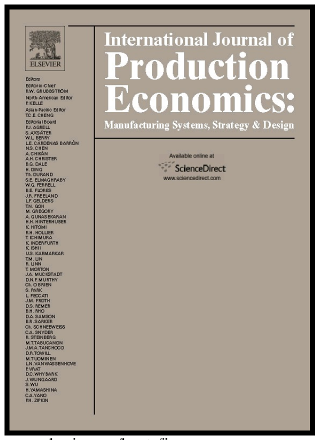
Author’s Accepted Manuscript



www.elsevier.com/locate/ijpe

The Impact of Organizational Context on Hard and Soft Quality Management and Innovation Performance

Jing Zeng, Wenqing Zhang, Yoshiki Matsui, Xinnde Zhao

PII: S0925-5273(16)30411-X
DOI: http://dx.doi.org/10.1016/j.ijpe.2016.12.031
Reference: PROECO6625

To appear in: *Intern. Journal of Production Economics*

Received date: 17 August 2015
Revised date: 19 February 2016
Accepted date: 28 November 2016

Cite this article as: Jing Zeng, Wenqing Zhang, Yoshiki Matsui and Xinnde Zhao, The Impact of Organizational Context on Hard and Soft Quality Managemen and Innovation Performance, *Intern. Journal of Production Economics* http://dx.doi.org/10.1016/j.ijpe.2016.12.031

The Impact of Organizational Context on Hard and Soft Quality Management and Innovation Performance

Jing Zeng[a*], Wenqing Zhang[b], Yoshiki Matsui[c], Xinnde Zhao[d]

[a]Deloitte Tohmatsu Consulting LLC, Chiyoda-ku, Tokyo, 100-6390, Japan
[b]Labovitz School of Business and Economics, University of Minnesota Duluth, Duluth, MN, USA
[c]International Graduate School of Social Sciences, Yokohama National University, 79-4 Tokiwadai Hodogaya-ku, Yokohama 240-8501, Japan
[d]Department of Economics and Decision Sciences, China-Europe International Business School (CEIBS), Shanghai, China

[*]Corresponding author. Tel.: +81 70 3611 6858; fax: +81 3 5220 8601.

Abstract

There are conflicting arguments about the relationship between quality management (QM) and innovation. Few studies have considered the role of organization context in influencing QM for innovation achievement. Taking a multi-dimensional view of QM, this study develops a research framework that examines relationships among organization contextual factors (centralization of authority and integration between functions), two dimensions of QM (hard QM and soft QM), and innovation performance (speed of new product introduction and product innovativeness). Survey data were collected from 238 plants in three industries across eight countries, and structural equation modeling was used to test the framework. Our results indicate that two QM dimensions respectively mediate the effect of contextual factors on innovation performance. Hard QM directly influences speed of new product introduction, while soft QM directly influences product innovativeness. Centralization of authority facilitates hard QM but impedes soft QM, while a high level of integration between functions is favorable to both hard QM and soft QM. A decentralized structure combined with strong integration between functions is beneficial for fostering product innovativeness through soft QM. Some other managerial implications are discussed in this study as well.

Keywords: organizational context, quality management, innovation performance

1. Introduction

Currently, most competitive environments exhibit the characteristics of globalization, rapid technological transfer, and competition that is severe. To anticipate, adapt, and satisfy the changing market needs of severe competitive environments on a continual basis, firms must be innovative, flexible, and creative. Great challenges are presented on the traditional productivity-focused approach to manufacturing by eliminating perturbations and enhancing stability. How can firms create instability in the midst of stability? Productivity and innovation have been traditionally regarded as a paradox that needs to be addressed in every manufacturing environment (Bell and Burnham, 1989). The last two decades have witnessed an increasingly greater preponderance and wide spread adoption of quality management (QM) schemes. As QM has been recognized as a competitive advantage, an insurgence of its implementation to various operational and financial performance measures have been reported (Kaynak, 2003; Lagrosen and Lagrosen, 2005). Therefore, would QM also create a competitive advantage in innovation? If so, in what situations would QM be beneficial to innovation, and what key factors enable it?

Previous literature has provided insight into the role of QM practices in innovation, but there are inconsistencies, even controversies, in identifying the relationships between QM and innovation. Past studies usually use an integrated approach to consider QM as a single factor influencing innovation (Sadikoglu and Zehir, 2010; Santos-Vijande and Álvarez-González, 2007; Prajogo and Sohal, 2003). Negligence of the different dimensions of QM might be one reason for the conflicting QM-innovation relationship (Martínez-Costa and Martínez-Lorente, 2008). It is also possible that QM would also have different relationships with innovation in different contexts. However, most studies on the QM-innovation relationship investigate only direct effect of QM on innovation without consideration of organizational context. Organizations face both the internal context (e.g. organization culture) and external context (e.g. business environment). A few studies have investigated the influence of business strategy (Prajogo and Sohal, 2006), business environment (Hung, 2007; Santos-Vijande and Álvarez-González, 2007) and knowledge management (Hung et al., 2010) on the QM-innovation relationship. More studies incorporating contextual factors, such as organizational context, are needed to provide further explanation to the ambiguous relationship between QM and innovation and to help organizations identify suitable approaches to enhancing innovation performance through QM in different contexts. Additionally, the scope of the past studies is restricted to specific regions, such as Spain (Santos-Vijande and Álvarez-González, 2007), Australia (Prajogo and Sohal, 2003; 2004), and Taiwan (Hung, 2007; Hung et al., 2010), impeding the generalization of the conclusion. Expanding the regional scope by including more countries will supplement the literature.

This study fills these gaps by simultaneously (1) adopting a multi-dimensional view of QM by distinguishing different dimensions of it, (2) using a context-dependent approach and examining the role of organization contextual factors in influencing QM and further innovation, (3) expanding the scope from a regional level to a global level. The objective of this study is to investigate the effect of organization contextual factors on different dimensions of QM in achieving innovation performance on a global basis. This is expected to shed more light on the critical issue of how negative impacts of QM can be avoided and positive results for innovation be obtained. The specific research questions are:

RQ1: How do contextual factors relate to different dimensions of QM?

RQ2: How are two dimensions of QM related to mediate the effect of contextual factors on innovation performance?

RQ3: What is the suitable approach to achieve a certain level of innovation performance indicators?

The remainder of this paper is organized as follows. The next section provides the extant literature, based on which a set of research hypotheses are proposed. We then describe the research methodology, followed by presenting the results of hypotheses testing. Section 5 discusses the main findings and implications stemming from this research. Section 6 includes limitations of this study and future research. Finally, the conclusions are summarized in the last section.

2. Literature review and hypothesis development

Our study was built on the following research streams, from where we formulate our hypotheses.

2.1. Socio-technical systems (STS) theory and multi-dimensions of QM

Socio-technical systems (STS) theory views organizations as consisting of two independent but linked systems: a social system and a technical system. While the technical system focuses on the processes, tasks, and technologies to produce designated output, the social system takes into account the relationship among people and their attributes, such as attitudes, skills, and values (Bostrom and Heinen, 1977a, 1977b). STS argues that there should be ‘‘congruence’’ between the technical and social systems of a process. These two subsystems, technical and social, affect each other in the process of producing goods and services and operating a business, and they need to work mutually to produce optimized outputs (Pasmore et al., 1982).

The socio-technical view has been adopted by operations management, which has addressed the importance of developing the social forces in an organization to support the implementation of advanced manufacturing practices. For example, Shah and Ward (2007) have defined lean production as “a socio-technical system” that requires a flexible, dedicated, and engaged work force and requires organizations to effectively manage their social and technical systems simultaneously to eliminate waste and minimize inventory.

In applying STS perspective to QM, QM scholars have maintained the co-existence of technical and social systems in QM. Jayaram et al. (2010) argue that the quality system design constructs collectively encompass a socio-technical mix of tactics ranging from empowerment and training on the socio-end of the continuum to design and supplier management at the opposite technical end of the continuum. Wilkinson (1992) notes that the "hard" aspect of QM involves a range of production techniques, such as statistical process control and quality function deployment, reflecting the production orientation of the QM gurus; the "soft" aspect of QM is more concerned with a social system encompassing the establishment of customer awareness and the management of human resources. Following this classification, we examine QM from two dimensions, hard QM and soft QM, and draw on the work of Flynn et al. (1994, 1995) and Zeng et al. (2015) to construct the hard QM and soft QM.

Hard QM is generally defined as QM practices that focus on controlling processes and products through techniques and tools in order to conform to and satisfy established requirements. Similar to Zeng et al. (2015), we consider the following two most important hard QM elements: process management and quality information. The term process management covers the planning and monitoring of manufacturing process through the techniques and tools applied to a process in order to reduce process variation, so that it operates as expected, without exceptions such as breakdowns, missing materials, fixtures, tools, etc. and despite workforce variability (Flynn et al., 1994). According to Flynn et al. (1994), process management includes three major practices: process control, preventative maintenance, and housekeeping. The use of statistical process control is important to track process performance for in-production quality assurance (Deming, 1986; Ahire and Dreyfus, 2000), heavy reliance on preventive maintenance aiming to conduct safety activities and avoid equipment breakdowns through scheduled maintenance (Flynn et al., 1995; Arauz et al., 2009), and emphasis on housekeeping, which keeps the cleanliness and organization of the workplace, thus avoiding clutter that hides defects and their causes (Flynn et al., 1994; Schonberger, 2007). The importance of quality information as an essential technical QM practice has been highlighted by QM literature. The availability of information on quality performance and productivity, charts posted on the shop floor showing defect rates, schedule compliance, and machine breakdowns can effectively assist in operational controls (Flynn et al., 1994). The quality information that is provided to workers is expected to be timely and accurate to make sure the operational controls will be effective and efficient.

Soft QM can be generally defined as the QM practices that are directed toward involvement and commitment of management and employees, training, learning, and internal cooperation or teamwork – in other words, promoting the human aspects of the system. Consistent with Zeng et al. (2015), this study uses small group problem solving, employee suggestion, and task-related training for employees to capture the concept of soft QM. The developing and encouraging team problem-solving approaches (Flynn et al., 1995), taking advantage of employees' ability to make proposals for improvements (Forza and Filippini, 1998), and providing quality-oriented and job-specific training (Garvin, 1984; Flynn et al., 1994) all have been highlighted as important areas of soft aspects of QM by previous literature. Small group problem solving is another form of the use of improvement teams. As part of the continuous improvement, it takes good advantage of collective expertise and efforts. Group decision making also makes easy the implementation of problem solving plans. A channel for employee suggestion enables a firm to tap into its employees' ideas and improve the firm's general performance. Specifically, an employee suggestion friendly environment encourages employees to share their ideas and suggestions on how the prevailing process can be further improved based on their first-hand experience (Forza and Salvador, 2001). Task-related training for employees aims to update employees' skill and knowledge in order to maintain a work force with cutting-edge skills and abilities (Flynn et al., 1994). This could not just help employees to better perform their tasks, but also transform employees into flexible problem solvers and encourage them to be involved with their jobs (Kaynak, 2003).

According to the STS approach, a successful system is the result of concurrent configuration of technical, organizational, and social aspects of the system, which articulates the relationship between hard QM and soft QM. Techniques and tools promoted by hard QM through practices, such as process control and use of quality information, are important to yield quality improvement. However, simply upgrading technology and promoting these technical practices, which are also easy to be imitated and adopted by competitors, may not necessarily increase the competitive advantage over time. Strong human resource utilization is required to identify and eliminate sources of quality problems effectively, as continuous quality improvement is highly contingent upon the defect-prevention and problem-solving abilities of employees (Ahire and Ravichandran, 2001). As Bowen and Lawler (1992) noted, ultimately it is "people that make quality happen." Firms have to be customer focused, maintain competency, and promote employee participation in decision-making processes through training and empowerment. Systematic encouragement is indispensible for ensuring in-process quality. It empowers workers to examine processes to prevent errors and to inspect their own work to monitor quality (Ebrahimpour and Withers, 1992; Everett and Sohal, 1991). Previous studies, such as Ahire and Ravichandran (2001), Anderson et al. (1995), Flynn et al. (1995), Kaynak (2003), all tend to model QM practices-performance relationships in the sequence of (1) soft QM practices, (2) hard QM practices, (3) quality performance, and they empirically found that soft QM facilitates the implementation of hard QM. Rahman and Bullock (2005) empirically found soft QM, such as workforce commitment, use of teams, and personnel training, positively affect hard QM, such as technology utilization and continuous improvement. As such, we hypothesize:

H1. Soft QM has a positive impact on hard QM.

2.2. Organization Context

QM brings changes to the goals of the organization and the ways and means to achieve those goals (Ahire and Ravichandran, 2001). QM can be considered as an administrative innovation, as it constitutes a set of practices oriented toward the development of a quality-focused organizational system (Ravichandran, 2000; Westphal et al., 1997). Examining the impact of organizational factors on levels of innovativeness, referred to as “innovation variance research” by Subramanian and Nilakanta (1996), has been one of the main streams of innovation research. The underlying assumption of this stream of research is that organizational innovativeness is facilitated and influenced by organizational characteristics, such as size, degree of centralization, degree of formalization, resource slack, and degree of specialization (Kimberly and Evanisko, 1981; Damanpour, 1987, 1991). This context-dependent approach has been widely adopted to administrative innovation in organizational theory literature. For example, Damanpour (1987) conducted a comparative analysis of the relationships between six organizational factors (functional differentiation, specialization, professionalism, administrative intensity, organizational size, and organizational slack) and several types of innovations using data from public libraries located in northeastern United States (US). His findings indicate that these factors had a significant effect on the adoption of administrative innovations. Thus, the implementation of administrative innovation, such as QM, and their effects on organizational performance, such as innovation performance, could be affected by contextual factors.

However, in QM literature, QM has traditionally been advocated as a management practice that is universally applicable to organizations rather than a context-dependent practice. Some recent studies have raised doubt about the "universal validity" of QM (Sousa and Voss, 2001, 2008; Jayaram et al., 2010; Zhang et al., 2012). They suggest that the inconsistent performance in QM implementation may be due to contextual factors. Most of the empirical studies using the context-dependent approach to study the influence of contextual factors on QM implementation mainly focus on cross-country comparisons of QM practices or the effect of company size on these practices (Sila, 2007). Sousa and Voss (2001) analyze manufacturing strategy as a contextual factor and found that QM practices are contingent on manufacturing strategy. Zhang et al. (2012) empirically investigate both the internal contextual factor (organizational structure) and the external contextual factor (environmental uncertainty) on the relationship between two different groups of QM practices (quality exploration and quality exploitation) and operational performance.

The application of a context-dependent approach to the study on QM-innovation relationship is rather limited. This will be reviewed in a later section. Previous studies have examined the contextual factors including organization strategy (Prajogo and Sohal, 2006), business environment (Hung, 2007; Santos-Vijande and Álvarez-González, 2007) and knowledge management (Hung et al., 2010). As a further effort of contributing to this research stream, this study focuses on examining organization contextual factors that drive QM to yield innovation. In doing this, it is expected to provide more explanation to the conflicting relationship between QM and innovation in existent literature.

We draw on literature from both QM and innovation to identify the important contextual factors influencing QM to achieve innovation. Innovation literature suggests that organizational innovation is subject to influences in different categories, including the individual, organizational, and environmental. Of all potential influences, organizational factors have the primary importance in determining innovation and, thus, have been most widely studied (Damanpour, 1987, 1991; Kimberly and Evanisko, 1981). We also focus on organizational factors, since QM can be viewed as organizational innovation as mentioned earlier. Organizational factors can also cover a broad range. Damanpour (1991) conducted a meta-analysis of the relationships between 13 organizational factors and organizational innovation. These factors range from structural, process, resource, to cultural factors. To narrow down the focus, we particularly examine the following organizational factors that have the possibility to influence the relationship between different dimensions of QM and innovation performance, as suggested by the literature discussed below.

2.2.1. Centralization of authority

Researchers contend that certain features of organizations themselves either facilitate or encourage adoption of innovation. Among the possible organizational factors, nearly all researchers hold that centralization of authority is important in a theoretical sense (Kimberly and Evanisko, 1981). Centralization of authority refers to the centrality of location of decision-making authority (Subramanian and Nilakanta, 1996). Much has been discussed about the effect of centralization of authority on organizational innovativeness. There is a widespread belief that innovativeness is facilitated in a decentralized organization. The flexibility and openness of this type of organization, are believed to enhance innovativeness by encouraging new ideas. Conversely, the concentration of power in centralized organizations is considered to be a major impediment to the adoption of innovations (Aiken and Hage, 1971).

Though we view QM as an organization innovation, we argue that centralization of authority can have a different influence on the different dimensions of QM rather than just have a single effect on QM. In a centralized organization, the power for decision making is centralized rather than empowered to employees, creating tight management control. Walton (1985) states that organizations operating under the control model of management emphasize management prerogatives and positional authority and allocate status symbols to reinforce the hierarchy. Hard QM strives to control activities to increase consistency, reduce waste, and speed the flow of work (Flynn et al., 1995). Since hard QM puts high priority on reducing variation in individual processes, or getting processes "in control", the centralized structure would facilitate hard QM. In contrast, soft QM emphasizes on the responsibility delegation and the commitment of all employees. Employees need to be "empowered" to make certain decisions on the job, to talk to others as needed to solve problems, and to find new ways of doing their work that will reduce wasted steps or improve quality (Spencer, 1994). Therefore, centralization of authority would impede the development of soft QM. These arguments lead to the following hypotheses:

H2: Centralization of authority has a positive impact on hard QM.

H3: Centralization of authority has a negative impact on soft QM.

2.2.2. Integration between functions

Integration between functions refers to the extent to which various functions or departments of an organization work interrelatedly (Germain, 1996). Functions and departments can work in a well-integrated decision-making way whereby departments do not seem to be in constant conflict, managers work well together on important decisions, and generally speaking, all people in the plant work well together. Integration can be accomplished through a number of mechanisms including cross-functional committees, liaison personnel, and task forces (Germain, 1996). QM implementations should start with a coordinating team that assembles three different types of groups referred to as the cross-functional three "P" teams: process, product, and project teams (Plenert, 1996). Utilization of cross-functional integration can result in a cooperative climate, an essential component to QM implementation.

A higher level of cross-functional integration can increase knowledge transfer and lateral communication (Damanpour, 1991; Nahm et al., 2003). By working together, sharing information, and watching out for one another, individuals could build communication and coordination channels for the exchange of relevant expertise and knowledge (Janz and Prasarnphanich, 2003). The use of lateral relations can improve decision quality through the presence of local information relevant to solving the problem (Flynn and Flynn, 1999). When firms possess a higher level of integrated mechanism, they are more inclined to increasing the social interaction within the organization, thus creating an organizational environment of knowledge sharing and cooperation. Soft QM, which promotes employee involvement, teamwork, training, and learning, can benefit from such an environment. Employees in such an organization should be able to have access to the broadest variety of knowledge for work and problem solving, thus they can have a broad rather than a narrow understanding of problems and issues (Nahm et al., 2003). This can facilitate the implementation of QM tools and techniques and help solve quality problems, leading to more successful implementation of hard QM. Actually, cross-functional integration has been regarded as one of the key elements of QM philosophy (Plenert, 1996). Without integration and coordination of functions, organizations can be ineffective in the exchange and implementation of new ideas. A free exchange of ideas between functional areas without constantly being concerned about the chain-of-command is critical for both continuous improvement and innovation. In light of the above reasoning, the following hypotheses are developed.

H4: Integration between functions has a positive impact on hard QM.

H5: Integration between functions has a positive impact on soft QM.

2.3 Relationship between QM and innovation performance

While quality is doing things better, innovation is doing things differently (McAdam et al., 1998). There are both positive and negative arguments about this relationship in the literature. Prajogo and Sohal (2001) note that the conflict between the two groups of arguments exists in many facets including magnitude of change, behavioral traits, ways of thinking, approaches, and principles embodied in QM in contrast to innovation. QM covers a wide spectrum of philosophy and methodologies. Quality tools and techniques, such as process control, 5s, and the use of quality information, help eliminate waste and improve efficiency, but they reduce slack resources that are necessary for fertilizing innovation (Sadikoglu and Zehir, 2010), thereby impeding innovation. Continuous improvement can encourage change and creative thinking in how work is organized and conducted, which is instrumental to innovation (Prajogo and Sohal, 2001). However, scholars such as Harari (1993) have noted the negative impact. Continuous improvement focuses on incremental change and requires standardization or formalization. This would yield rigidity and inhibit innovation by trapping people into focusing on the details of the current quality process rather than new ideas.

QM promotes employee empowerment, involvement, and teamwork and enables employees to participate in decision making and to suggest ideas for improvement of their product and process. This especially links to creativity and knowledge management, which could nurture innovative behaviors and lead to a beneficial effect on innovation (McAdam, 2004; Molina et al., 2007). Also, the implementation of QM will transform organizational structures to be flexible, which is one of the critical factors for innovation (Pfeifer et al., 1998). However, in practice, employee empowerment and involvement are usually constrained to simple job execution and lower scales of the improvement opportunity. The emphasis of group work on quality control would also inhibit independent entrepreneurship and individual creativity, yielding a detrimental effect upon radical innovations (Prajogo and Sohal, 2001).

A few empirical studies have demonstrated the overall positive impact of a set of QM practices on innovation (Prajogo and Sohal, 2004; Martínez-Costa and Martínez-Lorente, 2008; Santos-Vijande and Álvarez-González, 2007; Sadikoglu and Zehir, 2010). Singh and Smith (2004), with a sample of Australian manufacturing organizations, could not find a strong link between QM and innovation. Contrasting to these studies based on an integrated approach for QM, scholars have argued that not all QM practices contribute to innovation. Prajogo and Sohal (2004) and Zeng et al. (2015) divide QM into two dimensions, hard and soft, and conclude that only soft QM positively relates to innovation performance. Perdomo-Ortiz et al. (2006) found three QM practices (process management, product design, and human resource management) standing out for the establishment of business innovation capability. Kim et al. (2012) highlight the critical role of process management through which a set of interlocked QM practices positively relates to innovation. Abrunhosa and Sá (2008) argue that the overall impact of QM and innovation is difficult to generalize, since QM is a complex management philosophy encompassing both hard and soft elements, which may lead to contrasting results in association with innovation. Taking this suggestion, we adopt a multi-dimensional view of QM in examining the QM-innovation relationship in this study.

A few studies also have considered the influential factors on the QM-innovation relationship. Prajogo and Sohal (2006) empirically analyze the relationship between organization strategy (differentiation strategy, and cost leadership strategy), QM, and three performance measures (product quality, product innovation, and process innovation). Their findings indicate that differentiation strategy is positively and significantly related to QM, and the relationship between differentiation strategy and three performance measures is partially mediated by QM. Hung (2007) examines the influence of the business environment on the relationship between QM and innovation performance through a case study on a leading global firm. The study shows that the firm obtains planned quality performance of QM in a default stable internal environment, but it obtains innovation performance when the external environment changes, indicating the moderating role of the business environment in the relationship between QM practices and innovation performance. Santos-Vijande et al. (2007) investigate the contribution of QM to the organization's innovativeness and innovation performance in terms of technical and administrative innovation under different market turbulence conditions. They propose innovativeness as a mediating factor between QM and innovation performance and confirm the moderating role of market turbulence on the impact of QM on technical innovation and innovativeness. Hung et al., (2010) investigate the role of knowledge management for QM to achieve innovation performance. Their results show that QM mediates the relationship between knowledge management and organizational innovation performance. They conclude that knowledge management can be a facilitator enhancing innovation performance through QM. Prajogo and Sohal (2004) address the research needs of focusing on identifying and examining several key factors that drive the application of the multidimensionality of QM. In this vein, we further contribute to the literature by examining the role of the organization contextual factors in driving hard and soft QM to achieve innovation. In light of the fact that previous studies reviewed above usually have restricted their scope to a specific geographical region (e.g. US, Spain, Turkey, Australia, and Canada) and thus impeded the generation of a conclusion, we strive to expand the scope by embracing samples from multi-countries.

Innovation is defined as adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization (Damanpour, 1991). Most traditional typology of distinguishing types of innovation is product innovation and process innovation. Product innovations are new products or services introduced to meet an external user or market need, while process innovations are new elements introduced into an organization's production or service operations—input materials, task specifications, work and information flow mechanisms, and equipment used to produce a product or render a service (Ettlie, 1990). Additionally product innovations are usually aligned with a differentiation strategy, while process innovations aid the effective implementation of a low-cost strategy (Yamin et al., 1999).

In this study, we particularly focus on product innovation, whose relationship with QM suffers more ambiguity and insufficient investigation in the previous literature, as compared to the relationship between QM and process innovation. QM has a great emphasis on process, as continuous improvement, the essential concept of

QM, is aimed basically at simplifying or streamlining a process and executing it in a better or faster manner (Lawler, 1994; Samaha, 1996). Particularly, QM's origin is rooted in the idea of statistical process control, and hence is so clearly oriented toward process. Thus, QM would be closely related to process innovation, which has been empirically supported by previous studies such as Prajogo and Sohal (2003). In contrast, analyzing the relationship between QM and product innovation would be more challenging but very important, as the potential market success for product innovation has often been diluted by poor quality (Flynn, 1994). Conventional wisdom would suggest product innovation and quality represent a tradeoff that cannot be simultaneously achieved. However, there is empirical evidence on the positive impact of QM on fast product innovation (Flynn, 1994; Zeng et al., 2015). To shed more light on this issue, we particularly focus on product innovation in this study based on two criteria: speed of new product introduction and product innovativeness, which are conceptualized and used in previous innovation studies, such as Deshpande et al. (1993) and Prajogo and Sohal (2003). Speed of new product introduction describes how quickly an idea moves from conception to its first commercialization or introduction into the marketplace. At the firm level, it measures the capability to move quickly from ideas to actual products in the marketplace. Product superiority in terms of unique features and innovativeness is a key factor that differentiates new product winners from losers. Product innovativeness is often used to refer to the newness of the product's technology (Song and Parry, 1997 and Song and Parry, 1999) or the degree to which a new product is different from other substitute goods that customers can recognize (Dewar and Dutton 1986, Sethi et al. 2001). It is one of the three positional advantages, along with supplier involvement in production and product launch quality (Song et al. 2011). Breaking down QM dimensions and production innovation criteria, we proceed to a detailed discussion on the relationship between each QM dimension and innovation criteria.

Mokhtar and Yusof (2010) contend that hard QM, which involves the monitoring of activities including finding and eliminating quality deficiencies to ensure that customer requirements are met, can bring organization with effectiveness and efficiency, leading to higher new product performance. They also empirically found quality tools to be positively associated with new product performance. Flynn (1994) provides empirical evidence on the significance of hard QM, particularly quality information and housekeeping, in differentiating fast, medium, and slow product innovators. She argues that receiving immediate and useful quality information from the manufacturing process is instrumental in speeding new products to the market. Housekeeping can facilitate quick changes between products, making it simpler to phase-in new products without disrupting shopfloor operations. Perdomo-Ortiz et al. (2006) also demonstrate that hard QM, particularly process management, stands out as a positive forerunner of the accumulation of business innovation capability, which can lead to product innovation. Therefore, we propose the following hypotheses:

H6a: Hard QM has a positive impact on the speed of new product introduction.

H6b: Hard QM has a positive impact on product innovativeness.

Galende and De La Fuente (2003) classify the determinants of business innovation into three groups: tangible factors, intangible factors, and business strategy factors. Soft QM fosters motivation and empowerment of the employees, teamwork, leadership, and cooperation, which are all related to intangible factors for developing innovation capability. Flynn (1994) highlights the importance of soft QM in achieving fast product innovation; soft QM helps establish teamwork, encourage creative ideas from employees, and promote a communicative environment, thereby facilitating process improvement and the fast introduction of new products and innovative enhancements. Prajogo and Sohal (2004) demonstrate that soft QM, such as top management leadership for quality and human resource management are positively related to product innovation, which is measured by the number of innovations, the speed of new product introduction, the speed of innovation, and the level of innovativeness. Consequently, the following hypotheses are developed:

H7a: Soft QM has a positive impact on the speed of new product introduction.

H7b: Soft QM has a positive impact on product innovativeness.

Based on both theoretical reasoning and empirical findings discussed above, the hypothesized relationships are modeled as depicted in Figure 1. As can be seen, the major constructs in the research model are organizational factors (centralization of authority and integration between functions), two dimensions of QM (soft QM and hard QM), and innovation performance. Each of the paths between these constructs defines a direction of causation. Two structural models are developed to test the causal relationship among the constructs. They will be tested separately depending on each indicator of innovation performance – Speed of New Product Introduction and Product Innovativeness. For simplicity, the two models are respectively labeled as "model for SNPI" and "model for PI." Within each model, only one indicator of innovation performance—speed of new product introduction or product innovativeness—is examined.

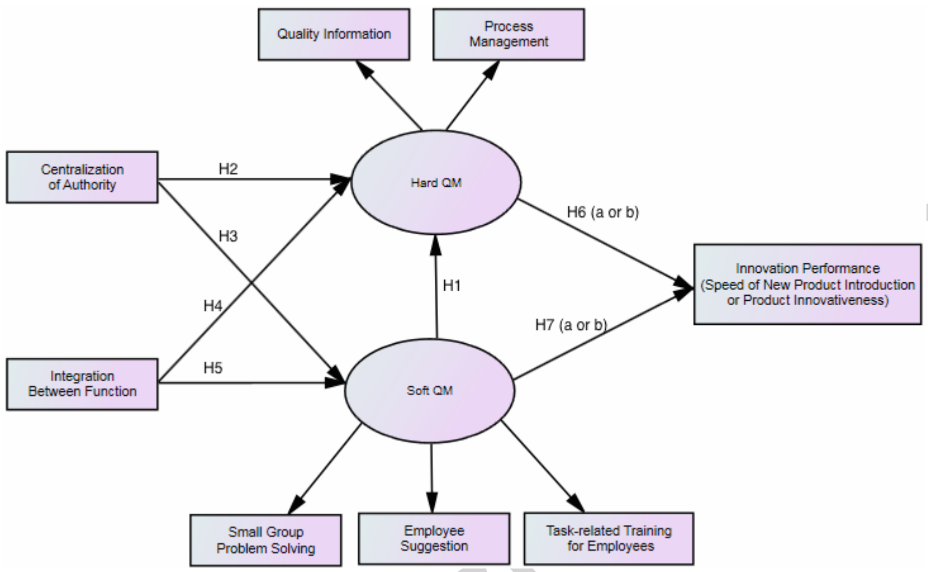


Fig 1. Conceptual model for the impact of organizational context on hard QM, soft QM, and innovation performance

3. Research methodology

3.1. Sample

Data used in this study were collected through an international joint research project named High Performance Manufacturing (HPM), round 3. The aim of this project is to study management practices and their impact on plant performance within global competition. The sample consists of 238 manufacturing plants that are traditional or world-class plants and was stratified by industry and nation. Countries included in the sample are the United States, Japan, Italy, Sweden, Austria, Korea, Germany, and

Finland. The three industries chosen are electrical and electronics, machinery, and automobile. Since these industries were the ones in transition, a great deal of variability in performance and practices was expected to be present (Schroeder and Flynn, 2001). Even though the data was collected during 2003–2005, we can expect that the structural relationship between organization characteristics, management practices, and performance to have remained stable in the last decade and that the findings from the study will be relevant to current business and management practice.

All plants in the sample represented different parent corporations with 366 plants solicited for participation by calling or personal visit. Participating plants totaled 238, and each plant received a batch of questionnaires. The question items were assigned to multiple questionnaires and distributed to the appropriate respondents. For comprehensive details on the HPM survey, please refer to Schroeder and Flynn (2001) and Peng et al. (2008). Table 1 summarizes the profile of the sample by industry and country.

Table 1 Profile of Sample Plants

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

3.2. Measures

Constructs for QM are mainly adopted from Flynn et al. (1994, 1995) and are divided into hard QM and soft QM following the validated framework by Zeng et al. (2015). Hard QM consists of two measurement scales: quality information and process management, while soft QM consists of three measurement scales: small group problem solving, employee suggestion, and task-related training for employees. Particularly, process management is constructed as a super-scale measured by process control, preventive maintenance, and housekeeping. In total seven measurement scales are measured through perceptual questions over seven points on the Likert scale (1=Strongly disagree, 4=Neither agree nor disagree, 7=Strongly agree). Each of these measurement scales has multiple respondents from the same plant. These respondents are from six positions: direct worker, human resource manager, quality manager, supervisor, process engineer, and plant superintendent. To minimize the problems of respondents' inattention and acquiescence, several measurement items were designed to be reverse-scored, as noted in Appendix. A minus sign is shown next to the items that had a reverse scaling. The reversed score was converted to corresponding positively worded value. For example, if the score for item 5 of Housekeeping 'Our plant is disorganized and dirty' was 6, which was considered to reflect an undesirable practice, to maintain the consistency with the other questions, its score was converted to 2.

Focusing on product innovation, as discussed in the literature review, we measure product innovation by two criteria: speed of new product introduction and product innovativeness. Instead of lumping both into one single indicator, we examine two indicators separately to provide a more in-depth analysis. Both criteria are based on a five-point scale, where a high score indicates that plant manager perceives that the plant has been relatively successful pursuing these performance indicators compared to its competitors.

3.3. Testing measurement scales

Three steps are executed in the validation process for the measurement scales: reliability, content validity, and construct validity. As shown in Table 2, the reliability and validity tests for the four measurement scales for hard QM labeled under Measure Name from Process control to Quality information and three measurement scales for soft QM labeled from Small group problem solving to Task-related training for employees are conducted on a dataset at an individual level consisting of a response from each participant. Reliability is broadly defined as the degree to which scales are free from error and, therefore, consistent (Nunnally and Bernstein, 1994). Reliability is operationalized through the internal consistency method. Cronbach's alpha is used as the reliability indicator and a value of 0.6 or above is considered acceptable. We eliminate the items that do not strongly contribute to Cronbach's alpha and whose content is not critical. Table 2 shows the Cronbach's alpha value for all scales. As can be seen, most of the scales exceed the lower limit by a substantial margin, indicating a good reliability of the measurement scales.

Table 2 Summary of measurement analysis

Measure Name	Mean	S.D.	Cronbach Alpha	Eigenvalue (% variance)
Process control	4.811	0.827	0.824	2.964(59)
Preventive maintenance	4.858	0.666	0.675	2.202(44)
Housekeeping	5.516	0.687	0.817	2.847(57)
Quality information	4.878	0.843	0.791	2.759(55)
Small group problem solving	5.046	0.640	0.824	3.211(54)
Employee suggestion	5.171	0.624	0.834	3.025(60)
Task-related training for employees	5.187	0.625	0.792	2.477(62)
Centralization of authority	3.488	0.862	0.756	2.018(67)
Integration between functions	5.136	0.599	0.808	3.006(60)
Process management	4.987	0.577	0.696	1.878(63)

Content validity is ensured through an extensive review of literature and empirical studies. Construct validity measures the extent to which the items in a scale all measure the same multivariate construct. Factor analysis is used to establish construct validity, and the results demonstrate that all scales are one-dimensional. The eigenvalues for each measurement scale are presented in Table 2, and the factor loadings by item are shown in the Appendix. The eigenvalue of the first factor for each scale is above the minimum eigenvalue of 1.00, and all factor loadings meet the criterion of larger than 0.6. Thus, all of items contribute to their respective scales, indicating a good construct validity.

After establishing satisfactory measurement performance, a dataset at the plant level is aggregated by averaging the item scores for each measurement scale. All scale responses are averaged into a single plant response per scale. Aggregating respondents across respondent category and collecting the same data from different respondents can help to address the issue of common method bias. Based on this plant-level data, the super-scale Process Management consisting of Process control, Preventive maintenance, and Housekeeping is subject to the same process of testing reliability and validity as above. This super-scale is found to be reliable and valid as shown at the bottom of Table 2, and it is computed by averaging the scores of its three measurement scales.

To further assess the reliability and convergent validity of higher order construct: Hard QM, Soft QM as well as super scale Process Management, Bagozzi and Yi's (1998) composite reliability (CR) index and Fornell and Lacker's (1981) average variance extracted (AVE) index were calculated. The results are reported in Table 3. CR are above the required threshold of 0.6 indicating an acceptable reliability. The AVE value exceeded the acceptable cut off point of 0.5 indicating convergent validity.

Table 3. Reliability and validity for higher order construct

Higher order construct	Composite reliability	Average variance extracted
Hard QM	0.961	0.925
Soft QM	0.822	0.608
Process Management	0.712	0.50

4. Hypothesis testing

Structural equation models (SEM) decompose the empirical correlation or covariance among the variables to estimate the path coefficients. SEM consists of two components: the measurement model and the structural equation model.

Hypotheses are tested using AMOS software. Absolute, incremental, and parsimonious measures are used to evaluate the overall model fit, since each set of measures provides different aspects and information on evaluating the model fit (Shah and Goldstein, 2006). Indices for absolute fit measures, such as the chi-squared value and Root Mean Squared Error of Approximation (RMSEA), assess how well a priori model reproduces or fits the sample data. Low χ^2, which is associated with a significance level exceeding 0.05, is considered indicative of good fit. However, the χ^2 measure is often criticized for its over sensitivity to sample size, especially where the sample size exceeds 200 respondents. We report χ^2 in this study, but it is not used to evaluate the fit. RMSEA is an alternative measure of absolute fit. It is a measure of fit per degree of freedom. Typically, models with a RMSEA value below 0.10 are treated as acceptable (Hair, et al. 2006, p748). Incremental fit indices measure the performance of the proposed model in comparison to some alternative baseline model, such as a null model that assumes all observed variables are unrelated. One of the most popular measures of this kind is the Comparative Fit Index (CFI), which ranges from 0 (no fit) to 1 (perfect fit). A commonly recommended value is 0.90 or above (Bentler, 1990). Parsimonious fit measures, such as normed Chi-Square (χ^2/d.f.) and the Parsimony Normed Fit Index (PNFI), 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 3 are associated with good-fitting models (Hair et al., 2006). PNFI is a member of the Tucker Lewis Index family and is also commonly used. A PNFI of

0.50 or above is desirable. The results for the two models evaluated are reported respectively below.

4.1. The model for SNPI

The overall fit statistics for the hypothesized model are χ^2 =35.807, df=17, χ^2/df =2.106, p-value=0.005, CFI=0.974, PNFI=0.450, RMSEA=0.068, which indicate an acceptable level of model fit according to the criteria mentioned above. All paths except the one from soft QM to speed of new product introduction (standardized coefficient=-0.28; p-value=0.180) are significant. The result is shown in Figure 2.

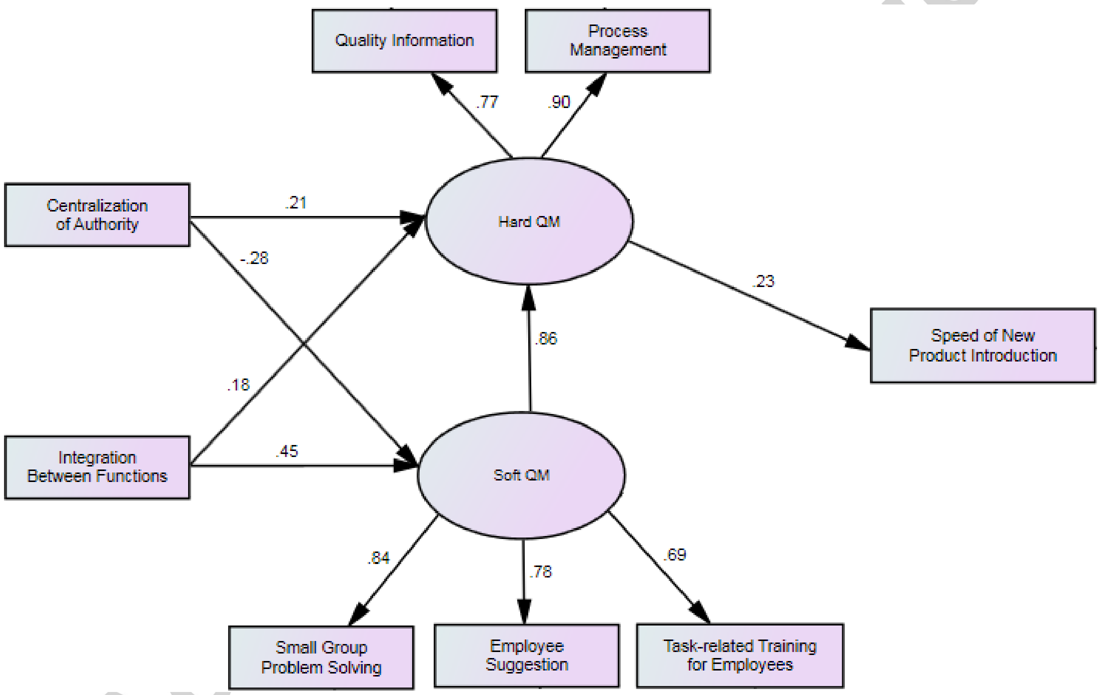


Fig 2. The result of the model for SNPI

Table 4 presents the estimated values of the standardized coefficients of all measurement scales to their related latent construct and the relative p-value. Some measurement scales do not present p-values in that the relative path coefficient is fixed at 1, as suggested in SEM theory. The two measurement scales of hard QM and three measurement scales of soft QM all have significant estimates of the standardized coefficients between 0.69 and 0.90. This result again demonstrates a good measurement model for both hard QM and soft QM.

Table 5 presents the analysis results of the structural model. Among seven hypotheses, six are supported and only one is rejected. The results indicate that soft QM positively influences hard QM supporting H1. Centralization of authority shows a positive impact on hard QM and a negative impact on soft QM suggesting support for H2 and H3. Integration between functions shows a positive impact on both hard QM and soft QM, which leads to the acceptance of H4 and H5. Hard QM positively influences innovation performance in terms of the speed of new product introduction, but soft QM does not show a significant impact on the speed of new product introduction. Therefore, H6a is supported, while H7a is rejected.

4.2. The model for PI

The overall fit statistics for the hypothesized model are χ^2 =37.196, df=17, χ^2/df =2.188, p-value=0.003, CFI=0.972, PNFI=0.449, RMSEA=0.071, which also suggest an acceptable level of model fit. Figure 3 shows the result. There is one insignificant path that is from hard QM to product innovativeness (standardized coefficient=-0.08; p-value=0.685).

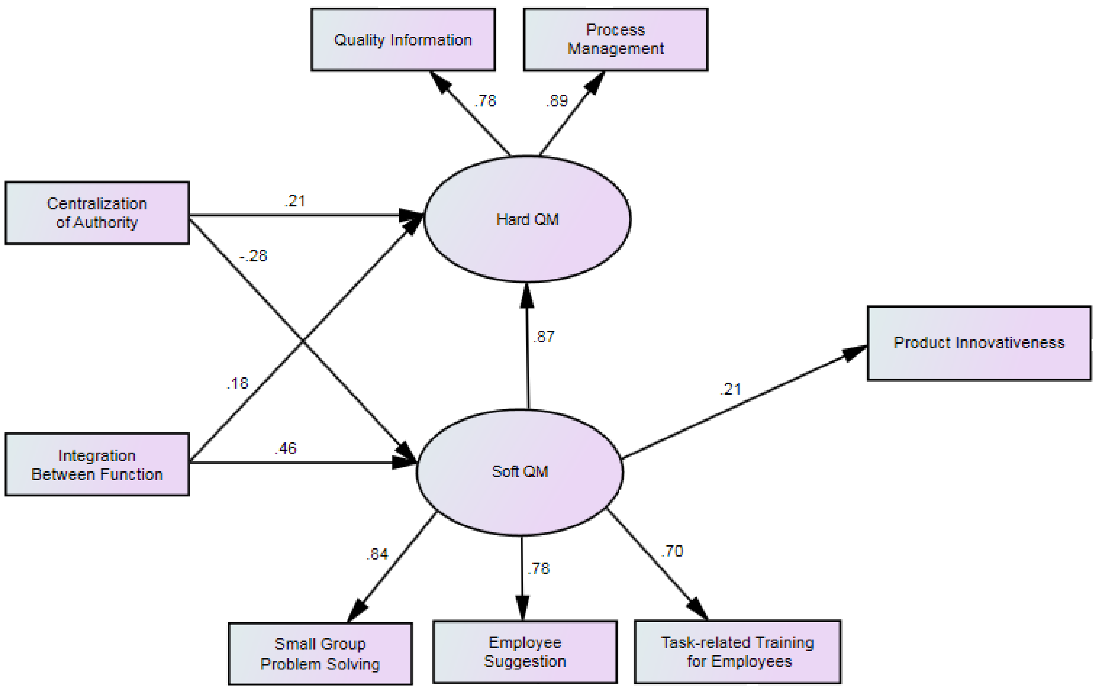


Fig 3. The result of the model for product innovativeness

As can be seen from Table 4, the result also demonstrates strong links between each observed variable to its respective latent construct (i.e., soft QM and hard QM) as indicated by the significance and coefficients of the paths.

As indicated by Table 5, among seven hypotheses, six are supported, and only one is rejected. The results indicate that soft QM positively influences hard QM supporting H1. The results also show that centralization of authority has a positive impact on hard QM and a negative impact on soft QM, suggesting support for H2 and H3. Both hard QM and soft QM are positively influenced by integration between functions, providing support for H4 and H5. Statistically, hard QM does not significantly affect product innovativeness, but soft QM does, rejecting H6b and supporting H7b.

Table 4 Results for the measurement model of hard QM and soft QM

Construct name	Measurement scales	Model for SNPI		Model for PI	
		Standardized Coefficient	p-value	Standardized Coefficient	p-value
Hard QM	Quality information	0.77	-	0.78	-
	Process Management	0.90	0.000	0.89	0.000
Soft QM	Small group problem solving	0.84	-	0.84	-
	Employee suggestion	0.78	0.000	0.78	0.000
	Task-related training for employees	0.69	0.000	0.70	0.000

Table 5. Results of the structural model of the impact of organizational context on hard QM, soft QM, and innovation performance

Model for SNPI				
Causing construct	Caused construct	Hypothesis	Standardized coefficient	p-value
Soft QM	Hard QM	H1	0.86	0.000
Centralization of authority	Hard QM	H2	0.21	0.000
Centralization of authority	Soft QM	H3	-0.28	0.000
Integration between functions	Hard QM	H4	0.18	0.000
Integration between functions	Soft QM	H5	0.45	0.000
Hard QM	Speed of New Product Introduction	H6a	0.23	0.001
Soft QM	Speed of New Product Introduction	H7a	Not supported	
Model for PI				
Causing construct	Caused construct	Hypothesis	Standardized coefficient	p-value
Soft QM	Hard QM	H1	0.87	0.000
Centralization of authority	Hard QM	H2	0.21	0.000
Centralization of authority	Soft QM	H3	-0.28	0.000
Integration between functions	Hard QM	H4	0.18	0.001
Integration between functions	Soft QM	H5	0.46	0.000
Hard QM	Product innovativeness	H6b	Not supported	

Soft QM	Product innovativeness	H7b	0.21	0.003

5. Discussion and implications

The findings and their implications are reflected in this section. First, most previous studies that examine the impact of the contextual factors on QM implementation (e.g. Das et al., 2000; Sila, 2007) consider QM as a single factor without giving consideration to the possible different impacts on the different dimensions that QM embodies. Zhang et al. (2012) raise the issue about how to customize the different dimensions of a quality system to match different contextual conditions. The findings in this study also address this concern by demonstrating that the organizational factors have different relationships with different dimensions of QM. While centralization of authority can facilitate the implementation of hard QM, it impedes the implementation of soft QM. Further studies need to give more attention to the different dimensions of QM subject to the influence of contextual factors.

Second, one of the interesting findings is that the paths for different dimensions of QM to achieve innovation performance under the influence of organization context vary on specific innovation indicators. The results show that when targeting the speed of new product introduction, leveraging hard QM that more focuses on the technical and mechanical elements of QM is essential. Hard QM can gain a direct support from centralized power, cross-functional integration, and soft QM promoting social elements. However, an excessive degree of centralization would be detrimental, realizing that it negatively relates to the soft QM. To facilitate QM to achieve a higher speed of new product introduction, the decision on the extent to which an organization is centralized depends on the way in which QM is implemented. Martínez-Costa and Martínez-Lorente (2008) note that the organizations would take different ways to implement QM by focusing more on the technical dimension or social dimension of QM. Organizations that emphasize the technical dimension of QM (hard QM) more, would benefit more by a great extent of centralization. This can assure that the QM tools and techniques can be well planned, controlled, and implemented to speed up the new product introduction. Comparatively, organizations that focus on the social dimension of QM (Soft QM) more by promoting employee empowerment, involvement, and addressing top management support find that the speed of new product introduction is hard to achieve when the organization is highly centralized. However, in either case where organizations emphasize hard QM or soft QM more, a high level of integration between functions is favorable and desirable. Soft QM tends to benefit more in such an environment, as suggested by the greater standardized coefficient for the effect of integration between functions on soft QM compared to that on hard QM. Together, a moderate degree of centralization and a high level of cross-functional integration with an integrated approach promoting both hard QM and soft QM can lead to a high speed of new product introduction.

Regarding the attainment of product innovativeness, the path from contextual factor to different dimensions of QM to product innovativeness is different. It is advised that organizations focus more on the social dimension of QM by establishing soft QM when targeting product innovativeness, since soft QM imposes a direct effect on product innovativeness as shown by the empirical findings. In this case, a decentralized organizational structure and a high level of integration between functions are highly helpful. However, focusing on QM tools and techniques does not seem to elevate the achievement of product innovativeness beyond improved quality.

This study contributes to the development of the literature in the following ways. The multidimensional view of QM is proven to be important and a useful lens that screens distinct paths going through either hard or soft QM dimension respectively leading to specific innovation indicators. Each QM dimension is subject to different influences of the organizational contextual factors and links to different innovation criteria. Earlier studies on the QM-innovation relationship were usually limited to simply treating a list of QM practices as a one-dimensional scale that influences innovation, which can lead to inconsistent results. Moreover, this study enhances our understanding of the effect of organization contextual factors on the dimensions of QM and innovation. It contributes to the use of a context-dependent approach in the QM arena, which is still scant and mainly theoretical. Furthermore, this study extends the boundary of the current regionally restricted studies by testing the causal relationship based on the global sample. By breaking down innovation performance in to specific indicators and demonstrating distinct paths leading to each innovation indicator, this study provides a more detailed and targeted approach for the organizations leveraging the role of organizational factors and multidimensionality of QM to achieve innovation.

6. Limitations and future research

It is important to view this study in the context of its limitations. First, the data used to conduct analysis was collected from 2003–2005. It is acknowledged that the implementation level of QM has become more widespread and pervasive across business organizations since these data were collected. However, we argue that the structural relationships between management practices and performance are likely to have remained fairly constant. The use of a longitudinal approach is desired to provide stronger inferences in this regard as well as providing opportunities for expanding the topic. Another limitation is that this study utilizes survey-based subjective and qualitative data. It asks managers their perception of innovation performance. Using subjective measurement allowed us to compare firms in different industries. There is no quantitative measurement item to evaluate innovation. Though this study adapts measurement items from the literature, future researchers need to develop more objective and comprehensive measurement items for extending this research. Further, it would be worthwhile to conduct case studies that investigates the causal relationship between organization context, QM dimensions, and innovation to complement our survey analysis. Case studies can offer in-depth insight on how organization contextual factors drive different QM dimensions to create innovation efficiently.

7. Conclusion

This study provides empirical findings on the role of organizational contextual factors that drive the application of the multidimensionality of QM to achieve the specific goal of innovation. The different ways that organizational factors influence QM implementation have been demonstrated, which also verifies the meaning and necessity of distinguishing dimensions of QM (hard QM and soft QM). Centralization of authority presents as a double-edged sword, helpful for the implementation of hard QM but harmful for the implementation of soft QM. On the other hand, integration between functions contributes to both dimensions of QM but has a stronger effect on soft QM. In response to the third research question, in-depth SEM analysis based on the breakdown of innovation performance reveals the specific innovation target, speed of new product introduction or product innovativeness, would require different approaches to achieve. The speed of new product introduction strongly relies on successful implementation of QM tools and techniques with soft QM as an underlying support, which desires a centralized organizational structure and strong functional integration. On the other hand, product innovativeness highly demands a quality infrastructure base that involves, empowers, and trains people for quality. A decentralized structure combined with strong integration between functions is beneficial for fostering product innovativeness through soft QM.

Appendix: Question items of measurement scales

Factor loadings are given in parentheses following each item.

(-) indicates the reversed items

Centralization of Authority

1. Even small matters have to be referred to someone higher up for a final answer (0.812)
2. This plant is a good place for a person who likes to make his own decisions. (removed)
3. Any decision I make has to have my boss's approval. (0.858)
4. There can be little action taken here until a supervisor approves a decision. (0.789)

Integration Between Functions

1. The functions in our plant work well together. (0.888)
2. The functions in our plant cooperate to solve conflicts between them, when they arise. (0.833)
3. The marketing and finance areas know a great deal about manufacturing. (removed)
4. Our plant's functions coordinate their activities. (0.835)
5. Our plant's functions work interactively with each other. (0.855)

Process Control

1. Processes in our plant are designed to be "foolproof" (0.581)
2. A large percent of the processes on the shop floor are currently under statistical quality control (0.815)
3. We make extensive use of statistical techniques to reduce variance in processes (0.825)
4. We use charts to determine whether our manufacturing processes are in control (0.734)
5. We monitor our processes using statistical process control (0.862)

Preventive Maintenance

1. We upgrade inferior equipment, in order to prevent equipment problems (0.689)
2. In order to improve equipment performance, we sometimes redesign equipment (0.542)
3. We estimate the lifespan of our equipment, so that repair or replacement can be planned (0.748)
4. We use equipment diagnostic techniques to predict equipment lifespan (0.734)
5. We do not conduct technical analysis of major breakdowns (0.578) (-)

Housekeeping

1. Our plant emphasizes putting all tools and fixtures in their place (0.698)
2. We take pride in keeping our plant neat and clean (0.811)
3. Our plant is kept clean at all times (0.856)
4. Employees often have trouble finding the tools they need (0.586) (-)
5. Our plant is disorganized and dirty (0.791) (-)

Quality Information

1. Charts showing defect rates are posted on the shop floor (0.758)
2. Charts showing schedule compliance are posted on the shop floor (0.754)
3. Charts plotting the frequency of machine breakdowns are posted on the shop floor (0.692)
4. Information on quality performance is readily available to employees (0.781)
5. Information on productivity is readily available to employees (0.726)

Small Group Problem Solving

1. During problem solving sessions, we make an effort to get all team members’ opinions and ideas

before making a decision (0.643)

2. Our plant forms teams to solve problems (0.805)
3. In the past three years, many problems have been solved through small group sessions (0.786)
4. Problem solving teams have helped improve manufacturing processes at this plant (0.775)
5. Employee teams are encouraged to try to solve their own problems, as much as possible (0.652)
6. We don't use problem solving teams much, in this plant (0.710) (-)

Employee Suggestion

1. Management takes all product and process improvement suggestions seriously (0.809)
2. We are encouraged to make suggestions for improving performance at this plant (0.780)
3. Management tells us why our suggestions are implemented or not used (0.764)
4. Many useful suggestions are implemented at this plant (0.819)
5. My suggestions are never taken seriously around here (0.711) (-)

Task-related Training for Employees

1. Our plant employees receive training and development in workplace skills, on a regular basis (0.854)
2. Management at this plant believes that continual training and upgrading of employee skills is important (0.779)
3. Employees at this plant have skills that are above average, in this industry (removed)
4. Our employees regularly receive training to improve their skills (0.879)
5. Our employees are highly skilled, in this plant (0.608)

References

Bell, R.R., Burnham, J.M., 1989. The paradox of manufacturing productivity and innovation. Business Horizons, 32 (5), 58-64.

Abrunhosa, A., Sá, P., 2008. Are TQM principles supporting innovation in the Portuguese footwear industry? Technovation, 28(4), 208-221.

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

Ahire, S.L., Ravichandran, T., 2001. An innovation diffusion model of TQM implementation. IEEE Transactions on Engineering Management, 48(4), 445–464.

Aiken, M., Hage, J., 1971. The organic organization and innovation. Sociology, 5(1), 63-82.

Anderson, J.C., Rungtusanatham, M., Schroeder, R.G., Devaraj, S., 1995. A path analytic model of a theory of quality management underlying the Deming management method: preliminary empirical findings. Decision Sciences, 26(5), 637–658.

Arauz, R., Matsuo, H., Suzuki, H., 2009. Measuring changes in quality management: an empirical analysis of Japanese manufacturing companies. Total Quality Management and Business Excellence, 20(12), 1337-1374.

Bagozzi, R.P., Yi, Y., 1998. On the evaluation of structural equation model. Journal of the Academy of Marketing Science, 16(1), 74–94.

Bentler, P.M., 1990. Comparative fit indexes in structural models. Psychological Bulletin, 107(2), 238-246.

Bostrom, R., Heinen, J.S., 1977a. MIS problems and failures: A soci-technical perspective, Part I: The causes. MIS Quarterly, 1(3), 17-32.

Bostrom, R.P., Heinen, J.S., 1977b. MIS problems and failures: A socio-technical perspective, Part II: The application of socio-technical theory. MIS Quarterly, 1(4), 11-28.

Bowen, D., Lawler, L., 1992. Total quality-oriented human resource management. Organizational Dynamics, 24(4), 39–41.

Damanpour, F., 1987. The adoption of technical, administrative and ancillary innovations: impact of organizational factors. Journal of Management, 13(4), 675-688.

Damanpour, F., 1991. Organizational innovation: a meta-analysis of effects of determinants and moderators. Academy of Management Journal, 34(3), 555-590.

Das, A., Handfield, R. B., Calantone, R. J., Ghosh, S., 2000. A Contingent View of Quality Management - The Impact of International Competition on Quality. Decision Sciences, 31(3), 649–690.

Deming, W.E., 1986. Out of the Crisis. MIT Press, Cambridge, MA

Deshpande, R., Farley, J.U., Webster, F.E. Jr., 1993, Corporate culture, customer orientation, and innovativeness in Japanese firms: a quadrad analysis. Journal of Marketing, 57(1), 23-7.

Dewar, R. D., J. E. Dutton. 1986. The adoption of radical and incremental changes: An empirical analysis. Management Science, 32(11), 1422–1433

Ebrahimpour, M., Withers, B.E., 1992. Employee involvement in quality improvement: A comparison of American and Japanese manufacturing firms operating in the U.S.. IEEE Transaction on Engineering Management, 39(2), 142-148.

Ettlie, J.E., 1990. What make a manufacturing firm innovative? Academy of Management Executive, 4(4), 7-20.

Everett, R.J., Sohal, A.S., 1991. Individual involvement and intervention in quality improvement programme: Using the Andon system. International Journal of Quality & Reliability Management, 8(2), 21-34.

Flynn, B.B., 1994. The relationship between quality management practices, infrastructure and fast product innovation. Benchmarking for Quality Management and Technology, 1(1), 48-64.

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), 659-691.

Flynn, B.B., Flynn, E.J., 1999. Information-processing alternatives for coping with manufacturing environment complexity. Decision Sciences, 30(4), 1021-1052.

Forza, C., Flippini, R., 1998. QM impact on quality performance and customer satisfaction: A causal model. International Journal of Production Economics, 55(1), 1-20.

Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 27 (February), 39–50.

Forza, C.,Salvador,F., 2001. Information flows for high-performance manufacturing. International Journal of Production Economics. 70(1),21–36.

Galende, J., De La Fuente, J.M., 2003. Internal factor determining a firm's innovative behaviour. Research Policy, 32(5), 715-736.

Garvin, D.A., 1984. Japanese quality management. Columbia Journal of World Business, 19(3), 3-12.

Germain, R., 1996. The role of context and structure in radical and incremental logistics innovation adoption. Journal of Business Research, 35(2), 117–127.

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.

Harari, O., 1993. The eleventh reason why TQM doesn't work. Management Review, 82 (May), 31-36.

Hung, H-M., 2007. Influence of the environment on innovation performance of TQM. Total Quality Management, 18(7), 715-730.

Hung, R.Y-Y., Lien, B.Y-H., Fang, S-C., McLean, G.N., 2010. Knowledge as a facilitator for enhancing innovation performance through total quality management. Total Quality Management, 21(4), 425-438.

Janz, B.D., Prasarnphanich, P., 2003. Understanding the antecedents of effective knowledge management: The importance of a knowledge-centered culture. Decision Sciences, 34(2), 351–384.

Jayaram, J., Ahire, S.L., Dreyfus, P., 2010. Contingency relationships of firm size, TQM duration, unionization, and industry context on TQM implementation – a focus on total effects. Journal of Operations Management, 28(4), 345-356.

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

Kim, D.Y., Kumar, V., Kumar, U., 2012. Relationship between quality management practices and innovation. Journal of Operations Management, 30(4), 295-315.

Kimberly, J.R., Evanisko, M.J., 1981. Organizational innovation: the influence of individual, organizational, and contextual factors on hospital adoption of technological and administrative innovations. Academy of Management Journal, 24(4), 689-713.

Lagrosen, Y., Lagrosen, S., 2005. The effects of quality management – a survey of Swedish quality professionals. International Journal of Operations & Production Management, 25 (10), 940–952.

Lawler, E.E., 1994. Total Quality Management and employee involvement: are they compatible? Academy of Management Executive, 8(1), 68–76.

Martínez-Costa, M., Martínez-Lorente, A.R., 2008. Does quality management foster or hinder innovation? An empirical study of Spanish companies. Total Quality Management, 19(3), 209–221.

McAdam, R., Armstrong, G., Kelly, B., 1998. Investigation of the relationship between total quality and innovation: a research study involving small organisations. European Journal of Innovation Management, 1(3), 139-147.

McAdam, R., 2004. Knowledge creation and idea generation: a critical quality perspective. Technovation, 24(9), 697-705.

Mokhtar, S.S.M., Yusof, R.Z., 2010. The influence of top management commitment, process quality management and quality design on new product performance: A case of Malaysian manufacturers. Total Quality Management, 21(3), 291-300.

Molina, L.M., Lloréns-Montes, J., Ruiz-Moreno, A., 2007. Relationship between quality management practices and knowledge transfer. Journal of Operations Management, 25 (3), 682–701.

Nahm, A.Y., Vonderembse, M.A., Koufteros, X.A., 2003. The impact of organisational structure on time-based manufacturing and plant performance. Journal of Operations Management, 21(3), 281-306.

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

Pasmore, W., Francis, C., Shani, A., 1982. Social technical systems: A North American reflection on empirical studies of the seventies. Human Relations, 35(12), 1179-1204.

Peng, D.X., Schroeder, R.G., Shah, R., 2008. Linking routines to operations capabilities: a new prospective. Journal of Operations Management, 26(6), 730-748.

Perdomo-Ortiz, J., González-Benito, J., Galende, J., 2006. Total quality management as a forerunner of business innovation capability. Technovation, 26(10), 1170-1185.

Pfeifer, T., Siegler, S., Varnhagen, V., 1998. Business excellence through a robust development process for innovative products. Total Quality Management and Business Excellence, 9(4&5), 191–194.

Plenert, G., 1996. Total Quality Management (TQM) Putting Structure behind the Philosophy. International Business Review, 5(1), 67-78.

Prajogo, D.I., Sohal, A.S., 2001. TQM and innovation: A literature review and research framework. Technovation, 21(9), 539-558.

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

Prajogo, D.I., Sohal, A.S., 2004. The multidimensionality of QM practices in determining quality and innovation performance – an empirical examination. Technovation, 24(6), 443–453.

Prajogo, D.I., Sohal, A.S., 2006. The relationship between organization strategy, total quality management (TQM), and organization performance—the mediating role of TQM. European Journal of Operational Research, 168(1), 35-50.

Rahman, S.-U., Bullock, P., 2005. Soft QM, hard QM, and organisational performance relationships: An empirical investigation. Omega, 33(1), 73-83.

Ravichandran, T., 2000. Swiftness and intensity of administrative innovation adoption: An empirical investigation of TQM in information systems. Decision Science, 31(3), 691-724.

Sadikoglu, E., Zehir, C., 2010. Investigating the effects of innovation and employee performance on the relationship between total quality management practices and firm performance: An empirical study of Turkish firms. International Journal of Production Economics, 127(1), 13-26.

Samaha, H.E., 1996. Overcoming the TQM barrier to innovation. HR Magazine, 41(6), 145–149.

Santos-Vijande, M.L., Álvarez-González, L.I., 2007. Innovativeness and organizational innovation in total quality oriented firms: The moderating role of market turbulence. Technovation, 27(9), 514-532.

Schonberger, R.J., 2007. Japanese production management: an evolution – with mixed success. Journal of Operations Management, 25(2), 403-419.

Schroeder, R.G., Flynn, B.B., 2001. High Performance Manufacturing: Global Perspectives. John Wiley & Sons, New York.

Sethi, R., Smith, D.C., Park, C.W., 2001. Cross-functional product development teams, creativity, and the innovativeness of new consumer products. Journal of Marketing Research, 38(1), 73–85.

Shah, R., Goldstein, S.M., 2006. Use of structural equation modeling in operations management research: Looking back and forward. Journal of Operations Management, 24(2), 148-169.

Shah, R., Ward, P.T., 2007. Defining and developing measures of lean production. Journal of Operations Management, 25(4), 785-805.

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.

Singh, P.J., Smith, A.J.R., 2004. Relationship between QM and innovation: An empirical study. Journal of Manufacturing Technology Management, 15(4), 394–401.

Song, X.M. and Parry, M.E., 1997. A cross-national comparative study of new product development processes: Japan and the United States. The Journal of Marketing, 61(2), 1-18.

Song, X.M. and Parry, M.E., 1999. Challenges of managing the development of breakthrough products in Japan. Journal of Operations Management, 17(6), 665-688.

Song, L.Z., Song, M. and Di Benedetto, C.A., 2011. Resources, supplier investment, product launch advantages, and first product performance. Journal of Operations Management, 29(1), 86-104.

Sousa, R., Voss, C.A., 2001. Quality management: universal or context-dependent? Production and Operations Management, 10(4), 383-404.

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 organization and total quality management: a comparison and critical evaluation. Academy of Management Review, 19(3), 446-471.

Subramanian, A., Nilakanta, S., 1996. Organizational innovativeness: Exploring the relationship between organizational determinants of innovation, types of innovations, and measures of organizational performance. Omega, 24(6), 631-647.

Walton, R.E., 1985. From control to commitment: transforming work force management in the United States. In: Clark, K., Hayes, R., Lorenz, C. (Eds.), The Uneasy Alliance: Managing the Productivity–Technology Dilemma. Harvard Business School Press, Boston, pp. 237–265.

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(2), 366-394.

Wilkinson, A., 1992.The other side of quality: ‘soft’ issues and the human resource dimension. Total Quality Management, 3(3), 323–329.

Yamin, S., Gunasekaran, A., Mavonda, F.T., 1999. Relationship between generic strategies, competitive advantage and organizational performance: An empirical analysis. Technovation, 19(8), 507–518.

Zeng, J., Phan, C.A., Yoshiki, M., 2015. The impact of hard and soft quality management on quality and innovation performance: An empirical study. International Journal of Production Economics,162,216–226.

Zhang, D., Linderman, K., Schroeder, R.G., 2012. The moderating role of contextual factors on quality management practices. Journal of Operations Management, 30(1-2), 12-23.