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

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**A B S T R A C T**

The results from studies of the relationship between total quality management (TQM) practices and firm performance and from those on the effects of TQM practices on various types of performance measures are mixed. There is no extensive empirical evidence about the effect of TQM practices on employee performance and innovation performance, and few empirical studies have investigated the mediating effect (indirect relationship) of one type of performance measure on the relationship between TQM practices and another type of performance measure. The objective of this study was to investigate the relationships between TQM practices and multiple performance measures and to examine the mediating effects of employee performance and innovation performance on the relationship between TQM practices and firm performance. The study used a cross-sectional survey methodology—we sent questionnaires to 500 randomly selected ISO 9001:2000 certified firms in different industries in the Marmara region in Turkey in 2005 and 2006 and obtained 373 usable questionnaires. After confirming the validity and reliability of the latent variables with confirmatory and exploratory factor analyses, we tested the model and hypotheses using structural equation modeling. Results of the study support the proposed hypotheses that employee performance and innovation performance partially mediate the relationship between TQM practices and firm performance. The study also provides managerial and research implications, research limitations, and suggestions for future studies.

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1. Introduction

Total quality management (TQM) is a systematic quality improvement approach for firm-wide management for the purpose of improving performance in terms of quality, productivity, customer satisfaction, and profitability. Since TQM practices have been embraced by many firms around the world for decades, they have earned the attention of many researchers from diverse areas. While there are many success stories related to TQM practices, some TQM programs have failed, and some authors (e.g., Bohan, 1998; Masters, 1996; Whalen and Rahim, 1994; McCabe and Wilkinson, 1998; Taylor and Wright, 2003) have found reasons for these failures.

Results from studying the relationship between TQM practices and firm performance have been mixed (e.g., Kaynak, 2003; Nair, 2006; York and Miree, 2004; Sadikoglu, 2004; Prajogo and Sohal, 2001; Hung, 2007), so a need remains to re-examine this relationship. Replication research contributes empirical generalizations and knowledge development, and consistent research results among multiple studies using a variety of methodologies give support to the strength and generality of research results (cf. Kaynak, 2003). Replication research also contributes to validating cause-and-effect relationships, uniting the empirical results of a discipline, and increasing knowledge by reducing type I errors, by evaluating the robustness and generalization of empirical results, and by developing theory through satisfying the criterion of reproducibility (cf. Nair, 2006).

In order to be competitive in a changing marketplace, firms must improve both quality and innovativeness (Feng et al., 2006; Hung, 2007; Irani et al., 2004). Continuous (incremental) improvement and breakthrough innovation both have their place in a firm (Irani et al., 2004). Some scholars (e.g., Prajogo and Sohal, 2004, 2001; Kaynak, 2003) have claimed that the effects of TQM practices on various types of performance measures differ. In addition, few empirical studies have investigated the mediating effect (indirect relationship) of one type of performance measure on the relationship between TQM practices and another type of performance measure (e.g., Kaynak, 2003; Prajogo and Sohal, 2006, 2004; Choi and Eboch, 1998; Sia, 2007). Moreover, there is no extensive empirical evidence about the effect of TQM practices...
on employee performance or the effect of employee fulfillment on firm performance (Sila, 2007).

Some scholars have suggested that future studies examine the direct and indirect effects of TQM practices on employee performance (cf. Sila, 2007), on the level of innovation (e.g., Feng et al., 2006), and on various performance measures (e.g., Kaynak, 2003; Stashhevsky and Elizur, 2000), and others have suggested investigating the correlation between quality performance and innovation performance (e.g., Prajogo and Sohal, 2001), and between innovation performance and firm performance (e.g., Mazzanti et al., 2006). The objective of this study is to investigate the relationships between TQM practices and performance measures and to examine the mediating effects of employee performance and innovation performance on the relationship between TQM practices and firm performance.

The paper is organized as follows. Section 1 introduces the importance and purpose of the research. Section 2 reviews quality management practices and summarizes the results of previous studies on the relationship between TQM practices and various performance measures. Section 3 presents the proposed research model, the hypotheses related to the relationship between TQM practices and performance measures, and the research methodology, including the survey instrument, data collection processes, and statistical analysis. Section 4 provides results from the data analyses, including sample demographics, and results from the explanatory and confirmatory factor analysis, tests for reliability and validity of the constructs, and the structural path analysis for latent variables. Section 5 presents discussions, results, further research implications, and research limitations. The final section, Section 6, concludes.

2. Theoretical background

After we thoroughly reviewed the literature, the TQM factors we developed in the questionnaire were leadership, training, employee management, information and analysis, supplier management, process management, customer focus, and continuous improvement, and the performance measures were employee performance, innovation performance, and firm performance. Although not exhaustive, these factor areas have often been considered the critical factors of TQM (e.g., Sila and Ebrahimpour, 2003; Conca et al., 2004; Claver et al., 2003). We briefly explain these factors in the following section.

2.1. Leadership

Leadership, unlike internal management control, is the management task of maintaining and practicing a vision of the organization with respect to customer requirements. Examples of visionary leadership are “clarity of vision, long-range orientation, coaching management style, participative change, employee empowerment, and planning and implementing organizational change” (Anderson et al., 1994, p. 480). Leaders’ effectiveness depends less on their position than on the respect and influence they have developed within the organization. According to Deming, management and leadership are different in that anyone with a vision who can lead others toward that vision can be a leader (Gluckman and Roome, 1993; Goetsch and Davis, 2006). TQM theory holds that, with a full commitment to a total quality setting, leaders can organize and synergize people’s activities to achieve the common goal of the organization.

2.2. Training

Training topics in a total quality setting involve technical skills (statistical process control methods such as control charts and Pareto diagrams, design tools such as design of experiments, and quality function deployment), supervision skills (managerial problem-solving tools), communication, new work procedures, teamwork, and customer relations (Flynn et al., 1994; Goetsch and Davis, 2006).

2.3. Employee management

Deming claimed that people in research, design, sales, and production must work interdependently as a team across traditional organizational functions, rather than working independently within their functions, in order to foresee problems in production that may be encountered and to improve the quality of the current and future product or service. Teamwork in design is fundamental in that loss of time and sales may occur if departments do not work as a team from the start (Deming, 1986; Walton, 1986; Hackman and Wageman, 1995). Functions work as a team in order to achieve a common goal and prevent subunit optimization (putting the needs of a unit ahead of the needs of the firm) (Dean and Bowen, 1994; Johnston and Daniel, 1991). Non-managerial employees can make significant contributions when they are empowered, so employee suggestions and participation are encouraged in a total quality setting.

2.4. Information and analysis

Managers should make decisions based on analysis of relevant data and information. Organizations measure, analyze, and review data and information to achieve strategic objectives and to anticipate and respond to any organizational or external changes. Managers in a total quality setting provide reliable, high-quality, and timely data and information for all key users, including employees and suppliers, to improve organizational efficiency, effectiveness, and innovation. Business needs and strategy determine the measures that will provide the critical data and information for decision-making (National Institute of Standards and Technology, 2006).

2.5. Supplier management

The vendors and purchasing departments in a TQM setting work together to reduce costs and improve quality continuously because teams bring consistency of effort along with knowledge. Deming’s Point 4 indicates the advantages of working with a single supplier and building a long-term relationship marked by trust and loyalty (Deming, 1986; Walton, 1986). Buyers should select suppliers on the basis of quality, rather than solely on the basis of cost, and should work with them to improve their quality practices (Hackman and Wageman, 1995).

2.6. Process management

Process management emphasizes activities, as opposed to results, through a set of methodological and behavioral practices. Process management includes preventive and proactive approaches to quality management, such as designing fool-proof and stable production schedules and work distribution to reduce variations and improve the quality of the product in the production stage (Kaynak, 2003; Flynn et al., 1995; Saraph et al., 1989).
2.7. Customer focus

Customer focus, which is the most important part of production, means producing and delivering products and services that fulfill customers' present and future needs and expectations. Customer focus also refers to exceeding customers' expectations in order to ensure long-term organizational success and survival (Deming, 1986; Dean and Bowen, 1994). In a total quality setting, regular contact with customers is maintained in order to identify their changing needs and requirements via such methods as focus groups and customer site visits, and performance is continuously measured against those requirements (Deming, 1986; Johnston and Daniel, 1991; Hackman and Wageman, 1995; Bullington et al., 2002). In fact, many firms use customer care indicators in performance evaluations of the employees (Wilkinson et al., 1993). Internal customers, whose work depends on the work of other employees, are also important, and employees must view themselves as customers of and suppliers to other employees (Evans and Lindsay, 1993; Dean and Bowen, 1994).

2.8. Continuous improvement

Continuous improvement refers to searching for never-ending improvements and developing processes to find better methods in the process of converting inputs into outputs. By improving interlinked processes, a firm can do a better job of satisfying customers' needs and expectations (Stevenson, 1996; Dean and Bowen, 1994). In his fifth Point, Deming proposed decreasing the proportion of defects and continuously improving product/service design (Deming, 1986).

In a total quality setting, work processes are reviewed and improved constantly (Spencer, 1994), and process-management heuristics are used to improve team problem-solving and decision-making (Hackman and Wageman, 1995). Reduction in variation improves output, the need for rework, mistakes, and waste of staff, machine time, and materials (Anderson et al., 1994; Walton, 1986; Johnston and Daniel, 1991).

3. Research model and proposed hypotheses

Tables 1 and 2 summarize study results of positive and negative (or non-significant) relationships or correlations between TQM practices and various performance measures, respectively. Fig. 1 shows the proposed research model of the relationship between TQM practices and performance measures.

The literature contains both negative and positive arguments about the relationship between TQM practices and innovation performance. Some authors (cf. Prajogo and Sohal, 2001; Weirach, 2006) have contended that employees of TQM firms work to improve the existing system incrementally by focusing on the details of the current quality process than new ideas to change substantially the current system of work. In addition, “management by fact” necessitates a set of data, tools, and techniques with which to analyze the existing system, leading to solutions based on prior experience and inhibiting innovative solutions. The negative viewpoint states that process management practices focus on improving the process by eliminating waste and obtaining efficiency and are not compatible with innovation. Promoting efficiency reduces slack resources, which is necessary in organizational efficiency. Customer focus also leads organizations to incremental improvements in current products and services that will satisfy the current needs of the existing customers, rather than to breakthrough (radical) improvements that will satisfy the latent needs of current and future customers.

The incremental approach results in achieving product conformance, rather than product innovation, and constrains the firm’s ability to innovate. Continuous improvement inhibits breakthrough improvement (innovation) since it focuses on incremental change, necessitates standardization in order to establish control, stability, and routine, and prevents people from thinking of radical changes in the organization.

However, positive viewpoint claims that TQM practices improve innovation performance. Deming assumed that any failure to meet strategic objectives is usually caused by the system, so the system should be worked on through new-idea generation and cooperation at all levels for continuous improvement. Since the focus of problem-solving is on the system, rather than on the people to solve problems, fear and mistrust tend to be eliminated in a TQM firm (Gluckman and Roome, 1993), so employees will contribute to new-idea generation for innovative new products and services that will delight customers. Furthermore, since management is responsible for producing innovative products that will meet the changing needs of the customers in a total quality setting, leadership encourages employees to participate in decision-making and to suggest innovative ideas for solving problems and improving products, services or processes so that innovative behaviors will nurture and develop within the organization (cf. Prajogo and Sohal, 2001). Moreover, empowerment, employee involvement, teamwork, and employee mindlessness will contribute to the success of organizational innovations, new-idea generation, and risk-taking in pursuit of delighting customers (cf. Prajogo and Sohal, 2001, 2003, 2004; Goetsch and Davis, 2006; Noe et al., 2000). Making decisions based on relevant, reliable, high-quality, and timely data and information will contribute to introducing innovative products and services in a timely and effective way, and to benchmarking the performance of the firm internally via performance management and externally with competitors. In addition, in today's rapid and continually changing environment, customers' needs and expectations also change. Focusing on the customer stimulates firms to delight customers by innovatively exceeding customer needs and expectations, which means going beyond conforming to standards, with new products and services that will maintain and improve their competitiveness in the market. Customer focus will encourage firms to search for new customer needs and expectations, to develop and introduce new products, and to continuously adapt to the market's changing needs (Prajogo and Sohal, 2001, 2003). Thus, the following hypothesis is proposed:

H1. TQM practices are positively related to innovation performance.

Employee performance refers to employee satisfaction, absenteeism, tardiness, commitment, motivation, and effort, while employee fulfillment means employees' feelings about satisfaction of their needs in the work. Employee fulfillment is often measured in terms of job satisfaction, job commitment, and pride of workmanship. Pride of workmanship is the employees' feelings about delivering quality products and services to customers (Anderson et al., 1994).

Participative leadership sets the tone for a quality culture because employees are considered valuable assets. Participative leadership motivates employees to direct their individual goals to the organization's goals, leading them to work harder. Employees do not feel fear or job insecurity in a total quality setting, and top management initiates open communication between employees and management and supports employee involvement and empowerment so that employees will feel a sense of ownership,
|---------------------|---------------------|-----------------------|----------------------------------|----------------------|----------------------|------------------------|---------------------|--------------------------|
self-actualization, loyalty to the organization, pride in their work, and satisfaction from that work (Goetsch and Davis, 2006; Deming, 1986; Flynn et al., 1995).

Employees’ continuous growth, learning, and development are facilitated in a total quality setting. They are not blamed for problems since about 85 percent of the problems are caused by the system, which is the responsibility of management. Employees are given training based on their needs to improve their skills and knowledge and help them do their jobs well (Goetsch and Davis, 2006).

Employees will feel more satisfied and absenteeism will be lower when their jobs include the core characteristics of skill variety, task identity (doing a meaningful unit of work), task significance, autonomy, and feedback, which are the cornerstones of effective employee management practices in a TQM firm (Hackman and Wageman, 1995).

Quality circles or quality improvement teams will help to make employees feel they are valued, respected, and important. Employee participation in decision-making and problem-solving, soliciting their ideas for improving and developing existing and new products, services, and processes, empowering them in managing their daily work, and teamwork will improve acceptance of decisions and changes made in the work place, employee commitment, quality of work life, turnover rate, absenteeism,
morale and motivation, job satisfaction, and work performance (Flynn et al., 1995; Fuentes et al., 2004; Rahman and Bullock, 2005; Mohrman et al., 1995; Deming, 1986). Effective process management practices will also improve employee fulfillment (Anderson et al., 1994, 1995).

Based on the reviewed literature, the following hypothesis is suggested:

**H2. TQM practices are positively related to employee performance.**

Customer satisfaction is the perceptions of customers concerning whether their needs and requirements are met by the products and services they buy (Anderson et al., 1994; Evans and Lindsay, 1993). An organization’s survival depends on the satisfaction of its customers (Deming, 1994, 1981–1982, 1986; Brah et al., 2002), so firms should use customer satisfaction to assess performance (Madu and Kuei, 1993).

Successful teamwork practices will increase employees’ knowledge of their jobs and the consistency of their efforts, and it will improve firm performance in areas such as reduced cost and improved quality. In addition, effective statistical analyses of relevant, current, reliable, and accurate data and information will facilitate monitoring of the management systems and processes for improving performance in a total quality setting (Gluckman and Roome, 1993; Corbett et al., 1998; Hackman and Wageman, 1995). Furthermore, successful supplier management practices will minimize total cost. Supplier performance, with respect to variability of the supplier’s products, product quality, delay, and rework, will improve when a firm works with a few suppliers, providing them necessary training and technology and monitoring their performance (Deming, 1986). Effective buyer–supplier management and information sharing improve processes and conformance quality performance of buyer and supplier (Yang et al., 2009). Moreover, effective TQM practices will stabilize processes to improve quality, scrap, rework, and inventory levels to minimize production cost and cycle time, and reduced cycle time will improve delivery performance and productivity (Sila, 2007; McAdam and Bannister, 2001). Reducing process variation will increase output uniformity and decrease nonconforming products, such as scrap and rework, since quality problems are solved proactively (Anderson et al., 1994; Forza and Filippini, 1998; Ahire and Dreyfus, 2000). Regular preventive maintenance will increase reliability and reduce interruptions in the production process, thereby improving product quality (Ho et al., 1999).

Giving priority to customers’ real requirements and future needs and maintaining close contact with customers to identify their needs continuously will help ensure customer satisfaction through improved quality products and services with reasonable prices, thus improving market share of the firm. Understanding and satisfying customer needs will lead to reductions in defective products and costs. Customer focus will also have a positive impact on relative product quality (Pragogo and Sohal, 2004), growth/share, profitability, and means of performance improvement, such as product loyalty. Customer focus encourages firms to search for knowledge about customers’ needs and expectations and to provide added value for their customers (Fuentes et al., 2004).

Reducing product variation will increase output and reduce the need for rework, mistakes, and waste in staff, machine time, and materials. The TQM philosophy insists on continuously improving performance in order to meet the challenges of relentless competition. Continuously improving processes, products, or service quality will reduce scrap and rework costs, reduce waste and non-value-added activities, and enhance productivity and lead time (Kaynak, 2003; Anderson et al., 1994; Walton, 1986; Johnston and Daniel, 1991). These advantages will enable the firm to obtain greater profitability by increasing profit margins (cf. Fuentes et al., 2004). Successful continuous improvement efforts will improve a firm’s processes, products, or services and enable it to meet and satisfy changing customer demands and needs (Anderson et al., 1994; Rungtusanatham et al., 1998). Based on the reviewed literature, the following hypothesis is suggested:

**H3. TQM practices are positively related to firm performance.**

Leaders in a total quality setting will motivate employees to produce new products or services by focusing on customers’ changing needs and expectations. Ensuring job security and managers’ responsibility for the problems caused by the systems in a TQM firm will eliminate fear and distrust among employees and improve their job satisfaction.

Satisfied and motivated employees will contribute to improving quality, generating new ideas for product, service, or process improvements, and introducing new products or services in the marketplace in a timely and effective way. Thus, the following hypothesis is proposed:

**H4. Employee performance is positively related to innovation performance.**

Firms introduce new products to meet changing and rising customer expectations, to improve customer satisfaction and loyalty, and thereby to become competitive in the market. New product design (innovation performance) will reduce costs, meet customers’ demands (Fuentes et al., 2004), and increase product quality (Pragogo and Sohal, 2003).

There is little empirical evidence about the effect of innovation performance on firm performance. Some authors have found that innovative firms had higher market share, growth rates, profit (Mazzanti et al., 2006; Department of Trade and Industry (DTI), 1993), and quality performance (Pragogo and Sohal, 2004) than non-innovators. Thus, the following hypothesis is suggested:

**H5. Innovation performance is positively related to firm performance.**

In a total quality setting, employee involvement in decision-making and performance improvement of process, product or service is highly valued, encouraged, and rewarded. In such a work environment, employees will work harder to improve the process, product, or service quality (Kaynak, 2003).

Hiring a new employee can be extremely costly (cf. Monk and Wagner, 2006). Moreover, high turnover rate causes firms to lose employees’ historical knowledge of the job, customers, and skills, which are crucial to being competitive. In a total quality setting, when problems occur because of employees, the employees are given necessary training or transferred to other positions, rather than hiring new employees. This practice will make the firm more competitive by saving the hiring cost and keeping valuable historical knowledge and skills of the existing human resources, which are difficult to quantify (Goetsch and Davis, 2006; Monk and Wagner, 2006). Incremental improvement of the existing processes can also come from learning curve, which means that an experienced worker will lead to a decrease in cost per unit over time (Anderson et al., 1994). Thus, employee retention will improve organizational effectiveness in terms of costs as a result
of less need for hiring and training activities (Koys, 2001) and improved productivity (Arthur, 1994).

Deming’s management method claims employee fulfillment and pride of workmanship contribute to customer satisfaction (Anderson et al., 1994). Focusing on internal customers’ needs and requirements, and employee performance, skills and motivation will improve manufacturing cycle times (McAdam and Bannister, 2001), (external) customer satisfaction (Evans and Lindsay, 1993), and work performance (cf. Soltani et al., 2003). When employees are satisfied with their jobs and salaries, they are more likely to continue to work in the firm, and the firm will save the direct and indirect costs of hiring a new employee (Evans and Lindsay, 1993; Dean and Bowen, 1994; Deming, 1994, 1981–1982, 1986).

Some authors have found that employee performance has a positive effect on customer satisfaction and loyalty (e.g., Testa et al., 1998; Hallowell et al., 1996; Heskett et al., 1994; Rucci et al., 1998; Harrison and Freeman, 1999; Sila, 2007; Hartline and Ferrell, 1996; Fuentes et al., 2004; Anderson et al., 1994, 1995), as well as on organizational effectiveness in terms of productivity, product, or service quality, and operational results (e.g., Grandzol, 1998; Ryan et al., 1996; Koys, 2001; Arthur, 1994). Based on the reviewed literature, the following hypothesis is offered:

H6. Employee performance is positively related to firm performance.

4. Research methodology

4.1. Measurement instrument and sample

We adapted items for TQM factors and performance measures from the studies of Rahman and Bullock (2005), Chong and Rundus (2004), Fuentes et al. (2004), Cua et al. (2001), Saraph et al. (1989), Kannan and Tan (2005), Prajogo and Sohal (2004), and Kaynak (2003). The questionnaire included a five-point Likert-type scale anchored at (1) strongly disagree and (5) strongly agree, indicating respondents’ disagreement or agreement with each item.

We used a cross-sectional survey methodology in this study, and the unit of the sample was at the plant level. The sample was selected randomly among firms who have ISO 9001:2000 quality assurance system certificates in different industries in the Marmara region in Turkey. Although being ISO-9000 certified does not ensure the firm has achieved real improvements in the quality of the processes, products, or services, and TQM implementation (Taylor and Wright, 2003), the certification is compatible with a subset of TQM (Goetsch and Davis, 2006; Montgomery, 2005). Following Conca et al. (2004), we used ISO-certified firms as respondents since they have had a head start on the TQM journey. We sent 500 questionnaires to the firms in 2005 and 2006, assuring confidentiality, and offering the resulting general firm profile for participating in the survey in order to obtain a high response rate. We requested perceived (subjective) data from the respondents in order to measure the intensity of TQM practices and performance measures of the firm. Respondents completed the questionnaires mostly via face-to-face interviews, but they also participated in the survey by mail, e-mail, and fax. We obtained 373 usable questionnaires, a response rate of 74.6 percent.

We conducted exploratory factor analysis (EFA) using principal component extraction with varimax rotation to identify factors with eigenvalues of at least one to obtain more-easily interpreted factor loadings. We added firm size and firm type variables to the equations as control variables to help make the results more credible and to mitigate potential missing-variable bias. We performed a bi-variate correlation analysis to identify the correlation of TQM factors with each other and with measures of firm performance, and operationalized a single composite TQM construct, following Hendricks and Singhal (1996, 1997), Easton and Jarrell (1998), Douglas and Judge (2001), and Rungtusanatham (2001). The TQM index, which equals the aggregate of the means of all TQM factors, can be formulated as follows:

\[
\text{TQM index} = \sum_{i=1}^{8} \frac{m_i \text{item}_{ij}}{m_i}
\]

where item \(_{ij}\) is the \(j\)th measurement item of the \(i\)th factor’s measurement scale and \(m_i\) the number of measurement items in the \(i\)th factor’s measurement scale. The use of TQM index will lessen some of the potential multicollinearity problems in the analysis.

We used confirmatory factor analysis (CFA) to refine the resulting scales in EFA and to assess unidimensionality and convergent validity of the measures. After confirming validity and reliability of the latent variables, we tested the model and the hypotheses using structural equation modeling (SEM) via path analysis. The effects of high correlations and potential for multicollinearity problem were reduced using SEM. The model was assessed by examining the goodness-of-fit statistics indices: ratio of \(\chi^2\) to degree of freedom, root mean square error of approximation (RMSEA), Akaike’s information criterion (CAIC), parsimony goodness-of-fit index (PGFI), parsimony normed fit index (PNFI), and comparative fit index (CFI).

5. Results of the analysis

5.1. Sample demographics

Table 3 provides a descriptive summary of the respondents.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Service (51.2%)*</th>
<th>Transportation (102 (27.3%))</th>
<th>Information technology (44 (11.9%))</th>
<th>Finance: (27 (7.2%))</th>
<th>Healthcare: (14 (3.8%))</th>
<th>Other (41 (1.1%))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job title</td>
<td>Senior manager (top manager, vice manager, human resource manager, or total quality manager): (76 (7%))</td>
<td>Middle manager (department manager or chief): (88 (26.3%))</td>
<td>Low-level manager (foremen): (81 (21.7%))</td>
<td>Employee (engineer or technician): (155 (41.6%))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of employees</td>
<td>Small (less than 150): (175 (46.9%))</td>
<td>Medium (between 150 and 250): (21 (5.6%))</td>
<td>Large (more than 250): (172 (46.1%))</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scope of operation</td>
<td>Regional: (28 (7.5%))</td>
<td>National: (232 (62.2%))</td>
<td>International: (106 (28.2%))</td>
<td>Global: (7 (1.9%))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sector</td>
<td>Private: (366 (98.1%))</td>
<td>Public: (7 (1.9%))</td>
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</tbody>
</table>

* Numbers in the parentheses give percentages of the corresponding values.
5.2. Results of the exploratory factor analysis

Before performing principal component analysis, we measured the homogeneity of the data for sampling adequacy. Table 4 shows a data matrix for the analysis of TQM practices and performance measures. As the table shows, the KMO measure is greater than the “middling” value of 0.7 (cf. Black and Porter, 1995), and the result of Barlett’s test (BT) is less than 0.05. Thus, the data have homogeneity and adequacy for principal component analysis.

We used independent and dependent variables (TQM factors and performance measures) together in EFA. As Table 5 shows, the final measurement instrument, with 53 items, included eight TQM factors and three performance measures, which explained 67.08 percent of the total variance, with the eigenvalue of more than one. All items in leadership, customer focus, and employee performance measures in the initial instrument were retained after EFA. The firm performance measure includes items related to operating performance, quality performance, and customer satisfaction.

5.3. Tests for reliability and validity of the constructs

Internal consistency reliability of the multiple-item measurement scale is measured by Cronbach’s alpha. We performed reliability analyses to ensure that the scale items measured the corresponding latent variables consistently and were free of measurement error using Cronbach’s alpha (cf. Kannan and Tan, 2005). There was no situation in which the reliabilities of the constructs would increase substantially if the items were deleted from the analysis. Since the TQM practices construct is operationalized as an aggregate of mean scores of eight TQM factor measurement scales, we calculated the reliability of the TQM index from the formula given in Runugsatanantham (2001, p. 666) and found the reliability of the TQM index was 0.97. Table 6 lists descriptive statistics, Cronbach’s alpha values, and Pearson correlations for the variables in the research model. The table shows that the alpha values of all TQM factors and performance measures surpassed the 0.70 threshold. All TQM and perceived performance scales had acceptable reliabilities since the values of alpha were equal to or higher than 0.70. One exception was the alpha value of 0.69 for the innovation performance measure, but this value is still acceptable since it is very close to the threshold value. Thus, the constructs had satisfactory reliabilities.

Prior to structural equation modeling (SEM), we tested the validity of the model. The items resulting from EFA were screened by conducting a CFA to determine whether they measured their related TQM practices and performance measures. All TQM practices and performance measures had statistically significant factor loadings on their assigned scales. The measurement model for all factors was estimated without constraining the covariance matrix of the factors. The confirmatory measurement model was found to be statistically acceptable at the 0.001 level of significance. The retained measurement items, the corresponding standardized factor loadings, and t values resulting from testing the items’ coefficients in CFA are given in Appendix A.

Content validity, the extent of coverage of the items in the issues measured, is related to the subjective evaluation of the validity of the 11 dimensions in this paper. These factors had content validity since their items were derived from an exhaustive review of the literature. Construct validity assesses how well the individual item is related with the scale. We retained items that had a factor loading of at least 0.50. Factor loading establishes unidimensionality of the measures used in this study. As shown in Table 5, all factor loadings of TQM scales and performance measures exceed the 0.50 threshold.

Convergent validity refers to the agreement of items that measure the same construct. CFA can be used to assess convergent validity (Bagozzi et al., 1991), so a test of each item’s path coefficient in CFA was used. All items load significantly on their respective constructs (with the lowest t value being 7.22), and each item’s coefficient was twice as large as its standard error. Thus, the measures indicated high convergent validity.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Data matrix for the analysis of TQM practices and performance measures.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy</td>
<td>0.94</td>
</tr>
<tr>
<td>Barlett’s test (BT) of sphericity</td>
<td>Chi-square</td>
</tr>
<tr>
<td></td>
<td>12,755.56</td>
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</tbody>
</table>

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<tr>
<th>Table 5</th>
<th>Rotated factor matrix of the TQM practices and performance.</th>
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<tbody>
<tr>
<td>Variables</td>
<td>Factor loadings</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Item #1</td>
</tr>
<tr>
<td>Leadership</td>
<td>0.66</td>
</tr>
<tr>
<td>Training</td>
<td>0.79</td>
</tr>
<tr>
<td>Employee management information analysis</td>
<td>0.79</td>
</tr>
<tr>
<td>Supplier management process management</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>0.75</td>
</tr>
<tr>
<td>Customer focus continuous improvement</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>0.58</td>
</tr>
<tr>
<td>Employee performance innovation performance</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>0.80</td>
</tr>
<tr>
<td>Firm performance</td>
<td>0.72</td>
</tr>
</tbody>
</table>
Discriminant validity shows the extent to which different factors are discrete. As Table 6 shows, the correlation coefficients between TQM factors and performance measures are lower than the reliability coefficients, so the measures have discriminant validity.

Criterion-related validity assesses the extent to which items in a construct correlate with an external variable. In this study, TQM practices are the predictors, and the three performance measures are the outcomes. The bi-variate correlations of the TQM index with employee performance, innovation performance, and firm performance are 0.65, 0.39, and 0.66, respectively. Since these correlations are statistically significant at the $p < 0.001$ level, there is strong criterion-related validity.

As evident in the results of bi-variate correlation, TQM variables show significant and positive correlations, indicating the interdependence of quality management practices. Relatively high multicollinearity between independent variables can cause difficulties in determining inferences based on regression estimates because of high standard errors of the estimated correlation coefficients. When $r$ is less than or equal to 0.8, the obtained results will be close to the true values (Asher, 1983); as Table 6 shows, the correlations among TQM practices were less than 0.8. In addition, we measured the variance inflation factor (VIF) to assess inflation in parameter estimates that are due to collinearities among TQM practices (multicollinearity) in the multiple regression analysis. Since VIF values of all TQM variables were less than 3, their multicollinearity did not have an undue effect on the least squares estimates. Normality tests for the variables used in the measurement model showed that the normality assumption was satisfied.

### Table 6
Descriptive statistics, Cronbach's alpha, and bivariate correlations for the variables in the research model*

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>Mean</th>
<th>S.D.</th>
<th>Alpha value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td>1.00</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3.99</td>
<td>0.64</td>
<td>0.83</td>
</tr>
<tr>
<td>Training</td>
<td>0.50</td>
<td>1.00</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3.82</td>
<td>0.85</td>
<td>0.89</td>
</tr>
<tr>
<td>Employee management</td>
<td>0.53</td>
<td>0.59</td>
<td>1.00</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3.68</td>
<td>0.74</td>
<td>0.92</td>
</tr>
<tr>
<td>Information and analysis</td>
<td>0.63</td>
<td>0.48</td>
<td>0.49</td>
<td>1.00</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3.98</td>
<td>0.64</td>
<td>0.79</td>
</tr>
<tr>
<td>Supplier management</td>
<td>0.50</td>
<td>0.39</td>
<td>0.54</td>
<td>0.46</td>
<td>1.00</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3.89</td>
<td>0.76</td>
<td>0.87</td>
</tr>
<tr>
<td>Process management</td>
<td>0.48</td>
<td>0.56</td>
<td>0.52</td>
<td>0.53</td>
<td>0.47</td>
<td>1.00</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3.40</td>
<td>0.82</td>
<td>0.87</td>
</tr>
<tr>
<td>Customer focus</td>
<td>0.57</td>
<td>0.43</td>
<td>0.55</td>
<td>0.51</td>
<td>0.57</td>
<td>0.46</td>
<td>1.00</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>4.14</td>
<td>0.65</td>
<td>0.87</td>
</tr>
<tr>
<td>Continuous improvement</td>
<td>0.47</td>
<td>0.44</td>
<td>0.47</td>
<td>0.47</td>
<td>0.50</td>
<td>0.43</td>
<td>1.00</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3.78</td>
<td>0.83</td>
<td>0.75</td>
</tr>
<tr>
<td>TQM index</td>
<td>0.76</td>
<td>0.75</td>
<td>0.79</td>
<td>0.75</td>
<td>0.73</td>
<td>0.77</td>
<td>0.74</td>
<td>0.72</td>
<td>1.00</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>30.68</td>
<td>4.45</td>
<td>0.97</td>
</tr>
<tr>
<td>Employee performance</td>
<td>0.26</td>
<td>0.24</td>
<td>0.37</td>
<td>0.29</td>
<td>0.34</td>
<td>0.22</td>
<td>0.34</td>
<td>0.25</td>
<td>0.39</td>
<td>0.34</td>
<td>1.00</td>
<td>–</td>
<td>4.05</td>
<td>0.73</td>
<td>0.69</td>
</tr>
<tr>
<td>Innovation performance</td>
<td>0.47</td>
<td>0.47</td>
<td>0.58</td>
<td>0.45</td>
<td>0.48</td>
<td>0.48</td>
<td>0.47</td>
<td>0.47</td>
<td>0.65</td>
<td>1.00</td>
<td>–</td>
<td>–</td>
<td>3.75</td>
<td>0.81</td>
<td>0.81</td>
</tr>
<tr>
<td>Firm performance</td>
<td>0.48</td>
<td>0.40</td>
<td>0.54</td>
<td>0.49</td>
<td>0.56</td>
<td>0.50</td>
<td>0.54</td>
<td>0.49</td>
<td>0.66</td>
<td>0.61</td>
<td>0.41</td>
<td>1.00</td>
<td>3.86</td>
<td>0.66</td>
<td>0.84</td>
</tr>
</tbody>
</table>

* N=373; all correlations are significant at the $P < 0.001$ level (2-tailed).

### Table 7
Results of the measurement model and structural model.

<table>
<thead>
<tr>
<th>Goodness-of fit statistics</th>
<th>Measurement model for TQM and performance</th>
<th>Structural model</th>
<th>Recommended values for satisfactory fit of a model to data</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\chi^2$/df</td>
<td>390.51/129→3.03</td>
<td>479.29/164→2.92</td>
<td>&lt;3.0</td>
</tr>
<tr>
<td>Root mean square error of approximation (RMSEA)</td>
<td>0.07</td>
<td>0.07</td>
<td>&lt;0.08</td>
</tr>
<tr>
<td>Akaike’s information criterion (CAIC)</td>
<td>681.22</td>
<td>797.68</td>
<td>&lt;Saturated model and independence model</td>
</tr>
<tr>
<td>CAIC for saturated model</td>
<td>1183.59</td>
<td>1453.53</td>
<td></td>
</tr>
<tr>
<td>CAIC for independent model</td>
<td>3618.23</td>
<td>3725.20</td>
<td></td>
</tr>
<tr>
<td>Parsimony goodness-of-fit index (PGFI)</td>
<td>0.68</td>
<td>0.69</td>
<td>&gt;0.5</td>
</tr>
<tr>
<td>Parsimony normed fit index (PNFI)</td>
<td>0.75</td>
<td>0.77</td>
<td>&gt;0.5</td>
</tr>
<tr>
<td>Comparative fit index (CFI)</td>
<td>0.92</td>
<td>0.99</td>
<td>&gt;0.90</td>
</tr>
</tbody>
</table>

### Table 8
Construct structural model.

<table>
<thead>
<tr>
<th>Links in the model</th>
<th>Hypotheses</th>
<th>Standardized parameter estimates</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Sign</td>
<td>Estimate</td>
<td>t value</td>
</tr>
<tr>
<td>TQM→innovation performance</td>
<td>H1</td>
<td>+</td>
<td>0.38</td>
</tr>
<tr>
<td>TQM→employee performance</td>
<td>H2</td>
<td>+</td>
<td>0.73</td>
</tr>
<tr>
<td>TQM→firm performance</td>
<td>H3</td>
<td>+</td>
<td>0.47</td>
</tr>
<tr>
<td>Employee performance→innovation performance</td>
<td>H4</td>
<td>+</td>
<td>0.16</td>
</tr>
<tr>
<td>Innovation performance→firm performance</td>
<td>H5</td>
<td>+</td>
<td>0.13</td>
</tr>
<tr>
<td>Employee performance→firm performance</td>
<td>H6</td>
<td>+</td>
<td>0.29</td>
</tr>
</tbody>
</table>

* $p < 0.1$.  
** $p < 0.05$.  
*** $p < 0.001$.  

5.4. Test results of the structural model

After CFA, the full latent variable model was tested. The results of the measurement model and structural model with the recommended values of the fit indices for the satisfactory fit of a model to data are shown in Table 7. The goodness-of-fit statistics was in the range of the recommended values of these fit indices, and no items were deleted in CFA since all the paths were statistically significant. Thus, the measurement model and structural model satisfactorily fit the data. Table 8 shows the SEM results of the relationship between TQM practices and three performance measures; each path gives the related hypothesis, estimated path coefficients, and t values. As the table shows, all the paths in the model are supported.

6. Discussion and study implications

Results of the study reveal that all TQM practices are significantly and positively correlated with all performance measures, that is, employee performance, innovation performance, and firm performance. Positive and relatively strong correlations indicate that firms that excel in one area are likely to excel in other areas as well.

Results of the study indicate that the synergies among TQM practices are significantly and positively related to all performance measures. Although conventional wisdom states that continual process improvement and radical (breakthrough) improvement cannot coexist in an organization, we found no negative effect of TQM practices on innovation performance and that, in fact, the contrary is the case: successful TQM efforts improve the performance of the firm in terms of radical innovation. Moreover, results of the study show that successful TQM efforts improve employees' (internal customer) motivation, satisfaction, pride-of-work, absenteeism, and turnover, since the employees are treated as valuable assets in a total quality setting. Based on our results, effective TQM practices improve quality performance (scrap, waste, etc.), operating performance (inventory, cost, productivity), and customer satisfaction.

Results of the study show that employee performance has a significant and positive effect on innovation performance and firm performance. The successful efforts of satisfied, motivated, and committed human resources generate innovative ideas for new products or services and improve quality performance, operating performances, and customer satisfaction directly. Furthermore, innovation performance has a significant and positive impact on firm performance; innovation of new products or services improves firm performance by reducing quality and operating costs and “delighting” the customers in terms of exceeding their current and latent requirements and expectations. The faster the firms introduce new products or services into the market, the higher the performance the firms obtain.

Results of the study also reveal that effective TQM practices improve innovation performance indirectly through employee performance. When managers treat employees as valuable assets and do not blame for the failures of the system, employees can become innovative thinkers and risk takers and improve the innovativeness of the firm. Satisfied and experienced employees have historical knowledge and insight on their external customers’ needs and requirements and the skills to innovate new products to satisfy the customers and improve competitiveness of the firm.

Results of the study also indicate that successful TQM efforts improve firm performance indirectly through employee performance. TQM practices create an environment and culture that motivates employees and helps them feel pride in their work, which leads to increased effectiveness and efficiencies, which improve quality performance, operating performance, and customer satisfaction.

Finally, results of the study show that successful TQM efforts improve firm performance indirectly through innovation performance. Customer focus, teamwork, and information and analysis practices help the firm determine customers’ current and changing needs and expectations, benchmark competitors, and introduce new products or services to improve firm performance. Results of the study also find that employee performance improves firm performance indirectly through innovation performance as employees generate ideas for new products or services to improve competitiveness of the firm.

6.1. Managerial implications

Managers can use the model periodically to assess where their firm stands in the TQM journey. They can also measure the effects of TQM practices on various performance measures in order to evaluate the effectiveness of TQM practices. The positive relationships between TQM practices and various performance measures can motivate the leaders of the firms to commit resources in time, effort, and capital to the implementation of TQM practices in pursuit of improved innovation, employee, and firm performances and, ultimately, competitiveness in the marketplace. Our results show that firms can combine continuous improvement and breakthrough innovation to improve performance and competitiveness. Firms should also work to improve the employees’ (internal customers’) satisfaction, motivation, commitment, and effort in order to improve innovation performance, customer satisfaction, and firm performance.

6.2. Research implications

Strategic planning is one of the key factors of TQM practices and can be added to the proposed model in a future study. A future study can also use multiple methods and multiple informants to eliminate potential common method bias and improve the ability of the findings to be generalized.

The mediating (indirect) relationships among TQM practices and relationships between each TQM practice and various performance measures can also be investigated in future studies. The moderating effects of contextual factors such as firm size, firm type, scope of operations, degree of competition, managerial knowledge, and ISO-9000 registration can be studied to evaluate complex relationships among these variables as well.

6.3. Research limitations

The study has several limitations. First, while the study collected perceived data about actual TQM practices and performance measures, some respondents might have been motivated to give desired data, that is, data that made their firms look good. In addition, because about 63 percent of the respondents were low-level managers and employees (engineers or technicians), they might not have evaluated correctly the current levels of firm performance. This error would cause concerns about generalizability, reliability, and validity of the study. However, since the model is reliable and valid in terms of exceeding the required threshold values, this bias would not cause serious problem.

Moreover, the study did not use objective measures of performance, which could have given more accurate information with which to test the hypotheses. However, using subjective measurement allowed us to compare firms in different industries.
Since the data for independent and dependent variables were collected from a single respondent in the firm, common method variance and common method bias might occur. We performed Harman's one-factor test to isolate artificial covariance resulting from common method variance as a post-hoc remedy (Podsakoff and Organ, 1986); the results showed that there is more than one factor in the unrotated principal component factor analysis solution of all variables and that the first factor explains 34.88 percent of variance out of total 67.08 percent variance. Thus, there is no substantial amount of common method variance in the study.

7. Conclusions

Results of the study illustrate the importance of continued efforts toward implementing TQM practices in firms by revealing the positive impacts of effective TQM practices on innovation performance, employee performance, and firm performance. Although conventional wisdom states that TQM practices are detrimental to breakthrough innovation, the study suggests that continuous improvement and process management can be combined with breakthrough innovation.

The study also shows that employee performance partially mediates the relationships between TQM practices and innovation performance, as well as that between TQM practices and firm performance, and that innovation performance partially mediates the relationship between TQM practices and firm performance. We also find that employee performance improves innovation performance and firm performance and that innovation performance improves firm performance and mediates the relationship between employee performance and firm performance. Results of the study indicate that employees are valuable and non-imitable sources in a firm in generating innovative ideas to introduce new products, services, or processes, increasing productivity, efficiency, and quality, in reducing costs, and in delighting customers. Thus, the study reveals that firms should focus and satisfy employees’ needs to improve performance, market share, and competitiveness. The study also finds that firms should improve innovativeness to become competitive in a changing marketplace. The study shows that firms should synergize employees’ performance and innovative potential to excel in their market.

Acknowledgements

The authors are grateful to B. Kerem Goktas and Songul Zehir for administering the questionnaires. We also thank the respondents who filled out the questionnaires for their cooperation. Finally, we thank two anonymous reviewers and Dr. T.C. Edwin Cheng for their comments and suggestions on the earlier version of this article.

Appendix A. Measurement scales, survey items, and their sources

A. Total quality management

Only the items that remained after the reliability tests, EFA, and CFA, are shown in the appendix. The first value in parenthesis gives the standardized factor loadings of the retained items. The second value represents the t value resulting from testing of each item’s coefficient in CFA.

A.1. Leadership (0.74).
All items in this scale were adapted from the study of Cua et al. (2001):

1. all major department heads within our plant accept their responsibility for quality,
2. plant management provides personal leadership for quality products and quality improvement,
3. all major department heads within our plant work toward encouraging JIT production,
4. our top management strongly encourages employee involvement in the production process,
5. plant management creates and communicates a vision focused on quality improvements,
6. plant management is personally involved in quality improvement projects.

A.2. Training (0.67, t value = 12.64).
Items 1–6, 7, and 8–11 in this scale were adapted from Saraph et al. (1989), Rahman and Bullock (2005), and Fuentes et al. (2004) studies, respectively.

1. Specific work-skills training (technical and vocational) given to hourly employees throughout the organization,
2. quality-related training given to hourly employees throughout the organization,
3. quality-related training given to managers and supervisors throughout the organization,
4. training in the “total quality concept” (i.e. philosophy of company-wide responsibility for quality) throughout the organization.

A.3. Employee management (0.77, t value = 14.56).
Items 1–5, 6, and 8–10 in this scale were adapted from Cua et al. (2001), Rahman and Bullock (2005), and Fuentes et al. (2004) studies, respectively.

1. During problem solving sessions, we make an effort to get all team members’ opinions and ideas before making a decision,
2. our plant forms teams to solve problems,
3. in the past 3 years, many problems have been solved through small group sessions,
4. problem solving teams have helped improve manufacturing processes at this plant,
5. employee teams are encouraged to try to solve their problems as much as possible,
6. ideas from production operators are actively used,
7. in this organization, teamwork is commonplace—the expected way of doing business,
8. in this organization, everyone participates in improving our products, services, and processes,
9. employees do not hesitate to voice their opinions, make suggestions, or inquire about any of the activities of the organization.

A.4. Information and analysis (0.71, t value = 13.37).
All items in this scale were adapted from Saraph et al. (1989) study:

1. extent to which quality data (cost of quality, defects, errors, scrap, etc.) are used as tools to manage quality,
2. extent to which quality data are used to evaluate supervisor and managerial performance,
3. thoroughness of new product/service design reviews before the product/service is produced and marketed,
4. clarity of product/service specifications and procedures,
5. extent to which implementation/producbility is considered in the product/service design process.

A.5. Supplier management (0.70, t value = 13.17).
All items in this scale were adapted from the study of Kannan and Tan (2004):
1. emphasizing quality instead of price in supplier selection,
2. considering commitment to quality in supplier selection,
3. considering process capability in supplier selection,
4. considering commitment to continuous improvement in supplier selection.

A.6. Process management (0.70, t value = 13.16).
Items 1–4 and 5–6 in this scale were adapted from Cua et al. (2001) and Saraph et al. (1989) studies, respectively:
1. a large percent of the equipment or processes on the shop floor are currently under statistical quality control,
2. extensive use of statistical techniques to reduce variance in processes,
3. charts to determine whether our manufacturing processes are in control,
4. monitoring processes using statistical process control,
5. training in the basic statistical techniques (such as histogram and control charts) in the organization as a whole,
6. training in advanced statistical techniques (such as design of experiments and regression analysis) in the organization as a whole.

A.7. Customer focus (0.72, t value = 13.65).
Items 1–2, 3–4, and 5–7 in this scale were adapted from Rahman and Bullock (2005), Chong and Rundus (2004), and Fuentes et al. (2004) studies, respectively:
1. customer requirements are disseminated and understood,
2. know our customers’ current and future needs,
3. we frequently are in close contact with our customers,
4. our customers frequently visit our plant,
5. managers and supervisors encourage activities that improve customer satisfaction,
6. satisfying our customers, and meeting their expectations, is the most important thing we do,
7. senior executives behave in ways that increases the importance of customers.

A.8. Continuous improvement (0.65, t value = 12.29).
All items in this scale were adapted from Fuentes et al. (2004) study:
1. many of our products/services have been improved in the recent past.
2. This organization has received recent compliment and recognition for improving its products/services/processes.

B. Employee performance
Items 1–2 and 3 in this scale were adapted from Fuentes et al. (2004) and Rahman and Bullock (2005) studies, respectively:
1. level of employee satisfaction (0.89),
2. level of absenteeism (0.56, t value = 11.35),
3. employee morale (0.88, t value = 20.47).

C. Innovation performance
All items in this scale were developed based on the criteria suggested by Prajogo and Sohal (2004):
1. the number of new products/services in our firm has increased in the last 5 years (0.65),
2. our firm is the first one offering new products/services in the market (0.80, t value = 7.22).

D. Firm performance
Items 1–2 and 3–5 in this scale were adapted from Kaynak (2003) and Fuentes et al. (2004) studies, respectively. This scale includes operating performance, quality performance, and customer satisfaction measures:
1. reducing customer complaints (0.84),
2. level of customer satisfaction (0.88, t value = 19.86),
3. products/services quality to meet or exceed customer’s demands (0.67, t value = 14.04),
4. delivery lead-time of purchased materials (0.57, t value = 11.36),
5. delivery lead-time of finished products/services to customer (0.57, t value = 11.36).

References