Quality Exploitation versus Quality Exploration: Measurement, Antecedents, and Performance Implications

A DISSERTATION
SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
OF THE UNIVERSITY OF MINNESOTA
BY

Dongli Zhang

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

Dr. Kevin Linderman and Dr. Roger G. Schroeder, Co-advisers

June 2009

Acknowledgements

The process of writing and completing a doctoral dissertation requires support from many people. The most important people I would like to thank are my advisors, Professor Kevin Linderman and Professor Roger Schroeder. They are world-class scholars, and they are also kind and supportive. Both of them have supervised my dissertation from the beginning to the end. I have learned so much from them and I will always remember their guidance and support during my Ph.D. journey. It was both a privilege and a pleasure to work with them. They will be the role models for me in my whole professional life.

I would like to thank my committee member, Professor Susan Meyer Goldstein. Susan provided me many great suggestions, and she always encouraged me positively. She amazed me with her responsiveness. I would not be surprised if I saw a quick response from her within an hour, or sometimes within 5 minutes. As a successful female professor, Susan sets a great example for me to follow.

I would also like to thank Professor Geoff Maruyama. Geoff is another one of my committee members, and his expertise in Structural Equation Methods provided me great guidance and help during my dissertation journey. As the associate vice president for system academic administration, Geoff has a very busy schedule. But he could always find time to respond my questions and provide me valuable comments.

I am also in debt to all the faculty members in the Operations and Management Science department. It would have been impossible for me to complete my thesis without the research skills and knowledge I have learned from this distinguished team. Many thanks should also go to all my fellow Ph.D. students in the OMS department.

Their company and friendship made this journey delightful. The HOM cluster staff also offered their strong support to me. Special thanks to Deb Brashear and Vicki Lund for their support.

I also want to thank the Juran Center for Leadership in Quality. I was fortunate to receive fellowships from the Juran Center twice. This generous support helped me focus on my dissertation research without worrying about my financial situation.

I was also fortunate to be part of the High Performance Manufacturing project. The data used in this thesis is from the HPM project. I am thankful to all the members in the HPM team for their effort in data collection. Special thanks to Professor Roger Schroeder for initializing and organizing the project.

Last but not least, I want to thank my family, and especially my husband, Yuqi Feng. Yuqi has been very supportive throughout the years. When our two daughters were little, he took care of them during the night, so I could have a good sleep and have the energy to read seminar papers and think about research questions. The love and support from my family made this journey a delightful one.

Abstract

Quality management (QM) practices and the benefits related to these practices have been addressed in many studies. Although these practices are touted as "universal remedies," there are mixed results and high-profile failures in their implementation. The necessity of customization of the practices has been proposed in some studies. However, research on how to customize and what factors should be considered is still scant. This dissertation research makes an effort to address this customization issue. Specifically, the dissertation is organized into three essays.

Essay 1 differentiates and examines two different aspects of QM practices that have different objectives: quality exploitation (QEI) and quality exploration (QER). QEI includes the QM practices that aim to control the known problems and processes. The objective of QEI is to ensure the consistency and efficiency of outcomes. QER includes the QM practices that aim to explore the unknown and to identify and pursue novel solutions. QER keeps organizations open and flexible to new ideas. Essay 1 develops a reliable and valid set of measures for QEI and QER and empirically shows that these measures can discriminate QEI and QER as two separate constructs. It provides a solid foundation for further research on customization of QM practices.

Essay 2 examines performance associated with QEI and QER under different organizational structures and different levels of environmental uncertainty. The results of essay 2 provide possible ways to customize the QM practices. Two types of models are used in the study to understand organizational structure: mechanistic and organic. Organizations with a mechanistic structure are structured hierarchically and are centrally controlled by an authority. In contrast, organic structure settings present more

flexible and open-type internal arrangements of an organization. In an organization with a mechanistic structure, QEI is proposed to be more effective than QER. In contrast, QER should be more effective than QEI in an organization with an organic structure. The focus on QEI or QER also needs to be adjusted according to the environmental uncertainty the organization faces in order to attain high performance benefits. Organizations facing high environmental uncertainty should focus on QER to gain more performance benefits. In contrast, organizations facing low environmental uncertainty should get more benefits from QEI. Essay 2 provides empirical evidence that supports the above relationships between QEI, QER, and performance under different contextual conditions.

Essay 3 investigates the theoretical motivation for the adoption and implementation of QEI and QER. Two different theoretical views are identified and empirically tested: the institutional view and the rational view. Institutional perspectives generally emphasize the role of social factors rather than economic or efficiency factors in driving organizational actions. The rational view suggests that goals and objectives may be a motivational factor that influences the organization's implementation of QEI or QER. Based on the different aims of QEI and QER, their implementation might be driven by different goals of an organization. Empirical results show certain support for both the institution view and the rational view to explain the implementation of QEI and QER.

Table of Contents

List of Tables

List of Figures

List of Appendices

Chapter 1

Introduction

1.1 Research background

In today's increasingly competitive and rapidly changing world, companies keep looking for new ways to increase their competitiveness to ensure their survival and success. A variety of improvement initiatives or new approaches have been introduced to companies, such as total quality management (Crosby, 1979; Deming, 1986; Juran, 1986), lean manufacturing (Womack, et al., 1990), and Six Sigma (Harry, 1998; Pande et al., 2000). The success of some leading companies has led thousands of others to emulate them and their practices. However, despite many remarkable successes, a number of studies revealed a disturbing pattern of failure (Powell, 1995). The conclusion of most large studies has been that only about a third of the companies that attempted to implement the most popular best practices achieved the results expected – by the companies' own admissions. In the few studies that asked customers and suppliers, rather than the companies themselves, to evaluate the overall effectiveness of such programs, the success rate was even lower (Hayes, et al., 2003).

To address the low success rate of implementing these practices, serious questions have been raised about some of the basic premises underlying them. It has been clear that no one practice is appropriate in every situation. Customization of these improvement practices based on an organization's situation might be necessary to achieve expected results. The necessity of customization of the improvement initiatives has been proposed by several studies (Westphal et al., 1997; Hayes, et al., 2003; Sousa and Voss, 2008), but research on how to customize them and what factors should be considered is still scant. This research addresses this problem and starts with quality management (QM) as the focal approach.

1.2 Objectives and research questions

Quality management (QM) practices and the benefits related to these practices have been addressed in many studies (e.g. Nair, 2006; Kaynak, 2003; Flynn et. al., 1995; Forza and Filippini, 1998). Some QM practices have been advocated as universally applicable to all organizations (Crosby, 1979; Deming, 1986; Juran, 1986).Those practices spread very quickly in the 1980s and 1990s It is now widely believed that QM practices are essential to different kinds of organizations for their survival and growth. However, although these practices are sold as "universal remedies," there are mixed results and high-profile failures in their implementation (Powell, 1995).

Some researchers have noticed the phenomenon and tried to provide explanations and corresponding remedies. Hackman and Wageman (1995) argue that the problem is caused by the failure to fully implement all of the key practices. Other researchers claim that the absence of complementary assets that must be combined with QM practices is the reason for not achieving competitive advantage (Waldman and Gopalakrishnan, 1996; Carmen et al., 1996). Beer (2003) argues that the failure of QM programs occurs because senior management tends to motivate change through top-down programs, which results in undermining unit leaders' commitment and their capacity to perform improvement. Douglas and Judge (2001) try to explore this problem from an organizational structure point of view. They find some support for the moderating influence of organizational structure on the implementation effectiveness of QM practices. Recently, there are two comprehensive literature reviews on QM practices and their influence on firm performance (Nair, 2006; Kaynak, 2003). Unfortunately, no conclusion has been drawn that can provide practitioners useful guidance to accomplish expected performance improvement and avoid QM failures.

Sitkin et al. (1994) point out that one limitation of existing studies is that all QM practices are treated as one set when their influence on performance is examined. According to Dale et al. (2001), research on QM should be based on a contingency approach rather than an assumption of universal applicability. A contingency perspective implies that QM practices should be matched appropriately to certain situational requirements. Sousa and Voss (2002, p.105) also point out that "there may be no one best implementation approach to suit all organizations and each company may need a tailored implementation program." In their recent paper, Sousa and Voss (2008) propose again that further research is needed to understand the contextual conditions that can be used to tailor the so called "best practices." However, there is no adequate guidance on such a matching or tailoring process in the Operations Management literature.

In 1991, March proposed that there were two kinds of learning activities within an organization: the exploration of new possibilities and the exploitation of old certainties. Both exploration and exploitation are essential for organizations, as they compete for scarce resources. Therefore, choosing the "right" balance is essential for organizations (March, 1991). Relying upon March's (1991) notions of exploitation and exploration, this paper separates QM practices into two different yet related sets: quality exploitation (QEI) and quality exploration (QER). On the one hand, organizations need QEI to control stable and familiar processes and improve the efficiency of those processes. On the other hand, organizations need QER to get new insights about process innovation and exploration of the unknown. The use of each should be more or less effective in different external or internal conditions. Ignoring this may result in inappropriate implementation of QM practices, and consequently ineffective performance.

Although Sitkin et al. (1994) propose that we need to distinguish different QM practices to better address the relationship between QM practices and performance, studies on how to distinguish them are very scant. While there is some theoretical underpinning, there is no existing research that provides a measurement instrument to operationalize the two aspects of QM. Consequently, there is no empirical evidence to support the theory. The purpose of this study is to fill this void. Development and validation of a measurement instrument will be the first step of the study.

The performance implication of QM practices has been addressed by many studies (e.g. Nair, 2006; Kaynak, 2003; Flynn et. al., 1995; Forza and Filippini, 1998). Due to the inconsistent results of these studies, some researchers propose that a contingency approach should be used and contextual factors should be considered. From a contingency point of view, this study investigates the relationship between QEI, QER, and performance under different contextual factors.

A great amount of research on QM focuses on analyzing the relationship between QM practices and the performance results, with few studies addressing the antecedents or determinants of QM implementation. Therefore, the motivation that leads to the implementation of QM practices is underdeveloped. To gain more benefits from QM initiatives, it is necessary to first look at the motivation for the adoption and implementation. Research on the antecedents or motivation of adoption may help organizations implement the right practices at the beginning. Westphal et al. (1997) identify some unexplored issues of best practices adoption. They argue that it would be more appropriate to explore how organizations define and implement new practices than simply to predict whether organizations adopt at all. Accordingly, antecedents that influence the implementation of QEI versus QER will be investigated in the study.

To summarize, this study answers the following questions:

1. How do we discriminate between and measure QEI and QER?

2. What contextual factors plausibly moderate relationships of QEI and QER with performance (organizational structure, environmental uncertainty)?

3. What antecedent variables are predictive of the implementation of QEI and QER?

1.3 Research methods

The unit of analysis in this study is the manufacturing plant. Overall, most studies on QM have either focused on plant-level data or firm-level data (Nair, 2006). A firm may have several plants that face different internal and external conditions and have a different focus on QEI or QER. Therefore, plant level data is more appropriate than firm level data in developing a measurement instrument and also in further research on customization of QM practices.

The data used in this study are obtained from a comprehensive project conducted by a team of international researchers in the field of production and operations management. The project has lasted for more than 15 years and collected data for three rounds. The first and second rounds are called the World Class

Manufacturing (WCM) project and the third round is called the High Performance Manufacturing (HPM) project. The third round data are used in this study.

The HPM project collects data from a stratified sample consisting of traditional and world-class reputation plants. The plant size is restricted to those with at least 250 employees. The data include 238 manufacturing plants located in eight countries: Austria, Finland, Germany, Italy, Japan, Korea, Sweden, and the United States.

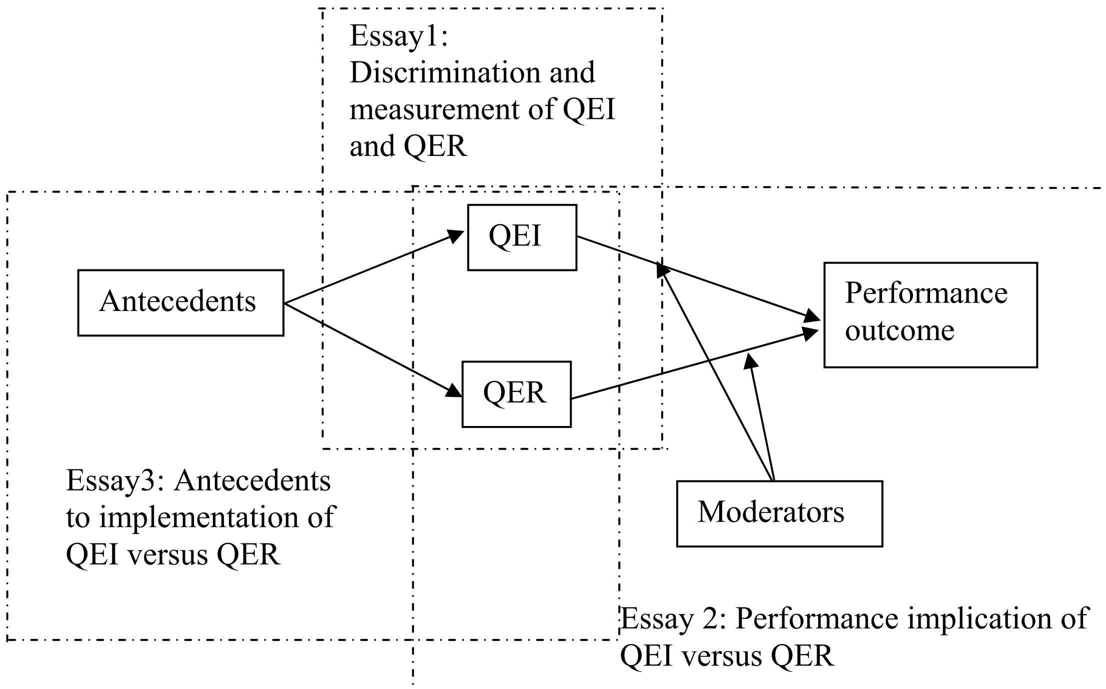
The plants are selected in three industries: automobile suppliers, electronics, and machinery. In each industry, there are approximately the same numbers of plants. The three industries provide a good setting for research on QEI and QER, since the plants within each industry face different environmental factors and competitive pressures. These differences in plants may result in a different focus on QEI and QER, which provides enough variation to conduct research on the two constructs.

A variety of data analysis methods are used in this study. For developing and validating the measurement instruments of QEI and QER, both exploratory and confirmatory factor analyses are used in the study. Sub group analysis, ANOVA, and fixed effects regression models are used to test hypotheses regarding performance implications and implementation antecedents.

1.4 Design of the dissertation research

To address the three research questions identified in section 1.2, this study consists of three interrelated essays. Each essay studies one of the three major research questions. The design of the three essays is illustrated in Figure 1-1.

Figure 1-1: Design of the dissertation



The dissertation will be organized around the three essays. Essay 1 (Chapter 2) is titled "Quality Exploitation versus Quality Exploration: Discrimination and Measurement." It examines two different aspects of QM practices that have different objectives: quality exploitation (QEI) and quality exploration (QER). Essay 1 theoretically describes the two constructs, develops a reliable and valid set of measures for QEI and QER and shows that these measures can discriminate QEI and QER as two separate constructs. It provides a solid foundation for further research on customization of QM practices.

Essay 2 (Chapter 3), entitled "The Moderating Role of Contextual Factors: Performance Implication of Quality Exploitation versus Quality Exploration," examines performance influences of QEI and QER under different organizational structures and different levels of environmental uncertainty. Two types of model have been used in efforts to understand organizational structure: mechanistic and organic (Burns and Stalker, 1961). Organizations with a mechanistic structure are structured hierarchically and are controlled by a central authority. In contrast, organic structural settings present more flexible and open internal arrangements of an organization (Spencer, 1994). In an organization with a mechanistic structure, QEI might be more effective than QER. In contrast, QER might bring more performance benefit than QEI in an organization with an organic structure.

Environmental uncertainty has been proposed as having an influence on the relationship between QM practices and performance in several studies (Benson et al. 1991; Sitkin et al. 1994; Nair, 2006). Uncertainty means that decision makers do not have sufficient information about environmental factors and they have a difficult time predicting external changes. There are two dimensions of environmental uncertainty: simple-complex and stable-unstable. The simple-complex dimension concerns environmental complexity, which refers to heterogeneity, or the number and dissimilarity of external elements relevant to an organization's operations. The stable-unstable dimension refers to whether elements in the environment are dynamic. The main dynamic elements in the environment include customer needs (demand) change, product/process change, and competition (Daft, 2004). This research focuses on the stable-unstable aspect of the environmental uncertainty. Organizations facing high uncertainty might be more likely to focus on QER to gain more performance benefits. In contrast, organizations facing low uncertainty may get more benefits from QEI. In summary, the focus on QEI or QER needs to be adjusted according to the uncertainty an organization faces in order to get expected performance benefits.

Essay 3 (Chapter 4), entitled "Implementation of Quality Exploitation versus Quality Exploration: Institutional or Rational," investigates different theories or views for the adoption and implementation of QEI and QER. Two different views are identified and empirically tested: institutional and rational. Institutional perspectives generally emphasize the role of social factors rather than economic or efficiency factors in driving organizational actions. Institutional mechanisms might be reflected by companies that are from the same country or in the same industry (Haunschild and Miner, 1997). Rational view suggests that goals and objectives may be a motivational factor that influences the organization's implementation of QEI or QER. Based on the different aims of QEI and QER, their implementation might be driven by different goals of an organization. This study adapts Porter's (1980) generic strategy model. The implementation of QEI might be motivated more by low cost strategy, while QER might be driven by the goal of differentiation. ANOVA and fixed effects regression models are used to empirically test the two views. The results show certain evidence to support both of them, which suggest that when companies implement QM practices, they consider both institutional environments and their own specific goals.

Finally, Chapter 5 discusses the academic and practical contribution of the dissertation. It also includes a discussion of the limitations of the research and future research directions.

Chapter 2

Quality Exploitation versus Quality Exploration: Discrimination and Measurement

2.1 Introduction

To survive in today's hyper-competitive and rapidly changing world, companies keep searching for new ways to improve performance. A number of quality management (QM) practices have been implemented. The successful implementation of some leading companies has led many other organizations to emulate their QM practices. Despite remarkable successes some organizations have had with these practices, a number of subsequent studies revealed a disturbing pattern of failure (Powell, 1995). The conclusion of most large studies has been that only about a third of the companies that attempted to implement the most popular QM practices achieved the results expected–by the companies' own admissions. For instance, Dooyoung et al. (1998) report estimates of quality management practices failure rates as high as 60-70 percent. In some studies the success rate was even lower when customers and suppliers evaluated performance rather than the companies themselves (Hayes et al., 2003).

Some researchers have noticed the phenomenon and tried to provide explanations and corresponding remedies. Hackman and Wageman (1995) argue that the problem is caused by the failure to fully implement all of the key practices. Other researchers claim that the absence of complementary assets that must be combined with QM practices is the reason for not achieving competitive advantage (Waldman and Gopalakrishnan, 1996; Carmen et al., 1996). Beer (2003) argues that the failure of QM programs occurs because senior management tends to motivate change through top-down programs, which results in undermining unit leaders' commitment and their capacity to perform improvement. Douglas and Judge (2001) investigated this problem from an organizational structure point of view. They find some support for the moderating influence of organizational structure on the implementation effectiveness of QM practices. Recently, there have been two comprehensive literature reviews on QM practices and their influence on firm performance (Nair, 2006; Kaynak, 2003). Unfortunately, no conclusion has been drawn that can provide practitioners useful guidance to achieve expected performance improvement and avoid QM failures.

Sitkin et al. (1994) point out that one limitation of existing studies is that all QM practices are treated as one set when their influence on performance is examined. According to Dale et al. (2001), research on QM should be based on a contingency approach rather than an assumption of universal applicability. A contingency perspective implies that QM practices should be customized appropriately to certain situational requirements (Westphal, et al. 1997). Sousa and Voss (2002, p.105) also point out that "there may be no one best implementation approach to suit all organizations and each company may need a tailored implementation program."

In 1991, March proposed that there were two kinds of learning activities within an organization: the exploration of new possibilities and the exploitation of old certainties. Both exploration and exploitation are essential for organizations, as they compete for scarce resources. Therefore, choosing the "right" focus is essential for organizations (March, 1991). A few other organization theorists also have argued the distinctions between exploitation and exploration, or sometimes called control and exploration (e.g. Sutcliffe et al., 2000; Eisenhardt and Tabrizi, 1995). The notion of exploitation and exploration has emerged as an underlying theme in research on organizational learning and strategy (Levinthal and March, 1993; Vera and Crossan, 2004), innovation (Rothaermel and Deeds, 2004), and entrepreneurship (Shane and Venkataraman, 2000). Exploitative activities emphasize the need for efficiency, focusing on customer-responsive and highly reliable processes, while explorative activities emphasize anticipating change requirements, focusing on the need for learning and innovation (Benner and Tushman, 2003; Sutcliffe et al., 2000).

Relying upon March's (1991) notions of exploitation and exploration, this paper distinguishes QM practices as comprised of two different yet related sets: quality exploitation (QEI) and quality exploration (QER). On the one hand, organizations need to control stable and familiar processes and improve the efficiency of manufacturing or service processes. So QEI includes the QM practices that aim to control the known problems and processes. The objective of QEI is to ensure the consistency and efficiency of outcomes. On the other hand, organizations need new insights about innovation and exploration of the unknown. Therefore, QER includes the QM practices that aim to explore the unknown and to identify and pursue novel solutions. QER keeps organizations open and flexible to new ideas.

Although Sitkin et al. (1994) propose that we need to distinguish different QM practices to better address the relationship between QM practices and performance, studies on distinguishing them are very scant. While there is some theoretical underpinning, there is no existing research that provides a measurement instrument to operationalize the two different sets of QM practices. Consequently, there is no empirical evidence to support the differentiation. The purpose of this chapter is to start to fill this void. Development and validation of a measurement instrument will be an important first step for further research on the two aspects of QM practices and on the customization of QM practices.

This chapter is organized into six sections, the first of which is this introduction. Section 2 describes the constructs of QEI and QER. Section 3 and 4 convey the steps of instrument development and research methods used to examine the reliability and validity of the measurement model. Section 5 introduces a second-order factor model to further distinguish QEI and QER. Section 6 discusses the contributions and limitations of the research and future research directions.

2.2 Description of the constructs of QEI versus QER

QM comprises two fundamentally different goals, exploitation and exploration, and the effectiveness of QM requires that managers tailor their organization's focus between exploitation and exploration to match the situational factors they face. Matching different forms of QM practices to internal and external requirements of an organization should enhance effectiveness of QM programs and accelerate the sustainability of quality advantage.

2.2.1 The distinction between exploitation and exploration

Making choices about how much to invest in different types of activities is always a central concern for organizations. Two broad types of activities between which firms divide attention and resources–exploitation and exploration-have been proposed in the literature. Based on March's (1991) description, exploitation implies activities captured by terms such as refinement, choice, production, efficiency, and execution.

Exploration includes activities characterized by search, discovery, experimentation, variation, and innovation.

A few other organization theorists also have argued the distinctions between exploitation and exploration, or sometimes called control and exploration (e.g. Sutcliffe et al., 2000; Eisenhardt and Tabrizi, 1995). Exploitative activities emphasize the need for efficiency, focusing on highly reliable processes and consistent results, while exploratory activities emphasize anticipating change requirements, focusing on the need for change and innovation (Benner and Tushman, 2003; Sutcliffe et al., 2000).

QM practices as an important part of the overall organization activities could also be examined from this dual point of view. On the one hand, organizations need to control stable and familiar processes and improve the efficiency of manufacturing or service processes. So quality exploitation includes the QM practices that aim to control the known processes. The objective of QEI is to ensure the consistency and efficiency of outcomes. On the other hand, organizations need new insights about innovation and exploration of the unknown. Therefore, quality exploration includes the QM practices that aim to explore the unknown and to identify and pursue novel solutions. QER keeps organizations open and flexible to new ideas. Understanding both should be considered important to attaining expected and sustained benefits from QM practices.

2.2.2 Common QM precepts

To define the constructs of QEI and QER, it is necessary to outline the common guiding QM precepts that can then be parceled into QEI and QER. Over time in the development of academic literature, the term QM has gained consistency in its meaning. According to Sousa and Voss (2002, p. 106) QM can be “reliably distinguished from other strategies for organizational improvement and there is substantial agreement in the literature as to which practices fall under the QM umbrella."

A good definition of QM should be parsimonious and based on prior theory development papers (Wacker, 1998; 2004). Dean and Bowen (1994) define QM as Customer Focus, Continuous Improvement, and Team Work. Sitkin et al. (1994) describe QM as Customer Satisfaction, Continuous Improvement, and the Systems View of Organization. Both these definitions are parsimonious and based on prior theories. Sitkin et al.'s (1994) definition pays more attention to the systems view of an organization, while Dean and Bowen (1994) emphasize team work. The use of teams has been promoted by many scholars (e.g. Ishikawa, 1985). Still others have emphasized a comprehensive systems view to improve organizational performance (e.g. Deming, 1986; Feigenbaum, 1991; Juran and Godfrey, 1999). Besides these two, many different and more complex frameworks have been used in previous research (e.g. Flynn et al., 1994; Powell, 1995; Ahire et al., 1996; Ahire and O'Shaughnessy, 1998; Rungtusanatham, 1998; Kaynak, 2003). The most commonly used QM elements are summarized in Table 2-1.

Table 2-1: Most commonly used QM elements

QM elements	Descriptions
Leadership	Creation of quality awareness, establishment of quality goals, acceptance of quality responsibility, participation in the quality initiative
Customer focus	Fulfillment of customer needs, input from customer requirements, feedback from customers
Process management	Process definition, statistical process control, process improvement
Employee involvement/Team work	Employee participation on quality teams, employee responsibility for quality, employee suggestions
Training	Employee training in problem solving techniques, communication, and skills
Supplier quality management	Long-term, cooperative relationships with suppliers, a small number of reliable suppliers, supplier involvement in production and design

Supporting Literature: Flynn et al., 1994; Powell, 1995; Ahire et al., 1996; Ahire and O'Shaughnessy, 1998; Rungtusanatham, 1998;Ahire and Dreyfus, 2000; Douglas and Judge, 2001; Kaynak, 2003

This paper develops a framework that is parsimonious and at the same time has content validity. The focus of the framework developed in this study is the QM elements that should be customized based on certain conditions. Leadership is a commonly used QM element, and it has been agreed that management has a complex leadership role in QM activities. Besides creating awareness and establishing goals, the upper managers must participate extensively in the quality initiative. Roles played by upper management include but are not limited to setting up quality vision and policies, approving the major quality goals, providing resources, acquiring training in managing for quality, revising the reward system, and serving on project teams (Juran and Godfrey, 1999). Strong leadership for quality is observed in all the companies that have become quality leaders, which demonstrates that leadership is not context dependent. The leadership roles played by upper management are equally important to both QEI and QER. This paper focuses on the elements that can differentiate these two constructs, so leadership is not included in the framework.

The framework used in this study also focuses on activities within a plant. The relationship between suppliers and producers and the practices used for supplier development will be studied in the future research. So Supplier Management, an important element of QM, is not included in the framework at the current stage. Four major dimensions are included in the framework: customer focus, process management, teamwork, and training.

2.2.3 Define QEI versus QER

Customer Focus

The customer is the principal and ultimate judge of quality performance. The goal of fulfilling customer needs is fundamental to quality management (Dean and Bowen, 1994). The attempts of organizations to design and deliver products and services that fulfill customer needs can be seen in all kinds of industries. A strong competitive advantage is driven by customer wants and needs, so meeting the needs of internal and external customers is critical to QM (Wheelwright, 1989). To create satisfied customers, the organization needs to identify customers' needs, design the production and service systems to meet those needs, and measure the results as the basis for improvement. The organization must also use customer focus as a key driver for its strategic planning activities.

Exploitative activities in Customer Focus pay more attention to understanding the needs of known customers. Responding to those needs is a main task of QEI. In contrast, exploratory oriented Customer Focus tries to involve customers in the early stage of product design to identify new customer needs. Developing new products to respond to those needs is the main task of QER. This is consistent with the idea of "design for quality," in which customer input is an important part of the design process.

Process Management

Organizations are sets of interlinked processes, and control and improvement of these processes is an important part of QM (Flynn et al., 1994; Powell, 1995; Ahire et al., 1996; Ahire and O'Shaughnessy, 1998; Rungtusanatham, 1998; Kaynak, 2003). Process orientation reflects an organization's commitment to enhance the reliability and control of performance and at the same time search for better methods to improve the processes. In practice, most quality practices focus on enhancing organizational performance by control and improvement of processes. By implementing process control and improvement tools, employees are exposed to data about their work processes and are encouraged to use scientific methods to analyze and improve those processes.

For Process Management, QEI focuses on exploiting existing processes and resources. Increasing control and consistency of the processes plays an important role in QEI. QER instead pays attention to improving and exploring processes and to learning from process improvement experiences. Improvement of the processes is the most important task in QER.

Teamwork

Collaboration among employees can make important contributions to organizations when the employees have the power and necessary preparation. Teamwork is an important form of employee collaboration (Dean and Bowen, 1994).

Teamwork practices include identifying the needs of all groups and organizations involved in decision making, trying to find solutions that will benefit everyone involved, and sharing responsibility and credit (Ciampa, 1991). Teamwork within a certain function and cooperation across different functions are both proposed to be effective ways for problem-solving (Dean and Bowen, 1994).

From a teamwork perspective, QEI focuses on encouraging employees within a function to work closely as a team. Teamwork within a certain function helps to solve problems that exist in the function and increases consistency of the outcomes. In contrast, QER's emphasis is on cross-functional cooperation. Through cross-functional cooperation, individual members are exposed to more and more diverse points of view than would be the case if they worked mostly by themselves or within functional units. By exposing employees to different points of view, the employees are more likely to come up with creative and novel solutions.

Training

Employee training is clearly identified as a critical component of QM and has become a key factor for achieving business success (Kaynak, 2003: Bowen and Lawler, 1992). Training generally includes quality-oriented training and job-specific training, and both of them usually are based upon job skill requirements (Evans and Lindsay, 2005). For example, customer-contact personnel usually need a higher level of training in behavioral topics than manufacturing engineers, who may need more advanced statistical skills.

Training for QEI focuses on the skills required by current job positions, which helps employees to better understand job requirements and increase efficiency of their work. Training for QER instead emphasizes multi-task training. Through multi-task training, employees will actively teach and learn from one another, which increases the total pool of knowledge and skill available for the employees. Knowledge enrichment then helps employees develop the ability of creative thinking and searching for novel solutions to problems (Hackman and Wageman, 1995).

The description of the constructs and the supporting literature are listed in Table 2-2. Measurement scales are developed based on the description of the eight constructs and a literature review of the existing measurement instruments on QM.

Table 2-2: Description of the constructs and support literature

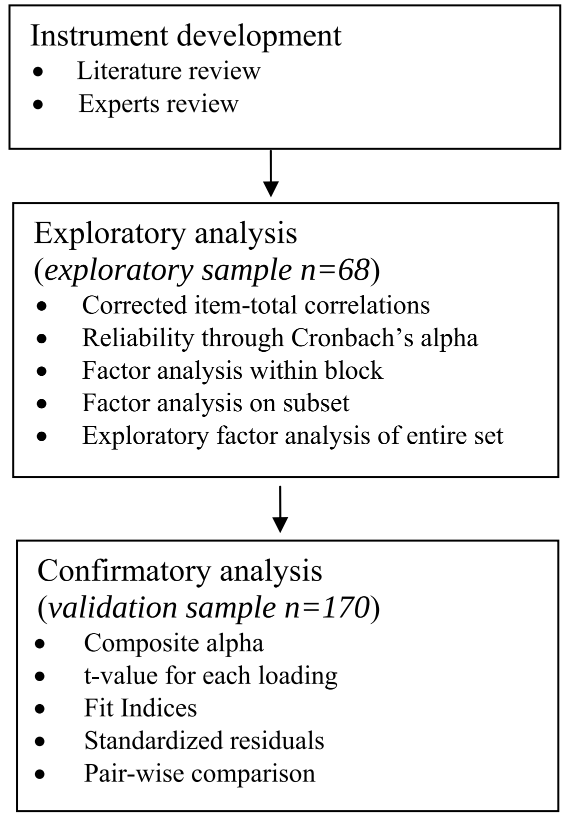
	QEI	QER
Customer Focus	Identify existing customers Assess customers' needs Better understand customer expectations Respond to customer needs and expectations	Explore new needs for customers Involve customers in the early stage of product development
	Sitkin et al., 1994; Dean and Bowen, 1994; Powell, 1995; Anderson et al., 1998; Ahire and O'Shaughnessy, 1998; Douglas and Judge, 2001; Sila, 2007	
Process Management	Increase process control Increase process reliability	Explore new improvement of products and processes Dynamic change of the organization
	Dean and Bowen, 1994; Flynn et al., 1994; Powell, 1995; Ahire et al., 1996; Ahire and O'Shaughnessy, 1998; Rungtusanatham, 1998; Kaynak, 2003	
Teamwork	Focus on within functional problem solving	Focus on cross-functional cooperation
	Sitkin et al., 1994; Dean and Bowen, 1994; Hackman and Wageman, 1995; Dow et al., 1999; Martinez-Lorente et al., 1998; Lai, 2001	
Training	Conduct training on existing skills	Conduct training on multiple skills
	Ahire and O'Shaughnessy, 1998; Dow et al., 1999; Ahire and Dreyfus, 2000; Douglas and Judge, 2001; Kaynak, 2003; Linderman et al., 2004	

2.3 Scale development and content validity

The scales were developed based on existing theory, a comprehensive literature review, and discussions with QM experts. Figure 2-1 shows a roadmap of the instrument development approach and research methods.

Nunnally and Bernstein (1994) and Churchill (1979) note that an effective instrument should cover the content domain of each construct. Therefore, content validity is the major consideration during the first stage of scale development. According to Nunnally and Bernstein (1994), content validity determines if the instrument is truly a comprehensive measure of the constructs. Determination of content validity is generally a subjective and rational judgment (Emory, 1980). This study demonstrates content validity in two ways. First, the scales for QEI and QER were developed based on a comprehensive literature review. Second, to further assure that each construct was consistent with the way it is conceptualized, the items for all scales were reviewed by several QM experts including professors and Ph.D. students in the field of Operations Management (Robinson et al., 1991). Conceptual description of each construct and corresponding measurement items were given to the experts. The experts decided whether to keep an item or drop it. They also provided suggestions to add additional items. Thirty-one items emerged from this stage (see Appendix 2-1 for all the 31 items).

Figure 2-1: Roadmap for instrument development



Besides content validity, the items that measure a construct should also agree with each other (convergent validity), and the items of one construct should be discriminable from measures of other constructs (discriminate validity). Each construct should be reliable, which means its scales have the ability to consistently yield the same response (Flynn et al., 1994; Scullen, et al., 2003). These validity and reliability issues were addressed in both exploratory and confirmatory analysis below.

2.4 Data and research methods

2.4.1 The data

Unit of analysis

The unit of analysis in this study is the plant. Overall, most studies on QM have either focused on plant level data or firm level data (Nair, 2006). A firm may have several plants that face different internal and external conditions and have a different focus on QEI or QER. Therefore, plant level data is more appropriate than firm level data in developing a measurement instrument and also in further research on customization of QM practices.

Data description

The data used in this study are obtained from a comprehensive project conducted by a team of international researchers in the field of production and operations management. The project has lasted for more than 15 years and collected data for three rounds. The first and second rounds are called the World Class Manufacturing (WCM) project and the third round is called the High Performance Manufacturing (HPM) project. The third round data are used in this study.

The HPM project collects data from a stratified sample consisting of traditional and world-class reputation plants. The plant size is restricted to plants with at least 250 employees. The data include 238 manufacturing plants located in eight countries: Austria, Finland, Germany, Italy, Japan, Korea, Sweden, and the United States. The plants are selected in three industries: automobile suppliers, electronics, and machinery. In each industry, there is approximately the same number of plants. The distribution by country and industry of the 238 plants is shown in Table 2-3.

Table 2-3: Sample distribution

		Industry			
		Auto Suppliers	Electronics	Machinery	Total
Country	Austria	4	10	7	21
	Finland	10	14	6	30
	Germany	19	9	13	41
	Italy	7	10	10	27
	Japan	13	10	12	35
	Korea	11	10	10	31
	Sweden	7	7	10	24
	USA	9	9	11	29
	Total	80	79	79	238

The HPM data includes only one plant per firm in the sample, which helps to maximize the independence of units in the study. Multiple respondents and multiple measurement methods (subjective and objective) are used in the project to reduce the common method bias.

The response rate of the HPM project is 65% which ensures a representative sample. This high response rate is the result of efforts such as telephoning the plant managers and offering each plant a profile report that indicates its performance relative to other plants in the same industry.

2.4.2 Exploratory analysis

All potential measurement items for QEI and QER are assessed using 7-point Likert scales. Descriptive statistics of the 31 potential measurement items are listed in Table 2-4 (refer to Appendix 2-1 for the description of the 31 items).

Table 2-4: Descriptive statistics of potential measurement items

Measurement item	Mean (S.D.)	Measurement item	Mean (S.D.)
cfqei1	5.33 (0.78)	cfqer1	5.06 (1.46)
cfqei2	5.69 (0.70)	cfqer2	4.71 (1.68)
cfqei3	5.23 (0.68)	cfqer3	4.65 (1.50)
pmqei1	4.52 (1.09)	cfqer4	4.81 (1.52)
pmqei2	4.81 (1.10)	cfqer5	4.70 (2.11)
pmqei3	4.74 (1.22)	pmqer1	5.50 (0.70)
twqei1	5.40 (0.74)	pmqer2	6.24 (0.45)
twqei2	5.37 (0.66)	pmqer3	6.09 (0.49)
twqei3	4.89 (0.87)	pmqer4	5.44 (0.65)
twqei4	4.45 (1.55)	twqer1	5.52 (0.69)
trqei1	5.09 (0.84)	twqer2	3.99 (1.05)
trqei2	5.72 (0.75)	twqer3	5.38 (0.68)
trqei3	5.01 (0.80)	twqer4	5.45 (0.74)
trqei4	5.01 (0.90)	trqer1	5.26 (0.77)
		trqer2	5.18 (0.71)
		trqer3	5.18 (0.76)
		trqer4	5.16 (1.51)

For exploratory purposes, 30% of the entire dataset was randomly selected, which resulted in a sample of 68 plants. The methods employed for exploratory evaluation of measurement scales included corrected item-total correlations (CITC), reliability estimation using Cronbach's alpha, exploratory factor analysis within block, exploratory factor analysis on subset, and exploratory factor analysis on the entire set.

Corrected item-total correlation is the correlation of the item to the summated scale score. It is a diagnostic measure that is used for purification purposes. Rules of thumb suggest that the item-to-total correlations should exceed .5 (Hair et al., 2006). Six items have CITC scores less than 0.5 and were eliminated from further analysis (items in italics in Appendix 2-1).

Reliability is broadly defined as the degree to which scales are free from error and, therefore, consistent (Nunnally and Bernstein, 1994; Flynn, et al., 1994; Chen and

Paulraj, 2004). The Cronbach's α coefficient (Cronbach, 1951) is used in this study to evaluate the internal consistency reliability of the scales. Traditionally, a scale is considered reliable if the α value is 0.70 or higher (Nunnally and Bernstein, 1994). Table 2-5 shows that the Cronbach's alpha reliabilities for the eight scales met the acceptable criteria of values greater than 0.7.

Within block factor analysis, which addresses the internal rule of uni-dimensionality, shows whether one or more than one factors can be identified in a given block of items. The analysis result shows that only one factor has emerged from each block of items. The loadings, eigenvalues, and percent of variance explained were all checked to assess the convergent validity of the items and they all show acceptable results (see Table 2-5).

Table 2-5: Reliability and Convergent validity of exploratory analysis

Scale	Number of items	Cronbach's α	Eigenvalue	% of variance
Customer Focus for Quality Exploitation	3	.700	1.87	62.33
Customer Focus for Quality Exploration	4	.801	2.515	62.887
Process Management for Quality Exploitation	3	.874	2.397	79.884
Process Management for Quality Exploration	3	.721	1.941	64.702
Teamwork for Quality Exploitation	3	.846	2.318	77.269
Teamwork for Quality Exploration	3	.841	2.277	75.915
Training for Quality Exploitation	3	.897	2.507	83.578
Training for Quality Exploration	3	.801	2.15	71.678
total	25			

To address the discriminant validity between the constructs, we conducted both factor analysis on subsets and factor analysis on the entire set (Campbell and Fiske, 1959). QEI and QER on the same dimension were treated as a subset. Therefore, 4 subsets were identified: Customer Focus, Process Management, Teamwork, and Training. Since the main purpose of the paper was to distinguish between QEI and QER, the subset analysis provides useful information to discriminate between the two. Table 2-6 shows the results of factor analysis on the subsets. Based on the sample size, a factor loading needs to be higher than 0.65 to be significant at the 0.05 significance level and have a power level of 80 percent (Hair et al., 2006, p.128). Table 2-6 shows that all items are loaded to the factor that they are supposed to load with factor loadings higher than 0.7, and no cross-loading in the subset analysis is higher than 0.4. Subset analysis shows good discriminant validity between QEI and QER.

Table 2-6: Exploratory factor analysis on subsets

Subset 1 (CFQEI vs. CFQER)			Subset 2 (PMQEI vs. PMQER)		
Item	Factor 1	Factor 2	Item	Factor 1	Factor 2
cfqei1	.100	**.782**	pmqei1	**.917**	.092
cfqei2	.174	**.819**	pmqei2	**.768**	.330
cfqei3	-.263	**.783**	pmqei3	**.944**	.058
cfqer1	**.817**	-.114	pmqer1	.218	**.828**
cfqer2	**.764**	.149	pmqer2	.019	**.743**
cfqer3	**.796**	.145	pmqer3	.171	**.795**
cfqer4	**.781**	-.098			
Subset 3 (TWQEI vs. TWQER)			**Subset 4 (TRQEI vs. TRQER)**		
Item	Factor 1	Factor 2	Item	Factor 1	Factor 2
twqei1	.167	**.876**	trqei1	**.881**	.288
twqei2	.343	**.829**	trqei2	**.890**	.069
twqei3	.030	**.874**	trqei3	**.866**	.383
twqer1	**.864**	.089	trqer1	.153	**.888**
twqer2	**.832**	.198	trqer2	.170	**.734**
twqer3	**.870**	.181	trqer3	.294	**.829**

The results of the factor analysis on the entire set are shown in Table 2-7. Eight factors were predicted to emerge from this analysis, but the results found 7 factors instead. As a general rule in exploratory factor analysis, the minimum is to have five times as many observations as the number of variables to be analyzed (Hair, et al., 2006, p.112). Based on the 25 items, at least a sample size of 125 is needed to have enough power to do the analysis. So the small sample size could be one reason why the expected 8 factors did not emerge. Customer Focus for Quality Exploitation (CFQEI) and Process Management for Quality Exploration (PMQER) are not distinguished well in the analysis. A correlation matrix of the 8 factors is shown in Table 2-8. CFQEI and PMQER have a correlation of 0.664, which is significant at the 0.01 significance level. A 95% confidence interval is constructed for the correlation. The confidence interval (0.48, 0.85) does not include 1, providing evidence that the two constructs are different.

Table 2-7: Exploratory factor analysis on the entire set[1]

	Component						
	1	2	3	4	5	6	7
cfqei1	**.715**	.140	.189	.110	.005	.198	.028
cfqei2	**.604**	.322	.273	.196	.112	.043	.147
cfqei3	**.377**	.419	.252	-.180	.311	.186	.135
pmqei1	.023	.178	.116	.024	**.872**	.156	.121
pmqei2	.314	.086	-.007	-.088	**.756**	-.008	.079
pmqei3	-.061	.106	.081	-.076	**.904**	.154	.155
twqei1	.257	**.787**	.132	-.010	.236	.114	.087
twqei2	.235	**.729**	.224	-.034	.096	.283	.355
twqei3	.224	**.770**	.301	-.025	.109	.053	.038
trqei1	.239	.041	.420	.028	.163	.215	**.711**
trqei2	.186	.265	.049	.002	.247	.238	**.796**
trqei3	.216	.116	.458	.160	.171	.270	**.710**
cfqer1	-.028	-.134	.033	**.798**	-.230	.008	.074
cfqer2	.304	-.282	.077	**.723**	.067	-.102	-.098
cfqer3	.113	.162	-.075	**.779**	-.079	-.178	.192
cfqer4	-.197	.099	-.051	**.830**	.089	.033	-.125
pmqer1	**.789**	.115	.203	-.070	.150	.068	.175
pmqer2	**.509**	.261	-.199	-.190	-.018	.143	.399
pmqer3	**.586**	.377	.246	.044	.069	.018	.232
twqer1	.063	.073	.026	-.124	.106	**.792**	.270
twqer2	.125	.105	.157	.001	.175	**.869**	-.053
twqer3	.132	.160	-.025	-.087	.029	**.796**	.346
trqer1	.160	.345	**.763**	.003	.019	.007	.203
trqer2	.148	.192	**.781**	-.078	.048	.206	-.001
trqer3	.366	.117	**.734**	.030	.152	-.115	.291

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 8 iterations.

Table 2-8: Pearson Correlations of the 8 constructs from exploratory analysis

	CFQEI	PMQEI	TWQEI	TRQEI	CFQER	PMQER	TWQER	TRQER
CFQEI	1							
PMQEI	.339**	1						
TWQEI	.612**	.362**	1					
TRQEI	.530**	.294*	.464**	1				
CFQER	.026	-.098	-.064	.034	1			
PMQER	.664**	.338**	.569**	.474**	-.044	1		
TWQER	.347**	.336**	.378**	.461**	-.148	.354**	1	
TRQER	.548**	.288*	.535**	.498**	-.001	.517**	.229	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

[1] See Appendix 2-1 for definition of terms.

2.4.3 Confirmatory analysis

The confirmatory analysis used the validation sample of 170 plants. LISREL 8.51 is used to run a Confirmatory Factor Analysis (CFA). The t-values associated with each of the loadings are all significant at the 0.001 significance level. All items are significantly related to their specified constructs with factor loadings greater than 0.5 (Table 2-8), which verifies the proposed relationship among indicators and constructs. Reliability of each construct is examined again by computing its composite reliability (Fornell and Larcker, 1981, Hair, et al. 2006). Composite reliability is an aggregate measure of the degree of internal consistency among measurement items of the same construct. It is computed from the squared sum of factor loadings (λi) for each construct and the sum of the error variance terms for a construct (δi). The following equation is used to compute the composite reliability:

$$\text{Composite reliability} = \frac{(\sum_{i=1}^{n} \lambda i)^2}{(\sum_{i=1}^{n} \lambda i)^2 + (\sum_{i=1}^{n} \delta i)}$$

A reliability value of greater than 0.70 is recommended, while a value between 0.60 and 0.70 is also acceptable provided that other indicators of reliability are good (Nunnally, 1978; Hair et al., 2006). All constructs have composite reliability greater than 0.70 except one (PMQER) with a reliability value of 0.64 (Table 2-9). However, in the exploratory analysis PMQER shows good reliability with a Cronbach alpha value of 0.721. Overall, the constructs show good reliability.

Table 2-9: Standardized factor loadings and reliability estimates

	CFQEI	CFQER	PMQEI	PMQER	TWQEI	TWQER	TRQEI	TRQER
cfqei1	0.76							
cfqei2	0.80							
cfqei3	0.56							
cfqer1		0.78						
cfqer2		0.74						
cfqer3		0.62						
cfqer4		0.85						
pmqei1			0.90					
pmqei2			0.67					
pmpei3			0.90					
pmqer1				0.60				
pmqer3				0.59				
pmqer4				0.64				
twqei1					0.88			
twqei2					0.77			
twqei3					0.66			
twqer1						0.73		
twqer3						0.80		
twqer4						0.77		
trqei1							0.93	
trqei2							0.77	
trqei4							0.86	
trqer1								0.89
trqer2								0.53
trqer3								0.78
Composite Reliability	0.75	0.83	0.87	0.64	0.82	0.81	0.89	0.79

**All item loadings are significant at the 0.01 level

With respect to fit indices, the CFA model demonstrates a good fit. Absolute, incremental, and parsimonious measures were used to evaluate the overall model fit, since each measure provides different aspect and information on evaluating the model fit (Maruyama, 1998; Shah and Goldstein, 2006). Absolute fit measures such as Root Mean Square Error of Approximation (RMSEA) assess how well an a priori model reproduces or fits the sample data. Typically models with RMSEA value below 0.10 are treated as acceptable (Hair, et al. 2006, p748). The RMSEA of this model is 0.047. Using the 90 percent confidence interval for this RMSEA, we conclude the true value of this index is between 0.034 and 0.059. Even the upper bound of this RMSEA is well within the recommended levels for a good fit.

Incremental fit measures, such as Comparative Fit Index (CFI), Incremental Fit Index (IFI), and Non-normed Fit Index (NNFI), assess the model by comparing it with some alternative baseline model, such as a null model which assumes all observed variables are unrelated. This model has a CFI of 0.94, IFI of 0.94, and NNFI of 0.92. All of them are above the recommended cutoff points of 0.9.

Parsimonious fit measures such as normed χ^2 (χ^2/d.f.) assess the parsimony of the proposed model by evaluating the fit of the model versus the number of estimated coefficients needed to achieve the level of fit (complexity). This model has a normed χ^2 of 1.38. Generally, χ^2/d.f. ratios below 2 are associated with good-fitting models (Hair et al., 2006).

The above fit measures suggest that the model represents good fit, which means it adequately captures the relationships among the observed variables. To further check the model fit, standardized residuals are examined as a diagnostic measure. It is generally recommended that no more than 10% of the absolute values of standardized residuals are greater than 2.5 (Hu and Bentler, 1995). An absolute residual value greater than 4.0 may suggest a potentially unacceptable degree of error (Hair, et al. 2006). In this CFA model, out of 300 standardized residuals, the absolute values of 12 residuals are larger than 2.5, which is about 4%. There is no absolute residual value greater than 4.0 in this model. Overall, the results of the CFA model show good model fit and convergent validity.

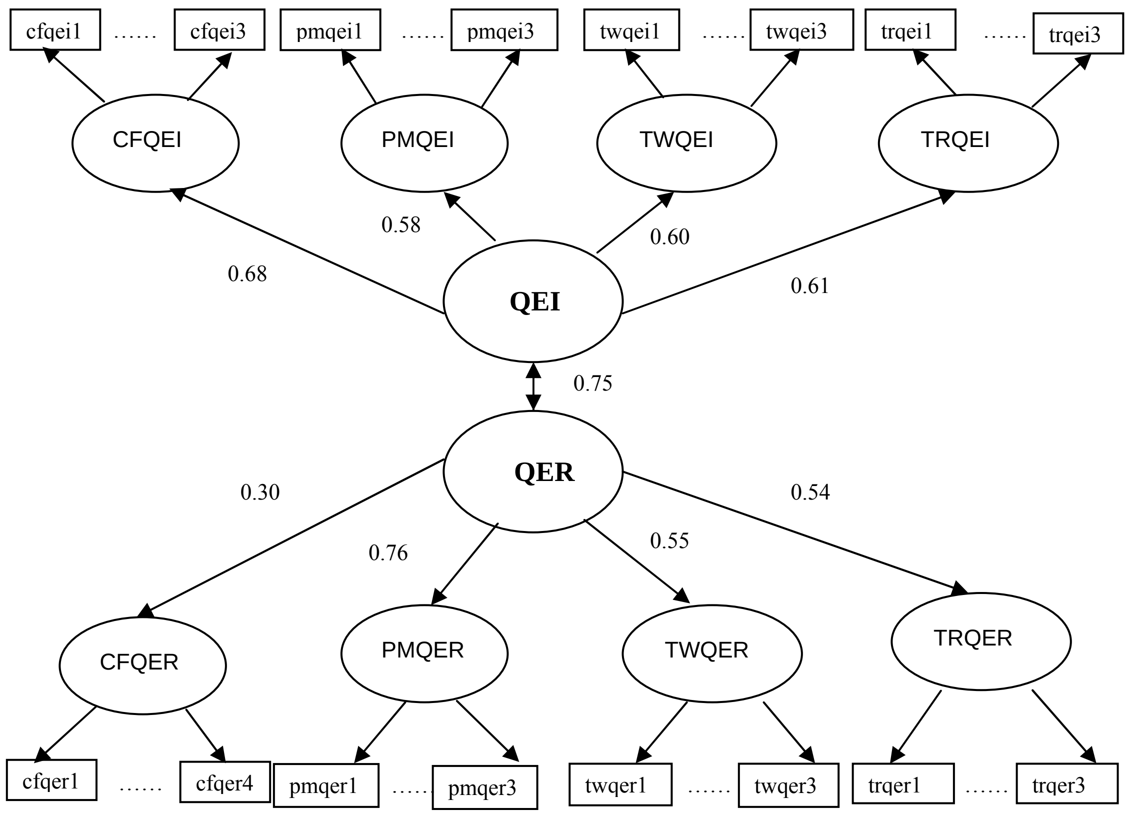
Discriminant validity refers to the uniqueness and the separation of the measures (Bagozzi and Phillips, 1991). In other words, it stands for the extent to which the measures are distinctly different from each other. Assessing discriminant validity of the measurement instrument is an important part of this research, since QM practices usually are treated as one set. Showing that QEI and QER can be discriminated both conceptually and empirically provides the foundation of this study.

To assess discriminant validity in CFA, a pair-wise comparison between two constructs is used (Bagozzi and Phillips, 1982). The analysis is performed by comparing the model with each pair-wise correlation constrained to equal 1.0 with an unconstrained model. The difference between the χ^2 values of the two models is checked to see if the discriminant validity is supported or not. For the 8 constructs of the model, 28 pairs are compared. All χ^2 differences between the constructs are significant ($p<0.001$), providing sufficient evidence of discriminant validity between the constructs.

2.5 A second-order factor model

The first-order factor model shows a good fit. However, we were empirically examining if there exist two different aspects of QM: QEI and QER. To be consistent with our conceptualization of the two constructs, each of them is modeled as a second-order latent factor measured through the 4 first-order factors we have identified. CFA is used to check the model fit, and absolute, incremental, and parsimonious measures are used to evaluate the fit results. The RMSEA is 0.059, and a 90 percent confidence interval for RMSEA is (0.048, 0.07). The normed χ^2 (χ^2/d.f.) is 1.59. The model also has a NNFI of 0.90, CFI of 0.91, and IFI of 0.91. The loadings of the first-order factors on the two second-order factors are shown in Figure 2-2. A good model fit is suggested by these different fit indices.

Figure 2-2: Second-order factor model



To assess discriminant validity of the second-order factor model, a pair-wise comparison between the two second-order factors is used (Bagozzi and Phillips, 1982). The comparison is performed by comparing the model with correlation constrained to equal 1.0 with an unconstrained model. The difference between the χ^2 values of the two models is checked to see if the discriminant validity is supported or not. A significant χ^2 difference demonstrates the uniqueness of the two factors. Discriminant validity between the two second-order factors in this model is shown by a significant χ^2 difference ($\Delta\chi^2$=12.6, d.f.=1) with a p-value less than 0.001.

The correlation between the two second-order factors is also checked to further assess the distinctiveness of the two factors. The two factors have a correlation of 0.75, which has a 95% confidence interval of (0.63, 0.845). The upper bound of the confidence interval is below the suggested cut-off value of 0.90 (Bagozzi and Phillips, 1991), which further suggests the distinctiveness of the two second-order factors.

The results of construct reliability, convergent validity, and discriminant validity show that the measurement instrument we developed for QEI and QER is reliable and valid. Furthermore, the results support the theory that there exist two different yet related aspects of QM: QEI and QER.

2.6 Discussion and conclusions

With the increasing reliance on QM practices to gain competitive advantage, more knowledge about implementing and getting performance benefits from these practices is needed to make them more sustainable. How to customize these practices according to situational factors becomes a challenging question to both researchers and practitioners. This study provides possible solutions to this question by distinguishing between different QM practices. Analyses suggest that there exist two different aspects of QM practices with different objectives: quality exploitation (QEI) and quality exploration (QER). The use of these practices should be more or less effective in different external or internal conditions. Ignoring this may result in inappropriate implementation of QM practices, and ineffective or inconsistent performance can result. The major contribution of this study is that it empirically supports the theory that there exist two different yet related aspects of QM: QEI and QER. Furthermore, the paper develops a valid and reliable set of measures for operationalizing QEI and QER.

This study contributes to the research on QM, which is, as Chase (1998) claimed, the unquestioned major area in the field of operations management, as well as in the management field in general. Many scholars are concerned that the potential contributions of QM could be lost if its theoretical underpinnings and boundary conditions are not critically assessed. This study is the first empirical test for measuring and discriminating between the two concepts in QM literature. It provides a foundation for further research on customization of QM practices.

From a practical point of view, this research has important managerial implications. Despite the increasing popularity of QM practices, practitioners still suffer from mixed performance results, particularly in the situation when customization is important. By distinguishing QEI from QER, this study provides a basis of guidance for practitioners to customize QM practices according to situational factors.

This study also has some limitations. One limitation is that although the measurement scales used in the paper are developed based on a comprehensive literature review, they are drawn from the HPM database. So the measurement items are limited by the database. However, HPM is a comprehensive survey database with quality management as a major component, which fits the research purpose of the study very well. Another limitation is that the data used in this study is coming from only manufacturing plants. The discrimination between QEI and QER could not be generalized to the service industry at this point. However, manufacturing plants have a longer history of implementing QM practices and provide a more mature setting for this research. We use the manufacturing industry as a starting point.

Future research is needed to check if the influence of QEI and QER on performance is different under various circumstances, which may include different internal factors and environmental factors. Such research will provide guidelines on customization of QM practices. It will also contribute to the discussion in the literature over whether a universal or a context-dependent approach to QM is needed. Institutional theory and contingency theory are two underlining theories for the discussion. Until now, these discussions are scant and mainly theoretical (Sila, 2007). Research on the performance implications based on the discrimination of QEI and QER will hopefully shed light on what contingencies should to be considered. Research on this will help researchers and practitioners understand the underlying conditions to implement different QM practices.

Appendix 2-1: Potential Measurement items–Quality Exploitation and Quality Exploration

Measurement of research constructs (dropped item in italics)

Respondents were asked to indicate the extent to which they agree or disagree with each of these statements about their plant and organization. 1: Strongly disagree, 4: Neutral, 7: Strongly agree

CFQEI (customer focus for quality exploitation)

CFQEI1 We frequently are in close contact with our customers
CFQEI2 Our customers give us feedback on our quality and delivery performance
CFQEI3 We regularly survey our customers' needs.

CFQER (customer focus for quality exploration)

CFQER1 We consulted customers early in the design efforts for this product.
CFQER2 We partnered with customers for the design of this product
CFQER3 Customers were frequently consulted about the design of this product.
CFQER4 Customers were an integral part of the design effort for this project.
CFQER5 Customers became involved in this project only after the design was completed. (CITC: 0.205)

PMQEI (process management for quality exploitation)

PMQEI1 We make extensive use of statistical techniques to reduce variance in processes.
PMQEI2 We use charts to determine whether our manufacturing processes are in control.
PMQEI3 We monitor our processes using statistical process control.

PMQER (process management for quality exploration)

PMQER1 We strive to continually improve all aspects of products and processes, rather than taking a static approach.
PMQER2 If we aren't constantly improving and learning, our performance will suffer in the long term. (CITC: 0 .417)
PMQER3 We believe that improvement of a process is never complete; there is always room for more incremental improvement.
PMQER4 Our organization is not a static entity, but engages in dynamically changing itself to better serve its customers.

TWQEI (teamwork for quality exploitation)

TWQEI1 Our supervisors encourage the people who work for them to work as a team.
TWQEI2 Our supervisors encourage the people who work for them to exchange opinions and ideas.
TWQEI3 Our supervisors frequently hold group meetings where the people who work for them can really discuss things together.

TWQEI4 Our supervisors rarely encourage us to get together to solve problems. (CITC: 0 .145)

TWQER (teamwork for quality exploration)

TWQER1 The functions in our plant cooperate to solve conflicts between them, when they arise
TWQER2 The marketing and finance areas know a great deal about manufacturing. (CITC: 0 .474)
TWQER3 Our plant's functions coordinate their activities
TWQER4 Our plant's functions work interactively with each other.

TRQEI (training for quality exploitation)

TRQEI1 Our plant employees receive training and development in workplace skills, on a regular basis.
TRQEI2 Management at this plant believes that continual training and upgrading of employee skills is important.
TRQEI3 Employees at this plant have skills that are above average, in this industry. (CITC: 0 .302)
TRQEI4 Our employees regularly receive training to improve their skills.

TRQER (training for quality exploration)

TRQER1 Employees at this plant learn how to perform a variety of tasks.
TRQER2 The longer an employee has been at this plant, the more tasks they learn to perform.
TRQER3 Employees are cross-trained at this plant, so that they can fill in for others, if necessary.
TRQER4 At this plant, each employee only learns how to do one job. (CITC: 0 .062)

Chapter 3

The Moderating Role of Contextual Factors: Performance Implication of Quality Exploitation versus Quality Exploration

3.1 Introduction

Facing difficult challenges to survive and grow in an increasingly competitive environment, firms are continuously searching for different ways to improve performance and gain a competitive advantage. One source for improvement is to implement process improvement initiatives. Quality management (QM), as an important form of process improvement initiatives, has become an all-pervasive management practice and found its way into most sectors of today's business society (Sousa and Voss, 2002). QM practices and the benefits related to these practices have been addressed in many studies (e.g. Nair, 2006; Kaynak, 2003; Forza and Filippini, 1998). It is now widely believed that QM practices are essential for successful survival and growth of different kinds of organizations (Crosby, 1979; Deming, 1986, 1994; Juran, 1986). However, although these practices are sold as "universal remedies," there are mixed performance results and high-profile failures in their implementation (Powell, 1995). The mixed performance results are mentioned in many studies (e.g. Nair, 2006; Kaynak, 2003). Some studies find QM practices have a strong positive relationship with performance (e.g. Prajogo and Sohal, 2003; Ho et al., 2001), while other studies fail to find any relationship between the two (e.g. Mohrman et al., 1995; Choi and Eboch, 1998). A considerable number of organizations have tried to implement these practices but have failed to achieve the expected advantage, while some other organizations have implemented the practices with great success (Douglas and Judge, 2001). In the

Mohrman et al. (1995) study, 83% of the surveyed companies were found to have had a positive or very positive experience with QM, while Dooyoung et al. (1998) report estimates of QM failure rates as high as 60-70%.

Some scholars have noticed the phenomenon and tried to provide explanations for the inconsistent performance implication of QM programs and suggest corresponding remedies. Foster (2006) points out that two concepts need to be considered regarding quality management to address its performance influence: organizational context and contingency theory. Consistent with Foster's (2006) opinion, Sousa and Voss (2008) also raise doubt as to the "universal validity" of quality management practices. They suggest that the inconsistent performance implication of the QM practices may be due to these practices being context dependent. More research is needed to understand the contextual conditions under which these practices are effective. Nair (2006) also points out that future investigation should consider a contingency view and evaluate if there are moderating factors on the relationship between QM practices and firm performance and whether the moderating effects are dependent on specific QM practice and performance measure that is under investigation. Consistent with Nair's (2006) view, Sitkin et al (1994) point out that one limitation of existing studies is that all QM practices are treated as one set when their influence on performance is examined.

To address the performance implication of QM practices, it is helpful to base our research on a contingency approach rather than an assumption of universal applicability. A contingency perspective implies that QM practices should be matched appropriately to certain contextual requirements (Foster, 2006, Sousa and Voss, 2008). In their review of QM research for the past two decades, Sousa and Voss (2002, p.105) point out that "there may be no one best implementation approach to suit all organizations and each company may need a tailored implementation program." They have also proposed in their recent paper (Sousa and Voss, 2008) the possibility of individual QM practices being context dependent and more studies are needed to identify important contingency variables that distinguish between different types of organizational contexts and produce guidelines on which practices to emphasize in each of them. Therefore, a research that incorporates contingency theory (Lawrence and Lorsch, 1967; Thompson, 1967; Woodward, 1958) and addresses the relationship between different QM practices and performance under different circumstances will further the research on QM and at the same time provide detailed guidance for plant managers to implement QM programs.

This research investigates how certain contextual factors influence the relationship between QM practices and manufacturing performance. The central question being addressed is "how can organizations get more benefits from QM practices under different contextual conditions?" Drawing from the management literature, we differentiate two different kinds of QM practices: Quality Exploitation (QEI) and Quality Exploration (QER). QEI includes QM practices that aim to control stable and familiar processes and improve the efficiency of manufacturing or service processes. QER, on the other hand, are QM practices that are used to get new insights about process innovation and exploration of the unknown. The moderating effects of two contextual factors on the relationship between QER, QEI, and operational performance are empirically investigated: organizational structure and environmental uncertainty. The findings provide implications for organizations in selecting the right focus of QEI or QER to get more performance benefits from their quality initiatives.

The rest of the paper is arranged as follows. It starts in Section 3.2 with a review of the theoretical foundation for the proposed model. Section 3.3 describes empirical data used in this study and measurement instruments. Data analysis and results are presented in Section 3.4. Section 3.5 concludes the paper with a discussion of theoretical and practical implications as well as limitations and possible future research.

3.2 Theoretical foundation

3.2.1 Research framework

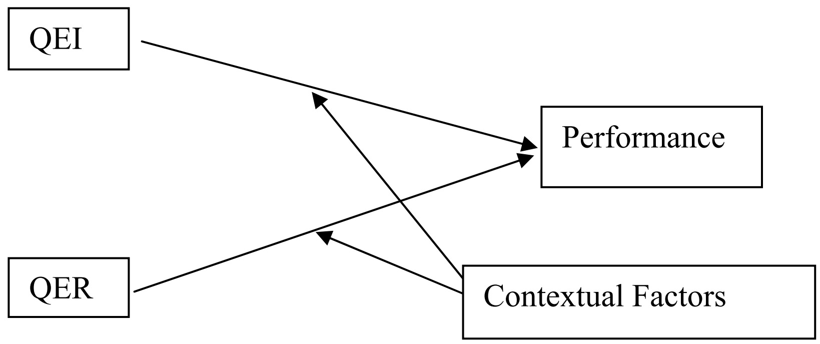
To provide more solid and useful advice to managers, it is necessary to produce guidelines regarding what kind of QM practices they should focus on according to an organization's specific internal or external conditions (Sousa and Voss, 2002). March (1991) proposed that there were two kinds of learning activities within an organization: the exploration of new possibilities and the exploitation of old certainties. Both exploration and exploitation are essential for organizations. However, since they compete for scarce resources, choosing the "right" focus is extremely important for organizations (March, 1991). A few other organization theorists also have argued the distinctions between exploitation and exploration, or sometimes called control and exploration (e.g. Sutcliffe et al., 2000; Eisenhardt and Tabrizi, 1995).

Relying upon March's (1991) notions of exploitation and exploration, this paper distinguishes QM practices into two different yet related sets: quality exploitation (QEI) and quality exploration (QER). On the one hand, organizations need to control stable and familiar processes and improve the efficiency of manufacturing or service processes.

So QEI includes the QM practices that aim to control the known problems and processes. The objective of QEI is to ensure the consistency and efficiency of outcomes. On the other hand, organizations need new insights about innovation and exploration of the unknown. Therefore, QER includes the QM practices that aim to explore the unknown and to identify and pursue novel solutions. QER keeps organizations open and flexible to new ideas.

To investigate the performance implication of QM practices, QEI and QER need to be discussed separately since they may perform differently under various conditions. It is suggested by many scholars that contextual factors should be considered when assessing the link between QM and performance. For example, Nair (2006) claims that the research on context-dependence of QM is gaining momentum. However, presently there are very few survey-based empirical studies that examine the moderating role of contextual variables in the effectiveness of QM on performance. To help managers implement these practices in real business settings, contingency factors need to be considered. The essence of the contingency theory is that organizational effectiveness relies on fitting characteristics of an organization to contingencies that reflect the situation of the organization (Burns and Stalker, 1961; Donaldson, 2001). A moderating effect occurs when a third variable or construct changes the relationship between two related variables. In our research setting, the contingency view means the impact of QM practices on performance is dependent on the level of certain contextual factors. Contextual factors have a moderating effect on the relationship between QM practices and performance. Furthermore, the moderating effect may vary for QEI and QER. The proposed framework is shown in Figure 3-1.

Figure 3-1: The proposed framework



In this study, the moderating effect of two contextual factors is investigated: organizational structure and environmental uncertainty. These two factors are traditional contingency theory variables (Donaldson, 2001; Germain et al., 2008), and both of them have been argued as having a supporting role in QM effectiveness (Sitkin et al., 1994; Douglas and Judge, 2001). Their influence on the relationship between QM practices and performance needs to be addressed to better understand the performance implication of QM initiatives (Douglas and Judge, 2001; Kaynak, 2003; Sousa and Voss, 2002; Nair, 2006).

3.2.2 Constructs

Quality Exploitation and Quality Exploration

Making choices about how much to invest in different types of activities is always a central concern for organizations. Two broad types of activities between which firms divide attention and resources–exploitation and exploration-have been proposed in the literature. Based on March's (1991) description, exploitation implies activities captured by terms such as refinement, choice, production, efficiency, and execution. Exploration includes activities characterized by search, discovery, experimentation, variation, and innovation. QM practices as an important part of the overall organization activities could also be examined from this point of view. On the one hand, organizations need to control stable and familiar processes and improve the efficiency of manufacturing or service processes. So quality exploitation includes the QM practices that aim to control the known processes. The objective of QEI is to ensure the consistency and efficiency of outcomes. On the other hand, organizations need new insights about innovation and exploration of the unknown. Therefore, quality exploration includes the QM practices that aim to explore the unknown and to identify and pursue novel solutions. QER keeps organizations open and flexible to new ideas.

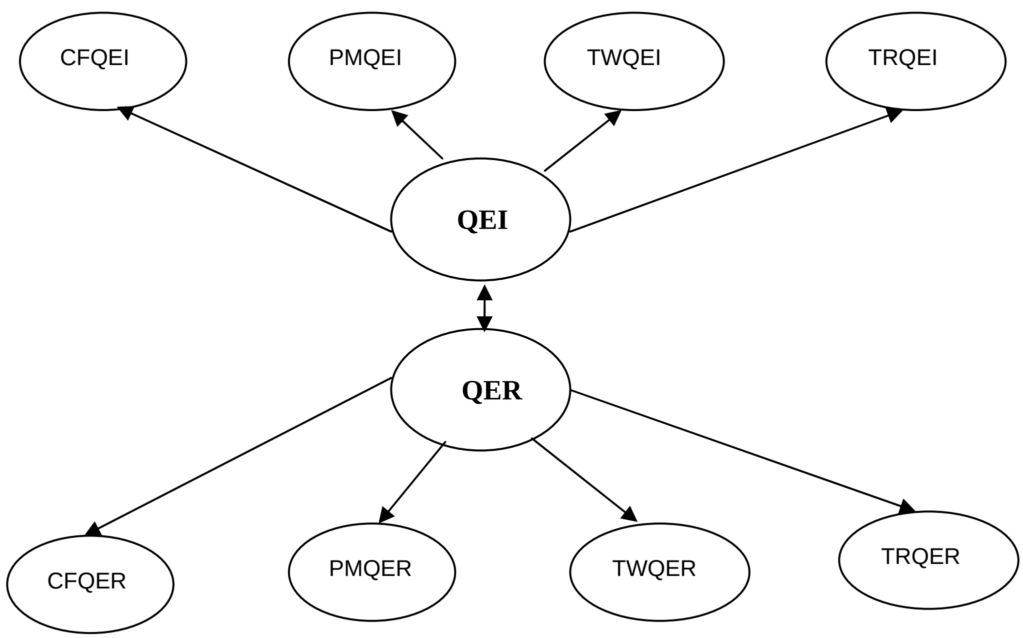
To define the constructs of QEI and QER, it is necessary to outline the common guiding QM precepts that can then be parceled into QEI and QER. Over time in the development of academic literature, the term QM has gained consistency in its meaning. A good definition of QM should be parsimonious and based on prior theory development papers (Wacker, 1998; 2004). Based on a comprehensive literature review, this paper develops a framework that is parsimonious and at the same time has content validity. The focus of the framework developed in this study is the QM elements that should be customized based on certain conditions. Four major dimensions are used to describe the constructs of QEI and QER: customer focus, process management, teamwork, and training. The description of the constructs and the supporting literature are listed in Table 3-1.

Table 3-1: Description of the constructs of QEI and QER and supporting literature

	QEI	QER
Customer Focus (CF)	Identify existing customers Assess customers' needs Better understand customer expectations Respond to customer needs and expectations	Explore new needs for customers Involve customers in the early stage of product development
	Sitkin et al., 1994; Dean and Bowen, 1994; Powell, 1995; Anderson et al., 1998; Ahire and O'Shaughnessy, 1998; Douglas and Judge, 2001; Sila, 2007	
Process Management (PM)	Increase process control Increase process reliability	Explore new improvement of products and processes Dynamic change of the organization
	Dean and Bowen, 1994; Flynn et al., 1994; Powell, 1995; Ahire et al., 1996; Ahire and O'Shaughnessy, 1998; Rungtusanatham, 1998; Kaynak, 2003	
Teamwork (TW)	Focus on within functional problem solving	Focus on cross-functional cooperation
	Sitkin et al., 1994; Dean and Bowen, 1994; Hackman and Wageman, 1995; Dow et al., 1999; Martinez-Lorente et al., 1998; Lai, 2001	
Training (TR)	Conduct training on existing skills	Conduct training on multiple skills
	Ahire and O'Shaughnessy, 1998; Dow et al., 1999; Ahire and Dreyfus, 2000; Douglas and Judge, 2001; Kaynak, 2003; Linderman et al., 2004	

A visualized description of the two constructs is shown in Figure 3-2. Both of the constructs have four sub dimensions, which in this research are labeled as: CFQEI, PMQEI, TWQEI, TRQEI, CFQER, PMQER, TWQER, and TRQER.

Figure 3-2: A visualized description of QEI and QER



Organizational Structure

Two types of models have been used in an effort to understand organizational structure: mechanistic and organic (Burns and Stalker, 1961). Organizations with a mechanistic structure are structured hierarchically and are centrally controlled by an authority. In contrast, organic structure settings present more flexible and open-type internal arrangements of an organization (Spencer, 1994). Recent theory and research on organizational structures argues that a mechanistic structure implies a stabilizing impact on organizations while an organic structure has a creative impact (Eisenhardt and Tabrizi, 1995).

Formalization, standardization, and centralization are key dimensions in the mechanistic-organic structural typology (Burns and Stalker, 1961; Daft, 2004; Yasai-Ardekani, 1989, Gharajedaghi and Ackoff, 1984). A high degree of formalization, standardization, and centralization can be observed in an organization with mechanistic structure. A mechanistic structured organization is characterized by the following (Burns and Stalker, 1961; Daft, 2004; Yasai-Ardekani, 1989; Zanzi, 1987): (1) the specialized differentiation of function; (2) the abstract nature of each task which is pursued with techniques and purposes more or less distinct from those of the concern as a whole; (3) the use of formal hierarchy for co-ordination; (4) hierarchic structure of control, authority, and communication; (5) a tendency for interaction between members of the concern to be vertical; (6) a greater importance and prestige attached to internal than to general knowledge, experience, and skill.

In contrast, organic structure settings present more flexible and open-type internal arrangements of an organization. An organic structured organization is characterized by these traits (Burns and Stalker, 1961; Daft, 2004; Yasai-Ardekani, 1989; Zanzi, 1987): (1) the contributive nature of special knowledge and experience to the common task of the concern; (2) the adjustment and continual redefinition of individual tasks through interaction with others; (3) an informal network of control, authority, and communication; (4) a lateral rather than a vertical direction of communication through the organization; (5) content of communication consisting of information and advice rather than instructions and decisions; (6) importance and prestige attached to affiliations and expertise valid in the industrial, technical, and commercial environments outside the firm

Environmental Uncertainty

Environmental uncertainty means that decision makers do not have sufficient information about environmental factors and they have a difficult time predicting external changes. There are two dimensions of environmental uncertainty: simple-complex and stable-unstable (Daft, 2004). The Simple-complex dimension concerns environmental complexity, which refers to heterogeneity, or the number and dissimilarity of external elements relevant to an organization's operations. The stable-unstable dimension refers to whether elements in the environment are dynamic. Under unstable conditions, environmental elements shift abruptly.

Researchers of Operations Management consider more of the stable-unstable dimension of the environmental uncertainty. The definition of uncertainty in the Operations Management literature takes several different approaches, such as the rates of environmental change (Lawrence and Lorsch, 1967) and task variability (Perrow, 1967). Some researchers in QM identify environmental uncertainty as degree of competition, change of customer needs, and rate of product/process change (Benson et al., 1991). Sitkin et al. (1994) identify three sources of uncertainty: task uncertainty, product/process uncertainty, and organizational uncertainty. Summarizing from the existing literature, there are three major sources of uncertainty: customer, product/process, and competitors. This study therefore focuses on these three main dynamic elements: customer needs (demand change), product/process change, and competition.

Manufacturing performance

The unit of analysis in this study is the plant. Overall, most studies on QM have either focused on plant-level data or firm-level data (Kaynak, 2003; Nair, 2006). A firm may have several plants that face different internal and external conditions and have a different focus on QEI or QER. Therefore, plant level data are more appropriate than firm level data for the current study.

Several dimensions have been used in the Operations Management literature to assess plant level manufacturing performance (Hayes and Wheelwright, 1984; Leong et al., 1990; Ferdows and DeMeyer, 1990; Ward et al. 1995; Ward and Duray, 2000). For example, Ferdows and DeMeyer (1990) contend that four dimensions are the most critical: cost efficiency, quality, dependability, and flexibility. Jayaram et al. (1999) focus on four manufacturing performance dimensions: cost, quality, time, and flexibility. Ward and Duray (2000) categorize manufacturing performance scales into the four dimensions of cost, quality, delivery, and flexibility by using factor analysis. Based on the previous literature, four dimensions of manufacturing performance are used in this study to evaluate the plant performance: cost, quality, delivery, and flexibility.

3.2.3 Hypotheses

Organizational structural as a moderator

Organizational structure has been argued as having a supporting role in QM effectiveness (Waldman and Gopalakrishnan, 1996; Cole and Scott, 2000). Shea and Howell (1998) suggest that the preferred structure for organizations that have effective QM programs should balance the need for control of activities with the flexibility needed to respond and adapt quickly to the changing market. Douglas and Judge (2001) propose that organizational structure has a moderating effect on the relationship between QM and performance. Their empirical study assesses the moderating effect by using data from the general medical hospital industry. Their research finds some support for the moderating role of organizational structure. However, since Douglas and Judge (2001) treat QM practices as one whole set, their conclusion implies that both high mechanistic and high organic structure have a positive effect on the relationship between QM and financial performance. Therefore, it does not provide insight into how to design a quality system that matches different contextual conditions.

This study proposes that when assessing the moderating role of organizational structure, QEI and QER need to be analyzed separately, which will give insight into how to design and customize quality systems to fit an organization's specific needs. QM practices that focus on exploitation may be implemented effectively in an organization with mechanic characteristics, since mechanic structure focuses more on formalization, standardization, and centralization. However, the characteristics such as the focus on hierarchy and specialized knowledge within each function may become obstacles for organizations to find new customers, explore new technologies and processes, and encourage creative and individual thinking. Therefore, in an organization with mechanistic structure, QEI might be more effective than QER. In contrast, features of organic structure are helpful for organizations to conduct practices such as searching for new customers, learning from the latest technologies, finding new ways to do things, collaborating across different functions, etc. However, quality practices aimed at controlling and increasing efficiency might be less effective due to the low level of formalization and standardization of an organic structured organization. Therefore, QER might bring more performance benefit than QEI in an organization with organic structure.

The proposed moderating role of organizational structure is summarized in the following hypotheses:

Hypothesis 1a. QEI influences performance to a greater degree than QER in organizations with mechanistic structure.

Hypothesis 1b. QER influences performance to a greater degree than QEI in organizations with organic structure.

Environmental uncertainty as a moderator

Environmental uncertainty has been proposed as having an influence on the relationship between QM practices and performance in several studies (Benson et al. 1991; Sitkin et al. 1994; Nair, 2006). It is suggested by many scholars that more research is needed to address the role of environment on the effectiveness of QM practices (Sousa and Voss, 2001; Sila, 2007). Because of incomplete information or changing conditions, organizations have difficulty predicting and responding to the future uncertainties. Change of customer needs, change of products or processes, and competitor actions are several major contributors to overall environmental uncertainty.

When organizations operate in an environment with low uncertainty, exploitive activities that emphasize refining existing competencies will bring organizations more advantage. With low environmental uncertainty, customer needs and products are relatively stable and competitive pressure is relatively low. Focusing on existing customers' needs, controlling of the processes, and within functional training and teamwork will make the organization more competitive in the market. Therefore, organizations facing low uncertainty may get more benefits from QEI. In contrast, organizations facing high environmental uncertainty are more likely to focus on QER to gain more performance benefits. With quick changes of customer needs, products, and competitors' reactions, finding customers' new needs, improving processes, and collaborating between functions can help organizations respond quickly to conditional changes. Therefore, explorative activities will bring organizations more competitive advantage and performance benefits in an unstable environment. In summary, the focus on QEI or QER needs to be adjusted according to the uncertainty an organization faces in order to get expected performance benefits. This suggests the following hypotheses:

Hypothesis 2a. QEI influences performance to a greater degree than QER when environmental uncertainty is low.

Hypothesis 2b. QER influences performance to a greater degree than QEI when environmental uncertainty is high.

3.3 Data and measures

3.3.1 Data

The current study uses a secondary data source to empirically evaluate the hypotheses proposed in the paper. The data source is plant-level data from the High Performance Manufacturing (HPM) project. The data collection is a comprehensive project conducted by a team of international researchers in the field of production and operations management. The project has lasted for more than 15 years and collected data for three rounds. The first and second rounds are called the World Class Manufacturing (WCM) project and the third round, which is used in this study, is called the High Performance Manufacturing (HPM) project. HPM database is a valuable and comprehensive source of data to conduct plant-level research.

The HPM project has a sample size of 238 and collects data from a stratified sample consisting of traditional and world-class reputation plants. All the sample plants have at least 250 employees. Data is collected from eight countries and three industries. The eight countries are Austria, Finland, Germany, Italy, Japan, Korea, Sweden, and the United States. Data are collected using mailed surveys which gather cross-sectional data on plant level manufacturing and administrative practices, internal and external environment of manufacturing plants, and operational and market-based performance.

The plants are selected in three industries: automobile suppliers, electronics, and machinery. In each industry, there is approximately the same number of plants. The three industries provide a perfect setting for research on QEI and QER, since the plants within each industry face different environmental factors and competitive pressures. These differences in plants may result in a different focus on QEI and QER, which provides enough variation to conduct research on the two constructs. The distribution of the sample across countries and industries is shown in Table 3-2.

Table 3-2: Sample distribution across industry and country

		Industry			
		Auto Suppliers	Electronics	Machinery	Total
Country	Austria	4	10	7	21
	Finland	10	14	6	30
	Germany	19	9	13	41
	Italy	7	10	10	27
	Japan	13	10	12	35
	Korea	11	10	10	31
	Sweden	7	7	10	24
	USA	9	9	11	29
	Total	80	79	79	238

The HPM data includes only one plant per firm in the sample, which helps to maximize the independence of units in the study. Multiple respondents and multiple measurement methods (subjective and objective) are used in the project to reduce the common method bias. The response rate of the HPM project is 65% which ensures a representative sample. This high response rate is the result of efforts such as telephoning the plant managers and offering each plant a profile report that indicates its performance relative to other plants in the same industry.

3.3.2 Measures

Quality Exploitation and Quality Exploration

The scales for measuring QEI and QER were developed based on existing theory, a comprehensive literature review, and discussions with QM experts. There are four dimensions for both QEI and QER, so we need items to measure eight first level factors: CFQEI, CFQER, PMQEI, PMQER, TWQEI, TWQER, TRQEI, and TRQER. Items for each of the eight scales were identified based on a comprehensive literature review. Then the items were reviewed by several professors with expertise in quality management. Twenty-five items are finalized to measure the eight scales (see Appendix 3-1).

To be consistent with our conceptualization of the two constructs of QEI and QER, we modelled each of them as a second-order latent factor measured through the 4 first-order factors we have identified. Confirmatory Factor Analysis (CFA) was used to check the model fit, reliability, and validity. Absolute, incremental, and parsimonious measures are used to evaluate the fit results. The software LISREL 8.51 was used to run the CFA model. Table 3-3 shows the correlation matrix of the 25 measurement items.

We assessed model fit for indication of reliability and validity by using a series of fit measures, since each measure provides different information for evaluating the model's ability to represent the data (Hair et al., 2006; Hu and Bentler, 1995). Table 3-4 summarizes the fit statistics of the second-order measurement model. Absolute fit measures such as Root Mean Square Error of Approximation (RMSEA) are a direct measure to assess how well a specified model reproduces the observed data. Lower RMSEA values indicate better fit, and typically a model with RMSEA value below 0.10 is treated as acceptable (Hair, et al. 2006, p748). Incremental fit measures differ from absolute fit indices in that they assess the model by comparing it with some alternative baseline model, such as a null model which assumes all observed variables are unrelated. This class of fit indices, such as Comparative Fit Index (CFI), Incremental Fit Index (IFI), and Non-normed Fit Index (NNFI), represents the improvement in fit by the specification of related multi-item constructs. Parsimonious fit measures such as normed χ^2 (χ^2/d.f.) assess the parsimony of the proposed model by evaluating the fit of the model versus the number of estimated coefficients needed to achieve the level of fit (complexity). Generally, χ^2/d.f. ratios below 2 are associated with good-fitting models (Hair et al., 2006). The loadings of the items on the first-order factors (which are all significant at 0.01 significant level) and composite reliability are shown in Table 3-5. The loadings of the first-order factors on the two second-order factors (which are all significant at 0.05 significant level) are shown in Figure 3-3. A good model fit is suggested by these different fit indices.

Table 3-3: Correlation matrix of the 25 measurement items for QEI and QER

	cfqei1	cfqei2	cfqei3	pmqei1	pmqei2	pmqei3	twqei1	twqei2	twqei3	trqei1	trqei2	trqei3	cfqer1	cfqer2	cfqer3	cfqer4	pmqer1	pmqer2	pmqer3	twqer1	twqer2	twqer3	trqer1	trqer2	trqer3
cfqei1	1																								
cfqei2	.57	1																							
cfqei3	.41	.42	1																						
pmqei1	.25	.31	.37	1																					
pmqei2	.31	.29	.21	.58	1																				
pmqei3	.21	.23	.28	.82	.62	1																			
twqei1	.19	.30	.37	.28	.27	.22	1																		
twqei2	.20	.22	.39	.21	.20	.15	.70	1																	
twqei3	.20	.28	.34	.20	.20	.12	.59	.53	1																
trqei1	.27	.25	.35	.34	.24	.32	.30	.36	.35	1															
trqei2	.18	.24	.32	.27	.19	.19	.34	.38	.31	.69	1														
trqei3	.19	.26	.33	.31	.22	.26	.39	.41	.38	.82	.66	1													
cfqer1	.11	.06	-.05	.12	.17	.11	-.00	.03	-.00	.15	.00	.10	1												
cfqer2	.22	.28	.06	.09	.10	.12	-.03	-.09	-.01	.06	-.08	-.00	.53	1											
cfqer3	.10	.18	.04	.12	.16	.10	.05	.10	.12	.10	.07	.16	.48	.58	1										
cfqer4	.14	.18	-.03	.21	.19	.20	.07	.03	.03	.11	-.00	.11	.70	.56	.47	1									
pmqer1	.47	.41	.32	.31	.31	.26	.34	.26	.32	.25	.21	.28	.03	.17	.11	-.01	1								
pmqer2	.33	.39	.33	.30	.24	.28	.24	.25	.22	.23	.32	.21	-.05	.00	.11	-.02	.36	1							
pmqer3	.35	.46	.39	.27	.22	.19	.41	.32	.29	.30	.26	.37	-.01	.11	.18	.04	.46	.38	1						
twqer1	.17	.23	.35	.28	.20	.28	.34	.36	.17	.33	.34	.30	.03	-.02	-.09	-.02	.13	.24	.19	1					
twqer2	.18	.19	.32	.36	.29	.35	.31	.29	.21	.28	.27	.28	.05	-.00	-.00	.04	.18	.21	.28	.58	1				
twqer3	.15	.18	.24	.30	.22	.29	.30	.30	.23	.26	.32	.33	-.01	-.09	.04	-.03	.18	.29	.33	.58	.64	1			
trqer1	.20	.33	.23	.24	.19	.16	.37	.36	.35	.44	.40	.46	-.01	-.00	.10	-.04	.27	.21	.36	.22	.22	.19	1		
trqer2	.18	.28	.18	.13	.17	.08	.34	.32	.31	.32	.30	.36	.00	-.01	.08	.00	.19	.08	.22	.21	.20	.12	.49	1	
trqer3	.17	.27	.25	.23	.19	.19	.31	.31	.31	.45	.32	.49	-.03	.01	.12	-.07	.33	.23	.41	.18	.18	.13	.71	.40	1

Table 3-4: Fit statistics of the second-order measurement model

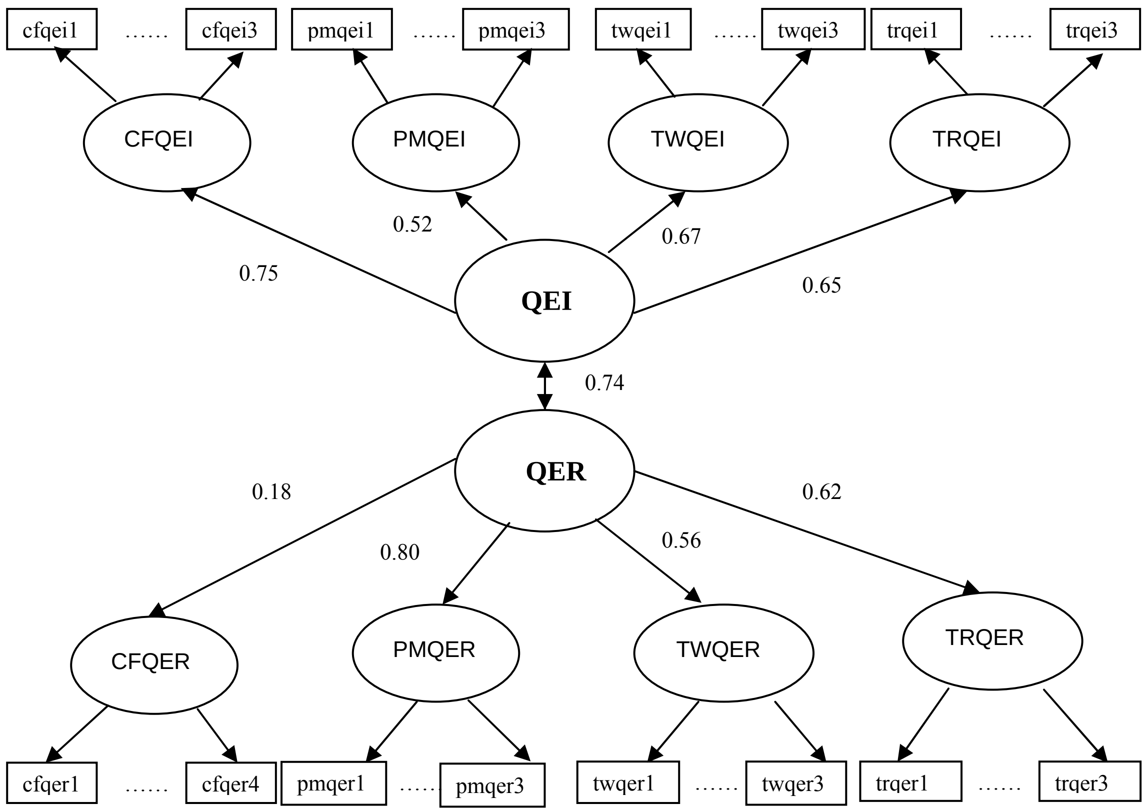
RMSEA	0.059
90% confidence interval of RMSEA	(0.051, 0.068)
χ^2	488
χ^2/d.f	1.83
NNFI	0.91
CFI	0.92
IFI	0.92

Table 3-5: Standardized factor loadings and reliability estimates

	CFQEI	CFQER	PMQEI	PMQER	TWQEI	TWQER	TRQEI	TRQER
cfqei1	0.69							
cfqeiI2	0.77							
cfqei3	0.62							
cfqer1		0.78						
cfqer2		0.72						
cfqer3		0.65						
cfqer4		0.80						
pmqei1			0.91					
pmqei2			0.67					
pmpei3			0.90					
pmqer1				0.65				
pmqer3				0.56				
pmqer4				0.70				
twqei1					0.87			
twqei2					0.80			
twqei3					0.68			
twqer1						0.74		
twqer3						0.80		
twqer4						0.79		
trqei1							0.91	
trqei2							0.75	
trqei4							0.90	
trqer1								0.88
trqer2								0.55
trqer3								0.79
Composite Reliability	0.73	0.83	0.87	0.67	0.83	0.82	0.89	0.79

**All item loadings are significant at the 0.01 level

Figure 3-3: Second-order factor model



<u>Organizational structure</u>

Organizational structure could be assessed by the degree of centralization of authority, the use of formal hierarchy for co-ordination, a lateral or a vertical direction of communication through the organization, or whether the task is precisely defined, etc (Burns and Stalker, 1961; Daft, 2004; Yasai-Ardekani, 1989). Since organizational structure is a multi-dimensional concept and cannot be measured directly, several indicators will be used to capture the concept. This method will ensure the simplicity of the data analysis and at the same time capture the essence of the concept. In this study, two indicators regarding the number of levels in an organization are used to measure the use of formal hierarchy of the organization (see Appendix 3-3). Formal hierarchy is an important aspect of organizational structure, and we use the measurement of hierarchy as an approximation of organizational structure. The two seven-point Likert scale indicators are adapted from existing literature (Burns and Stalker, 1961; Aiken and Hage, 1966; Zanzi, 1987). The two indicators have a positive correlation of 0.79. The average of the scores is used to address how organic or mechanic a plant is. A higher value of this score implies high degree of mechanic.

<u>Environmental uncertainty</u>

To capture different aspects of environmental uncertainty, three indicators are used to measure the concept. The three seven-point Likert scale indicators capture the change of customer needs, the unstable and unpredictable nature of the demand for the products, and competitive pressures respectively (see Appendix 3-3). The average of the three indicator scores is used to represent how uncertain the environmental is. The index allows for the possibility of the presence of more than one type of environmental uncertainty (Pagell and Krause, 1999). A higher value of this index implies higher level of environmental uncertainty. The correlations between the three indicators are shown in Table 3-6.

Table 3-6: Correlations between indicators of environmental uncertainty

	EU1	EU2	EU3
EU1	1.0		
EU2	.151*	1.0	
EU3	.186**	.187**	1.0

* correlation is significant at 0.05 level
** correlation is significant at 0.01 levle

Manufacturing performance

Previous research often treats manufacturing performance as with four dimensions: cost, quality, delivery, and flexibility. Accordingly, this study also examines manufacturing performance with these four dimensions. Metrics for these performance dimensions are adapted from previous research (Ferdows and De Meyer, 1990; Klassen and Whybark, 1999; Roth and Miller, 1990; Schroeder, et al., 2002). A set of measurement items in a 1-5 scale is used to measure each dimension (Appendix 3-2). Cost is measured as unit cost of manufacturing, inventory turnover, and cycle time. Quality is assessed by both conformance to product specifications and product capability. Delivery performance (on-time delivery) and fast delivery are used to measure delivery respectively. Finally, flexibility is measured by the ability to change product mix and volume.

The scales for manufacturing performance are assessed for validity and reliability. Grounding the scales in the literature ensures content validity. Cronbach's alpha is calculated for each manufacturing performance scale (Table 3-7). Table 3-7 shows that the overall Cronbach's alpha values of each of the manufacturing performance scales exceeded 0.6, load on a single factor, and explain more than 50% of the variance. Appendix 3-2 shows the factor loadings of the items of each manufacturing performance dimensions.

Table 3-7: Manufacturing performance dimensions, scale reliability, and variance explained

Performance dimension	Cronbach's alpha	Eigenvalue	Variance explained (%)
Cost	.712	1.927	64.233
Quality	.663	1.498	74.902
Delivery	.755	1.606	80.322
Flexibility	.719	1.563	78.138

Based on the four dimensions of the manufacturing performance, a higher level overall weighted performance is calculated. The significant positive correlations between the performance dimensions (Table 3-8) ensure the validity of the summated performance. Weights are calculated based on organizations' manufacturing and market goals (Table 3-9). For example, if low price of the product is an important goal of an organization, then cost will get a higher weight in calculating performance. By introducing weights based on manufacturing and market goals, the performance measurement can better represent an organization's competitive advantage.

Table 3-8: Correlation matrix of performance scales

	Cost	Quality	Delivery	Flexibility
Cost	1.0			
Quality	.383	1.0		
Delivery	.409	.368	1.0	
Flexibility	.376	.251	.467	1.0

** all the correlations are significant at 0.01 level

Table 3-9: Goals and weights for performance dimensions

Manufacturing and market goals	Weights
Low price (C)	W1 = C/ (C+Q+D+F)
High performance quality (Q)	W2 = Q/ (C+Q+D+F)
Fast delivery (D)	W3 = D/ (C+Q+D+F)
Ability to rapidly change over products on short notice (F)	W4 = F/ (C+Q+D+F)

The weighted performance is calculated using the following formula:

Weighted Performance = w1*cost + w2*quality + w3*delivery +w4*flexibility

3.4 Analysis

The main task of the data analysis is to test the moderating effect of organizational structure and environmental uncertainty on QEI and QER effectiveness, which means that the impact of QEI and QER on manufacturing performance varies across the different levels of the two moderators. Subgroup analysis and regression analysis are the two common ways to test for a moderating effect (Hair et al., 2006). In subgroup analysis, the sample is split into subgroups of low versus high levels of the contingency variable and the same kind of data analysis method (e.g. regression) is used within each group. In regression analysis, the moderating effect is commonly operationalized as an interaction term, and the regression coefficient of the interaction term on performance will be assessed (Donaldson, 2001). If a researcher hypothesizes that the predictive ability of certain predictors differs across different moderator levels, this hypothesis reflects the strength of moderation and can be tested using subgroup analysis. Conversely, if a researcher specifies that the performance outcome is jointly determined by the interaction of the predictor and the moderator, then this hypothesis reflects the form of moderation and can be tested using regression analysis (Venkatraman, 1989).

In this study, we hypothesize that the influence of QEI and QER on manufacturing performance differs across different levels of organizational structure and environmental uncertainty. We are testing the strength of the two moderating effects. Therefore, subgroup analysis is the appropriate method to use here. In addition, subgroup analysis has one more advantage, in that it represents an intuitive way of showing moderating effects.

To create subgroups based on the two moderators, the frequency distribution of the moderators needed to be checked first. If the moderating factor shows two clear peaks rather than one, then logical groups may be created around each peak. Figures 3-4 and 3-5 show the frequency distribution of the organizational structure score and the environmental uncertainty score. Both of them show a unimodal distribution (one peak). If the moderator variable displays a unimodal distribution, one way to conduct subgroup analysis is that "some fraction (i.e., 1/3) of the observations around the median value could be deleted and the remaining observations (which are likely now bimodal) used to create groups" (Hair et al., 2006 p 871). In this study, we first rank all sample manufacturing plants by the organizational structure score and divide the sample into three natural groups: 0-33 percentage, 34-67 percentage, and 68-100 percentage. Then we delete the second (middle) group and label the first group as organic structure and the third group as mechanistic structure. We follow the same procedure and create subgroups based on the environmental uncertainty score and get two subgroups: low uncertainty group and high uncertainty group.

Figure 3-4: Frequency distribution of the organizational structure score

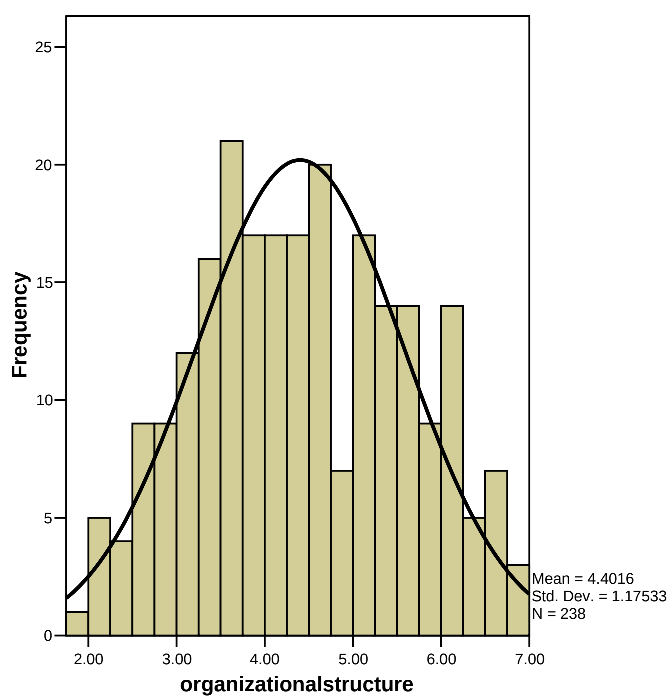
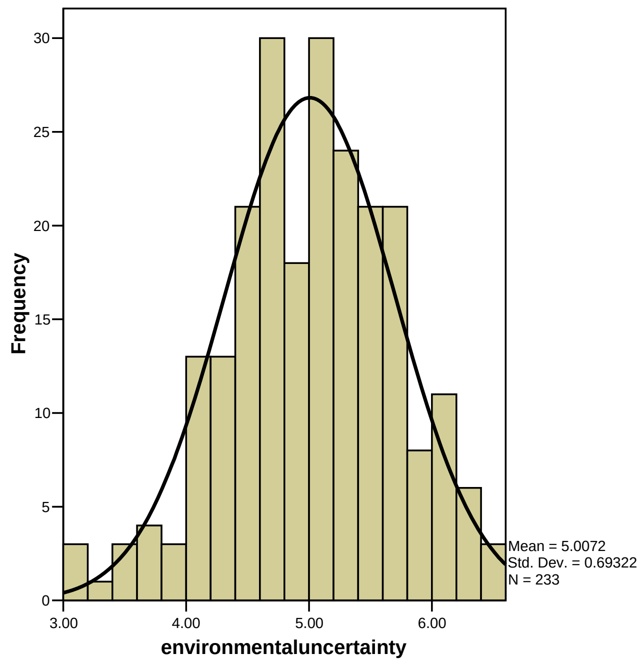


Figure 3-5: Frequency distribution of the environmental uncertainty score



Within each sub group, regression is conducted with weighted performance as the dependent variable and QEI and QER as independent variables. Several control variables commonly used for plant level studies are considered in the regression function: size and age of the plant, industry type, and country. Size is operationalized by number of personnel employed (Ettlie, 1995). Since performance may increase with size but at a decreasing rate with respect to size, the natural log of the employee number (Donaldson, 2001) is used in the regression equation. Plant age is measured as the number of years elapsed since the plant was built. For the three industry types, two dummy variables are included in the regression. Seven dummy variables are used to represent the eight countries. The initial regression equation is shown as below:

$$\text{Weighted Performance} = \beta_0 + \beta_1 \text{ Size} + \beta_2 \text{ Age} + \beta_3 \text{ Industry1} + \beta_4 \text{ Industry2} + \beta_5 \text{ Country1} + \beta_6 \text{ Country2} + \beta_7 \text{ Country3} + \beta_8 \text{ Country4} + \beta_9 \text{ Country5} + \beta_{10} \text{ Country6} + \beta_{11} \text{ Country7} + \beta_{12} \text{ QEI} + \beta_{13} \text{ QER}$$

Of the four control variables, only dummy variables of 'Industry' show significant regression coefficients in the above regression model. Since 'Size', 'Age', and seven dummy variables of 'Country' show insignificant regression coefficients, a more parsimonious model is preferred. We first delete 'Size' from the model, and the regression coefficients of 'Age' and 'Country' are still insignificant. Then 'Age' is deleted from the model and all the seven dummy variables of 'Country' still show insignificant regression coefficients. Therefore, 'Size', 'Age', and 'Country' are all deleted from the model as control variables. The final regression equation is shown as below:

$$\text{Weighted Performance} = \beta_0 + \beta_1 \text{ Industry Type 1 (Machinery)} + \beta_2 \text{ Industry Type 2 (Electronics)} + \beta_3 \text{ QEI} + \beta_4 \text{ QER}$$

We also test the assumptions of the regression models used in this study and do not find violations of the regression assumptions. Multicollinearity between predictor variables were also checked by calculating the variance inflation factor (VIF). All the VIF values of the regression models were within the range of 1 to 3.5; therefore, there is no warning sign of multicollinearity. The regression results are shown in Table 3-10 and Table 3-11.

Table 3-10 shows that in organic structure, QER has a significant positive relationship with the weighted performance (with a regression coefficient of .282 and a p-value of 0.06) while the regression coefficient of QEI is insignificant. This result is consistent with hypothesis 1b, which states that QER influences performance to a greater degree than QEI in organizations with organic structure. In contrast, in mechanistic structure, QEI shows a significant positive relationship with the weighted performance (with a regression coefficient of 0.396 and a p-value of 0.049) while the regression coefficient of QER is insignificant. This supports hypothesis 1a, which hypothesizes that QEI influences performance to a greater degree than QER in organizations with mechanistic structure. Both hypothesis 1a and 1b are supported.

Table 3-10: Regression results within subgroups of organic structure and mechanistic structure

	Dependent variable: weighted performance	
	organic	mechanistic
Industry type 1 (M)	.182	.418***
Industry type 2 (E)	-.103	.071
QEI	.006	.396**
QER	.282*	.110
R-Square	.142	.264
Adjusted R-Square	.085	.219
P-value of overall model	.05	<.001

- * P < 0.1
- ** P < 0.05
- *** P < 0.01

Table 3-11 shows the regression results in the two subgroups: low environmental uncertainty and high environmental uncertainty. When environmental uncertainty is low, QEI shows a significant positive relationship with the weighted performance (with a regression coefficient of 0.372 and p-value of 0.03) while QER fails to show a significant relationship. This supports hypothesis 2a, which states that QEI influences performance to a greater degree than QER when environmental uncertainty is low. In the other subgroup, when environmental uncertainty is high, QER has a significant relationship with the weighted performance (with a regression coefficient of 0.347 and a p-value of 0.069) while QEI has an insignificant regression coefficient. The result is consistent with what we hypothesized in hypothesis 2b, that QER influences performance to a greater degree than QEI when environmental uncertainty is high. Both hypothesis 2a and 2b are supported.

Table 3-11: Regression results within subgroups of low uncertainty and high uncertainty

	Dependent variable: Weighted performance	
Uncertainty	low	high
Industry type 1 (M)	.315**	-.107
Industry type 2 (E)	-.012	-.185
QEI	.372**	-.034
QER	.009	.347*
R-Square	.175	.140
Adjusted R-Square	.119	.085
P-value of overall model	.021	.049

- * P < 0.1
- ** P < 0.05
- *** P < 0.01

3.5 Discussion and conclusions

With the increasingly reliance on quality management practices to gain competitive advantage, more knowledge about implementing and getting performance benefits from these practices is needed to make them more sustainable. To get the expected benefits from quality management initiatives, customizing the QM activities has been proposed by many scholars. How to customize the quality practices according to situational factors becomes a challenging question to both researchers and practitioners. This study provides possible solutions to this question by introducing a contingency view of QM and distinguishing between different QM practices. We suggest that there exist two different aspects of QM practices that have different objectives: quality exploitation (QEI) and quality exploration (QER). To investigate the relationships between QEI, QER and performance, certain contingency factors are considered in the research.

This study investigates the performance implication of QEI and QER under different levels of organizational structure and environmental uncertainty, which are identified as two major contingency factors in organization theory. The results provide support of the moderating role of organizational structure and environmental uncertainty on the link between QEI, QER, and manufacturing performance. This research contributes to the literature in two ways: it 1) supports the contingency view of QM effectiveness and empirically validates the moderating effect of two contingency factors on the link between QM practices and performance, and 2) provides insight for practitioners on how to get more benefits from QM initiatives.

3.5.1 The moderating effect of organizational structure and environmental uncertainty

The subgroup analysis shows that the impact of QEI and QER on manufacturing performance varies across the different levels of organizational structure and environmental uncertainty. This supports the contingency view of the relationship between QM practices and performance instead of the traditional belief of "universal remedy."

Our research shows that in organizations with organic structure, explorative quality practices bring more performance benefit than exploitive practices. In contrast, the relationship between exploitive quality practices and manufacturing performance is much stronger in organizations with mechanistic structure. For organizations facing high environmental uncertainty, explorative quality practices have a significant positive relationship with operational performance while exploitative quality practices fail to show a significant relationship. For organizations operating in a low uncertainty environment, exploitative quality practices show stronger relationship with the performance.

The results of this study contribute to the discussion in the literature over whether a universal or a context-dependent approach to quality management is needed. Until now, these discussions are scant and mainly theoretical (Sila, 2007; Sousa and Voss, 2008). Sousa and Voss (2008) raise doubts of the 'universal validity' of QM practices and propose that more research should be done to check if those practices are context dependent and what might be the contextual factors. This research provides strong evidences to support a context-dependent approach to quality management and identifies two important contextual factors.

3.5.2 Managerial implications

Despite the increasing popularity of QM practices, practitioners still suffer from mixed performance results, particularly in the situation where customization is important. By distinguishing QEI from QER and examining moderating effect of certain situational factors, this study provides a basis of guidance for practitioners to customize QM practices.

This research provides empirical evidence that the performance influence of QEI and QER differs across different types of organizational structure and different levels of environmental uncertainty. The empirical findings offer important implications about quality management initiatives. In an increasingly competitive business environment where scarce resources have to be allocated for many different purposes, the findings of this research could help organizations choose the right focus of the quality management practices and allocate their resources wisely based on their organizational structure and the external environment they are facing.

3.5.3 Limitations and future research

This study is subject to several limitations. One limitation is that although the measurement scales used in the paper are developed based on a comprehensive literature review, they are drawn from the HPM database. So the measurement items are limited by the database. However, HPM is a comprehensive survey database with quality management and manufacturing performance as major parts, which fits the research purpose of the study very well. Another limitation is that the data used in this study is coming from only manufacturing plants. The discrimination between QEI and QER and their performance implication under different situational conditions could not be generalized to the service industry at this point. However, manufacturing plants have a longer history of implementing QM practices and provide a more mature setting for this research. Therefore the manufacturing industry is a good starting point of the research.

Several ways to extend the current study should be considered in the future research. First, we could collect data from other contexts such as service and healthcare and examine the contingency view of quality management in other contexts. Second, the current research can be expanded to include the supply chain. Now most studies on quality management initiatives are within the scope of one link of the supply chain. A holistic view of the supply chain that investigates the cooperation between suppliers, producers, and customers should bring further insights into the research on quality management effectiveness. Third, as Sousa and Voss (2008) point out, more key contingency variables need to be identified in the Operations Management discipline. This paper investigates the moderating role of two contingency factors, and future research could focus on identifying more relevant contingencies. Finally, the antecedent of the implementation of the different quality practices should be investigated to help the organizations choose the right focus from the beginning.

Appendix 3-1: Measurement items–QEI and QER

Respondents were asked to indicate the extent to which they agree or disagree with each of these statements about their plant and organization.

1: Strongly disagree, 4: Neutral, 7: Strongly agree

CFQEI (customer focus for quality exploitation)

cfqei1 We frequently are in close contact with our customers
cfqei2 Our customers give us feedback on our quality and delivery performance
cfqei3 We regularly survey our customers' needs.

CFQER (customer focus for quality exploration)

cfqer1 We consulted customers early in the design efforts for this product.
cfqer2 We partnered with customers for the design of this product
cfqer3 Customers were frequently consulted about the design of this product.
cfqer4 Customers were an integral part of the design effort for this project.

PMQEI (process management for quality exploitation)

pmqei1 We make extensive use of statistical techniques to reduce variance in processes.
pmqei2 We use charts to determine whether our manufacturing processes are in control.
pmqei3 We monitor our processes using statistical process control.

PMQER (process management for quality exploration)

pmqer1 We strive to continually improve all aspects of products and processes, rather than taking a static approach.
pmqer2 We believe that improvement of a process is never complete; there is always room for more incremental improvement.
pmqer3 Our organization is not a static entity, but engages in dynamically changing itself to better serve its customers.

TWQEI (teamwork for quality exploitation)

twqei1 Our supervisors encourage the people who work for them to work as a team.
twqei2 Our supervisors encourage the people who work for them to exchange opinions and ideas.
twqei3 Our supervisors frequently hold group meetings where the people who work for them can really discuss things together.

TWQER (teamwork for quality exploration)

twqer1 The functions in our plant cooperate to solve conflicts between them, when they arise
twqer2 Our plant's functions coordinate their activities
twqer3 Our plant's functions work interactively with each other.

TRQEI (training for quality exploitation)

trqei1 Our plant employees receive training and development in workplace skills, on a regular basis.
trqei2 Management at this plant believes that continual training and upgrading of employee skills is important.
trqei3 Our employees regularly receive training to improve their skills.

TRQER (training for quality exploration)

trqer1 Employees at this plant learn how to perform a variety of tasks.
trqer2 The longer an employee has been at this plant, the more tasks they learn to perform.
trqer3 Employees are cross-trained at this plant, so that they can fill in for others, if necessary.

Appendix 3-2: Measurement items–operational performance

Please circle the number which indicates your opinion about how your plant compares to its competition in your industry, on a global basis.

1. Poor or low end of the industry, 3. Average, 5. Superior or better than average

	Factor loading
Cost	
Unit cost of manufacturing	.703
Inventory turnover	.847
Cycle time (from raw materials to delivery)	.846
Quality	
Conformance to product specifications	.865
Product capability and performance	.865
Delivery	
On time delivery performance	.896
Fast delivery	.896
Flexibility	
Flexibility to change product mix	.884
Flexibility to change volume	.884

Appendix 3-3: Indicators for organizational structure and environmental uncertainty

Respondents were asked to indicate the extent to which they agree or disagree with each of these statements about their plant and organization.

1: Strongly disagree, 4: Neutral, 7: Strongly agree

Indicators for organizational structure

OS1 There are many levels between the lowest level in the organization and top management.
OS2 Our organizational chart has many levels.

Indicators for environmental uncertainty:

EU1 The needs and wants of our customers are changing very fast.
EU2 The demand for our plant's products is unstable and unpredictable.
EU3 Our competitive pressures are extremely high.

Chapter 4

Implementation of Quality Exploitation versus Quality Exploration: Institutional or Rational?

4.1 Introduction

Organizations are increasingly adopting process improvement initiatives as a means to achieve competitive advantages. Quality Management (QM), as one of the most important improvement initiatives, has been widely implemented in companies across the world. Both scholars and practitioners have long recognized the critical role of Quality Management and also realized the need to implement QM practices effectively (Juran and Godfrey, 1999; Westphal et al., 1997; Kaynak, 2003). However, a great number of research projects on QM focus on analyzing the relationship between QM practices and the performance results, with few of them addressing the antecedents or determinants of QM implementation. Therefore, the motivation that leads to the implementation of QM practices is underdeveloped. To gain more benefits from QM initiatives, it is necessary to first look at the motivation for the adoption and implementation. Research on the antecedents or motivation of adoption may help organizations implement the right practices at the beginning. Research on antecedents of adoption may also be helpful to the research on performance effects (Ketokivi and Schroeder, 2004; Dean and Snell, 1996).

Also, researchers have typically examined the QM practices and their influence on performance as a whole. Given the scope of QM is broad and complex, research on implementation of QM practices and their performance implication should consider different aspects of QM practices (Sitkin, et al., 1994; Westphal et al., 1997). Drawing from the management literature on exploitation and exploration (March, 1991; Benner and Tushman, 2003), this research differentiates two different kinds of quality management practices with different objectives: Quality Exploitation (QEI) and Quality Exploration (QER). Quality Exploitation includes QM practices that aim to control stable and familiar processes and improve the efficiency of manufacturing or service processes. Quality Exploration, in contrast, is defined as QM practices that are used to get new insights about process innovation and explore the unknown.

This research investigates the motivation of organizations to implement QEI and QER practices. Building upon the existing literature, two different views have been identified in the study: institutional view and rational view. Based on the institutional view, organizations facing similar institutional factors should have similar implementation pattern or focus of QEI and QER. Based on the rational view, organizations' implementation focus of QEI and QER should be related to their strategic goals. Porter's (1980) model of business strategies is used in the study. For the companies with low cost as their strategic goal, more QEI should be implemented than QER. In contrast, for the companies whose strategic goal is differentiation, QER should be focused on more. This study utilizes survey data collected from different industries and countries and empirically examines the two different views of QEI and QER implementation. It contributes to the existing quality management literature in several ways. First, this study explores the antecedents to QM implementation by differentiating two different sets of quality management practices: QEI and QER. Secondly, it identifies two different views to explain the motivation of QEI and QER implementation. And lastly, it tests the proposed model using large-scale cross-sectional data. Besides its contribution to the quality literature, this research will also provide insights for practitioners on quality program implementation.

The rest of the paper is arranged as follows. Section 4.2 presents the theoretical foundation for the proposed model. Section 4.3 describes empirical data used in this study and measurement instrument. Data analysis and results are presented in Section 4.4. Section 4.5 concludes the paper with a discussion of theoretical and practical implications as well as limitations and possible future research.

4.2 Theoretical foundation

4.2.1 Differentiation between Quality Exploitation and Quality Exploration

With limited attention and resources, making choices about how much to invest in different types of activities is always a central concern for organizations. March (1991) proposes two broad types of activities between which firms could divide attention and resources: exploitation and exploration. Based on March's (1991) description, exploitation implies activities captured by terms such as refinement, choice, production, efficiency, and execution. Exploration includes activities characterized by terms such as search, discovery, experimentation, variation, and innovation. The differentiation between exploitation and exploration has been further investigated in some other studies in the management field (e.g. Benner and Tushman, 2003).

The tension between exploitation and exploration also exists in quality management practices (Sitkin, et al., 1994). Two types of QM practices are identified based on March's (1991) differentiation: quality exploitation (QEI) and quality exploration (QER). On the one hand, organizations need to control stable and familiar processes and improve the efficiency of manufacturing or service processes. So quality exploitation includes the QM practices that aim to control the known processes. The objective of QEI is to ensure the consistency and efficiency of outcomes. On the other hand, organizations need new insights about innovation and exploration of the unknown. Therefore, quality exploration includes the QM practices that aim to explore the unknown and to identify and pursue novel solutions. QER keeps organizations open and flexible to new ideas.

To define the constructs of QEI and QER, it is necessary to first outline the common guiding QM precepts that can then be parceled into QEI and QER. Over time in the development of academic literature, the term QM has gained consistency in its meaning. A good definition of QM should be parsimonious and based on prior theory development papers (Wacker, 1998; 2004). Based on a comprehensive literature review, this paper develops a framework that is parsimonious and at the same time has content validity. The focus of the framework developed in this study is the QM elements that could be customized based on certain contextual conditions. Four major dimensions are used to describe the constructs of QEI and QER: customer focus, process management, teamwork, and training. The description of the constructs and the supporting literature are available in Section 3.2.2.

4.2.2 Hypotheses

To explain the implementation motivation of QEI and QER, two different views are identified in the study: institutional view and rational view. Drawing upon institutional theory, the institutional view states that organizations tend to implement similar practices of other companies that face similar institutional factors while the rational view tries to explain the implementation of QEI and QER based on companies' strategic goals. The basic assumption is that companies try to focus more on the practices that can directly help the achievement of their strategic goals.

Institutional theory, an important theory of organizational behavior research (Scott, 2001), examines the influence of the institutional context on organizational structure and practices. It provides insights into why firms benchmark and implement other institutions' practices. Institutional forces from the institutional environment lead to compliance to institutional pressures and homogeneity of firms through isomorphism. Isomorphism is the process that causes one unit in a group to resemble other units that face the same set of environmental conditions. There are three core mechanisms for institutional adaptation: mimetic forces, coercive forces, and normative forces. Mimetic forces press the organizations to copy or model other organizations because of the uncertainty faced by the organization. Since it is not clear to management what practices might be helpful to improve performance, they just simply imitate the practices of other institutions that face similar environment. Coercive forces are the external pressures exerted on organizations to adopt practices similar to other organizations. The external pressures are usually coming from governments or big companies that have power to influence their suppliers or partners. Normative forces are pressures to adopt practices that are considered by the professional community to be up to date and effective (DiMaggio and Powell, 1983; Daft, 2004).

Meyer and Rowan (1977) summarize institutionalization as a social process by which structures, polices, and programs acquire "rule-like status" as legitimate elements of the organization. Institutional perspectives generally emphasize the role of social factors rather than economic or efficiency factors in driving organizational actions.

Based on institutional theory, organizations with similar context will become increasingly similar.

According to Westphal et al.'s (1997) study of the diffusion of QM practices in hospitals, QM principles and practices diffuse through institutional mechanisms. Although early adopters of QM are motivated by economic efficiency, late adopters adopt QM practices for legitimacy. Ketokivi and Schroeder (2004) conducted empirical research based on the data from 164 manufacturing plants. They found that the institutional perspective is a good explainer for practices such as cross-functional cooperation, JIT manufacturing, cross-training, long-term supply chain relationship, and design for manufacturability. Although they do not include many QM practices in their preliminary empirical test, they argue that QM is also an institutionalized practice, which is "a set of organizational routines that becomes perceived as economically valuable even in the absence of empirical evidence of its economic effectiveness" (Ketokivi and Schroeder, 2004, p. 64).

The implementation of QEI and QER practices can be related to all the three core institutional mechanisms. In the face of uncertainty, companies may mimic the quality practices from the successfully companies. This action reflects the mimetic forces of institutional similarity. When there is a power difference between organizations, some big companies may require their suppliers or partners to implement certain QEI or QER practices. Coercive forces play an important role in activities like this. Or sometimes, companies may implement some QM practices because of normative forces, which means the practices are recognized and becoming popular in the quality field.

Institutional mechanisms might be reflected by companies that are from the same country or in the same industry (Haunschild and Miner, 1997). When companies try to implement some quality practices, they usually will benchmark and mimic the successful companies in the same industry. Being in the same industry can also reflect the coercive pressures coming from some big companies and the normative forces coming from the professional community. Being in the same country can reflect the coercive forces coming from the government. Therefore, country and industry, the two commonly identified institutional factors (Haunschild and Miner, 1997; Scott, 2001; Ketokivi and Schroeder, 2004), are used in the study to check the institutional view of the motivation to QEI and QER implementation.

The institutional view of implementation suggests the following hypotheses:

Hypothesis 1a. The implementation of QEI practices varies by country and industry.

Hypothesis 1b. The implementation of QER practices varies by country and industry.

Another view is identified to explain the implementation of QEI versus QER, which is called the rational view in this study. Scott (2003) identifies three systems models of organizations, which are rational systems, natural systems, and open systems. The rational systems approach emphasizes structural arrangements to facilitate organizational goals and objectives. From this point of view, organizations are collectivities oriented to the pursuit of relatively specific goals. Goals and objectives provide criteria for generating and selecting among alternative actions (Simon, 1964; 1997). They also guide resource allocation decisions inside an organization. This rational perspective might play a significant role in understanding the adoption and implementation of best practices since those practices might contribute to the achievement of some specific goals. However, existing literature in the OM field that has tried to establish the relationship between goals, objectives, and the implementation of the best practices is scant.

The rational perspective on organizations states that the purpose of organizational activities is to achieve certain goals. To identify different goals of an organization, this study adapts Porter's generic business strategy model which has successfully withstood many empirical tests in the strategy literature (e.g. Robinson and Pearce, 1988; Nayyar, 1993). Porter's (1980) strategy model states that all business strategies involve a choice between differentiation and delivered cost. Therefore, Porter's model offers two fundamental types of business strategic goals: cost leadership and differentiation. The model of the two strategic goals has been used extensively in manufacturing research (e.g. Ward and Duray, 2000). A low-cost strategy represents firms' efforts to generate a competitive advantage by becoming the lowest cost producer in an industry. In pursuing such a strategy, the emphasis is on efficiency and cost reduction. On the other hand, firms with differentiation strategy may pursue a certain form of uniqueness that can differentiate themselves from their competitors.

Drawing upon the strategy literature, this paper argues that goals and objectives may be a motivational factor influencing the organization's implementation of QEI or QER. Based on the different aims of QEI and QER practices, their implementation might be driven by different goals of an organization.

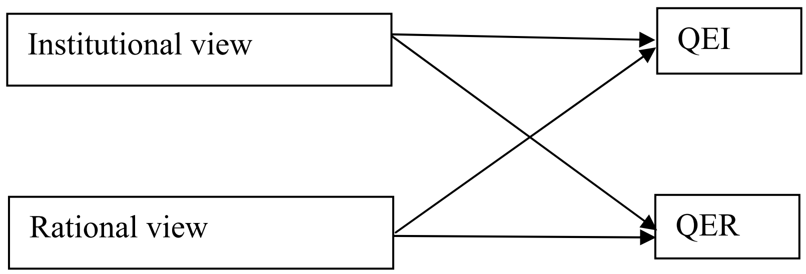
Maintaining low cost strategy requires a continuous search for cost reductions in all possible ways. QEI includes the QM practices that aim to control the known problems and processes. The objective of QEI is to ensure the consistency and efficiency of process outcomes. Increasing consistency and efficiency will result in lower cost. In other words, QEI might be directly helpful to achieve the strategic goal of low cost. In contrast, differentiation strategy focuses on enhancing some unique aspect of the products or services provided by the organizations. QER includes the QM practices that aim to explore the unknown and pursue novel solutions. QER keeps organizations open and flexible to new ideas. Novel solutions and new ideas might help the company to be perceived throughout its industry as unique. In other words, QEI practices might directly contribute to the strategic goal of differentiation. From a rational point of view, goals and objectives provide criteria for generating and selecting among alternative actions. Organizations tend to invest more in the actions that directly support their goals. Therefore, organizations that focus more on cost leadership might implement more QEI, while organizations that focus more on differentiation might view QER implementation more important. The following hypotheses reflect the rational view:

Hypothesis 2a. The implementation of QEI practices is driven by the organization's strategic goal of low cost.

Hypothesis 2b. The implementation of QER practices is driven by the organization's strategic goal of differentiation.

The two different views of the implementation of QEI and QER are summarized in Figure 4-1.

Figure 4-1: Antecedents of implementation of QEI versus QER



4.3 Data and measures

4.3.1 Data

The data used for empirical analysis in this study is from the High Performance Manufacturing (HPM) project. The project team consists of scholars from over 10 countries. Data are collected from 238 manufacturing plants that are located in eight countries: Austria, Finland, Germany, Italy, Japan, Korea, Sweden, and the United States. The sample plants are selected from three industries: automobile suppliers, electronics, and machinery. All the sample plants have 250 or more employees, and the average plant size is 866 employee (including both hourly personnel and salaried personnel).

Data are collected using mailed surveys which gather cross-sectional data on plant level manufacturing and administrative practices, internal and external environment of manufacturing plants, and operational and market-based performance. The HPM database provides a valuable and comprehensive source of data to conduct plant-level research. During the data collection process, a survey coordinator is appointed in each participating plant to work with the research team. The Survey coordinator then distributes the surveys and collects them when they are completed. In return for participation, each plant receives a detailed report that compares its own operations and performance to other plants in the same industry. The HPM project yields a response rate of 65%, which is the result of the above effort. The distribution of the sample across countries and industries is shown in Table 4-1.

Table 4-1: Sample distribution across industry and country

		Industry			
		Auto Suppliers	Electronics	Machinery	Total
Country	Austria	4	10	7	21
	Finland	10	14	6	30
	Germany	19	9	13	41
	Italy	7	10	10	27
	Japan	13	10	12	35
	Korea	11	10	10	31
	Sweden	7	7	10	24
	USA	9	9	11	29
	Total	80	79	79	238

4.3.2 Measures

Quality Exploitation and Quality Exploration

The scales for measuring QEI and QER were developed based on existing theory, a comprehensive literature review, and discussions with QM experts. There are four dimensions for both QEI and QER, so we need items to measure eight first level factors: CFQEI, CFQER, PMQEI, PMQER, TWQEI, TWQER, TRQEI, and TRQER. Items for each eight scales were identified based on a comprehensive literature review. Then the items were reviewed by several professors with expertise in quality management. Twenty-five items were finalized to measure the eight scales (see Appendix 4-1).

To be consistent with our conceptualization of the two constructs of QEI and QER, we model each of them as a second-order latent factor measured through the 4 first-order factors we have identified. Confirmatory Factor Analysis (CFA) is used to check the model fit, reliability, and validity. For a detailed description of model fit and other related measurement information, see section 3.3.2.

Institutional view

Country and industry are used in the study to check the institutional view of the motivation to QEI and QER implementation. Eight countries and three industries are treated as categorical data.

Rational view: the goal of low cost and differentiation

Goals are measured by several 5-point Likert scale items. The questions assess a plant's emphasis on a specific goal dimension relative to its leading competitors. The strategic goal of low cost is measured by a single item: low manufacturing unit costs. The strategic goal of differentiation is measured by four items: percent of sales spent on R&D, percent of sales spent on marketing expenses, brand image, and product features. The four items are loaded on a single factor, with factor loading 0.76, 0.66, 0.76, and 0.72 respectively. The Cronbach's alpha value is 0.698 and the total variance explained is 53% (See appendix 4-2).

4.4 Analysis

4.4.1 Institutional view

Industry and country effects were checked to examine the institutional view, and one way ANOVA was utilized to analyze the industry and country effects. The purpose of using one way ANOVA analysis is to check if there are significant differences of

QEI and QER implementation across countries and industries. The ANOVA analysis of QEI across the three industries has an F value of 12.18 and a p-value less than 0.001, and the ANOVA analysis of QER across the three industries has an F value of 3.61 and a p-value of 0.03. The above results show that for both QEI and QER implementation, companies within the same industry demonstrate significant similarity. In other words, strong industry effect is shown through ANOVA analysis. Post hoc Bonferroni tests were conducted following the ANOVA and the industry pairs that show significant differences of QEI or QER implementation are listed in Table 4-2 and 4-3.

Table 4-2: Industry pairs with QEI implementation difference

	Industry Pair	Mean difference	Std. error	Significant
QEI	Electronics Machinery	0.42	0.11	.000
	Auto suppliers Machinery	0.50	0.11	.000

Table 4-3: Industry pairs with QER implementation difference

	Industry Pair	Mean difference	Std. error	Significant
QER	Electronics Machinery	0.26	0.10	.035

Out of three possible pairs of industries, two pairs show a significant mean difference of QEI implementation. The electronics industry implements more QEI than the machinery industry. Auto suppliers also implement more QEI than machinery. The machinery industry implements the least QEI among the three industries. For QER implementation, one pair out of three possible pairs of industries shows mean difference. The electronics industry implements more QER than machinery. Compare to machinery, the electronics industry is higher on both QEI and QER implementation.

The ANOVA analysis of QEI implementation across the eight countries has an F value of 2.51 and a p-value of 0.017, and the ANOVA analysis of QER implementation across the eight countries has an F value of 4.62 and a p-value less than 0.001. The above results show that for both QEI and QER implementation, companies within the same country demonstrated significant similarity. In other words, strong country effect is shown through ANOVA analysis. Post hoc Bonferroni tests were conducted following the ANOVA, and the country pairs that showed significant differences of QEI or QER implementation are listed in Table 4-4 and 4-5.

Table 4-4: Country pairs with QEI implementation difference

	Country Pair	Mean difference	Std. error	Significant
QEI	Austria Japan	.62	0.19	.04
	Austria Italy	.75	0.21	0.009

Table 4-5: Country pairs with QER implementation difference

	Country Pair	Mean difference	Std. error	Significant
QER	Finland Japan	.68	0.15	.000
	USA Japan	.56	0.15	0.008
	Austria Japan	.75	0.17	0.000

Out of 28 possible pairs of countries, two pairs show mean difference of QEI implementation. Austria shows higher QEI implementation than both Japan and Italy. Out of 28 possible pairs, three pairs of countries show mean difference of QER implementation. Japan shows lower QER implementation than Finland, USA, and Austria. The results of Japan are quite counter intuitive. One possible explanation is that when people talk about Japanese manufacturers, they usually would think about companies like Toyota or Honda. Other Japanese companies may not focus so much on quality practices as Toyota or Honda. So the industry level data shows different results than what people may have in mind.

To further investigate country and industry effect, the implementation of QEI and QER was compared within each country and industry. T-tests were used here to show whether there is significant difference of QEI and QER implementation within each country or industry. The results are shown in Table 4-6 and 4-7.

Table 4-6: Implementation difference of QEI and QER across countries

		QEI-QER		
Country	n	Mean	Std. Error Mean	t
Austria	21	0.078	.108	.72
Finlan	30	-.217	.095	-2.26*
Germany	41	.103	.076	1.35
Italy	27	-.315	.088	-3.54**
Japan	35	.202	.070	2.88**
Korea	31	.104	.075	1.40
Sweden	24	-.034	.116	-.29
USA	29	-.050	.079	-.64

- * P < 0.05
- ** P < 0.01

Table 4-7: Implementation difference of QEI and QER across industries

		QEI-QER		
Industry	n	Mean	Std. Error Mean	t
Auto suppliers	80	.138	.051	2.70**
Electronics	79	0.007	.053	.12
Machinery	79	-.161	.057	-2.82**

- * P < 0.05
- ** P < 0.01

The results in Table 4-6 and 4-7 show that within each country or industry, there are differences in implementation of QEI and QER. This result could make the institutional argument stronger. Three countries show significant differences of QEI and QER implementation. In Finland and Italy, more exploratory practices are implemented than exploitation practices while Japan shows more exploitation activities than exploration.

Two out of three industries show significant differences of QEI and QER implementation. Auto suppliers implement more exploitation practices than exploration practices. While machinery shows the opposite, more exploration practices are implemented. For the electronics industry, there is no significant difference between QEI and QER implementation.

4.4.2 Rational view

The rational view states that strategic goals may be a motivational factor that influences the organization's implementation of QEI or QER. Organizations that focus more on cost leadership might implement more QEI, while organizations that focus more on differentiation might view QER implementation as more important. Table 4-8 shows the correlations between strategic goals, QEI, and QER.

Table 4-8: Correlations between strategic goals, QEI, and QER

	Low cost	Differentiation	QEI	QER
Low cost	1			
Differentiation	-.117	1		
QEI	.217**	.107	1	
QER	.106	.172**	.743**	1

- *P < 0.05
- ** P < 0.01

The correlations in Table 4-8 support the relations we hypothesized. QEI shows a significant positive relation with the low cost goal, while QER shows a strong positive relation with the differentiation goal. However, further analysis is needed to check the hypothesized relations. Regression analysis is used to investigate the rational view. The strategic goals of low cost and differentiation are used as independent variables, while QEI and QER are modeled as dependent variables. The regression equations are listed below:

$$QEI = \beta_0 + \beta_1 \text{ low cost} + \beta_2 \text{ Differentiation} \quad \text{(Model 1a)}$$

$$QER = \beta_0 + \beta_1 \text{ low cost} + \beta_2 \text{ Differentiation} \quad \text{(Model 1b)}$$

Before analyzing the regression results, the underlying assumptions of linear regression were examined. The underlying assumptions include linearity, homoscedasticity, independent error terms, and normality. For both model 1a and 1b, residual analyses show that none of the assumptions is violated. The absolute values of all standardized residuals were less than 3, with a range of (-2.293, 2.646) for model 1a and (-2.006, 2.328) for model 1b. . The VIF value of the two independent variables for both models was 1.014, which means multicollinearity between the two independent variables is not a concern here.

The regression results are shown in Table 4-9. For both the regression equations, low cost and differentiation have positive regression coefficients.

Table 4-9: Regression results with two independent variables

	Standardized β coefficient	
	Dependent: QEI	Dependent: QER
Low cost	.228**	.13*
Differentiation	.135*	.187**
R-square	.063	.046
Adjusted R-square	.055	.038
P-value of overall model	.001	.004

- * P < 0.05
- ** P < 0.01

Since strong country and industry effects were shown in the previous analysis, fixed effects regression models were used to further capture the relationship between strategic goals and different quality practices. Fixed effects regressions are the appropriate technique to use here because our data fall into categories of countries and industries. When we have data that fall into such categories, we will want to control for characteristics of those categories that might affect the relationship between the independent and dependent variables.

Hypotheses 2a and 2b specify the relationships between strategic goals and different quality practices. The effect of each strategic goal on QEI or QER is assumed to be identical across all the countries and industries. Therefore, the basic fixed effects regressions were used here which report the average within-group effect.

We can use industry and QEI as examples to show the theory behind fixed effects regressions. The variation of QEI practices comes from two sources: the across group variation (variation from one industry to the other) and within group variation (variation within each industry). The solution of fixed effects regressions is to focus on within group variation to estimate the average of the effects of strategic goals on QEI across the three industries. It holds constant (fixes) the average effects of each industry.

There are two fixed factors in our regression models: country and industry. The fixed effects regression models are shown in Table 4-10.

Table 4-10: Fixed effects regression models

	Model 2a	Model 2b
Dependent variable	QEI	QER
Fixed factors	Country Industry	Country Industry
Covariates	Low cost, Differentiation	Low cost, Differentiation

Results of the fixed effects regressions are summarized in Table 4-11. When the average effects of countries and industries hold constant, the regression results show that both the strategic goals of low cost and differentiation have significant positive relations with QEI and QER. So the strategic goals cannot explain the difference between QEI and QER implementation.

Table 4-11: Fixed effects regression results

	β coefficient	
	Dependent: QEI	Dependent: QER
Low cost	.326**	.247**
Differentiation	.153**	.156**
Austria	.357	.214
Finland	.201	.254
Germany	-.024	-.164
Italy	-.35*	-.105
Japan	-.359*	-.597**
Korea	-.071	-.227
Sweden	.015	-.014
Electronics	-.086	.012
Machinery	-.54**	-.253**
R-square	.261	.234
Adjusted R-square	.224	.196
Significance of overall model	P value <.001**	P value <.001**

- * P < 0.05
- ** P < 0.01

The regression shows different results from Table 4-8. So we continued the analysis and further investigated the relations between strategic goals and QM practices. In Porter's strategy model, he proposes the idea that only one strategy should be adopted by a firm and pursuing more than one strategy might make the organization lose their entire focus (Porter, 1980). However, some companies in reality do pursue two goals at the same time. The existence of such kind of companies in our dataset may mix up the relationship between goals and different QM practices. We checked the measurement of low cost strategy (one 5-point Likert scale item) and differentiation strategy (four 5-point Likert scale items) and found 27 plants in the dataset are pursuing both the strategies, which means they have the values of both low cost strategy and differentiation strategy greater than or equal to 4. The 27 plants have a mean value of low cost strategy of 4.36 with a standard deviation of 0.35 and a mean value of differentiation strategy of 4.22 with a standard deviation of 0.2. The 27 plants were deleted from further analysis in order to see a clear relationship pattern between goals and QM practices.

After deleting the 27 plants with high values of both low cost strategy and differentiation strategy, we run the fixed effects regression with the remaining 211 plants. The results are summarized in Table 4-12.

Table 4-12: Fixed effects regression on partial dataset

	β coefficient	
	Dependent: QEI	Dependent: QER
Low cost	.286**	.226**
Differentiation	.095	.139**
Austria	.142	.048
Finland	.182	.251
Germany	-.138	-.24
Italy	-.386*	-.198
Japan	-.46**	-.687**
Korea	-.135	-.292
Sweden	-.056	-.114
Electronics	-.076	.025
Machinery	-513**	-.23*
R-square	.242	.230
Adjusted R-square	.199	.186
Significance of overall model	P value <.001**	P value <.001**

- * P < 0.05
- ** P < 0.01

The results in Table 4-12 show that when QEI is the dependent variable, low cost strategy has a significant positive regression coefficient, while differentiation strategy has an insignificant regression coefficient. In the model when QER is the dependent variable, both low cost strategy and differentiation strategy have significant positive regression coefficients. QEI practices are driven by low cost strategy, while QER practices are driven by both low cost and differentiation strategy. Hypothesis 2 is partially supported. One possible reason that the low cost goal motivates both QEI and QER practices might because of our specific research setting. All the data are from manufacturing plants where low cost is considered important even in the companies who have a differentiation strategic focus.

4.5 Discussion and conclusions

With the increasingly reliance on quality management practices to gain competitive advantage, more knowledge about implementing and getting performance benefits from these practices is needed to make them more sustainable. Building insight into this topic contributes to both our theoretical and practical understanding of quality management.

This study examines quality management practices by differentiating two aspects of QM practices that have different objectives: quality exploitation (QEI) and quality exploration (QER). It then investigates the motivation of QEI and QER implementation. Two different views of motivation are identified in the study: institutional view and rational view.

4.5.1 Findings and implications

The ANOVA analysis and the post hoc tests show institutional effects when organizations implement quality practices. Plants in different countries or industries show much more differences in QEI or QER implementation than plants within the same country or industry. Furthermore, regression analysis shows that there is certain evidence to support that there are implementation differences between QEI and QER based on companies' strategic goals. The implementation of QEI is positively related to the strategic goal of low cost, while the implementation of QER is driven by both the low cost goal and the differentiation goal. The results show that when organizations consider quality management programs, they benchmark other organizations' practices in the same country or industry and at the same time think about their own strategic goals.

The above findings contribute to the research on quality management in three ways: they 1) investigate the implementation of quality management practices by differentiating two aspects of quality practices: exploitation and exploration, 2) connect strategic goals with the implementation of different QM practices, and 3) empirically show that both institutional mechanism and strategic goals play certain roles in QEI or QER implementation. Both scholars and practitioners are trying hard to find ways to make quality programs more effective. Customization of QM practices is one possible solution that is proposed by many scholars. However, research on how to customize those practices is still scant. This study examines different objectives of QM practices and categorizes them into two groups: exploitation and exploration. This differentiation provides a solid basis for research on customization of the practices. The findings of the current study show that when companies implement QM practices, they consider both institutional legitimacy and their own strategic goals and objectives. Different goals and objects may motivate different QM practices. Although scholars propose customization as one possible solution for QM effectiveness, there is no strong support in literature yet. Our findings suggest that when companies implement QM practices, they consider both institutional environments and their own specific goals. The findings support both institutional legitimacy and customization concern.

The findings also provide chances for organizations to do it right at the beginning when implementing QM programs. Empirical analysis results show that low cost motivates both QEI and QER practices. Even though, theoretically, exploitation practices might be more helpful for low cost goal and exploration practices might contribute more to differentiation goal. When implementing quality programs, companies should think about both their institutional environments and their strategic goals in order to choose the right focus at the beginning and benefit more from QM practices.

4.5.2 Limitations and future research

This study has several limitations. One limitation is that the data used in empirical analysis is secondary data. Although the measurement scales used in the paper are developed based on a comprehensive literature review, they are drawn from the HPM database. So the measurement items are limited by the database. However, HPM is a comprehensive survey database with quality management and manufacturing performance as major parts, which fits the research purpose of the study very well. Another limitation is the cross-sectional nature of the study. Cross-sectional study is widely used to establish relationship among different variables. However, cross-sectional data cannot show causal relations. This limitation provides a chance for future longitudinal studies. Another limitation is that the data used in this study is coming from only manufacturing plants. The discrimination between QEI and QER and the motivation for their implementation could not be generalized to the service industry at the current stage. However, manufacturing plants have a longer history of implementing

QM practices and provide a more mature setting for this research. Therefore the manufacturing industry is a good starting point for the research.

The above limitations are also chances for designing future studies. Several ways to extend the current study should be considered in the future research. First, replication of our model may be carried out in other settings: for example, we could collect data from service or healthcare and examine the implementation pattern in their business settings. Findings from different business settings may provide us more insight on successful QM implementation. Second, we could conduct a longitudinal study that links the motivation of quality practices implementation, the implementation processes, and the performance outcomes together. Longitudinal studies have been very rare in the quality field. A longitudinal study will definitely be helpful in understanding the necessary antecedents for successful implementation of the quality programs. Third, achieving sustainable competitive advantage through quality programs is the ultimate goal for implementing QM practices. Establishing the relations between the successful implementation of QEI, QER, and sustainable quality advantage could be a direction of future study.

Appendix 4-1: Measurement items-QEI and QER

Respondents were asked to indicate the extent to which they agree or disagree with each of these statements about their plant and organization.

1: Strongly disagree, 4: Neutral, 7: Strongly agree

CFQEI (customer focus for quality exploitation)

cfqei1 We frequently are in close contact with our customers
cfqei2 Our customers give us feedback on our quality and delivery performance
cfqei3 We regularly survey our customers' needs.

PMQEI (process management for quality exploitation)

pmqei1 We make extensive use of statistical techniques to reduce variance in processes.
pmqei2 We use charts to determine whether our manufacturing processes are in control.
pmqei3 We monitor our processes using statistical process control.

TWQEI (teamwork for quality exploitation)

twqei1 Our supervisors encourage the people who work for them to work as a team.
twqei2 Our supervisors encourage the people who work for them to exchange opinions and ideas.
twqei3 Our supervisors frequently hold group meetings where the people who work for them can really discuss things together.

TRQEI (training for quality exploitation)

trqei1 Our plant employees receive training and development in workplace skills, on a regular basis.
trqei2 Management at this plant believes that continual training and upgrading of employee skills is important.
trqei3 Our employees regularly receive training to improve their skills.

CFQER (customer focus for quality exploration)

cfqer1 We consulted customers early in the design efforts for this product.
cfqer2 We partnered with customers for the design of this product
cfqer3 Customers were frequently consulted about the design of this product.
cfqer4 Customers were an integral part of the design effort for this project.

PMQER (process management for quality exploration)

pmqer1 We strive to continually improve all aspects of products and processes, rather than taking a static approach.
pmqer2 We believe that improvement of a process is never complete; there is always room for more incremental improvement.
pmqer3 Our organization is not a static entity, but engages in dynamically changing itself to better serve its customers.

TWQER (teamwork for quality exploration)

twqer1 The functions in our plant cooperate to solve conflicts between them, when they arise
twqer2 Our plant's functions coordinate their activities
twqer3 Our plant's functions work interactively with each other.

TRQER (training for quality exploration)

trqer1 Employees at this plant learn how to perform a variety of tasks.
trqer2 The longer an employee has been at this plant, the more tasks they learn to perform.
trqer3 Employees are cross-trained at this plant, so that they can fill in for others, if necessary.

Appendix 4-2: Measurement items–strategic goals

Respondents were asked to position their emphases of the following items relative to those of their leading competitors:

1: Significantly lower, 5: Significantly higher

Low cost:

Low manufacturing unit costs

Differentiation (α = 0.698):

	Factor loading
Percent of sales spent on R&D	0.76
Percent of sales spent on marketing expenses	0.66
Brand image	0.76
Product features	0.72

Chapter 5

Conclusions

In today's increasingly competitive and rapidly changing world, companies keep looking for new ways to increase their compatibility to ensure their survival and success. A variety of improvement initiatives or new approaches are introduced to companies, such as total quality management, lean manufacturing, and Six Sigma. The success of some leading companies has led thousands of others to emulate them and their practices. However, despite many remarkable successes, a number of subsequent studies revealed a disturbing pattern of failure. This dissertation is designed to address the mixed results of performance implication of quality management practices and answer one fundamental question: how to customize the quality management practices to help companies get more benefits from quality management initiatives.

Since the specific theoretical the practical contributions and future research directions for each individual essay are discussed in detail in the previous chapters, this chapter will summarize the overall contributions and limitations of the dissertation.

5.1 Contributions to theory

This study contributes to the research on quality management, which is, as Chase (1998) claimed, the unquestioned major area in the field of operations management, as well as in the management field in general. With the increasingly reliance on QM practices to gain competitive advantage, more knowledge about implementing and getting performance benefits from these practices is needed to make them more sustainable. The necessity of customization of the QM practices has been proposed by several scholars. How to customize these practices according to situational factors becomes a challenging question to both researchers and practitioners. This study provides possible solutions to this question by distinguishing between different QM practices.

One important contribution of this research is that it theoretically differentiates two different aspects of QM practices that have different objectives: quality exploitation (QEI) and quality exploration (QER). Quality Exploitation is defined as QM practices that aim to control stable and familiar processes and improve the efficiency and consistency of manufacturing or service processes. Quality Exploration, in contrast, is defined as QM practices that are used to get new insights about process innovation and exploration of the unknown. This research empirically supports the theory and develops a valid and reliable set of measures for oprationalizing QEI and QER. This study is the first empirical test for measuring and discriminating between the two concepts in QM literature. It provides a solid foundation for further research on customization of QM practices.

This study also contributes to the discussion in the literature about whether a universal or a context-dependent approach to quality management is needed. Until now, these discussions are scant and mainly theoretical (Sila, 2007; Sousa and Voss, 2008). This research provides strong evidence to support a context-dependent approach to quality management and identifies two important contextual factors: organizational structure and environmental uncertainty. It supports the contingency view of QM effectiveness and empirically validates the moderating effect of these two contingency factors on the link between QM practices and performance. In organizations with organic structure, explorative quality practices bring more performance benefits than exploitive practices. In contrast, the relationship between exploitive quality practices and manufacturing performance is much stronger in organizations with mechanistic structure. For organizations facing high environmental uncertainty, explorative quality practices have a significant positive relationship with operational performance while exploitative quality practices fail to show a significant relationship. For organizations operating in a low uncertainty environment, exploitative quality practices show stronger relationship with their performance.

Another important contribution of this study is that it investigates the implementation of QEI and QER using two different views: institutional and rational. By using the rational view, it connects strategic goals with QM implementation. The study empirically shows that both institutional mechanism and strategic goals play certain roles in QEI or QER implementation. When companies implement QM practices, they consider both institutional legitimacy and their own strategic goals and objectives. Different goals and objects may motivate different QM practices. Although scholars propose customization as one possible solution for QM effectiveness, there is no strong support in literature yet. Our findings suggest that when companies implement QM practices, they consider both institutional environments and their own specific goals. The findings support both institutional legitimacy and customization concern.

5.2 Contributions to practices

From a practical point of view, this research has important managerial implications. Despite the increasing popularity of QM practices, practitioners still suffer from mixed performance results, particularly in the situation when customization is important. Customization of QM practices is one possible solution to QM effectiveness that is proposed by many scholars. However, research on how to customize those practices is still scant. This study examines different objectives of QM practices and categorizes them into two groups: exploitation and exploration. This differentiation provides a possible solution for customization of the QM practices.

This research is important to manufacturing managers because it provides empirical evidence that there are two different kinds of QM practices: QEI and QER. It also empirically shows that the performance influences of QEI and QER differ across different types of organizational structure and different levels of environmental uncertainty. The empirical findings offer important implications about quality management initiatives. In an increasingly competitive business environment where scarce resources have to be allocated for many different purposes, the findings of this research could help organizations choose a more effective focus for the quality management practices and allocate their resources wisely based on their organizational structure and the external environment they are facing.

The findings also provide chances for organizations to do it right at the beginning when implementing QM programs. Empirical analysis results show that the low cost goal motivates both QEI and QER practices. Even though, theoretically, exploitation practices might be more helpful for the low cost goal and exploration practices might contribute more to the differentiation goal. When implementing quality programs, companies should think about both their institutional environments and their strategic goals in order to choose the right focus at the beginning and benefit more from QM practices

5.3 Limitations and future research

This study is subject to several limitations. One limitation is that although the measurement scales used in the paper are developed based on a comprehensive literature review, they are drawn from the HPM database. So the measurement items are limited by the database. However, HPM is a comprehensive survey database with quality management and manufacturing performance as major parts, which fits the research purpose of the study very well. Another limitation is the cross-sectional nature of the study. Cross-sectional study is widely used to establish relationship among different variables. However, cross-sectional data cannot show causal relations. This limitation provides a chance for future longitudinal studies. Another limitation is that the data used in this study is coming from only manufacturing plants. The discrimination between QEI and QER, their performance implications under different situational conditions, and the motivation for their implementation could not be generalized to the service industry at this point. However, manufacturing plants have a longer history of implementing QM practices and provide a more mature setting for this research. Therefore, the manufacturing industry is a good starting point of the research.

It is clear that future research is needed to gain a better understanding of this important topic of quality management. The above limitations are also chances for designing future studies. First, replication of the models may be carried out in other settings. For example, we could collect data from service or healthcare and examine the implementation pattern and the performance implication of QEI and QER in these different business settings. Second, the current research can be expanded to include the supply chain. Now most studies on quality management initiatives are within the scope of one link of the supply chain. A holistic view of the supply chain that investigates the cooperation between suppliers, producers, and customers should bring further insights into the research on quality management effectiveness. Third, we could conduct a longitudinal study that links the motivation of quality practices implementation, the implementation process, and the performance outcomes together. Such longitudinal study will be helpful in understanding the necessary antecedents for a quality program's success. Finally, achieving sustainable competitive advantage through quality programs is the ultimate goal for implementing QM practices. Establishing the relations between the successful implementation of QEI, QER, and sustainable quality advantage could also be a direction for future study.

References

Ahire, S. L., Golhar, D. Y., Waller, M. A. 1996. Development and validation of TQM implementation constructs. Decision Sciences, 27(1): 23-56.

Ahire, S. L., O'Shaughnessy, K. C. 1998. The role of top management commitment in quality management: an empirical analysis of the auto parts industry. International Journal of Quality Science, 3(1): 5-37.

Ahire, S. L., Dreyfus, P. 2000. The impact of design management and process management on quality: an empirical investigation. Journal of Operations Management, 18(5): 549-575.

Aiken, J., Hage, M. 1966. Organizational alienation: A comparative analysis. American. Sociological Review(31): 497-507.

Anerson, R. D., Jerman, R. E., Crum, M. R. 1998. Quality management influences on logistics performance. Logistics and Transportation Review, 34(2): 137-148.

Bagozzi, R. P., Phillips, L. W. 1982. Representing and Testing Organizational Theories: A Holistic Construal. Administrative Science Quarterly, 27(3): 459.

Bagozzi, R. P., Phillips, L. W. 1991. Assessing construct validity in organizaitonal research. Administrative Science Quarterly, 36: 421-458.

Beer, M. 2003. Why Total Quality Management programs do not persist: the role of management quality and implications for leading a TQM transformation. Decision Science, 34(4): 623-642.

Benner, M. J., Tushman, M. L. 2003. Exploitation, exploration, and process management: the productivity dilemma revisited. Academy of Management Review, 28(2): 238-256.

Benson, P. G., Saraph, J.V., Schroeder, R. G. 1991. The Effects of Organizational Context on Quality Management: An Empirical Investigation. Management Science, 37(9): 1107-1124.

Bower, D. E., Lawler, E. E. III. 1992. Total quality-oriented human resources management. Organizational Dynamics, (Spring): 29-41.

Burns, T., Stalker, G. M. 1961. Mechanistic and organic systems, Classics of organizational theory. Pacific, CA: Brooks/Cole.

Campbell, D. T., Fiske, D. W. 1959. Convergent and discriminant validation by the multitrait-multimethod matrix. Psychological Bulletin, 56: 81-105.

Carmen, J., Shortell, S., Foster, R., Hughes, E., Boerstler, H., O'Brien, J., O'Connor, E. 1996. Keys for successful implementation of total quality management in hospitals. Health Care Management Review, 21(1): 48-60.

Chase, R. B. 1998. Production and Operations Management: Manufacturing and Services (8th ed.). London: Irwin McGraw-Hill.

Chen, I. J., Paulraj, A. 2004. Towards a theory of supply chain management: the constructs and measurement. Journal of Operations Management, 22(2): 119-150.

Choi, T. Y., Eboch, K. 1998. The TQM Paradox: Relations among TQM practices, plant performance, and customer satisfaction. Journal of Operations Management(17): 59-75.

Churchill, G. A. 1979. A paradigm for developing better measures of marketing constructs. Journal of Marketing Studies, 16: 12-27.

Ciampa, D. 1991. Total quality: a users' guide for implementation. Reading, MA: Addison-Wesley.

Cole, R. E., Scott, W. R. 2000. The quality movement and organization theory. Thousand Oaks, CA: Sage Publications, Inc.

Cronbach, L. J. 1951. Coefficient alpha and the internal structure of tests. Psychometrika, 16: 297-334.

Crosby, P. B. 1979. Quality is free. New York: McGraw-Hill.

Daft, R. L. 2004. Organization Theory and Design. Cincinnati: South Western College Publishing.

Dale, B. G., Y-Wu, P., Zairi, M., Williams, A. R. T., Van Der Wiele, T. 2001. Total quality management and theory: An exploratory study of contribution. Total Quality Management, 12(4): 439-449.

Dean, J. J. W., Bowen, D. E. 1994. Management theory and total quality: Improving research and practice through theory development. Academy of Management Review, 19(3): 392-418.

Dean, J. J. W., Snell, S. A. 1996. The strategic use of integrated manufacturing: an empirical examination. Strategic Management Journal, 17(6): 459-480.

Deming, W. E. 1986. Out of the Crisis. Cambridge, MA: MIT, Center for Advanced Engineering Study.

Deming, W. E. 1994. The new economics for industry, education, government (2nd ed.). Cambridge, MA: MIT Press.

DiMaggio, P. J., Powell, W. W. 1983. The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. American Sociological Review, 48(2): 147-160.

Donaldson, L. 2001. The Contingency Theory of Organizations. Thousand Oaks, CA: Sage Publications.

Dooyong, S., Kalinowski, J. G., El-Enein, G. 1998. Critical implementation issues in total quality management. SAM Advanced Management Journal, 63(1): 10-14.

Douglas, T. J., Judge Jr, W. Q. 2001. Total quality management implementation and competitive advantage: The role of structural control and exploration. Academy of Management Journal, 44(1): 158-169.

Dow, D., Samson, D., Ford, S. 1999. Exploding the myth: do all quality management practices contribute to superior quality performance? Production and Operations Management, 8(1): 1-27.

Eisenhardt, K., Tabrizi, B. 1995. Accelerating adaptive processes: Product innovation in the global computer industry. Administrative Science Quarterly, 40: 84-110.

Emory, C. W. 1980. Business Research Methods. Homewood, IL: Irwin.

Ettlie, J. E. 1995. Product-process development integration in manufacturing. Management Science, 41(7): 1224.

Evans, J. R., Lindsay, W. M. 2005. The Management and Control of Quality (6th ed.). Mason, Ohio: South-Western.

Feigenbaum, A. V. 1991. Total Quality Control (3rd ed.). New York: McGraw-Hill.

Ferdows, K., De Meyer, A. 1990. Lasting improvements in manufacturing performance: In search of a new theory. Journal of Operations Management, 9(2): 168-184.

Flynn, B. B., Schroeder, R. G., Sakakibara, S. 1994. A framework for quality management research and an associated measurement instrument. Journal of Operations Management, 11(4): 339-366.

Flynn, B. B., Schroeder, R.G., Sakakibara, S. 1995. The impact of quality management practices on performance and competitive advantage. Decision Sciences, 26(5): 659-692.

Fornell, C., Larcker, D.F. 1981. Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. Journal of Marketing Research (JMR), 18(1): 39-50.

Forza, C., Filippini, R. 1998. TQM impact on quality conformance and customer satisfaction: A causal model. International Journal of Production Economics, 55(1): 3-20.

Foster, S. T. 2006. One Size Does Not Fit All. Quality Progress, 39(7): 54-61.

Germain, R., Claycomb, C., Dröge, C. . 2008. Supply chain variability, organizational structure, and performance: The moderating effect of demand unpredictability. Journal of Operations Management, 26(5): 557-570.

Gharajedaghi, J., Ackoff, R. L. 1984. Mechanisms organisms and social systems. Strategic Management Journal, 5(3): 289-300.

Hackman, J. R., Wageman, R. 1995. Total quality management: Empirical, conceptual, and practical issues. Administrative Science Quarterly, 40(2): 309-343.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., Tatham, R. L. 2006. Multivariate Data Analysis (6th ed). Upper Saddle River, New Jersey: Prentice Hall.

Harry, M. J. 1998. Six sigma: A breakthrough strategy for profitability. Quality Progress, 31(5): 60-64.

Haunschild, P., Miner, A. 1997. Modes of interorganizational imitation: the effects of outcome salience and uncertainty. Administrative Science Quarterly, 42(3): 472-500.

Hayes, R., Pisano, G., Upton D., Wheelwright, S. 2003. Operations, Strategy, and Technology: Pursuing the Competitive Edge. NJ: Wiley.

Hayes, R. H., Wheelwright, S. C. 1984. Restoring our competitive edge - competing through manufacturing: John Wiley & Sons.

Ho, D. C. K., Duffy, V.G., Shih, H.M. . 2001. Total quality management: an empirical test for mediation effect. International Journal of Production Research (39): 529-548.

Hu, L.-T., Bentler, P. 1995. Evaluating model fit. In Hoyle (Ed.), Structural Equation Modeling: Concepts, Issues, and Applications.: 76-99. London: Sage.

Ishikawa, K. 1985. What is total quality control? The Japanese way. In D. J. Lu (Ed.). Englewood Cliffs, NJ: Prentice-Hall.

Jayaram, J., Droge, C., Vickery, S. K. 1999. The impact of human resource management practices on manufacturing performance. Journal of Operations Management, 18(1): 1-20.

Juran, J. M. 1986. The quality trilogy: A universal approach to managing for quality. Quality Progress, 19(8): 19-24.

Juran, J. M., Godfrey, A. B. 1999. Juran's Quality Handbook (5th ed.). New York: McGraw Hill.

Kaynak, H. 2003. The relationship between total quality management practices and their effects on firm performance. Journal of Operations Management, 21(4): 405-435.

Ketokivi, M. A., Schroeder, R. G. 2004. Strategic, structural contingency and institutional explanations in the adoption of innovative manufacturing practices. Journal of Operations Management, 22: 63-89.

Klassen, R. D., Whybark, D.C. 1999. The impact of environmental technologies on manufacturing performance. Academy of Management Journal, 42(6): 599-615.

Lai, C. L., Ip, W. H., Lee, W. B. 2001. The system dynamics model for engineering services. Managing Service Quality, 11(3): 191-199.

Lawrence, P. R., Lorsch, J. W. 1967. Organization and Environment. Cambridge: Harvard University Press.

Leong, G., Synder, D., Ward, P. 1990. Research in the Process and Content of Manufacturing Strategy. OMEGA, 18(2): 109.

Levinthal, D. A., March, J. G. 1993. The Myopia of Learning Strategic Management Journal, 14: 95-112.

Linderman, K., Schroeder, R. G., Zaheer, S., Liedtke, C., Choo, A. S. 2004. Integrating quality management practices with knowledge creation processes. Journal of Operations Management, 22: 589-607.

March, J. G. 1991. Exploration and exploitation in organizational learning. Organization Science, 2(1): 71-87.

Martinez-Lorente, A., Gallego-Rodriguez, A., Dale, B. G. 1998. Total quality management and company characteristics: an examination. Quality Management Journal, 5(4): 59-71.

Maruyama, G. 1998. Basics of Structural Equation Modeling. Thousand Oaks, CA: Sage.

Meyer, J. W., Rowan, B. 1977. Institutionalized organizations: formal structure as myth and ceremony. American Journal of Sociology, 83(2): 340-363.

Mohrman, S. A., Tenkasi, R. V., Lawler III, E. E., Ledford Jr., G. G. 1995. Total quality management: Practice and outcomes in the largest US firms. Employee Relations, 17(3): 26-41.

Nair, A. 2006. Meta-analysis of the relationship between quality management practices and firm performance - implications for quality management theory development. Journal of Operations Management, 24(6): 948-975.

Nayyar, P. R. 1993. On the measurement of competitive strategy: evidence from a large multiproduct U.S. firm. Academy of Management Journal, 36(6): 1652-1669.

Nunnally, J. C. 1978. Psychometric Theory. New York: McGraw-HIll.

Nunnally, J. C., Bernstein, I. H. 1994. Psychometric Theory (3rd ed.). New York: McGraw-Hill.

Pagell, M., Krause, D. R. 1999. A multiple-method study of environmental uncertainty and manufacturing flexibility. Journal of Operations Management(17): 307-325.

Pande, P. S., Neuman, R.P., Cavanagh, R.R. . 2000. The Six Sigma way: How GE, Motorola, and other companies are honing their performance. New York, NY: McGraw-Hill.

Perrow, C. 1967. A framework for the comparative analysis of organizations. American Sociological Review, 32: 194-208.

Porter, M. E. 1980. Competitive Strategy: Techniques for Analyzing Industries and Competitors. New York: Free Press.

Powell, T. 1995. Total quality management as competitive advantage: A review and empirical study. Strategic Management Journal, 16: 15-37.

Prajogo, D., Sohal, A. 2003. The relationship between TQM practices, quality performance, and innovation performance: An empirical examination. International Journal of Quality & Reliability Management, 20(8): 901-918.

Robinson, J. P., Shaver, P. R., Wrightsman, L. S. 1991. Criteria for Scale Selection and Evaluation. In J. P. Robinson, Shaver, P.R., Wrightsman, L. S. (Ed.), Measures of Personality and Social Psychological Attitudes. San Diego, CA: Academic Press.

Robinson Jr., R. B., Pearce II, J.A. 1988. Planned patterns of strategic behavior and their relationship to business-unit performance. Strategic Management Journal, 9(1): 43-60.

Roth, A. V., Miller, J.G. 1990. Manufacturing strategy, manufacturing strength, managerial success and economic outcomes, Manufacturing strategy. Boston, MA: Kluwer Academic.

Roth, A. V., Miller, J.G. . 1990. Manufacturing strategy, manufacturing strength, managerial success and economic outcomes, Manufacturing strategy. Boston, MA: Kluwer Academic.

Rothaermel, F. T., Deeds, D.L. 2004. Exploration and exploitation alliances in biotechnology: A system of new product development. Strategic Management Journal, 25(3): 201-221.

Rungtusanatham, M., Forza, C., Filippini, R., Anderson, J. C. 1998. A replication study of a theory of quality management underlying the Deming management method: insights from an Italian context. Journal of Operations Management, 17(1): 77-95.

Schroeder, R. G., Bates, K. A., Junttila, M. A. 2002. A resource-based view of manufacturing strategy and the relationship to manufacturing performance. Strategic Management Journal, 23: 105-117

Scott, W. R. 2001. Institutions and Organizations: Sage Publications.

Scott, W. R. 2003. Organizations: Rational, Natural, and Open Systems (5th ed.). Upper Saddle River, NJ: Prentice-Hall.

Scullen, S. E., Mount, M. K., Judge, T. A. 2003. Evidence of the construct validity of developmental ratings of managerial performance. Journal of Applied Psychology, 88(1): 50-66.

Shah, R., Goldstein, S. M. 2006. Use of structural equation modeling in operations management research: Looking back and forward. Journal of Operations Management, 24: 148-169.

Shane, S., Venkataraman, S. . 2000. The promise of entrepreneurship as a field of research. Academy of Management Review (25): 217-226.

Shea, C., Howell, J. 1998. Organizational antecedents to the successful implementation of total quality management. Journal of Quality Management, 3: 3-24.

Sila, I. 2007. Examining the effects of contextual factors on TQM and performance through the lens of organizational theories: An empirical study. Journal of Operations Management, 25(1): 83-109.

Simon, H. A. 1964. On the concept of organizational goal. Administrative Science Quarterly, 9: 1-22.

Simon, H. A. 1997. Administrative behavior: A study of decision-making processes in administrative organizations (4th ed.). New York: Free Press.

Sitkin, S. B., Sutcliffe, K.M., Schroeder, R.G. 1994. Distinguishing control from learning in total quality management: a contingency perspective. Academy of Management Review, 19(3): 537-564.

Sousa, R., Voss, C. A. 2002. Quality management re-visited: a reflective review and agenda for future research. Journal of Operations Management, 20(1): 91-109.

Sousa, R., Voss, C. A. 2008. Contingency research in operations management practices. Journal of Operations Management, 26(6): 697-713.

Spencer, B. A. 1994. Models of organizaiton and total quality management: A comparison and critcical evaluation. Academy of Management Review, 19(3): 446-471.

Sutcliffe, K. M., Sitkin, S. B., Browning, L. D. 2000. Tailoring process management to situational requirements. In R. E. Cole, Scott, W. R. (Ed.), The Quality Movement and Oragnization Theory. Thousand Oaks, California: Sage Publications, Inc.

Thompson, J. 1967. Organizations in Action. New York: McGraw-Hill.

Venkatraman, N. 1989. The Concept of Fit in Strategy Research: Toward Verbal and Statistical Correspondence. Academy of Management Review, 14(1): 423.

Vera, D., Crossan, M. 2004. Theatrical improvisation: Lessons for organizations. Organization Studies, 25(5): 727-749.

Wacker, J. G. 1998. A definition of theory: research guidelines for different theory-building research methods in operations management. Journal of Operations Management, 16(4): 361-385.

Wacker, J. G. 2004. A theory of formal conceptual definitions: developing theory-building measurement instruments. Journal of Operations Management(22): 629-650.

Waldman, D., Gopalakrishnan, M. 1996. Operational, organizational, and human resource factors predictive of customer perceptions of service quality. Journal of Quality Management, 1(1): 91-107.

Ward, P. T., Duray, R., Leong, G. K., Sum, C. C. 1995. Business environment, operations strategy, and performance: an empirical study of Singapore manufacturers. Journal of Operations Management, 13(2): 99-116.

Ward, P. T., Duray, R. 2000. Manufacturing strategy in context: environment, competitive strategy and manufacturing strategy. Journal of Operations Management(18): 123-138.

Westphal, J. D., Gulati, R., Shortell, S. M. 1997. Customization or conformity? An institutional and network perspective on the content and consequences of TQM adoption. Administrative Science Quarterly, 42: 366-394.

Wheelwright, S. C. 1989. Competing through manufacturing. In R. Wild (Ed.), International Handbook of Production and Operations Management: 15-32. London: Cassell Educational Ltd.

Womack, J. P., Jones, D.T., Roos, D. 1990. The machine that changed the world. New York: Harper Perennial.

Woodward, J. 1958. Management and Technology. London: H.M.S.O.

Yasai-Ardekani, M. 1989. Effects of environmental scarcity and munificence on the relationship of context to organizational structure. Academy of Management Journal, 32(1): 131-156.

Zanzi, A. 1987. How Organic is your Organization? Determinants of Organic/Mechanistic Tendencies in a Public Accounting Firm. Journal of Management Studies, 24(2): 125-142.