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Exploring total quality management in stent-device companies

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EXPLORING TOTAL QUALITY MANAGEMENT IN
STENT-DEVICE COMPANIES

A Thesis

Presented to

The Faculty of the Department of Aviation and Technology

San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Masters of Science

by

Parul Dhamija

December 2008

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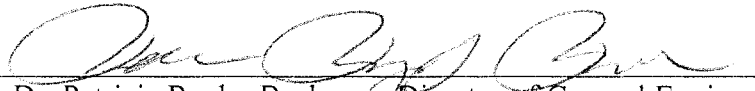
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STENT DEVICE COMPANIES

by
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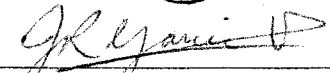
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ABSTRACT
EXPLORING TOTAL QUALITY MANAGEMENT IN
STENT-DEVICE COMPANIES

By Parul Dhamija

As companies continue to grow and flourish in our modern era, the competition among businesses has begun to rise steadily and the interactions between each department within an organization fail to have a successful quality system. Many companies have adopted TQM not only because of its advances in technology but also because of its ability to improve the quality of devices. Since then, many companies have attempted to contend with their competitors by fully understanding the principles of quality control. In order to analyze the significance of TQM, research will be conducted at the top stent-device companies in the United States.

To identify the critical variables important to stent-device companies, a questionnaire was used with 39 survey questions and one open-ended question. Conclusions drawn from this study validate that stent-device companies follow four of the eleven TQM factors: continuous improvements, organizational structures, peer team support, and communication and information sharing.

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Chapter 1

Introduction to the Study

Introduction

Globalization, including off-shoring and outsourcing, has intensified competition for firms in all industries. This competition has reinforced the Darwinian concept of “survival of the fittest” as companies seek to retain superiority over other companies in their industries. Many factors determine the “fitness” and dominance of a company, but two key factors that distinguish a successful company from a failed one are quality and customer satisfaction. Quality is the secret to competitive advantage in today's business environment. Total Quality Management (TQM) provides a systems approach to improving overall quality in an organization. TQM can be applied to the entire spectrum of organizations, whether in the public or the private sector, manufacturing or service providers, and industrially advanced and underdeveloped countries.

A company successfully implements TQM when all the members of an organization aim to improve the processes, services, and products within that organization. The aim for improvement originates from the teachings and implementation methods suggested by W. Edwards Deming (American Society of Quality, n.d.). Although Deming's successors, Phillip B. Crosby, Armand V. Feigenbaum, and Joseph M. Juran, may have carried out and popularized his philosophy, Deming's influence is so prevalent in their teachings, that he is

commonly labeled “the father of the quality evolution” (American Society of Quality, n.d.).

Dr. W. Edward Deming, the guru of TQM, developed his philosophy on the premise of fourteen basic points, which he refers to as “the Fourteen Points of Management” (Deming, 2006). His fourteenth point, “top management commitment and action,” has influenced many top organizations, defining the guidelines of their highest management departments (Deming, 2006). These points not only influenced philosophers and professors, but also showed importance for improvement in organizations nationwide. It has been suggested that by utilizing even one of Deming’s fourteen points, an organization can improve its quality, productivity, and customer service. Table 1 displays a list of Deming’s fourteen points and Figure 1 illustrates the structure of TQM. According to Deming’s fourteen points, an organization “must know what they are committed to—that is, what they must do. [The organization] also need[s] to create a structure in top management that will push everyday and take action in order to accomplish the transformation” (Leadership Institute, 2005).

Gurnani (1999) argued that in order to implement TQM, an organization should adhere to eight specific elements. These eight elements are described in Table 2. According to Gurnani, following these eight elements will allow companies to have a successful quality system and will result in significant improvement in the company's productivity and the quality of its products.

Table 1

Deming's Fourteen Points

From "Total Quality Management," (n.d.), American Society of Quality, Retrieved February 10, 2008, from <http://www.asq.org/learn-about-quality/total-quality-management/overview/overview.html>.

1. Create constancy of purpose for improving products and services.
2. Adopt the new philosophy.
3. Cease dependence on inspection to achieve quality.
4. End the practice of awarding business on price alone; instead, minimize total cost by working with a single supplier.
5. Improve constantly and forever every process for planning, production and service.
6. Institute training on the job.
7. Adopt and institute leadership.
8. Drive out fear.
9. Break down barriers between staff areas.
10. Eliminate slogans, exhortations and targets for the workforce.
11. Eliminate numerical quotas for the workforce and numerical goals for management.
12. Remove barriers that rob people of pride of workmanship, and eliminate the annual rating or merit system.
13. Institute a vigorous program of education and self-improvement for everyone.
14. Put everybody in the company to work accomplishing the transformation.

TQM is not only concentrated on quality aspects, but also “on the participation of all its members and [since it aimed] at long-term success through customer satisfaction, [this] benefit[ed] all members of the organization and to society” (Total quality management, 2008). Due to the benefits TQM provides to its members and the organizations, all companies associated with quality should implement a Total Quality Management program to improve performances of their business (Talha, 2004).

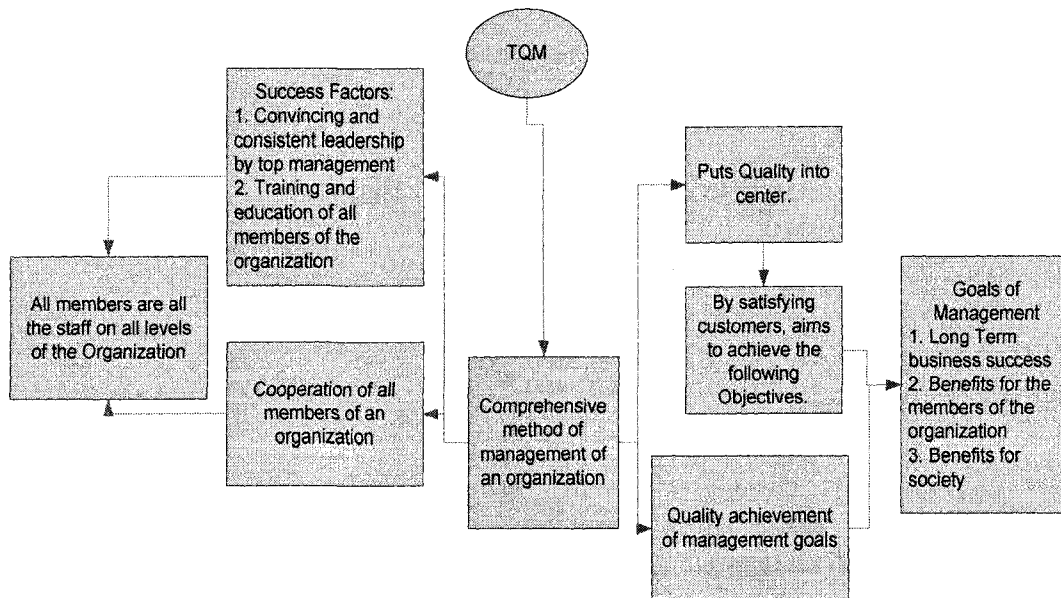


Figure 1. Structure of TQM.

From *What is Total Quality Management?* (n.d.), Retrieved January 15, 2008, from <http://www.kwaliteg.co.za/tqm/Total%20Quality%20Management.htm>.

According to Chase (1998), many companies have adopted TQM because of its technological advancement and unique methodology that improves the quality of products and services. These companies, attempting to contend with their competitors, recognized that “the principle of quality is the most powerful corporate leverage point” (Chase, 1988, p. 111) to achieve both customer satisfaction and to lower costs. Soltani, Lai, and Gharneh (2005) influenced by the research of Anderson, Rungtusanatham, and Schroeder (1994), Waldman (1994), and Dean and Bowen (1994) outlined five pillars based on Total Quality Management (p. 623):

- 1) *Top management commitment.* For executives, this works as an effective quality improvement program.

- 2) *Customer-centric advancements.* Building a trustworthy relationship with internal and external customers.
- 3) *Relentless development.* Instilling ambition in employees to strive to set their own goals and deadlines.
- 4) *Benchmarking.* Involving structure by problem solving, finding improvements, and identifying processes.
- 5) *Strengthening the employee base.* Trusting the employees to make their own decisions.

All five pillars have one underlying premise, which is that there are “no shortcuts to quality, no quick fixes, and that improvement required full commitment and support from the top, extensive training and participation of employees” (Rahman and Siddiqui, 2006, p. 623). Thus, in order for the TQM to be successful, the implementation has to be complete and fully supported by the upper management.

Statement of the Problem

The primary purpose of this study was to identify and summarize any problems with the implementation of TQM in stent-device companies. In addition, the study observed the effects of customer and job satisfaction within a stent-device organization.

Table 2

Steps to TQM Implementation

From "Pitfalls in total quality management implementation: The case of a Hong Kong company," by Gurnani, H., 1999, *Total Quality Management*, 10(2), p. 213.

- (1) *Quality policy*: People follow policy, good or bad. To ensure that all employees understand what behavior is expected of them by top management, a clear and concise policy on quality needs to be stated.
- (2) *Senior management commitment*: An essential factor is strong commitment from the management. This should be made transparent to the whole company through adequate support, monitoring, coherence and absolute top priority to quality improvement programs.
- (3) *Steering committee*: The steering committee plays the dual role of 'quality leaders' and 'quality guardian'. Real leadership is needed to make the quality improvement effort sustainable over time.
- (4) *Employee commitment and involvement*: Quality improvement is impossible unless it is committed to by all employees throughout the company hierarchy. For this to happen, the ingredients include frequent participation, enthusiasm and total involvement. Employee involvement is a process of empowering members of the organization to make decisions and to solve problems appropriate to their levels in the organization (Maccoby, 1992).
- (5) *Training and problem-solving tools*: Training provides a common language and a common set of tools to be used in the firm. Like quality improvement, education and quality improvement is a continuous journey. Management must consider who must learn what, how and by when.
- (6) *Communication*: An effective and efficient two-way communication channel is one of the prerequisites in any quality improvement programs. It can be used to communicate sincere commitment to change from the top management as well as to transit inputs to the TQM program from the subordinates (Longenecker and Scazzero, 1993).
- (7) *Standards and measurement*: It is essential to have a criterion for measuring progress towards the company's vision, which states how the needs of external and internal customers are best met. Therefore, standards must be established to be compared with the current performance. At the same time, to ensure the success and real benefit of the monitoring procedures, other activities such as benchmarking are essential to support quality improvement by helping set the improvement direction and the current target levels.
- (8) *Reward and recognition*: Recognizing people means informing individuals that their accomplishments are being appreciated. Teams and individuals who successfully apply the quality process must be recognized and possible rewarded so that the rest of the organization will know what is expected of them.

Research Questions

In the realm of the stent-device industry, the measures of quality are concentrated on employee job satisfaction, customer service, and a skilled and trained work force. This study attempted at identifying the alliance between quality performance outcomes and significant quality practices (expected variables of quality performance). For this reason, this study concentrated on the following five research questions, derived from Kontoghiorghes and Dembeck's (2001) study in the technical services organization:

Research Question 1. What are the determinants of external customer satisfaction with the quality of services provided by the stent-devices organization?

Research Question 2. What are determinants of employee satisfaction within internal processes in the stent-device organization?

Research Question 3. What are the determinants of employee satisfaction with the quality of work output from associated employees in the stent-device organization?

Research Question 4. What are the determinants of reward and communication from upper management in the stent-device organization?

Research Question 5. To what extent is having all necessary skills and knowledge to perform one's job associated with teamwork in the stent-device organization?

The Significance of the Study

This study shows the significance of TQM in stent-device companies; this is an area not studied previously with respect to TQM. The study also illustrates the performance and expected quality variables used in stent-device companies. Without further investigation, the study provides a link between the TQM factors proposed by Kontoghiorghes & Dembeck. The study explores these issues by examining the TQM programs implemented in the top four stent companies in the United States. The stent is one of the most significant inventions in the history of medical devices. One of the reasons for choosing Stent-device producing companies is that quality is of critical importance in this industry. Stents are important because they reduce the chances of any long-term anticoagulation therapy for a patient and a faulty device can result in tragic consequences for a patient.

Delimitations

There are limitations to this study that can skew its outcome. One main limitation is that there are only a few stent-device companies studied and not the entire industry. In addition, the survey conducted was for both the Total Quality Management and Sociotechnical Systems, and not just the Total Quality Management System. Last, the study did not include all departments in the companies, but only focused on the Quality Departments in the participating companies.

Definition of Terms

Customer Satisfaction. The quality of the services expected by the customer (Customer satisfaction, 2008).

Quality Performance. Measurable outcomes of performance that meets quality expectations (Myers, 2004).

Assumptions

In this study, there is an assumption that TQM factors will determine if TQM is used in a correct manner within the stent-device company. In addition, there is no way to determine the proper implementation of TQM. However, enough data is available to determine whether a relationship exists between customer service and job satisfaction. As a result, this study used an open-ended question in the questionnaire to verify if TQM was successful in the stent-device companies. The study also assumed that all stent-device companies were ISO 13485:2003 certified.

Chapter 2

Review of Related Literature

This chapter introduces specific literature related to the field of Total Quality Management. The purpose of this literature review is not only to study the significance of TQM, but also to determine the effects of TQM in different organizations. By analyzing the literature, one can observe its methodology, how information was obtained (either by surveys or interviews), and the implementation of TQM in different industries.

Background of TQM

The philosophy of Total Quality Management, evolved over the last three decades, included a template for success through customer satisfaction. TQM is also a philosophy “aiming at continuous improvement and involvement of the whole organization starting from the top of the hierarchy and ending at the bottom level of employees” (El-Kafafi, 2006, p. 441). Therefore, TQM is relevant for all employees and not restricted to just the employees of quality departments.

In the 1970s, Deming, the “father” of improving quality, stressed the importance of customer service and quality focus within an organization. TQM-A cornerstones of quality (2006) explained Deming’s work as maintaining reliability of purpose, training employees, setting goals, and reducing cost by integrating the workforce and continuous improvement. According to Deming, TQM’s purpose was to help sustain the honesty of the system, and to create an infrastructure to maintain

the management system. TQM is also an integrated approach concentrating on teamwork, employee participation, customer satisfaction, management commitment, and competitive benchmarking (El-Kafafi, 2006). This integrated approach also lowers costs, satisfies customers, improves and advances products and services, and helps empower employees (Agus & Abdullah, 2000).

TQM has evolved and advanced significantly since Deming created the philosophy in the early 1970s. According to Walsh, Hughes, and Maddox (2002), TQM could be described as a development for an organizational culture, which supports customer satisfaction through tools, training, and techniques. With customer satisfaction now its primary goal, TQM has been redefined as “fitness for use” by Juran and Gryna (1980). This helps define the “focus on the satisfaction of customer needs. The key to competitive advantage lies in continuously satisfying the customers’ needs in a fashion that is superior and more consistent than competitors” (Walsh et al., 2002, p. 299).

In order to achieve the highest rate of customer satisfaction, there are certain guidelines that need to be followed. Once the framework of the TQM philosophy is implemented, customer satisfaction needs to be obtained and maintained on an ongoing basis. “Customers would only be satisfied by quality products which are defect free. TQM helps focus on organization’s activities by eradicating the causes of defective products thus preventing such products ever reaching the customer” (Walsh et al., 2002, p. 300). According to Walsh and his colleagues, the purpose of TQM in

organizations was to minimize the defects in their products, thus directly satisfying their customers.

For TQM to survive in large organizations, companies need to concentrate on customer satisfaction. To focus on customer satisfaction, it is necessary for the organization to meet customer needs through communication, planning, and continual improvement (Total Quality Management, n.d.). Goals for a successful TQM include TQM, culture, leadership, involvement, and process quality (Total Quality Management, n.d.). This requires the organization to have strong leadership, the contribution of all employees, and thorough processing of quality and measurement information.

Common Problems in TQM

According to Zeitz, Johannesson, and Ritchie (1997), a common “problem” with TQM implementation was that supervisors and operators did not recognize the policies established by the top management. In order to have a successful TQM implementation, a company should use eleven TQM standards including “leadership support and participation, continuous improvement, customer satisfaction sensitivity, organization structures, quality tools and equipment, peer team support, support for training and education, communication and information-sharing, formal quality programs, quality culture perceptions and awareness, and job satisfaction” (Myers, 2004, p. 84). A company should concentrate on these factors by understanding and expanding on areas that need improvement. This would initiate a “trickle effect” in

which the top division's actions "trickle" down to all the other areas of employment, strengthening the relationship between all levels of the company.

Second, many companies failed to implement TQM due to lack of accurate understanding about their Quality Management Systems (Gurnani, 1999). Another reason why companies were unsuccessful with the implementation of TQM was because companies tried to incorporate other improvement programs, neglecting to implement either (TQM or improvement programs) completely, causing problems with improvement program (Gurnani, 1999).

The third problem noted by Ooi, Veeri, Yin, and Vellapan (2006) was that training must be properly implemented in order for TQM to improve strategic performances and productivity and lower manufacturing costs. In order to implement TQM accurately, a company needs to train all levels of the organization on the job requirements. Customer requirements and expectations should be in the organization's policies and activities. The organization needs to follow customer requirements to avoid customer dissatisfaction. Many times "management tries to change the culture by describing new attitudes but fail to take the steps needed to influence the actions of the employees" (Gurnani, 1999, p. 218). This was because the organization failed to change the employees' attitude once there was a change. Having clear communication with all employees within the organization was important, as it makes sure the organizations are aware of the results and effects of implementation.

Overview of Related Literature

By looking at related literature, one can observe the methodology in other studies, analyze the information obtained by these studies, and determine similarities and differences within industries. This review covers studies undertaken in various sectors in countries ranging from industrially underdeveloped countries of Africa to emerging economies like China and India and advanced countries like the US and Japan. One study by Rahman and Siddiqui (2006) focused on exploring TQM for Information Systems in Indian Firms (IS). The data “intended to represent a large variance in their annual turnovers, worth of assets, IS budgets and the segment of the industry to which they catered” (p. 625). The use of data was from a questionnaire and the recipients were selected from many different types of industries. The survey questionnaire was mailed to 300 Indian companies and then another reminder questionnaire was sent to those companies that did not respond within eight weeks of receiving the questionnaire. The authors concluded that the TQM program showed a significant increase in the quality of products and greater customer satisfaction.

A study by Miyagawa and Yoshida (2004) assessed the TQM practices in Japanese-owned manufacturers in China. The authors focused on the performance of businesses after implementing TQM. Miyagawa and Yoshida (2004) adapted the questionnaire used by the “US Malcolm Baldrige National Quality Award” (MBNQA). MBNQA is a way for American companies to recognize their quality achievements and business performances. The questionnaire used the following nine categories: leadership, information, strategy, human resources, quality assurance,

supplier quality, quality and operational results, customer focus and satisfaction, and general matters such as public responsibilities and employee training (Miyagawa and Yoshida, 2004). A five-point scale measured the responses from the questionnaire. The authors got a response rate of twenty-six percent from the 200 companies in the population. The results showed an increase in the company's performance among Japanese-owned manufacturers in China. This data also revealed that TQM programs help increase business performance in manufacturing companies.

Prasad, Motwani, and Tata (1999) completed a study using MBNQA to analyze the TQM programs within Costa Rican companies. The authors felt there was a need to recognize if Costa Rican companies could understand quality management methodologies by using TQM. Prasad et al. (1999) looked at the quality practices in Costa Rican companies to observe the weaknesses of the managers and specify particular areas of improvement. The authors looked at seven different areas in the study: "leadership, strategic quality planning, information and analysis, human resource development and management, management of process quality, customer focus and satisfaction, and quality and operational results" (p. 251). The authors utilized the seven criteria by using a seven-point Likert-scale and a two-point scale to ask a few yes and no questions. The authors concluded that many managers believed that quality leads to lower costs; thus, they needed to use quality as a strategic tool to advance themselves. Many Costa Rican companies understood TQM practices, but many of them did not use the program. Prasad et al. (1999) felt that companies

needed to practice the TQM program “as a part of their strategy to make a full place within global manufacturing” (p. 250).

Another study by Huarng and Chen (2002, p. 226) tested the idea that TQM enhanced quality performance. Consequently, Huarng and Chen (2002) distributed a questionnaire to observe whether “TQM philosophy enhanced quality performances, TQM methods enhanced quality performances, and the integration of TQM philosophy and TQM tools enhanced quality performance” (p. 226). Some, but not all, of the measures were successful. The strongest measures were customer focus, leadership, and management. Huarng and Chen (2002) concluded that the TQM program they used overall helped improve business performance. The authors were able to conclude that working teams, quality practices, close relationship with suppliers, and complex manufacturing technologies all played a role in the success of the company.

Jonas, Kihuo, and Tadashi (2002) analyzed the TQM program in 190 Japanese companies. The survey had 80 key elements translated into Japanese. The authors used a 5-likert scale in their questionnaire and had key elements based on seven categories (leadership, information and analysis system, strategic planning, human resources, customer and market, management process, and business results). The authors used the American MBNQA categories as a survey methodology to provide empirical support for TQM improvement and review. In conclusion, the authors felt that “although the TQM remains helpful for Japanese business performance, globalization has created a highly competitive environment where companies using

only TQM will not be able to survive in the long term” (p. 318). According to the authors, leadership, human resources, and strategic planning were the most successful in the Japanese TQM companies. In the end, Jonas et al. (2002) suggested that using a self-assessment questionnaire would be the best way to calculate the business performance of a company.

Another study examined the TQM philosophy to see if TQM was suitable for companies in Ireland. Walsh and his colleagues (2002) completed a study in Ireland about the TQM philosophy. This research used questionnaires, which were separated into a preliminary questionnaire and a secondary questionnaire. In the secondary questionnaire, the authors used both open and closed ended questions. The closed-ended questions had questions using the Likert-scale. The authors noticed that many Irish companies implemented TQM programs and discovered that TQM was suitable for their needs. They suggested that TQM programs offered companies a guarantee of success and competitiveness. Walsh et al. (2002) concluded that the TQM program was successful; but to improve the implementation, companies needed to concentrate more on the development and continuation of the TQM program.

Ooi, Baker, Arumugam, Vellapan, and Loke (2007) studied TQM practices and job satisfaction in Malaysian semiconductor organizations. This study was different from others because it investigated and examined the relationship between teamwork and TQM practices. The author did a case study and concentrated on one company. Two other managers who had implemented TQM already used the questionnaire used by this author. Employees from different job levels had questionnaires sent out to

them. Oii et al. (2007) used a 7-point Likert scale and received a return rate of 14.6 percent from the participants. Oii et al. (2007) received data from the questionnaires and was able to conclude “teamwork, organizational trust, organizational culture, and customer focus [were] positively associated with employees' job satisfaction” (p. 62). The authors were able to determine from the questionnaires that teamwork was a dominant TQM practice, leading to higher levels of job satisfaction. At the conclusion, Oii et al. (2007) noted that TQM practices highlighted the importance of teamwork and helped employees work together.

A study by Ziaul Huq concentrated on management issues in the TQM program. Huq (2005) focused on twenty companies from different industries, including health care and insurance, and studied them over a period of two years to observe significant changes in the management practices of the companies after implementing TQM. Most of the companies that succeeded in their management practices had strong leadership that stressed solving tactical problems. To gain information from different companies regarding their TQM implementation, the authors used a qualitative research technique. Huq (2005) used groups of MBA students to interview personnel from the companies. Huq (2005) was able to conclude that implementing the TQM program did have a positive effect in those industries.

Ozden Bayzit (2003) also did a study on TQM practices. Bayzit generalized that TQM was successful on a long-term basis. Bayzit's goal was to study the companies in Turkey to see how they practiced TQM. Bayzit used surveys and

questionnaires, mailing them to the quality managers and directors of the companies and discovered that most of the companies succeeded in “upper management support, employee participation and commitment, customer focus, quality education and training, teamwork, and use of statistical techniques because of the implementation of TQM” (p. 345). By the end of the study, Bayzit (2003) discovered that the reason many companies in Turkey implemented TQM was to generate a competitive advantage. In conclusion, the study was successful as it clarified that upper management, customer focus, employee participation, training, use of statistical analysis, and teamwork in Turkish companies led to improvements in quality.

Mohrman, Tenkasi, Lawler II, and Ledford Jr. (1995) surveyed 1000 large companies in the United States to see how companies practiced TQM and its individual outcomes. The survey consisted of the thirteen most commonly used practices of TQM in companies. These practices were separated into two different scales based on the usage of each of the practices. The two scales were cost of quality monitoring and the relationship of suppliers in a quality viewpoint. An evaluation was made for practices that did not fit either of the scales on an individual scale. The authors discovered from their results that in order to benefit from TQM, the companies needed to use the TQM standards more extensively. This study by Mohrman et. al. (1995) was one of the few studies that took an extensive look on the TQM practices in a company and “provided an overview of the [TQM practices] used by large US companies to survive in the new competitive environment” (p. 40).

Another study by Linus Osuagwu (2002) studied TQM strategies in Nigerian companies. Osuagwu (2002) researched three aspects of TQM: the emphasis of Nigerian companies on TQM implementation, “effects of environmental factors on TQM strategies, and relations of TQM strategies with environmental factors and organizational performance” (p. 140). The author concentrated on the upper staff including directors and managers as the subjects. Osuagwu (2002) used a common age group for working professionals and the author’s main idea was to evaluate how well the implementation of the TQM had taken place in Nigerian companies. Osuagwu (2002) used questionnaires consisting of five sections concentrating on different areas of the TQM strategy including extent of practice of the TQM, environmental factors, organizational performance measures, quantitative measures, and background data. One of the biggest factors that affected the TQM implementation was the environmental factor; however, in the end, Osuagwu (2002) concluded that implementing TQM was successful in the Nigerian companies.

As explained previously in this chapter, many research studies have focused on different aspects of TQM; however, all these studies reached the same conclusion. To have a successful implementation of TQM, quality performance and TQM should be one of the industry’s highest goals.

Chapter 3

Methodology

This chapter gives a detailed account of the methodology and procedures employed in this study. The chapter is organized into three different sections. The first section of this chapter discusses the population, the second section will focus on the instrumentation, and the last section will concentrate on mapping of the research questions and instrumentation.

Population of the Study

The study was conducted in the stent-device industry in the United States. There are four stent-device companies; all were included in the study. The selected companies had between 200 to 500 total employees in all their divisions. The companies were surveyed with the help of a questionnaire sent through mail. Respondents were primarily Quality Managers, Engineers, and Supervisors. The population surveyed is 100 employees in the quality department that worked in the four stent-device companies: Edwards Lifesciences, Medtronic, St. Jude Medical, and Memry Corporation. These stent companies were the top stent-device companies according to the U.S Food and Drug Administration (FDA) in 2007. The Quality Manager distributed the questionnaire and consent form to the employees in the Quality department (approximately fifteen employees in one of the company's division studied) during spring of 2008. The consent form (Appendix B) explains the voluntary nature of this research study and was verbally explained to the Quality Manager or the Human Resources.

Instrumentation

This research study identifies TQM practices in the stent-device industry. An empirical research study was constructed to detect whether the firms conducted a TQM implementation and identify the most important TQM practices related to the quality performances in the medical device industry.

The questionnaire in this study is derived from a previous study by Myers (2004). Myers used the questionnaire in a technical service organization, whereas the questionnaire in this study centered on stent-device companies. Lindsay and Petrick's (1997) used the questionnaire first, and then it was modified by Kontoghiorghes and Dembeck in 2001 and Myers in 2004. The questionnaire provided a linkage model to display any pertinent relationship between (a) external customer satisfaction and quality practices, (b) employee satisfaction with internal processes and quality practices, (c) quality work output from peers and quality practices, and (d) employees' resolutions to unexpected problems in a timely fashion. This research used the TQM standards developed by Myers (2004) in Table 3 as the basis for the questionnaire.

The survey instrument consisted of the consent form (Appendix B) and the questionnaire. The questionnaire in this study has 43 questions (Appendix C), 39 of which are the 6-point Likert scale, 1 open-ended question, and 3 demographic questions. The demographic questions consisted of the respondent's position in the company, respondent's education, and gender. These questions are optional because some respondents request confidentiality. The results for the demographic data are in Table 4.

Table 3

TQM Standards for the Questionnaire

From "Identification of Critical Total Quality Management and Sociotechnical Variables for Quality Performance in a Technical Services Organization", by P.J. Myers, 2004, Walden University, p. 113.

- | | |
|-----|---|
| 1. | Leadership support and participation |
| 2. | Continuous improvement |
| 3. | Customer satisfaction sensitivity |
| 4. | Organizational structures |
| 5. | Quality tools and equipment |
| 6. | Peer team support |
| 7. | Support for training and education |
| 8. | Communication and information sharing |
| 9. | Formal quality programs |
| 10. | Quality culture perceptions and awareness |
| 11. | Job satisfaction |

Validity. The questionnaire instrument fits the norm of internal validity.

Charles Stangor (2004) claims internal validity is “the extent to which changes in the dependent variable can confidently be attributed to the influence of the independent variable rather than to the potential influence of confounding variables” (p. 226).

Myers (2004) measured reliability using Cronbach’s alpha and the split-half technique and compared it to the reliability of Kontoghiorghes and Dembeck (2001). Kontoghiorghes and Dembeck (2001) had a reliability of 0.95 for their survey instrument (p. 40). Myers (2004) reliability lead to a Cronbach’s alpha of 0.94 and a split-half coefficient of 0.89 (p. 155).

Table 4

Demographic Data from Participants

Question #	Demographics	*Responses
41 (Position)	Member of a support function (secretary, customer service, HR, finance, sales, etc.)	0
	Engineer/Technician (engineer, biologist, chemist, geologists, etc.)	21
	Mid-level manager/supervisor (division, section, function)	8
	Senior level executive (CEO, president, vice president, director)	0
42 (Highest Degree Attained)	No high school	
	High school	2
	Technical certificate	
	Bachelors	16
	Masters	11
	Doctoral	
43 (Gender)	Male	15
	Female	14

* Note: One respondent did not respond to the demographic section of the questionnaire.

Mapping of Research Questions

Research Questions 1-4 are based on quality performances: Research Question 1 on external customer satisfaction, Research Question 2 on employee satisfaction with internal processes, Research Question 3 on employee job satisfaction with the quality work output from peers, and finally Research Question 4 on employees' reactions to rewards and communication. Research Question 5 compares all the quality performance indicators to the expected variables from Research Questions 1 through 4. In addition, the following approach identifies a link among the quality factors and a universal set of properties. Table 5 shows the mapping of the research

question to the survey questions. The table also shows the survey questions used for each research question.

Table 5

Mapping of Research Questions to the Dependent Variables and Survey Questions

Research Question	Dependent Variable	Survey Questions
What are the expected variables of external customer satisfaction with the quality of services provided by the stent-device organization? (Research Question 1)	Perception of External Customers Satisfaction	People in the organization turn to their supervisors for advice about how to improve their work (Q9)
		There are excellent working relationships between work teams in the organization (Q15)
		The right tools, equipment, material are available to get the job done (Q19)
		People in the organization care about meeting or exceeding their customers' expectations (Q23)
		The amount of work produced by the co-workers is in the approved/expected range (Q29)
		How the internal processes contribute to producing quality output (Q31)
		Employees react quickly and resolve unexpected problems in a timely fashion (Q35)
What are the expected variables of employee satisfaction within internal processes in the stent-device organization? (Research Question 2)	Perception of Employee Satisfaction	The structure of the organization makes it easy to focus on improving processes (Q12)
		People are rewarded when they produce high-quality output (Q22)
		Key processes in the organization are regularly measured and audited (Q26)
		Having a formal quality

		improvement process in place has impacted the quality output positively (Q27)
		The amount of work produced by the co-workers is in the approved/expected range (Q29)
What are the expected variables of employee satisfaction with the quality work output from associated employees in the stent-device organization? (Research Question 3)	Perception of quality of work output received from the fellow workers	People in the organization see the continuing improvement of work produced as essential to the success of the organization (Q5)
		People in the organization are challenged by their supervisors to find ways to improve the system (Q10)
		There is sufficient time for team members to perform jobs in a professional manner (Q21)
		The amount of work produced by the co-workers is in the approved/expected range (Q29)
		Employees react quickly and resolve unexpected problems in a timely fashion (Q35)
What are the expected variables that indicate employees to react quickly and resolve unexpected problems in a timely manner in the stent-device organization? (Research Question 4)	Perception of Reward and Communication	People in the organization see the continuing improvement of work produced as essential to the success of the organization (Q5)
		Supervisors provide guidance to make the continuous improvement of work produced a high priority (Q11)
		People in the organizations project/account/functional team share responsibility for the success or failure of work produced (Q14)
		People are rewarded when they produce high-quality output (Q22)
		Effective communication channels exist within and between work teams in the organization (Q24)

		How the internal processes contribute to producing quality output (Q31)
		Given opportunities for training and education to become better at my job (Q38)
To what extent is having all necessary skills and knowledge to perform one's job associated with quality performance in the stent-device organization? (Research Question 5)	Perception of Team Work	Quality of work output I receive from the fellow workers (Q30)
		How the internal processes contribute to producing quality output (Q31)
		External customers are satisfied with the quality of services provided (Q32)
		Inputs received from others in the organization to complete the tasks are received in a timely fashion (Q33)

Chapter 4

Results and Data Analysis

This chapter focuses on the results of the survey, data analysis, comparison of the dependent variables, and the findings for each research question.

The questionnaire consisted of 43 questions (Appendix C), 39 questions of which had a 6-point Likert scale rating with 1 indicating “Strongly Disagree” and 6 indicating “Strongly Agree.” Question 40 was an open-ended question; for this question, the respondents put any comments they felt would add to the understanding of quality issues in their organization. The questionnaire had three optional demographic questions (Table 4), which were Questions 41 through 43.

The questionnaire was sent to the Quality Managers who forwarded the questionnaires to their quality departments. Each division per company had at least 100 to 250 employees and approximately 15 employees (Manager, engineers, or supervisors) in the quality department. The entire population of the quality department employees received the survey and a total of 30 percent responded. For respondents, however, possible excuses the participants made to participate in the surveys included (a) unavailability of respondents, (b) disbelief in validity of surveys, (c) apathy towards subject of survey, and (d) lack of time to complete the survey.

According to Anton and Perkins (1997), if the response rate fell below thirty percent, this could show an increase of non-response error. The return rate on the questionnaires was at least thirty percent, which implied that the data could be analyzed and acceptable for this study.

The four stent companies used in this study were Edwards Lifesciences (Irvine Division), Medtronic (Santa Rosa Division), St. Jude Medical (St. Paul Division), and Memry Corporation (Menlo Park Division). For the Edwards Lifesciences' stent division, twenty questionnaires were sent out and ten questionnaires were returned with a return rate of 50 percent. Twenty questionnaires were sent to the Medtronic stent division and seven were returned with a return rate of 35 percent. Fifteen questionnaires were sent to St. Jude Medical stent division's quality department, and six questionnaires were returned with a return rate of 40 percent. There were twelve questionnaires sent to the quality department at Memry Corporation and seven were returned with a response rate of 58 percent. All questionnaires sent back were valid and usable for the study.

Table 6 presents a distribution of the survey questions that are separated into two categories. Variously agree represents the percentage of responses marked 4 (somewhat agree), 5 (agree), or 6 (strongly agree) and variously disagree represents the percentage of responses marked 1 (strongly disagree), 2 (disagree), or 3 (somewhat disagree). Twenty-two questions had a higher interrelated reliability with at least 80% variously agree. Six of the thirty-nine questions had lower than 67% indicated under variously agree. Also, Question 21 had the smallest percentage (37%) out of the 39 questions for variously agree.

The questionnaire also introduced one open-ended question (Question 40). This open-ended question provided an opportunity for the participants to express their thoughts on the quality system in their company. Not all respondents wrote

something for Question 40. There was a 33 percent response rate on Question 40 (Table 7). The comments primarily revolved around organizational structures, support for training and education, communication and information sharing from upper management to the rest of the employees, and quality culture perception and awareness.

Table 6

Distribution of Survey Responses

Question	Variously Agree (%)	Variously Disagree (%)
Q20 [Team members are committed to produce high quality work]	100%	0%
Q23 [People in the organization care about meeting or exceeding their customers' expectations]	100%	0%
Q28 [People experience stress in meeting responsibilities]	100%	0%
Q36 [Employee has necessary skills and knowledge to perform their job]	100%	0%
Q4 [Innovators get ahead in the organization]	100%	0%
Q30 [Team member are satisfied with the quality of work output from the rest of the team]	97%	3%
Q27 [Having a formal quality improvement process impacts quality output positively]	96%	4%
Q1 [People are aware of how their jobs contribute to quality]	93%	7%
Q14 [People in a team share responsibility]	93%	7%
Q17 [People in a team hold each other accountable for work produced]	93%	7%
Q34 [Easy accessibility with the people in the organization]	90%	10%
Q5 [People in the organization see the continuing improvement of work produced as essential to the success of the organization]	90%	10%
Q26 [Key processes are regularly measured and audited]	87%	13%

Q29 [Amount of work produced by team members is in an expected range]	87%	13%
Q37 [Supervisors encourage new skills and behavior]	87%	13%
Q9 [People turn to supervisors for advice]	87%	13%
Q16 [People within a team encourage others to work as a team]	83%	17%
Q32 [External customers are satisfied of the quality of services]	83%	17%
Q7 [People live to high ethical standards]	83%	17%
Q19 [The right tools and equipment are available to get the job done]	80%	20%
Q22 [People are rewarded]	80%	20%
Q38 [Employees have the opportunity for training and education]	80%	20%
Q11 [Supervisors provide guidance to make continuous improvements a high priority]	77%	23%
Q15 [There are excellent working relationships between work teams in the organization]	77%	23%
Q39 [Employees receive praise and recognition]	77%	23%
Q25 [Needed facts and information are available]	73%	27%
Q10 [People in the organization are challenged]	70%	30%
Q2 [People plan ahead for changes that could impact the organization]	70%	30%
Q3 [Creativity encourages organization]	70%	30%
Q8 [Senior managers emphasize quality]	70%	30%
Q31 [People are satisfied with the internal process]	67%	33%
Q35 [Employees react quickly and solve problems in a timely fashion]	67%	33%
Q6 [The organization emphasizes doing things right the first time]	67%	33%
Q13 [People in the organization don't a positive demonstrate attitude towards quality]	60%	40%
Q24 [Effective communication channels exist between teams]	53%	47%
Q33 [Inputs from the team members are received in a timely fashion]	53%	47%
Q12 [Structure of organization makes it easy to focus on improving the process]	50%	50%
Q18 [There are a few bureaucratic barriers to get the job done]	50%	50%

Q21 [There is sufficient time for team members to perform jobs in a professional manner]	37%	63%
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Table 7

Open-Ended Questionnaire Responses

1. Shorten the cycle time for any changes
2. More training and QE professional development (education) opportunities
3. Inclusion of more business focused initiatives
4. Provide cause and effect relationships between the quality system and the individual tasks that employees perform using the real specific examples to better understand the quality system concept; which is not clearly understood in the companies
5. Make every employee responsible for the knowledge of the quality system, not just those in the quality organization.
6. More lean-currently do many things which seem unnecessary
7. Current FDA guiding/standard available for all quality personnel
8. Paperwork reduction and more contact with customers to make decisions
9. Find a way to have a control work load flow
10. Ways to express when training is required or who has completed training
11. Making it more relevant to managing the business and placing less emphasis on maintaining our ISO certification

*Note: All respondents did not respond to the open-ended question on the questionnaire.

Data Analysis

Table 8 displays the mean, standard deviation (S.D.), and total number of responses to each of the questions (N). Question 21 (There is sufficient time for team members to perform jobs in a professional manner) had the lowest mean (3.17) and the highest standard deviation (1.42), whereas Question 28 (People in the organization experience stress in meeting workload responsibilities) had the highest mean (5.15) and the low standard deviation of 0.681. Having a standard deviation above 1 indicates differentiation between the data. If the standard deviation is within +/- 1, the data signify that approximately 68% of the data are within the bell curve. The smaller

the standard deviation, the closer the values are to the mean, which shows less variation.

Table 8

Descriptive Statistics for each Survey Question

	Mea n	S.D.	N
Q1 [People are aware of how their jobs contribute to quality]	4.47	.776	30
Q2 [People plan ahead for changes that could impact the organization]	3.67	.661	30
Q3 [Creativity encourages organization]	4.03	.964	30
Q4 [Innovators get ahead in the organization]	4.50	.572	30
Q5 [People in the organization see the continuing improvement of work produced as essential to the success of the organization]	4.33	.661	30
Q6 [The organization emphasizes doing things right the first time]	4.23	1.135	30
Q7 [People live to high ethical standards]	4.53	1.008	30
Q8 [Senior managers emphasize quality]	4.17	1.053	30
Q9 [People turn to supervisors for advice]	4.53	.937	30
Q10 [People in the organization are challenged]	4.03	.890	30
Q11 [Supervisors provide guidance to make continuous improvements a high priority]	4.07	.868	30
Q12 [Structure of organization makes it easy to focus on improving the process]	3.47	1.252	30
Q13 [People in the organization don't demonstrate a positive attitude towards quality]	3.93	1.337	30
Q14 [People in a team share responsibility]	4.60	.968	30
Q15 [There are excellent working relationships between work teams in the organization]	4.07	.980	30
Q16 [People within a team encourage others to work as a team]	4.13	.973	30
Q17 [People in a team hold each other accountable for work produced]	4.33	.606	30
Q18 [There are a few bureaucratic barriers to get the job done]	3.47	1.074	30

Q19 [The right tools and equipment are available to get the job done]	4.03	.928	30
Q20 [Team members are committed to produce high quality work]	4.60	.563	30
Q21 [There is sufficient time for team members to perform jobs in a professional manner]	3.13	1.432*	30
Q22 [People are rewarded]	4.20	1.126	30
Q23 [People in the organization care about meeting or exceeding their customers' expectations]	4.77	.728	30
Q24 [Effective communication channels exist between teams]	3.70	1.022	30
Q25 [Needed facts and information are available]	4.13	.819	30
Q26 [Key processes are regularly measured and audited]	4.50	.861	30
Q27 [Having a formal quality improvement process impacts quality output positively]	4.62	.824	24
Q28 [People experience stress in meeting responsibilities]	5.13	.681	30
Q29 [The amount of work produced by team members is in an expected range]	4.20	.925	30
Q30 [Team member are satisfied with the quality of work output from the rest of the team]	4.37	.890	30
Q31 [People are satisfied with the internal process]	4.00	1.050	30
Q32 [External customers are satisfied of the quality of services]	4.30	.988	30
Q33 [Inputs from the team members are received in a timely fashion]	3.70	.837	30
Q34 [Easy accessibility with the people in the organization]	4.27	.785	30
Q35 [Employees react quickly and solve problems in a timely fashion]	3.93	1.015	30
Q36 [Employee has necessary skills and knowledge to perform their job]	4.73	.740	30
Q37 [Supervisors encourage new skills and behavior]	4.33	.758	30
Q38 [Employees have the opportunity for training and education]	4.50	1.106	30
Q39 [Employees receive praise and recognition]	4.10	1.155	30

* This question has a high standard deviation

Since there are many questions with a high standard deviation, a comparative chart is used to show the averages of each company's response to each question.

Table 9 shows the averages and standard deviation for each question and company. The table illustrated if there were any major changes between companies. Instead of naming each company by its name, the companies are called Company A, Company B, Company C, and Company D.

Table 9

Comparative Chart of each Companies Averages

Question #	Company A	Company B *	Company C	Company D
	Mean/S.D.	Mean/ S.D.	Mean/ S.D.	Mean/ S.D.
Q1 [People are aware of how their jobs contribute to quality]	4.80/1.03	3.80/0.38	4.40/0.55	4.50/0.54
Q2 [People plan ahead for changes that could impact the organization]	3.80/0.63	3.00/0.69	4.00/0.00	4.00/0.00
Q3 [Creativity encourages organization]	4.30/0.82	2.80/0.38	5.00/0.89	4.00/0.00
Q4 [Innovators get ahead in the organization]	4.40/0.70	4.20/0.49	5.00/0.00	4.50/0.54
Q5 [People in the organization see the continuing improvement of work produced as essential to the success of the organization]	4.50/0.85	4.00/0.69	4.60/0.52	4.00/0.00
Q6 [The organization]	4.90/1.01	3.60/0.98	3.00/0.00	5.00/0.00

emphasizes doing things right the first time]				
Q7 [People live to high ethical standards]	5.20/0.79	3.20/0.49	4.60/0.55	5.00/0.90
Q8 [Senior managers emphasize quality]	5.20/0.63	3.00/0.69	3.40/0.52	4.50/0.54
Q9 [People turn to supervisors for advice]	4.30/1.06	4.00/1.38	4.60/0.52	5.00/0.00
Q10 [People in the organization are challenged]	4.30/1.06	3.40/0.98	3.60/0.52	4.50/0.54
Q11 [Supervisors provide guidance to make continuous improvements a high priority]	4.20/1.23	3.80/0.38	3.40/0.55	4.50/0.54
Q12 [Structure of organization makes it easy to focus on improving the process]	4.10/1.00	2.00/0.69	3.00/0.00	4.50/0.54
Q13 [People in the organization don't a positive demonstrate attitude towards quality]	4.40/0.84	2.60/0.76	3.00/0.98	5.50/0.54
Q14 [People in a team share responsibility]	4.40/1.27	4.20/0.38	4.60/0.84	5.50/0.54
Q15 [There are excellent working relationships between work teams]	4.10/0.74	4.00/1.29	3.60/1.37	4.50/0.54

in the organization]				
Q16 [People within a team encourage others to work as a team]	4.00/0.94	4.00/0.69	4.20/1.76	4.00/0.00
Q17 [People in a team hold each other accountable for work produced]	4.30/0.68	3.80/0.38	4.60/0.52	4.50/0.54
Q18 [There are a few bureaucratic barriers to get the job done]	3.50/0.97	3.00/1.35	3.00/0.98	4.00/1.00
Q19 [The right tools and equipment are available to get the job done]	4.00/0.94	3.40/0.90	4.60/0.52	4.50/0.54
Q20 [Team members are committed to produce high quality work]	4.90/0.57	4.00/0.00	5.00/0.00	4.50/0.54
Q21 [There is sufficient time for team members to perform jobs in a professional manner]	3.15/1.33	2.20/0.90	2.00/0.00	5.00/0.00
Q22 [People are rewarded]	4.80/0.42	3.40/1.11	3.60/1.37	5.00/0.95
Q23 [People in the organization care about meeting or exceeding their customers' expectations]	4.70/0.82	4.00/0.00	5.00/0.00	5.50/0.54
Q24 [Effective	4.20/0.92	3.20/0.38	2.40/0.55	4.50/0.54

communication channels exist between teams]				
Q25 [Needed facts and information are available]	4.30/0.82	3.20/0.38	4.00/0.00	5.00/0.00
Q26 [Key processes are regularly measured and audited]	5.00/0.94	4.00/0.69	4.00/0.98	4.50/0.54
Q27 [Having a formal quality improvement process impacts quality output positively]	5.44/0.53	4.20/0.76	N/A/N/A	4.00/0.00
Q28 [People experience stress in meeting responsibilities]	5.40/0.52	5.20/0.90	5.40/0.52	4.50/0.54
Q29 [The amount of work produced by team members is in an expected range]	4.10/1.37	4.00/0.00	4.00/0.98	4.50/0.54
Q30 [Team member are satisfied with the quality of work output from the rest of the team]	4.00/1.16	4.40/0.54	5.00/0.98	4.50/0.54
Q31 [People are satisfied with the internal process]	4.40/0.84	3.40/0.79	2.60/0.52	5.00/0.00
Q32 [External customers are satisfied of the quality of services]	4.70/0.68	3.00/1.00	5.00/0.00	4.50/0.54
Q33 [Inputs from	4.00/0.82	3.00/0.58	3.60/0.52	4.00/1.00

the team members are received in a timely fashion]				
Q34 [Easy accessibility with the people in the organization]	4.30/1.06	4.00/0.95	4.00/0.00	4.50/0.54
Q35 [Employees react quickly and solve problems in a timely fashion]	4.00/0.94	3.40/0.54	4.20/1.60	4.00/0.90
Q36 [Employee has necessary skills and knowledge to perform their job]	4.70/0.82	4.40/0.54	5.60/0.55	4.50/0.54
Q37 [Supervisors encourage new skills and behavior]	4.70/0.95	3.80/0.82	4.00/0.00	4.50/0.54
Q38 [Employees have the opportunity for training and education]	4.20/1.48	4.20/1.38	4.60/0.52	5.00/0.00
Q39 [Employees receive praise and recognition]	4.00/1.49	4.00/0.69	3.00/0.98	5.00/0.00

Analyzing the data from Table 9, Company B has the lowest averages.

Company B has been dealing with layoffs, realigning the quality system, and change of management. This researcher believes that Company B's data is artificially affected by external forces; therefore this researcher will eliminate Company B from the data analysis, to see a better analysis of the research questions. Table 10 displays the mean, standard deviation for all companies except Company B.

Table 10

Descriptive Statistics of each Survey Question excluding Company B's Responses

	N	Mean	S.D.
Q1 [People are aware of how their jobs contribute to quality]	23	4.65	.775
Q2 [People plan ahead for changes that could impact the organization]	23	3.91	.417
Q3 [Creativity encourages organization]	23	4.39	.783
Q4 [Innovators get ahead in the organization]	23	4.57	.590
Q5 [People in the organization see the continuing improvement of work produced as essential to the success of the organization]	23	4.39	.656
Q6 [The organization emphasizes doing things right the first time]	23	4.43	1.121
Q7 [People live to high ethical standards]	23	4.91	.793
Q8 [Senior managers emphasize quality]	23	4.48	.947
Q9 [People turn to supervisors for advice]	23	4.61	.783
Q10 [People in the organization are challenged]	23	4.17	.834
Q11 [Supervisors provide guidance to make continuous improvements a high priority]	23	4.13	.968
Q12 [Structure of organization makes it easy to focus on improving the process]	23	3.96	.928
Q13 [People in the organization don't a positive demonstrate attitude towards quality]	23	4.30	1.259
Q14 [People in a team share responsibility]	23	4.74	1.054
Q15 [There are excellent working relationships between work teams in the organization]	23	4.09	.900
Q16 [People within a team encourage others to work as a team]	23	4.13	1.058
Q17 [People in a team hold each other accountable for work produced]	23	4.48	.593

Q18 [There are a few bureaucratic barriers to get the job done]	23	3.57	.992
Q19 [The right tools and equipment are available to get the job done]	23	4.30	.765
Q20 [Team members are committed to produce high quality work]	23	4.78	.518
Q21 [There is sufficient time for team members to perform jobs in a professional manner]	23	3.43	1.441
Q22 [People are rewarded]	23	4.48	.994
Q23 [People in the organization care about meeting or exceeding their customers' expectations]	23	5.00	.674
Q24 [Effective communication channels exist between teams]	23	3.87	1.100
Q25 [Needed facts and information are available]	23	4.43	.662
Q26 [Key processes are regularly measured and audited]	23	4.61	.891
Q27 [Having a formal quality improvement process impacts quality output positively]	17	4.76	.831
Q28 [People experience stress in meeting responsibilities]	23	5.13	.626
Q29 [The amount of work produced by team members is in an expected range]	23	4.26	1.054
Q30 [Team member are satisfied with the quality of work output from the rest of the team]	23	4.35	.982
Q31 [People are satisfied with the internal process]	23	4.13	1.100
Q32 [External customers are satisfied of the quality of services]	23	4.70	.559
Q33 [Inputs from the team members are received in a timely fashion]	23	3.91	.793
Q34 [Easy accessibility with the people in the organization]	23	4.26	.752
Q35 [Employees react quickly and solve problems in a timely fashion]	23	4.09	1.083
Q36 [Employee has necessary skills and knowledge to perform their job]	23	4.83	.778

Q37 [Supervisors encourage new skills and behavior]	23	4.43	.728
Q38 [Employees have the opportunity for training and education]	23	4.57	1.037
Q39 [Employees receive praise and recognition]	23	4.09	1.276

Analyzing the standard deviations from Table 8 and Table 10, removing Company B has led to changes in the thirteen standard deviations that were above 1.0. There are four Survey Questions (Questions 7, 8, 12, and 22) resulting to a lower standard deviation (standard deviation below 1.0) after removing Company B, three Survey Questions (Question 6, 13, and 39) having a lower standard deviation, but still above 1.0, and seven Survey Questions (Questions 18, 21, 24, 29, 31, 35, and 38) with a higher standard deviation than when Company B was included.

Using the data from the three remaining companies, a Pearson correlation was conducted for correlations between each dependent variable and the related survey questions. A strong Pearson correlation is any value of 0.40 or higher. This was the best method since the sample size was too small to use any other method to analyze the data. Table 11 shows each dependent variable with all the positive correlations. Company B is removed from the data analysis.

Table 11

Pearson's Correlation with each Dependent Variable

Dependent Variable	Strong Pearson Correlation	Pearson Value
Perception of External	Q6 [The organization emphasizes doing things right the first time]	0.432

customers satisfaction	Q21 [There is sufficient time for team members to perform jobs in a professional manner]	0.449
	Q28 [People experience stress in meeting responsibilities]	0.509
	Q31 [People are satisfied with the internal process]	0.450
Perception of Employee Satisfaction	Q6 [The organization emphasizes doing things right the first time]	0.763
	Q8 [Senior managers emphasize quality]	0.592
	Q11 [Supervisors provide guidance to make continuous improvements a high priority]	0.453
	Q12 [Structure of organization makes it easy to focus on improving the process]	0.807
	Q13 [People in the organization don't a positive demonstrate attitude towards quality]	0.692
	Q14 [People in a team share responsibility]	0.541
	Q15 [There are excellent working relationships between work teams in the organization]	0.631
	Q18 [There are a few bureaucratic barriers to get the job done]	0.638
	Q21 [There is sufficient time for team members to perform jobs in a timely manner]	0.823
	Q22 [People are rewarded]	0.647
	Q24 [Effective communication channels exist between teams]	0.879
	Q25 [Needed facts and information are available]	0.605
	Q28 [People experience stress in meeting responsibilities]	0.422
	Perception of Quality of work output received from the fellow workers	Q4 [Innovators get ahead in the organization]
Q10 [People in the organization are challenged]		0.422
Q13 [People in the organization don't demonstrate attitude towards quality]		0.420
Q15 [There are excellent working relationships between work teams in the organization]		0.427
Q16 [People within a team encourage others to work as a team]		0.655
Q17 [People in a team hold each other accountable for work produced]		0.638
Q29 [The amount of work produced by team members is in an expected range]		0.435

Perception of Reward and Communication	Q2 [People plan ahead for changes that could impact the organization]	0.420
	Q3 [Creativity encourages organization]	0.548
	Q5 [People in the organization see the continuing improvement of work produced as essential to the success of the organization]	0.461
	Q14 [People in a team share responsibility]	0.459
	Q15 [There are excellent working relationships between work teams in the organization]	0.784
	Q16 [People within a team encourage others to work as a team]	0.545
	Q18 [There are a few bureaucratic barriers to get the job done]	0.798
	Q22 [People are rewarded]	0.508
	Q33 [Inputs from the team members are received in a timely fashion]	0.591
	Perception of Team Work	Q4 [Innovators get ahead in the organization]
Q6 [The organization emphasizes doing things right the first time]		0.587
Q13 [People in the organization don't demonstrate attitude towards quality]		0.454
Q16 [People within a team encourage others to work as a team]		0.526
Q17 [People in a team hold each other accountable for work produced]		0.583
Q20 [Team members are committed to produce high quality work]		0.691
Q30 [Team member are satisfied with the quality of work output from the rest of the team]		0.681
Q32 [External customers are satisfied of the quality of services]		0.500
Q33 [Inputs from the team members are received in a timely fashion]		0.417
Q35 [Employees react quickly and solve problems in a timely fashion]		0.450

Research Question 1

Questions 9, 15, 19, 23, 29, 31, and 35 (See Appendix C) assessed the perception of external customer satisfaction. Table 12 shows the descriptive statistics with the mean and standard deviation for the survey questions in Research Question 1. Table 12 shows high means for all factors related to external customer satisfaction. This indicates a positive perception of external customer satisfaction. However, Questions 29, 31, and 35 have a standard deviation greater than 1.0.

Table 12

Descriptive Statistics for External Customer Satisfaction

	N	Mean	Std. Deviation
Q9 [People turn to supervisors for advice]	23	4.61	.783
Q15 [There are excellent working relationships between work teams in the organization]	23	4.09	.900
Q19 [The right tools and equipment are available to get the job done]	23	4.30	.765
Q23 [People in the organization care about meeting or exceeding their customers' expectations]	23	5.00	.674
Q29 [The amount of work produced by team members is in an expected range]	23	4.26	1.054
Q31 [People are satisfied with the internal process]	23	4.13	1.100
Q35 [Employees react quickly and solve problems in a timely fashion]	23	4.09	1.083

Figures 2, 3, 4 illustrated scatter plots for Survey Questions 29 (Amount of work produced by team members is in an expected range), 31 (People are satisfied with the internal process), and 35 (Employees react quickly and solve problems in a timely fashion). Figure 2 showed four minor outliers and one significant outlier. If

the outliers were removed, the standard deviation would be 0.51 for Question 29 (The amount of work produced by team members in an expected range). Figure 3 shows the individual responses separately for each company. Company C had the lowest ratings, where the respondents gave Question 31 a rate of 2 or 3. If Company C ratings were removed, the standard deviation for Question 31 (People are satisfied with the internal process) would be 0.70. Figure 4 had four minor outliers. If the four outliers are removed, the standard deviation would be 0.74.

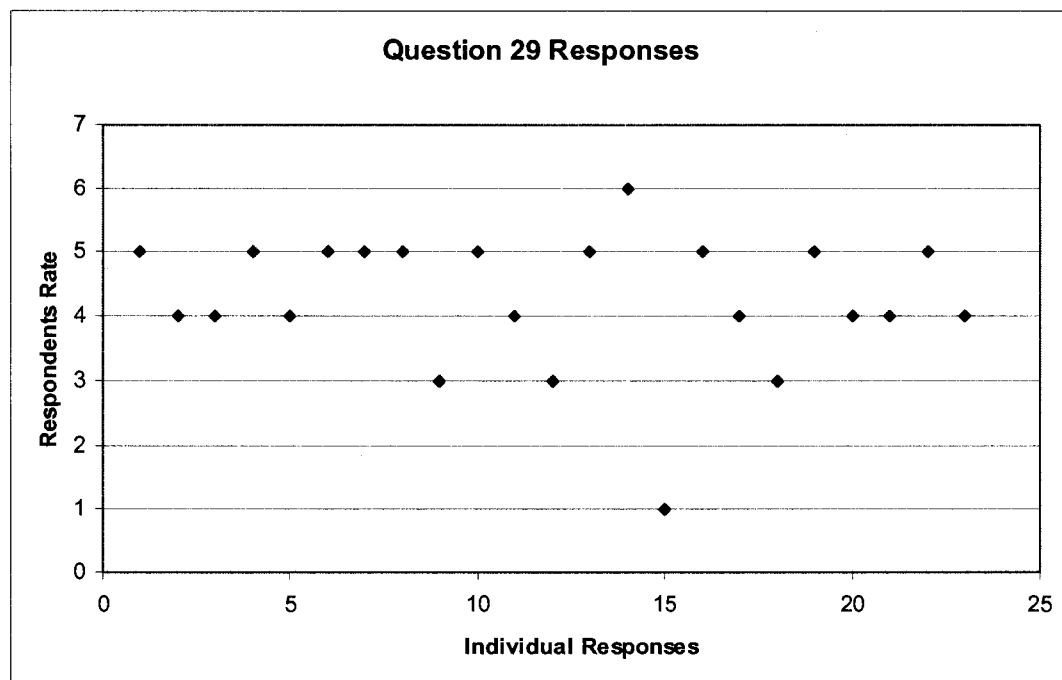


Figure 2. Scatter Plot for Question 29 (The amount of work produced by team members is in an expected range).

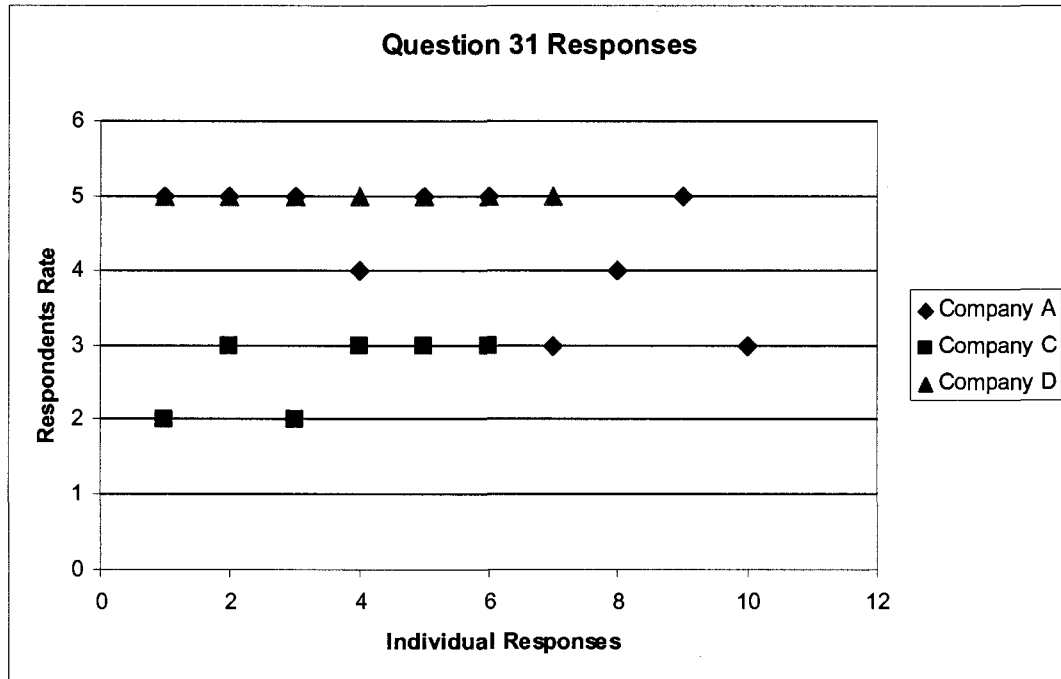


Figure 3. Scatter Plot for Question 31 (People are satisfied with the internal process).

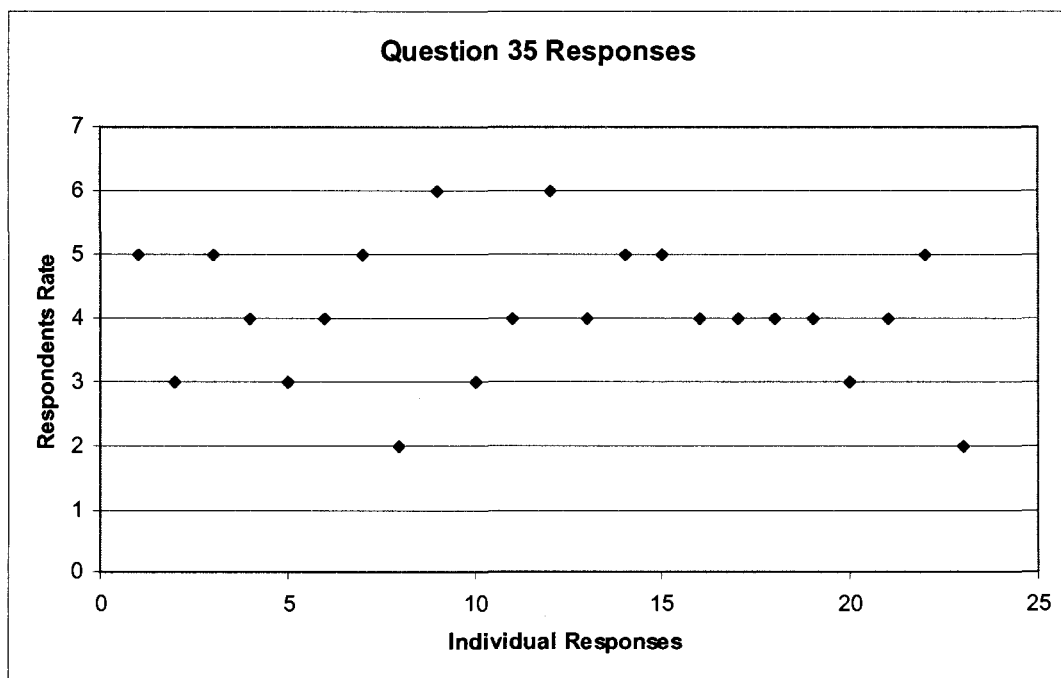


Figure 4. Scatter Plot for Question 35 (Employees react quickly and solve problems in a timely fashion).

According to the Pearson correlation matrix, external customer satisfaction had a positive correlation with one of the six survey questions used to assess this research question. Question 31 (People are satisfied with the internal process) was the only survey question with a strong correlation of 0.450.

Research Question 2

Dependent variable 2 (employee satisfaction) was evaluated with Survey Questions 12, 22, 26, 27, and 29 (Appendix C). Table 13 showed the descriptive statistics with the mean and standard deviation for the survey questions for Research Question 2. The means for employee satisfaction were either in the high 3's or in the 4's.

Table 13

Descriptive Statistics for Employee Satisfaction

	N	Mean	Std. Deviation
Q12 [Structure of organization makes it easy to focus on improving the process]	23	3.96	.928
Q22 [People are rewarded]	23	4.48	.994
Q26 [Key processes are regularly measured and audited]	23	4.61	.891
Q27 [Having a formal quality improvement process impacts quality output positively]	17	4.76	.831
Q29 [The amount of work produced by team members is in an expected range]	23	4.26	1.054

Figure 5 showed a slightly normal distribution histogram with employee satisfaction and residual frequencies of the Survey Questions (Questions 12, 22, 26,

27, and 29). Most of the responses to the survey questions for employee satisfaction do not fall within the bell shaped curve. Table 14 represented the Pearson correlation matrix for employee satisfaction. Employee satisfaction had a positive correlation will all survey questions. Questions 12 (Structure of organization makes it easy to focus on improving the process) had a strong positive correlation of 0.807 and Question 22 (People are awarded) had a stronger positive correlation of 0.647 with employee satisfaction.

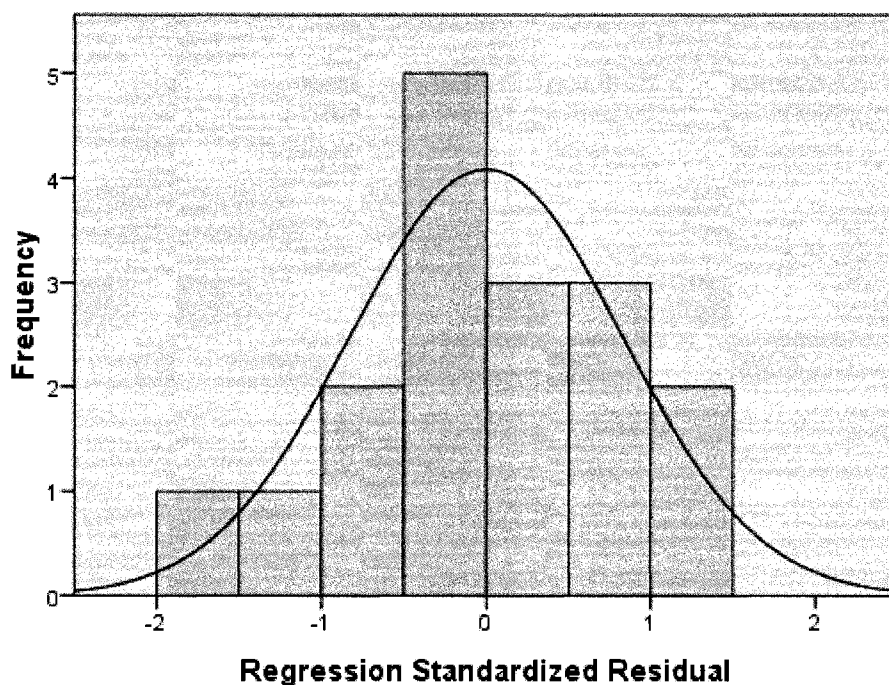


Figure 5. Histogram for Dependent Variable 2 (Employee Satisfaction).

Table 14

Pearson Correlation Matrix for Employee Satisfaction

Perception of Employee Satisfaction	<i>r</i>
Q12 [Structure of organization makes it easy to focus on improving the process]	0.807
Q22 [People are rewarded]	0.647
Q26 [Key processes are regularly measured and audited]	0.379
Q27 [Having a formal quality improvement process impacts quality output positively]	0.063
Q29 [The amount of work produced by team members is in an expected range]	0.048

Research Question 3

Questions 5, 10, 21, 29, and 35 (See Appendix C) assessed “quality of work output from fellow workers.” Table 15 illustrated the descriptive statistics with the mean and standard deviation for the survey questions in Research Question 3. The means are nominal with the means in the high 3’s and low 4’s, indicating a nominal perception of “quality of work output from fellow workers.” However, Questions 21, 29, and 35 had a standard deviation greater than 1.0 for “quality of work output from fellow workers.”

Figures 2, 4 and 6 showed the scatter plots for Survey Questions 21 (Enough time for team members to perform jobs in a professional manner), Question 29 (The amount of work produced by team members is in an expected range) and Question 35 (Employees react quickly and solve problems in a timely fashion). The scatter plots for Questions 29 and 35 demonstrated that if the minor outliers are removed, then the

standard deviation would be lower, expressing less variation than the individual responses. Question 21 had a higher standard deviation than the other survey questions since there was a greater variation from the respondents. All the respondents for Company C had rated Question 21 (There is sufficient time for team members to perform jobs in a professional manner) a 2 (Disagree). If Company C was removed and the two significant outliers from Company A were removed, the standard deviation would be much lower (0.85).

Table 15

Descriptive Statistics for "Quality of Work Output from Fellow Workers"

	N	Mean	Std. Deviation
Q5 [People in the organization see the continuing improvement of work produced as essential to the success of the organization]	23	4.39	.656
Q10 [People in the organization are challenged]	23	4.17	.834
Q21 [There is sufficient time for team members to perform jobs in a professional manner]	23	3.43	1.441
Q29 [The amount of work produced by team members is in an expected range]	23	4.26	1.054
Q35 [Employees react quickly and solve problems in a timely fashion]	23	4.09	1.083

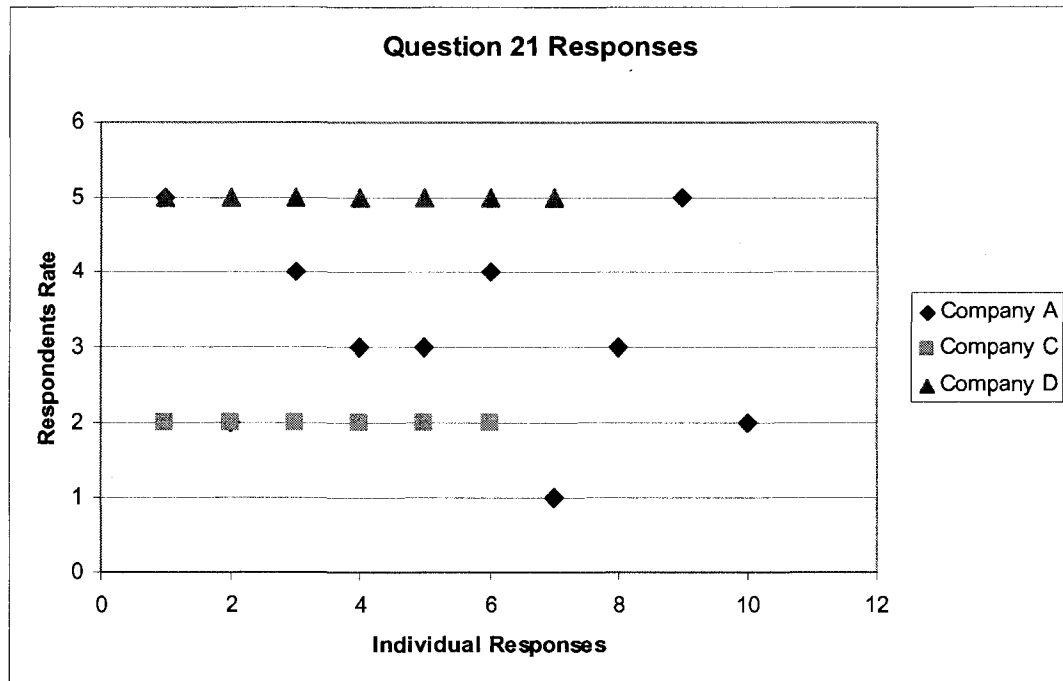


Figure 6. Scatter Plot for Question 21 (There is sufficient time for team members to perform jobs in a timely manner).

The histogram in Figure 7 illustrated a normal distribution with “quality of work output from fellow workers” and the residual frequencies of the Survey Questions (Questions 5, 10, 21, 29, and 35). Most of the responses to the survey questions for “quality of work output from fellow workers” did fall within the bell-shaped curve.

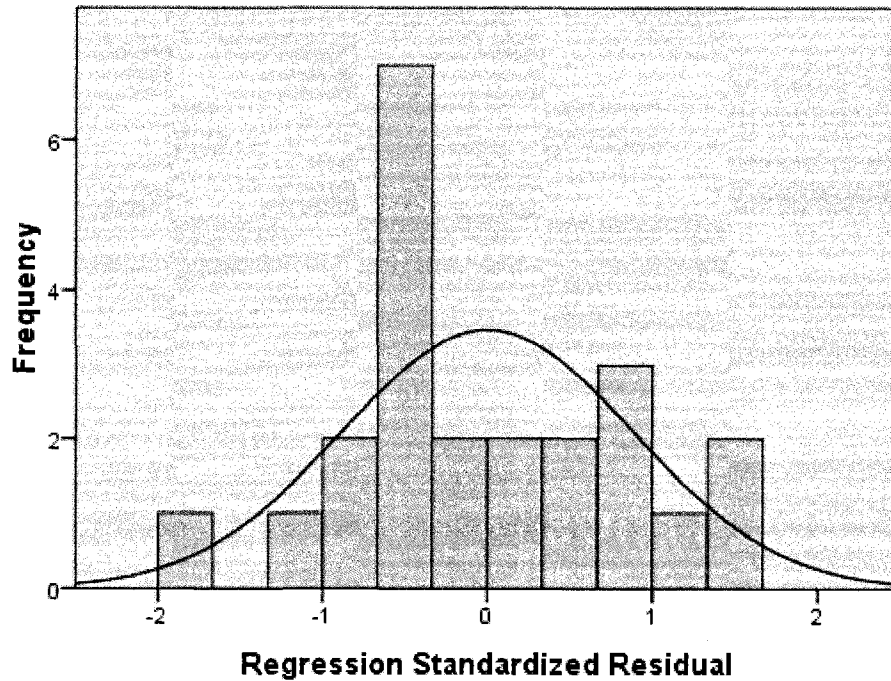


Figure 7. Histogram for Dependent Variable 3 (“Quality of Work Output from Fellow Workers”).

According to the Pearson correlation matrix (Table 16), “quality of work output from fellow workers” demonstrated a positive correlation to most of the Survey Questions (Questions 5, 10, 21, 29, and 35). In regards to dependent variable 3, all the Survey Questions (Questions 5, 10, 21, 29, and 35) revealed a positive correlation, but Question 10 (People in the organization are challenged), $r = 0.422$ and Question 29 (The amount of work produced by team members is in an expected range), $r = 0.435$ demonstrated a strong correlation.

Table 16

Pearson Correlation Matrix for “Quality of Work Output from Fellow Workers”

Perception of Quality of Work Output from fellow Workers	R
Q5 [People in the organization see the continuing improvement of work produced as essential to the success of the organization]	0.132
Q10 [People in the organization are challenged]	0.422
Q21 [There is sufficient time for team members to perform jobs in a professional manner]	0.177
Q29 [The amount of work produced by team members is in an expected range]	0.435
Q35 [Employees react quickly and solve problems in a timely fashion]	0.355

Research Question 4

Survey Questions 5, 11, 14, 22, 24, 31, and 38 (See Appendix C) assessed dependent variable 4 (reward and communication). Table 17 showed the descriptive statistics with the mean and standard deviation for the survey questions in Research Question 4. The means were nominal with the means in the high 3’s and low 4’s, indicating a nominal perception of reward and communication. However, Questions 14, 24, 31, and 38 had a standard deviation greater than 1.0 for reward and communication.

Table 17

Descriptive Statistics for Reward and Communication

	N	Mean	Std. Deviation
Q5 [People in the organization see the continuing improvement of work produced as essential to the success of the organization]	23	4.39	.656
Q11 [Supervisors provide guidance to make continuous improvements a high priority]	23	4.13	.968
Q14 [People in a team share responsibility]	23	4.74	1.054
Q22 [People are rewarded]	23	4.48	.994
Q24 [Effective communication channels exist between teams]	23	3.87	1.100
Q31 [People are satisfied with the internal process]	23	4.13	1.100
Q38 [Employees have the opportunity for training and education]	23	4.57	1.037

Research Question 4 had five survey questions with a high standard deviation (Questions 14, 22, 24, 31, and 38). Figures 3, 8, 9, 10, and 11 showed the scatter plots for Survey Questions 14 (People in a team share responsibility), Question 22 (People are rewarded), Question 24 (Employees Effective communication channels exist between teams), Question 31 (People are satisfied with the internal process), and Question 38 (Employees have the opportunity for training and education). The scatter plot for Question 14 had two significant outliers. If the two outliers were removed, the standard deviation would be 0.80. Questions 22 and 24 also had minor outliers, that if removed, the standard deviations will be below 1.0. Question 31 would have a

lower standard deviation if Company C was removed. Question 38 had one significant outlier, and if removed the standard deviation would be 0.70.

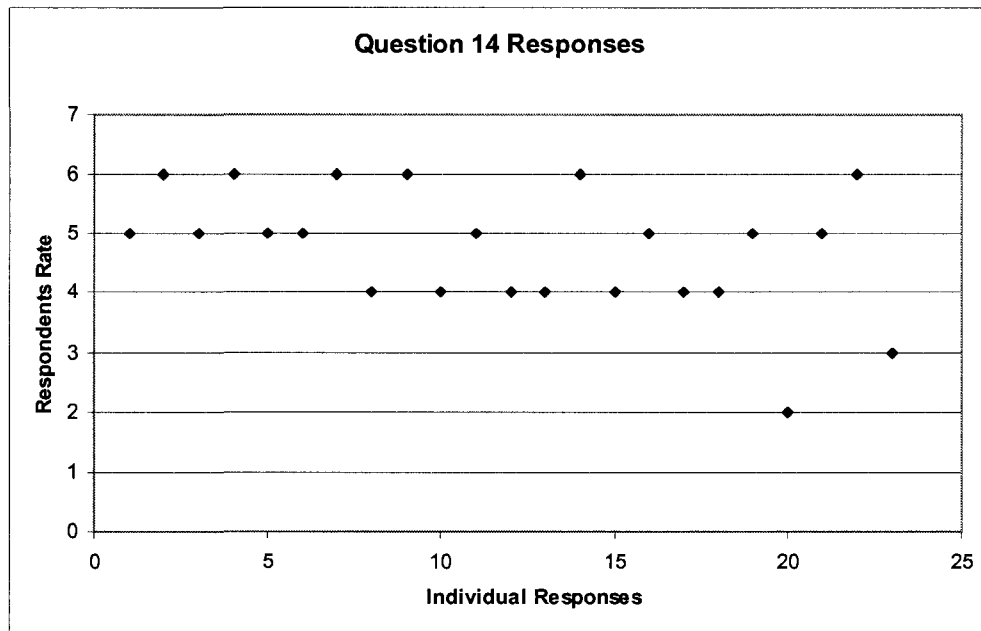


Figure 8. Scatter Plot for Question 14 (People in a team share responsibility).

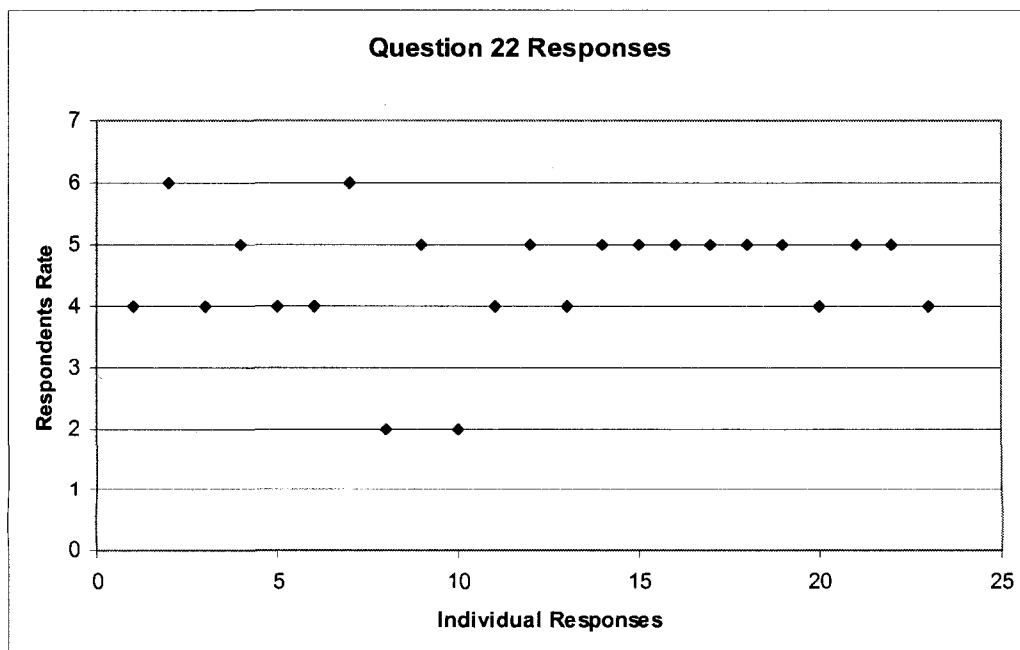


Figure 9. Scatter Plot for Question 22 (People are rewarded).

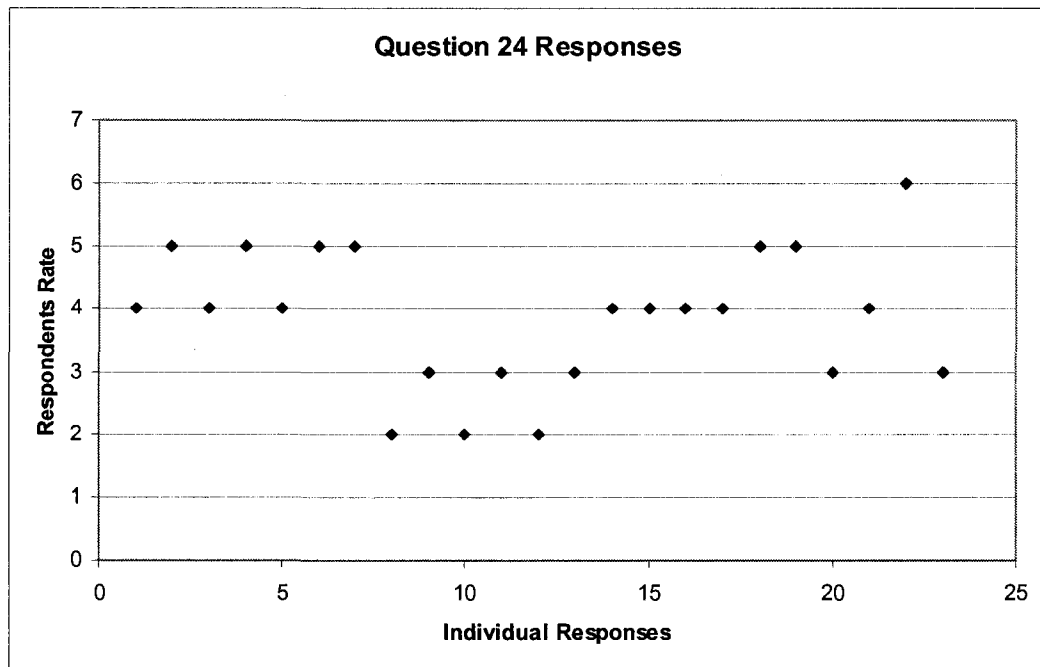


Figure 10. Scatter Plot for Question 24 (Employees Effective communication channels exist between teams).

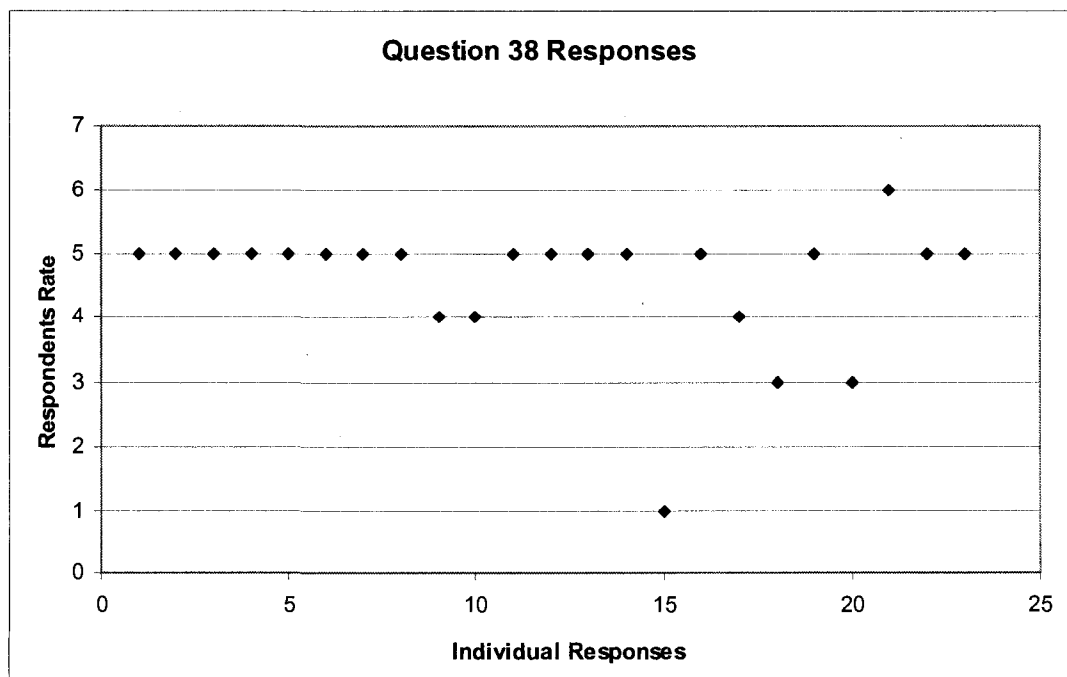


Figure 11. Scatter Plot for Question 38 (Employees have the opportunity for training and education).

The histogram in Figure 12 illustrated a slightly skewed distribution with high standard deviations, since many of the Survey Questions (Questions 5, 11, 14, 22, 24, 31, and 38) had a standard deviation greater than 1.0. Most of the responses to the survey questions for reward and communication do fall within the bell shaped curve.

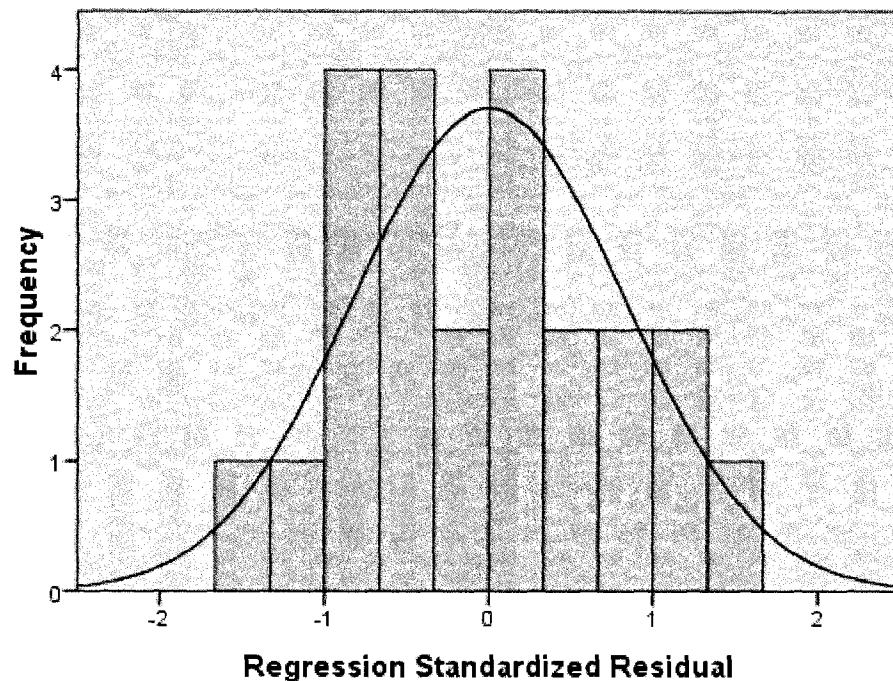


Figure 12. Histogram for Dependent Variable 4 (Reward and Communication).

The Pearson correlation matrix in Table 18 illustrated the correlation between the Survey Questions (Questions 5, 11, 14, 22, 24, 31, and 38) and dependent variables 4 (perception of reward and communication). All the survey questions had a positive correlation with dependent variable 4 (perception of reward and communication), but only Question 5 (People in the organization see the continuing improvement of work produced as essential to the success of the organization),

Question 14 (People in a team share responsibility), and Question 22 (People are rewarded) had a strong positive correlation with dependent variable 4 (perception of reward and communication).

Table 18

Pearson Correlation Matrix for Reward and Communication

Perception of Reward and Communication	<i>r</i>
Q5 [People in the organization see the continuing improvement of work produced as essential to the success of the organization]	0.461
Q11 [Supervisors provide guidance to make continuous improvements a high priority]	0.162
Q14 [People in a team share responsibility]	0.459
Q22 [People are rewarded]	0.508
Q24 [Effective communication channels exist between teams]	0.201
Q31 [People are satisfied with the internal process]	0.333

Research Question 5

Research Question 5 intended to compare all the quality performances (Dependent variables 1-4) to teamwork. The Pearson correlation for teamwork to the quality performances indicators are shown in Table 19. Question 31 (People are satisfied with the internal process) was the only quality performance with a weak correlation, since each company had a different opinion of their internal processes. All the data and results are put together to make conclusions regarding TQM. Chapter 5 discusses the conclusions and recommendations from the study.

Table 19

Pearson Correlation Matrix for Teamwork

Perception of Teamwork	<i>r</i>
Q30 [Team member are satisfied with the quality of work output from the rest of the team]	0.618
Q31 [People are satisfied with the internal process]	0.238
Q32 [External customers are satisfied of the quality of services]	0.500
Q35 [Employees react quickly and solve problems in a timely fashion]	0.450

Chapter 5

Summary, Conclusion, and Recommendations

The primary purpose of this study was to identify any problems with the implementation of TQM in stent device companies. This study also recognized the quality factors that are similar within companies and the areas that need more improvement. The problems faced in this study are the strength of the quality indicators and the small population. The conclusions derived from the five research questions. To measure the research questions, the data came from the 39-item questionnaire and an open-ended question. While Research Question 1 stemmed from external customer satisfaction, job satisfaction was the focus of Research Questions 2, 3, and 4. Research Question 5 was a comparison indicator of TQM.

Research Question 1. What are the determinants of external customer satisfaction with the quality of services provided by the stent-devices organization?

The descriptive statistics, scatter plots, and Pearson's correlation depicted a model summary for external customer satisfaction and the quality indicators. All survey questions for Research Question 1 had high means and positive correlation with the quality indicators, especially in regards to "People are satisfied with the internal process." Aside from this strong correlation, there are weaker correlations including-amount of work produced by team members is in an expected range, employees satisfied with their internal processes, and companies not providing support and training on quick employee response to problems.

Research Question 2. What are the determinants of employee satisfaction within internal processes in the stent-device organization?

The descriptive statistics, scatter plots, histogram, and Pearson's correlation depicted a model summary for employee satisfaction discussed in Chapter 4. The two-tailed Pearson correlation indicated a positive correlation with all variables. There are some strong positive correlations with quality indicators such as "Structure of organization makes it easy to focus on improving the process" and "Employees are rewarded." "The amount of work produced by team members in an expected range" had a weaker correlation since the standard deviation was high.

Research Question 3. What are the determinants of employee satisfaction with the quality work output from associated employees in the stent-device organization?

The descriptive statistics, scatter plots, histogram, and Pearson's correlation depicted a model summary for "quality of work output" discussed in Chapter 4. Using a two-tailed Pearson correlation, all variables demonstrated a positive correlation with "quality of work output." The variable with the strongest correlation to "quality of work output" were "People in the organization are challenged" and "Amount of work produced by team members is in an expected range." Even though these had the strongest correlation, the quality indicators, including amount of work produced by "team members are in an expected range", "enough time for team members to perform jobs in a professional manner", and "employees react quickly and solve problems in a timely fashion" are problems faced by the employees in the remaining companies.

Research Question 4. What are the determinants of that indicate reward and communication from upper management in the stent-device organization?

The descriptive statistics, scatter plots, histogram, and Pearson's correlation depicted a model summary for reward and communication discussed in Chapter 4. A two-tailed Pearson correlation test illustrates a positive correlation with reward and communication, but five of the seven survey questions related to Research Question 4 have a high standard deviation. "Employees see continuing improvement of work a success", "employees in a team share responsibility", and "employees are rewarded" have the strongest positive correlation with dependent variable 4.

Research Question 5. To what extent is having all necessary skills and knowledge to perform one's job associated with teamwork in the stent-device organization?

Research Question 5 was used to measure the quality performances indicated in Research Questions 1-4. There was no regression analysis for this research question, but a Pearson correlation matrix analysis was conducted on the data. From the correlations, all variables had a strong correlation, except "employees not satisfied with their company's internal process".

Conclusion

The purpose of this study was to distinguish the important TQM factors in stent-device companies. After identifying the expected variables for all the dependent variables, there are a total of 24 expected variables (quality indicators) and four dependent variables used for this study. The expected variables that showed quality performance satisfaction are the following:

- Employees in the organization turn to their supervisors for advice about how to improve their work.
- There are excellent working relationships between work teams in the organization.
- The right tools, equipment, and materials are available to get the job done.
- Employees in the organization care about meeting or exceeding their customers' expectations.
- The structure of the organization makes it easy to focus on improving processes.
- In this organization, people are rewarded when they produce high-quality output.
- Key processes in the organization are regularly measured and audited.

- Having a formal quality improvement process in place has impacted the company's quality output positively.
- Employees in the organization see the continuing improvement of work produced as essential to the success of the organization.
- Employees in the organization are challenged by their supervisors to find ways to improve the system.
- Supervisors provide guidance to make the continuous improvement of work produced a high priority.

Putting aside the positive effects of employee satisfaction, the companies should enhance themselves by having rewards and a particular structure to improve their quality output. Some possible improvements to increase an employee's work output within a company include managers not only satisfying employees through enthusiasm, but also training employees to manage their time efficiently. In essence, a direct improvement in education and training would produce higher employee work output. In addition to companies giving rewards for high quality output, companies need to concentrate on empowering training and education to all employees so they know how to solve problems in an effective manner and learn to communicate with teams members. Managers could provide guidance to their peers to make improvements on the quality system.

The Pearson correlation is the best indication to see if a variable has any correlation with the dependent variables. From the results, it turns out that there are

more irrelevant variables per research question than expected variables since many of the correlations were not strong. When reviewing Research Question 5 on correlations with quality performances, there are more strong correlations with knowledge and skills.

Some of the questions in Chapter 4 were analyzed by company to determine whether there were any differences in the responses. For specific questions (Question 21, Figure 6 and Question 31, Figure 3), there were significant differences between Company C and the other remaining two companies. Therefore TQM was not consistent between companies in the stent device industry.

Furthermore, none of the literature reviewed in Chapter 2 used the same TQM factors as in this present study. Many companies followed Deming's 14 points, but created their own TQM factors as they continued with the implementation, tending to disregard a few of the important points. From the data collected, not all stent companies used TQM to improve customer satisfaction. The stent device companies that were evaluated in this study followed few of the TQM factors, such as continuous improvements, organizational structures, peer team support, and communication and information sharing. The main factors missing from these companies are quality tools and equipment, support for training and education, formal quality programs, and job satisfaction. Employees exceeded their customer expectations but none necessarily had TQM in place in their companies. TQM is not necessary in a company, but in order to show an extensive continuous improvement and customer satisfaction, TQM would be an advantage.

Recommendations for Further Research

Some recommendations for further studies were identified from the findings in this study. Having a Likert-scale of 6 might be the cause of getting more positive answers than negative answers. If this study used an odd number Likert-scale, (i.e. 5 or 7 Likert-scale) then the participant might have used the neutral point more efficiently and not always leaned toward the highest number. Other recommendations would be adding more indicators to the questionnaire in addition to having a bigger population.

The questionnaire used in this study came from a study of TQM and Sociotechnical Systems, whereas this study used the questionnaire to determine TQM implementation in the stent device industry. Moreover, the population was so small that making an assumption would not be strategically correct. Finally, if the population involved other participants that were not in the quality department, the data would bring a greater, variety of opinions.

References

- Agus, A., & Abdullah, M. (2000). Total quality management practices in manufacturing companies in Malaysia: An exploratory analysis. *Total Quality Management, 11*(8), 1041-1051.
- American Society of Quality. (n.d.). *Total quality management*. Retrieved February 10, 2008, from <http://www.asq.org/learn-about-quality/total-quality-management/overview/overview.html>
- Anderson, J., Rungtusanatham, M., & Schroeder, R. (1994). A theory of quality management underlying the Deming management method. *Academy of Management Review, 19*(3), 472-509.
- Anton, J., & Perkins, D. (1997). *Listening to the voice of the customer*. New York: The Customer Service Group.
- Bayzit, O. (2003). Total quality management (TQM) practices in Turkish manufacturing organizations. *The TQM Magazine, 15*(5), 345-350.
- Chase, R. L. (1998). Creating a knowledge management business strategy to deliver bottom line results. *Management Trends International, 1*(1), 111-112.
- Customer satisfaction. (2008). In *BNET business dictionary*. Retrieved March 17, 2008, from <http://dictionary.bnet.com/definition/Customer+Satisfaction.html>
- Dean, J. W., & Bowen, D. E. (1994). Management theory and total quality: Improving research and practice through theory development. *Academy of Management Review, 19*(3). 392-418.
- Deming, E. (2006). *TQM-Fourteen points of Management*. Retrieved December 11, 2006, from http://www.valuebasedmanagement.net/methods_deming_14_points_management.html
- El-Kafafi, S. (2006). TQM models and their effectiveness in New Zealand water utilities services. *The TQM Magazine, 18*(5), 440-454.
- Engineering Statistics Handbook. (n.d.). *Quantile-quantile plot*. Retrieved February 15, 2008, from <http://www.itl.nist.gov/div898/handbook/eda/section3/qqplot.htm>
- Gurnani, H. (1999). Pitfalls in total quality management implementation: The case of a Hong Kong company. *Total Quality Management, 10*(2), 209-228.

- Ho, S. K. (1995). *TQM: An integrated approach* (3rd. ed.). Philadelphia, PA: Kogan Page Publishers.
- Huarnng, F., & Chen, Y. (2002). Relationships of TQM philosophy, methods and performance: A survey in Taiwan. *Industrial Management and Data Systems*, 102(4), 226-234.
- Huq, Z. (2005). Managing change: A barrier to TQM implementation in service industries. *Managing Service Quality*, 15(5), 452-469.
- Joiner, B. L., & Sholtes, P. R. (1986). The quality manager's new job. *Quality Progress*, 9(10), 52-56.
- Jonas, G. S., Kihuo, N., & Tadashi, O. (2002). Evaluation of TQM in Japanese industries and validation of a self-assessment questionnaire. *The TQM Magazine*, 14(5), 318-328.
- Juran, J. M., & Gryna, F. (1980). *Quality planning and analysis*. New York: McGraw.
- Kontoghiorghes, C., & Dembeck, D. (2001). Prioritizing quality management and sociotechnical variables in terms of quality performance. *Quality Management Journal*, 8(3), 41.
- Leadership Institute. (2005). *Who is Dr. W. Edwards Deming?* Retrieved January 3, 2007, from <http://www.lii.net/deming.html>
- Lindsay, W. M., & Petrick, J. A. (1997). *Total quality and organization development*. Boca Raton, FL: St. Lucia Press.
- Longenecker, C. O., & Scazzero, J. A. (1993). Creating a climate for quality. *Supervision*, 54(1), 14-16.
- Maccoby, M. (1992). Creating an empowered organization. *Research Technology Management*, 35(1), 50-51.
- Miyagawa, M., & Yoshida, K. (2004). An empirical study of TQM practices in Japanese-owned manufacturers in China. *International Journal of Quality & Reliability Management*, 22(6), 536-553.
- Mohrman, S. A., Tenkasi, R. V., Lawler II, E. E., & Ledford, G. E., Jr. (1995). Total quality management: Practice and outcomes in the largest US firms. *Employee Relations*, 17(3), 26-41.

- Myers, P. J. (2003). *Identification of critical total quality management and sociotechnical variables for quality performance in a technical services organization*. Ph.D. dissertation, Walden University, United States-Minnesota. Retrieved April 8, 2008, from ProQuest Digital Dissertations database. (Publication No. AAT 3118892).
- Ooi, K. B., Baker, N. A., Arumugam, V., Vellapan, L., & Loke, A. K. Y. (2007). Does TQM influence employees' job satisfaction? An empirical case analysis. *International Journal of Quality & Reliability Management*, 24(1), 62-77.
- Ooi, K. B., Veeri, A., Yin, L. K., & Vellapan, L. S. (2006). Relationships of TQM practices and employees' propensity to remain: An empirical case study. *The TQM Magazine*, 18(5), 528-541.
- Osuagwu, L. (2002). TQM strategies in a developing economy: Empirical evidence from Nigerian companies. *Business Process Management Journal*, 8(2), 140-160.
- Pearson, J. M., McCahon, C. S., & Hightower, R. T. (1995). Total quality management: Are information system managers ready? *Information and Management*, 29(5), 252-263.
- Prasad, S., Motwani, J., & Tata, J. (1999). TQM practices in Costa Rican companies. *Work Study*, 48(7), 250-256.
- Rahman, Z., & Siddiqui, J. (2006). Exploring total quality management for information systems in Indian firms. *Business Process Management Journal*, 12(5), 622-631.
- Soltani, E., Lai, P., & Gharnah, N. S. (2005). Breaking through barriers to TQM effectiveness: Lack of commitment of upper-level management. *Total Quality Management & Business Excellence*, 26(8/9), 1009.
- Stangor, C (2005). *Research methods for the behavioral sciences* (2nd ed.). New York: Houghton Mifflin Company.
- Stepwise regression. (2008). In *Wikipedia*. Retrieved March 3, 2008, from http://en.wikipedia.org/wiki/Stepwise_regression
- Talha, M. (2004). Total quality management (TQM): An overview. *The Bottom Line: Managing Library Finances*, 17(1), 15-19.
- Total quality management. (n.d.). *Q/P management group, INC*. Retrieved February 10, 2008, from <http://www.qpmg.com/tqm.htm>

- TQM- A cornerstone of quality. (2006). *Quality Progress*, 39(11), 32.
- UCLA: Academic Technology Services, Statistical Consulting Group. (n.d.). *Introduction to SAS*. Retrieved March 1, 2008, from <http://www.ats.ucla.edu/stat/sas/notes2/> (accessed).
- Waldman, D. A. (1994). The contributions of total quality management to a theory of work performance. *Academy of Management Review*, 19(3), 510-536.
- Walsh, A., Hughes, H., & Maddox, D. P. (2002). Total quality management continuous improvement: Is the philosophy a reality? *Journal of European Industrial Training*, 26(6), 299-307.
- What is total quality management? (n.d.). Retrieved January 15, 2008, from <http://www.kwaliteg.co.za/tqm/Total%20Quality%20Management.htm>
- Zeitz, G., Johannesson, R., & Ritchie J. E., Jr. (1997). An employee survey measuring total quality management practices and culture. *Group and Organization Management*, 22(4), 414.

Appendix A: Permission to Collect Data from IRB



San José State
UNIVERSITY

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To: Parul Dhamija

From: Pamela Stacks, Ph.D.
Associate Vice President
Graduate Studies and Research

Date: March 17, 2008

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

“Exploring total quality management in stent companies”

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to all data that may be collected from the subjects. The approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Dr. Pamela Stacks, Ph.D. immediately. Injury includes but is not limited to bodily harm, psychological trauma, and release of potentially damaging personal information. This approval for the human subject's portion of your project is in effect for one year, and data collection beyond March 17, 2009 requires an extension request.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services that the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at (408) 924-2480.

Protocol # S0802011

cc. Patricia Backer. 0061

The California State University:
Chancellor's Office
Bakersfield, Channel Islands, Chico,
Dominguez Hills, East Bay, Fresno,
Fullerton, Humboldt, Long Beach,
Los Angeles, Maritime Academy,
Monterey Bay, Northridge, Pomona,
Sacramento, San Bernardino, San Diego,
San Francisco, San José, San Luis Obispo,
San Marcos, Sonoma, Stanislaus

Appendix B: Consent Form

Researcher: Parul Dhamija
SJSU Graduate Student

Exploring Total Quality Management in Stent Companies

Letter to Study Participants

You are invited to participate in a survey that will gather information on Total Quality Management in your organization. This survey is being conducted with the understanding of your Quality Manager. You have been selected for this survey because you are full-time employee of this organization with knowledge of its work environment. Your responses to this survey will not be disclosed to your company. We ask that you read this form and ask any questions you may have before taking the survey.

1. You will be asked to complete a survey related to Total Quality Management
2. There is no foreseeable risk anticipated to any individual in the product group due to the project undertaken.
3. There are no discernable benefits expected in this project.
4. Although the results of this project may be published, no information that could identify you will be included.
5. There is no compensation for any participation.
6. Question about research/project may be addressed to Parul Dhamija, (510) 673-1238. Complaints about the research may be presented to Dr. Patricia Ryaby Backer, Director of General Engineering, at (408) 924-3214. Questions about research subjects' right or research-related injury may be present to Pamela Stacks, Ph.D., Associate Vice President, Graduate Studies and Research, at (408) 924-2480.
7. No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose to "not participate" in the study.
8. Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. You have the right to not answer questions you do not want to answer. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with San Jose State University or with any other participating institutions or agencies.
9. Completion of this survey indicates your willingness to participate in this study.
10. Please keep the consent form for your records and refer to it to reach the above-mentioned contacts in case they are needed.

Appendix C: Questionnaire

Total Quality Management Survey

Please use the following scale to indicate your answers to the statements below.

	1	2	3	4	5	6
	Strongly disagree	Disagree	Somewhat disagree	Somewhat agree	Agree	Strongly Agree
There is no right or wrong answers. Write the number (1,2,3,4,5, or 6) that best indicates the extent of your agreement with each statement below. Using a 1 – 6 Likert scale rating with 1 indicating Strongly Disagree and 6 indicating Strongly Agree.						
1.	People in the organization are aware of how their jobs contribute to the organization's quality mission.					
2.	People in the organization try to plan ahead for changes that might impact the organization's future performance.					
3.	Creativity is actively encourages in the organization.					
4.	Innovators are the people who get ahead in the organization.					
5.	People in the organization see the continuing improvement of work produced as essential to the success of the organization.					
6.	The organization emphasizes doing things right the first time.					
7.	People in the organization live up to high ethical standards.					
8.	Senior managers place great emphasis on quality.					
9.	People in the organization turn to their supervisors for advice about how to improve their work.					
10.	People in the organization are challenged by their supervisors to find ways to improve the system.					
11.	My supervisors provide guidance to make the continuous improvement of work produced a high priority.					
12.	The structure of the organization makes it easy to focus on improving processes.					
13.	Overall, people in my organization rarely demonstrate cynical attitudes towards quality.					
14.	People on my project/account/functional team share responsibility for the success or failure of work produced.					
15.	There are excellent working relationships between work teams in the organization.					
16.	People within the project team encourage each other to work as a team.					
17.	People working together on a project hold each other accountable for work produced.					
18.	There are few bureaucratic barriers to getting the job done properly.					

19.	The right tools, equipment, material are available to get the job done.	
20.	My fellow team members are committed to producing high-quality work.	
21.	There is enough time for people in the work group to perform jobs in a professional manner.	
22.	In this organization, people are rewarded when they produce high-quality output.	
23.	People in the organization care about meeting or exceeding their customers' expectations.	
24.	Effective communication channels exist within and between work teams in the organization.	
25.	The facts and information needed to do a good job are available to the people on project/account/functional teams.	
26.	Key processes in the organization are regularly measured and audited.	
27.	I feel that having a formal quality improvement process in place has impacted our quality output positively.	
28.	People in the organization experience stress in meeting workload responsibilities.	
29.	The amount of work produced by my co-workers is in the approved/expected range.	
30.	I am satisfied with the quality of work output I receive from my fellow workers.	
31.	I am satisfied with how our internal processes contribute to producing quality output.	
32.	External customers are satisfied with the quality of services we provide.	
33.	The inputs I receive from others in the organization to complete my tasks are received in a timely fashion.	
34.	I always have easy accessibility to people I need to interface with in order to perform my job.	
35.	In this organization, employees react quickly and resolve unexpected problems in a timely fashion.	
36.	I have all the necessary skills and knowledge to perform my job.	
37.	In this organization, supervisors' strongly encourage the acquisition and use of any new relevant skills and behaviors.	
38.	I am given opportunities for training and education to become better at my job.	
39.	When I apply new skills and knowledge, I always receive praise and recognition from my supervisor.	
40.	If I could change one thing about the quality system, I would change the following:	

Demographics (positions, education, and sex)		
41.	<p>1= Member of a support function (secretary, customer service, HR, finance, sales, etc.)</p> <p>2= Engineer/technician (engineer, biologist, chemist, geologists, etc.)</p> <p>3= Mid-level manager/supervisor (division, section, function)</p> <p>4= Senior level executive (CEO, president, vice president, director)</p>	
42.	<p>Highest Degree Attained:</p> <p>1= No high School</p> <p>2= High School</p> <p>3= Technical Certificate</p> <p>4= Bachelor</p> <p>5= Masters</p> <p>6= Doctoral</p>	
43.	<p>Sex:</p> <p>1= Male</p> <p>2= Female</p>	

Appendix D: Pearson Correlation

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Q1	1.000	0.324	0.235	0.450	0.548	0.234	0.466	0.175	-0.085	0.028	0.063	-0.022	0.020
Q2		1.000	0.387	0.579	0.462	0.376	0.251	0.110	0.727	-0.085	0.255	0.225	0.053
Q3			1.000	0.385	0.662	-0.047	-0.162	-0.264	0.113	-0.039	0.050	-0.288	-0.541
Q4				1.000	0.225	-0.251	0.304	-0.180	0.205	0.068	0.104	-0.202	-0.181
Q5					1.000	0.191	0.068	0.051	0.223	-0.130	-0.084	-0.120	-0.426
Q6						1.000	0.351	0.737	0.358	0.159	0.406	0.587	0.610
Q7							1.000	0.482	0.089	-0.182	-0.103	0.242	0.438
Q8								1.000	0.019	0.235	0.276	0.645	0.635
Q9									1.000	0.039	0.310	0.288	0.034
Q10										1.000	0.759	0.304	0.077
Q11											1.000	0.462	0.190
Q12												1.000	0.673
Q13													1.000

	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39
Q1	0.161	0.285	0.227	0.106	0.109	0.164	0.318	0.007	0.200	0.046	0.200	0.030	-0.106
Q2	0.237	-0.129	0.261	0.188	0.224	-0.119	0.251	-0.069	0.420	0.091	0.430	0.329	0.186
Q3	0.556	0.077	-0.240	0.229	-0.273	0.181	0.057	-0.181	0.548	0.266	0.087	-0.061	-0.172
Q4	0.200	0.161	0.264	0.430	-0.259	0.408	0.304	0.165	0.204	0.521	0.143	0.346	-0.068
Q5	0.458	0.202	-0.023	0.132	-0.074	-0.032	0.156	-0.216	0.461	0.139	0.103	-0.139	-0.151
Q6	0.342	-0.214	0.092	-0.309	0.763	-0.432	0.096	-0.033	0.155	-0.587	0.538	-0.065	0.322
Q7	0.294	0.299	0.028	-0.193	0.222	-0.062	0.060	-0.113	-0.044	-0.173	0.462	0.007	-0.127
Q8	0.705	0.273	0.051	-0.382	0.592	-0.142	0.239	0.136	0.046	-0.314	0.476	-0.288	0.077
Q9	-0.142	-0.262	0.350	0.126	0.168	-0.285	0.016	0.027	0.149	-0.192	0.392	0.453	0.400
Q10	-0.226	-0.220	0.308	0.422	0.271	0.021	0.505	0.649	0.133	0.049	0.094	0.354	0.583
Q11	0.031	-0.255	0.544	0.333	0.453	-0.259	0.430	0.701	0.162	-0.029	0.432	0.557	0.726
Q12	0.016	-0.068	0.012	-0.232	0.807	-0.290	0.303	0.278	0.320	-0.137	0.366	-0.068	0.502
Q13	-0.230	-0.168	0.040	-0.420	0.692	-0.315	0.028	0.056	-0.154	-0.454	0.196	-0.138	0.153
Q14	0.020	-0.360	0.310	0.399	0.541	-0.218	0.407	0.377	0.459	0.275	0.392	0.432	0.592
Q15	0.107	-0.344	-0.073	0.427	0.631	0.055	0.584	0.368	0.784	0.412	0.217	0.091	0.626
Q16	0.106	-0.370	0.090	0.655	0.063	0.070	0.394	0.355	0.545	0.526	-0.077	0.344	0.530
Q17	-0.164	-0.176	0.300	0.638	0.039	0.185	0.382	0.523	0.286	0.583	-0.082	0.501	0.483
Q18	0.139	-0.344	0.026	0.256	0.638	-0.086	0.701	0.220	0.798	0.251	0.274	0.073	0.498
Q19	-0.027	0.103	0.630	0.397	-0.103	0.014	0.420	0.488	-0.033	0.399	-0.004	0.461	0.018
Q20	0.617	0.512	0.192	0.245	-0.107	0.389	0.394	0.385	0.278	0.691	0.382	0.070	-0.108
Q21	-0.237	-0.520	0.461	0.177	0.823	-0.449	0.353	0.436	0.208	-0.173	0.332	0.437	0.745
Q22	0.233	-0.324	-0.211	0.148	0.647	-0.135	0.344	0.190	0.508	0.054	0.328	-0.010	0.539
Q23	-0.095	-0.216	0.256	0.275	0.368	0.121	0.255	0.179	0.311	0.347	0.000	0.130	0.211
Q24	0.135	-0.371	0.148	-0.082	0.879	-0.363	0.299	0.263	0.201	-0.240	0.301	0.068	0.591
Q25	-0.279	-0.253	0.286	0.106	0.605	-0.363	0.422	0.401	0.198	-0.023	-0.221	0.089	0.383
Q26	0.638	0.177	0.307	-0.149	0.379	0.115	0.336	0.363	-0.057	0.225	0.414	0.103	0.151

	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39
Q27	1.000	0.483	-0.124	-0.260	0.063	0.043	0.087	-0.051	0.270	0.248	0.412	-0.248	-0.267
Q28		1.000	0.015	-0.225	-0.422	0.509	0.024	0.021	-0.085	0.236	0.169	-0.329	-0.584
Q29			1.000	0.435	0.048	-0.168	0.300	0.656	-0.220	0.058	0.201	0.691	0.388
Q30				1.000	-0.128	0.119	0.449	0.549	0.355	0.618	-0.030	0.602	0.446
Q31					1.000	-0.450	0.326	0.232	0.333	-0.238	0.323	0.012	0.639
Q32						1.000	0.143	-0.019	0.121	0.500	0.005	-0.239	-0.407
Q33							1.000	0.574	0.591	0.417	0.305	0.339	0.412
Q34								1.000	0.082	0.392	0.199	0.560	0.639
Q35									1.000	0.450	0.180	-0.086	0.290
Q36										1.000	-0.101	0.127	0.062
Q37											1.000	0.322	0.251
Q38												1.000	0.580
Q39													1.000