CHALLENGES AND BARRIERS AFFECTING THE SUCCESS OF TOTAL QUALITY MANAGEMENT

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Challenges and Barriers Affecting the Success of Total Quality Management

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ABSTRACT

This thesis is a compilation of two papers. The first provides an overview of TQM from its beginnings through today's business climate. The fundamental principles of TQM are explored and the benefits identified. A review of the challenges and barriers that prohibit most companies from achieving these successes is conducted to understand why well intentioned companies are not always able to sustain this management technique. The second paper analyzes these challenges and barriers of TQM attempting to quantify their impact on the success of a TQM program. This study analyzes survey data using Structural Equation Modeling. The findings indicate the challenges associated with some of the TQM Principles are correlated and a few of them have an impact on the success of a TQM program. This research is unique in its attempt to apply quantifiable measures to the challenges faced by organizations that endeavor to implement TQM programs.

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DEDICATION

This thesis is dedicated to my children, Porter and Lily. I hope to lead you best by example.

TABLE OF CONTENTS

ABSTRACT……...iii

ACKNOWLEDGEMENTS……iv

DEDICATION……v

LIST OF TABLES…….....x

LIST OF FIGURES……xi

INTRODUCTION AND RESEARCH MOTIVATION…..……..……..1

PAPER 1. CHALLENGES AND BARRIERS TO TOTAL QUALITY MANAGEMENT: AN OVERVIEW……..……..…….....3

Abstract…...……..……...3

Introduction……...……...…….……...3

Evolution of Quality Management Theory…….……..……...4

Total Quality Management Principles…….…..……..…….8

Leadership and Top Management Commitment……...…….....8

Strategic Planning……...……..…...9

Human Resource Inclusion…….……..…...9

Transforming Organizational Culture……..……..10

Integration of Supply Chain……..……..…...10

Dynamic Customer Focus……..……....11

Continuous Improvement……..….11

Benefits of Total Quality Management and Measures of Success……..…….....12

Quality Improvements……..…….12

Increased Productivity……...13

Increased Profitability and Market Share……..……13

Greater Customer Satisfaction and Competitive Advantage…….....14

Development Process Improvements……..……...……....14

Greater Job Satisfaction……..…….....15

Common Language……..…….....15

Total Quality Management Challenges and Barriers…….....15

Leadership and Top Management Commitment……..…….....16

Strategic Planning……..…….....17

Human Resource Inclusion…….....17

Transforming Organizational Culture…….....18

Integration of Supply Chain……...……...……..19

Dynamic Customer Focus……..……....20

Continuous Improvement……...21

Future Research and Direction……...……...……...……..22

References……...…….……..22

PAPER 2. CHALLENGES AND BARRIERS AFFECTING THE SUCCESS OF TOTAL QUALITY MANAGEMENT…….…….……...28

Abstract…...……..…….28

Introduction…….....28

Literature Review……...…….. …….……...30

Hypothesis Development……...……. ……..……31

Research Methodology…….....……..…. ……....38

Data Analysis Approach……...……...……..……...…….41

Path Analysis…….……....41

Measurement Model……..……41

Correlation Study……..……..…...43

Structural Model……..……..……46

Data Analysis and Discussion…….....….. …….……...……46

Path Analysis…….……....46

Measurement Model……..…49

Correlation Study……..…….....50

Structural Model……..……..……51

Conclusion…...…..……..……..……...…….54

References…….……...……..54

CONCLUSION AND FUTURE RESEARCH DIRECTION….……..59

APPENDIX: TOTAL QUALITY MANAGEMENT SURVEY……...……60

LIST OF TABLES

Table Page

1. Profile of Respondents……... ……..…….40

2. Hypothesis of Relationships Between Each of the TQM Principles…….44

3. Path Analysis Results……..……..47

4. Correlation Study Results……...……...51

5. Hypothesis Coefficients……..……...53

LIST OF FIGURES

Figure Page

1. Hypothesis Development Model……... ……37

2. Relationships Between TQM Principles…….…...……45

3. Modified Measurement Model…….…….49

4. Relationships Between TQM Principles Modified……50

5. Structural Model……..……..52

INTRODUCTION AND RESEARCH MOTIVATION

This thesis is a compilation of two papers the consecutively analyze the managerial technique known as Total Quality Management (TQM). The first paper takes in depths look at the history of Quality Management (QM) which is where TQM sprouted from when Japan used quality management practices as a method to overcome their lack of raw materials. Following the historical journey of QM the first paper identifies seven core principles that make up TQM which include leadership and top management commitment, strategic planning, human resource inclusion, transforming organization culture, integration of supply chain, dynamic customer focus, and continuous improvement. Several benefits of TQM are also identified with corresponding measures of success to be used by companies who chose to implement TQM as a management strategy. The first paper ends with a summary of the challenges and barriers found under each of the seven principles that prohibit most companies from achieving these successes. This is done to better understand why even the most well intentioned companies are not always able to sustain this management technique.

The second paper expands upon the research conducted in the first paper by developing hypotheses to understand the impact these challenges have on the success or failure of TQM. The research methodology is documented detailing the use of a questionnaire, survey and sampling population. Following the data gathering Structural Equation Modeling (SEM) is applied to assess the measurement model, the correlations between each principle, and the structural model.

The reason for this research is because even thought there is a vast amount of literature available on the subject of TQM there is no extensive empirical evidence showing the effect of these identified challenges and barriers on the success of TQM implementation. Most of the

existing studies focus on impact of TQM practices or principles on organization's performance measures. This study attempts to measure the impact of these challenges and barriers on the success or failure of a TQM program.

PAPER 1. CHALLENGES AND BARRIERS TO TOTAL QUALITY MANAGEMENT: AN OVERVIEW[1]

Abstract

Total Quality Management (TQM) has been touted as the second industrial revolution dating back to the 1940's where it began its journey to bring Japan into the forefront of competitive quality. This paper provides a historical journey of TQM from its beginnings through its evolutionary transformation into today's business climate. The fundamental principles of TQM are explored and the resounding benefits identified with detailed measures of success. A review of the challenges and barriers that prohibit most companies from achieving these successes is conducted to better understand why even the most well intentioned companies are not always able to sustain this management technique founded on sound quality principles. Finally, this paper outlines future research direction to develop sound understanding and reasoning related to the identified challenges and barriers and to propose a conceptual implementation model based on them.

Introduction

The evolution of Quality Management has been filled with buzz words and acronyms, none of which had a more profound or lasting impact as Total Quality Management (TQM). The TQM philosophy arose from the Japanese quality management practices as a method to overcome their lack of raw materials by supplying finished goods for export [1]. Since TQM's beginning dating back to the 1950s when W. E. Deming and J. M. Juran arrived in Japan to give

[1] Rokke, C. and O. Yadav. International Journal of Performability Engineering, November 2012; 8(6): 653-665.

lectures on statistical process control [2, 3], many researchers have studied and documented the underlying principles and practices of this quality management theory. Slowly but surely the western countries began to recognize this quality movement and incorporated its paradigm's into their business structure after realizing Japan's slow and steady increase in market share.

This paper studies the evolution of quality management theory in Section 2 which includes the conception of quality related practices through today's concepts of Lean Six Sigma. Section 3 identifies the most prominent fundamental principles of TQM. These principles are directly related to the benefits identified in Section 4 that are incurred by organizations who have taken on TQM as a management method. Section 4 also highlights important measures of these benefits that are crucial to TQM's success. Finally, the challenges and barriers that prohibit most companies from achieving these successes are identified in Section 5 to better understand why even the most well intentioned companies are not always able to sustain this management technique.

Evolution of Quality Management Theory

Basic quality management (QM) principles can be found as far back as the 13th century when artisans completed individual products then inspected and improved the quality of their own work through close interaction with their customer before delivering the final product [4]. The factory system is the second phase of QM which started in Great Britain in the mid-1750s and grew into the Industrial Revolution in the early 1800s [5]. During this era, inspection was introduced which was good in theory but the activities to detect non-conformances have since been proven costly and time consuming. Therefore, improvements to the inspection era developed during the Quality Control (QC) phase of QM where standards for products and services were established and everyone worked to ensure conformance to these standards. One

of the founders of this era includes Frederick W. Taylor who published 'The Principles of Scientific Management' in 1911 [6].

Statistical Quality Control (SQC) built upon the QC phase. The SQC concept began in 1924 when Walter A. Shewhart, a statistician at Bell Laboratories, introduced the X-bar and R control charts. These charts were used to map the results of inspection process in an attempt to interpret and solve process problems [4]. In 1940, during World War II, the concept of acceptance sampling plan was introduced by Harold F. Dodge and Harry G. Roming [6]. These statistical tools paved the way to a more proactive approach for QM. Statistical Process Control (SPC) follows SQC with a goal to focus more on process behavior in an effort to prevent defects in products or services. During this time, the use of standards in quality management started gaining momentum because standards ensure desirable characteristics of products. The first attempt at standardization began in 1946 when delegates from 25 countries met in London and decided to create a new international organization, of which the object was to facilitate the international coordination and unification of industrial standards. The new organization, ISO, is now the world's largest standard developing organization [7].

Beginning in 1950, at the end of World War II, a series of postwar lectures was given by Deming to teach statistical quality control practices in Japan [2]. Deming's contributions placed more emphasis on management of a system for improving quality and his thinking was based on the use of statistical tools for continual improvement. In appreciation of Deming's work the Union of Japanese Scientists and Engineers (JUSE) created the Deming Prize to commemorate his contributions and friendship and to promote the continued development of quality control in Japan [3]. The founder of JUSE was business leader Ichiro Ishikawa and his son Kaoru Ishikawa is well known for his development of the basic seven tools of quality. Kaoru is also credited with

coining the term company-wide quality control [8]. During this same time back in the U.S., Armand Feigenbaum wrote a famous book Total Quality Control whose primary contribution to quality thinking was his assertion that the entire organization should be involved in quality improvement efforts.

Juran followed Deming's arrival in Japan in 1954 to give another series of lectures. Juran took a more strategic and planning based approach to improvement and he is well known for The Juran Trilogy and Pareto's law [2, 9]. Juran and Deming's work at this time contributed to the onset of what is now known as TQM.

TQM itself has no common definition; Miller [10] documents his definition as follows. *An ongoing process whereby top management takes whatever steps necessary to enable everyone in the organization in the course of performing all duties to establish and achieve standards which meet or exceed the needs and expectations of their customers, both external and internal.*

Shortly after Deming and Juran's era in Japan, there began an outgrowth of what is known as Quality Control Circles or QC Circles. A QC Circle is a voluntary study group dedicated to solving job-related problems. They were established in Japan in 1962, registered themselves with JUSE and by the end of 1979, there were over 100,000 registered QC Circles [9]. The phenomenon spread to the U.S. and the International Association of Quality Circles (IAQC) was formed in 1977, which later became the Association of Quality and Participation (AQP) [11]. In 1979 Philip Crosby published his famous book 'Quality is Free' [8] and he is recognized for promoting the concept of "zero defects" and for defining quality as a conformance to requirements [5]. The evolution of SPC and QC Circles combined with Philip Crosby's work is what can be defined as the Continuous Improvement era of QM.

Moving from the continuous improvement era into a more project based approach came when Bill Smith from Motorola developed the Six Sigma concept in 1986 as a strategy to deal with product and system failures. This process utilizes a methodology that consists of six steps: Define, Measure, Analyze, Improve, and Control (DMAIC) [4]. Also, in the mid-1980s, U.S. leaders realized that their companies needed to focus on quality in order to compete in an ever-expanding, demanding global market. Secretary of Commerce at the time, Malcolm Baldrige, was an advocate of quality management as a key to U.S. prosperity and sustainability. From this the Malcolm Baldrige National Quality Improvement Act of 1987 was passed to help enhance the competitiveness of U.S. businesses and the Malcolm Baldrige National Quality Award (MBNQA) was born [7]. The European Foundation for Quality Management (EFQM) Excellence Model [12] evolved shortly after and as noted by Funk [13] there are now twenty-five different quality awards available today just in the U.S. alone.

In 1988 Taiichi Ohno, who is considered to be the Father of the Kanban System, published his book *The Toyota Production System* in English [14]. This documented the principles and practices of Lean manufacturing, which includes fundamental principles of Industrial Engineering supported by actionable rules, operational innovations and continuous pursuit for perfection [15]. Lean Six Sigma was created in the late 1990s when both AlliedSignal and Maytag independently designed programs which combined aspects of both. They cross-trained employees in both methodologies, creating project frameworks that combined the two techniques [15].

Looking into the future of quality, ASQ recently published a study on the future of quality [5]. In this publication the top eight forces shaping the future of quality are identified as: global responsibility, consumer awareness, globalization, increasing rate of change, workforce of

the future, aging population, twenty-first century quality, and innovation. From this it appears as if the possibilities for the quality profession are limitless and unending.

Total Quality Management Principles

While the scope of TQM can be viewed as infinite there are some basic underlying principles of this management philosophy. A study conducted by Sila and Ebrahimpour [16] compiled the survey based research on TQM published between 1989 and 2000. Their findings identified twenty-five different TQM factors all of which could be considered relevant and important. However, based on literature review some of the principles that pose the greatest impact can be limited to just a small few and they are detailed below.

Leadership and Top Management Commitment

The first of the relevant TQM principles is leadership and it is not first on the list by coincidence. The fundamental reason for this importance is summarized by Oakland [17] as follows: to be successful in promoting business effectiveness and efficiency, TQM must be truly organization-wide; it must start at the top with the chief executive or equivalent. Oakland [17] continues his view on leadership by stating, the chief executive of an organization should accept the responsibility for and commitment to a quality policy in which he/she must really believe. If the owners or directors of the organization do not recognize and accept their responsibilities for the initiation and operation of TQM, then these changes will not happen. Management should be dedicated to the regular improvement of quality, not simply a one-step improvement to an acceptable plateau. The respondents of an empirical study regarding the quality in U.S. manufacturing industries identified that quality performance increases with top management support and one way of showing support is by visibility on the floor [18]. The reason for this is

best summarized by Garvin [19] as, it's one thing to say you believe in defect-free products, but quite another to take time from a busy schedule to act on that belief and stay informed.

Strategic Planning

Leadership also plays a fundamental role in the strategic planning principle of TQM. Juran was the initiator of this principle because he is the one who brought the managerial dimension to quality which broadened it from its statistical origins [20]. Juran's contributions to this principle include the pareto principles which millions of managers rely on to help separate the "vital few" from the "useful many" and the Juran Trilogy which defines three management processes: quality control, quality improvement and quality planning [20].

To establish a strategy it is up to leadership to produce documents which describe goals, both long and short range [21]. The long range goals should contain a strategy to achieve the goals [9, 22]. This strategy is essential because in today's business environment managers must plan strategically to maintain a hold on market share, let alone increase it [17].

Human Resource Inclusion

The next principle of TQM is the human resource inclusion principle which was propagated by Crosby [8] who adopted a human resources approach where worker input is valued and encouraged as central to the quality improvement program. Today the most renowned aspect of this principle falls within the organizations ability to empower their employees. By doing so, employees become responsible for their own actions and the control is shifted from the outside to the inside of individuals [17]. This reduces the need for supervisors [22] and provides a sense of ownership for the employees. Oakland [17] identifies that people do not need to be coerced to perform well and that people want to achieve, accomplish, influence activity and

challenge their abilities. It is up to leadership to provide the necessary resources for them to fulfill these desires.

Transforming Organizational Culture

Following the human resource inclusion principle is the Organizational Culture principle. Oakland [17] defines culture as, "how business is conducted, and how employees behave and are treated." Further, TQM is concerned chiefly with changing attitudes and developing skills so that the culture of the organization becomes one of preventing failure where everybody is constantly trying to do the right things, right the first time, every time. An organization's pre-existing culture plays an important role in TQM implementation and failures have been attributed to an organization's resistance to change [22]. Oakland [17] relates cultural change to strategic planning because cultural change will come about only as the result of a carefully planned and managed deployment process.

Integration of Supply Chain

Integration of the supply chain is without a doubt an essential fundamental principle of TQM. Ogden *et al*. [23] defines supply chain quality management as a systems-based approach to performance improvement that leverages opportunities created by upstream and downstream linkages with suppliers and customers. Mehra *et al*. [24] identify that it is believed "50 percent of a company's nonconformance are caused by defective purchased materials". Garvin [19] points out that without acceptable components and materials, no manufacturer can produce high quality products. Buyer-seller partnerships are emphasized and by investing in these partnerships a reduction in the supplier base is necessary [25]. This results in less suppliers and greater attention to detail.

Dynamic Customer Focus

The customer focus principle is defined by Foster [8] as a proactive approach to satisfying customer needs that is based on gathering data about our customers to learn their needs and preferences and then providing products and services that satisfy those changing needs and preferences. Mehra *et al*. [24] identify that having a profound knowledge of customer expectations is an important aspect of TQM because every activity is driven by this knowledge. Crosby, who is considered the founder of this principle, emphasizes the importance of determining customer requirements, defining those requirements as clearly as possible, and then producing products or services that conform to the requirements as established by the customers [8]. Also, Customer retention is as important as attracting new customers and organizations need to consider the lifetime worth of a loyal customer [25].

Continuous Improvement

Continuous improvement can be found in the origins of TQM with the onset of QC circles. The culture of continuous improvement per Zairi [26] means better and better quality, lesser and lesser variation which results from process management practices that bring forth incremental improvements and innovations in products, services and processes. There are three types of continuous improvements as documented by Sheffrey [27]: defect elimination, process elimination, and process improvement. Black and Porter [28] note that it is important for organizations to direct themselves away from a firefighting mentality at the operational level and instead focus on more constant reviews against customer and operational requirements. Mistakes do not fix themselves; they have to be identified, diagnosed, and then resolved through corrective action and corrective action programs will succeed only if they are backed by genuine top-level commitment [19]. Again, this emphasizes the criticality of leadership.

Benefits of Total Quality Management and Measures of Success

Our exhaustive literature review on TQM implementation clearly indicates that successful implementation of TQM in an organization has many benefits. Deming [29] identifies "improvement of quality transfers waste of man-hours and of machine-time into the manufacture of good product and better service." The result is a chain reaction; lower costs, better competitive position, and happier people on the job, jobs, and more jobs. The quantifiable benefits of successful TQM implementation are below with their identified measures of success.

Quality Improvements

The first underlying benefit of TQM may seem obvious until one begins to try to define this benefit. Hutton [30] confirms that the first absolute of quality management is to define quality. Shetty [31] identifies the next step as, once quality has been defined, a firm can test conformance and correct any problems. Methods used to measure quality improvements were noted in the Report to the Honorable Donald Ritter [32] as follows: increased reliability, on-time delivery, reduced errors, lower product lead time, and cost of quality. Typical quality costs identified by Shetty [31] include expenditures concerning: prevention costs, appraisal costs, internal failures, and external failures. Garvin [19] points out that the association between cost and quality is strong. Reducing field failures means lower warranty costs, and reducing factory defects cuts expenditures on rework and scrap. Lastly, it is important to note that companies need to recognize all activities have the potential to improve product quality and quality improvements are realized through close cooperation between departments, each department should provide defect free products or services to the following department treating it as an internal customer [31].

Increased Productivity

Kontoghiorghes and Gudgel[33] prove that a positive and significant relationship between quality and productivity exists and an organizational emphasis on continuous improvement of processes and quality will ultimately result in more cost-effective production, which in turn improves both productivity and profitability. The reasons why quality is related to productivity is pinpointed by Shetty [31] as elimination of defects reduces labor and/or machine hours, and inspection costs. In addition reducing scrap and waste lowers the cost of materials, fewer warranty claims decreases the material and labor required to repair defective products and a reduction in service costs decreases labor costs. Mohanty and Lakhe [34] identify this relationship in a TQM program through methods such as establishing quality as the primary operational goal, making everyone in the firm feel responsible for quality, a stress on quality improvement and zero defects as a goal and tracking back defects to their source.

Increased Profitability and Market Share

Shetty [31] points out that quality affects a firm's sales and market share because creating the reputation for higher quality decreases the elasticity of demand and provides opportunities for companies to charge higher prices and earn higher profit margins. The existing research literature shows that changes in product quality are strongly related to market share [31] and Garvin [35] points out those businesses in the Profit Impact of Market Strategy (PIMS) study that improved in quality during the 1970s increased their market share three times faster than those whose quality remained unchanged.

Greater Customer Satisfaction and Competitive Advantage

Reed *et al*. [36] define competitive advantage as, "the outcome of a strategy that generates increased value for a firm relative to its competition, and sustainability is present if the increased value remains when competitors stop trying to imitate the advantage." These authors identify that customers define quality and, in turn, quality creates customer satisfaction which leads to an improved competitive position.

Interestingly, there are strong ties between customer satisfaction and the other benefits of TQM. Kontoghiorghes and Gudgel [33] found that customer satisfaction was highly associated with all productivity indicators and Ugboro and Obeng [37] proved that job satisfaction is positively associated with customer satisfaction. To measure this benefit the report submitted to the Honorable Donald Ritter [32] identifies methods using customer satisfaction survey results for consumers overall perceptions about a product or service, the number of complaints received and customer retention rates.

Development Process Improvements

It is not just existing products that can potentially benefit from the improvements driven by TQM. Kondo [38] documents how Japan introduced the TQM concepts and techniques into new product development. Garvin [19] identifies the cost of extra hours spent pretesting a design is cheap compared with the cost of a product recall. Tellis *et al*. [39] found in the high-tech markets the best quality product, not the first to enter and build a network of users, ultimately dominated the market and their recommendation was to put more emphasis on the quality of new products rather than on the speed to market.

Greater Job Satisfaction

Ugboro and Obeng [37] identify a strong relationship between employee empowerment and job satisfaction, and between job satisfaction and customer satisfaction. In the article by Robinson and Stern [40] an example is given where an employee had proposed 40 ideas for her companies Kaizen program. When asked what she did with the prizes her response was surprisingly, "…I don't really do this for the rewards, you see, I do it for the fun of it." It is important for companies to pull this self-motivation out of their employees for the good of the organization. The Report to the Honorable Donald Ritter [32] identified in their review of American companies who adopted TQM techniques that somewhat better employee relations were realized and the methods to measure this included improved attendance and employee turnover.

Common Language

Hutton [30] identifies the most immediate benefit of TQM is a common language about quality, which aids communications. Hutton notes that with a common language, problems between individuals, departments or companies can be settled objectively, decreasing hassle. The way to do this is documented by Ugboro and Obeng [37] who reviewed organizations that had successfully implemented TQM and found these organizations to have communication systems that facilitate lateral and vertical flows of information critical to total quality objectives and actively involve employees in the definition of the organization's quality mission and objectives.

Total Quality Management Challenges and Barriers

Even though there is a plethora of success stories on TQM there is also an abundance of literature available that highlights the reasons why TQM has not been very successful. In the

very early times it was thought that TQM could not survive outside of Japan due to culture differences. However, this was proven wrong by Johnson and Ouchi [41] who identified several examples where Japanese companies successfully implemented TQM in their American factories. So what is it that compromises the benefits of this management theory? The following sections summarize the challenges found with each of the previously identified principles.

Leadership and Top Management Commitment

The level of commitment and support required from the leaders of an organization when trying to implement TQM is overwhelming and there are several reasons cited in literature as to why. The number one barrier of TQM implementation identified by Coulson-Thomas [42] is top management commitment. Tamimi and Sebastianelli [43] further support this in their study by finding the number one barrier to TQM is, "Management's compensation is (not) linked to achieving quality goals." Fuchsberg's [44] findings show that quality-performance measures such as defect rates and customer satisfaction levels play a key role in determining pay for senior managers among fewer than one in five companies across multiple industries surveyed and concluded that profitability still matters most. To overcome this, Lam [45] suggests that senior management should give up its elite status, move from fancy offices to where the action is and listen to the employees. Oakland [46] expands here stating, senior management commitment must be obsessional, not lip service and that to be successful in promoting business efficiency, effectiveness and cooperation, any approach must be truly organizational wide and it must start at the top with the chief executive, or equivalent.

Mohanty and Lakhe [34] observe that companies that can create a committed leadership to bring about behavioral changes for revitalization within the organization, in turn can show the most dramatic improvements. Committed leaders can engage employees' emotions, cognitions

and actions to realize that TQM is not a one-time event, but a set of on-going processes in the entire value chain of an enterprise.

Strategic Planning

All too often it is seen in industry that when faced with a compromising deadline or a budget cut a 'business decision' is made to compensate for the shortcomings which ultimately compromises the quality of the products or services. Goodman [47] identified that one of the basic problems that exist in most TQM efforts are the manner in which priorities are set (if they are even set at all). Mohanty and Lakhe [34] observed that most firms though, speak of long-term strategic planning, *etc*. but short-term operational focus with compliance and control mind-set always remains an immediate routine agenda.

Human Resource Inclusion

The most important and valuable asset in any company is the human workforce and consequently human resource inclusion is another essential element in a successful TQM transformation. The challenges of the different dimensions of human resource inclusion are many. The cultural shift toward TQM requires top management to share ownership of all relevant organizational information and this can sometimes be threatening to those who perceive information as power [48]. Also, Blackburn and Rosen [48] point out that a simple suggestion system and quality circles is not enough, Baldrige Award-winning company employees also participate on advisory groups, task forces, and cross-functional teams to solve problems and improve systems. Job design also requires a radical shift to better emphasize innovation, creativity and problem solving when in the past, work was organized to maximize efficiency and supervisors narrowly defined jobs and closely monitored both quality and productivity [48].

Training is an essential element of human resource inclusion and while most organizations train employees in functional and managerial skills, the Baldrige companies focus their training efforts on quality [48].

A performance review system is important for TQM transformation and Blackburn and Rosen [48] point out that rather than focus on past mistakes, managers should help employees solve performance problems and reward continuous improvements. Also, within the Baldrige Award winners there is a variety of formal and informal, financial and non-financial rewards for individuals and teams who contribute to the total quality effort [48]. But, this must be done with care because as identified by Robinson and Stern [49] rewards can do more harm than good for creativity and there is evidence to prove that incentives more often diminish creativity because they motivate someone to work on something primarily as a means to an end.

With respect to selection, promotion and career development the previous underlying assumption for many of these firms is that individuals with the requisite skills can readily be taught to produce quality work. However, under the new operating paradigm, employees will be expected to exhibit competencies in customer service, in self-direction and self-development, and in team-development skills [48].

Transforming Organizational Culture

Changing the culture of an organization could be fundamentally the most challenging aspect of the TQM implementation process because resistance to change is human nature. Lam [45] surveyed frontline supervisors and found that their perceptions were TQM has made work more demanding, there is more of it and it requires greater individual skill and accuracy. Sebastianelli and Tamimi [50] explain why this phenomenon occurs in their review of the most

common reason for failure, ineffective implementation, which results when TQM becomes extra work instead of a new way of doing things.

Fuchsberg [44] identifies that many quality plans are too amorphous to generate better products and services. To overcome these Reger *et al*. [51] provides a method to effectively implement TQM using mid-range changes. This magnitude of change, called tectonic change, represents an intermediate level whereby change is perceived to be sufficiently large enough to overcome cognitive inertia, but it is not so great that it overwhelms the organization. Kanji [52] states, "In many ways the problem-solving approach is the easiest and the cultural change is by far the most difficult aspect of the TQM process." Mohanty and Lakhe [34] observe that problems in implementing TQM really do not originate with employees, but from a lack of understanding of the factors that can collectively affect the TQM efforts.

Integration of Supply Chain

In today's unstable and fast paced economy desperate attempts are made at cost savings initiatives to improve the bottom line and one of the first places to look is the material burden costs which puts the quality of incoming products at second best. This is in direct contrast to one of Deming's [29] 14 Points for Management which states, "end the practice of awarding business on the basis of price tag. Instead, minimize total cost. Move toward a single supplier for any one item on a long-term relationship of loyalty and trust."

It is noted by Cole [53] that one of the significant reasons for Toyota's recent quality issues is the combination of rapid growth and increased product complexity which has had major implications for their supply management system. This occurred in response to accelerated growth; Toyota had to take on new suppliers because the existing supply base could not keep up with the demands. The result of this was seen in Toyota's relationship with suppliers which

became less collaborative and weakened the company's distinctive "relational contracting" system characterized by long-term close relationships with suppliers. Similar observations were documented by Mohanty and Lakhe [34] who identified that most of the companies they surveyed have supplier evaluation systems which presently lack in establishing the synergistic integrations between buyers and sellers.

It is more about supply chain modernization; finding ways to balance supply complexity with demand volatility. To accomplish all of this it is important for the supply chain to be adequately represented and as noted by Burnson [54] there are plenty of manufacturing companies that do not have anyone representing supply chain at the board level.

Dynamic Customer Focus

The number of challenges for the dynamic customer focus principle is surprising because it is one of the most emphasized principles noted in literature. Sebastianelli and Tamimi [50] identify the underlying obstacles associated with ineffective change management with one of them being lack of customer focus and they note a study of Malcolm Baldrige National Quality Award (MBNQA) winners who found that difficulties in implementing TQM are rooted in three causes, one of them being: integration with suppliers and customers.

In the study conducted by Black and Porter [28] on the identification of the critical factors of TQM they identified that, "essentially, if TQM is to become fully integrated into a business, the organization needs to deflect itself away from a 'business as usual' or firefighting mentality at the operational level, towards consistent reviews against customer and operational requirements. Summers [4] supports that meeting customer needs, requirements, and expectations involves more than providing a product or service; industry needs to integrate quality into all areas of operations, from the receptionist to the sales and billing departments.

Continuous Improvement

In 1993 the Wall Street Journal published an article citing the drop in Baldrige Award applicants and eluding to the onset of ISO 9000 as one of the possible reasons for this decline. This is concerning considering that in no way are TQM and ISO a replacement for each other. As noted by Vloeberghs and Bellens [55], ISO 9000 standards are very static and inflexible, are not driven by market developments, concentrate only on the organization's processes, justify the status quo, and do not use the learning capacity of organizations to change and renew themselves. Further, Heras-Saizarbitoriet *et al*. [56] identify that ISO standards do not measure the quality of goods or services of a firm, but rather establish the need to systemize and formalize a series of procedures. Finally, Zuckerman [57] notes that many companies don't understand that the point of registration is to test for consistency, not continuous improvement or product performance.

Haasan [58] identifies TQM as a dynamic system whereby the concepts involve actions, the components interact with each other, and the actions made to improve quality must be continuous. This is hard to do when always trying to adhere to a strict and regulated standard. Leonard and McAdam [22] note an important fact in the TQM life cycle is that it is not sequential nor does it have a specific formulaic route. Each organization plots its own customized route to success and will use various TQM-related tools, techniques, and philosophies along the way.

Elg *et al.* [59] provide an interesting insight into the direction of the quality management field as they point out that the absorption of the quality function into all departments is perhaps what today is threatening the role of the quality manager to becoming limited to handling the documentation and standardization related to the quality management system, similar to a

librarian. Perhaps more emphasis should be placed on the continuous improvement aspect of the quality field.

Future Research and Direction

This paper provides an overall history of quality management concepts with a focus on the evolution of TQM philosophy. It further provides the fundamental principles of TQM along with their benefits and methods of measurement in order to quantify the benefits. The paper also enumerates the basic challenges found in literature that inhibit the successful implementation of TQM. Future research can capitalize on this comprehensive summary through the development of a conceptual model founded on the challenges in relation to each of the unique principles. This may be done to prove the significance of the challenges on an organizations ability to sustain TQM programs.

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PAPER 2. CHALLENGES AND BARRIERS AFFECTING THE SUCCESS OF TOTAL QUALITY MANAGEMENT

Abstract

The existing literature on total quality management highlights countless benefits of its implementation. Despite these phenomenal benefits the total quality management has not been successfully adopted in every organization. The extensive literature review conducted earlier also highlights the challenges and barriers to successful TQM implementation [1]. This study attempts to measure the impact of these challenges and barriers on the success or failure of a TQM program. The data collected was analyzed using Structural Equation Modeling (SEM) with the aid of AMOS software in an attempt to prove or disprove the hypothesis statements related to each TQM principle and their underlying challenges and barriers identified earlier. The findings indicate that the challenges associated with some of the TQM Principles are correlated and a few of them do have an impact on the success of a TQM program.

Introduction

There is a vast archive of literature available on Total Quality Management (TQM) and the countless benefits that can be derived from TQM implementation. Various quality gurus over the period of time have advocated making quality a core business strategy and creating a work environment that supports quality management philosophy. Several quality awards have been established to encourage organizations to create business processes focused on customer satisfaction and quality of product and processes. There is a plethora of documentation available that highlights the impact of quality on increasing productivity and profitability in the long run

[2]. Also, many researchers have studied and documented the underlying principles and practices of TQM that drive successful implementation. However, if TQM is so phenomenal why it is not successfully applied in every organization?

In contrast to the positive findings, results from several studies on the relationship between quality management practices and organizational performance have shown mixed responses [3, 4]. These studies show that effects of TQM practices on various performance measures differ from organization to organization. Several other studies explore the impact of various factors in successful implementation of TQM in different types of industries and different cultures (or countries) [5]. However, most of these studies focus on relationship between successful implementation of TQM and factors affecting TQM implementation [6] as well as relationship among several TQM practices [7]. More recently, the researchers have started investigating causes of differing responses on performance measures. These studies have highlighted several challenges and barriers to TQM implementation [1, 8, 9, 10, 11]. To further investigate this issue, attempts have been made to analyze TQM challenges from a psychological perspective [12, 13, 14] and a statistical base [15, 16, 17]. However, there is no extensive empirical evidence showing the effect of these identified challenges and barriers on the success of TQM implementation. Most of the existing studies focus on impact of TQM practices or principles on organization's performance measures. This study attempts to measure the impact of these challenges and barriers on the success or failure of a TQM program. The study is performed by applying Structural Equation Modeling (SEM) approach to the challenges and barriers found under a defined set of TQM principles.

The rest of the paper is organized as follows: the second section provides an extensive literature review of the existing studies on TQM implementation. The third section develops

hypotheses to understand the impact these challenges have on the success or failure of TQM. The research methodology is documented in the fourth section where details on the questionnaire, survey and sampling population are provided. Following that SEM is applied to assess the measurement model, the correlations between each principle, and the structural model.

Literature Review

There has been a lot of research surrounding the challenges of TQM implementation. Several of these include a simple review of the challenges faced by quality management initiatives. For example, Tamimi and Sebastianelli [6] summarize the top twenty-five barriers of TQM collected through survey responses from quality managers. Masters [8] defines eight barriers that commonly plague organizations. Kotter [18] provides the reasons for TQM failure aligned to an eight step transformation process. Salegna and Fazel [9] prove through their study that non-TQM companies perceive the severity of problems differently from TQM companies. The financial performance linkage with TQM appears to be a controversy so Wayhan and Balderson [19] propose a research gauntlet for firms to perform a definitive assessment of the relationship between TQM and the subsequent financial performance.

Grant et al. [12] identify how TQM challenges the existing management theories and practices. This pushes TQM challenges into a realm of psychological review where Reger et al. [13] presents a cognitive theory of why planned organization change efforts, such as TQM, fail and then propose a dynamic model dependent on management's ability to reframe the change over time. Also, Fok et al. [14] reviews two reasons for resistance to TQM both related to human factors.

Methodological data reviews also show up in literature related to TQM challenges. A study was conducted by Sebastianelli and Tamimi [15] with a factor analysis on frequently cited barriers to TQM which resulted in a framework for evaluating the relative significance of management-related obstacles to TQM success. Burli et al. [16] performed factor analysis on the dimensions of TQM to analyze their interdependent relationships and the influence on ISO results. Cheng and Ngai [17] apply principle component analysis and correspondence analysis to TQM barriers. However, with the abundance of reviews and analysis available on TQM challenges none of the existing literature assesses the actual impact TQM challenges have on the resulting success. This study aims to investigate the impact of challenges and barriers on TQM implementation and bridge that gap in existing literature base.

Hypothesis Development

This study will analyze how much influence the challenges of TQM identified in literature actually have on the successful outcome of TQM. Through review of the existing literature, seven principles of TQM have been identified all with potential barriers and challenges [1]. These seven principles of TQM include: Leadership & Top Management Commitment, Strategic Planning, Human Resource Inclusion, Transforming Organizational Culture, Integration of Supply Chain, Dynamic Customer Focus and Continuous Improvement. The identified challenges and barriers are mapped into each of the TQM principles. These challenges will be used as a measureable variable by phrasing them in the form of a question. Each principle with its measured variables will be considered a construct. Each indicator variable for the corresponding TQM principle is abbreviated using a single or double letter representation. Using SEM the impact each of these constructs has on the success of TQM will be assessed. The full relationship diagram for this is shown in Figure 1. The lines representing the connection

between the principles and TQM Success represent a linear dependency so the arrow head is pointed towards the TQM Success. The direction of the arrows connecting the challenges associated with each principle is in reverse of this. This is due to the principles being unobserved variables that are relying on their associated challenges to represent them within the model.

The first of the relevant TQM principles is leadership and top management commitment. Its importance is best summarized by Oakland [20] who states that to be successful in promoting business effectiveness and efficiency, TQM must be truly organization-wide; it must start at the top with the chief executive or equivalent. Under the leadership & top management commitment principle, five challenges are identified that include top management's compensation is still linked to profitability [10, 21], top management's compensation is not linked to quality goals [6], and top management's compensation is not linked to customer satisfaction levels [21]. Also, the engagement of top management [22] and top management's support of quality initiative efforts are put to the test [7]. These challenges are represented as L1 through L5 on Hypothesis Development Model shown in Figure 1. Using these challenges in alignment with the principle the following hypothesis will be proved or disproved using SEM analysis.

H_a: The challenges identified under the TQM Principle Leadership and Top Management Commitment directly and positively influence TQM Success

The second TQM principle identified is strategic planning, which was founded by Juran because he is the one who brought the managerial dimension to quality that broadened it from its statistical origins [23]. The challenges faced under the strategic planning principle are very few. It includes either a lack of strategic planning meaning more focus on short term gains [3] or the

strategic plan is not followed properly [24]. These two challenges are represented as S1 and S2 in Figure 1 and they will be used as the measurable variables to assess the following hypothesis.

H_b: The challenges identified under the TQM Principle Strategic Planning directly and positively influence TQM Success

The third principle of TQM is the human resource inclusion which was propagated by Crosby [23]. He adopted a human resources approach where workers input is valued and encouraged as central to the quality improvement program. Surprisingly, a long list of challenges can be found under the human resource inclusion principle. These are shown as HR1 through HR8 in Figure 1. The first challenge is that TQM requires top management to share ownership of all relevant organizational information and this can sometimes be threatening to those who perceive information as power [25]. Second, a simple suggestion system and quality circles is not enough, follow up is required [25]. Third, the job design also requires a radical shift to better emphasize innovation, creativity and problem solving where in the past supervisors narrowly defined jobs [25]. The fourth challenge is in the past supervisors closely monitored productivity in addition to quality instead of eliminating productivity as a metric [25]. Fifth, most organizations train employees in functional skills rather than focus training efforts on quality [25]. The sixth challenge is a performance review system should help employees solve performance problems and reward continuous improvements rather than focus on past mistakes [25]. The seventh challenge is in regards to the reward system which needs to be closely monitored because it can motivate someone to work on something primarily as a means to an end [26]. Last, the eighth challenge under human resource inclusion falls under the selection, promotion and career development aspect where previous underlying assumption is that individuals with the requisite skills can readily be taught to produce quality work. However,

under TQM, employees are expected to exhibit competencies in customer service, self-direction and self-development, and team-development skills [25]. As a result of these collective challenges the following hypothesis will be reviewed for the Human Resource Inclusion principle of TQM:

H_c: The challenges identified under the TQM Principle Human Resource Inclusion directly and positively influence TQM Success

Transforming organizational culture is the fourth TQM Principle. This is summarized by Oakland [20] as TQM is concerned chiefly with changing attitudes and developing skills so that the culture of the organization becomes one of preventing failure where everybody is constantly trying to do the right things, right the first time and every time. Under the transforming organization culture principle, it is the perceptions that need to be assessed. For example the first challenge identified is that TQM has made work more demanding followed by it requires greater individual skills and accuracy [22]. Also, it is perceived that many quality plans are too amorphous and TQM should be implemented using mid-range changes rather than all at once [21]. The final challenge identified under this principle is in a lack of understanding of the factors that can collectively affect the TQM efforts [24]. These challenges are represented as O1 through O6 in Figure 1. Taking these challenges into consideration the hypothesis shown below will be analyzed to assess how much TOC impacts the success of TQM:

H_d: The challenges identified under the TQM Principle Transforming Organizational Culture directly and positively influence TQM Success

The fifth TQM Principle is integration of the supply chain and it is without a doubt a fundamental principle of TQM. Ogden et al. [27] defines supply chain quality management as a

systems-based approach to performance improvement that leverages opportunities created by upstream and downstream linkages with suppliers and customers. Several authors pointed out the benefits of buyer-seller relationships [28, 29, 30]. Integration of the supply chain principle has several easily identifiable challenges and they are summarized as follows: awarding business on the basis of price tag alone [31], supplier relationships are not long-term [31], supplier relationships are not collaborative [32], supplier evaluation systems do not establish synergistic integration between buyer and seller [24] and finally the supply chain is not represented at the board level in most companies [33]. Further, it is noted [34] that with respect to the supply chain the compliance solutions are static and inflexible. These are shown as SC1 through SC6 in Figure 1. The identified challenges collectively establish the basis for the construct which will align with proving or disproving the following hypothesis.

H_e: The challenges identified under the TQM Principle Integration of Supply Chain directly and positively influence TQM Success

The sixth TQM Principle is dynamic customer focus and it is best defined by Foster [34] as a proactive approach to satisfying changing customer needs. It is based on gathering data about our customers to learn their needs and preferences and then providing products and services that satisfy those changing needs and preferences. The dynamic customer focus principle faces four major challenges. They are represented as C1 through C4 in Figure 2. The challenges highlight that TQM efforts are not always integrated with customer expectations [15], business is conducted under a firefighting mentality [35], there needs to be more consistent reviews against customer requirements [35], and quality needs to be integrated into the sales department [36]. With these challenges the hypothesis shown below will be reviewed for the dynamic customer focus TQM principle.

H_f: The challenges identified under the TQM Principle Dynamic Customer Focus directly and positively influence TQM Success

Continuous improvement is the last TQM Principle and can be found in the origins of TQM with the onset of quality circles. The culture of continuous improvement per Zairi [30] means better and better quality, lesser and lesser variation which results from process management practices that bring forth incremental improvements and innovations in products, services and processes. There are many challenges found under the continuous improvement principle. The first few focus on the defaults of quality initiatives which are highlighted as being very static and inflexible, are not driven by market developments, concentrate only on the organization's processes, justify the status quo, and do not use the learning capacity of organizations to change and renew themselves [37]. Also, quality initiatives do not measure the quality of goods or services of a firm, but rather establish the need to systemize and formalize a series of procedures [38]. Further, many companies don't understand that the point of registration is to test for consistency, not continuous improvement or product performance [38]. Finally, the role of the quality manager is being limited to handling the documentation and standardization related to the quality management system [39]. The challenges are shown as CI1 through CI8 in Figure 1. This collectively establishes the base to assess the continuous improvement principle with and its effects on the success of TQM as represented in the following hypothesis.

H_g: The challenges identified under the TQM Principle Continuous Improvement directly and positively influence TQM Success

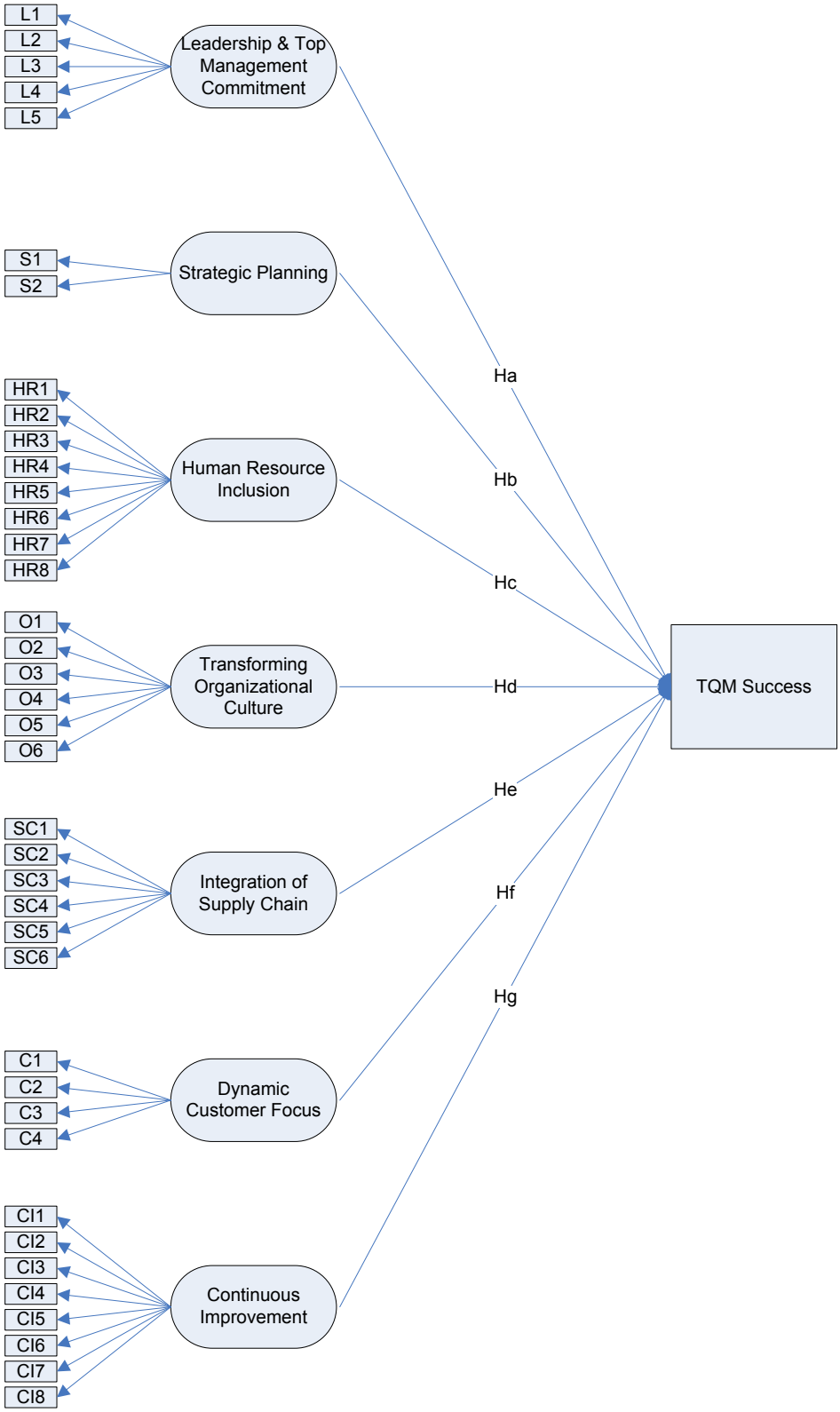

Figure 1: Hypothesis Development Model

Research Methodology

The multivariate analysis technique known as SEM is used for this study. The SEM can assess both measurement properties and test the key theoretical relationships all at once [40] and that is why SEM was chosen for the review of the relationships between the challenges identified under the TQM principles and the success of a TQM program.

This study used a six step process to complete the SEM analysis. Step 1 included an extensive literature review of the basic concepts of TQM which resulted in the development of the seven TQM principles identified previously. In Step 2 additional literature review was conducted that focused on identifying the challenges and barriers, which obstruct the successful implementation of TQM. Every challenge was categorized under one of the seven identified principles and together they formed the individual constructs for the model being assessed as shown in Figure 1 earlier. In Step 3 each of the challenges was structured in the form of a question to be used as a measureable variable or indicator for its corresponding principle. A total of thirty-nine indicators were developed and measured using a five-point Likert scale with end points 'Strongly Agree = 1' and 'Strongly Disagree = 5'. The first questionnaire was reviewed by four senior colleagues to assess content validity. They provided feedback on the structure of several questions and the adjustments to these questions were made before sending out to the full population.

In Step 4 this questionnaire was placed into an online survey resource and sent to professional contacts through email. The survey process lasted for three months from July through September 2012 and it must be noted the data reported was collected without approval from the Institutional Review Board (IRB). The total number of requests sent out was

approximately forty-five, all in a technical or professional position within the United States. The response rate was eighty percent with thirty-six returned surveys. Data cleaning resulted in thirty-one usable questionnaires for analysis. The profile of the respondent's for this study is shown in Table 1.

There are four demographics being monitored for each of the respondent's and they include: position in the company, role in TQM project, department, and industry. Each of the four categories has representation in every sub-category provided. This indicates that the responses collected have representation in each sub-category and there is a good mix of experience being collected upon.

In Step 5 the data was analyzed by first assessing the measurement model, which reviews the relationships between the individual constructs and the correlation between each of them. To do this first a review of the path estimates between the challenges and the principles is done. Following the review of the path estimates is an assessment of model fit and then the validity of the measurement model is assessed by reviewing the construct reliability and the discriminate validity. Next a review of the correlations between each individual construct is conducted by developing a set of hypothesis to determine if a relationship exists between each of the individual constructs. Last, a review of the measurement model's impact on the success of TQM is completed and this is considered the full structural model. This review entails again an analysis of model fit.

Throughout this review, modifications were made to the measurement model and the structural model based on the results of the analysis leading to Step 6 of this review where the final model is presented to be used as a tool for future researchers on the challenges of TQM.

Table 1: Profile of Respondents

	Frequency	Percentage
Position in Company		
Administrative Support	1	3.23%
Engineering/Technical Support	12	38.71%
Mid-level Management	9	29.03%
Production/Operation Support	7	22.58%
Other	2	6.45%
Total	31	100.00%
Role in TQM Project		
Core Team Member	17	54.84%
External Stakeholder	8	25.81%
Leader	4	12.90%
Other	2	6.45%
Total	31	100.00%
Department		
Human Resources	1	3.23%
Marketing	1	3.23%
Operations	8	25.81%
Product Design	5	16.13%
Quality	6	19.35%
Supply Management	2	6.45%
Technology Development	7	22.58%
Other	1	3.23%
Total	31	100.00%
Industry		
Automotive	3	9.68%
Chemical	1	3.23%
Computer/Software	1	3.23%
Electronics	7	22.58%
Healthcare	2	6.45%
Manufacturing	14	45.16%
Service	1	3.23%
Other	2	6.45%
Total	31	100.00%

Data Analysis Approach

For this study it was desired to review what impact each of the challenges identified in literature actually had on the success of a TQM program and how they interact with each other. The SEM approach is used to achieve this objective. The SEM is defined by Hair et al. [40] as a multivariate technique combining aspects of factor analysis and multiple regressions that enables the researcher to simultaneously examine a series of interrelated dependence relationships among the measured variables and latent constructs (variates) as well as between several latent constructs. The software used to perform the data analysis was IBM SPSS AMOS 21 (AMOS). The data analysis approach is described in four steps:

Path Analysis

The first step of analysis is to assess the path estimates between constructs and indicator variables for each individual principle of TQM. The path estimates should be at least 0.5 and ideally 0.7 or higher [40]. This is done to ensure the indicator variables adequately represent the challenges of the associated TQM principle.

Measurement Model

The second step is to review the measurement model. The measurement model is where the indicator variables for each construct are defined and the construct reliability is assessed.

The measurement model is first established for the SEM by aligning each of the challenges and barriers of TQM to the corresponding TQM principle and establishing correlations. Through review of the measurement model, construct validity is measured. Construct validity is defined

as the extent to which a set of measured variables actually represents the latent construct they are designed to measure [40].

The goodness of fit for the measurement model is assessed using the Chi-square statistic which is the conventional overall test of fit in covariance structure analysis. The Chi-square goodness of fit assesses the magnitude of discrepancy between the sample and fitted covariance matrices [41]. An ideal Chi-square value will be in the neighborhood of the degrees of freedom for the model [42]. The additional fit index that will be reviewed includes the Comparative Fit Index (CFI). This additional fit index was specifically chosen because per Hu [41] it performs better with smaller samples sizes. The CFI value that this model will be measured against is 0.92. This value is provided by Hair [40] based on a sample size less than two-hundred-fifty and the number of observed variables greater than or equal to thirty.

In addition to model fit the construct reliability of the measurement model is also assessed to ensure it demonstrates a satisfactory level of validity and reliability [43]. This is done by assessing the construct reliability (CR) and the variance extracted (VE). The CR will be computed according to Fornell and Larcker [43] and the VE will be computed according to Hair [40]. A CR value of 0.7 or higher suggests good reliability; reliability between 0.6 and 0.7 may be acceptable provided that other indicators of a model's construct validity are good [41]. A VE of 0.5 or higher suggests adequate convergence [40].

The discriminate validity of the measurement model is also assessed per the method defined by Fornell and Larcker [43] where the VE estimates should be greater than the squared correlation estimate.

Correlation Study

The third step following the measurement model review is a correlation study between each of the TQM principles. To test the correlation between each TQM principle twenty-one hypotheses were developed. The hypothesis are summarized in Table 2 and visually depicted in Figure 2.

To test the hypothesis of these relationships for the measurement model the critical ratio (CR) is used. The CR is found by dividing the covariance estimate by its standard error and is an observation on a random variable that has an approximate standard normal distribution [42]. Therefore, using a significance level of 0.05, any CR that exceeds 1.96 would be called significant [42] and the covariance between the TQM Principles would not be equal to zero. As a result at a CR greater than or equal to 1.96 the hypothesis shown above would be rejected.

Finally the full structural model is analyzed. The structural model is where the dependence relationships between each of the constructs and the success of a TQM program are reviewed in an attempt to accept or reject the previously stated hypothesis.

The structural model will be assessed using the maximum likelihood method in AMOS [42]. The hypothesis assessing the direct relationships between the TQM principles constructs and the success of a TQM program will be proven or disproven by reviewing the path coefficients to see if there is a significant and positive relationship [40]. H_o will not be rejected if the path coefficients are less than 1.96 at a significance level of 0.05. Also, the Model Fit will be confirmed again using the same goodness of fit tests as the measurement model and the previously defined acceptance values: Chi-square and CFI.

Table 2: Hypothesis of Relationships Between Each of the TQM Principles

H_1:	The covariance between the TQM Principles Leadership & Top Management Commitment and Strategic Planning is zero
H_2:	The covariance between the TQM Principles Strategic Planning and Human Resource Inclusion is zero
H_3:	The covariance between the TQM Principles Human Resource Inclusion and Transforming Organizational Culture is zero
H_4:	The covariance between the TQM Principles Transforming Organizational Culture and Integration of Supply Chain is zero
H_5:	The covariance between the TQM Principles Integration of Supply Chain and Dynamic Customer Focus is zero
H_6:	The covariance between the TQM Principles Dynamic Customer Focus and Continuous Improvement is zero
H_7:	The covariance between the TQM Principles Leadership & Top Management Commitment and Human Resource Inclusion is zero
H_8:	The covariance between the TQM Principles Strategic Planning and Transforming Organizational Culture is zero
H_9:	The covariance between the TQM Principles Human Resource Inclusion and Integration of Supply Chain is zero
H_{10}:	The covariance between the TQM Principles Transforming Organizational Culture and Dynamic Customer Focus is zero
H_{11}:	The covariance between the TQM Principles Integration of Supply Chain and Continuous Improvement is zero
H_{12}:	The covariance between the TQM Principles Leadership & Top Management Commitment and Transforming Organizational Culture is zero
H_{13}:	The covariance between the TQM Principles Strategic Planning and Integration of Supply Chain is zero
H_{14}:	The covariance between the TQM Principles Human Resource Inclusion and Dynamic Customer Focus is zero
H_{15}:	The covariance between the TQM Principles Transforming Organizational Culture and Continuous Improvement is zero
H_{16}:	The covariance between the TQM Principles Leadership & Top Management Commitment and Integration of Supply Chain is zero
H_{17}:	The covariance between the TQM Principles Strategic Planning and Dynamic Customer Focus is zero
H_{18}:	The covariance between the TQM Principles Human Resource Inclusion and Continuous Improvement is zero
H_{19}:	The covariance between the TQM Principles Leadership & Top Management Commitment and Dynamic Customer Focus is zero
H_{20}:	The covariance between the TQM Principles Strategic Planning and Continuous Improvement is zero
H_{21}:	The covariance between the TQM Principles Leadership & Top Management Commitment and Continuous Improvement is zero

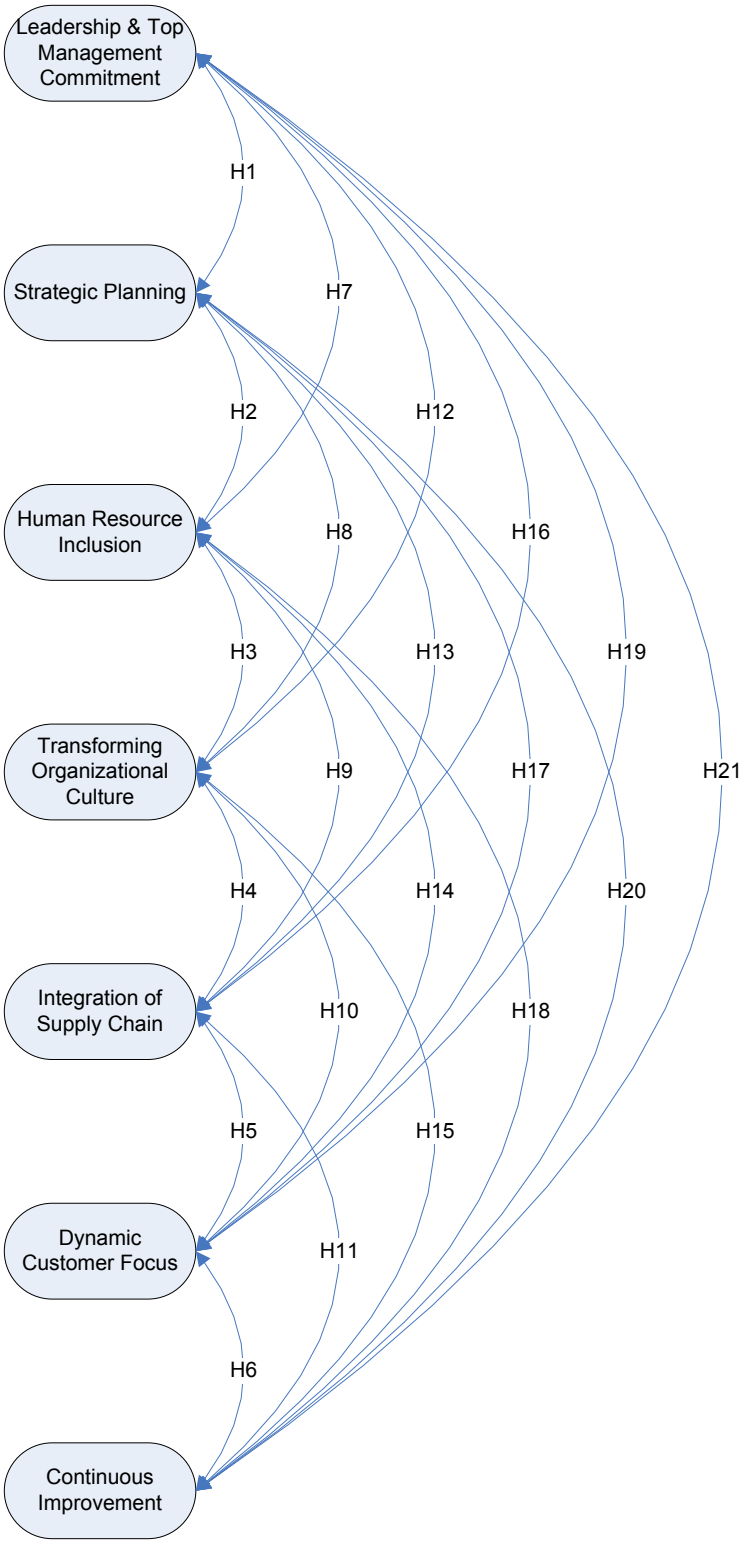

Figure 2: Relationships Between TQM Principles

Structural Model

Finally the full structural model is analyzed. The structural model is where the dependence relationships between each of the constructs and the success of a TQM program are reviewed in an attempt to accept or reject the previously stated hypothesis.

The structural model will be assessed using the maximum likelihood method in AMOS [42]. The hypothesis assessing the direct relationships between the TQM principles constructs and the success of a TQM program will be proven or disproven by reviewing the path coefficients to see if there is a significant and positive relationship [40]. H_o will not be rejected if the path coefficients are less than 1.96 at a significance level of 0.05. Also, the Model Fit will be confirmed again using the same goodness of fit tests as the measurement model and the previously defined acceptance values: Chi-square and CFI.

Data Analysis and Discussion

The data analysis results follow the identified process with path analysis being the first review. This is followed by review of the measurement model to check for reliability and validity. Then the correlation study is conducted to assess the relationships between each of the TQM principles and finally the structural model is analyzed.

Path Analysis

The results of the assessment using AMOS are summarized starting with the path analysis; the results are shown in Table 3.

The variances shown in Table 3 indicate all measured variables of the leadership and top management commitment construct are above the 0.5 – 0.7 threshold and hence will remain part

Table 3: Path Analysis Results

TQM Principle	Measured Variable	Variances	Notes
Leadership & Top Management Commitment	L1	2.07	
	L2	5.90	
	L3	2.55	
	L4	0.76	
	L5	1.00	
Strategic Planning	S1	Invalid	Removed - Underidentified Construct
	S2	Invalid	Removed - Underidentified Construct
Human Resource Inclusion	HR1	1.80	
	HR2	2.00	
	HR3	0.49	Removed
	HR4	-0.70	Removed
	HR5	1.68	
	HR6	1.27	
	HR7	1.50	
	HR8	1.00	
Transforming Organizational Culture	O1	Invalid	Original Regression Weight Estimate = 36.942 Removed - Reached Iteration Limit
	O2	-0.24	Removed
	O3	Invalid	Regression Weight Estimate = 47.016 Removed - Reached Iteration Limit
	O4	1.61	
	O5	1.01	
	O6	1.00	
Integration of Supply Chain	SC1	2.62	Removed - Underidentified Construct with remaining
	SC2	-2.02	Removed
	SC3	-1.56	Removed
	SC4	-1.40	Removed
	SC5	-1.11	Removed
	SC6	1.00	Removed - Underidentified Construct with remaining
Dynamic Customer Focus	C1	0.67	
	C2	-0.94	Removed
	C3	1.13	
	C4	1.00	
Continuous Improvement	CI1	0.50	Removed - Underidentified Construct with remaining
	CI2	-0.43	Removed
	CI3	0.43	Removed
	CI4	0.39	Removed
	CI5	-0.95	Removed
	CI6	-0.32	Removed
	CI7	0.38	Removed
	CI8	1.00	Removed - Underidentified Construct with remaining

of the measurement model. The opposite occurred for the strategic planning construct where both of the measured variables were below the threshold values and therefore, the entire construct was removed from the analysis. Human resource inclusion had only two of the eight measured variables fall below the limit and these two variables were removed from the measurement model.

Transforming organization culture construct required some preliminary investigation. The construct by itself needed to be examined because the initial measurement model would not run with it and ran into an iteration limit. The first and third measured variables associated with organizational culture showed the highest Regression Weight Estimate and were removed from the measurement model prior to even being able to conduct the path analysis. Following this adjustment one more out of the remaining four measured variables needed to be removed because it fell below the desired path estimate limit.

The integration of supply chain construct had four out of the six measured variables fall below the desired limits. However, because only two measured variables remained, the construct itself was under identified and could not be used for the modified measurement model. The same is true for the Continuous Improvement construct where six out of the eight measured variables fell below the limit and the remaining construct was under identified with remaining two variables.

These adjustments result in the modified measurement model shown in Figure 3. This modified measurement model reduces the number of correlations that can be assessed from twenty-one down to six. Also the number of hypothesis is reduced from seven down to four.

This is a significant adjustment because it eliminates the potential to examine all relationships of the TQM principles.

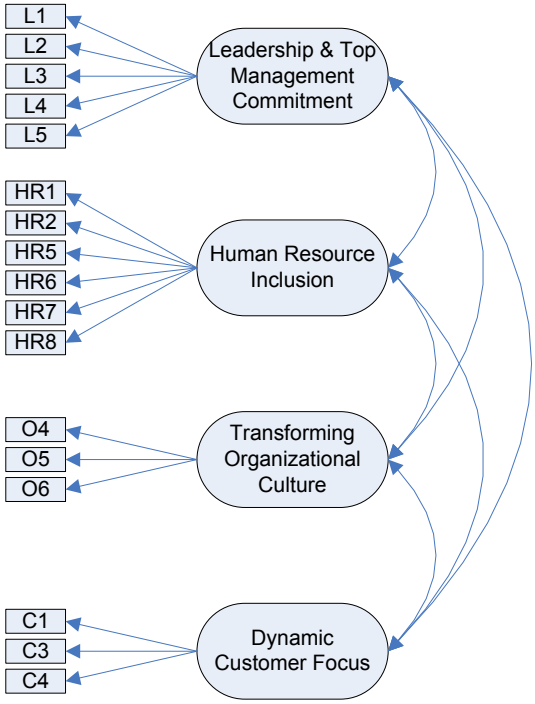

Figure 3: Modified Measurement Model

Measurement Model

After completing the path analysis, the next stage of the data analysis is confirmatory factor analysis to assess the reliability and validity of the measurement model.

The Chi-square for the measurement model is 174.61. This is not close to a zero Chi-squared value as desired and the degrees of freedom for the model are also relatively high at 113. The default model CFI value is 0.557, which again falls short of the desired 0.92 value.

The construct reliability is calculated at 0.10 and the variance extracted equals 0.30. Again, both values do not meet the desired minimum values which are 0.7 or higher and 0.5 or higher respectively.

Discriminate validity proves successful for only the TQM principles leadership and top management commitment and transforming organization culture. It falls short for human resource inclusion and dynamic customer focus whose inter-construct squared correlation estimate is greater than the variance extracted estimate.

Ultimately the measurement model proves to have poor model fit, reliability and validity. This may occur for several reasons but the most notable is the low sample size. Most likely these numbers would improve significantly given a larger pool of responses.

Correlation Study

Following the modification of the measurement model through path analysis only a few of the correlation hypothesis remain as shown in Figure 4.

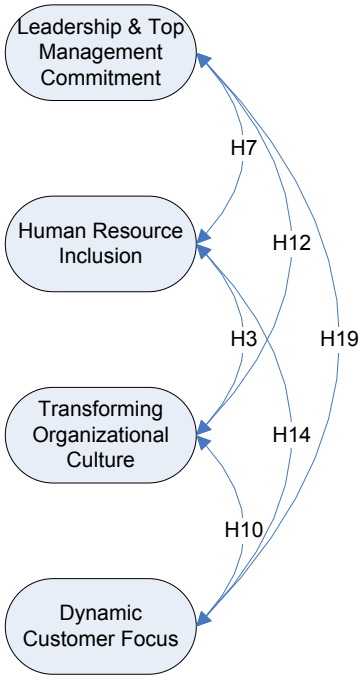

Figure 4: Relationships Between TQM Principles Modified

Of the remaining correlation hypothesis H10, H12, and H14 have a negative CR value resulting in the hypothesis not being supported. The remaining hypothesis: H3, H7 and H19 have a positive CR less than the desired 1.96 and these hypotheses will remain in the structural model. These results are summarized in Table 4.

Table 4: Correlation Study Results

Hypothesis		Critical Ratio	Hypothesis Supported
H_3:	The covariance between the TQM Principles Human Resource Inclusion and Transforming Organizational Culture is zero	1.410	Accept H_3
H_7:	The covariance between the TQM Principles Leadership & Top Management Commitment and Human Resource Inclusion is zero	0.678	Accept H_7
H_{10}:	The covariance between the TQM Principles Transforming Organizational Culture and Dynamic Customer Focus is zero	-1.814	Correlation is not positive
H_{12}:	The covariance between the TQM Principles Leadership & Top Management Commitment and Transforming Organizational Culture is zero	-0.741	Correlation is not positive
H_{14}:	The covariance between the TQM Principles Human Resource Inclusion and Dynamic Customer Focus is zero	-0.459	Correlation is not positive
H_{19}:	The covariance between the TQM Principles Leadership & top Management Commitment and Dynamic Customer Focus is zero	0.898	Accept H_{19}

As a result only the correlations between leadership and human resource inclusion, human resource inclusion and transforming organizational culture, and leadership and dynamic customer focus remain when setting up the structural model. These correlations along with the remaining path estimates will be reviewed in the following structural model assessment.

Structural Model

The final structural model to be assessed after the modifications made following the measurement model assessment and the correlation study is shown below in Figure 5.

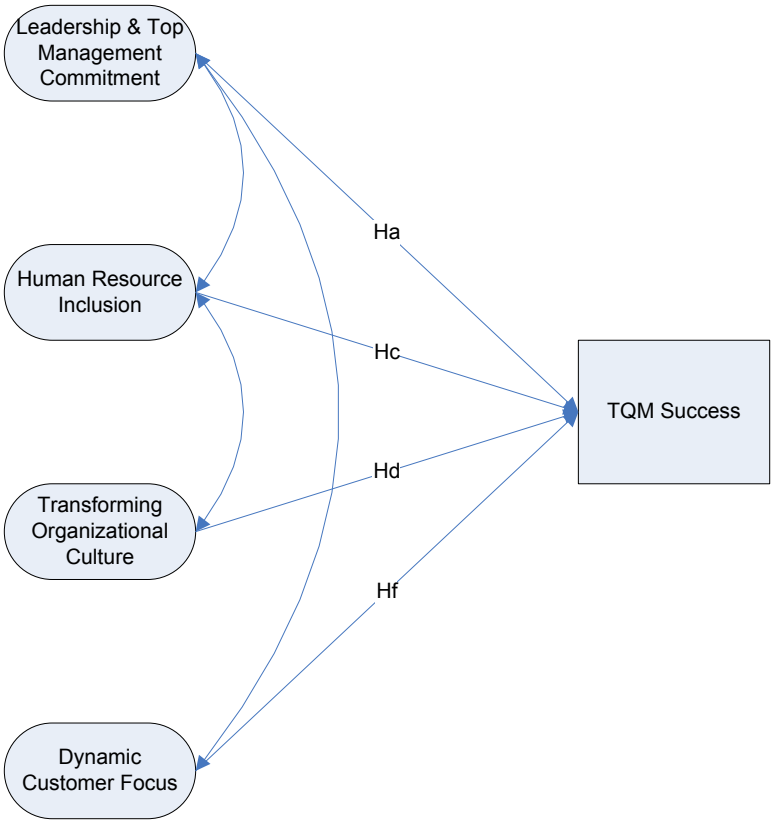

Figure 5: Structural Model

The model fit for the Structural Model is represented by a Chi-square value of 201.737 with 129 Degrees of Freedom and the CFI value is 0.517. The path coefficient values for each of the hypothesis are shown in Table 5.

Table 5: Hypothesis Path Coefficients

Hypothesis		Path Coefficients	H_o Supported
H_a:	The challenges identified under the TQM Principle Leadership and Top Management Commitment directly and positively influence TQM success	-1.498	Correlation is not positive, H_o is not supported
H_c:	The challenges identified under the TQM Principle Human Resource Inclusion directly and positively influence TQM success	0.630	Positive but not significant
H_d:	The challenges identified under the TQM Principle Transforming Organizational Culture directly and positively influence TQM success	0.253	Positive but not significant
H_f:	The challenges identified under the TQM Principle Dynamic Customer Focus directly and positively influence TQM success	0.310	Positive but not significant

Given these findings the hypothesis representing the challenges facing human resource inclusion, transforming organizational culture, and dynamic customer focus have a positive impact on the success of a TQM program albeit at a reduced significance value than desired. Also, while the TQM principle leadership and top management commitment does not have a positive impact on the success of a TQM program it does still correlate to the challenges of dynamic customer focus.

While all of the analysis results fall short of the desired significant values there is indication that findings show that an influence between the TQM principles and the impact they have on the success of a TQM program does exist. Perhaps given a larger samples size and re-assessment of the original survey questions for the indicator variables a stronger model fit and path coefficients would have resulted.

Results also show that a correlation does exist between the TQM principles leadership and top management commitment and human resource inclusion, leadership and top

management commitment and dynamic customer focus, and human resource inclusion and transforming organizational culture. Further, the TQM principles that show an effect on the success of a TQM program include human resource inclusion, transforming organization culture and dynamic customer focus.

Conclusion

The purpose of this study is to analyze the challenges and barriers of TQM and attempt to quantify their impact on the success of a TQM program. This research is unique in its attempt to apply quantifiable measures to the challenges faced by organizations that endeavor to implement and sustain TQM programs. The findings indicate that the challenges associated with some of the TQM Principles are correlated and a few of them do have an impact on the success of a TQM program. The main limitation of this study is the use of a small sample size due to budgetary restrictions. Practical implications of this study allow for leaders of TQM programs to focus on these challenges in an attempt to overcome them and ensure successful implementation and sustainment of TQM in their organization.

While this study fell short on the targeted values for model fit, reliability and validity, there can still be some inferences found on what the impacts of challenges associated with specific TQM principles may have on the success or failure of a TQM program. This can be useful to companies who are looking to pursue a TQM program and allow them to focus more attention on the challenges that have an impact.

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CONCLUSION AND FUTURE RESEARCH DIRECTION

The first paper provides an overall history of quality management concepts with a focus on the evolution of TQM philosophy. It further provides the fundamental principles of TQM along with their benefits and methods of measurement in order to quantify the benefits. The paper also enumerates the basic challenges found in literature that inhibit the successful implementation of TQM.

The second paper builds on the first by analyzing the challenges and barriers of TQM to quantify their impact on the success of a TQM program. This research is unique in its attempt to apply quantifiable measures to the challenges faced by organizations that endeavor to implement and sustain TQM programs. The findings indicate that the challenges associated with some of the TQM Principles are correlated and a few of them do have an impact on the success of a TQM program. The main limitation of this study is the use of a small sample size due to budgetary restrictions.

Practical implications of this study allow for leaders of TQM programs to focus on these challenges in an attempt to overcome them and ensure successful implementation and sustainment of TQM in their organization. Future research direction may be able to easily build on this study by applying to a larger samples size and/or to focus on the identified relationships in an attempt to better understand the dependencies. This would be useful to companies who are looking to pursue a TQM program and allow them to focus more attention on the challenges that may have an impact on their success.

APPENDIX: TOTAL QUALITY MANAGEMENT SURVEY

Total Quality Management Challenges and Barriers

Survey Information

You are being asked to participate in this survey because you are an engineering and/or technical professional who has participated in a Total Quality Management (TQM) project. This survey is intended to collect information regarding the challenges and barriers encountered when trying to implement or sustain TQM. This research is being conducted by Connie Rokke (Connie.Rokke@my.ndsu.edu) a master of science student in the Industrial Engineering program at North Dakota State University.

Your responses will be kept confidential. The amount of time required to complete this survey will be approximately 10-15 minutes.

Thank you in advance, your participation is appreciated.

Page 1

Total Quality Management Challenges and Barriers

Background Information

1. Have you participated in a TQM implementation project?

- Yes
- No

2. Was TQM successfully implemented?

- Yes
- No

3. How long did TQM remain successful?

- 0 - 1 year
- 1 - 5 years
- 5 - 10 years
- 10+ years

4. What best describes your position in the company when you participated in TQM?

- Executive Management
- Mid-level Management
- Administrative Support
- Engineering/Technical Support
- Production/Operation Support
- Other (please specify)

5. What best describes your role when you participated in a TQM project?

- Leader
- Core Team Member
- External Stakeholder
- Other (please specify)

Total Quality Management Challenges and Barriers

6. What best describes the department you were working in when you participated in TQM?

- Quality
- Supply Management
- Human Resources
- Marketing
- Operations
- Accounting
- Product Design
- Technology Development
- Other (please specify)

7. What best describes the industry you were working in when you participated in TQM?

- Automotive
- Chemical
- Computer/Software
- Electronics
- Healthcare
- Manufacturing
- Military
- Service
- Other (please specify)

Total Quality Management Challenges and Barriers

Survey Questions

Identify how strongly you agree or disagree with the following statements with respect to the organization that was initiating or did initiate TQM.

8. Top Management's compensation is directly linked to profitability.

Strongly Agree | Agree | Undecided/Don't Know | Disagree | Strongly Disagree

9. Top Management's compensation is directly linked to quality metrics such as defect rates.

Strongly Agree | Agree | Undecided/Don't Know | Disagree | Strongly Disagree

10. Top Management's compensation is directly linked to customer satisfaction levels.

Strongly Agree | Agree | Undecided/Don't Know | Disagree | Strongly Disagree

11. Top Management is engaged.

Strongly Agree | Agree | Undecided/Don't Know | Disagree | Strongly Disagree

12. Top Management supports quality initiative efforts.

Strongly Agree | Agree | Undecided/Don't Know | Disagree | Strongly Disagree

13. There is a long term strategic plan.

Strongly Agree | Agree | Undecided/Don't Know | Disagree | Strongly Disagree

14. The long term strategic plan is not followed.

Strongly Agree | Agree | Undecided/Don't Know | Disagree | Strongly Disagree

15. Relevant organizational information is perceived as power and is not shared with the employees.

Strongly Agree | Agree | Undecided/Don't Know | Disagree | Strongly Disagree

16. Employee suggestion systems simply ask for employee ideas and are not followed up.

Strongly Agree | Agree | Undecided/Don't Know | Disagree | Strongly Disagree

Total Quality Management Challenges and Barriers

17. Jobs are narrowly defined.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

18. Productivity is closely monitored.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

19. Employees are trained in functional skills only.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

20. Performance reviews focus on past mistakes.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

21. Reward systems are established as a means to an end.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

22. The employee selection process focuses only on individuals with the requisite skills.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

23. TQM has made work more demanding.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

24. TQM requires greater skill and accuracy when performing job functions.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

25. TQM has created more work.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

26. Current quality plans are too amorphous.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

27. TQM was implemented all at once.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

Total Quality Management Challenges and Barriers

28. There is a lack of understanding of the factors that collectively affect the TQM efforts.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

29. Business is awarded to suppliers based on price tag alone.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

30. Supplier relationships are long term.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

31. Supplier relationships are collaborative.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

32. Supplier evaluation systems establish synergistic integration between buyer and seller.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

33. Supply Chain Management is represented at the executive management level.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

34. Compliance solutions are static and inflexible.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

35. TQM efforts are integrated with customer expectations.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

36. Business is conducted under a firefighting mentality at the operational level.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

37. There are consistent reviews of customer requirements.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

38. Quality is integrated into the sales and marketing department.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

Total Quality Management Challenges and Barriers

39. Quality initiatives are static and inflexible.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

40. Quality initiatives are driven by market developments.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

41. Quality initiatives focus only on the organization's production process.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

42. Quality initiatives justify status quo.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

43. Quality initiatives use the learning capacity of organizations to change and renew themselves.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

44. Quality initiatives establish the need to systemize and formalize a series of procedures.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

45. Quality initiatives test for consistency, not continuous improvement or product performance.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○

46. The role of the quality manager is limited to documentation efforts only.

Strongly Agree	Agree	Undecided/Don't Know	Disagree	Strongly Disagree
○	○	○	○	○