. Provide the infrastructure and resources to ensure achievement of project objectives.
3. Provide an organizational structure conducive to meeting project objectives.
4. Make decisions based on data and factual information.
5. Empower and motivate all project personnel to improve the project processes and products.
6. Plan for future preventive actions. (ISO, 2003a, p. 7)

According to the ISO 10006:2003 Standard, the responsibility for creating a culture for quality rests with top management in both the project and originating organizations. The quality of culture is one of the foremost determinants of project success (ISO, 2003).

Miller and Cangemi (1993) identified leadership's failure to demonstrate a consistent and serious commitment to the quality process as one of the main contributors to the failure of TQM.

The guidelines within the ISO 10006:2003 Standard that emphasize the importance of leadership commitment in the promotion and support of a culture of quality in organizations can be utilized by organizational leaders toward the effective implementation of TQM, leading to the achievement of project objectives. The ISO 10006:2003 Standard addresses the involvement of people, another critical factor of TQM, in the following statement: "People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit" (ISO, 2003a, p. 7). As noted in the ISO 10006:2003 Standard, establishing the policies to implement and maintain a quality management system using quality management principles as a foundation is a process that is strategic and direction-setting.

Furthermore, organizations are dependent on their customers and should recognize the current and future needs of those customers and strive to meet and exceed them, as stated in the ISO 10006:2003 Standard (ISO, 2003a). Organizational leaders need to take a proactive approach in understanding customers' needs and expectations that are not clearly stipulated in formal and documented contracts and informal communication and plan their processes accordingly. The ISO 10006:2003 Standard provides the following guideline regarding the scope and the nature of interfaces between the organization and its stakeholders, including customers: "[They] should be established with all the interested parties to facilitate the exchange of information, as appropriate,

throughout the project. Any conflicts between interested party requirements should be resolved" (ISO, 2003a, p. 6).

The mutually beneficial supplier relationship is one of the eight quality management principles that form the basis of the ISO 10006:2003 Standard. The standard includes an emphasis on the interdependence between the organization and its suppliers in creating value for all parties. The ISO 10006:2003 Standard provides the guidelines regarding the implementation of this principle. Organizations should work together with suppliers to define tactics for securing outside products, most importantly those with extensive lead times. The issue of sharing any risk involved should be considered. The development of requirements that involve suppliers' methods and specific product specifications should be considered a joint enterprise. The initiating project organization must also take into account whether or not the supplier is capable of meeting the requirements and whether or not the customer has a specific preference regarding selection of suppliers and a preferred group of suppliers.

A search for studies related to the ISO 10006:2003 Standard resulted in very few articles, which indicated the existence of a gap in the current literature. The current study and its findings extend the current literature and narrow the existing gap through the following research question addressed in this study: What differences exist in project success based on the use of guidelines within the ISO 10006:2003 Standard?

Alignment between ISO 10006:2003 Standard and ISO 10007:2003 Standard

One of the seven project management process groupings necessary to produce the project's intended deliverables is change management (ISO, 2003a). According to the

ISO 10006:2003 Standard, the change management process addresses the identification, evaluation, authorization, documentation, implementation and control activities that are essential for effective changes that could impact project scope, objectives and project management plan. To ensure that the identified changes do not have any adverse impact on the functional and physical characteristics of the project's output both in terms of deliverable and non-deliverable items, these changes need to be controlled. One of the processes identified in the ISO 10007:2003 Standard (ISO, 2003b) is change control which includes the requirements for a documented and effective change control process.

The ISO 10007:2003 Standard provides the following criteria for the process for controlling changes:

1. A description of, justification for, and record of the change.
2. A categorization of the change, in terms of complexity, resources and scheduling.
3. An evaluation of the consequences of the change.
4. Details of how the change should be dispositioned.
5. Details of how the change should be implemented and verified. (ISO, 2003b, p. 4)

However, the search for studies related to the alignment between the ISO 10006:2003 Standard and the ISO 10007:2003 Standard and application of the ISO 10007:2003 in project focused organizations resulted in a limited number of documents covering these topics, which indicated the existence of a gap in the current literature. One of the findings noted in the 2004 WG07 Configuration Management Study Group

Report (ISO/IEC, 2004, p. 4) was that "ISO 10007 is written from a Quality systems point of view and refers to a "product's configuration." It is therefore applicable to both software and systems". Examination of the above finding and the five criteria outlined in the ISO 10007:2003 Standard for the process for controlling change point to the potential benefits that the integration of the ISO 10006:2003 change management guidelines and the configuration management processes outlined in the ISO 10007:2003 Standard offer to mitigate risks associated with the introduction of changes and configurations throughout project life cycle in both software and hardware applications. Although the scope of this study did not cover the impact of the ISO 10007:2003 Standard on project success, one of the recommendations for future research listed in Chapter 5 addresses this topic.

ISO 9001, Six Sigma, CMMI and TQM: A Comparative Analysis

Under the umbrella of quality and business improvement initiatives, many organizations have adopted several methodologies in addition to TQM. Among these methodologies are CMMI, the ISO 9001 Standard, and Six Sigma, which have received serious attention in the past 3 decades. Below are the results of an analysis of the literature review covering the relationship between these initiatives and TQM. The differences between each of the three initiatives and TQM and their application in the field of PM are addressed. Through such an analysis, it might be possible to identify the enablers of these initiatives that are similar to those in TQM and that will allow organizational leaders to utilize one more of these initiatives to improve project success.

ISO 9001 and TQM

Bendell and Boulter (2004) noted that the history of ISO 9000 began with standards established for military procurement during World War II. This foundation led to the publication in 1979 by the British Standards Institute of BS 5750, which was the first quality management standard. With relatively few changes, BS 5750 was adopted and became ISO 9000 in 1987. The international standard was updated with minor changes in 1994. Major changes were postponed until 2000 when, with a complete rewrite, ISO 9000 became ISO 9001:2000. The fourth edition of ISO 9001 (ISO 9001:2008, Quality Management Systems— Requirements), which replaced the previous edition (ISO 9001:2000) was published on November 15, 2008. According to ISO (2008), ISO 9001, an international standard, establishes guidelines and a framework for a quality management system in an organization.

The requirements of this international standard are generic and are applicable to all organizations without consideration of type, size, or product manufactured. The generic requirements and the application of the process approach promoted by the ISO 9001:2008 Standard allow ongoing control over linking individual and specific operations within the total system, along with their combination and interface (ISO, 2008). Furthermore, the ISO 9001:2008 Standard proposes the use of the PDCA methodology, which is the hallmark of TQM philosophy, as stated earlier, pointing to a common approach in meeting customer satisfaction through a continual improvement process.

Magd and Curry (2003), in their paper titled "ISO 9000 and TQM: Are They Complementary or Contradictory to Each Other?" cited several research studies suggesting that "those companies wishing to remain competitive and improve their quality systems are recommended the use of ISO 9000 as a foundation for a much broader system of TQM" (p. 252). Magd and Curry concluded that these approaches are complementary and ISO 9000 should be implemented first. Doing so creates consistency and stability in the organization. The subsequent implementation of TQM operates as an enhancement to employee motivation and efficiency of operations. As a result, there is an overall improvement in an organization's performance and success.

Regarding the impact of ISO 9000 on TQM and business performance, Han et al. (2007) found that the relationship between efforts to become certified to ISO 9000 and implementation of TQM practices is a positive and significant one. Han et al. concluded that their study did not find a direct positive correlation between ISO registration and business performance. However, the study did suggest that implementation of TQM practices improves an organization's competitiveness, which positively affects customer satisfaction.

Furthermore, according to PMI, the approach to quality management described in Chapter 8 of the *PMBOK* is designed to be compatible with the ISO. This compatibility has resulted in widespread application of the ISO 9001 Standard where, according to the survey conducted by ISO (2008), until the end of 2007 at least 951,486 ISO 9001:2000 certificates in 175 countries and economies worldwide had been issued. The survey also

indicated that the United States, with a total of 36,192 certificates, ranked seventh among the top 10 countries for ISO 9001:2000 certificates.

Six Sigma and TQM

Six Sigma is an approach to business improvement originally initiated by Motorola in the early 1980s, the goals of which were to reduce errors and variations (Lin, Sung, & Lin, 2009). George (2002) expanded on this concept by pointing out that in an organization driven by Six Sigma, it becomes more than a methodology for improvement. Six Sigma is a management system that aims to achieve enduring business leadership and excellent performance that benefit the business and its stakeholders with a goal of zero tolerance for errors. George identified customer centricity, financial results, management engagement, resource commitment, and execution infrastructure as the critical success factors for Six Sigma. According to George, Six Sigma through its customer centricity drivers such as voice of the customer, requirements, critical to quality, defect, and design for Six Sigma and through disciplined improvement approach ensures that gaps between the customer's desires and expectations and the current organization's capabilities are addressed.

One of the drawbacks associated with TQM mentioned by George (2002) is its lack of focus on financial results when compared to Six Sigma. According to George, there was no clear method of determining which projects demanded highest priority. Each project was managed with equal intensity without respect to its value or cost to the company or customer. Total quality management was often managed and prioritized by individuals according to their own metrics and who did not really understand the issues

that drove stakeholder value. With the advent of Six Sigma, this approach changed since Six Sigma is driven by financial performance.

In terms of management engagement, George (2002) pointed out that lack of focus on financial results, one of TQM's shortcomings, worked to the detriment of management involvement. Projects were managed with the hope that there would be an improvement in finances if there was an improvement in quality. With Six Sigma's emphasis on the bottom line, it is made clear to executives what they have to gain by their active engagement in the process. The results are the same as shown with TQM. Companies in which management is actively involved demonstrate the biggest gains.

Organizational leaders who recognize the financial benefits of Six Sigma and are committed to its implementation provide the necessary resources in terms of personnel that according to George (2002), generally amounts to approximately 1% of an organization's workforce. Organizational leaders can ensure the success of Six Sigma implementation with their commitment and the institutionalization of the Six Sigma infrastructure that actualizes the vision of the company leader into a group of projects prioritized to guarantee focus on customer needs, reap maximum shareholder value, and provide effective management of results.

Trained personnel committed to Six Sigma initiatives utilize the Define-Measure-Analyze-Improve-Control (DMAIC) improvement process and associated tools for its successful implementation. The strategy used by Six Sigma is driven by specific statistical tools within a well-defined and structured methodology to provide the necessary knowledge to compete in the marketplace by offering a product or service

better, faster, and at a lower cost than competitors (Kerzner, 2009). The continued and constant application of this strategy on all projects prioritized based on business issues results in lower costs, higher profits, and increased returns on stakeholder investment.

Green (2006) noted that TQM is experiencing a new iteration and is currently being identified under the name six-sigma. In responding to questions whether or not Six Sigma replaces TQM, or if its methods support the goals of TQM, Green noted that it would be helpful to reexamine the five important features that comprise TQM (i.e., strong customer focus, elevated employee involvement, continuous improvement, enlightened leadership and fact-based decision making) and determine the impact that Six Sigma has had on each feature. The conclusion made was that Six Sigma provides a disciplined methodological approach to quality management, helping to resolve TQM's shortcomings and provide the results expected by its use.

According to Pfeifer, Reissiger, and Canales (2004), the structure of six-sigma approach based that places heavy emphasis on a top-down-bottom-up approach ensures that there is a far-reaching pursuit of project goals. The customer-centric PM approach of Six Sigma relies heavily on the Deming cycle, a well-known and well-established method for problem solving within a continuous improvement framework (Pfeifer et al., 2004). Because the Deming cycle is more of a model than an explanation, the Six Sigma approaches to PM are, by necessity, quite structured.

In their investigation of the application of Six Sigma in the financial services industry, Lin, Sung, and Lin (2009) discovered that beyond its application in manufacturing and production, Six Sigma not only has unexploited potential but it can be

used in environments other than manufacturing. According to Lin et al., Six Sigma has expanded into a theoretical model relevant to any aspect of an organization. The approach provides to any company willing to implement its strategy a structured format to save money and time and to trim waste and has specific positive implications for financial tasks.

CMMI and TQM

Capability Maturity Model Integration is a process improvement framework developed in cooperation between the U.S. Department of Defense and the Software Engineering Institute and was first released in 1991. Capability Maturity Model Integration in its basic configuration contains a set of 22 process areas organized into the following four categories: process management, PM, engineering, and support. The PM category includes the following process areas: project planning (PP), project monitoring and control (PMC), supplier agreement management (SAM), integrated project management (IPM), risk management (RSKM), and quantitative project management (QPM). Capability Maturity Model Integration can be applied across the entire organizational spectrum. Functions that might have traditionally operated separately can be integrated, and improvement in priorities and goals can be set through its implementation. Capability Maturity Model Integration can serve as a reference point in reviewing quality processes in place and their effectiveness.

Gibson, Goldenson, and Kost (2006) reported evidence-based results of performance in 35 firms that apply CMMI practices in their operations. Results were categorized by cost, schedule, productivity, quality, customer satisfaction, and return on

investment. Median percentage improvement for each category was 34, 50, 61, 48, and 14%, respectively, and a 4.0 to 1.0 ratio in terms of return on investment. Increased CMMI implementation has been credited with substantial improvement in the performance categories noted above. Improvements in the noted categories have occurred concurrently and in a variety of industries. Whether or not the organization was small or large, well-established or relatively new, all companies specifically credited their achievements to CMMI practices.

Although both CMMI and Six Sigma promote process improvement and defect prevention similar to the ISO 9001 Standard and TQM, the literature review exposed greater interest in the integration of CMMI and Six Sigma than in the integration of CMMI and TQM and the ISO 9001 Standard. In comparing CMMI and Six Sigma, Siviy, Penn, and Harper (2005) noted that one does not replace the other. Rather, they work in concert. Capability Maturity Model Integration can be implemented to establish a process infrastructure addressing specific sectors while Six Sigma addresses issues across the entire organization with a special focus on issues and opportunities. For example, Six Sigma could determine which processes should be consistently replicable. Capability Maturity Model Integration could then establish processes based on best practices; Six Sigma could then ensure that these processes were practiced at optimal levels.

The analysis of the relationship between the ISO 9001 Standard, Six Sigma, CMMI, and TQM and the examination of their characteristics in terms of their position in the continuous improvement spectrum and their application in the field of PM revealed

several important findings. Similar to TQM, the ISO 9001 Standard, Six Sigma, and CMMI possess characteristics of a framework that supports a continuous improvement methodology and focus on the prevention and elimination of defects and reworks in product and service. In contrast to TQM, ISO 9001 Standard, Six Sigma, and CMMI also provide a disciplined approach that when pursued could assist organizational leaders in institutionalizing an effective system of processes for managing their operations with a focus on stakeholders' satisfaction.

Another factor that is unique to Six Sigma and is lacking in the ISO 9001 Standard and TQM and to some extent in CMMI is the focus on financial results. None of the eight quality principles on which the ISO 9001 Standard, similar to ISO 10006:2003, is based explicitly deal with the positive financial impact that the ISO 9001 Standard brings to organizations. In terms of financial results, according to George (2002), the foundation of Six Sigma is its focal point on financial consequences based on experiences gained the hard way. In contrast, TQM, the quality methodology that preceded the development of Six Sigma, reflects an emphasis on solving quality problems as its core. With respect to CMMI, although improvements in budget and decreases in the cost of quality are two of the benefits it brings to organizations, CMMI does not outline expectations directly related to the financial goals of organizations.

In terms of the application of the ISO 9001 Standard, Six Sigma, and TQM in a PM environment, their contributions are limited to the quality aspects of PM practices as noted in Chapter 8 of *PMBOK* (PMI, 2004). In addition to providing a structured approach for product and process quality assurance across an organization similar to the

ISO 9001 Standard and Six Sigma, CMMI also provides a baseline against which project planning, monitoring, control, and execution can be measured and improved.

As stated earlier in this section, until the end of 2007 almost 1 million organizations in various industry sectors had been certified to the ISO 9001 Standard (ISO, 2008). The purpose of this study was to examine empirically the benefits that TQM and the ISO 10006:2003 Standard can bring to the PM discipline. It is conceivable that a point will be reached when the ISO 10006:2003 Standard, based on the same eight quality management principles as the ISO 9001 Standard, will enjoy the same widespread application in project-focused organizations. However, a sustainable increase in the application of the ISO 10006:2003 Standard will be dependent on meeting organizations' needs for problem-solving tools that are offered by Six Sigma and the framework for managing activities supported by CMMI in an environment conducive to the application of the principles of TQM.

Theory of Constraints (TOC)

When discussing the topics of quality in general or TQM in particular, the names of experts such as Juran and Deming repeatedly come to the forefront. In addition, when discussing TOC, Eliyahu Goldratt's name repeatedly appears as the father of TOC. According to Reid (2007), TOC is a fairly new approach to management and has been consistently changed and refined since its beginnings in the early 1980s. Originally developed by Goldratt, its focus is the cause-and-effect relationship that governs an organization's performance.

Zadry and Yusof (2006) defined TOC as a blend of philosophy, principles and tools conceived to ensure optimal performance of any organization by enabling the members of that organization to identify, control and ultimately eliminate any problem that prevents that organization from operating at peak performance. In addition to moving back the beginning of TOC from the 1980s, as suggested by Reid (2007), to the 1970s, Mabin and Balderstone (2003) provided the following comprehensive history of the development of TOC:

> Although conceived in the 1970s in a manufacturing context as a scheduling algorithm, TOC has now been developed into a powerful and versatile management theory, as a suite of theoretical frames, methodologies, techniques and tools. It is now a systemic problem-structuring and problem-solving methodology which can be used to develop solutions with both intuitive power and analytical rigour in any environment. The changes of the name from Optimised Production Timetable (1979) to Optimised Production Technology (OPT) in 1982 and then to TOC at the beginning of 1987 signaled a major change in emphasis, first, from rule-based scheduling logic to the applications of software tool OPT and later to a focusing/iterative process of ongoing improvement. The addition of thinking processes (TPs) in the 1990s broadened the scope to an organization-wide perspective and the changes in people's thinking and behaviours required in any change process. (p. 570)

Mabin and Balderstone's (2003) synopsis of TOC conveyed the important message that TOC is a powerful management theory that encourages organizational leaders to

approach problems they face from a system perspective using a systems thinking process in an environment designed to support the focusing or iterative process of ongoing improvement. Such an approach will allow the identification of breakthrough and sustainable solutions to both simple and complex problems. Gupta and Boyd (2008) noted that TOC emphasizes

> the cross-functional and interdependent nature of organizational processes by viewing an organization as a chain (or network of chains) of interdependent functions, processes, departments or resources where a variety of inputs are transformed into a variety of products and services. (p. 993)

This message is reminiscent of the PDCA cycle, which is the hallmark of the TQM philosophy. The results of a meta-analysis of over 80 successful TOC applications reported by Mabin and Balderstone (2003) in their literature-based research showed that a sustained application of TOC resulted in measurable improvements in the operational and financial performance of an organization. Operational performance measures included lead time, cycle time, and due date performance. The financial performance measures included inventory, throughput, and profitability. More specifically, Gardiner et al. (1994) reported on several organizations that through the implementation of TOC had experienced improvement in one or more of the following: lead time, sales, and inventory.

Although improvements in the above measures have a direct impact on customer satisfaction, Gardiner et al. (1994) did not report on the impact of TOC on the measure of quality of product or service provided by the organizations involved in the case studies.

Had the scope of the meta-analysis included the impact of TOC on the final product or service measures, the results could have been used to analyze the impact of TOC on the successful implementation of management philosophies such as TQM or the successful implementation of PM relating to improvement in project success.

In discussing the positive impact of TOC on TQM implementation, Gardiner et al. (1994) asserted that TQM has many powerful yet cumbersome techniques at its service. When applied to all steps at one time, improvement is not quick or easy to see right away for the amount of work involved. Employees then shy away from anything but lip service to TQM, seeing little effect for their efforts. The theory of constraints provides the impetus needed to focus TQM efforts in a manner that achieves visible results. The application of TOC in a TQM environment ensures that quality efforts focus on eliminating the constraints and achieving rapid results. To the question of whether TQM is without merit, the response by Gardiner et al., (1994) was that TQM definitely had merit. Bur from the perspective of TOC, TQM's efforts should be directed toward resolving an organization's constraints.

Goldratt and Cox (1984) suggested that the following five focusing steps are the basis for the business improvement process proposed in TOC:

1. Identify the constraint(s).
2. Decide how to exploit the constraints(s).
3. Subordinate all else to the decision in the Step 2.
4. Elevate the constraint(s).
5. If in any previous steps a constraint is broken or eliminated, go to Step 1.

This theory indicates that "constraints determine the performance of a system and that any system contains only a few constraints" (Gardiner et al., 1994, p. 13). As Newbold (1998) explained,

> A basic principle of Theory of Constraints (TOC) is that the unpleasant problems or "undesirable effects" we experience in a field such as project management are usually the results of relatively few core problems. "Relatively few" means a manageable number. (p. xxxi)

Gill (2008) expanded on the TOC approach in handling the unpleasant problems through the use of the evaporating cloud, also known as the effect-cause-effect method. Gill further noted this method presents the opportunity to identify and define a specific problem and then resolve, or evaporate, it by directing it into an area where it can be addressed and challenged. Gill identified the following four steps associated with the effect-cause-effect method (pp. 537-538):

1. Problem realization.
2. Problem definition.
3. Stating trade-off assumptions.
4. Problem resolution.

Gill (2008) also noted that this feature of TOC describes its ability to locate underlying assumptions about a system, bring them to the forefront, and examine them under a microscope to ensure that a certain problem will not continue to occur in a specific situation.

In the introduction section of the current study, it was stated that due to its integrative nature, PM can contribute to project success when it is applied in an organization that supports a team environment and continuous improvement. When applying the philosophy, concepts, principles, and tools embedded in the TOC framework, organizational leaders are able to provide their members with the necessary tools they need to identify, manage, and break the most restrictive limiting factor that prevents them from contributing to the success of projects. Also stated was that the TOC framework supports the application of the PDCA cycle that enables organizations to continually identify and remove constraints to prevent them from reaching the desired organizational performance associated with project success.

Systems Theory

Chapter 1 included a brief discussion on the application of systems theory in creating an environment where leaders can apply management techniques effectively across processes in many organizational disciplines. To gain further appreciation of the potential benefits that a system approach in managing interrelated functions and processes can bring to organizations, it is prudent to define a system first. A system is generally understood to be comprised of a collection of units or parts that are organized and integrated to accomplish a specific goal (McNamara, n.d.-ahttp://managementhelp.org/systems/systems.htm). According to Newbold (1998), an organization is one long chain with each link being a dependent task or resource that leads to the next link in line. Each link in the chain relates to the ones that come before and after it, and nothing operates independently. From the perspective of the

organization, a system is defined as a group of processes and people that work in tandem in order to accomplish a common goal (Nelson & Daniels, 2007c).

In a survey conducted by the ISO (2008), it was reported that through the end of December, 2007, organizations and economies in 175 countries had been issued at least 951,486 ISO 9001:2000 certificates. Certification to the ISO 9001:2000 Standard (ISO, 2000), which is based on eight quality management principles including a systems approach to management, allows organizational leaders to achieve the overall organizational objectives in supporting their mission. These same eight quality management principles form the basis of ISO 10006:2003, with a specific focus on quality management in projects. Since both standards are based on common principles, the ISO 10006:2003 Standard should have the same widespread application as the ISO 9001:2000 Standard.

Organizations have recognized the following key benefits of the systems approach quality principle where "identifying, understanding and managing interrelated processes as a system contributes to the organization's effectiveness and efficiency in achieving its objectives" (ISO, n.d.-b, para. 1).

1. Integration and alignment of the processes that will best achieve the desired results.
2. Ability to focus effort on the key processes.
3. Providing confidence to interested parties as to the consistency, effectiveness and efficiency of the organization.

4. Structuring a system to achieve the organization's objectives in the most effective and efficient way.

5. Understanding the interdependencies between the processes of the system.

6. Structuring approaches that harmonize and integrate processes.

7. Providing a better understanding of the roles and responsibilities necessary for achieving common objectives and thereby reducing cross-functional barriers.

8. Understanding organizational capabilities and establishing resource constraints prior to action.

9. Targeting and defining how specific activities within a system should operate.

10. Continually improving the system through measurement and evaluation. (ISO, n.d.-b, para. 2)

The use of systems theory offers management the opportunity to approach the operation of an organization as a group of cohesive parts that function interdependently and as such accomplish common goals (Walbert, 2009). The interdependence of processes within a system makes systems thinking a suitable method for focusing on how the system functions as a whole. Systems thinking involves an emphasis on viewing the relationships between the processes and the elements of the system rather than just considering them in isolation and as a collection of independent elements without considering the impact of their interaction with other processes or elements in achieving common goals. Systems thinking offers an individual the ability to view the world from a specific perspective and see it as a group of patterns and structures rather than as discrete events (McNamara, n.d.-b).

Conti (2006) suggested that it is time to approach quality management concepts and practices from the systems thinking perspective. Recognizing the fact that quality is a desired attribute for every process of a system with interconnected processes, and the fact that the output of a process with poor quality could have an adverse effect on the quality of another process, organizational leaders should apply systems thinking and systems theory in the application of TQM principles with the aim of achieving a desired quality level at each process. From a PM perspective, due to the integrative nature of the five PM process groups listed earlier, organizational leaders can apply systems thinking and systems theory in managing the quality of projects to reach project objectives. The survey instrument for the current study included questions related to a systems view in managing projects and the results of this view on the success of projects in respondents' organizations.

Integration of TQM, the ISO 10006:2003 Standard, and PM

As part of the effort to reduce cost and increase efficiency of operations to remain competitive in an evolving economy, most organizational leaders who have implemented more than one management methodology have accepted the idea of integrating them as a critical step in their business strategy. This section includes a discussion on the integration of TQM, the ISO 10006:2003 Standard, and PM as a viable solution to improve the success of projects.

Hafeez et al. (2006) restated the concept of the integrative management philosophy as one of the characteristics of TQM, saying that the definition and focus of TQM are directed at achieving quality across the entire spectrum of an endeavor. This

includes not only the individual components of the organization but also the interaction between them. Escrig-Tena (2004) noted that TQM should be seen as a comprehensive plan focusing the efforts of the complete organization in order to provide customers with acceptable products or services. This goal is accomplished by concurrently mobilizing all resources available, including employees and management leadership.

According to researchers at PMI (2004), PM is a group of processes, including monitoring and control activities that are integrated into a unified functional entity. In the PM context, according to PMI (2004), this integration includes the features such as unifying and consolidating all activities that are critical to ensuring successful project completion and meeting all customer and stakeholder expectations. Furthermore, the integration is most concerned with effectively incorporating the processes of the PM process groups whose functions achieve project goals within the organization's guidelines (PMI, 2004). The integrative processes include the following:

1. Develop project charter.
2. Develop preliminary project scope statement.
3. Develop PM plan.
4. Direct and manage project execution.
5. Monitor and control project work.
6. Integrate change control.
7. Close project.

An examination of the relationships between the project quality management processes that include quality planning, perform quality assurance, and perform quality

control discussed earlier in the chapter and other knowledge areas of the *PMBOK* shows a clear interaction among them. Figure 4 is the flow diagram of project quality management processes and their interaction with several related integrative PM processes listed above. For example, a change request is initiated by the perform quality assurance process and after the request is reviewed as part of the integrated change control process, the approved request is submitted back to those responsible for performing quality assurance. According to researchers at PMI (2004),

> Approved changes need to be analyzed for any effects upon the quality management plan, quality metrics, or quality checklists. Approved changes are important inputs to QA [quality assurance] and can be used in areas such as audits, quality reviews, and process analysis. (p. 88)

Another example that helps to show the integrative nature of PM processes is the interaction between the quality planning process and the develop PM plan process. A quality management plan is the blueprint describing the steps that will be taken to implement quality policy in the performing organization. This quality management plan is a module of the overall plan for project management (PMI, 2004).

Pheng and Teo (2004) noted that TQM's capability to incorporate and institutionalize accepted TQM practices into daily behaviors in the workplace is believed to be the singular determinant of its successful implementation in an organization. The two examples listed above and the interaction between project quality management processes and several of the project integration management processes shown in Figure 4

clearly show the integrative nature of these processes and the need for an alignment of TQM practices embedded in these processes and PM practices.

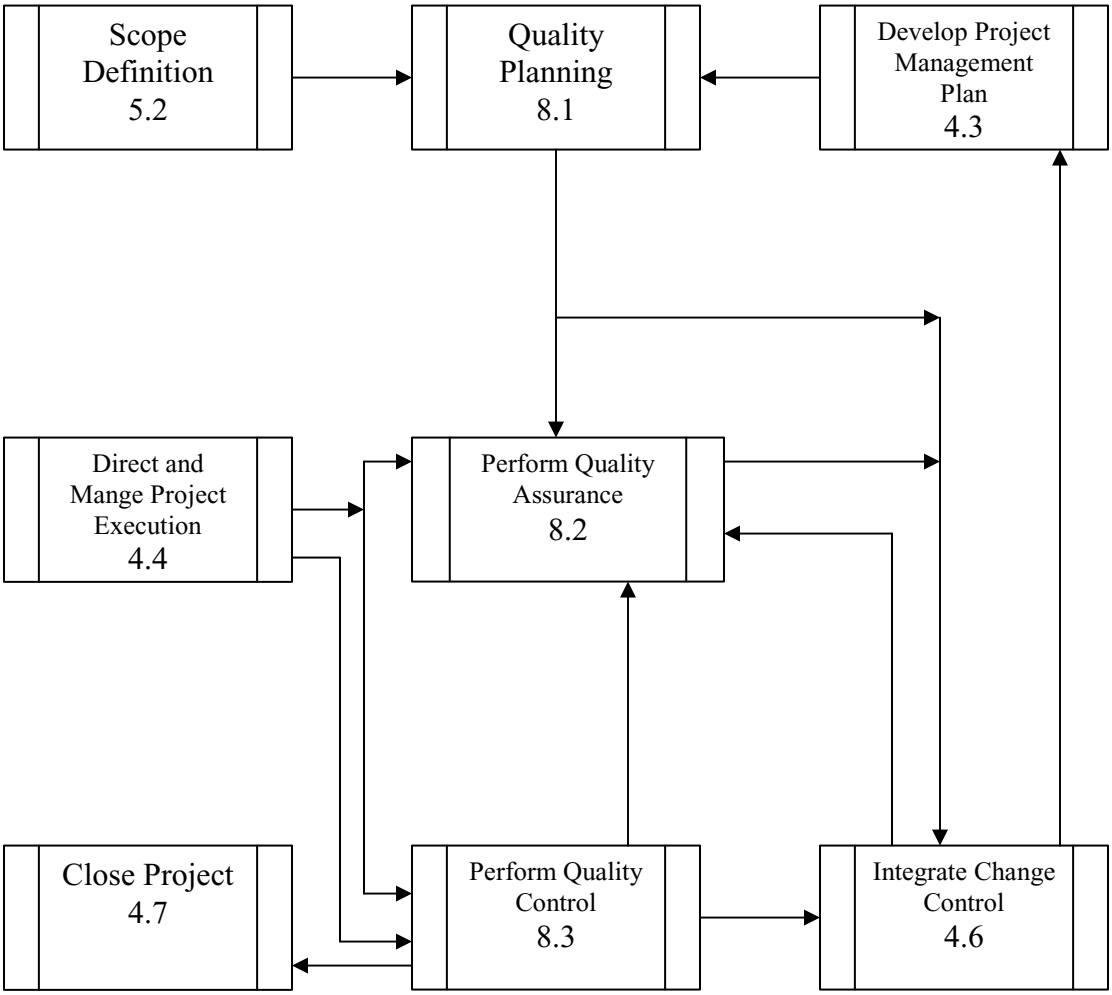

Figure 4. Project quality management process flow diagram.

Note. From *A Guide to the Project Management Body of Knowledge* (3rd ed., p. 183), by PMI, 2004, Newtown Square, PA: Author. Copyright 2004 by the Project Management Institute, Inc. Reprinted with permission.

An examination of the *PMBOK* (PMI, 2004) and the ISO 10006:2003 Standard points to a number of similarities and differences between them. Both documents are

process based. One of the eight quality management principles on which the ISO 10006:2003 Standard is based is the process approach, which promotes the philosophy of managing activities and related resources as a process. As detailed in ISO 10006:2003 (ISO, 2003), when actions and resources are administered from the perspective of a unified process, the achievement of a specific desired result is accomplished more effectively. Resource-related processes, personnel-related processes, interdependency-related processes, and scope-related processes are several of the processes included in the ISO 10006:2003 Standard (ISO, 2003). Similarly, the PMBOK (PMI, 2004) included 44 processes aggregated into five basic PM process groups. According to the PMBOK (PMI, 2004), the processes are relevant universally and throughout all sectors of industry. In addition, the PMBOK states that one of the required steps leading to project success is that the project team must determine which processes noted within the Project Management Process Groups are necessary to accomplish the goals of the project. Both the ISO 10006:2003 Standard and the *PMBOK* emphasize the importance of focusing on customer needs, expectations, and satisfaction as well as continual improvement in the context of PM practices.

One of the areas in which the ISO 10006:2003 Standard differs from the *PMBOK* (PMI, 2004) is the impact of top management commitment on PM. Although the *PMBOK* indicates project team commitment is crucial to project success, it does not indicate the active involvement of top management is an essential factor in the effective implementation of PM processes. As indicated earlier in this chapter, the ISO 10006:2003 Standard emphasizes the importance of establishing mutually beneficial

supplier relationships as part of PM practices. As part of this practice, the *PMBOK* states, "Purchasing should be planned so that the interfaces and interactions with suppliers can be managed by the project organization" (PMI, 2004, p. 24). The *PMBOK* does not cover the issue of mutually beneficial supplier relationships as in depth as does the ISO 10006:2003 Standard.

The above discussion provides some insight into the benefits that the combined application of ISO 10006:2003 and the *PMBOK* can bring to projects. One of the key findings from a survey conducted to study the bottom-line impact of implementing a PM office on organizations was provided by Stanleigh (2005), who observed that while the application of *PMBOK* in PM is widespread, the same cannot be said of ISO 10006:2003 guidelines. An important opportunity to improve quality is being missed. As Stanleigh concluded, the application of this standard ensures added quality to managing a project as well as to the end product or service provided.

The important role that TQM and *PMBOK* (PMI, 2004) play in the success of PM practices identified through related literature was covered earlier in this chapter. The chapter also included a discussion on the literature regarding the impact of synergy between TQM and PM and the application of the ISO 10006:2003 Standard on achieving project objectives. Although the amount of literature on the application of ISO 10006:2003 in project-centered organizations is almost nonexistent, the combined application of the ISO 10006:2003 Standard and *PMBOK* (PMI, 2004) might add to the positive impact of TQM and PM integration on project success. Responses to Research Question 2 provided adequate justfication for such an assumption by indicating that two

of the eight quality management principles of the ISO 10006:2003 Standard are essential in meeting project goals which is also promoted in the *PMBOK* knowledge area.

Summary

This chapter consisted of a review, analysis, and syntheses of the selected studies of TQM, PM, the ISO 10006:2003 Standard, TOC, and systems theory and their role and impact on project success. In addition, differences between the ISO 9001 Standard, Six Sigma, and CMMI initiatives and TQM and their application in the field of PM were analyzed. The purpose of the literature review was to sort through a large volume of relevant theoretical and empirical research studies using an effective and efficient approach to identify studies that substantiated the problem statement and addressed the two research questions. One of the objectives of the literature review was to identify linkages among critical TQM factors and project success measures that were utilized to facilitate the development of the Likert-type scale survey-based instrument to test the hypotheses based on the two research questions addressed in the study.

In their groundbreaking study on research published from 1989 to 2000, Sila and Ebrahimpur (2002) reviewed 347 TQM studies published throughout the world. An analysis of the 347 survey articles examined during that period revealed that in an integrated approach to TQM, eight factors were the most frequently covered in the literature and formed a universally accepted framework of TQM. The factors were customer focus and satisfaction, employee training, leadership and top management commitment, teamwork, employee involvement, continuous improvement and innovation, and quality information and performance measurement (Sila & Ebrahimpur,

2002). The synthesis of the information by Sila and Ebrahimpur provided the solid foundation for the design of an effective and comprehensive survey in the current study. Grandzol and Gershon (1998) developed and validated a survey instrument that provided a common basis for data collection that minimized discrepancies in study results based on the use of different survey instruments. Results of the research for developing standardized TQM modeling developed by Grandzol and Gershon were utilized to operationalize the TQM critical factors considered in the current study through the use of a survey instrument developed by the researcher. The review of literature on systems theory and TOC on which the current study was grounded and their application in a PM environment resulted in greater understanding and provided valuable information for the design of survey questions.

Chapter 3 includes a detailed discussion of the research methodology selected for the study. Included are details regarding the research sample, population, operationalization of the dependent and independent variables, and the development of the Likert-type scale survey-based instrument used to test the hypotheses. The chapter will also include a discussion of the importance of ethical considerations, implications for social change, and usefulness to the field relating to the study.

Chapter 3: Research Method

Chapter 2 included a discussion on how both TQM and PM can affect the success of projects when effectively implemented. The literature reviewed included a limited number of research studies addressing the complementary relationships between *PMBOK* (PMI, 2004), the ISO 10006:2003 Standard, and TQM principles and their reliance on systems thinking to improve project success. Although the literature review indicated that a limited amount of empirical evidence exists on the association between TQM application and PM and project success, the theoretical and empirical evidence of the application of the ISO 10006:2003 Standard in a PM environment was almost nonexistent. The purpose of the study was to examine empirically the connection between TQM critical factors and the use of the guidelines within the ISO 10006:2003 Standard in PM activities and project success indicators. This chapter consists of a discussion on the rationale for, and the design of, a quantitative comparative study and the use of an electronic Likert-type scale survey-based instrument to address the two research questions and the related hypotheses. The chapter also includes a discussion on the approach for selecting the sample, the dependent and independent variables and their operational definitions, the reliability and validity of the developed survey instrument, the data collection and analysis process, ethical considerations, implications for social change, and the usefulness of the research to the field of PM.

Research design is the coming together of a unique philosophical worldview and a selected strategy of inquiry and research method (Creswell, 2009). These worldviews, or basic sets of beliefs that influence the approach to study and research, were identified as

postpositivism, social construction, advocacy/participatory, and pragmatic. The philosophical worldview is

> a general orientation about the world and the nature of research that a researcher holds. These worldviews are shaped by the discipline area of the student, the beliefs of advisors and faculty in a student's area, and past research experience. (Creswell, 2009, p. 6)

These beliefs held by researchers direct their approach to research and the format that it takes, either qualitative, quantitative, or mixed method, through the strategy and design of their studies and will drive their research methods through their choice of questions, data collection, analysis and interpretation, write-up, and validation (Creswell, 2009).

Of the four possible worldviews (postpositivism, advocacy/participatory, constructivism, and pragmatism) discussed by Creswell (2009), constructivism shaped the current research. One of the key assumptions for the constructivism research worldview is that people are driven to understand how the world in which they live and work operates. People create personal meaning toward objects based on their experiences in the world (Creswell, 2009). The choice of postpositivism as the philosophical worldview led to the selection of the quantitative comparative strategy of inquiry and the proposed use of nonexperimental designs such as surveys to conduct the research. The remaining sections of this chapter include details on all components of the nonexperimental design research and method adopted for the study.

Research Design

Robson (2002) posited that framework for a good research design will include among its elements a high degree of consistency among the features of purpose, theory,

the research questions, methodology and sampling technique. Creswell (2009) expanded on the assertion by noting that included in the elements noted above would be the research problem itself, along with the researcher's personal experiences and the subject audience for whom the results and report are intended. Robson provided guidance on selecting a research strategy when considering the influence of research questions, indicating the type of questions the researcher seeks to answer will influence the choice of research strategy and questions such as what, how many, how much, who, and where indicate that the use of a nonexperimental fixed strategy such as survey provides the best option.

Robson (2002) explained that the design details in a non-experimental fixed study are determined prior to commencement of data collection. A pilot study is conducted during which the viability of the study is reviewed and any changes to the design made if required before any actual data is collected. Robson further noted that fixed designs are normally interested in the whole, rather than the sum of the parts, with the characteristics and general propensities of groups rather than individuals. Therefore, in conventional studies the findings are presented as group averages instead of individual results. Robson also noted fixed designs are traditionally based on the idea of a detached researcher that guards against any personal impact of the researcher on the findings. This is in contrast to applying flexible, qualitative design methods. The advantage of using fixed designs lies in its capability to go beyond individual differences to recognize configurations and relationships that can be connected to social institutions or organizations. Several methodologies were considered as possible methods of inquiry for the current study, including case study, descriptive, explanatory, and comparative research designs.

Case study, a long-established strategy focusing on a single case, whether an individual, group setting, or organization, involves numerous methods of data collection (Robson, 2002). Such methods can include quantitative data, but more frequently qualitative data are collected. Although the case study was considered as a possible candidate for the research, the logistics of data collection made the feasibility of this method prohibitive. Although the researcher received cooperation from the presidents of the PMI chapters and chairpersons of the ASQ sections contacted, access to their membership was controlled through the organizations. In addition, case study research requires face-to-face interviews, which were impossible due to the scope of the research, the physical limitations of geography, and the fact that a single researcher conducted the research.

Data collection in case-study-based research requires planning for access arrangements, availability of resources, scheduling of data collection activities, and specification of the periods of time involved (Robson, 2002). Although the PMI chapters and ASQ sections contacted by the researcher agreed to send the survey for the study to their members, access to the respondents was controlled through the organizations. Furthermore, the selection of case study for the research would have required in-depth interviews or observations of the respondents that were not feasible due to the scope of research and logistical constraints.

Singleton and Straits (2005) noted that there is a descriptive component to all research. The primary difference between the descriptive study and the explanatory study is in the breadth of the description. Descriptive research is a search for information about individual variables, whereas explanatory research involves an attempt to describe

the relationship between variables (Singleton & Straits, 2005). Furthermore, the descriptive study, which involves a search for information, concentrates on a limited number of elements of a well-defined unit and measures the elements in a precise and systematic manner and will ultimately describe them with a numerical methodology (Singleton & Straits, 2005). Robson (2002) also noted descriptive research involves an attempt to accurately portray people, events, and situations that occur. Because the goal of the current study was to compare the differences in project success measures based on TQM critical factors and the quality management principles of the ISO 10006:2003 Standard as documented in the two research questions, the best fit from a research design standpoint was a quantitative comparative approach, which involved comparing two or more items with the purpose of determining the differences between them.

The study involved comparing the impact each of the TQM critical factors and the quality management principles within the ISO 10006:2003 Standard on the measures of project success by providing an accurate description and systematic analysis of two sets of variables. The dependent variables were project success measures including on-time completion, within budget, to specification, and customer satisfaction. The independent variables were the eight quality management principles (customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making, and mutually beneficial supplier relationships) that form the basis of the ISO 10006:2003 Standard (ISO, 2003, p. 5) and the following critical factors of TQM : leadership, continuous improvement, internal and external cooperation, customer focus, learning company, employee fulfillment, and process management.

Furthermore, all fixed designs should be piloted (Robson, 2002). A pilot study is a smaller version of the main study. Robson provided the following reasoning for conducting a pilot study. Robson, (2002) also noted that a pilot study is conducted to enable the researcher to iron out any issues relating to data collection or to confirm that questions in a questionnaire can be understood and answered easily. According to Singleton and Straits (2005), the more effort that is expended on the front end of the study in planning and pretesting, the easier data analysis becomes at the end of the study and a higher quality of results is achieved.

As indicated by Singleton and Straits (2005), the dynamics of pretest and revision begin early in the survey process with the initial drafting of the questions and persists until the survey is introduced to respondents whose characteristics mirror those of the target population. Field pretesting a survey instrument requires a smaller sample of approximately 25-50 people with similar characteristics to those of the target respondents (Singleton & Straits, 2005). Also, with respect to a sampling methodology used during the pretest stage of the study, the subject pretest group does not reflect a probability sample since the results received will not be published. However, this does not eliminate the requirement that the group should be as diverse as the population being targeted (Singleton & Straits, 2005)

As part of the development of the instrument during the preparation of the study proposal, a field study was conducted with 15 professionals familiar with the nature of the study and the topics covered in the survey. These individuals reviewed the survey questions and provided their feedback. The main reason for selecting this group was that the researcher could easily access these individuals had there been a need for follow-up

contact. Based on the feedback received, the survey instrument was revised to include additional positions and industries, additional response options, and eliminated duplicate criteria. After gathering the data from the pilot study, further revisions to the constructs and survey instrument were made. The second stage involved a self-administered electronic Web survey disseminated to the memberships of ASQ sections and PMI chapters in Houston and Dallas, Texas.

Research Method

Creswell (2009) asserted that selecting the appropriate methodology is the most tangible and explicit part of the study for many proposal writers. The selected research method supported the research design framework. A Likert-type scale survey, which is a design approach for data collection, was employed in the nonexperimental fixed quantitative comparative study. As noted by Creswell, a survey design provides a snapshot, either quantitative or numeric, of the attitudes, opinions or trends in a specific population by surveying a sample of that population. The researcher can then extrapolate the results from the sample to make assertions about the entire population (2009). The study involved an investigation into individuals' perception of the benefits that the effective implementation of TQM and utilization of the guidelines provided in the ISO 10006:2003 Standard could bring to their organizations concerning the success of projects. The study included a Likert-type scale survey-based instrument designed to provide a clear description and useful analysis of data gathered from the respondents regarding their perceptions.

The data obtained in the quantitative comparative study addressed the following research questions through a survey of individuals involved with one or more projects:

1. What differences exist in project success based on TQM critical factors?

2. What differences exist in project success based on the use of guidelines within the ISO 10006:2003 Standard?

Based on the above research questions, a quantitative comparative approach was used in testing the following hypotheses:

$H1_0$: No significant differences exist among the seven TQM critical factors for the on-time-completion project success rating.

$H1_A$: Significant differences exist among the seven TQM critical factors for the on-time-completion project success rating.

$H2_0$: No significant differences exist among the seven TQM critical factors for the within-budget project success rating.

$H2_A$: Significant differences exist among the seven TQM critical factors for the within-budget project success rating.

$H3_0$: No significant differences exist among the seven TQM critical factors for the to-specification project success rating.

$H3_A$: Significant differences exist among the seven TQM critical factors for the to-specification project success rating.

$H4_0$: No significant differences exist among the seven TQM critical factors for the customer satisfaction project success rating.

$H4_A$: Significant differences exist among the seven TQM critical factors for the customer satisfaction project success rating.

$H5_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the on-time-completion project success rating.

$H5_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the on-time-completion project success rating.

$H6_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the within-budget project success rating.

$H6_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the within-budget project success rating.

$H7_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the to-specification project success rating.

$H7_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the to-specification project success rating.

$H8_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the customer satisfaction project success rating.

$H8_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the customer satisfaction project success rating.

Population and Sampling Technique

Defining a population is a two-step process (Singleton & Straits, 2005). The first step is to identify the target population, which is "the population to which the researcher would like to generalize his or her results" (Singleton & Straits, 2005, p. 115). In the

current study, the population was comprised of members of the ASQ and PMI organizations in the United States who have been involved in one or more projects.

The second step is to construct a sampling frame that identifies the target group from which the sample will be selected. Sampling issues are part of all research and crop up in different forms regardless of the type of investigative strategy or technique employed (Robson, 2002). With respect to the relation between the selected sample and the target population in research, Singleton and Straits (2005) reported that in an ideal situation the sample obtained should be representative of the population being targeted. A representative sample is defined as one that mirrors specific characteristics of the target population as closely as possible.

One of the main concerns associated with selecting a sampling frame is the impact on the research findings due to the omission of cases in the target population from the sampling frame. To address this concern, the use of a good list from the beginning can minimize the problem of omitted cases (Singleton & Straits, 2005). Local organizations such as schools, religious and professional organizations, and unions often have membership lists or directories that can be an excellent basis from which to choose an appropriate sampling frame.

The sampling frame consisted of members of the ASQ sections and PMI chapters located in Dallas and Houston, Texas. They are the two largest memberships in Texas of their respective organizations and thereby presented an accurate representative sample of the target population. The purposive sampling technique identified the specific unit sections and chapters as typical of the target population and by so doing reflected the variations across the general target population. An invitation to participate in the survey

was included in each respective organization's monthly newsletter, with a link to the survey instrument. The requirements for eligibility to participate in the study were membership in either ASQ or PMI and involvement in one or more projects. Because each member of the target population included in the respective ASQ sections' or PMI chapters' directory was notified and had the same chance of participating in the survey, there was no impact on the survey results regarding the problem of omitted cases.

In survey research, deciding on a sampling frame becomes the acquisition of a large enough list of the target population or of its subgroups (Singleton & Straits, 2005). The leadership of both ASQ sections and PMI chapters confirmed that their memberships would have electronic access to their respective organizations' websites and newsletters through which a link to the survey was available. Based on the above information, the sampling frame included approximately 8,500 members listed in their respective section's or chapter's directories and who receive electronic notifications via e-mail. Furthermore, it was assumed that due to their association with quality or PM societies, most of the individuals surveyed have an involvement in PM or quality-related activities and are familiar with PM concepts and the TQM philosophy.

To determine the needed sample size for a yield of sufficient power for multivariate analysis of variance (MANOVA), Wilson-VanVoorhis and Morgan (2007) used the work of Cohen (1988) to determine the number of participants needed to maintain adequate power. Wilson-VanVoorhis and Morgan wrote that "given a medium to large effect size**,** *30 participants per cell* should lead to about 80% power (the minimum suggested power for an ordinary study)" (p. 6). Given that formula, and the fact that Hypotheses 5 through 8 had eight dependent variables, the aim of the study was

to obtain 240 respondents. It was determined that the original sample size was not necessary due to the fact that the responses from both the pilot study and Stage 2 were similar enough in character to combine the two datasets to reach an overall sample size of 157.

Another factor that helped achieve an acceptable sample size was the commitment from the presidents of the selected ASQ sections and PMI chapters to include the survey on their organizations' websites as well as in their newsletters. This arrangement increased the exposure of the survey to the section and chapter members and consequently increased the probability of the members participating in the survey.

Instrumentation and Materials

When comparing a Web survey with other types of surveys, cost reduction, time savings, and flexibility can be advantages in the questionnaire design (Singleton & Straits, 2005). The following should be the raw materials for survey design: use of open-ended versus closed-ended questions, direct versus indirect questions, selecting the response formats pertaining to closed-ended questions, the need to use visual aids, and the use of questions from previous research (Singleton & Straits, 2005). The choice between open- and closed-ended questions is difficult because each choice has advantages and disadvantages (Singleton & Straits, 2005).

For the current study, survey questions were closed-ended except for several demographic questions for which respondents selected a response from several options provided. After analyzing several difficulties associated with open-ended questions, including varying length, poor articulation, and incomplete responses that require special skills to recognize the shortcomings, as well as the time it would require to code the

responses, the decision was made to develop closed-ended questions in the survey instument listed in Appendices A and B. Singleton and Straits (2005) explained that in studies using a self-administered questionnaire where participants write their responses rather than verbalize them the use of open-ended questions should be limited.

Regarding the use of questions from previous research, the review of literature identified several studies that utilized survey instruments that provided valuable information in developing survey questions appropriate for the current study. Concerning the choice between using direct versus indirect questions in the survey, Singleton and Straits (2005) observed that in a direct questions, the connection between the question and the information the researcher seeks is direct and obvious. With indirect questions, the association between the question and the information requested is not as clear. Because the respondents received clear instructions on the study's objectives and the questions asked, the survey included direct questions only.

The study included the use of a 5-point Likert-type scale that consisted of a series of responses: (a) *strongly agree*, (b) *agree*, (c) *neither agree nor disagree or no opinion*, (d) *disagree*, and (e) *strongly disagree*. The Likert-type scale is appealing to respondents and they enjoy completing this kind of survey (Robson, 2002). Singleton and Straits (2005) noted that the use of graphics in a self-administered questionnaire increases its appeal, and possibly its clarity, and could increase the incentive to respond and complete the questionnaire. There was no intention to use any visual aids in the survey for the current study. However, if the participants in the pilot study identified a need for visual aids, appropriate adjustments to the survey instruments would have been made.

A discussion earlier in this chapter indicated that the two major weaknesses of self-administered electronic Web surveys are nonresponse and coverage errors resulting from incomplete data collection and resulting in a reduced response rate. Michaelidou and Dibb (2006) provided additional insight into nonresponse error. A number of issues can affect the response rate to e-mail questionnaires or data collection via the internet, including study context. Unappealing questionnaire design, anxiety regarding anonymity and lack of completion incentives also influence response rate. As a result of their study, Michaelidou and Dibb recommended the following series of guidelines to researchers who consider using an e-mail survey as a means to reduce the impact of the nonresponse bias on the results of a study:

1. Using e-mail questionnaire with URL embedded design enables simpler handling, completion and transmission,
2. E-mail questionnaire design must adhere to the principle of anonymity and use mechanisms that enable this to be achieved,
3. The selection of the sampling frame must closely reflect the research objectives and subject under study,
4. There is also evidence that respondents are encouraged to reply to survey e-mails received from known sources, particularly those with which the individuals are already registered, and
5. Incentives should be used to encourage response rates, especially if the e-mail questionnaires are lengthy. (pp. 294-295)

One of the effective tools to increase respondent willingness and cooperation in participating in a survey is a good cover letter. The following features of a cover letter

could increase respondent willingness and cooperation and improve the response rate (Singleton & Straits, 2005):

1. identifying the researcher and the survey sponsor and the phone number of a contact person,
2. communicating the general purpose and importance of the study,
3. showing how the findings may benefit the individual or others,
4. explaining how the sample was drawn and the importance of each respondent's cooperation to the study,
5. assuring individuals that they will not be identified and that their responses will be kept confidential and will be combined with those of others for data analysis purposes,
6. explaining that the questionnaire will take only a few minutes to fill out or that the interview will be enjoyable and will be held at the respondent's convenience, and
7. promising to send respondents a summary of the study's findings. (p. 249)

In addition to including a cover letter that addressed the above information with the survey, as an incentive the respondents were informed that they would receive a copy of a PowerPoint presentation by M. Stanleigh titled *ISO 10006—Guidelines for Quality Management in Projects: Implications on Project Management and Quality Management Processes* (Stanleigh, 2004c). The return rate in the pilot phase was sufficient and in the requested timeframe. However, in Stage 2 due to a slow rate of response, e-mail reminders were sent to the leadership of the respective organizations requesting their cooperation in encouraging their membership to access the link to the survey.

Singleton and Straits (2005) noted that coverage error is a major weakness of surveys disseminated via the internet. The error stems from two interrelated factors: the percentage of the population that regularly accesses the internet, and the disparity between people who use the internet and those who do not. Coverage error should have had very little impact on the percentage of the population for the study who had access to the Internet. As noted earlier, the sampling frame for the proposed study included more than 8,500 members of the selected ASQ sections and PMI chapters who had access to the survey posted on the Web with a link sent through their e-mail address.

The survey instrument developed for the study was comprised of seven sections. Section I included the cover letter and the consent form where survey participants were made aware of information relative to the purpose of the study, the compensation they would receive after completing the survey, and the confidentiality of the information they would provide in the survey. The purpose of Section II of the survey was to gather demographic data on the survey partcipants. Section III was designed to collect information on the particpants' knowledge about TQM and the application of TQM in respondents' organizations. In Section IV of the survey, repondents were asked to provide information on their familiarity with the ISO 10006:2003 Standard and the application of the eight ISO 10006:2003 Standard quality management principles within their organizations. Section V included questions pertaining to the impact of TQM on project success and particpants' responses were aggregated to test the first four hypotheses associated with the research question of what differences exist in project success based on TQM critical factors. Section VI of the survey covered a set of questions on the impact of the eight quality management principles of the ISO

10006:2003 on project success. The information collected from these sets of questions provided the necessary data to test the last five hypotheses in the study related to the research question of what differences exist in project success based on the use of guidelines within the ISO 10006:2003 Standard.

In Section VII of the survey, respondents were asked to provide their perception of whether the recent economic recession and job cuts have had any adverse impact on the success of projects with which they have been involved. Although responses to these questions did not have any impact on the hypotheses tested in the study, they were analyzed and the results of the analysis are included in Chapter 4. Such analysis could provide valuable information to organizational leaders on the impact of economic conditions on project success and to the research community for consideration in future research.

Reliability and Validity

Robson (2002) noted that reliability and validity of data secured via a survey are heavily dependent on the technical expertise of the individuals who design and manage the survey. If the potential respondents cannot understand the questions, or if the questions are unclear and confusing, running the survey would be a waste of time and effort. When measuring variables, reliability is involved with issues of stability and consistency (i.e., whether the variable is measured consistently and dependably; Singleton & Straits, 2005). Singleton and Straits also suggested that adding questions or omitting ones that do not differentiate well can increase the level of reliability, along with ensuring that instructions and questions contained in the operational definition are clear.

To ensure reliability, there must be consistency in how the statements in the survey, the construct indicators, measure the underlying constructs (Grandzol & Gershon, 1998). Grandzol and Gershon also noted that as performed during the pilot phase, reliability was calculated for all sets of indicators using the SPSS software program. Typically, the use of Cronbach's coefficient alpha can test reliability (i.e., the extent to which several indicators are correlated with one another and measure a specific construct; Simon, 2006). The reliability of the survey instrument developed for the study was quantitatively tested using Cronbach's alpha coefficient during the pilot and Stage 2 of the survey for all indicators identified for the eight quality management principles of the ISO 10006:2003 Standard and the seven critical factors of TQM.

According to (Singleton & Straits, 2005), Content validity and face validity are two methods used for validity assessment rooted in individual assessment of an operational definition. Citing Flynn et al., Grandzol and Gershon (1998) identified content, construct, and criterion as the three common methods to assess validity. Grandzol and Gershon further explained, "Content validity cannot be measured numerically. It is established by expert and literature review" (p. 94). The existing literature includes a number of studies supporting the positive contribution of TQM to business performance as noted in Chapter 2, indicating a critical linkage among TQM factors and business results. However, researchers have conducted few studies to assess the positive impact of TQM implementation and the use of guidelines within the ISO 10006:2003 Standard on project success.

As suggested by Singleton and Straits (2005), construct validation stresses the relationship between the connotation of the responses to the instrument that measures

those responses. The issue being addressed is whether or not the instrument strictly measures the concept for which it was intended or could it be construed as measuring a different concept. While Robson (2002) reduced construct validity to its simplest form, known as face validity, Singleton and Straits undermined the credibility of face validity by noting that the basis of construct validity is evidence collected by research rather than mere appearances. To address this concern, the survey instrument was designed by utilizing a set of indicators with known operational definitions found in the literature (Grandzol & Gershon, 1998) and in a meta-analysis of TQM survey-based research published between 1989 and 2000 conducted by Sila and Ebrahimpur (2002).

Operationalization of Variables

Operationalization provides researchers with a framework for defining variables of interest into empirically and quantitatively measurable factors. According to Singleton and Straits (2005), the operational definition is a description of the research measures that will denote classification and value of each specific variable. Singleton and Straits further noted that researchers could consider different indicators for their operational definitions. The current study involved applying one set of dependent and two sets of independent variables to test the proposed hypotheses derived from the research questions. Singleton and Straits also noted that due to the flawed correlation between concepts and their associated indicators, researchers often decide to use more than one indicators defining measurement of the specific concept. Project success was the dependent variable operationalized in terms of the project success factors. Table 1 contains the indicators that reasonably represent the project success factors.

Table 1

Project Critical Success Factors

Critical success factors	Indicators
Operational	On-time completion (Y_1)
Product / service quality	To specification (Y_2)
Financial	Within -budget (Y_3)
Stakeholders' satisfaction	Customer satisfaction (Y_4)

The critical factors of TQM utilizing a set of indicators with known operational definitions found in the literature (Grandzol & Gershon, 1998; Sila & Ebrahimpur, 2002) were the first set of independent variables and are presented in Table 2. The indicators listed in Table 2 were retrieved from 25 TQM factors extracted by Sila and Ebrahimpur (2002) from their literature review of articles focusing on the TQM survey-based research conducted between 1989 and 2000. The 25 factors were ranked by the researchers based on the frequency of their mention in the articles reviewed. The greater the coverage (i.e., the higher the number of times the specific factor was mentioned), the higher the score given by Sila and Ebrahimpur. The higher score indicated the importance assigned to the specific factor. The factors with lower coverage scores and not used in this study could form the basis of future research.

The eight quality management principles on which the ISO 10006:2003 Standard is based (customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision making, and mutually beneficial supplier relationships) were the second set of independent variables and included the group of indicators presented in Table 3. The selected indicators, although not explicitly identified in the literature reviewed, were extracted from the general guidelines included in the ISO 10006:2003 Standard (ISO, 2003).

Table 2

Critical Factors of Total Quality Management

Critical factor	Indicators
Leadership (X_1)	Top management commitment (TMC– X_{1a}), Strategic planning (SP– X_{1b})
Continuous improvement (X_2)	Continuous improvement and innovation (CII– X_{2a})
Internal/external cooperation (X_3)	Teamwork (TW– X_{3a}), Communication (C– X_{3b})
Customer focus (X_4)	Customer focus and satisfaction (CFS– X_{4a})
Learning company (X_5)	Training (T– X_{5a})
Employee fulfillment (X_6)	Employee involvement(EI– X_{6a}), Employee satisfaction (ES– X_{6b})
Process management (X_7)	Quality information and performance (QI/PFM– X_{7a}), Process control (PC– X_{7b}), Product and service design (PSD– X_{7c})

Table 3

Eight Quality Management Principles of the ISO 10006:2003 Standard

Quality management principles	Indicators
Customer focus (X_8)	Increased customer satisfaction (ICS – X_{8a}), improved customer loyalty (ICL– X_{8b})
Leadership (X_9)	Establishing purpose for the organization (EP– X_{9a}), establishing direction for the organization (ED– X_{9b}), setting vision for the organization (SV– X_{9c}), setting objectives for the organization (SO– X_{9d})
Involvement of people (X_{10})	Employee motivation and commitment (EMC– X_{10a}), employee participation in and contribution to continual improvement (EPC– X_{10b})
Process approach (X_{11})	Consistent and predictable results (CPR– X_{11a}), lower operation costs through effective use of resources (LOC– X_{11b}), shorter cycle times through effective use of resources (SCT– X_{11c})
System approach to management (X_{12})	Integration and alignment of the processes (IAP– X_{12a}), ability to focus effort on the key processes (ATF– X_{12b})
Continual improvement (X_{13})	Improved capabilities (IC– X_{13a}), alignment of improvement activities (AIA– X_{13b}), quick response to opportunities (QRO– X_{13c})
Factual approach to decision making (X_{14})	Informed decisions (ID– X_{14a})
Mutually beneficial supplier relationships (X_{15})	Increased value for both parties (IV– X_{15a}), flexibility and speed of joint responses to changing market or customer needs and expectations (F– X_{15b}), and optimization of costs and resources (OCR– X_{15c})

In terms of measurement, which is the assignment of numbers or labels to a concept or categories of concepts, Singleton and Straits (2005) noted that while numbers in the physical sciences measure time, speed, or mass, interpretation of numerical results from different categories in social research is not always clear-cut and simple. Although there are various ways to measure the four indicators associated with project critical success factors as listed in Table 1, for the purpose of the current study, the Likert-type scale as outlined in the Appendices A and B was utilized to measure survey participants' aggregated responses in terms of their perception of the significant differences among the seven TQM critical factors and the eight quality management principles of the ISO 10006:2003 Standard for the four indicators associated with the project critical success factors listed in Table 1.

Data Collection and Analysis

Data Collection

The self-administered electronic survey instrument that included a series of closed-ended questions as well as several demographic-related questions listed in Appendices A and B utilized an ordinal response scale, namely the 5-point Likert-type scale technique, to collect survey data. To design and conduct the electronic survey, the study included the use of the online survey service Survey Monkey. Through its various design, collection, and analysis features, the Survey Monkey tool provided the necessary means to construct a survey instrument that met the needs of the study. The validation of survey responses feature of the tool allowed the establishment of a criterion requiring each respondent to answer every question except selected demographic questions. Through its Weblink feature, the tool enable the communication chairpersons of the ASQ

sections and the vice presidents of communications of the PMI chapters participating in the study to send out a link to the survey instrument via e-mail or post the link on their respective websites. The option of viewing the survey results immediately after data collection, generating a public link to the survey results, and downloading the survey results in their raw format for statistical analysis were critical features of the tool utilized in the research. Tables 4 and 5 identify the independent and dependent variables, the survey questions applied and the type of data collected for the critical factors of TQM and the eight quality management principles of the ISO 10006:2003 Standard, respectively.

Data Analysis

Singleton and Straits (2005) noted the choice made by the researcher in determining which techniques for analyzing data to use will depend on whether the purpose of the survey is descriptive, explanatory or is a combination of both. Earlier sections of this chapter indicated that the study utilized a quantitative comparative research methodology using a self-administered Likert-type scale in an electronic survey to address the two research questions and the related hypotheses. According to Simon (2006), while data provided through a Likert-type scale is ordinal in nature, the Likert scale can often be used in conjunction with interval procedures as long as each scale has a minimum of five categories, although seven categories per scale is preferable. The justification for using MANOVA tests that assume interval data in the study was based on a review of the literature on this topic, in which Jaccard and Wan (1996) found that "for many statistical tests, rather severe departures (from intervalness) do not seem to

affect Type I and Type II errors dramatically when scales of five or seven categories are used" (p. 4).

Table 4

Description of Data Collection Plan: Critical Factors of Total Quality Management

Dependent variable	Independent variables [a]	Survey question(s)	Type of data
Y_1, Y_2, Y_3, Y_4	X_1, X_{1a}, X_{1b}	Section V, Part A	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_2, X_{2a}	Section V, Part B	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_3, X_{3a}, X_{3b}	Section V, Part C	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_4, X_{4a}	Section V, Part D	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_5, X_{5a}	Section V, Part E	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_6, X_{6a}, X_{6b}	Section V, Part F	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_7, X_{7a}, X_{7b}, X_{7c}	Section V, Part G	Likert-type scale

[a] Independent variables include secondary factors for each of the TQM critical factors.

Table 5

Description of Data Collection Plan: Eight Quality Management Principles of the ISO 10006:2003 Standard

Dependent variables	Independent variables [a]	Survey question(s)	Type of data
Y_1, Y_2, Y_3, Y_4	X_8, X_{8a}, X_{8b}	Section VI, Part A	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_9, X_{9a}, X_{9b}, X_{9c}, X_{9d}	Section VI, Part B	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_{10}, X_{10a}, X_{10b}	Section VI, Part C	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_{11}, X_{11a}, X_{11b}, X_{11c}	Section VI, Part D	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_{12}, X_{12a}, X_{12b}	Section VI, Part E	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_{13}, X_{13a}, X_{13b}, X_{13c}	Section VI, Part F	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_{14}, X_{14a}	Section VI, Part G	Likert-type scale
Y_1, Y_2, Y_3, Y_4	X_{15}, X_{15a}, X_{15b}, X_{15c}	Section VI, Part H	Likert-type scale

[a] Independent variables include secondary factors for each of the eight quality management principles of the ISO 10006:2003 Standard.

Data were initially tabulated using standard summary statistics (means, standard deviations, frequencies, and percentages). As a general data analysis approach, bivariate comparisons of the ratings with the demographic variables were performed using either Pearson product–moment correlations or MANOVA tests. The MANOVA models were developed to test the hypotheses (see Table 6). The survey items are included in Sections IV, VI and VI of Appendices A and B. Subsequent Bonferroni post hoc tests helped to examine the within-subject differences for the ratings. The alpha level for the study was set at $\alpha = .05$. However, due to the exploratory nature of the study, findings significant at the $\alpha = .10$ level were noted to suggest avenues for future research.

Ethical Considerations

The researcher conducted the study in an ethical, moral, and responsible manner as stipulated in the requirements set by the Walden University's Institutional Review Board. Creswell (2009) stated that ethics extend far beyond the simple practice of abiding by a fixed set of guidelines such as those proposed by professional organization. The researcher did not face any ethical issues during the study that were not addressed in the requirements set by Walden University's Institutional Review Board (IRB) outlined in their approval letter dated 10-27-09 with approval # 10-127-09-0334036, found in Appendix E.

Table 6

Description of Data Analysis Plan

Alternative hypothesis	Survey items[a]	Analysis technique
1. Significant differences exist among the seven TQM critical factors for the on-time-completion project success rating.	12a, 13a, 14a,…, 23a	MANOVA
2. Significant differences exist among the seven TQM critical factors for the within-budget project success rating.	12b, 13b, 14b,…, 23b	MANOVA
3. Significant differences exist among the seven TQM critical factors for the to-specification project success rating.	12c, 13c, 14c,…, 23c	MANOVA
4. Significant differences exist among the seven TQM critical factors for the stakeholder-satisfaction project success rating.	12d, 13d, 14d,…, 23d	MANOVA
5. Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the on-time-completion project success rating.	24a, 25a, 26a,…,43a	MANOVA
6. Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the within-budget project success rating.	24b, 25b, 26b,…,43b	MANOVA
7. Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the to-specification project success rating.	24c, 25c, 26c,…,43c	MANOVA
8. Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the stakeholder-satisfaction project success rating.	24d, 25d, 26d,…,43d	MANOVA

[a] For some of the TQM critical factors and the eight quality management principles of the ISO 10006:2003 Standard, multiple survey items were aggregated to create the relevant factor or the principle. See Table 2 and Table 3.

It is of paramount importance that a researcher anticipates, considers, and actively addresses ethical and moral issues throughout an entire study from the time that the research problem and questions are identified until the results of the study are disseminated. The survey cover letter included statements clearly describing the questions the study addressed and the purpose of the study to the respondents to prevent

any misconceptions. Creswell (2009) described deception as a situation in which the respondents understand the purpose of study in a specific manner, but in reality the researcher's purpose is completely different. Creswell also suggested that researchers should inform the respondents of the sponsoring institution. One method to guard against marginalizing and disempowering the study participants is that the "proposal developers can conduct pilot projects to establish trust and respect with the participants so the inquirers can detect any marginalization before the proposal is developed and the study begun" (Creswell, 2009, p. 88). The cover letter accompanying the survey included statements assuring the respondents that their personal data would remain anonymous and confidential and that their responses would be combined with those of other participants for data analysis purposes only. Only the researcher and Walden University had access to the data provided by the respondents. The survey cover letter also conveyed the benefits of the study to the participants and their organizations and advised that the survey would take only several minutes of their time to complete. As a token of appreciation, respondents were informed that after completing the survey, they would receive a copy of the PowerPoint presentation by M. Stanleigh titled *ISO 10006—Guidelines for Quality Management in Projects: Implications on Project Management and Quality Management Processes*. Because of logistical issues with linking an attachment to the survey, respondents could not download this presentation when they completed the survey. Instead, a link to the presentation will be placed on each organization's website so that participants may access it. At the end of the research period, a link will be placed on the organizations' websites to enable participants to view the results of the study.

Implications for Social Change

Implications for social change that arose from the study included both theoretical and empirical impacts. From the theoretical perspective, results of the study provided additional insight on TQM's critical factors and new discussions of the ISO 10006:2003 Standard and their positive impact on project success to individuals interested in gaining additional knowledge within the field of PM. "As with other professions such as law, medicine, and accounting, the body of knowledge rests with the practitioners and academics who apply and advance it" (PMI, 2004, p. 3). Results of the study add to the constantly evolving PM body of knowledge. From an empirical point of view, organizational leaders might be able to use the results of the study to meet and exceed customer expectations by increasing project success in terms of on-time completion, meeting budgetary constraints, and meeting or exceeding product and service quality requirements while improving employee morale.

Usefulness to the Field

Organizational leaders involved with projects that have implemented TQM but do not realize its full potential might be able to use the results of the study to improve the interaction between various PM processes throughout a project's life cycle. Results of the study could provide encouragement to management in organizations who perceive TQM as another fad to reconsider the position and show support by investing in the resources required for effective TQM implementation with the goal of improving business performance in general and project success in particular. The results of the study provided empirical evidence that TQM is one of the tools that, when effectively implemented and integrated with PM practices, can fulfill this goal. The results of the

study might increase the level of knowledge in organizations involved in PM processes on the benefits that the ISO 10006:2003 Standard can bring to PM practices, resulting in improvements in project success. From a research perspective, the study could further stimulate interest in the future of PM research.

Summary

Chapter 3 included an overview of the research design framework supported by common philosophical worldviews, strategies of inquiry, and research methods. A discussion on the rationale for selecting the constructivist worldview, a quantitative comparative method of inquiry, and a Likert-type scale self-administered Web-based survey as the method for data collection followed. The chapter also included a discussion of the population and of the selection of purposive sampling technique for the study. Furthermore, the chapter included a discussion on the importance of the concepts of reliability and validity in research and techniques that helped to improve the reliability and validity of the survey instrument and the data collection process, including conducting a field test and pilot study. Chapter 4 contains the findings of the study, focusing on their relation to the research questions and a test of the related hypotheses. Chapter 5 presents the analysis and the interpretation of the results, practical and social change implications of the study, and recommendations for future research.

Chapter 4: Data Analysis

The purpose of this study was to gain further knowledge of the perceived value of TQM on project success and to identify potential reasons for the limited use of the ISO 10006:2003 Standard in improving project success. Project success was identified in terms of the following four critical factors: product/service quality, operational, financial, and stakeholders' satisfaction with the following four respective indicators: to specification, on-time completion, within budget, and customer satisfaction.

The data obtained in the quantitative comparative study addressed the following research questions through the use of a survey of individuals involved in PM utilized in testing the eight hypotheses listed below:

1. What differences exist in project success based on TQM critical factors?

2. What differences exist in project success based on the use of guidelines within the ISO 10006:2003 Standard?

$H1_0$: No significant differences exist among the seven TQM critical factors for the on-time-completion project success rating.

$H1_A$: Significant differences exist among the seven TQM critical factors for the on-time-completion project success rating.

$H2_0$: No significant differences exist among the seven TQM critical factors for the within-budget project success rating.

$H2_A$: Significant differences exist among the seven TQM critical factors for the within-budget project success rating.

$H3_0$: No significant differences exist among the seven TQM critical factors for the to-specification project success rating.

$H3_A$: Significant differences exist among the seven TQM critical factors for the to-specification project success rating.

$H4_0$: No significant differences exist among the seven TQM critical factors for the customer satisfaction project success rating.

$H4_A$: Significant differences exist among the seven TQM critical factors for the customer satisfaction project success rating.

$H5_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the on-time-completion project success rating.

$H5_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the on-time-completion project success rating.

$H6_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the within-budget project success rating.

$H6_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the within-budget project success rating.

$H7_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the to-specification project success rating.

$H7_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the to-specification project success rating.

$H8_0$: No significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the customer satisfaction project success rating.

$H8_A$: Significant differences exist among the eight quality management principles of the ISO 10006:2003 Standard for the customer satisfaction project success rating.

To test the hypotheses, the quantitative comparative study involved a purposive sampling using a Likert-type scale survey-based approach to receive responses from participants who are members of the PMI and ASQ in the two largest cities in Texas. The remaining sections of this chapter provide a detailed description of the development of the survey instrument and the results of the pilot phase and Stage 2 of the study. The chapter also includes an analysis, discussion, and summary of the survey findings and their implication on the research questions and the proposed hypotheses.

Development of Likert-type Scale Survey Instrument

The researcher developed a Likert-type survey instruments for the purpose of field testing. Feedback was solicited from 15 professionals familiar with the topics covered and the purpose of the study. The field testing was conducted prior to beginning the pilot study to determine whether or not issues involving wording of the survey, order of the questions, or format of the survey existed.

The individuals who participated in the field testing were chosen because they were easily accessible to the researcher and available in the event there was a need for follow-up contact. The participants were asked to review the survey and offer any suggestions for change or improvement. As a result of their feedback, the survey

instrument was changed to include more positions and industries and additional response options. Duplicate criteria were eliminated.

Data Collection for the Pilot Phase of the Study

Robson (2002) noted that pilot studies should be conducted in all fixed design research, with the pilot study being a less expansive version of the complete research study. The reason behind the pilot study is to allow the researcher the opportunity to work through any technical issues that could arise in the process of data collection and resolve them. Singleton and Straits (2005) explained that experience shows the more effort expended in the field-testing stage of research, the easier data analysis becomes at the end of the research study and a higher quality result is achieved. The pilot phase allowed testing of the reliability of the survey instrument developed for the study and quantitatively tested for all indicators identified for the eight quality management principles of the ISO 10006:2003 Standard and the seven critical factors of TQM.

Preparation for conducting the pilot study began with approaching the leadership of ABS Group, ABS Consulting, and ASQ Houston Section 1405 for permission to solicit the participation of their respective memberships. The leaders of each organization agreed and their letters of agreement are included in Appendix A. After receiving permission from ABS Group and ABS Consulting, a letter of invitation found in Appendix D was sent via e-mail to selected employees involved on a regular basis in PM. The letter included a link to the pilot survey. The researcher attended several monthly meetings of ASQ Houston Section 1405 and handed out a notification of the opportunity to participate in the research study. Those who responded were then sent a

letter of invitation to participate and upon agreeing to participate received from the researcher a link to access the pilot study survey. Fifty-one individuals participated in the survey.

Pilot Study Demographic Data

The survey for the pilot study included a set of 11 demographic questions to get an idea of the demographic characteristics of the participants. Table 7 provides detailed information on the collected data. More than of 66% of the respondents had worked in their respective industry more than 10 years. More than 31% of respondents were consultants. This result was expected, because one of the three organizations whose employees participated in the pilot study is a consulting organization. About 30% of the respondents were project managers, more than 92% had been involved in more than two projects, and 80.4% of respondents were from Houston. Forty-two (82.4%) of the respondents were male and 9 (17.6%) were female.

Table 7

*Frequency Counts for Selected Variables (*N = *51)*

Variable and category	*N*	%
Years of employment		
Less than 1 year	0	0.0
1 to 5 years	11	21.6
6 to 10 years	6	11.8
More than 10 years	34	66.7
Type of industry		
Consulting	16	31.4
Education	1	2.0
Information technology	1	2.0
Manufacturing	9	17.6
Oil and gas	15	29.4
Other	9	17.6

(*table continues*)

Variable and category	*N*	%
Current position		
Engineer	10	19.6
Manufacturing engineer	4	7.8
Project manager	15	29.4
Project sponsor	1	2.0
Project team member	1	2.0
Quality engineer	5	9.8
Quality manager	8	15.7
Quality technician	1	2.0
Other	6	11.8
Number of projects		
One	4	7.8
Two or more	47	92.2
Location		
Houston	41	80.4
Other	10	19.6
Gender		
Male	42	82.4
Female	9	17.6
Familiarity with TQM		
No	4	7.8
Somewhat	20	39.2
Yes	27	52.9
Has TQM been successfully implemented in organization?		
No	16	31.4
Somewhat	28	54.9
Yes	7	13.7
Familiarity with the ISO 10006 Standard		
No	32	62.7
Somewhat	14	27.5
Yes	5	9.8
Organization used ISO guidelines to improve project success		
No	34	66.7
Somewhat	15	29.4
Yes	2	3.9
Have the ISO guidelines helped improve project success		
No	35	68.6
Somewhat	15	29.4
Yes	1	2.0

In addition, 52.9 and 39.2% of the survey respondents indicated being familiar or somewhat familiar with TQM, respectively. In response to the question of whether TQM had been successfully implemented in their organization, 31.4, 54.9, and 13.7% of the respondents selected the *no*, *somewhat*, and *yes* choices, respectively. Only 9.8% of respondent were familiar with the ISO 10006:2003 Standard and 27.5% were somewhat familiar with the standard. The remaining 62.7% of the respondents were not familiar with the ISO 10006:2003 Standard.

Regarding the question of whether their organization had used ISO guidelines to improve project success, 34 (66.7%) of the respondents said *no*, 15 (29.4%) stated *somewhat*, and only 2 (3.9%) said *yes*. And finally, in response to the question regarding whether the ISO guidelines helped improve project success, almost the same rate of responses as in the previous question was received. The response to the last two questions confirmed the researcher's perception of the lack of widespread familiarity with the standard by individuals involved in the field of quality management and PM and the limited use of the eight quality management principles that make up the guidelines within the ISO 10006:2003 in their respective organization.

Pilot Study Data Analysis

Table 8 displays the psychometric characteristics for the eight summated scale scores for the pilot study. The top four rows of Table 8 show the results for the 12 TQM related survey items for each of the four project success criteria. The bottom four rows of Table 8 show the results for the 20 ISO 10006:2003 related items listed on the survey for the same four project success criteria. According to Simon (2006),

> The most common measure of internal reliability or consistency is Cronbach's alpha which ranges from 0 to 1.0. Scores toward the higher end of this range (above 0.70) suggest that the items in the index are measuring the same thing. (p. 77)

The Cronbach alpha reliability coefficients ranged in size from $r = .81$ to $r = .92$ with a median-sized coefficient of $r = .89$. These results indicated that all scales had acceptable levels of internal reliability.

Table 8

*Psychometric Characteristics for Summated Scale Scores (*N = *45)*

Scale	Number of items	*M*	*SD*	Low	High	Alpha
TQM on time	12	4.23	0.42	3.25	5.00	.81
TQM within specification	12	4.25	0.45	3.25	5.00	.84
TQM within budget	12	3.99	0.52	2.92	5.00	.87
TQM Customer satisfaction	12	4.21	0.41	3.25	5.00	.80
ISO 10006 on time	20	4.13	0.46	3.25	5.00	.92
ISO 10006 within specification	20	4.06	0.44	3.25	5.00	.91
ISO 10006 within budget	20	4.06	0.47	3.15	5.00	.92
ISO 10006 customer satisfaction	20	4.13	0.45	3.30	4.90	.91

Note. Ratings given using a 5-point metric: 1 = *strongly disagree* to 5 = *strongly agree*.

Stage 2 Demographic Data

The first 11 questions listed in Stage 2 of the survey were designed after reviewing the data from the pilot study to get clearer and more useful information on the demographic characteristics of the 106 participants who completed the survey. Table 9 includes detailed information on the composed data. A total of 66 (62.3%) were employed in their respective industry more than 10 years. Almost 40% of the respondents were from the oil and gas sector and 30.2% were from the manufacturing

sector. This result was expected because 94 (88.7%) of respondents were from Houston, where oil and gas is one of the major industry sectors. Of the 106 respondents, 38 were quality managers and 18 were quality engineers. Only 16 (15.1%) of the respondents selected the project manager position. Because 105 (99.1%) of the 106 respondents had been involved in two or more projects in the 5 years prior to completing the survey, these demographic data did not pose any problem in terms of the survey coverage and the study's first assumption that participants in the survey are or have been employed by organizations involved with PM processes. Eighty respondents were male and 26 were female.

The last five of the 11 demographic questions in the Stage 2 study were substantially different from the corresponding questions in the pilot study. The revised questions were more focused on getting information on the positive impact of TQM and ISO 10006:2003 Standard when the initiatives had been implemented. In response to the question of implementation of TQM critical factors in respondents' organizations in the past 5 years, 73 stated *yes* and 31 stated *somewhat*, for a total of more than 98%. Furthermore, 49% of the respondents believed that more than 50% of projects had successfully incorporated one or more of the seven TQM critical factors, and 51% believed that less than 50% of projects had successfully incorporated one or more of the seven TQM critical factors. These results pointed to the widespread use of the TQM critical factors in organizations but with less clarity on the positive impact of the TQM critical factors on project-management-related activities in general and on project success in particular.

The last three demographic questions related to the ISO 10006:2003 Standard. Only 12 (11.3%) of the respondents were familiar with the ISO 10006:2003 Standard, compared to 55 (51.9%) and 39 (36.8%) who said *somewhat* or *no*, respectively. In response to the question of the percentage of projects for which the ISO 10006:2003 quality management principles were utilized, of the 77 participants who had said *yes* or *somewhat* to Question 9 and elected to respond to this question, seven had said none, 14 said less than 25%, 21 said between 25 and 50%, 14 chose the 50 to 75% range, and 21 respondents selected the 75% and higher level. Finally, of the 75 participants who said yes or somewhat to Question 9 and elected to respond to the question of whether the ISO 10006:2003 Quality Management Principles helped to improve success, 9 said *no*, 24 said *somewhat*, and 42 (39.6%) said *yes*.

The response to the last three questions again confirmed the researcher's perception of limited familiarity with the standard by individuals involved in the field of quality management and PM. However, 56 (52.8%) of the 77 respondents believed that one or more of the eight ISO 10006:2003 quality management principles had been utilized in the projects in which they are or have been involved and 66 (62.2%) of the 75 respondents believed that the principles had a positive impact on project success. The information retrieved from the last three questions on the Stage 2 survey could be construed as an indication that regardless of under what name the eight quality management principles are introduced, they are perceived to have a positive impact on project success.

Table 9

*Frequency Counts for Selected Variables (*N = *106)*

Variable and category	*n*	%
Years employed in the industry		
Less than 1 year	2	1.9
1 to 5 years	24	22.6
6 to 10 years	14	13.2
More than 10 years	66	62.3
Type of industry		
Construction	2	1.9
Consulting	10	9.4
Education	1	0.9
Information technology	3	2.8
Manufacturing	32	30.2
Pharmaceutical	2	1.9
Oil and gas	42	39.6
Other	14	13.2
Current position		
Engineer	3	2.8
Manufacturing engineer	4	3.8
Project manager	16	15.1
Project sponsor	1	0.9
Quality engineer	18	17.0
Quality manager	38	35.8
Quality technician	3	2.8
Other	23	21.7
Number of projects in last 5 years		
One	1	0.9
Two or more	105	99.1
Location		
Houston	94	88.7
Dallas	1	0.9
Other	11	19.6
Gender		
Male	80	75.5
Female	26	24.5
TQM critical factors utilized in past 5 years		
No	2	1.9
Somewhat	31	29.2
Yes	73	68.9

(*table continues*)

Variable and category	*n*	%
Percentage of projects where the TQM critical factors implemented successfully		
None	0	0.0
Less than 25%	25	23.6
Between 25 and 50%	29	27.4
Between 50 and 75%	28	26.4
More than 75%	24	22.6
Familiar with ISO 10006:2003 Standard		
No	39	36.8
Somewhat	55	51.9
Yes	12	11.3
Percentage of projects where the ISO 10006:2003 quality management principles had been utilized		
None	7	6.6
Less than 25%	14	13.2
Between 25 and 50%	21	19.8
Between 50 and 75%	14	13.2
More than 75%	21	19.8
No response	29	27.4
Have the ISO 10006:2003 quality management principles helped?		
No	9	8.5
Somewhat	24	22.6
Yes	42	39.6
No response	31	29.2

Data Collection for Stage 2 of the Study

As stated earlier in this section, for the pilot study, data from 51 respondents were gathered. During this process, input was solicited from respondents and changes were incorporated into the Stage 2 survey (see Appendix B). Cronbach alpha reliability coefficients were computed and all scales yielded acceptable levels of internal reliability. In addition, through a preliminary analysis of the pilot data, all eight of the hypotheses of the study were tested using MANOVA, and all eight null hypothesis were rejected and the data supported the alternative hypothesis at the $p < .05$ level.

For Stage 2, an additional 106 acceptable surveys were collected after considerable effort spanning 2 months. Data collection for Stage 2 of the study began with formal requests sent to the leadership of the ASQ sections in Houston and Dallas and the PMI chapters in Houston and Dallas requesting access to their memberships to ask for their participation in the survey. Letters of consent, located in Appendix C, were received from the organizations' presidents. Each organization inserted a notice of the opportunity to participate in the survey in their online newsletters and on their websites. The notice contained a link to the formal letter of invitation to participate, a copy of which can be found in Appendix D. In addition, the ASQ Houston section notified its membership of the opportunity to participate via global e-mail. Due to the limited number of respondents from these recruitment efforts, two reminder e-mails were sent after the original e-mail. The ASQ Dallas section and the PMI chapters in Houston and Dallas declined to send a global e-mail inviting their members to participate.

Upon completing the letter of consent, potential participants clicked on a link to the survey instrument. Completed surveys were electronically sent to SurveyMonkey and deposited into one of four receptacles, one for each of the participating organizations. This procedure enabled the researcher to determine how many respondents from each organization participated. There were 117 responses, of which 106 were completed surveys. The majority of the respondents were members of the ASQ Houston section.

A decision was made to consider merging the two datasets together (pilot study data and Stage 2 data) into one file to increase the overall sample to $N = 157$. This decision would only be considered acceptable if few or none of the 60 opinion scales

showed significant differences between the two datasets. Using an alpha level of $\alpha = .05$, for 60 *t* tests, the possibility of Type I errors would expect three of the 60 tests to be significant simply by chance events alone (Aczel & Sounderpandian, 2006). Given that only one of 60 tests was significantly different, the decision was made to consider the opinions of the two datasets (Pilot and Stage 2) to be similar enough to merge the two datasets together into one dataset of $N = 157$.

Stage 2 Data Analysis

Research Hypothesis 1

Research Hypothesis 1 predicted significant differences exist among the seven TQM critical factors for the on-time-completion project success rating. To address this hypothesis, Table 10 displays the results of the MANOVA test and accompanying repeated measures analysis of variance (ANOVA) test. Inspection of Table 10 shows both the overall MANOVA test ($p = .001$) and the repeated measures ANOVA test ($p = .001$) to be statistically different between the seven ratings. The highest mean ratings were for Rating 3, Internal/External Cooperation ($M = 4.59$) and Rating 1, Leadership ($M = 4.43$).

Bonferroni post hoc tests showed Rating 3, internal/external cooperation ($M = 4.59$), to be significantly higher than five of the other ratings at the $p = .001$ level and higher than Rating 1, leadership, at the $p = .01$ level. In addition, Rating 1, leadership ($M = 4.43$), was significantly higher than four of the other ratings at the $p = .001$ level and higher than Rating 6, employee fulfillment at the $p = .002$. Rating 6, employee fulfillment ($M = 4.20$), was also significantly higher than Rating 4, customer focus ($p =$

.004); Rating 2, continuous improvement (p = .02); and Rating 7, process management (p = .05). No other pair of ratings was significantly different from each other at the p = .05 level (see Table 10).

Table 10

*TQM Critical Factors for On-Time-Completion Project Success Ratings (*N = *157)*

Rating	*M*	*SD*
1. Leadership	4.43	0.68
2. Continuous improvement	3.93	0.97
3. Internal/external cooperation	4.59	0.63
4. Customer focus	3.96	0.97
5. Learning company	4.08	0.95
6. Employee fulfillment	4.20	0.77
7. Process management	4.02	0.77

Note. MANOVA results: F (6, 151) = 22.71, p = .001. Repeated measures ANOVA results: F (6, 936) = 27.77, p = .001. Bonferroni post hoc tests: 3 > 2, 4, 5, 6, 7 (p = .001); 3 > 1 (p = .01); 1 > 2, 4, 5, 7 (p = .001); 1 > 6 (p = .002); 6 > 4 (p = .007); 6 > 2 (p = .02); 6 > 7 (p = .05); no other pair of ratings was significantly different from each other at the p = .05 level.

Research Hypothesis 2

Research Hypothesis 2 predicted that significant differences exist among the seven TQM critical factors for the within-budget project success rating. To address this hypothesis, Table 11 displays the results of the MANOVA test and accompanying repeated measures ANOVA test. Inspection of Table 11 showed both the overall MANOVA test (p = .001) and the repeated measures ANOVA test (p = .001) to be statistically different between the seven ratings. The highest mean ratings were for Rating 3, internal/external cooperation (M = 4.22), and Rating 1, leadership (M = 4.13).

Table 11

*TQM Critical Factors for Within-Budget Project Success Ratings (*N *= 157)*

Rating	*M*	*SD*
1. Leadership	4.13	0.80
2. Continuous improvement	3.75	1.02
3. Internal/external cooperation	4.22	0.76
4. Customer focus	3.66	1.00
5. Learning company	3.78	0.97
6. Employee fulfillment	3.89	0.81
7. Process management	3.90	0.79

Note. MANOVA results: F (6, 151) = 17.12, p = .001. Repeated measures ANOVA results: F (6, 936) = 20.36, p = .001. Bonferroni post hoc tests: 3 > 2, 3, 4, 5, 6, 7 (p = .001); 1 > 2, 4, 5 (p = .001); 1 > 7 (p = .002); 1 > 6 (p = .003); no other pair of ratings was significantly different from each other at the p = .05 level.

Bonferroni post hoc tests showed Rating 3, internal/external cooperation (M = 4.22), to be significantly higher than all other ratings except Rating 1, leadership, at the p = .001 level. There was no significant difference between Rating 1, leadership, and Rating 3, internal/external cooperation. However, Rating 1, leadership (M = 4.13), was significantly higher than Rating 2, continuous improvement; Rating 4, customer focus; and Rating 5, learning company, at p = .001. In addition, Rating 1, leadership, was higher than Rating 7, process management, at the p = .002 level and higher than Rating 6, employee fulfillment, at the p = .003 level. No other pair of ratings was significantly different from each other at the p = .05 level (see Table 11).

Research Hypothesis 3

Research Hypothesis 2 predicted that significant differences exist among the seven TQM critical factors for the to-specification project success rating. To address this

hypothesis, Table 12 displays the results of the MANOVA test and accompanying repeated measures ANOVA test. Inspection of Table 12 showed both the overall MANOVA test (p = .001) and the repeated measures ANOVA test (p = .001) to be statistically different between the seven ratings. The highest mean ratings were for Rating 3, internal/external cooperation (M = 4.44); Rating 5, learning company (M = 4.32); and Rating 7, process management (M = 4.31).

Table 12

*TQM Critical Factors for To-Specification Project Success Ratings (*N = *157)*

Rating	*M*	*SD*
1. Leadership	4.17	0.79
2. Continuous improvement	4.10	0.93
3. Internal/external cooperation	4.44	0.70
4. Customer focus	4.27	0.87
5. Learning company	4.32	0.83
6. Employee fulfillment	4.15	0.76
7. Process management	4.31	0.73

Note. MANOVA results: F (6, 151) = 10.83, p = .001. Repeated measures ANOVA results: F (6, 936) = 7.35, p = .001. Bonferroni post hoc tests: 3 > 1, 2, 6 (p = .001); 7 > 2 (p = .02); no other pair of ratings was significantly different from each other at the p = .05 level.

Bonferroni post hoc tests showed Rating 3, internal/external cooperation (M = 4.44) to be significantly higher than three of the other ratings at the p = .001 level. In addition, Rating 7, process management (M = 4.31), was significantly higher than Rating 2, continuous improvement, at the p = .02 level. No other pair of ratings was significantly different from each other at the p = .05 level (see Table 12).

Research Hypothesis 4

Research Hypothesis 4 predicted that significant differences exist among the seven TQM critical factors for the customer satisfaction project success rating. To address this hypothesis, Table 13 displays the results of the MANOVA test and accompanying repeated measures ANOVA test. Inspection of Table 13 showed both the overall MANOVA test (p = .001) and the repeated measures ANOVA test (p = .001) to be statistically different between the seven ratings. The highest mean ratings were for Rating 4, customer focus (M = 4.59) and Rating 3, internal/external cooperation (M = 4.45).

Table 13

*TQM Critical Factors for Customer Satisfaction Project Success Ratings (*N = *157)*

Rating	*M*	*SD*
1. Leadership	4.16	0.81
2. Continuous Improvement	4.20	0.93
3. Internal/External Cooperation	4.45	0.72
4. Customer Focus	4.59	0.78
5. Learning Company	4.19	0.81
6. Employee Fulfillment	4.15	0.77
7. Process Management	4.17	0.71

Note. MANOVA results: F (6, 151) = 14.93, p = .001. Repeated measures ANOVA results: F (6, 936) = 17.18, p = .001. Bonferroni post hoc tests: 4 > 1, 2, 5, 6, 7 (p = .001); 3 > 1, 5, 6, 7 (p = .001); 3 > 2 (p = .002); no other pair of ratings was significantly different from each other at the p = .05 level.

Bonferroni post hoc tests showed Rating 4, customer focus (M = 4.59) to be significantly higher than all other ratings except Rating 3, internal/external cooperation, at the p = .001 level. In addition, Rating 3, internal/external cooperation (M = 4.45), was

significantly higher than Ratings 1, 5, 6, and 7 at the $p = .001$ level and higher than Rating 2, continuous improvement, at the $p = .002$ level. No other pair of ratings was significantly different from each other at the $p = .05$ level (see Table 13).

Research Hypothesis 5

Research Hypothesis 5 predicted that significant differences exist among the eight quality management principles of the ISO 10006:2003 for the on-time-completion project success rating. To address this hypothesis, Table 14 displays the results of the MANOVA test and accompanying repeated measures ANOVA test. Inspection of Table 14 showed both the overall MANOVA test ($p = .001$) and the repeated measures ANOVA test ($p = .001$) to be statistically different between the eight ratings. The highest mean ratings were for Rating 3, involvement of people ($M = 4.38$), and Rating 7, factual approach to decision making ($M = 4.37$).

Bonferroni post hoc tests found Rating 3, involvement of people ($M = 4.38$), to be significantly higher than five of the other ratings at the $p = .001$ level and higher than Rating 5, system approach to management at the $p = .02$ level. In addition, Rating 7, factual approach to decision making ($M = 4.37$), was significantly higher than five of the other ratings at the $p = .001$ level. Furthermore, Rating 5, system approach to management, was significantly higher than two other ratings at the $p = .001$ level and also higher than Rating 4, process approach ($p = .02$), and Rating 6, continual improvement ($p = .03$). Rating 1, customer focus ($M = 3.80$), was significantly lower than Rating 2, leadership ($p = .001$); Rating 6, continual improvement ($p = .003$); Rating 4, process approach ($p = .01$); and Rating 8, mutually beneficial supplier relationship ($p = .04$). No

other pair of ratings was significantly different from each other at the $p = .05$ level (see Table 14).

Table 14

ISO 10006:2003 Quality Principles for On-Time-Completion Project Success Ratings (N = 157)

Rating	*M*	*SD*
1. Customer focus	3.80	0.92
2. Leadership	4.07	0.74
3. Involvement of people	4.38	0.70
4. Process approach	4.04	0.71
5. System approach to management	4.20	0.74
6. Continual improvement	4.05	0.71
7. Factual approach to decision making	4.37	0.79
8. Mutually beneficial supplier relationship	4.01	0.78

Note. MANOVA results: F (7, 150) = 17.89, $p = .001$. Repeated measures ANOVA results: F (7, 1092) = 25.20, $p = .001$. Bonferroni post hoc tests: 3 > 1, 2, 4, 6, 8 ($p = .001$); 3 > 5 ($p = .02$); 7 > 1, 2, 4, 6, 8 ($p = .001$); 5 > 1, 8 ($p = .001$); 5 > 4 ($p = .02$); 5 > 6 ($p = .03$); 2 > 1 ($p = .001$); 6 > 1 ($p = .003$); 4 > 1 ($p = .01$); 8 > 1 ($p = .04$); no other pair of ratings was significantly different from each other at the $p = .05$ level.

Research Hypothesis 6

Research Hypothesis 6 predicted that significant differences exist among the eight quality management principles of the ISO 10006:2003 for the within-budget project success rating. To address this hypothesis, Table 15 displays the results of the MANOVA test and accompanying repeated measures ANOVA test. Inspection of Table 15 showed both the overall MANOVA test ($p = .001$) and the repeated measures ANOVA test ($p = .001$) to be statistically different between the eight ratings. The highest

mean ratings were for Rating 7, factual approach to decision making (M = 4.30), Rating 3, involvement of people (M = 4.15), and Rating 4, process approach (M = 4.12).

Table 15

*ISO 10006:2003 Quality Principles for Within-Budget Project Success Ratings (*N *= 157)*

Rating	*M*	*SD*
1. Customer focus	3.59	0.94
2. Leadership	3.96	0.76
3. Involvement of people	4.15	0.78
4. Process approach	4.12	0.71
5. System approach to management	4.01	0.78
6. Continual improvement	3.87	0.75
7. Factual approach to decision making	4.30	0.78
8. Mutually beneficial supplier relationship	4.02	0.78

Note. MANOVA results: F (7, 150) = 16.19, p = .001. Repeated measures ANOVA results: F (7, 1092) = 27.86, p = .001. Bonferroni post hoc tests: 7 > 1, 2, 5, 6, 8 (p = .001); 3 > 1, 6 (p = .001); 3 > 2 (p =.002); 4 > 1, 6 (p = .001); 4 > 2 (p = .02); 8 > 1 (p = .001); 8 > 6 (p = .02); 5 > 1 (p = .001); 5 > 6 (p = .03); 2 > 1 (p = .001); 6 > 1 (p = .002); no other pair of ratings were significantly different from each other at the p = .05 level.

Bonferroni post hoc tests showed Rating 7, factual approach to decision making (M = 4.30), to be significantly higher than five of the other ratings at the p = .001 level. In addition, Rating 3, involvement of people (M = 4.15) was significantly higher than Ratings 1 and 6 at the p = .001 level and the Rating 2, leadership, at the p = .002 level. Furthermore, Rating 4, process approach, was significantly higher than two other ratings at the p = .001 level and also higher than Rating 2, leadership, at the p = .02 level. Rating 6, continual improvement (M = 3.87), was significantly lower than Rating 5 (p = .03) and Rating 8 (p = .02). Rating 1, customer focus (M = 3.59), was significantly lower than

Rating 7, factual approach to decision making; Rating 3, involvement of people; and Rating 4, process approach (p = .001). No other pair of ratings was significantly different from each other at the p = .05 level (see Table 15).

Research Hypothesis 7

Research Hypothesis 7 predicted that significant differences exist among the eight quality management principles of the ISO 10006:2003 for the to-specification project success rating. To address this hypothesis, Table 16 displays the results of the MANOVA test and accompanying repeated measures ANOVA test. Inspection of Table 16 showed both the overall MANOVA test (p = .001) and the repeated measures ANOVA test (p = .001) to be statistically different between the eight ratings. The highest means were for Rating 7, factual approach to decision making (M = 4.41); Rating 3, involvement of people (M = 4.27); and Rating 5, system approach to management (M = 4.10).

Bonferroni post hoc tests showed Rating 7, factual approach to decision making (M = 4.41), to be significantly higher than six of the other ratings at the p = .001 level. In addition, Rating 3, involvement of people (M = 4.27) was significantly higher than Ratings 1, 2, 4, 6, and 8 at the p = .001 level and Rating 5, system approach to management, at the p = .007 level. Furthermore, Rating 5, system approach to management (M = 4.10) was significantly higher than Rating 4, process approach (p = .001); Rating 8, mutually beneficial supplier relationships (p =.004); and Rating 6, continual improvement (p = .04). No other pair of ratings was significantly different from each other at the p = .05 level (see Table 16).

Table 16

*ISO 10006:2003 Quality Principles for To-Specification Project Success Ratings (*N = *157)*

Rating	*M*	*SD*
1. Customer focus	3.95	0.89
2. Leadership	4.01	0.77
3. Involvement of people	4.27	0.75
4. Process approach	3.89	0.72
5. System approach to management	4.10	0.76
6. Continual improvement	3.96	0.74
7. Factual approach to decision making	4.41	0.73
8. Mutually beneficial supplier relationship	3.92	0.76

Note. MANOVA results: F (7, 150) = 21.54, p = .001. Repeated measures ANOVA results: F (7, 1092) = 24.91, p = .001. Bonferroni post hoc tests: 7 > 1, 2, 4, 5, 6, 8 (p =.001); 3 > 1, 2, 4, 6, 8 (p = .001); 3 > 5 (p = .007); 5 > 4 (p =.001); and 5 > 8 (p =.004); 5 > 6 (p = .04); no other pair of ratings was significantly different from each other at the p = .05 level.

Research Hypothesis 8

Research Hypothesis 8 predicted that significant differences exist among the eight quality management principles of the ISO 10006:2003 for the customer satisfaction project success rating. To address this hypothesis, Table 17 displays the results of the MANOVA test and accompanying repeated measures ANOVA test. Inspection of Table 17 showed both the overall MANOVA test (p = .001) and the repeated measures ANOVA test (p = .001) to be statistically different between the eight ratings. The highest mean ratings were for Rating 1, customer focus (M = 4.39); Rating 3, involvement of people (M = 4.34); and Rating 7, factual approach to decision making (M = 4.31).

Table 17

ISO 10006:2003 Quality Principles for Customer Satisfaction Project Success Ratings (N = 157)

Rating	*M*	*SD*
1. Customer focus	4.39	0.78
2. Leadership	4.05	0.76
3. Involvement of people	4.34	0.70
4. Process approach	3.93	0.73
5. System approach to management	4.00	0.76
6. Continual improvement	4.02	0.71
7. Factual approach to decision making	4.31	0.75
8. Mutually beneficial supplier relationship	4.04	0.70

Note. MANOVA results: F (7, 150) = 14.36, p = .001. Repeated measures ANOVA results: F (7, 1092) = 23.75, p = .001. Bonferroni post hoc tests: 1 > 2, 4, 5, 6, 8 (p = .001); 3 > 2, 4, 5, 6, 8 (p = .001); 7 > 2, 4, 5, 6, 8 (p =.001); no other pair of ratings was significantly different from each other at the p = .05 level.

Bonferroni post hoc tests found Rating 1, customer focus (M = 4.39); Rating 3, involvement of people (M = 4.34); and Rating 7, factual approach to decision making (M = 4.31) to be significantly higher than five of the other ratings at the p = .001 level. No other pair of ratings was significantly different from each other at the p = .05 level (see Table 17).

Table 18 displays the psychometric characteristics for the 60 scale scores used in the study. Sixteen scales were based on a single item, and the other 44 scales consisted of two or more items. For the 44 multiple-item scales, the Cronbach alpha reliability coefficients ranged in size from r = .65 to r = .93 with a median alpha coefficient of r = .82, which indicated that all scales had acceptable levels of internal reliability (Simon, 2006).

Table 18

*Psychometric Characteristics for Summated Scale Scores (*N = *157)*

Metric	Factor	Items	*M*	*SD*	Alpha [a]
On-time [b]	Leadership	2	4.43	0.68	.65
On-time [b]	Continuous improvement	1	3.93	0.97	n/a
On-time [b]	Internal/external cooperation	2	4.59	0.63	.83
On-time [b]	Customer focus	1	3.96	0.97	n/a
On-time [b]	Learning company	1	4.08	0.95	n/a
On-time [b]	Employee fulfillment	2	4.20	0.77	.85
On-time [b]	Process management	3	4.02	0.77	.80
Within specification [b]	Leadership	2	4.17	0.79	.69
Within specification [b]	Continuous improvement	1	4.10	0.93	n/a
Within specification [b]	Internal/external cooperation	2	4.44	0.70	.81
Within specification [b]	Customer focus	1	4.27	0.87	n/a
Within specification [b]	Learning company	1	4.32	0.83	n/a
Within specification [b]	Employee fulfillment	2	4.15	0.76	.76
Within specification [b]	Process management	3	4.31	0.73	.81
Within budget [b]	Continuous improvement	1	3.75	1.02	n/a
Within budget [b]	Internal/external cooperation	2	4.22	0.76	.77
Within budget [b]	Customer focus	1	3.66	1.00	n/a
Within budget [b]	Learning company	1	3.78	0.97	n/a
Within budget [b]	Employee fulfillment	2	3.89	0.81	.80
Within budget [b]	Process management	3	3.90	0.79	.80
Customer satisfaction [b]	Leadership	2	4.16	0.81	.72
Customer satisfaction [b]	Continuous improvement	1	4.20	0.93	n/a
Customer satisfaction [b]	Internal/external cooperation	2	4.45	0.72	.83
Customer satisfaction [b]	Customer focus	1	4.59	0.78	n/a
Customer satisfaction [b]	Learning company	1	4.19	0.81	n/a
Customer satisfaction [b]	Employee fulfillment	2	4.15	0.77	.77
Customer satisfaction [b]	Process management	3	4.17	0.71	.81
On-time [c]	Customer focus	2	3.80	0.92	.84
On-time [c]	Process approach	3	4.04	0.71	.76
On-time [c]	System approach to management	2	4.20	0.74	.78

(*table continues*)

Metric	Factor	Items	*M*	*SD*	Alpha [a]
On-time [c]	Continual improvement	3	4.05	0.71	.78
On-time [c]	Factual approach to decision	1	4.37	0.79	n/a

	making				
On-time [c]	Mutually beneficial supplier relationships	3	4.01	0.78	.78
Within specification [c]	Customer focus	2	3.95	0.89	.84
Within specification [c]	Leadership	4	4.01	0.77	.92
Within specification [c]	Involvement of people	2	4.27	0.75	.85
Within specification [c]	Process approach	3	3.89	0.72	.74
Within specification [c]	System approach to management	2	4.10	0.76	.82
Within specification [c]	Continual improvement	3	3.96	0.74	.83
Within specification [c]	Factual approach to decision making	1	4.41	0.73	n/a
Within specification [c]	Mutually beneficial supplier relationships	3	3.92	0.76	.82
Within budget [c]	Customer focus	2	3.59	0.94	.89
Within budget [c]	Leadership	4	3.96	0.76	.91
Within budget [c]	Involvement of people	2	4.15	0.78	.83
Within budget [c]	Process approach	3	4.12	0.71	.78
Within budget [c]	System approach to management	2	4.01	0.78	.83
Within budget [c]	Continual improvement	3	3.87	0.75	.82
Within budget [c]	Factual approach to decision making	1	4.30	0.78	n/a
Within budget [c]	Mutually beneficial supplier relationships	3	4.02	0.78	.83
Customer satisfaction [c]	Customer focus	2	4.39	0.78	.84
Customer satisfaction [c]	Leadership	4	4.05	0.76	.93
Customer satisfaction [c]	Involvement of people	2	4.34	0.70	.83
Customer satisfaction [c]	Process approach	3	3.93	0.73	.77
Customer satisfaction [c]	System approach to management	2	4.00	0.76	.80
Customer satisfaction [c]	Continual improvement	3	4.02	0.71	.83
Customer satisfaction [c]	Factual approach to decision making	1	4.31	0.75	n/a
Customer satisfaction [c]	Mutually beneficial supplier relationships	3	4.04	0.70	.79

Note. Ratings based on 5-point scale: 1 = *strongly disagree* to 5 = *strongly agree*.

[a] Cronbach alpha reliabilities were not calculated for scales with only one item. [b] This scale was based on the TQM questions. [c] This scale was based on the ISO questions.

Additional Findings

Table 19 displays the results of the MANOVA test and accompanying repeated measures ANOVA test used to compare the impact ratings on the four project outcomes for the most recent recession and job cuts. Inspection of Table 19 showed both the overall MANOVA test ($p = .001$) and the repeated measures ANOVA test ($p = .001$) to be statistically different between the seven ratings. The highest mean ratings were for Rating 3, recession—within budget ($M = 3.53$), and Rating 1, recession—on time ($M = 3.48$).

Table 19

*Impact on Project Outcomes Based on Most Recent Recession and Job Costs (*N = *157)*

Rating	*M*	*SD*
1. Recession—On time	3.48	1.13
2. Recession—Within specification	3.11	1.15
3. Recession—Within budget	3.53	1.15
4. Recession—Customer satisfaction	3.29	1.10
5. Job cuts—On time	3.44	1.27
6. Job cuts—Within specification	3.03	1.21
7. Job cuts—Within budget	3.22	1.23
8. Job cuts—Customer satisfaction	3.21	1.23

Note. MANOVA results: F (7, 150) = 9.71, $p = .001$. Repeated measures ANOVA results: F (7, 1092) = 10.57, $p = .001$. Bonferroni post hoc tests: 3 > 2, 6 ($p = .001$); 3 > 7 ($p = .003$); 3 > 8 ($p = .04$); 1 > 2, 6 ($p = .001$); 1 > 7, 8 ($p = .05$); 5 > 6 ($p = .001$); 5 > 2 ($p = .006$); 5 > 7, 8 ($p = .01$); 4 > 6 ($p = .01$); no other pair of ratings was significantly different from each other at the $p = .05$ level.

Bonferroni post hoc tests found Rating 3, recession—within budget ($M = 3.53$) to be significantly higher than Rating 2, recession—within specification, and Rating 6, job

costs—within specification, at the $p = .001$ level. In addition, Rating 3 was significantly higher than Rating 7, job costs—within budget ($p = .003$), and Rating 8, job costs—customer satisfaction ($p = .04$). Rating 1, recession—on time ($M = 3.48$), was significantly higher than Rating 2, recession—within specification, and Rating 6, job Costs—within specification, at the $p = .001$ level and Rating 7, job costs—within budget, and Rating 8, job costs—customer satisfaction, at the $p = .05$ level. Rating 5, job costs—on time ($M = 3.44$), was significantly higher than Rating 6, job costs—within specification ($p = .001$); Rating 2, recession—within specification ($p = .006$); Rating 7, job costs—within budget ($p = .01$); and Rating 8, job costs—customer satisfaction ($p = .01$). In addition, Rating 4, recession—customer satisfaction ($M = 3.29$), was significantly higher than Rating 6, job costs—within specification ($p = .01$). No other pair of ratings was significantly different from each other at the $p = .05$ level (see Table 19).

Pearson product–moment correlations were performed comparing the respondents' years of work experience and their gender (1 = male, 2 = female) with the 60 opinion scales. None of the 60 correlations relating the respondents' level of experience with the opinion scales were significant at the $p < .05$ level.

Three of the 60 correlations for the respondents' gender with the opinion scales were significant at the $p < .05$ level. Specifically, male respondents had more agreement with the ratings for (a) TQM customer focus within specification scale ($r = -.17$, $p = .03$), (b) ISO process approach within specification scale ($r = -.16$, $p = .04$), and (c) ISO process approach within budget ($r = -.17$, $p = .03$). Since only three of 120 correlations

were statistically significant, a decision was made to forego displaying these results in a table and simply report the findings in the narrative.

Summary of Results

This study aimed to analyze empirically the perception of individuals who are involved in PM regarding the impact of the seven TQM principles and the eight quality principles of the ISO 10006:2003 Standard on project success. The survey of 157 individuals knowledgeable about topics covered in the study revealed that significant differences exist among the seven TQM principles and the eight quality principles of the ISO 10006:2003 Standard as well on all four selected project success factors. The four factors were on-time completion, within budget, to specifications, and customer satisfaction.

Both the MANOVA and the repeated measures ANOVA tests at the $p = .001$ significance level showed statistical difference between the seven critical factors of TQM. The two tests found the same results for the eight quality management principles of the ISO 1006:2003 Standard. For the seven critical factors of TQM, the lowest and the highest mean of survey responses were 3.75 and 4.59, respectively. For the ISO 10006:2003, the lowest and the highest mean of survey responses were 3.59 and 4.41, respectively. The findings revealed that most respondents either strongly agreed or agreed that the seven critical factors of TQM and the eight quality management principles of the ISO 10006:2003 Standard have a positive impact on project success in terms of the four selected success factors.

The Seven Critical Factors of TQM

The Bonferroni post hoc tests showed that at the $p = .001$ significance level, the internal and external cooperation, one of the seven principles of TQM, was significantly higher than five other TQM principles in terms of its impact on the on-time completion factor of project success. For the same project success factor, internal and external cooperation was also found to be significantly higher than leadership at the $p = .01$ significance level. The Bonferroni post hoc tests revealed that leadership was significantly higher than four other TQM principles in terms of its impact on the on-time completion project success factor.

The Bonferroni post hoc tests showed that internal and external cooperation was significantly higher than all other TQM principles except for leadership in terms of its impact on the within-budget factor of project success. For the within-specification project success factor, the Bonferroni post hoc tests showed internal and external cooperation to be significantly higher than leadership, continuous improvement, and employee fulfillment. For the customer satisfaction project success factor, although the survey results showed the impact of customer focus to be significantly higher than other principles, Bonferroni post hoc tests showed internal and external cooperation to be significantly higher than leadership, learning company, employee fulfillment, and process management. The above discussion led to the following two conclusions: (a) cooperation among internal and external stakeholders of the originating and the project organizations is instrumental in achieving desired project success as defined by its fours factors and (b) focus on customer needs and expectations has a positive impact on customer satisfaction.

The Eight Quality Principles of ISO 1006:2003 Standard

The results of the Bonferroni post hoc tests of the survey responses revealed that involvement of people has a significantly higher positive impact on project success in terms of on-time completion than the customer focus, leadership, process approach, continual improvement, and mutually beneficial supplier relationship quality principles of the ISO 10006:2003 Standard. The Bonferroni post hoc tests also showed the same results when considering a factual approach to decision making and the on-time completion factor of project success. When the above results are viewed in unison, it can be concluded that in project-focused organizations that allow employee involvement in the decision-making process based on a factual approach, projects will experience higher on-time completion compared to organizations that focus on customer focus, leadership, process approach, continual improvement, and mutually beneficial supplier relationship.

Regarding the positive impact of the eight quality principles of the ISO 10006:2003 Standard on project success while considering the within-specification factor, almost identical results were found for the on-time project completion factor of project success as stated above. The single difference was that a factual approach to decision making also had a significantly higher positive impact on project success than a system approach to management. Again these results could indicate that involvement of people and taking a factual approach in decision making has greater positive impact on completing projects not only on time but also within specification.

When considering the positive impact of the eight quality management principles of the ISO 10006:2003 Standard on the success of projects in terms of remaining within

budget, the factual approach to decision making comes to the forefront compared to customer focus, leadership, system approach to management, continual improvement, and mutually beneficial supplier relationship principles of the standard. With respect to the within budget factor, the involvement of people is shown to have only a slightly higher positive impact than customer focus and continual improvement. The Bonferroni post hoc tests showed similar results as those achieved for the involvement of people quality management principle. These results point out that the factual approach to decision making and involvement of people, and a process approach to a lesser degree, could result in completing projects within the budgetary constraints.

The Bonferroni post hoc tests also showed that the customer focus quality management principle of the ISO 10006:2003 Standard had a significantly higher positive impact on project success than leadership, process approach, system approach to management, continual improvement, and mutually beneficial supplier relationship when customer satisfaction is being considered. The same results were found for involvement of people and a factual approach to decision-making principles. The results not only confirmed that involvement of people and a factual approach to decision making principles are essential in meeting project constraints expressed in project on-time completion, project specification, and the project budgetary requirements, results also confirmed that customer focus plays the same critical role in achieving customer satisfaction.

This chapter included a detailed description of the survey instrument and the methodology for collecting survey data and provided an analysis of the findings from the

survey pilot phase and Stage 2. The analysis showed that significant differences exist among the seven TQM principles and the eight quality principles of the ISO 10006:2003 Standard on all four selected project success factors. Considering the TQM principles, it was found that: (a) cooperation among internal and external stakeholders of the originating and the project organizations is instrumental in achieving desired project success and (b) focus on customer needs and expectations has a positive impact on customer satisfaction. For the eight quality principles of the ISO 10006:2003 Standard, the results of the study revealed that in project-focused organizations that allow employee involvement in the decision-making process based on a factual approach, projects will experience higher on-time completion compared to organizations that focus on customer focus, leadership, process approach, continual improvement, and mutually beneficial supplier relationship.

Chapter 5 presents a summary of the key findings derived from the study. The chapter further highlights the limitations of the research, makes recommendations for future research and actions by leaders in the project focused organizations where there is recognition for the need to improve the success of their projects through application of the TQM and the ISO 10006:2003 Standard. The chapter also outlines the implications of this study for social change

Chapter 5: Conclusions and Recommendations

The Standish Group's CHAOS summary report, published in 2009, reflected project success rates considered the worst in a decade. Only 32% of all projects undertaken were described as successful; 44% were considered late, were over budget, or did not meet required specifications; and 24% of projects were either cancelled or delivered but never put in service. The problem addressed in this study was that while organizations involved in PM have adopted TQM to improve business performance, many organizations do not consider the principles and guidelines within the ISO 10006 Standard to ensure project success as viable tools to effectively deal with the conditions contributing to the decrease in project success rates. The purpose of this study was to empirically assess the contribution of the application of TQM principles and the guidelines within the ISO 10006:2003 Standard on project success in project-focused organizations by addressing two related questions of (a) what differences exist in project success based on TQM critical factors and (b) what differences exist in project success based on the use of guidelines within the ISO 10006:2003 Standard.

A summary of key findings and an analysis of results obtained through the use of an electronic self-administered survey to address the two research questions that were the focus of this study and how these results relate to those found in several studies listed in Chapter 3 are included. In addition, this chapter includes recommendations for action and use of the results of this study in organizations for improving project success. Finally, this chapter provides insight on the limitations of the study, recommendations for future research, and the implications of the study on social change.

Summary of Key Findings

The two research questions addressed in this study were as follows: (a) what differences exist in project success based on TQM critical factors and (b) what differences exist in project success based on the use of guidelines within the ISO 10006:2003 Standard. A total of eight hypotheses were developed for this study. The first four hypotheses related to the first research question and the remaining four hypotheses addressed the second research question. A Likert-type scale survey-based instrument was developed and data were obtained from individuals involved in PM to test the proposed eight hypotheses.

The synthesis of findings from the comprehensive research studies conducted by Sila and Ebrahimpur (2002) and Shenawy et al. (2007) identified several critical factors associated with the accepted framework of TQM philosophy that provided the foundation for the selection of the following seven critical factors and design of the survey instrument for study: leadership, continuous improvement, internal and external cooperation, customer focus, learning company, employee fulfillment, and process management. The study revealed that significant differences do exist among the seven TQM critical factors and the eight quality principles of the ISO 10006:2003 Standard on project success in terms of the four selected success factors. Specifically, it was found that cooperation among internal and external stakeholders of the originating and the project organizations is instrumental in achieving desired project success, and focus on customer needs and expectations has a positive impact on customer satisfaction.

One of the two underpinning theoretical frameworks of this study was systems theory. According to Kerzner (2009), general systems theory infers the development of a comprehensive management technique with the tools to traverse organizational functions such as manufacturing, finance, marketing, engineering while still operating in a management mode. The results of this study as noted above substantiated the application of systems theory in a PM environment where through the implementation of a management technique that supports cooperation among various internal and external stakeholders (i.e., TQM), projects are successfully executed.

Furthermore, the results of the study revealed that involvement of people and a factual approach to decision making, two of the eight quality management principles of the ISO 10006:2003 Standard, are essential in meeting project constraints expressed in terms of project on-time completion, project specification, and project budgetary requirements. The second theory on which this study was grounded is the TOC that addresses the question of which thinking processes enable people to invent simple solutions to seemingly complicated situations. The factual approach to decision making, one of the findings from this study with a strong positive impact on project success, is closely associated with the systemic problem structuring and problem solving methodology inherent in the TOC in resolving complex problems faced by so many project-focused organizations, including poor project success.

The TOC also deals with the question of how organizational leaders can use the psychological aspects of individuals and organizations to implement the solutions to seemingly complex problems. Another finding from this study was the significant

positive impact of the involvement of people on project success. This finding confirmed the applicability of the TOC in project-focused organizations where it enables leaders in organizations to provide individuals involved in PM activities with the necessary tools to identify, manage, and break the factors restricting and limiting the success of projects.

Limitations of the Research

Kerzner (2004) noted that the use of surveys in explanatory research poses a major disadvantage. While a connection between variables may be easily inferred with a survey, it is not as easy to establish a cause-and-effect relationship in research based on a survey as it is in research based on experiments. This study was specifically designed to investigate the association between critical factors of TQM and quality management principles of the ISO 10006:2003 Standard and variables that measure project success. Should the cause-and-effect relationships between the variables be of interest, additional studies would be necessary. The subjective perspective of participants' responses to the survey questionnaire might include a lack of knowledge of accurate information related to project success or failure. In addition, since the survey instrument did not include any questions seeking objective measures of project success in terms of the four selected indicators, the results of the study were based solely on self-reporting. The exclusion of certain employees due to demographic or job-related constraints could have also introduced coverage error because of a limited or incomplete sampling frame.

The exclusion of certain employees due to demographic or job-related constraints could have introduced coverage error because of a limited or incomplete sampling frame.

An additional limitation inherent in the research study was the use of a single methodology, the Likert-type scale survey-based approach. The research did not include additional sources to boost the precision of the research. According to Robson (2002), the use of more than one method of data collection such as observation, interview, and documents in combination with quantitative and qualitative approaches could help counter all threats to validity in situations where similar results are produced. According to Singleton (2006), the use of a variety of methods that do not have the same methodological limitations to test hypotheses enables the researcher to foster confidence in statements about social interaction.

Recommendation for Actions

The results of this empirical study showed that the individuals involved in PM who participated in the survey strongly believe that application of critical factors of TQM and the eight quality management principles of the ISO 10006:2003 Standard have a positive impact on project success. In organizations where the TQM principles have been adopted in all business activities, the results of this study could be used to confirm the benefits that these principles bring to the organization. Furthermore, the results of the study could help the organizational leaders focus their attention and resources on those critical factors of TQM such as cooperation among internal and external stakeholders of the originating and the project organizations and focus on the customer.

For those project-focused organizations where the TQM philosophy has failed to meet organizational leadership's expectations or to achieve its full potential due to its limited or inconsistent application, the results of this study could provide strong

motivation to reconsider the positive impact that the critical factors of TQM have on project success. To maximize the benefits that can be gained through application of the TQM principles, organizational leaders need to redeploy their available resources to those areas of the organization that have greater potential in applying these principles in projects. Furthermore, in those organizations where the TQM philosophy has never been considered as a viable tool for business improvement in general and project success in particular, the results of the study could provide valuable information to start applying the TQM philosophy and its critical factors gradually with a focus on those factors found in this study and with the strongest impact on project success. Through application of the plan-do-check-act (PDCA) cycle and lessons learned through continuous improvement methodologies, one or more of the TQM principles can be introduced in a specific phase of the project life cycle, altered and refined if necessary to meet the needs of project team, and then applied to other phases of the project. Although the results of this study did not show leadership as the most significant factor with a positive impact on project success, regardless of the extent of the application of TQM philosophy in an organization, the support and commitment of the leaders in these organizations is critical for the successful implementation of this philosophy with the aim of improvement in project success.

The recommendations for action regarding the application of the eight quality management principles of the ISO 10006:2003 Standard in project-focused organizations are very similar to those listed for the TQM critical factors. By encouraging employee involvement and through a factual approach to decision making, project-focused

organizations could experience improvement in project success. What is different, however, is the lack of awareness of the ISO 10006:2003 Standard that was confirmed in this study. This shortcoming can be overcome through a concerted effort in disseminating the new knowledge gained from this study to the quality management and PM practitioners by the researcher and organizations such as ASQ and PMI. One possible approach that ASQ and PMI organizations can take in order to increase the knowledge of the ISO 10006:2003 Standard among the members of the project teams and their organizations' leadership willingness to apply its principles is by emphasizing the fact that the ISO 9001 Standard has been widely adopted by almost one million organizations throughout the world (ISO, 2008), and is based on the same eight quality management principles of the ISO 10006:2003 Standard.

Recommendations for Future Research

The scope of this study was limited to members of the ASQ sections and PMI chapters in the two largest cities in Texas. This scope could be expanded to include more diverse memberships in several different fashions. The population could be expanded to include members of both organizations in additional locations within the state of Texas and could also be expanded to include member of additional professional organizations and corporations within Texas and across the United States.

Further research could include expanded project success criteria to include the following as noted by Kerzner (2009, p. 7): (a) with a minimum of mutually agreed upon scope changes, (b) without disturbing the main work flow of the organization, and (c) without changing the corporate culture. Kerzner (2009) noted that it is rare to have a

project completed without some type of change to the original scope. However, while changes in scope might be unavoidable, they also have the potential to have a detrimental effect on project morale and on the entire project. Any change to the original scope of the project should be minimal and should require the approval of the end user and project manager.

Project managers must understand their role as not separate from the operations of the parent company. They must manage their specific project within the work flow and guidelines, rules, and policies of the original organization. Any adjustments or trade-offs project managers are obligated to make must be done under the umbrella of the parent company. Project manages cannot consider themselves as operating in a vacuum.

Each corporation has its own specific corporate culture. While each project may be different and have different goals, the project manager cannot expect personnel to approach each project with behavior or tactics that do not coincide with the company's corporate culture. Each project should be approached and piloted with the same cultural values and standards set in place by the originating company.

Furthermore, the scope of this study could be expanded through future empirical research to study the potential benefits that the integration of the ISO 10006:2003 Standard and the ISO 10007:2003 Standard can bring to project focused organization in their effort to improve project success. In addition, the scope of this study could be extended to examine the implications that application of the ISO 9001 Standard, Six-Sigma, and CMMI in the project management field have on project success. A large number of organizations have adopted these quality or business improvement initiatives

in the manufacturing and service sectors and have been found to be valuable in improving business performance. Since the ISO 9001 Standard is based on the same eight quality management principles of the ISO 10006:2003 Standard, the project-focused organizations that are certified to the ISO 9001 Standard could benefit from the results of empirical studies on the impact of the ISO 9001 Standard on project success.

Implications for Social Change

Each organization is comprised of individuals and its ultimate success can be attributed in great part to making the best use of the involvement and capabilities of these individuals that leads to the satisfaction of all stakeholders, both internal and external. The empirical results generated in the study can serve as a reference point for organizational leaders hoping to improve project success relating to on-time completion, meeting budgetary constraints, and meeting or exceeding product and service quality requirements. Increased project success will in turn have a positive impact on employee morale and satisfaction and increase employees' willingness to satisfy internal and external customers.

From a theoretical perspective, results of this study provide additional insight into the critical factors of TQM and the ISO 10006:2003 Standard. The results can stimulate new discussions about the positive impact their implementation and use have on increased project success by those involved in the field of PM. In addition, this study might serve as the foundation for further research in the field of PM and will add to the increasing PM body of knowledge.

Conclusion

The purpose of this study was to examine empirically the benefits that TQM and the ISO 10006:2003 Standard can bring to the PM discipline. Results of the study revealed that cooperation among internal and external stakeholders of the originating and project organizations, and employee involvement in project-focused organizations have a significant positive impact on project success. In addition, it was found that when the individuals involved with projects focus their efforts on satisfying their internal and external customers while taking a factual approach to decision making throughout the project cycle, improvement in project success follows. Daily and Bishop (2003) posited that the achievement of employee involvement that is successful results in a leaner organization, one whose environment fosters resourcefulness and participation and ultimately reflects high quality in organizational performance. It is the responsibility of the leaders in project-focused organizations to demonstrate effective leadership that rewards employee involvement and cooperation and provides an environment that is conducive to a factual-based decision-making process immune to changes that are inherent in all projects. Through such leadership, the principles upon which TQM and the ISO 10006:2003 Standard are based on could be applied effectively throughout the project life cycle leading to continual improvements in project success, increased project stakeholders' satisfaction, and consequently improved business conditions that are critical to any organization's survival.

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Appendix A: Survey Instrumentation—Pilot Study

Dear study participant,

Attached is a research survey which consists of a total of 45 questions divided into six sections. When answering the questions in Sections IV through VI please base them on your experience in the most recent projects (no greater than 3) in which you have been involved over the last 5 years. Please answer all the questions.

Thank you,

Herzl Marouni

SECTION I. RESPONDENT BACKGROUND

*** 1. How long have you been employed in this industry?**

- Less than a year
- 1-5 years
- 6-10 years
- More than10 years

*** 2. Which one of the following best describes your industry? (Please select the best option)**

- Agriculture
- Construction
- Consulting
- Education
- Finance and Banking
- Information Technology
- Manufacturing
- Pharmaceutical
- Oil and Gas
- Retail & Wholesale
- Other

*** 3. Which one of the following best describes your current position? (Please check as many as apply)**

- Engineer
- Manufacturing Engineer
- Project Manager
- Project sponsor
- Project Team Member
- Quality Engineer
- Quality Manager
- Quality Technician
- Other

* **4. How many projects are you, or have you been involved with, in the last five years?**

- ○ One
- ○ 2 or more
- ○ 6 to 10
- ○ More than 10

* **5. Where are you located?**

- ○ Dallas
- ○ Houston
- ○ Other city

* **6. What is your gender?**

- ○ Male
- ○ Female

SECTION II. FORMATION ON THE APPLICATION OF TOTAL QUALITY MANAGEMENT (TQM)

* **7. Are you familiar with TQM prniciples/phiosophy?**

- ○ No
- ○ Somewhat
- ○ Yes

* **8. In your opinion, has TQM been implemented successfully in your organization?**

- ○ No
- ○ Somewhat
- ○ Yes

SECTION III. INFORMATION ON THE APPLICATION OF THE ISO 10006:2003 STANDARD ...

* **9. Are you familiar with the ISO 10006:2003 Standard?**

- ○ No
- ○ Somewhat
- ○ Yes

* **10. Has your organization utilized the guidelines within the ISO 10006:2003 Standard to improve project success?**

- ○ No
- ○ Sometimes
- ○ Yes

* **11. If you answered yes to question 10, in your opinion have the guidelines within the ISO 10006:2003 Standard helped your organization to improve project success?**

- ○ No
- ○ Sometimes
- ○ Yes

SECTION IV. IMPACT OF TOTAL QUALITY MANAGEMENT (TQM) ON PROJECT SUCCESS

Please respond to the following statements by selecting one of the following five options: (5) Strongly agree; (4) Agree; (3) Neither agree nor disagree or no opinion; (3) Disagree; (1) Strongly Disagree.

Part A. This set of statements is about your perception of the impact of "Leadership" on each of the following four project success criteria:

*** 12. Top management commitment (TMC) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 13. Strategic planning (SP) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION IV (CONTINUED).

Part B. This set of statements is about your perception of the impact of "Continuous improvement" on each of the following four project success criteria:

*** 14. Continuous improvement and innovation (CII) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION IV (CONTINUED).

Part C. This set of statements is about your perception of the impact of "Internal/External cooperation" on each of the following four project success criteria:

*** 15. Teamwork (TW) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 16. Communication (C) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION IV (CONTINUED).

Part D. This set of statements is about your perception of the impact of "Customer focus" on each of the following four project success criteria:

*** 17. Customer focus and satisfaction (CFS) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION IV (CONTINUED).

Part E. This set of statements is about your perception of the impact of "Learning company" on each of the following four project success criteria:

*** 18. Training (T) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION IV (CONTINUED).

Part F. This set of statements is about your perception of the impact of "Employee fulfillment" on each of the following four project success criteria:

*** 19. Employee involvement (EI) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 20. Employee satisfaction (ES) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION IV (CONTINUED).

Part F. This set of statements is about your perception of the impact of "Employee fulfillment" on each of the following four project success criteria:

*** 19. Employee involvement (EI) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 20. Employee satisfaction (ES) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION IV (CONTINUED).

Part G. This set of statements is about your perception of the impact of "Process management" on each of the following four project success criteria:

*** 21. Quality information and performance (QI/PFM) has positive impact on:**

	strongly disagree	agree	neither agree nor disagree or no opinion	disagree	strongly agree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 22. Process control (PC) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 23. Product and service design (PSD)has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION V. IMPACT OF THE EIGHT QUALITY MANAGEMENT PRINCIPLES OF THE ISO 100...

Please respond to the following statements by selecting one of the following five options: (5) Strongly agree; (4) Agree; (3) Neither agree nor disagree or no opinion; (3) Disagree; (1) Strongly Disagree.

Part A. This set of statements is about your perception of the impact of "Customer focus" on each of the following four project success criteria:

*** 24. Increased customer satisfaction (ICS) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 25. Improved customer loyalty (ICL) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION V (CONTINUED).

Part B. This set of statements is about your perception of the impact of "Leadership" on each of the four project success criteria:

*** 26. Establishing purpose for the organization (EP) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 27. Establishing direction for the organization (ED) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 28. Setting vision for the organization (SV) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 29. Setting objectives for the organization (SO) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION V (CONTINUED).

Part C. This set of statements is about your perception of the impact of "Involvement of people" on each of the following four project success criteria:

*** 30. Employee motivation and commitment (EMC) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 31. Employee participation in and contribution to continual improvement (EPC) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION V (CONTINUED).

Part D. This set of statements is about your perception of the impact of "Process approach" on each of the following four project success criteria:

*** 32. Consistent and predictable results (CPR) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 33. Lower operation costs through effective use of resources (LOC) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 34. Shorter cycle times through effective use of resources (SCT) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION V (CONTINUED).

Part D. This set of statements is about your perception of the impact of "Process approach" on each of the following four project success criteria:

*** 32. Consistent and predictable results (CPR) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 33. Lower operation costs through effective use of resources (LOC) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 34. Shorter cycle times through effective use of resources (SCT) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION V (CONTINUED).

Part E. This set of statements is about your perception of the impact of "System approach to management" on each of the following four project success criteria:

*** 35. Integration and alignment of the processes (IAP) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 36. Ability to focus effort on the key processes (ATF) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION V (CONTINUED).

Part F. This set of statements is about your perception of the impact of "Continual improvement" on each of the following four project success criteria:

*** 37. Improved capabilities (IC) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 38. Alignment of improvement activities (AIA) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 39. Quick response to opportunities (QRO) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION V (CONTINUED).

Part G. This set of statements is about your perception of the impact of "Factual approach to decision making" on each of the following four project success criteria:

*** 40. Making informed decisions (ID)has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION V (CONTINUED).

Part H. This set of statements is about your perception of the impact of "Mutually beneficial supplier relationships" on each of the following four project success criteria:

*** 41. Increased value for both parties (IV) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 42. Flexibility and speed of joint responses to changing market or customer needs and expectations (F) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 43. Optimization of costs and resources (OCR) has positive impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

SECTION VI. IMPACT OF THE ECONOMIC RECESSION ON PROJECT SUCCESS

Part A. This set of statements is about your perception of the adverse impact of recent economic recession on each of the following four project success criteria:

*** 44. The recent economic recession has had an adverse impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

*** 45. Job cuts due to the recent economic recession in your organization has had adverse impact on:**

	strongly agree	agree	neither agree nor disagree or no opinion	disagree	strongly disagree
on-time	○	○	○	○	○
within specification	○	○	○	○	○
within budget	○	○	○	○	○
customer complaint	○	○	○	○	○

21. SECTION VII. ADDITIONAL COMMENTS

Please provide any additional comments or suggestions you may have for the improvement of the survey questions/structure.

46. Comments / Sugessions

Appendix B: Survey Instrumentation—Stage 2 Study

Instructions

Dear study participant,

Attached is a research survey which consists of a total of 45 questions divided into six sections. When answering the questions in Sections IV through VI please base them on your experience in the most recent projects (no greater than 3) in which you have been involved over the last 5 years. Please answer all the questions.

Please note that the Project Management Institute (PMI) defines project as "A temporary series of tasks designed to create a special product or service."

Thank you,

Herzl Marouni

SECTION I. RESPONDENT BACKGROUND

*** 1. Which one of the following describes your industry? (Please select the best option.)**

- Agriculture
- Construction
- Consulting
- Education
- Finance and Banking
- Information Technology
- Manufacturing
- Pharmaceutical
- Oil and Gas
- Retail & Wholesale
- Other

Other (please specify)

*** 2. How long have you been employed in this industry?**

*** 3. Which one of the following best describes your current position? (Please select the best option)**

- Engineer
- Manufacturing Engineer
- Project Manager
- Project sponsor
- Project Team Member
- Quality Engineer
- Quality Manager
- Quality Technician
- Other

Other (please specify)

* **4. How many projects are you, or have you been involved with, in the last five years?**

  Please note that the Project Management Institute (PMI) defines project as "A temporary series of tasks designed to create a special product or service."

* **5. Where are you located?**

  - ○ Dallas
  - ○ Houston
  - ○ Other city

* **6. What is your gender?**

  - ○ Male
  - ○ Female

SECTION II. FORMATION ON THE APPLICATION OF TOTAL QUALITY MANAGEMENT (TQM)

* **7. Have any of the following TQM critical factors been utilized in your organization in the last five years?**

Leadership
Continuous improvement
Internal/ external cooperation
Customer focus
Learning company
Employee fulfillment
Process management

- ○ No
- ○ Somewhat
- ○ Yes

* **8. In your opinion, in what percentage of the projects in which you have been involved have the TQM critical factors listed in question #7 above been implemented successfully?**

- ○ None
- ○ Less than 25%
- ○ Between 25% and 50%
- ○ Between 50% and 75%
- ○ More than 75%

SECTION III. INFORMATION ON THE APPLICATION OF THE ISO 10006:2003 STANDARD ...

* **9. Are you familiar with the ISO 10006:2003 Standard?**

- ○ No
- ○ Somewhat
- ○ Yes

10. If you answered somewhat or yes to question #9 above, in what percentage of the projects in which you have been involved have any of the Quality Management Principles listed below been utilized?

Customer focus
Leadership
Involvement of people
Process approach
System approach to management
Continual improvement
Factual approach to decision making
Mutually beneficial supplier relationships

- ○ None
- ○ Less than 25%
- ○ Between 25% and 50%
- ○ Between 50% and 75%
- ○ More than 75%

11. If you answered sometwhat or yes to question #9 above, in your opinion have the Quality Management Principles listed helped to improve the success of projects in which you have been involved?

- ○ No
- ○ Somewhat
- ○ Yes

SECTION IV. IMPACT OF TOTAL QUALITY MANAGEMENT (TQM) ON PROJECT SUCCESS

Please respond to the following statements by selecting one of the five options indicated.

Part A. This set of statements is about your perception of the impact of "Leadership" on each of the following four project success criteria:

*** 12. Top management commitment (TMC) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 13. Strategic planning (SP) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION IV (CONTINUED).

Part B. This set of statements is about your perception of the impact of "Continuous improvement" on each of the following four project success criteria:

*** 14. Continuous improvement and innovation (CII) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION IV (CONTINUED).

Part C. This set of statements is about your perception of the impact of "Internal/External cooperation" on each of the following four project success criteria:

*** 15. Teamwork (TW) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 16. Communication (C) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION IV (CONTINUED).

Part D. This set of statements is about your perception of the impact of "Customer focus" on each of the following four project success criteria:

*** 17. Customer focus and satisfaction (CFS) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION IV (CONTINUED).

Part E. This set of statements is about your perception of the impact of "Learning company" on each of the following four project success criteria:

*** 18. Training (T) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION IV (CONTINUED).

Part F. This set of statements is about your perception of the impact of "Employee fulfillment" on each of the following four project success criteria:

*** 19. Employee involvement (EI) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 20. Employee satisfaction (ES) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION IV (CONTINUED).

Part G. This set of statements is about your perception of the impact of "Process management" on each of the following four project success criteria:

*** 21. Quality information and performance (QI/PFM) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 22. Process control (PC) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 23. Product and service design (PSD)has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION V. IMPACT OF THE EIGHT QUALITY MANAGEMENT PRINCIPLES OF THE ISO 100...

Please respond to the following statements by selecting one of the five options indicated.

Part A. This set of statements is about your perception of the impact of "Customer focus" on each of the following four project success criteria:

*** 24. Increased customer satisfaction (ICS) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 25. Improved customer loyalty (ICL) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION V (CONTINUED).

Part B. This set of statements is about your perception of the impact of "Leadership" on each of the four project success criteria:

*** 26. Establishing purpose for the organization (EP) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 27. Establishing direction for the organization (ED) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 28. Setting vision for the organization (SV) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 29. Setting objectives for the organization (SO) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION V (CONTINUED).

Part C. This set of statements is about your perception of the impact of "Involvement of people" on each of the following four project success criteria:

*** 30. Employee motivation and commitment (EMC) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 31. Employee participation in and contribution to continual improvement (EPC) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION V (CONTINUED).

Part D. This set of statements is about your perception of the impact of "Process approach" on each of the following four project success criteria:

*** 32. Consistent and predictable results (CPR) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 33. Lower operation costs through effective use of resources (LOC) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 34. Shorter cycle times through effective use of resources (SCT) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION V (CONTINUED).

Part E. This set of statements is about your perception of the impact of "System approach to management" on each of the following four project success criteria:

*** 35. Integration and alignment of the processes (IAP) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 36. Ability to focus effort on the key processes (ATF) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION V (CONTINUED).

Part F. This set of statements is about your perception of the impact of "Continual improvement" on each of the following four project success criteria:

*** 37. Improved capabilities (IC) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 38. Alignment of improvement activities (AIA) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 39. Quick response to opportunities (QRO) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION V (CONTINUED).

Part G. This set of statements is about your perception of the impact of "Factual approach to decision making" on each of the following four project success criteria:

*** 40. Making informed decisions (ID)has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION V (CONTINUED).

Part H. This set of statements is about your perception of the impact of "Mutually beneficial supplier relationships" on each of the following four project success criteria:

*** 41. Increased value for both parties (IV) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 42. Flexibility and speed of joint responses to changing market or customer needs and expectations (F) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 43. Optimization of costs and resources (OCR) has positive impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

SECTION VI. IMPACT OF THE ECONOMIC RECESSION ON PROJECT SUCCESS

Part A. This set of statements is about your perception of the adverse impact of recent economic recession on each of the following four project success criteria:

*** 44. The recent economic recession has had an adverse impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

*** 45. Job cuts due to the recent economic recession in your organization has had adverse impact on project:**

	strongly disagree	disagree	neither agree nor disagree or no opinion	agree	strongly agree
on-time completion	○	○	○	○	○
within budget	○	○	○	○	○
to specification	○	○	○	○	○
customer satisfaction	○	○	○	○	○

Appendix C: Consent Forms

September 10, 2010

Herzl Marouni
c/o Walden University

Re: Letter of Cooperation for Participation in Research Study

Dear Mr. Marouni

Please accept this as our formal consent to your request to access our membership to request their participation in a survey study to advance your doctoral studies.

We understand that you will be collecting data from our membership through the use of an electronic survey instrument, access to which will be publicized via our website and newsletter. We understand that this survey is strictly anonymous, will take approximately 20 minutes to complete and will be administered online. Each of our members invited to participate has the option of declining to participate and participants' names will not be revealed in your dissertation.

The responses of individual members will be combined with the responses of all participants for data analysis purposes only. The results of the study will increase the level of knowledge in organizations of the benefits that the ISO 10006:2003 can bring to their project management practices resulting in improved project success.

We understand that the results of the study will be made available to all participants upon completion of your dissertation.

I am aware that you are available to answer questions at any time at 281.673.2890 during working hours or via e-mail at herzl.marouni@waldenu.edu.

My signature below indicates formal consent of our organization to participate in your survey.

Very truly yours,

Luiz Feijo, Manager, Houston Project Development
ABS Americas

Lew Rogers, Senior Human Resources
ABS Americas

ABS PLAZA, 16855 NORTHCHASE DRIVE, HOUSTON, TX 77060-6008 USA
Tel: 1-281-877-6000 Fax: 1-281-877-6218 Email: humanresourcesbureau@eagle.org

John S. Gorman III

Project Management Institute – Houston Chapter, Inc.

Phone: (281) 636-4459

Project Management Institute Houston

Herzl Marouni

Walden University

Phone: (281) 673-2890

Dear Mr. Marouni

Please accept this as PMI Houston Chapter, Incorporated's formal consent to your request for PMI Houston to publish your request to ask for their participation in a survey to advance your doctoral studies in our monthly Newsletter and on our www.pmihouston.org website.

We understand that you will be collecting data from our membership through the use of an electronic survey instrument, access to which will be publicized via our website and newsletter. We understand that this survey is strictly anonymous, will take approximately 20 minutes to complete and will be administered online. Each of our members invited to participate has the option of declining to participate and participants' and their organizations' names will not be revealed in your dissertation.

We understand that the responses of individual members will be combined with the responses of all participants for data analysis purposes only. The results of the study will increase the level of knowledge in organizations of the value that the ISO 10006:2003 Standard and Total Quality Management can bring to their project management practices resulting in improved project success.

We understand that the results of the study will be made available to all participants and the PMI Houston Chapter Board of Directors upon completion of your dissertation for their personal use and use within the chapter organization.

I am aware that you are available to answer questions at any time at 281.673.2890 during working hours or via e-mail at herzl.marouni@waldenu.edu.

My signature below indicates formal consent of the PMI Houston Chapter, Inc. to participate in your survey.

Very truly yours,

John S. Gorman III
President 2009
Project Management Institute – Houston Chapter, Inc.
9/16/2009

PMI Dallas Chapter
Making project management indispensable for business results.℠
PMB 4847 • 11401 Audelia Road • Dallas, TX 75243-7200 • www.PMIDallas.org
P O Box 251231, 3905 Hedgecox Rd, Plano TX 75025

September 21, 2009

Herzl Marouni
c/o Walden University

Re: Letter of Cooperation for
Participation in Research Study

Dear Mr. Marouni

Please accept this as PMI Dallas Chapter, Incorporated's formal consent to your request to access our membership to ask for their participation in a survey to advance your doctoral studies in our monthly newsletter and on our www.pmidallas.org website.

We understand that you will be collecting data from our membership through the use of an electronic survey instrument, access to which will be publicized via our website and newsletter. We understand that this survey is strictly anonymous, will take approximately 20 minutes to complete and will be administered online. Each of our members invited to participate has the option of declining to participate and participants' and their organizations' names will not be revealed in your dissertation.

We understand that the responses of individual members will be combined with the responses of all participants for data analysis purposes only. The results of the study will increase the level of knowledge in organizations of the value that the ISO 10006:2003 Standard and Total Quality Management can bring to their project management practices resulting in improved project success.

We understand that the results of the study will be made available to all participants and the PMI Dallas Chapter Board of Directors upon completion of your dissertation.

I am aware that you are available to answer questions at any time at 281.873.2890 during working hours or via e-mail at herzl.marouni@waldenu.edu

My signature below indicates formal consent of the PMI Dallas Chapter, Inc. to participate in your survey.

Very truly yours,

Dwaraka R. Iyengar
2009 President
PMI Dallas Chapter, Inc.

ASQ
AMERICAN SOCIETY FOR QUALITY

Greater Houston Section

September 16, 2009

Herzl Marouni
c/o Walden University

Re: Letter of Cooperation for
Participation in Research Study

Dear Mr. Marouni

Please accept this as ASQ Greater Houston Section's formal consent to your request for ASQ Greater Houston Section 1405 to publish your request to ask for their participation in a survey to advance your doctoral studies in our monthly Newsletter and on our www.asqhouston.org website.

We understand that you will be collecting data from our membership through the use of an electronic survey instrument, access to which will be publicized via our website and newsletter. We understand that this survey is strictly anonymous, will take approximately 20 minutes to complete and will be administered online. Each of our members invited to participate has the option of declining to participate and participants' and their organizations' names will not be revealed in your dissertation.

We understand that the responses of individual members will be combined with the responses of all participants for data analysis purposes only. The results of the study will increase the level of knowledge in organizations of the value that the ISO 10006:2003 Standard and Total Quality Management can bring to their project management practices resulting in improved project success.

We understand that the results of the study will be made available to all participants upon completion of your dissertation.

I am aware that you are available to answer questions at any time at 281.673.2890 during working hours or via e-mail at herzl.marouni@waldenu.edu.

My signature below indicates formal consent of the ASQ Greater Houston Section 1405 to participate in your survey.

Very truly yours,

Gregory Soape

Chair – ASQ Greater Houston Section 1405

Member units (Sections or Forum/Divisions) of the American Society for Quality retain authority only in matters related to their operations and not in conflict with limitations imposed.

ABS Group

13 October 2009

Mr. Herzl Marouni
11714 Bob White
Houston, Texas 77035
c/o Walden University

Dear Herzl:

I confirm on behalf of ABS Group of Companies, Inc. and ABSG Consulting Inc. that Mr. Nassif has agreed with your request to access the companies' employee roster as noted in your letter to Mr. Nassif dated October 5, 2009 with the conditions as previously discussed and indicated in that letter.

Yours sincerely

Sarah M. Barton
General Counsel
ABS Group of Companies, Inc.

cc: Tony Nassif

ABS Group of Companies, Inc. • 16855 Northchase Drive • Houston, Texas 77060-6005 USA • Tel: 1-281 673-2800 • Fax: 1-281-673-2900
www.abs-group.com

"Martin, Frederick" <frederick.martin@lmco.com >
11/17/2009 03:17 PM

To Joe Sofinowski <j.sofinowski@verizon.net>, "HMarouni@absconsulting.com" <HMarouni@absconsulting.com>
cc
bcc
Subject RE: Re: FW: PhD Dissertation: Analysis of Perceived Value of ISO 10006 Standard and Total Quality Management on Project Success - Electronic Survey - ASQ Dallas Section 1402

Thanks Joe

Fred Martin
Supplier Quality Manager
Missile and Fire Control SW
Ph: 972-603-9105
MS PT-17
From: Joe Sofinowski [mailto:j.sofinowski@verizon.net]
Sent: Tuesday, November 17, 2009 11:31 AM
To: HMarouni@absconsulting.com
Cc: Martin, Frederick
Subject: Re: Re: FW: PhD Dissertation: Analysis of Perceived Value of ISO 10006 Standard and Total Quality Management on Project Success - Electronic Survey - ASQ Dallas Section 1402

There is a blurb about the survey in the monthly newsletter, with a link inside the newsletter to the invitation document. I try to avoid sending files through email to prevent them being blocked by antivirus filters. Our email message contains a link to the posted newsletter.

Joe

Nov 17, 2009 05:25:38 PM, HMarouni@absconsulting.com wrote:

> Dear Mr. Martin,
>
> Thank you for all your help. What was done with our Houston participants was to e-mail the invitation letter to all members in additional to posting a notice on the Houston section website with a blurb regarding the survey and a link leading to the invitation letter. Were you planning to do it the same way for Dallas Section? I would greatly appreciate it if you could since this greatly increase the response rate.
>
> Let me know if you need any additional information from me on disseminating the survey to your members.
>
> Best regards,
>
> Herzl Marouni
> Senior Consultant
> ABS Consulting

INVITATION TO PARTICIPATE

DISSERTATION PILOT STUDY

Dear ASQ Greater Houston Section member,

Your participation is requested in a research pilot study on "Analysis of Perceived Value of The ISO 10006 Standard and Total Quality Management on Project Success".

- The purposes of this study are to gain knowledge of the perceived value of TQM on project success, and to identify potential reasons for the limited use of the ISO 10006:2003 standard in project management and success.
- The goal is to stimulate further research in the area of PM research.
- The results of the study will increase the level of knowledge in the organizations of the benefits that the ISO 10006:2003 Standard can bring to their PM practices resulting in improvement in project success.
- The survey will take approximately 20 minutes of your time.
- The survey will be completely anonymous.
- The survey will be accessed through the ASQ website and newsletter via e-mail notification.

Thank you for agreeing to participate in the pilot study. The study is currently scheduled to be accessible in October-November, 2009.

Mr. Herzl Marouni
ASQ Greater Houston Section member
PhD Candidate
Walden University.

First Name	Last Name	Have you been involved in one or more projects?		Have you or your organization been involved in TQM initiatives?		Please sign and or initial if you agree to participate in the research pilot study that will be conducted by Herzl Marouni
		Yes	No	Yes	No	

Appendix D: Invitation Letter to Participants

Dear _____,

You are invited to participate in study for research on "Analysis of Perceived Value of The ISO 10006 Standard and Total Quality Management on Project Success". This is a continuing step in a larger study that will form the basis of my doctoral dissertation through Walden University.

You were selected to participate based on your familiarity with project management and involvement with projects. Your responses will be combined with those of other participants for data analysis purposes only. Please read this form and ask any questions you may have before acting on this invitation to participate in the study.

The goal is to get at least 240 respondents by December 21, 2009, so please do your best to complete this survey before that date.

Please note that if you participated in the pilot study for this research you may not participate in this stage of the research.

Background Information:
The purposes of this study are to gain knowledge of the perceived value of TQM on project success, and to identify potential reasons for the limited use of the ISO 10006:2003 standard in project management and success.

The following links lead to two documents summarizing the content of the ISO 10006:2003 Standard and its close relationship with the Project Management Institute Body of Knowledge (PMBOK). Feel free to access these documents should you like to review them prior to beginning your participation in this survey.

http://www.bia.ca/articles/pj-combining-iso-10006-pmbok-to-ensure-successful-projects.htm

http://www.qualitydigest.com/inside/standards-article/iso-10006-and-pmbok-path-successful-projects

Procedures:
If you agree to be in the study, you will be asked to take a brief electronic survey. The survey will take approximately 20 minutes of your time.

Voluntary Nature of the Study:

Your participation in this study is strictly voluntary. No one at your organization will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind during the study. Your decision whether or not to participate will not affect your current or future relations with the institution in which you are employed. If you decide not to participate or discontinue participation, there is no penalty for doing so.

Risk and Benefits of Being in the Study:
Since respondent identification will not be collected, there is no risk that your answers will be connected to you or your organization in any way. There is no conflict of interest inherent in your participation in this study. There are no physical risks to you, nor is it likely that you will suffer any adverse psychological effects. Individual participants may benefit from this study to the extent that the findings will stimulate further research in the area of PM research. In addition, organizations that have implemented TQM but do not realize its full potential could use the results of this study to improve the interaction between various PM processes throughout project life cycle. The results of the study will increase the level of knowledge in organizations of the benefits that the ISO 10006:2003 Standard can bring to their PM practices resulting in improvement in project success.

Compensation:
As a token of appreciation, after completing the survey you will receive a copy of the power point presentation by Mr. Michael Stanleigh entitled "ISO 10006…guidelines for quality management in projects; Implications on project management & quality management processes".

Confidentiality:
Your participation and your responses are anonymous and confidential. No one, not even the researcher, will know who participated in the study. Research records will be kept in password protected media; only the researcher will have access to the records. All files will be destroyed one year following completion of the study.

Contacts and Questions:
The researcher conducting this study is Herzl Marouni. The researcher's dissertation committee chairperson is Dr. Walter McCollum. If you have any questions, please contact:

Mr. Herzl Marouni
11714 Bob White, Houston Texas 77035
Mobile: 713-806-5874
E-mail address: mailto:Herzl.marouni@walden.edu

Dr. Walter McCollum
Mobile: 571-215-3938
E-mail address: mailto:Walter.McCollum@Waldenu.edu

Walden University's Institutional Review Board (IRB) approval number for this study is **10-27-09-0334036** and it expires on **October 26, 2010.**

Statement of Consent:
I have read the above information. I have asked questions and received answers.

If you select the first link below, you will be signing this form and giving your consent to take part in the current research study. You may keep a copy of the informed consent form.

Selecting the first link below assures the following:

I acknowledge that I understand the nature of the study, the potential risks to me as a participant, and the means by which my identity will be kept confidential. My signature on this form also indicates that I am 18 years old or older and that I give my permission to voluntarily serve as a participant in the study described.

I understand the above statements and give consent for my information to be used in the study. (Selecting this link will take the participant to the electronic survey)

I understand the above statements and do NOT give consent for my information to be used in the study. (Selecting this link will take the participant to their respective organization website)

Best regards,

Herzl Marouni
ASQ Senior Member

Appendix E: IRB Approval Letter

Original E-mail
From: IRB@waldenu.edu
Date: 10/27/2009 09:28 PM
To: herzl.marouni@waldenu.edu
Subject: IRB materials approved-Herzl Marouni

Dear Mr. Marouni,

This email is to notify you that the Institutional Review Board (IRB) has approved your application for the study entitled, "Analysis of Perceived Value of ISO 10006 Standard and Total Quality Management on Project Success."

Your approval # is 10-27-09-0334036. You will need to reference this number in your dissertation and in any future funding or publication submissions.

Your IRB approval expires on October 26, 2010. One month before this expiration date, you will be sent a Continuing Review Form, which must be submitted if you wish to collect data beyond the approval expiration date.

Your IRB approval is contingent upon your adherence to the exact procedures described in the final version of the IRB application materials that have been submitted as of this date. If you need to make any changes to your research staff or procedures, you must obtain IRB approval by submitting the IRB Request for Change in Procedures Form. You will receive an IRB approval status update within 1 week of submitting the change request form and are not permitted to implement changes prior to receiving approval. Please note that Walden University does not accept responsibility or liability for research activities conducted without the IRB's approval, and the University will not accept or grant credit for student work that fails to comply with the policies and procedures related to ethical standards in research.

When you submitted your IRB application, you a made commitment to communicate both discrete adverse events and general problems to the IRB within 1 week of their occurrence/realization. Failure to do so may result in invalidation of data, loss of academic credit, and/or loss of legal protections otherwise available to the researcher.

Both the Adverse Event Reporting form and Request for Change in Procedures form can be obtained at the IRB section of the Walden web site or by emailing irb@waldenu.edu: http://inside.waldenu.edu/c/Student_Faculty/StudentFaculty_4274.htm

Researchers are expected to keep detailed records of their research activities (i.e., participant log sheets, completed consent forms, etc.) for the same period of time they

retain the original data. If, in the future, you require copies of the originally submitted IRB materials, you may request them from Institutional Review Board.

Please note that this letter indicates that the IRB has approved your research. You may not begin the research phase of your dissertation, however, until you have received the **Notification of Approval to Conduct Research** (which indicates that your committee and Program Chair have also approved your research proposal). Once you have received this notification by email, you may begin your data collection.

Both students and faculty are invited to provide feedback on this IRB experience at the link below:

http://www.surveymonkey.com/s.aspx?sm=qHBJzkJMUx43pZegKlmdiQ_3d_3d

Sincerely,
Jenny Sherer, M.Ed.
Operations Manger
Office of Research Integrity and Compliance
E-mail: irb@waldenu.edu
Fax: 626-605-0472
Tollfree : 800-925-3368 ext. 1341
Office address for Walden University:
155 5th Avenue South, Suite 100
Minneapolis, MN 55401

Curriculum Vitae

PROFESSIONAL SUMMARY:

Seventeen Years experience in Electronics Engineering with board exposure to Quality and Reliability Engineering. Twelve Years experience in Quality Management Systems Certification activities. Strong analytical and problems-solving skills with managerial experience.

PROFESSIONAL EXPERIENCE:

University of Houston,- School of Technology, Houston, Texas
Part time faculty member January 2010- Current

ABS Consulting, Houston, Texas
Senior Consultant 2009- Current

ABS, Houston, Texas
Director of TQM 2008-2009

ABS QUALITY EVALUATIONS, Inc., Houston, Texas
Vice-President, Certification 2005-2008
Director of Certification 2003- 2004
Manager of Certification 1999-2003
Senior Certification Engineer 1998-1999
Senior Quality Management Systems Auditor 1993-1998

TELXON CORPORATION, Houston, Texas
Manufacture of various electronic and radio (hardware and software)
Quality Engineer Supervisor 1992-1993
Electronic Sustaining Engineering Supervisor 1989-1992
Senior Component Engineer 1982-1989

UNIVERSITY OF HOUSTON, Houston, Texas
Research Assistant, Well-Logging Laboratory 1982-1985

MACGOBAR/DRESSER INDUSTRIES, Houston, Texas
Manufacture of various instruments/products (hardware and software) used in land and off-shore for well-logging and oil/gas exploration
Electronics Technician 1980-1981

TELXON CORPORATION, Houston, Texas
Manufacture of various electronic and radio (hardware and software) based units used in inventory and industrial process control applications
Electronics Technician 1978-1980

ELSCINT, INC. INDUSTRIAL MEDICAL CENTER, Haifa, Israel
Manufacture of various medical and surgical devises such as MRIs
Electronics Technician 1977-1978

EDUCATION:

Ph.D. Candidate, Applied Management and Decision Sciences, Walden University, 2006
MBA, University of Phoenix, 2005
MSEE, University of Houston, 1985
BSEE, University of Houston, 1982

CERTIFICATIONS:

ASQ Certified Reliability Engineer, 1999-Present
ASQ Certified Quality Engineer, 1992-Present
ASQ Certified Quality Auditor, 1993-Present
RABQSA Quality System Lead Auditor, 1995
IRCA Lead Auditor, 1995
ISO/TS 16949 Lead Auditor, 1999
TL 9000 Lead Auditor, 2002
QC 080000 IECQ HSPM Lead Assessor, 2007
ISO 27001 ISMS Lead Auditor, 2007
ISO 28000 Lead Auditor, 2008

MEMBERSHIPS:

Member of American Society for Quality (ASQ), 1989-Present
Member of Project Management Institute (PMI), 2008 - Present
Member, Executive Committee of Section 1405 Greater Houston ASQ
Chief Proctor and Community Outreach Co-chair, Section 1405 Greater Houston ASQ

PUBLICATIONS:

"Analysis of the Parallel-Disk Sample Holder for Dielectric Permittivity Measurement," IEEE Transactions on Geoscience and Remote Sensing, Vol. GE-25, No. 5, September, 1987.

Contributor to the monthly Interpretations Column of the Quality Systems Update publication, 2002-2008

Reviewer of technical books for Quality Progress Magazine, 2001-2004

PROFESSIONAL DEVELOPMENT/TECHNICAL SKILLS:

Attended ASQ Instructor Excellence Seminar- Mastering the Delivery of Training
Taught ASQ Reliability Refresher Course, Houston
Attended "Cost of Quality" Seminar, Houston

Attended “Reliability Symposium” University of Tucson
Attended 16-hour “ASQ Continuous Improvement” Seminar, Houston
Attended 3-day “ISO 9000 Internal Audit Training” Seminar, Houston
Attended several ASQ Annual Quality Congress meetings
Attended several ASQ Annual Quality Audit Division meetings
Computer literate in Windows environment, Microsoft Word, Microsoft Access, and Microsoft Excel