Author's Accepted Manuscript

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 PII:
 S0925-5273(17)30139-1

 DOI:
 http://dx.doi.org/10.1016/j.ijpe.2017.05.002

 Reference:
 PROECO6707

To appear in: Intern. Journal of Production Economics

Received date: 21 October 2016 Revised date: 1 April 2017 Accepted date: 2 May 2017

Cite this article as: Young Sik Cho, Joo Y. Jung and Kevin Linderman, The QM Evolution: Behavioral Quality Management as a Firm's Strategic Resource *Intern. Journal of Production Economics* http://dx.doi.org/10.1016/j.ijpe.2017.05.002

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The QM Evolution: Behavioral Quality Management as a Firm's Strategic Resource

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ABSTRACT

Firms implement various quality management (QM) practices to improve process quality. Scholars recognize that QM practices consist of both technical and behavioral oriented practices. The relationship of technical and behavioral oriented practices on performance has led to paradoxical relationships. Improving quality performance necessitates understanding the relationship between technical and behavioral orientated practices. This study empirically examines the relationship between technical and behavioral quality practices by collecting survey data from both US-based (N = 152) and China-based (N = 222) firms. The analysis

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uses the structural equation modeling technique, and shows that behavioral QM practices fully mediate the relationship between technical QM practices and firm performance. This implies that behavioral QM practices act as a strategic resource which helps generate a competitive advantage. The results contribute to understanding how quality management practices can lead to a competitive advantage.

Keywords: Behavioral quality management; Technical quality management; QM Paradox; QM evolution; Resource-based view; Structural equation modeling. anus

1. Introduction

Over the last two decades, several studies have shown that quality management (QM) practices can be classified as either behavioral-oriented or technical-oriented practices (Flynn et al., 1995; Anderson et al., 1995; Powell, 1995; Dow et al., 1999; Rahman and Bullock, 2005; Naor et al., 2008; Gadenneand Sharma, 2009; Dubey and Gunasekaran, 2015). However, the literature has been inconsistent in terms of the characterization and how these practices influence performance. For instance, studies have described these two clusters as: infrastructure versus core quality practices (Flynn et al., 1995), tangible versusintangible quality practices (Powell, 1995), people versus tools quality practices (Dow et al., 1999), and soft versus hard quality practices (Rahman and Bullock, 2005). Further, some studies give conflicting results about the performance benefits of the different practices. For example, some studies assert that the technical-oriented QM practices such as product design, process management, and statistical

control have a direct influence on the organization's performance (Flynn et al., 1995; Anderson et al., 1995; Rahman and Bullock, 2005; Zu, 2009), whereas other research argues that behavioral-oriented QM practices such as support from top management, customer focus, and supplier relationship are the source of competitive advantage rather than the technical QM practices (Powell, 1995; Samson andTerziovski, 1999; Dow, Samson, and Ford, 1999; Naor et al., 2008; Jung and Hong, 2008).

This study synthesizes the fragmented literature on the relationships between behavioral and technical quality practices and their effects on firm performance. In addition, we investigate the paradoxical relationships between behavioral QM and technical QM on firm performance by empirically testing the samples from U.S.-based firms and China-based firms. This study examines the precise relationship between behavioral QM and technical QM to understand how firms get a competitive advantage through QM practices. Addressing these questions should help clarify how different quality management practices influences a firm's competitive advantage.

2. Behavioral versus technical quality management practices

Although a number of studies have identified a number of different elements of QM, they show remarkable consistency in how to conceptualize the key elements of QM (Flynn et al., 1995; Powell, 1995; Dow et al., 1999; Rahman and Bullock, 2005; Jun et al., 2006; Naor et al., 2008).For instance, QM practices such as employee involvement, cooperative supplier relations, customer focus, and commitment of top management have generally been conceptualized as the behavioral aspects of QM practices('behavioral QM' hereafter), while QM practices such as process management, information and analysis, strategic planning, and benchmarking techniques

have been conceptualized as the technical aspects of QM practices ('technical QM' hereafter), as shown in Table 1. In addition, behavioral QM consists of human-oriented, intangible, and relationship-driven practices, whereas technical QM consists of data-oriented, tangible, and technology-driven practices (Powell, 1995; Dow et al., 1999; Jun et al., 2006; Naor et al., 2008).

	Flynn et al. (1995)	Powell (1995)	Dow et al. (1999)	Rahman and Bullock (2005)	Jun et al. (2006)	Naor et al. (2008)	Dubey and Gunaseka ran (2015)
Behavior al QM Practices	 Infrastruct ure: Work attitudes Top manage ment support Workfor ce manage ment Supplier relations hip Custome r relations hip 	 Intangible: Executive commitm ent Adopting the philosoph y Closer to customer s Closer to suppliers Open organizati on Employe e empower ment 	 People: Employe e commitm ent Share vision Customer focus Use of teams Personnel training Cooperati ve supplier relations 	 Soft: Workfor ce commit ment Shared vision Custome r focus Use of teams Personne l training Cooperat ive supplier relations 	 <i>HR-</i> <i>focused:</i> Employe e empower ment Employe e training Teamwor k Appraisal system Employe e compensa tion 	 Infrastruct ure: Top manage ment support Workfor ce manage ment Supplier involve ment Custome r involve ment 	 Soft: Human resource focus Quality culture Motivat ional leadersh ip Relation ship with partners

Table 1 Key elements of behavioral QM and technical QM on major studies.

Technica I QM Practices	 <i>Core:</i> Statistica l control and feedback Process flow manage ment Product design process 	 Tangible: Benchmarking Training Zerodefects mentality Flexible manufact uring Process improve ment Measure ment 	 <i>Tools:</i> Use of benchmar king Use of advanced manufact uring systems Use of just-in-time principles 	 Hard: Compute r based technolo gies Just-in- time principle s Technol ogy utilizatio n Continu ous improve ment enables 	Core: • Quality informat ion on processe s • Process manage ment • Product design
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There are two major research streams in the literature on the relationship between technical QM, behavioral QM, and organizational performance. One research stream focuses on the relative importance of technical QM versus behavioral QM practices on organizational performance (Powell, 1995; Samson andTerziovski, 1999; Naor et al., 2008; Jung and Hong, 2008; Gadenne and Sharma, 2009). The other major research stream focuses on the sequential relationship between technical and behavioral QM practices and their effect on organizational performance (Flynn et al., 1995; Anderson et al., 1995; Sousa and Voss, 2002; Rahman and Bullock, 2005; Zu, 2009). The Appendix summarizes the major studies on behavioral versus technical quality management practices.

2.1. Relative Benefit of QM Practices

A number of studies examine the relative benefit of behavioral QM versus technical QM (Powell, 1995; Samson and Terziovski, 1999; Naor et al. 2008; Jung and Hong, 2008). For instance, Powell (1995) argued that that tacit behavioral-orientated QM practices such as

executive commitment, employee empowerment, and an open cultureleads to a competitive advantage, while tangible and technical-orientated QM tools such as quality training, process improvement, and benchmarking generally do not generate a competitive advantage. Samson and Terziovski (1999) argued that not all QM practices serve as strong predictors of operational performance. For instance, behavioral aspects of QM practices such as people management, top management leadership, and customer focus primarily influenced operational performance. Similarly, Naor et al. (2008) investigated 189 manufacturing plants located across multiple nations including the US, Japan, Sweden, Finland, Germany, and South Korea in order to examine the relative importance of technical QM and behavioral QM practices on firm performance. behavioral-oriented quality They found practices (so-called that 'infrastructure'quality practices) such as support from top management, workforce management, supplier involvement, and customer involvement had a significant positive influence on manufacturing performance both in Eastern and Western countries, whereas technical-oriented quality practices (so-called 'core' practices) such as quality information, product design, and process management do not directly affectfirm performance across different countries (Naor et al., 2008).

2.2 Sequential Benefit of QM Practices

The other major research stream focuseson exploring the relationship between technical and behavioral QM practices on organizationalperformance (Flynn et al., 1995; Anderson et al., 1995; Rahman and Bullock, 2005; Zu, 2009). For example, Flynn et al. (1995) proposed a sequential model for the relationship between QM practices and performance, and argued that behavioral QM practices (e.g.top management support, customer relationship, supplier relationship, work force management, and work attitudes) have a supportive influence on

technical QM practices (e.g. product design process, process flow management, and statistical control and feedback). Essentially, Flynn et al.'s (1995) model argues that behavioral QM practices enhances the effectiveness of technical QM on organizational performance. Rahman and Bullock's (2005) empirically tested 261 manufacturing firms in Australia and found results consistent with Flynn et al. (1995). Theirstudyshows a strong association betweenbehavioral QM practices andtechnical QM practices, and that technicalQM practices significantlyinfluence organizational performance. This further supports the view that behavioralQM practices indirectly haveinfluences organizational performance by strengthening the effectiveness of technical QM practices (Rahman and Bullock, 2005). More recently, Zu's (2009) research investigated 226 US manufacturing plants, and found similar results with the extant literature - they showed that behavioral QM indirectly contributes to firm performance by supporting technical QM practices. To sum up, the extant literature has been predominantly concerned with testing or verifying the sequential relationship between behavioral QM, technical QM, and organizational performance.

3. Hypotheses development

We investigate themediating effect of behavioral QM on the relationship between technical QM and performancefor the following reasons. Much of literature over the past two decades has suggested that behavioral QM practices, relative to technical QM, has a significantly greater positive influence on organizational performance (Powell, 1995; Samson andTerziovski, 1999; Naor et al., 2008; Jung and Hong, 2008). This suggests that behavioral QM practices are the ultimate source of a competitive advantage, that is, BQ \rightarrow P. But the other stream of literature suggests a sequential relationship of 'behavioral QM \rightarrow technical QM \rightarrow performance' ('BQ \rightarrow TQ \rightarrow P' hereafter) (Flynn et al., 1995; Anderson et al., 1995; Rahman and Bullock, 2005;

Zu, 2009), or alternatively sequential relationship may have the following relationship 'technical $QM \rightarrow behavioral QM \rightarrow performance' ('TQ \rightarrow BQ \rightarrow P' hereafter)$, as shown in Figure 1. In other BO→Pand $BQ \rightarrow TQ \rightarrow Pcontradict$ words. each other because the case where $BQ \rightarrow TQ \rightarrow Pindicates$ that behavioral QM has an indirect effect on organizational performance behavioral QM has a more significant direct effect on performance than does technical QM. Nevertheless, to the best of our knowledge, we were unable to find any study that investigated the relationship represented TQ \rightarrow BQ \rightarrow P, which challenges the BQ \rightarrow TQ \rightarrow P relationship. Thus, these arguments lead us to question the validity of extant knowledge of the relationship between behavioral and technical QM practices. From a practical perspective, understanding this relationship has implications on how managers implement these practices to get a performance advantage.



Fig. 1.Paradox of the relationships between behavioral QM, technical QM, and organizational performance. * = significant positive effect; *ns* = not significant; B = behavioral QM; T = technical QM; P = performance.

Understanding this relationship helps understand how firms can get a competitive advantage from quality management practices. The resource-based view (RBV) argues that a

firm's sustainable competitive advantages (SCA) come from resources that are valuable, rare, imperfectly imitable, and non-substitutable (Barney, 1991; Lado et al., 1992; Barringerand Harrison, 2000; Barney andHesterly, 2006). Powell (1995) argued that behavioral QM practices such as employee empowerment and executive commitment typically act as sources of SCA because of their imperfectly imitable features; however, technical QM practices can easily mimicked, and therefore are not a strategic resource. Similarly, Reed et al. (2000) argued that tacit behavioral oriented QM aspects such as the commitment of topmanagement, employee education, teams, and culture are closely associated with a firm's SCA because they inherently complex and interact withone another, which makes them difficult to imitate. Hence, behavioral QM practices have a more critical and direct effect on a firm's competitive advantage than do technical QM practices, at least from thisperspective.

To summarize, all the arguments above can be condensed as the following two statements; first, the sequential relationship of $TQ \rightarrow BQ \rightarrow P$ could be more in sync with $BQ \rightarrow P$ than $BQ \rightarrow TQ \rightarrow P$ and second, the relationship of $TQ \rightarrow BQ \rightarrow P$ can be elucidated by the RBV. Thus, there is a need to investigate the statistical relationship of $TQ \rightarrow BQ \rightarrow P$. Furthermore, even though research has shown $BQ \rightarrow TQ \rightarrow P$ has as statistically significant relationship, in the event that $TQ \rightarrow BQ \rightarrow P$ is shown to be a more statistically significant relationship (e.g. behavioral QM acting as a mediator between technical QM and firm performance) than $BQ \rightarrow TQ \rightarrow P$, it might be evident that $TQ \rightarrow BQ \rightarrow P$ statistically provides more reliable knowledge than $BQ \rightarrow TQ \rightarrow P$. Therefore, by employing Baron and Kenny's (1986) mediation analysis technique, we propose the following hypothesis to examine whether behavioral QM practices have a mediation effect on the relationship between technical QM practices and firm performance:

H1. Behavioral QM practices positively mediate the relationship between technical QM practices and firm performance.

This research principally focuses on the on examining the relationship of $TQ \rightarrow BQ \rightarrow P$ as stated in Hypothesis 1. However, Baron and Kenny (1986)laid out several prerequisite steps which must be satisfied to establish a mediation relationship. First, the independent variable (i.e., TQ here) should significantly predict the criterion variable (i.e., P here). Next, the independent variable should significantlypredict the mediator variable (i.e., BQ here). Lastly, the mediator variable should be correlated with the criterion variable. Therefore, we propose the following extended hypotheses to confirmall the prerequisites for the mediation test:

H1a. Technical QM practices have a significantly positive effect on firm performance.

H1b. Technical QM practices have a significantly positive effect on behavioral QM practices.H1c. Behavioral QM practices have a significantly positive effect on firm performance.

The hypothesis for each pathway in the research model can be mathematically expressed by the equations (1) to (4), where β is the regression coefficient, *i* is regression intercept, and *e* is error in the estimation. Additionally, the following abbreviations were used for simplicity: technical quality management (TQ), behavioral quality management (BQ), and firm performance (FP):

H1a:
$$FP = i_1 + \beta_1(TQ) + \varepsilon_1$$
 (1)

H1b: BQ =
$$i_2 + \beta_2(TQ) + \mathcal{E}_2$$
 (2)

H1c:
$$FP = i_3 + \beta_3(BQ) + \mathcal{E}_3$$
 (3)

In particular, the mediation effect of behavioral QM on the relationship between technical QM and firm performance can be described by the following linear equation:

H1: FP =
$$i_4 + \beta_4(TQ) + \beta_5(BQ) + \mathcal{E}_4$$
 (4)

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4. Methodology

4.1. Survey instrument

Primary data was collected via a survey to test the hypotheses in this study. The survey instruments should have good content validity (Singleton and Straits, 2010). Hence, we first conduct a literature review of behavioral QM practices, technical QM practices, and firm performance. We then synthesize the somewhat fragmented literature, and identified themost common elements for each type of QM practice. The measurementitems relevant to QM practices initially came mostly from Samson and Terziovski's (1999) study. However, some items were slightly revised based on some other studies such as Powell (1995), Choi and Eboch (1998), Dow et al. (1999), Kaynak (2003), Rahman and Bullock (2005), Jun et al. (2006), Naor et al. (2008), and Zu (2009) in order to suit our research purpose. The survey questionnaire used a five point Likert scale to estimate the degree to which the respondents agreed or disagreed with a given item. Next, the questionnaire was refined by a pilot study (N = 15) with MBA students to confirm the operationalization of the survey instrument. Simultaneously, we enlisted the assistance of China-based operations professors to translate our English survey questionnaire into Chinese and to direct the survey research in China. During the translation process, two Chinese translators conducted independenttranslations of the survey questionnaire, and then evaluated each other's work (Brislin, 1980; Douglas & Craig, 2007). After undergoing several revisions through the process of intensive reviews and additional pilot testconducted in both the U.S. and China, we eventually completed the final version of the survey questionnaire, in both English and Chinese.

4.2. Data collection in the U.S. and China

The target respondent for the survey was a senior-level quality manager who was mainly responsible for the QM practices at their company. Hence, the following criteria helped select the respondent to ensure accuracy of the response.First, the selected respondent should be familiar with the firm's QM practices and performances. Second, the target respondent was selected based on their rank in the company; a higher rank was preferred.

The online survey was designed based on Dillman et al.'s (2008) guidelines for collecting primary data. The U.S. survey began with email invitations that had a web survey link to the questionnaire. We sent emails to 419 quality managers in over 30 states in the U.S. who were in charge of quality assurance. There were two rounds of invitations to participate in the survey which resulted ina total of 152 usable responses for a response rate of 36.3%. Collecting the data from China begin with the cooperation of one of China's leading business schools located in Xian. On our behalf, they sent a Chinese version of the survey questionnaire to 340 firms that primarily operate in the Shaanxi province of China. We collected a total of 222 usableresponses from the China-based firms with a response rate of 65.3%. In the U.S. sample, 43.4% were manufacturing firms and 56.6% were service firms, and of the China sample, 51.8% were manufacturing firms and 48.2% were service firms. Table 2 summarizes the demographic profile of our survey participants.

Category		U.S. sample	China sample
Firm's Age	Less than 5 years	6 (4%)	22 (10%)
	5-9 years	15 (10%)	30 (14%)
	10-19 years	16 (11%)	54 (24%)
	20-29 years	27 (18%)	19 (9%)
	More than 29 years	88 (58%)	96 (43%)
Firm's Size ^a	Less than 10	5 (3%)	4 (2%)
	10-99	23 (15%)	27 (12%)
	100-199	15 (10%)	22 (10%)
	200-500	25 (16%)	29 (13%)

 Table 2 Description of the sample.

		More than 500	84 (55%)	138 (63%)						
Industry		Manufacturing	66 (43%)	115 (52%)						
-		Service	86 (57%)	103 (48%)						
Survey		20-29	11 (7%)	40 (38%)						
Respondent	1 ~~~	30-39	17 (11%)	52 (50%)						
-	Age	40-49	51 (34%)	12 (11%)						
		More than 49	73 (49%)	1 (1%)						
	Ennerionee	Less than 5 years	57 (38%)	43 (41%)						
	Experience	5-10 years	36 (24%)	30 (29%)						
	willi a	10-15 years	16 (11%)	15 (14%)						
	current job	More than 15 years	41 (27%)	17 (16%)						
		Majority: quality managers	such as quality ass	urancedirector,						
	Loh Titlo	quality control manager, and director of quality improvem								
	Job The	Minority: operations manager, systems manager, maintenance								
		manager, and CEO.								
Note: Not including missing responses. Number of employees.										
5. Scale Assessment										
5.1. Validity of	5.1. Validity of measurements									

5. Scale Assessment

5.1. Validity of measurements

A confirmatory factor analysis (CFA) helped validate the measures used in this study. Tables3, 4, and 5 give a description of each item and the final results from the factor analysis. In the U.S. sample, the factor loading for each item ranges between .652 and .958, satisfying the suggested threshold of .50 or higher (Hair et al., 2010). In the China sample, most of items meet the threshold, ranging between .604 and 1.020. However, the quality outcome factor of the China sample contains one item whose factor loading is .447; nevertheless, the item is significantly loaded in the related factor (p = .009, t = 2.612) and also the internal consistency measured by Cronbach's alpha meets the acceptable level of .60 or higher (Cronbach, 1951; Nunnally, 1978; Hair et al., 2010) so the item was kept in our measures. In addition, Table 6 presents the bivariate

correlations among the measured variables, the means, and the standard deviations of both the

U.S. and the China samples.

Table 3 CFA	test results	of measures	:behavioral (DM	practices
				•	

	Items Description	Beta	S.E. ^a	<i>t</i> -value	Supporting Literature
Ma	anagement Commitment α^{b} = .821 (.633)				Flynn et al. (1995), Powell (1995), Samson andTerziovski
-	Senior managers actively encourage change and implement a culture of trust, involvement, and commitment in moving towards "Best Practice."	.862*** (.675***)	.081 (.138)	11.937 (7.591)	(1999), Naor et al. (2008), Kaynakand Hartley (2008), Zu (2009)
-	There is a high degree of unity of purpose				S
	throughout our c*mpany, and we have eliminated barriers between individuals and/or	.809*** (.686***)	.087 (.126)	11.937 (7.591)	
En	appartments. $\alpha = .$	737 (.591)	~		Powell (1995), Ahire et al.
-	Our company has effective 'top-down' and 'bottom-up' communication processes.	.779*** (.637***)	.114 (.140)	10.078 (7.325)	(1996), Dow et al. (1999), Samson and Terziovski (1999), Jun et al. (2006),Naor et al. (2008)
-	Employee flexibility, multi-skill, and training are actively used to support improved performance	.753*** (.660***)	.086 (.133)	10.078 (7.325)	
Cu =	stomer Involvement α .846 (.742)				Dow et al. (1999), Samson and Terziovski (1999), Das et al.
-	We have an effective process for resolving external customers' complaints.	.859*** (.800***)	.083 (.121)	11.986 (9.343)	(2000), Rahman and Bullock (2005), Abdullah et al. (2008), Naor et al. (2008), Zu (2008), Akgün et al. (2014)
-	Customer complaints are used as a method to initiate improvements in our current processes.	.854*** (.739***)	.084 (.095)	11.986 (9.343)	
Su = .	pplier Involvement α 892 (.780)				Saraph et al. (1989), Powell (1995), Dow et al. (1999),

-	We work closely with our suppliers to improve each other's processes.	.893*** (.857***)	.072 (.101)	13.667 (10.616)	Kaynak (2003), Rahman and Bullock (2005),Naor et al. (2008),Kaynakand Hartley
-	Our suppliers work closely with us in product development.	.902*** (.750***)	.075 (.087)	13.667 (10.616)	(2008)

Note: U.S. sample N = 152, China sample N = 222 (the figure in the parenthesis represents the estimate of the China sample); ^aStandard error; ^bCronbach's alpha; *** p < 0.001.

Items Description	Beta	S.E. ^a	<i>t</i> -value	Supporting Literature			
Strategic Planning $\alpha^{b} = .822$ (.585)				Black and Porter (1996), Choi andEboch (1998), Samson			
- We have a mission statement which has been communicated throughout the company and is supported by our employees.	.765*** (.682***)	.079 (.132)	11.336 (8.278)	and Terziovski (1999), Cho and Jung (2014), Akgün et al. (2014)			
- We have a comprehensive and structured quality planning process which regularly sets and reviews short and long-term goals. Process Management $\alpha = .672$.915*** (.604***)	.098 (.110)	11.336 (8.278)	Flynn et al. (1995), Powell			
(.681)				(1995), Samson and Terziovski			
- Our suppliers have an effective system for measuring the quality of the materials they send to us.	.652*** (.731***)	.089 (.119)	8.445 (9.438)	(1999),Naor et al. (2008), Akgün et al. (2014)			
- We have well established methods to measure the quality of our products and services.	.781*** (.707***)	.158 (.095)	8.445 (9.438)				
Use of Benchmarking α = .903 (.757)				Powell (1995), Dow et al. (1999), Samson andTerziovski			
- We have undertaken benchmarking in relative cost position.	.905*** (.815***)	.063 (.118)	15.438 (9.391)	(1999), Jung and Hong (2008)			
- We have undertaken benchmarking in operating processes.	.909*** (.747***)	.067 (.095)	15.438 (9.438)				
Information and Analysis α = .889 (.779)				Choi andEboch (1998),Samson and Terziovski (1999), Naor et			
 We regularly review our product quality and procedures. 	.898*** (.806***)	.073 (.108)	13.949 (9.195)	al. (2008), Vanichchinchai andIgel (2011), Akgün et al. (2014)			
- We regularly review other firms' processes in bringing new products to market.	.892*** (.792***)	.070 (.110)	13.949 (9.195)				

Table 4 CFA test results of measures: technical QM practices

Note: U.S. sample N = 152, China sample N = 222 (the figure in the parenthesis represents the estimate of the China sample); ^aStandard error; ^bCronbach's alpha; *** p < 0.001.

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Items Description	Beta	S.E. ^a	<i>t</i> -value	Supporting Literature
Quality Outcome α^{b} = .665 (.628)				Samson andTerziovski (1999),Kaynak (2003), Jung and
- Cost of Quality (error, scrap, rework, inspection) as a % of total sales	.665*** (.447**)	.260 (.174)	3.658 (2.612)	Hong (2008), Kaynakand Hartley (2008)
- Defects as a % of	.750***	.287	3.658	
production volume Customer Satisfaction $\alpha = .927 (.928)$	(1.020**)	(.842)	(2.612)	Juran (1992), Choi andEboch (1998),Rungtusanatham et al. (1998),
- Customer satisfaction with regard to our products/services has increased over the past three years.	.902*** (.867***)	.062 (.102)	14.621 (9.008)	Samson and Terziovski, (1999), Das et al. (2000), Rahman and Bullock (2005),Zu (2009), Sadikoglu and Zehir (2010)
 Your company's customer satisfaction level. 	.958*** (1.000***)	.075 (.120)	14.621 (9.008)	
Business Performance $a = 849 (636)$		<u> </u>		Samson and Terziovski (1999), Jung and Hong (2008) Akgiin et al. (2014)
- Growth In Sales	.872*** (.667***)	.108 (.184)	10.330 (5.241)	Cho and Jung (2014a)
- Growth In Market Share	.753*** (.506***)	.083 (.184)	9.721 (5.002)	
 Net Profit Margin 	.804*** (.664***)	.087 (.198)	10.330 (5.241)	

Table 5 CFA test results of measures: firm performance

Note: U.S. sample N = 152, China sample N = 222 (the figure in the parenthesis represents the estimate of the China sample); ^aStandard error; ^bCronbach's alpha; ** p < 0.01; *** p < 0.001.

Table 6 Bivariate correlations and descriptive statistics.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	Mea n	SD
Behavioral Q	QM													
1 Manageme nt Commitme nt													3.39 (3.1 5)	1.15 (.83)
2 Employee Involvemen t	.76** (.46* *)												3.20 (3.0 8)	.98 (.82)

3 Customer Involvemen t 4 Supplier Involvemen	.63** (.40* *) .51** (.39*	.60** (.46* *) .54** (.36*	.45** (36*										3.66 (3.4 7) 3.27 (3.4	.96 (.82) .92 (82
t	*)	*)	*)										3))
Technical QM	[
5 Strategic	.73**	.70**	.60**	.50**									3.58	1.05
Planning	(.55*	(.50*	(.57*	(.42*									(3.3	(.79
	*)	*)	*)	*)									9))
6 Process	.59**	.62**	.53**	.71**	.57**								3.44	.86
Manageme	(.36*	(.35*	(.43*	(.62*	(.47*								(3.4	(.75
nt	*)	*)	*)	*)	*)								5))
7 Use of	.52**	.52**	.63**	.53**	.56**	.62**							3.40	.91
Benchmarki	(.38*	(.44*	(.46*	(.37*	(.51*	(.46*							(3.4	(.77
ng	*)	*)	*)	*)	*)	*)							0))
8 Information	.51**	.48**	.52**	.52**	.60**	.60**	.67**						3.30	.93
& Analysis	(.27*	(.35*	(.30*	(.46*	(.32*	(.50*	(.36*						(3.4	(.80
	*)	*)	*)	*)	*)	*)	*)				\mathbf{O}		5))
Firm Perform	ance	4 1.	10.1	0.6	4.5.4		0 1 <i>1 1 1</i>						•	0.1
9 Quality	.21**	.16*	.19*	.06	$.1^{/*}$.12	.21**	.07					3.80	.91
Outcome	(.23*	(.20*	(.14*	(.11)	(.11)	(.12)	(.07)	(.16					(3.5	(.99
1.0	*)	*) 50**)	02**	27**	25**	05**	*)	04**				3))
I Customer	.46**	.50**	.49**	.23**	.3/**	.35**	.25**	.26*	.24**				2.99	1.01
. Satisfaction	(.12)	(.19*	(.23*	(.09)	(.18*	(.13)	(.15*		Ţ.1/*				(2.4	(.81
1 Dusinasa	01**	*) 25**	*) 20**	06	*))2**	16*)	(.04))	20*			3))
1 Dusiness	.21***	(12)	.20	.00	.23***	$.10^{*}$	(01)	$(14)^{-1}$	00	.39** *			2.04	.90
	(.09)	(.15)	(.14.	(.08)	(.19.	(.11)	(.01)	(.14 *)	(.03)				(2.9	(.64
е)		.)			.)		(.09			0))
Control Varia	bles)				
1 Firm A ge ^a	06	00	01	03	03	06	03	11	03	12			1 15	1 10
I I IIII Age	(12)	(10)	(11)	(03)	(12)	(15*	(12)	(05)	05	12	- 26**		(3.6	(1.1.9
•	(.12)	(.10)	(.11)	(05)	(.12)	(.15	(.12)	(.05)	(.17 *))	.20		(3.0	(1.4)
)))	(.50 *)		1)	0)
1 Firm Size ^b	16*	15	05	02	.00	11	05	.00	19*	-	11	.52**	4.05	1.24
	(04)	(01)	(.12)	(02)	(.07)	(.08)	(.10)	(-	(.05)	.20*	(.14*	(.52*	(4.2	(1.1
	··· /			- · ·	<u> </u>	</td <td></td> <td>.01)</td> <td>· · · · /</td> <td>(.01</td> <td>)</td> <td>*)</td> <td>2)</td> <td>5)</td>		.01)	· · · · /	(.01)	*)	2)	5)
)	·	,	,	,

Note: Pearson correlations; U.S. sample N = 152, China sample N = 222 (the figure in the parenthesis represents the estimate of the China sample); ^a Length of time in business (e.g., $3 = 10 \sim 19$ years, $4 = 20 \sim 29$ years), ^bNumber of employees (e.g., $3 = 100 \sim 199$, $4 = 200 \sim 500$); * p < 0.05, ** p < 0.01 (two-tailed). 5.2. *Measurement model fit testing*

Before testing our hypotheses, we assessed the goodness of fit of our measurement model by usingvarious fit indices such as the normedchi-square (X^2 /d.f.), the comparative fit index (CFI), the root mean square error of approximation(RMSEA), RMSEA 90% confidence interval,

and the Tucker-Lewis coefficient index (TLI). Table 7 gives the model fit statistics; all constructs pass the recommended thresholds, and the overall model also fits the data very well.

Fit Index	Threshold	BehavioralTechnicalQMQM		Firm Performance	Overall Measure Model ^h
Chi-square	$(X^2/d.f.)$	16.32 (31.87)	33.37 (28.76)	8.76 (10.59)	305.95 (234.34)
Degree of Freedom (<i>d.f.</i>)		16 (16)	16 (16)	11 (11)	175 (175)
$X^2/d.f.$	<3.00 ^d	1.02 (1.99)	2.08 (1.79)	.79 (.96)	1.74 (1.34)
CFI ^a	>0.90 ^e	.99 (.97)	.97 (.98)	1.00 (1.00)	.94 (.96)
RMSEA ^b	$<\!\!0.08^{ m f}$.01 (.06)	.08 (.06)	.00 (.00)	.07 (.04)
RMSEA 9	0% CI	.00 ~ .07 (.03 ~ .10)	.04 ~ .12 (.02 ~ .09)	.00~.07 (.00 ~ .07)	.05 ~.08 (.02 ~ .05)
TLI ^c	Close to 1.00 ^g	.99 (.92)	.96 (.94)	1.00 (1.00)	.91 (.95)

 Table 7 Test results of goodness of fit of measurement model

Note: U.S. sample N = 152, China sample N = 222 (the figure in the parenthesis represents the estimate of the China sample), CI = Confidence interval.

^aComparative fit index

^bRoot mean square error of approximation

^cTucker-Lewis coefficient index

^dSegars and Grover (1998), Hair et al. (2010)

^e Byrne (1998)

^fBollen and Long (1993)

^gBentler and Bonett (1980)

^hAll factors are included.

5.3.Multi-group invariance analysis

We performed invariance tests for manufacturing and service sample in order to validate the equivalency across the two groups. First, configural invariance is tested to examine whether the factor loadings estimated for each group show similar pattern (Leuschner et al., 2012; Yan and Nair, 2015). The unconstrained two-group CFA demonstrates good model fit both for the

China sample (Normed Chi-square = 1.233, p = .002, CFI = .955, RMSEA = .033, RMSEA CI = .021 ~ .043, TLI = .928) and the U.S. sample (Normed Chi-square = 1.588, p< .001, CFI = .915, RMSEA = .063, RMSEA CI = .053 ~ .072, TLI = .865). Besides, all factor loadings estimated for the two groups are highly significant (p< .001) and above the recommended threshold of .50 (Hair et al., 2010). Hence, the configural invariance exists across the two groups. Second, we tested for metric invariance to evaluate whether the measures are equivalently reliable between manufacturing and service respondents (Koufteros and Marcoulides, 2006; Yan and Nair, 2015). Table 8 shows the results of the metric invariance tests. There are no significant changes in the model fit statistics such as X^2 , RMSEA, and TLI for the fully constrained two-group CFA models. Therefore, it is concluded that our respondents in manufacturing and service industry interpreted and responded to the survey questionnaire in a very similar manner (Koufteros and Marcoulides, 2006; Leuschner et al., 2012).

	$X^2/d.f.$	ΔX^2 RMSEA	ARMSEA	TLI	ΔTLI	Metric Invariance
U.S. ^a	1.578	32.9 ^{ns} .062	001	.868	.003	Yes
China ^b	1.248	34.0 ^{ns} .034	.001	.924	004	Yes

 Table 8 Metric invariance testing

5.4. Common method variance testing

The data for both predictor and criterion variables came from a single respondent which can potentially lead to problems with common method variance. Common method variance is the "variance that is attributable to the measurement method rather than to the constructs the measures represent" (Podsakoff et al, 2003, p. 879). Thus, as ex-ante remedies for controlling

Note: ^a Manufacturing N = 66, service N = 86; ^b Manufacturing N = 115, service N = 103 (not including missing responses); ns = not significant (p> .05); RMSEA = Root mean square error of approximation; TLI = Tucker-Lewis coefficient index.

CMV, we allowed respondents answer questions anonymously (Podsakoff et al, 2003) and we also collected the data from upper level informants (Kaynak, 1997; Miller and Roth, 1994). After collecting the data, we evaluated the existence of CMV through the single-method-factor approach, which controls for the effects of a single unmeasured latent method factor (Podsakoff et al., 2003). Hence, we examined the significance of the structural parameters both with and without the common latent factor (CLF) in the model (Podsakoff et al., 2003; Carlson and Kacmar, 2000). For the U.S. sample, the test results show that there is no significant difference in the parameters between the CFA models without the CLF (Chi-square = 305.954; *d.f.* = 175; p < .001; Normed Chi-square = 1.748; CFI = .943; RMSEA = .070; TLI = .911) and with the CLF (Chi-square = 301.538; d.f. = 174; p<.001; Normed Chi-square = 1.733; CFI = .945; RMSEA = .070; TLI = .913), which indicates that the CMV threat is not a major problem in this study (see Fig. B.1. and B.2.inAppendix B for more details). For the China sample, when adding the CLF to the CFA model, some changes in parameters occurred between the CFA model without CLF (Chi-square = 234.348; *d.f.* = 175; *p* = .002; Normed Chi-square = 1.339; CFI = .966; RMSEA = .039; TLI = .947) and with CLF (Chi-square = 216.131; *d.f.* = 174; *p* = .016; Normed Chi-square = 1.242; CFI = .976; RMSEA = .033; TLI = .962), implying that the possibility of CMV cannot be completely eliminated from the China sample. Nevertheless, the changes are minimal and not significant so the CMV is not a critical problem in this study (see Fig. B.3. and B.4.in Appendix B for more details).

6. Results

6.1. Hypothesized SEM analysis

We employ structural equation modeling (SEM) analysis to test the hypotheses. Table 9 summarises the test results from the SEM analyses using the IBM AMOS software. Table 9 suggests a direct effect of each factor (H1a - H1c) for both the U.S. and China samples. However, in H1, the examination of the mediation effect of behavioural QM on the relationship between technical QM and firm performance is only strongly supported for the U.S. sample. Specifically, for the U.S. sample (N =152), the test result of H1a in Table 9 indicates that technical QM practiceshave a significantly positive influence on firm performance ($\beta = .43$, t = 7.24, p < .001); nevertheless, the test result of H1 explicitly demonstrates that the direct positive influence of technical QM on firm performance is significantly weakened ($\beta = -.94$, t = -1.86, p = .06) when inserting the behavioural QM factor between technical QM and firm performance eventhough both the direct effect of behavioral QM on firm performance ($\beta = 1.48$, t = 2.90, p = .004) and the direct effect of technical QM on behavioral QM (β = .94, t = 8.27, p < .001) are still significantly positive, as illustrated in Fig. 2. This implies that a firm's behavioral QM practices have a full mediating influence on the relationship between technical QM practices and firm performance. Therefore, using Baron and Kenny's (1986) mediation test methodology, H1 is completely supported for the U.S.-based firms. On the other hand, for the same test in the China sample (N = 222), we could not find any mediation influence of behavioral QM on the relationship between technical QM and performance because both the effect of behavioral QM on performance ($\beta = -.48$, t = -.75, p = .45) and the effect of technical QM on performance (β = .73, t = 1.15, p = .25) are simultaneouly weakened when inserting the behavioral QM factor between technical QM and performance, as shown in Fig.3. Further, R^2 for the performance variables in China sample ranges only between .03 and .09, implying that more than 91 % of

the variation in firm performance cannot be appropriately explained by the exogenous variables such as technical QM and behavioral QM.Thus, H1 is not supported for the China sample.

Table 9 Test results of SEM analyses on various interplayrelationships between technical QM, behavioral QM, and firm performance.

Test	Purpose	Results of U.S. Sample(N = 152)	R^2	Results of China Sample(N = 222)	R^2
1	To examine the direct effect of T on P: <i>H1a</i>	.43*** (T)→(P)	.18	.23** (T)→(P)	.05
2	To examine the direct effect of T on B: <i>H1b</i>	.94*** T→B	.88	1.05*** T → B	1.10
3	To examine the direct effect of B on P: <i>H1c</i>	.59*** B→P	.35	.29*** B→P	.09
4	To examine the mediating effect of B on the relationship between T and P: <i>H1</i>	$\xrightarrow{.92^{***}} \xrightarrow{.56^{***}} P$	B: .85 P: .31	$\begin{array}{c} 1.04^{***} .25^{**} \\ \hline \end{array} \\ \begin{array}{c} \bullet \\ \end{array} \\ \end{array} \\ \begin{array}{c} \bullet \\ \end{array} \\ \begin{array}{c} \bullet \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \bullet \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \bullet \\ \end{array} \\$	B: 1.09 P: .06
		.94*** B 1.48** T 94†	B: .88 P: .46	1.05*** B48 T .73 P	B: 1.10 P: .03

Note: Standardized regression coefficients, † p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. B = behavioral QM; T = technical QM; P = firm performance.



Fig. 2.Mediating effect of behavioral QM on relationship between technical QM and firm performance (U.S. sample, N = 152). † p < 0.1; ** p < 0.01; *** p < 0.001; () *t*-statistics; Chi-square = 608.917; *d.f.* = 219; Normed Chi-square = 2.780; CFI = .832; TLI = .788

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Fig. 3.Mediating effect of behavioral QM on relationship between technical QM and firm performance (China sample, N = 222). *** p < 0.001; () *t*-statistics; Chi-square = 459.654; *d.f.* = 219; Normed Chi-square = 2.099; CFI = .862; TLI = .827

6.2. Post hoc analysis

For the China sample, the SEM test results show no mediation effect of behavioral QM between technical QM and firm performance. However, Table 9 shows significant correlations exist among exogenous and endogenous variables. Hence, we tested whether the indirect effect of behaviroal QM practices on firm performance through technial QM practices is significant. We performed the Sobel (1982) tests by the folloing equations, where a is the unstandardized regression coefficient between behavioral QM and technical QM; b is the unstandardized

coefficient between technial QM and firm performance; SE_a is the standard error of a; SE_b is the standard error of b:

$$z$$
-value = $a*b/SQRT(b^2*SE_a^2 + a^2*SE_b^2)$

The Sobel test results show the z-value is 4.600 (S.E. = 0.263, p < 0.001), implying that the techinal QM practices significantly carries the influence of the behavioral QM practices to the firm performance for the sample of China-based firms.

7. Implication

Our study results reveal several meaningful implications and contributions to both theory and practices. First, the findings of this study contribute to the literature on the resource-based view of the firm (Wernerfelt, 1984; Barney, 1991), while integrating with the literature on quality management. The results for the U.S. sample shows that behavioral QM has a full mediation effect on technical QM and firm performance, implying that behavioral QM is a more critical strategic resource for generating a firm's SCA than is technical QM. Hayes et al. (2005) argue that although it seems that the QM program contributes to improving a firm's operating performance, most of the improvement comes from soft QM components such as commitment of top management, customer involvement, and employee involvement. In the same vein, our study results support the idea that behavioral QM practices have a significantly greater positive influence on firm performance than do technical QM practices (Powell, 1995; Dow et al., 1999; Samson and Terziovski, 1999; Naor et al., 2008; Jung and Hong, 2008; Abdullah et al., 2008). In addition, the behavioral QM aspects of a firm such as skilled leadership, human resource management, and relationships with its customers and suppliers are typically non-substitutable

knowledge-based resources that its competitors cannot easily imitate (Barney, 1991; Lado et al., 1992; Powell, 1993; Barringer and Harrison, 2000; Barney and Hesterly, 2006). Therefore, considering the results and the extant literature, we concluded that behavioral QM practices should be viewed as more strategic resource for a firm's SCA than technical QM practices.

Second, our study results contribute to the QM literature by not only synthesizing the fragmented literature on the QM practices and their effects on firm performance, but also by answering the question which had been remained unsolved for a long time. The synthesized literature review of this study points out two paradoxical research findings: (i) one research stream has maintained that only behavioral-related QM practices only have a significant positive influence on the competitive adavantages of firms (i.e., 'BQ \rightarrow P' relationship) (Powell, 1995; Samson and Terziovski, 1999; Naor et al., 2008; Jung and Hong, 2008); (ii) the other research stream has uphold that behavioral QM practices are necessary to support and enhance the direct effects of techanical practices on performance (i.e., 'BQ \rightarrow TQ \rightarrow P' relationship) (Flynn et al., 1995; Anderson et al., 1995; Sousa and Voss, 2002; Rahman and Bullock, 2005; Zu, 2009). Therefore, our study empirically verified these two contradicting research findings by clarifyinghow behaviroal QM and technical QM frameworks interplay each other to get the performance benefits. Our study gives some mixed results. For the U.S. sample, the study result shows that technial QM practices has the indirect effects on firm performance through behavioral QM practices; whereas, for the China sample, behavioral QM practices has the indirect effects on firm performance through techingal QM practices. In revisiting the RBV, our findings suggest that for the U.S.-based firms, behavioral QM practices act as strategic resources for generating competitive advantages; on the other hand, for the China-based firm, technical QM practices work as strategic resources. From a practical perspective, these study findings have implications

on how effectively managers implement their QM practices to get the performance benefits. The study results suggest that the U.S.-based mangers should pay more attention to the HR practices (e.g., employee training, employee empowerment, sharing vision through organization, and effective communication process) as well as the cooperative relationship with suppliers and customer for achieving sustainable competitive advantages, while the China-based mangers should invest more intheir technial-related quality practices such as information system, benchimarking techquies, and statistical control tools for generating the performance benefits.

Third, the results of our study raise a more fundamental question about the existing conceptualization of QM practices.For instance, in the extant literature, behavioral QM practices are known as 'infrastructure' practices, which constitute the fundamental environment that supports the effective implementation of technical QM practices, while technical QM practices are known as 'core' practices, which are more directly related to the improvement of organizational performance (Flynn et al., 1995; Samson and Terziovski, 1999; Rahman and Bullock, 2005; Zu, 2009). However, our study results explicitly indicate that behavioral QM practices are critically associated with successful firm performance, while technical QM practices, as the foundation facilities, are mainly related to behavioral QM practices. Based on these arguments, we suggest that it is probably more appropriate to refer to behavioral QM practices as 'core' practices and technical QM practices as 'infrastructure' practices. Figuratively speaking, a horse-drawn coach (i.e., technical QM practices) would not achieve its main purpose, tranportation (i.e., firm performance), without a coachman (i.e., behavioral QM practices), suggesting that the successful transportation of the coach is more critically dependent upon the driving capabilities of the coachman (i.e., behaviroal QM practices), rather than on the structural excellence of the coach (i.e., technical QM practices).

Last but not least, our study results also make contributions to the process improvement research by providing a concrete future research direction. Through the mediation analysis of H1 testing, we could support that the 'TQ \rightarrow BQ \rightarrow P' relationship is statistically a more reliable than the 'BQ \rightarrow TQ \rightarrow P' relationships, at least in the context of U.S.-based firms' QM implementation. However, the post hoc study results demonstrate that 'BQ \rightarrow TQ \rightarrow P' framework is a more reliable than the 'TQ \rightarrow BQ \rightarrow P' for the China-based firms. These contracting results between the U.S. and China can be understood the view that competitive priorities evolve over time with changing business conditions (Krajewisk et al., 2010). For example, it is rationalized that for the U.S.based firms, behavioral QM practices have evolved as a firm's 'order winner' because the QM programs in the U.S.-based firms reached maturity, while technical QM practicesact as the 'order qualifier' which is the minimum requirement that a firm must satisfy for its survival in the market. On the other hand, it is induced that for the China-based firms, technical QM practices still act as the 'order winner' because technical QM programs such as statistical quality control and information system have not yet universalized in China, continuously producing a competitive edge. However, our study could not suggest any statistical evidences since we did not control for the program maturity of each firm. This is necessary to empirically investigate whether the structural movement of 'BQ \rightarrow TQ \rightarrow P' \rightarrow 'TQ \rightarrow BQ \rightarrow P' historically happened as QM practices reach maturity stage. Therefore, it is strongly recommended that future research should involve conducting 'generalizability replication' by using a similar design (e.g. 'BQ \rightarrow TQ \rightarrow P' frame) but different data (e.g. more recent data), or 'validity replication' using a different design (e.g. 'TQ \rightarrow BQ \rightarrow P' frame) but similar data (e.g. used data) for the previously conducted QM studies (Tsang and Kwan, 1999; Eden, 2002; Frohlichand Robb Dixon, 2006). We also recommend that future research explore how the interplay between behavioral and technical QM practices in

determining firm performance changes according to the program maturity of a firm's OM practices; it might be feasible through a longitudinal research design.

In conclusion, our study results show that behavioral QM practices act as a strategic resource which helps generate a competitive advantage. This finding helps contribute to understanding how quality management practices lead to a performance advantage and why managers should pay more attention to the human-oriented quality management practices for -ge his contractions of the second se achieving sustainable competitive advantages.

Study	Objective	Type & Sample	Simplified Model & Results	Key Findings
Flynn et al.(1995)	To investigate the relationship between quality management (QM) practices and quality performance.	Empirical / 706 managers of 42 manufacturing plants located in the U.S.	B [*] →T [*] P	Infrastructure QM practices (e.g., top management support, customer relationship, supplier relationship, work force management, and work attitudes) affect core QM practices (e.g., product design process, process flow management, and statistical control and feedback). The core QM practices have a direct influence on quality performance.
Powell (1995)	To examine QM as a potential source of sustainable competitive advantage.	Empirical / 54 US-based firms, employing 50 or more workers.	B*P T	Intangible QM practices such as employee empowerment, executive commitment, and open culture significantly contribute to firm's competitive advantage, while tangible QM techniques such as process improvement, benchmarking, quality training do not generally relate to competitive

Appendix A.Majorstudies on behavioural versus technical quality managementpractices.

advantage.

Dow et al. (1999)	To identify the core dimensions of quality management practices and investigate how these practices contribute to superior quality outcomes.	Empirical / 698 manufacturing plants located in Australia and New Zealand.	(B) * → P	Only three of the nine quality practice constructs such as employee commitment, shared vision, and customer focus have a significant positive association with superior quality performance.
Rahman and Bullock (2005)	To investigate the relationships among soft QM, hard QM, and organizational performance.	Empirical / 261 manufacturing firms located in Australia.	B [*] →T [*] P	The study results indicate that there are significant positive associations between soft QM and hard QM and between hard QM and organizational performance. The study denotes that soft QM has an indirect influence on performance by strengthening the effect of hard QM.
Jun et al. (2006)	To identify critical elements of QM practices that would contribute to the enhancement of employee satisfaction and loyalty.	Empirical / 407 employees of two Maquiladora- based firms in Mexico.	(B) * → P)	HR-focused QM practices such as teamwork, employee compensation, and employee empowerment have a significantly positive effect on employee satisfaction. In turn, the reinforced

employee satisfaction contributes to a higher level of employee loyalty. Naor et al. To investigate Empirical / Organizational (2008)the relationship culture more 189 significantly among manufacturing organizational impacts on plants located in infrastructure culture. six countries infrastructure quality including the and core quality management U.S., Japan, practices than on practices, and Sweden. manufacturing core quality Finland, performance. management Germany, and practices, regardless South Korea. of where the manufacturing plant is located in six countries. Besides, infrastructure quality practices pled have a positive and significant effect on manufacturing performance while core quality practices have no significant effect on it both in the Eastern and the Western countries. Abdullah et al. To examine the Empirical / Soft QM factors impact of soft (2008)such as 255 managers factors of QM management of electronics practices on commitment, firms located in quality employee Malaysia. improvement involvement, customer focus, and organizational reward, and training performance. are significantly associated with quality improvement. Some soft factors such as management

				commitment, employee involvement, and customer focus are also significantly associated with organizational performance.
Jung and Hong (2008)	To investigate the relationships among the organizational citizenship behavioral (OCB), soft QM, hard QM, and firm performance.	Empirical / 230 Maquiladora firms located at the border between Texas in the U.S. and Mexico.	B T P	Soft QM factor which consists of leadership, people management, and customer focus shows a strong positive effect on firm performance, while hard QM factor which contains planning, process management, and information analysis does not represent any significant impact on firm performance.
Gadenneand Sharma (2009)	To explore key soft and hard QM factors in Australian firms and their effect on performance.	Empirical / 119 CEOs and senior managers of Australian small and medium-sized firms.	B T P	The study indicates that a higher achievement in firm performance is likely to be influenced by a combination of both soft and hard QM factors.
Zu (2009)	To examine the different influences of infrastructure and core QM practices on quality performance.	Empirical / 226 manufacturing plants located in U.S.	B [*] →T [*] P	The study shows that infrastructure QM has a significant positive influence on core QM, and that core QM practices significantly affect quality

Dubey	To examine the impacts of soft	Empirical /	on the results, the study suggests that infrastructure QM practices indirectly contribute to quality performance by improving the effectiveness of core QM practices. The study identifies that soft dimensions
(2015)	QM practices on firm performance.	132 cement manufacturing firms in India $B \xrightarrow{*} P$	of QM such as human resource, quality culture, motivational leadership, and relationship with partners, are significant positive determinants of firm performance.

* = significant positive effect; B = behavioral-oriented quality practices; T = technical-oriented quality practices; P = performance-related variables.



Appendix B. Common method variance testing based on a single-method-factor approach

Fig. B.1. CFA without the common latent factor (U.S. sample, N =152) Chi-square = 305.954; *d.f.* = 175; *p*<.001; Normed Chi-square = 1.748; CFI = .943; RMSEA = .070; TLI = .911



Fig. B.2. CFA with the common latent factor (US sample, N = 152) Chi-square = 301.538; *d.f.* = 174; *p*<.001; Normed Chi-square = 1.733; CFI = .945; RMSEA = .070; TLI = .913

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Figure B.3. CFA without the common latent factor (China sample, N = 222) Chi-square = 234.348; d.f. = 175; p = .002; Normed Chi-square = 1.339; CFI = .966; RMSEA = .039; TLI = .947

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Figure B.4. CFA with the common latent factor (China sample, N = 222) Chi-square = 216.131;*d.f.* = 174; *p* = .016; Normed Chi-square = 1.242; CFI = .976; RMSEA = .033; TLI = .962

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Accepted manuscript