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THE ROLE OF QMS IN THE RELATIONSHIP BETWEEN INNOVATION CLIMATE AND PERFORMANCE

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ABSTRACT

The emergence of new global competitors, the convergence of high-technology industries and the increasing speed and cost of technological development promise an increasingly uncertain environment for organizations, making adaptation to changes in the environment a central theme in the study of the organization for both organization theory and strategic management. This paper is thus seeks principally to verify that, while innovation and QM alone do not possess the qualities required to provide organizations with sustainable competitive advantages, the bundle of innovation and QM together with other resources and competencies will allow organizations to obtain a competitive advantage and adapt to their environment. The results show that the factors determining innovation—such as resistance to change, cohesion, and workload pressures—have repercussions for the firms' capacity to adapt to their environment, and that a QM context facilitates this adaptation. Finally, we can conclude that a climate of support for innovation is positively related to the organization's performance.

Key words: Fit; Coalignment; Climate for Innovation; Quality Management; Performance

1. Introduction

Adaptation to changes in the environment has been a central theme in the study of organizations for years. This may be particularly true in fast-paced industries or hypercompetitive environments characterized by rapid technological change, shortened product life cycles, increasing competitive rivalry, and global competition (Gutiérrez-Gutiérrez, 2010). The past decade has witnessed an increase of interest in strategic flexibility, which gives a firm the ability to respond promptly to market opportunities and changing technologies. Technological advances in diverse fields such as communication and transportation have endowed organizations with the ability to carry out real-time market research, reduce new product development time and cost, offer a wider product line, mass customize products, and upgrade products at faster pace than ever before.

Many organizations have found it almost impossible to address these competitive forces without some major internal and external structural adjustments (Power and Reid, 2005) to provide greater innovative capacity. Organizations' responses to the demands in their environment can be classified along a *continuum* whose extremes emphasize defensive and proactive approaches. Both alternatives are viable ways of confronting environmental change; however, in a context characterized by dynamism in competition and markets, a proactive response can mean greater immunity. Under these circumstances, organizations continually maintain the rhythm of change and often cause change (Miles and Snow, 1994). It is therefore necessary to analyze how organizations anticipate the innovation required by their environment and restructure themselves internally in response to or in order to prevent change (Hurley *et al.*, 2005). The literature focuses attention increasingly on factors that act as barriers to innovation. However, it has paid only slight attention to the role played by the processes for implementing systems of quality management (QM). The implementation of a QM system is one of the alternatives that organizations have used to respond to the demands of an increasingly turbulent, unpredictable environment. Although QM and innovation remain two separate disciplines and this separation is accurate in some respects, it is also clear that the two fields share a wide number of common practices and methodologies. Both innovation and quality have been suggested by management scholars as key variables underpinning the creation of competitive advantage, especially in a turbulent environment where customers' needs are changing (Tamayo-Torres *et al*., 2011). Even, the hypotheses formulated by Kim *et al*. (2012) demonstrate that QM practices, through process management, are directly or indirectly associated with innovation. These findings provide vital insights for academics and practitioners interested in the relationship between QM practices and innovation. Choi *et al*. (2012) also demonstrate empirically that corporate process innovations exert positive effects on quality improvement and QM. Our research will analyze the influence that QM exercises as a critical factor on proactive processes of innovation.

Despite the foregoing, most empirical studies use indices of innovation that measure the number of times firms have changed, modified, or adopted different components or behaviors. They do not analyze the fit between the real level of innovation and the level required by the environment (*innovation gap*) as a variable to explain performance.

The literature identifies two foci to determine the concept of fit. The first is the direct fit approach to managers' perceptions of the congruence between firm innovation and environmental innovation. In this focus, the degree of fit between firm innovation and environmental innovation can be assessed by a single question (Cable and Judge, 1997). Second, the indirect fit approach (Kristof, 1996) involves a comparison of two separate measures, each representing comparable dimensions of firms and environment. Both indirect and direct fit approaches carry their own advantages and pitfalls in operationalizing fit constructs. Indirect fit can produce a separate and meaningful demonstration of the process of comparison between firms and environment. The direct fit approach has been criticized for its inherent inability to separate the independent effects of firms and environment and for potential response bias. In this research, we decided to use the second focus, since our objective was to have two separate measures, one for the firm and others for the environment, in order subsequently to analyze the degree of fit between the firm and the environment. The situation can thus arise in which the firm's level of real innovation does not reach the level required, even though the absolute level of real innovation or the number of changes carried out may be high from a manager's perspective. In this case, the adjustment is insufficient and management of the innovation inefficient. We call this way of measuring proactive adaptation the *innovation gap*, and we define it as the continuous search for and introduction of new ideas, products, and services in advance of other firms in the environment.

From our perspective, QM can influence the desirability of undertaking innovations or, more specifically, the environment-innovation coalignment measured by the innovation gap. This paper proposes, first, to show whether quality and innovation perform a fundamental role as combined joint alternatives in the management of firms. Second, we analyze factors that determine the technical innovation gap and the repercussions of QM implementation on that relation and on the capacity to adapt to the environment through innovation. This analysis will also enable us, on the one hand, to obtain information that will help managers to direct innovation in their organizations and, on the other, to determine the essential factors that stimulate organizations that have implemented QM to achieve better adaptation to the environment through innovation. To do this, the sections that follow first briefly review past conceptual studies of innovation and QM, as well as of the problems involved in measuring them. We then describe the sample and methodology of a field study that provides an initial test of our hypotheses. Finally, we present and discuss the findings and suggest implications for future research and practice.

2. Relation between Quality Management and Innovation

Most authors affirm that QM is not an obstacle to the development of innovation in organizations (Prajogo and Sohal, 2006). Bessant *et al*. (2005) consider the implementation of QM systems to be a strategy that supports innovation and contributes significantly in differentiating more and less innovative organizations. In the same way, Samaha (1996) suggest that QM helps to identify the processes that need to be renovated or replaced by new, more efficient ways of working in an organization. QM thus becomes a catalyst in innovation processes.

Vinodh *et al.* (2008) affirm that both QM and innovation have a common goal: to satisfy customer needs. This goal can be reached through the support that different QM practices give to incremental or radical processes of innovation (Geffen and Rothenberg, 2010). The former establishes that organizations can adopt two basic forms of innovation: imitation of innovations performed by other organizations or the development of their own innovations. Both kinds of innovation are easier to adopt in organizations that work in a QM context, as a result of the support for innovation that different principles promoted by quality management provide (Lorente *et al*., 1999). Among the QM principles and practices that help innovation, Lorente *et al*. underline the following: (1) continuous improvement causes employees to be more disposed to accepting new ideas; (2) orientation to the client induces changes in organizations to cover and satisfy clients' needs, stimulating innovation; (3) training programs develop knowledge and basic abilities in employees, making them better prepared to understand and accept new systems for performing their tasks; (4) *empowerment* and teamwork contribute to generating ideas for improvement on the part of the employees, encouraging innovation; and finally, (5) *benchmarking*, a completely innovative practice, whose goal is to discover whether other organizations do things better, helps the firm to copy, adapt and achieve the levels of efficiency of organizations that develop the best practices (Mellat-Parast *et al*., 2007).

Prajogo and Sohal (2001) analyze how three principles of quality management—orientation to the client, continuous improvement and teamwork—are related to innovation. They focus on orientation to the client that leads organizations to search for new needs and expectations of their clients. This induces innovation in terms both of development and introduction of new products and of continuous adaptation to changes in market needs. This principle is also characterized by the need to understand and surpass clients' expectations and needs, a way of acting closely related to innovation. Continuous improvement is impossible if the company does not innovate. Finally, *empowerment* causes the employees to feel a greater degree of autonomy, making them less limited by technical issues and rules and thus making their work more innovative. Further, teamwork, one of the most effective communication channels, is one of the key principles of organizational innovation. When people work in a team, their abilities and knowledge complement each other, encouraging the creation of new ideas and achieving greater innovation. Subsequently, Honarpour (2012) shows that quality management through five of its principles—customer focus, leadership, people management, supplier relation and continuous improvement—is directly related to innovation.

In the empirical studies that consider QM as a necessary strategy for the adoption of innovations, we would first call attention to the study by Flynn (1994), which sought to analyze the role of QM in the speed of developing new products. The study focuses on the following elements: leadership, relations with providers, orientation to the client, control processes, etc. The results indicate that certain practices, like leadership and upper management's support for quality efforts as well as the characteristics of the development of new products, create significant differences in the speed with which new products are introduced. More (1992) also analyzes the influence of QM on innovation and concludes that the relations of cooperation with clients are a key element in the innovation process, as they aid in the development of new products that satisfy the needs of clients.

Pekovic and Galia (2009) have affirmed that a company cannot be successful in managing innovation before it has developed the capability to manage quality. Thompson (1994) supports the idea that companies need to appreciate competitive dimensions, particularly between quality and innovation. They show that these dimensions are interrelated in cumulative performance, not as a trade-off between the two; only companies that are capable of synergistically managing both will survive in the global competition of the future.

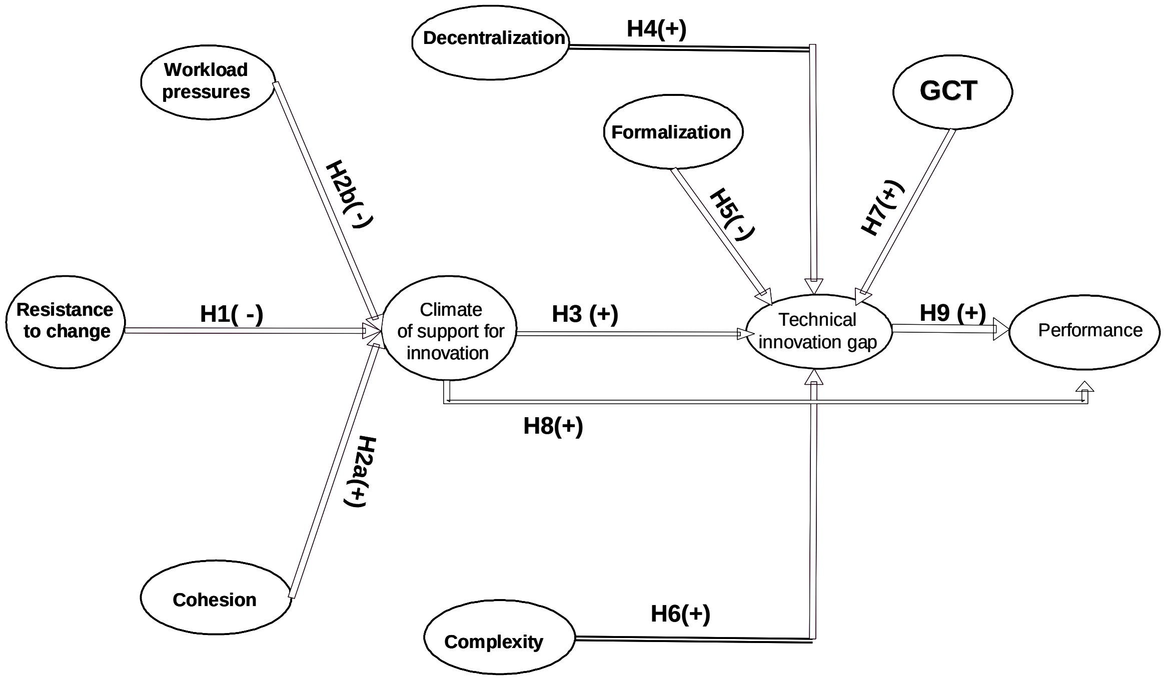
3. Research framework and hypotheses

The resource-based view (RBV) of the firm discusses the nature of resources possessed by organizations and details the qualities that such resources must maintain in order to be converted into sustainable competitive advantages over time (Barney, 1991). Advocates of this theory propose that an organizational resource must be valuable, rare, imperfectly tradable, and inimitable in order to provide the firm with a sustainable competitive advantage (Barney, 1991). To develop and maintain any potential competitive advantages, the organization must also possess the ability to effectively and efficiently exploit the full potential of its resources. Indeed, recent extensions of RBV theory note that sustainable competitive advantages are not achieved through the strategic utilization of any one resource, but through the bundling and revitalizing of multiple, distinctive firm resources and competencies to create valued outputs capable of becoming sustainable competitive advantages (Choi et al., 2010).

This perspective complements the dynamic capabilities framework of Teece *et al*. (1997), who maintain that, as business environments increase in dynamism and complexity, firms lose the ability to adapt incrementally and maintain existing competitive advantages. According to this framework, the key to establishing sustainable competitive advantage is related to the firm's abilities to bundle competencies and resources in order to build competitive advantage, while "exploiting existing internal and external firm-specific competencies to address changing environments" (Teece *et al.,* 1997, p. 510). Organizations possessing such skill can scan the environment for threats, opportunities, and pressures to change, build strategic competencies through learning to meet environmental requirements and customer needs, and bundle existing competencies with acquired or developed resources to extend or create competitive advantages (Lloréns-Montes et al., 2004).

The main thesis of this paper is that, while innovation and QM alone possess the qualities required to provide organizations with competitive advantages, the bundle of innovation and QM together with other resources and competencies will enable the organization to obtain a sustainable competitive advantage. We thus propose in Figure 1 the model through which we will attempt to verify the hypotheses that follow, and to determine whether there are differences between companies with some form of Quality Management system and companies without them.

Figure 1. Theoretical model



First, resistance to change is considered one of the factors influencing the orientation and the receptivity of the organization's members to new ideas and innovation (Zwick, 2002). To avoid negative response to their attempt to implement a climate supportive of innovation, managers should thus be aware that resistance to change exists among the members of their organization. For example, Leenders and Chandra (2013) consider that positive attitudes towards innovation of the managers of the company will stimulate innovations. In the same way, Keng-Boon *et al.* (2013) show that organizations adopting the right TQM dimensions may not only reduce the number of errors made and generate positive quantitative results, but also increase their employees' involvement, satisfaction level and commitment towards the organization.

Further, once they notice resistance to change, managers should work to understand the reason for this resistance, learn its origin and establish the strategies necessary to achieve the support and commitment of the organization's members to innovation. In a context of resistance to change, the manager thus performs an important labor in identifying the causes of resistance, its origin, and how to manage it. This cannot be carried out if the manager does not realize that resistance to change exists in the organization.

In the literature, we also find various studies that explicitly support the idea that members of firms that implement QM have a more positive orientation to change than firms that do not implement QM (Detert *et al.*, 2000). Weeks *et al.* (1995), for example, consider that the desire and ability to change is an important characteristic determining the potential success of QM processes; organizations that have implemented QM have an advantage with respect to those that have not in that they can count on employees who want to adapt themselves to change, lowering the resistance to any kind of innovation.

A QM context thus implies a positive orientation of the members of the organization to the change. Any organizational atmosphere that encourages continuous improvement and participation implies continuous support for change and a management strategy to reduce resistance to change. We therefore propose the following hypothesis:

H1: *The negative relation between resistance to change and the climate of support for innovation will be less significant in firms implementing QM.*

Different components of the organizational climate influence orientation, receptivity to new ideas and innovation. Thus, managers should encourage a climate characterized by strong cohesion among the members of the organization and possessing sufficient material resources, information, and time to perform the tasks assigned (Lovelace *et al*., 2001).

Correspondingly, the different principles and elements needed for successful QM implementation involve a change in the organizational climate (Nelson *et al*., 1999) of firms that have implemented QM with respect to those that have not. The internal-external cooperation and the principle of teamwork present in a QM context generate an organizational climate characterized by cohesion, cooperation and camaraderie among the different members of the organization (Detert *et al*., 2000). Likewise, the managers' collaboration and support of the organization's members together with the identification and measurement of weaknesses rather than strengths mean that the employees perform their tasks without workload pressures and provide information about personal errors and mistakes (Wruck and Jensen, 1994). We can formulate the following hypotheses:

H2a: *The positive relation between cohesion and the climate of support for innovation will be more significant in firms implementing QM.*

H2b: *The negative relation between workload pressures and the climate of support for innovation will be less significant in firms implementing QM.*

It is also necessary to create and sustain a climate of support for innovation among the organization's members to encourage the adoption of innovations (Wan *et al*., 2005). This means first that managers are responsible for developing the combination of positive values, beliefs and behavior toward innovation and, second, that a climate characterized by support for innovation provides the motivation and management necessary for monitoring the progress of organization's members toward innovation.

QM creates the necessary commitment to the development of a climate of support for innovation (McAdam and Armstrong, 2001). The principle of orientation to the client and continuous improvement of QM involve the identification and satisfaction of the clients' needs, which will create the base for generating ideas and seeking constant improvements in the organization, meaning a continuous climate of support for innovation in firms that have implemented QM. Taking these considerations into account, we have formulated the following hypothesis:

H3: *The positive relation between the climate of support for innovation and the technical innovation gap will be more significant in firms implementing QM.*

Innovation literature establishes that generation, development and implementation of new ideas and behaviors in the organization depend on the characteristics of the structure of the organization. Thus, the central-dual theory emphasizes that a structure characterized by high professionalism, low centralization and formalization facilitates the adoption of technical innovations (Damanpour, 1996).

The literature shows various studies that demonstrate implicitly or explicitly the differences between organizational structures in firms that implement QM and in those that do not. For example, Dean and Evans (1994) argue that firms that implement QM delegate a greater number of responsibilities and initiatives to employees than those that have not. Thus, QM implementation generates a new management paradigm, which involves the end of bureaucracy and its replacement by another structure. Firstly, this structure is characterized by greater decentralization (Dean and Evans, 1994); implementing principles of orientation to the client, teamwork and continuous improvement requires a greater delegation of responsibility and authority in decision-making among the different employees in the organization (Hartmann and Patrickson, 1998). Secondly, the structures are characterized by greater formalization (Prajogo and Sohal, 2001). QM requires the implementation and development of a series of driving or motivating elements, particularly management by processes. This driving element assumes that organizations should seek the most effective process for obtaining products and services that satisfy the needs and desires of their clients. Thus, when the organizations have determined the processes, it will be necessary to establish a series of generally documented specifications on how activities are executed. Likewise, the combination of demands from clients provided to the managers of different departments, the information on quality provided to most of the departments, and the information on progress toward goals for quality are also formally documented (Germain and Spears, 1999).

Thirdly, a QM context means more complex structures (Prajogo and Sohal, 2001). Implementing participation involves putting into practice a “parallel structure” (Shani and Rogberg, 1994). This structure is formed of different classes of teamwork (progress groups, quality circles and quality committees) responsible for identifying, analyzing and resolving problems related preferably to quality and function parallel to the formal structure. The foregoing discussion leads us to formulate the following hypotheses:

H4: *The positive relation between decentralization and the technical innovation gap will be more significant in firms implementing QM.*

H5: *The negative relation between formalization and the technical innovation gap will be more significant in firms implementing QM.*

H6: *The positive relation between complexity and the technical innovation gap will be more significant in firms implementing QM.*

Drawing on the foregoing discussion, on studies like that by Perdomo-Ortiz *et al.* (2009), who suggest that all the practices of an HRM system based on total quality management are suitable for improving innovation performance, and by Sadikoglu and Zehir (2010), who investigate the relationships between TQM practices and innovation performance as they benefit firm performance, we can establish that QM is not an obstacle to the adoption of innovations in the organization. On the contrary, QM encourages both the adoption and the different phases of the innovation process by means of its principles, elements and practices (Bossink, 2002).

H7: *Firms that implement QM possess a greater technical innovation gap.*

Although we can defend the relation between a climate of support for innovation and performance theoretically, we find relatively few empirical studies in the literature that try to analyze this relation. Several authors have verified the existence of a positive relation between different dimensions of the organizational climate in firms that include the climate of support for innovation and performance (Akgün *et al.*, 2009). The results of these studies confirm that managers who encourage a climate characterized by support for innovation will obtain better performance than those who do not recognize this relation. To support this relation, we propose:

H8: *Firms with a climate of support for innovation obtain better performance.*

Finally, the relation between innovation and performance has been analyzed in both theoretical and empirical studies. Thus, the theoretical strategy together with the theory of resources and capacities argues a positive relation between innovation and performance that enables the obtaining of competitive advantages, as Eschenbächer *et al.* (2011) explain in their paper on Apple. Various empirical studies also support this relation (Klomp and Leeuwen, 2001).Consequently, innovation can be considered a necessary component for improving the organization's performance and strengthening competitive advantage. The theory of strategic management also emphasizes that firms that are adjusted to the environment can improve their performance, while those that are not or that respond slowly have few possibilities for increasing their performance (Miles and Snow, 1994). As a result, organizations that obtain a greater technical innovation gap can improve their performance by adjusting to the demands of the environment. We can establish the following:

H9: *Firms with a greater technical innovation gap obtain better performance.*

4. Research method

Sample. The firms were randomly selected from the Duns and Bradstreet database, which includes the 50,000 largest companies operating in Spain. We decided to use CEOs as our key informants, since they receive information from a wide range of departments and are therefore a very valuable source for evaluating the different variables of the organization. They also play a major role in forming and molding these variables by determining the types of behavior that are expected and supported (Baer and Frese, 2003).

Surveys were mailed to managers of the 1500 selected firms along with a cover letter. The managers are characterized as follows: 42%firms that catalogue their activity as services, 36% as industrial and 22% both industrial and services. Further, 72.1% of the firms were large and 25.9% of medium size.

207 managers finally answered the questionnaire but, because of missing values, only 202 questionnaires were included in the research. The response rate was 13.8 percent. We analyzed whether there are significant differences between firms that responded right away and those that responded at the end of the time period. Considering that there were three response periods in the final sample—those we received with the first mailing, those received with the first reminder, and finally those received with the second reminder—we performed a variance analysis of the model variables. The results obtained confirm that there were no significant differences, and we did not find significant differences in type of business or

number of employees, between the respondents and the sample, or between early and late respondents.

Finally, we analyzed the possible risk of bias between non-respondents and respondents. The database provided secondary information on the number of employees and billing for all sample firms that did not respond. The Kolmogorov-Smirnov test did not show significant differences in occupation (p=0.496) or gender (p=0.633), nor did we find any other evidence of bias in the sample.

Measurement

Structure of the Organization. We will now describe the scales used for measuring the structure of the organization; first, complexity has been measured by a scale adapted from Van de Ven and Ferry (1980). The scale was composed of five items that measure the degree of horizontal differentiation and professionalism in an organization. To measure formalization, we adapted the scale proposed by Oldham and Hackman (1981). The scale is composed of nine items that include the existence of norms and procedures in the organization, the degree of monitoring of these norms and procedures by members of the organization, and the degree of variation permitted employees with respect to the rules and procedures that define their work. Finally, the decentralization scale used is a modification of the scale proposed by Hage and Aiken (1970). This scale was composed of 10 items that measure the degree of decentralization in terms of the frequency of participation in decision-making and the degree of influence in decisions. We validated our scale for the organizational structure using a confirmatory factor analysis, which indicated deletion of Items 4 and 5 from the scale of complexity, Items 6 and 9 from the scale of formalization and Items 4 and 9 from that of decentralization. After this deletion, item loadings were as proposed and significant ($p < .01$), showing evidence for convergent validity and high reliability (complexity: α = .8717; formalization: α = .9020; decentralization: α = .9190).

Organizational Climate. We based our measurement of the organizational climate on the scales of Koys and Decotis (1991). We developed a 7-point Likert-type scale composed of five items that include the organization's orientation to innovation, three items that include workload pressures and three items that represent cohesion in the organization. The results showed that the final scale was unidimensional and had high reliability (α = .9319 climate of innovation; α = .9222 cohesion; α = .8159 workload pressures).

Resistance to change. We measured resistance to change using the scale proposed by Dunham *et al*. (1989). This scale is formed of five items related to the knowledge, affective response and behavior toward change demonstrated by members of the organization. We validated the scales using a confirmatory factor analysis, which indicated deletion of Item 1 on the scale of resistance to change. After this deletion, item loadings were as proposed and significant ($p < .01$), showing evidence for convergent validity and high reliability (resistance to change α = 0.7850).

Performance. Performance was measured using the scale proposed by Venkatraman and Ramanujam (1986). To do this, we used a scale composed of seven items that capture financial, operative and organizational performance. We validated the scales using a confirmatory factor analysis, which indicated deletion of Items 2, 6 and 7 on the scale for performance. After this deletion, item loadings were as proposed and significant ($p < .01$), showing evidence for convergent validity and high reliability (performance: α = .9195).

Gap innovation. Finally, to measure innovation, we used studies of innovation to identify two perspectives for measuring this variable. Firstly, we drew up a closed list of innovations adopted by an organization over a period of time, as an indication of the number of innovations adopted. Secondly, we compiled all of the innovations that had taken place over a period of time. The first approach is more appropriate for studying organizations that develop more or less the same functions, as it permits them to adopt each of the innovations included in the list to achieve their objectives. However, since our research sample is composed of firms from different sectors, we used the second approach.

For this reason, based on the definition put forward by Damanpour (1991), we designed a Likert-type 7-point scale made up of four items that correspond to technical innovation. Managers were asked to indicate the number of innovations introduced by the organization over a three-year period, using 1 to indicate a low number and 7 to express a high number of innovations.

The variable we studied was the technical innovation gap, which implied the organization's constant search for and introduction of new ideas, products and services, before other firms in its environment. It was therefore necessary to double up the aforementioned items and to ask managers about the number of innovations introduced by the excellent firms in the sector. We used precisely these firms because, according to Parasuraman *et al*. (1993), perceptions of what is required cannot indicate an infinite ideal point but, rather, a feasible ideal point that reflects the reality perceived by the manager interviewed. Subsequently, we established the difference between the innovation introduced by excellent firms in the environment (required innovation) and that adopted by the organization (real innovation). This difference produces both positive values (required innovation – real innovation > 0), when the firm is somewhat rigid as regards the requirements of the environment; and negative values (required innovation – real innovation < 0), when firms show excess innovation. Since the innovation gap corresponds to a proactive attitude as regards the firms in the environment, we had to homogenize the data to be used by recodifying them and transforming the scale into positive values ranging from 1 to 13. The categories do not refer to the level of agreement or disagreement with the statement included in each item but rather to the level of difference between required and real values (from 13 to 1), 13 reflecting the highest magnitude of innovation and 1 the lowest. We validated our technical innovation gap scales using a confirmatory factor analysis for four items, which indicated deletion of Item 4. After this deletion, item loadings were as proposed and significant ($p< .01$), showing evidence for convergent validity and high reliability ($\alpha = .8144$).

QM. To investigate the effects of QM, we have divided the sample into firms with high and low degrees of QM implementation. To do this, we asked the manager to evaluate, first, whether QM had been implemented and, second, the degree of implementation of different QM elements, such as leadership, strategy, human resource management, processes management and resources management, using a scale from 1 to 5, where 1 signifies a low degree of implementation and 5 a high degree.

5. Results

We estimated effects via structural equation modeling (Bollen, 1989) using LISREL 8.30 with the correlation matrix and asymptotic covariance matrix as inputs. This type of analysis has the advantage of correcting for unreliability of measures and also gives information on the unique paths between constructs after potentially confusing variables are controlled for. We used a recursive non-saturated model, taking uncertain environment (ξ_1), complexity (ξ_2), cohesion (ξ_3), resistance to change (ξ_4), workload pressures (ξ_5), decentralization (ξ_6), and formalization (ξ_7) as the exogenous latent variables, the climate of support for innovation(η_1) as the first-grade endogenous latent variable, and technical innovation gap (η_2) and performance (η_3) as the second-grade endogenous latent variables. We verified the presence of sufficient individual reliabilities for the construct items, as well as of correct composed reliabilities and extracted variances of the latent variables (Table 1). Loadings indicate that each item loads significantly on its respective construct, suggesting that the measurement scale for each construct demonstrates high convergent validity.

Table 1. Validity, reliability and internal consistency of scales

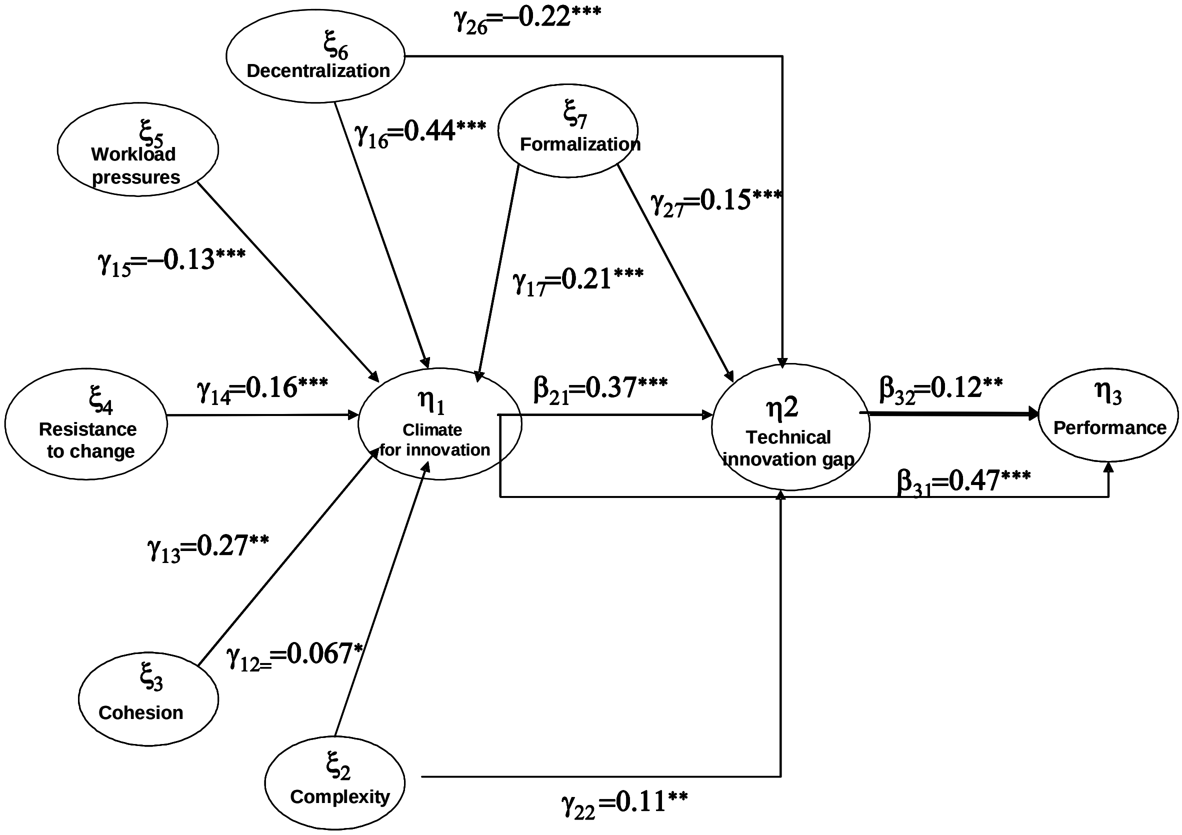
Variable	Item	Validity, Reliability and Internal Consistency		
		Λ*	R^2	A. M.
UNCERTAIN ENVIRONMENT	INCER1	0.68	0.46	α = 0.8273
	INCER2	0.86	0.73	C. R. = 0.791
	INCER3	0.70	0.49	E.V. = 0.561
COMPLEXITY	COMPPLE1	0.73	0.53	α = 0.8717
	COMPLE2	0.96	0.91	C. R. = 0.879
	COMPLE3	0.83	0.69	E. V. = 0.711
COHESION	COHES1	0.84	0.71	α = 0.9222
	COHES2	0.95	0.90	C. R. = 0.925
	COHES3	0.90	0.80	E. V. = 0.804
RESISTANCE TO CHANGE	RC2	0.80	0.64	α = 0.7850 C. R. = 0.845 E. V. = 0.660
	RC3	0.84	0.70	
	RC4	0.64	0.40	
	RC5	0.76	0.57	
WORKLOAD PRESSURES	PRES1	0.93	0.85	α =0.8159
	PRES2	0.66	0.43	C. R. = 0.811
	PRES3	0.71	0.50	E. V. = 0.594
DECENTRALIZATION	DESC1	0.77	0.59	α = 0.919 C. R. = 0.912 E. V. = 0.567
	DESC2	0.78	0.60	
	DESC3	0.76	0.57	
	DESC5	0.77	0.59	
	DESC6	0.75	0.57	
	DESC7	0.75	0.57	
	DESC8	0.76	0.59	
	DESC10	0.68	0.46	
FORMALIZATION	FORMA1	0.66	0.43	α =0.902 C. R. = 0.909 E. V. = 0.590
	FORMA2	0.67	0.45	
	FORMA3	0.89	0.78	
	FORMA4	0.74	0.55	
	FORMA5	0.83	0.69	
	FORMA7	0.77	0.59	
	FORMA8	0.80	0.64	
CLIMATE OF SUPPORT FOR INNOVATION	CLIMATE1	0.83	0.69	α =0.9319
	CLIMATE2	0.91	0.83	C. R. = 0.945
	CLIMATE3	0.88	0.78	E. V. = 0.709

	CLIMATE4	0.80	0.65	
	CLIMATE5	0.78	0.60	
TECHNICAL INNOVATION GAP	GAP1	0.71	0.51	α =0.8144 C. R. = 0.823 E. V. = 0.610
	GAP2	0.84	0.70	
	GAP3	0.79	0.62	
PERFORMANCE	DESEMP1	0.76	0.58	α =0.9195 C. R. = 0.823 E. V. = 0.734
	DESEMP3	0.92	0.84	
	DESEMP4	0.86	0.74	
	DESEMP5	0.88	0.78	

λ* = Standardized Structural Coefficient; R^2 = Reliability; α = Alpha Cronbach; C. R. = Compound Reliability; E. V. = Extracted Variance; f. p. = fixed parameter;
A. M. = Adjustment Measurement; *** p < 0.001 two-tailed.

Figure 2 shows standardized structural coefficients. Most of the coefficients are significant for a level of p<0.001, except the coefficients that represent the relation between the technical innovation gap and complexity and performance, which are significant at p<0.01, and the relation between complexity and climate of support for innovation, which is significant at a level of p<0.05. The overall fit measures, the multiple squared correlation coefficients of the variables, and the signs and significance levels of the path coefficients all indicate that the model fits the data well (χ^2_{825}= 1582.10, p < .001; NFI = .95; NNFI = 1.02; CFI = 1.00; RMSEA = .068). All of the modification indices for the beta pathways between major variables were small, suggesting that adding additional paths would not significantly improve the fit. The residuals of the covariance were also small and centered on zero. Inspection of the standardized parameter estimates showed that the hypotheses were supported. These results partially verify Hypotheses 1 to 6 and confirming Hypotheses 8 and 9.

Figure 2. Parameters and Relationship



□□and□□* = Standardized Structural Coefficient. * p< 0.05; ** p < 0.01; *** p < 0.001 two-tailed

Once we analyzed the significant relations on the theoretical model proposed, we performed the t-test for different means to determine whether the implementation of a QM program means that there are differences in the variables that compose the model. As can be observed in Table 2, for a significance level of p<0.01, statistically significant differences exist, taking QM as the independent variable and formalization and decentralization as the dependent variables. Likewise, for a significance level of p<0.05, statistically significant differences exist for the dependent variables of cohesion and performance. Finally, for a significance level of p<0.1, statistically significant differences exist for the dependent variables of climate of support for innovation and resistance to change. However, there are no statistically significant differences when we consider QM as the independent variable and technical innovation gap, complexity, and workload pressures as the dependent variables. These results lead us to reject Hypothesis H7.

Table 2.t-test for independent samples

Dependent variables	**MEANS**		
	No QM n=127	QM n=75	t
Technical innovation performance	7.653	8.017	1.470
Formalization	4.639	5.071	2.839***
Decentralization	3.738	4.249	2.813***
Complexity	3.475	3.560	0.342
Climate of support for innovation	5.1874	5.4853	1.897*
Cohesion	4.7402	51200	2.282**
Workload pressures	3.595	3.591	-0.024
Resistance to change	4.354	4.600	1.646*
Performance	4.162	4.685	1.989**

Level of significance ***p<0.01; **p<0.05*; p<0.1

Next, we will try to obtain more detailed information with respect to the differences in the significant relations between firms that implement QM and those that do not. To do this, we use a regression analysis, proposing different models, in order to accept or reject the proposed hypotheses. To ensure that the results are not affected by problems of multicollinearity, we calculated the tolerance indexes and inflation factors of the variance for each regression model. All cases maintained levels well below the recommended levels, indicating that the results are not affected by possible multicollinearity. Table 3 presents the results of the regression analysis for firms that have and firms that have not implemented QM.

Table 3. Results of regression analysis

Dep. Variables / Indep. Variables	Technical Innovation Gap				Climate of Support for Innovation			
	With QM N=127	Without QM N=75	With QM N=127	Without QM N=75	With QM N=127	Without QM N=75	With QM N=127	Without QM N=75
Decentralization	0.359*** 2.965	-0.169* -1.884						
Formalization	-0.029 -0.251	0.279*** 3.079						
Complexity	0.013 0.105	0.033 0.373						
Climate			0.303*** 2.714	0.203*** 2.319				
Workload Pressures					-0.166* -1.739	-0.030 -0.368		
Cohesion					0.555*** 5.827	0.408*** 4.957		
Resistance Change							0.427*** 4.036	0.483*** 6.174
R^2	0.128	0.085	0.092	0.041	0.355	0.170	0.182	0.234
F	3.469 p<0.05	3.827 p<0.01	7.366 p<0.01	5.379 P<0.01	19.780 p<0.01	12.665 p<0.01	16.292 p<0.01	38.116 p<0.01

Notes:* p < 0.05; ** p < 0.01; *** p < 0.001 two-tailed.
t-students are shown in parentheses below the variables.

We performed another regression analysis using the climate of support for innovation as dependent variable and the model of resistance to change as the explanatory variable. The results of the regression analysis are shown in Table 3. As can be seen, the model with QM is significant and explains 18.2% of the climate of support for innovation, and the variable is significant (t=4.036, p<0.001). The model without QM explains 23.4% of the variation in the climate of support for innovation, and the variable is also significant (t=6.174, p<0.001), partially rejecting Hypothesis H1.

Next, we performed a regression model using the climate of support for innovation as dependent variable and cohesion and workload pressures as independent variables. The independent variables explain a greater variance in the climate of support for innovation in firms that implement QM (model with QM R^2 =0.355; F=19.780, p<0.01; model without QM R^2 =0.170; F=12.665, p<0.01). Further, the parameters of the variables cohesion and workload pressures are more significant in the model for QM (model with QM t=5.827, p<0.001; t=-1.7939, p<0.1, respectively). These results enable us to accept Hypotheses H2a and H2b.

We then proposed a model using the technical innovation gap as dependent variable and the climate of support for innovation as the independent variable. As can be seen in Table 3, the sample equation explains a greater variance in the technical innovation gap for firms that implement QM (R^2 =0.092; F=7.366, p<0.01) than for those that do not (R^2= 0.041; F= 5.379, p<0.05), verifying Hypothesis H3.

We considered the technical innovation gap as the dependent variable and formalization, complexity and decentralization as the independent variables. In the model corresponding to firms with QM in relation to the innovation gap, the determination coefficient (R^2) was 0.128, with $F=3.469$, $p<0.05$, which means that the sample regression equation explains a significant percentage of the variance of the technical innovation gap. Further, the value of the t-student indicates that the parameter of decentralization is significant and positive for the technical innovation gap ($t=2.965$, $p<0.01$). In contrast, in the model for firms that do not implement QM, the determination coefficient (R^2) was 0.085 and the F-statistic was 3.827, $p<0.01$, indicating that the sample equation explains a significant percentage of the technical innovation gap, but less than the previous model. Further, the significant parameters for the technical innovation gap are decentralization, which influences negatively ($t=-1.884$, $p<0.1$), and formalization, which has a positive affect ($t=3.079$, $p<0.01$). These results lead us to accept Hypothesis H4 and reject Hypotheses H5 and H6.

6. Discussion and conclusions

In this section, we synthesize the results of the different parts of the paper, according to whether they are related to the climate of support for innovation, to the structure of the organization, to the technical innovation gap or to performance.

Resistance to change: The results obtained show that the relation between resistance to change and climate of support for innovation is significant. The results also indicate that significant differences exist with respect to resistance to change among firms that implement QM programs and those that do not; firms that implement QM have a more positive attitude to change in the organization than firms that do not. Moreover, for firms that implement QM and those that do not, resistance to change (measured as a positive attitude to change) exercises a positive and significant influence on obtaining a climate of support for innovation. However, managers of firms that do not implement QM perceive this relation more positively.

In a QM context, managers perceive the need for a positive attitude to change in order to develop a climate of support for innovation. Nevertheless, the same managers have begun to understand the reason for resistance to change, to learn where it comes from and to establish the strategies necessary for obtaining support and commitment to change from the organization’s members when implementing the QM system. This has led to less resistance to change in their organization and can mean less emphasis on this relation. In contrast, organizations that have not implemented QM programs and which thus have greater resistance to change in the organization are concentrated on the development of different strategies to confront this resistance, meaning that they perceive this relation more positively.

Cohesion: the results obtained in the analysis show that organizational climate is a fundamental element for the formation of a work environment that supports and encourages innovation. The organization needs an organizational climate characterized by a combination of people committed to one purpose, certain objectives and a common focus to achieve the desired results. Cohesion has a positive and significant influence on the climate of support for innovation.

We have also verified that managers of organizations that have implemented QM perceive a climate characterized by greater cooperation and camaraderie among members of the organization. Further, in both firms that implement QM and those that do not, cohesion exercises a positive and significant influence on obtaining a climate that supports innovation. However, managers of the organizations that have implemented QM perceive this relation more positively.

Workload pressure: The research has also enabled us to verify a significant and negative relation between workload pressures and the climate of support for innovation. However, we have confirmed that there are no significant differences in workload pressures between firms that implement QM and those that do not. This may be due to the fact that the assignment for achieving the objectives defined in each unit or area of the organization is a principle of general rationality in the design and management of each organization.

The results obtained confirm that the managers of the organizations that have implemented QM perceive the need to develop a climate for the support of innovation by creating a work environment characterized by fewer workload pressures. In contrast, managers of organizations that have not implemented QM do not perceive workload pressures as a determining factor for the development of an environment that supports innovation.

We can also affirm that the influence of a climate of support for innovation on the technical innovation gap is significant. Moreover, organizations that implement QM programs are characterized by a greater orientation to innovation than those that do not. Finally, in both firms, the climate of support for innovation exercises a positive and significant influence on obtaining the technical innovation gap. However, managers in firms that have implemented QM perceive this relation more positively.

With respect to the variables for organizational structure:

Decentralization: The results of the empirical study we have performed confirm the significant influence of decentralization on the technical innovation gap. On the one hand, the results permit us to confirm that significant differences exist regarding decentralization in firms that implement QM and those that do not. Organizations that implement QM have more decentralized structures than those that do not. On the other hand, the results allow us to verify, for firms that implement QM, that decentralization exercises a more positive and significant influence on obtaining the technical innovation gap. Managers in a QM context seek proactive adaptation by generating decentralized structures. In contrast, in firms that do not implement QM, decentralization exercises a significant and negative influence on obtaining the technical innovation gap.

Formalization: The empirical results of the research have verified a significant effect of formalization on the technical innovation gap. The results also verify that differences exist between firms that implement QM programs and those that do not. Organizations that implement QM have more formalized structures than those that do not. Finally, the results enable us to confirm that firms that implement QM perceive a negative and nonsignificant relation between formalization and the technical innovation gap. In contrast, firms without QM perceive a positive and significant relation between formalization and the technical gap.

Our results confirm the conclusions obtained by other studies of the influence of QM on the design of more formalized structures (Germain and Spear, 1999). Managers of the organizations that implement QM perceive that less formalized structures are necessary to improve the technical innovation gap, as the negative sign indicates, although they still do not consider the influence of this variable significant. This confirms the coexistence of two different subfoci in QM, one more oriented to control and formalization, the other with slight formalization and greater orientation to innovation and learning (Sitkin *et al*., 1994). The CEOs in this study believe that a high level of formalization of processes introduces rigidity into the organization’s behavior, imprinting a bureaucratic seal on the functioning of the firms and negatively affecting the achievement of the innovation gap. However, firm managers are still at a midpoint between the two subfoci and have not taken the necessary steps to implement definitively a QM system oriented to innovation and learning (*Total Quality Learning*) and characterized by the absence of formalization.

Complexity: It has been verified empirically that complex organizations have a significantly positive relation to the technical innovation gap. Likewise, we have confirmed that there are no significant differences in complexity between firms that implement QM and those that do not.

We find the explanation of these results in the scale of measurement for complexity, which was initially composed of five indicators but was reduced to three to assure reliability in the model of measurement for structure. QM implies more complex structures but is defined as the number of activities or subsystems identified in the organization.

If we analyze the results of the innovation gap (also considered as quantity of innovations), we must emphasize that the results of the global model support the theoretical arguments of the central-dual theory and those of previous works (Damanpour, 1996). The professionalism of the organization's members is consistently related to technical innovation. Innovations of a technical nature depend on the professionals in the technical center of the organization.

The study has enabled us to confirm that no significant differences exist between firms that implement QM and those that do not, with respect to the technical innovation gap, rejecting Hypothesis H8. These results are paradoxical, given that, as we confirmed with the verification of the previous hypotheses, QM implementation influences positively the relations between the determining factors and the technical innovation gap. One explanation of these contradictory results can be found in a conflict between espoused theory and theory-in-use (Garmendia, 1994). Upper management may believe it encourages one thing in its organization, while what it demonstrates and encourages in its actions is quite another. It is also possible that management's values and perceptions do not become employee practices (Hosfstede, 1994). Management can create a climate favorable to innovation, but these perceptions of the way that putting the innovation into practice will be compensated and supported may not be shared by the rest of the members of the organization. Innovation is not an individual activity; it is a collective achievement (Oerlemans and Knoben, 2010).

Finally, if we analyze performance, we can confirm by the empirical study that the climate of support for innovation exercises a positive effect on the organization's performance. We have thus verified empirically that the existence of a climate of support for innovation is an important determinant of the organization's performance.

We can also establish a positive relation between the technical innovation gap and performance, confirming the existence of a positive and significant relation. Further, these results support those obtained in previous studies on the importance of innovation as an element for enhancing the organization's performance (Capron, 1999). However, our study adds empirical evidence, showing that a higher level of technical innovation with respect to excellent firms in the sector is an important element for obtaining improvements in performance.

7. Implications, limitations and future lines of research

Our review of the literature leads us to propose the combined consideration of QM and innovation based on the fact that the two currents of research have points in common. Managers of firms that implement QM will also be able to obtain a higher level of adaptation to their environment through innovation, which allows them to improve performance and achieve competitive advantages with respect to firms that have not implemented QM, as long as they take into account the following considerations:

First, innovation is not an individual act. As this study has shown, it is not enough for management to value innovation; innovation must be a practice of the organization. This leads us to consider the importance of going beyond the values of upper management and their expression in policies and procedures to ensure the implementation of innovation. It is important to consider the congruence of the innovation with the values of the specific groups in the organization that will be affected.

The second consideration is that managers should implement a climate of support for innovation by developing a work climate characterized by cooperation between the members of the organization and availability of the resources needed to perform their tasks, that is, more cohesion and fewer workload pressures. Likewise, managers of organizations must continue to focus on developing strategies such as education about change for the organization's members; communication with those affected concerning the nature and extent of the change; the participation, development and implementation of training programs in which the organization's members are recycled and can expand and even transform their knowledge to adapt themselves to the requirements of innovation; and finally emotional support and understanding for those affected, through the use of formal and informal methods. Managers should continue on their path to reducing resistance to change among the members of the organization by implementing the strategies mentioned above.

The third consideration is that, if firms that implement QM wish to achieve a proactive adaptation to the environment through technical innovation, they must continue to advance in developing a QM focus less oriented to formalization and control.

The results of this research should be analyzed taking into account an important limitation. Because we have used a transversal analysis, relations of causality should be treated with some caution. To decrease this problem, we incorporated a temporal dimension into the relations between variables in the phrasing of some questions, in which the person interviewed had to consider the time frame.

We would also emphasize several lines of investigation that could be pursued in the future. First, the analysis of the different forms of adaptation to environment through innovation should be developed in greater depth. It would be useful to consider proactive adaptation to the environment, to focus on reactive adaptation to environment through innovation and to contrast the results.

Finally, the line of research on the relation between QM and innovation could be expanded to consider different QM elements—leadership, management of human resources, etc.—and to analyze their influence both on the innovation gap and on determinants of innovation.

References

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

Akgün, A.E., Keskin, H. and Byrne, J., 2009. Organizational emotional capability, product and process innovation, and firm performance: An empirical analysis. *Journal of Engineering and Technology Management*, 26, 103-130.

Baer, M. and Frese, M., 2003. Innovation is not enough: climates for initiative and psychological safety, process innovations, and firm performance. *Journal of Organizational Behavior*, 24, 45–68.

Barney, J.B., 1991. Firm resources and sustained competitive advantage. *Journal of Management*, 17, 99-120.

Bessant, J., Lamming, R., Noke, H. and Philips, W., 2005.Managing innovation beyond the steady state.*Technovation*, 25, 1366-1377.

Bollen, K.A., 1989. Structural equations with latent variable. United States of America: Wiley-Inter-science Publication.

Bossink, B.A.G., 2002. The strategic function of quality in the management of innovation.*Total Quality Management*, 13 (2), 195-205.

Cable, D.M. and Judge, T.A., 1997. Interviewer perceptions of person-organization fit and organizationalselection decisions, *Journal of Applied Psychology*, 82 (4), 546-561.

Capron, L., 1999. The long-term performance of horizontal acquisitions.*Strategic Management Journal*, 20, 987-1018.

Choi, D.O., Jongeun, O., Yeonbae, K. and Junseok, H., 2010. Competition in the Korean Internet portal market: Network effects, profit, and market efficiency. *Review of Industrial Organization*, August.

Choi B., Kim, J., Leem, B., Lee, C. and Hong, H., 2012.Empirical analysis of the relationship between Six Sigma management activities and corporate competitiveness: Focusing on Samsung Group in Korea. *International Journal of Operations & Production Management*, 32 (5), 528-550.

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

Damanpour, F., 1996. Organizational complexity and innovation: developing and testing multiple contingency models. *Management Science*, 42 (5), 693-716.

Dean, J.W. and Evans, J.R., 1994. Total Quality Management, organization and strategy.St. Paul: West Publishing.

Detert, J.R., Schroeder, R.G. and Mauriel, J.J., 2000. A framework for linking culture and improvement initiatives in organizations.*Academy of Management Review*, 25 (4), 850-863.

Dunham, R.B., Grube, J.A., Gardner, D.G., Cummings, L.L. and Pierce, J.L., 1989. The development of an attitude toward change instrument, paper presented at Academy of Management Annual Meeting, Washington, DC.

Eschenbächer, J., Seifert, M. and Thoben, K., 2011. Improving distributed innovation processes in virtual organisations through the evaluation of collaboration intensities. *Production Planning & Control*. 22 (5), 473–487.

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

Garmendia, J.A. 1994, Tres culturas. Madrid: Esic Editorial.

Geffen, C. and Rothenberg, S., 2010. Suppliers and environmental innovation: The automotive paint process. *International Journal of Operations and Production Management*, 20 (2), 166-186.

Germain, R. and Spear, N., 1999. Quality management and its relationship with organizational context and design.*The International Journal of Quality and Reliability Management*, 16 (4), 371-391.

Gutiérrez-Gutiérrez, L.J., Tamayo-Torres, J. and García-Morales, V.J., 2010. Un estudio empírico del impacto de las iniciativas actuales de gestión de la calidad sobre la innovación y flexibilidad organizativa. *Revista Española de Financiación y Contabilidad*, 148, 677-709.

Hage, J. and Aiken, M., 1970.Social change in complex organizations.New York: Random House.

Hartmann, L.C. and Patrickson, M., 1998. Individual decision making: Implications for decision training in TQM. *International Journal of Quality and Reliability Management*, 15 (6), 619-633.

Hofstede, G., 1994. Cultures and organizations: Software of the mind. London: Harper Collins Publishers.

Honarpour, A., Jusoh, A. and Khalil, M. 2012. Knowledge management,Total Quality Management and innovation**:**A new look**.***Journal of Technology Management & Innovation*, 7 (3), 22-31.

Hurley, R.F.,Hult, T.M. and Knight, G.A., 2005. Innovativeness and capacity to innovate in a complexity of firm-level relationships: A response to Woodside. *Industrial Marketing Management*, 34, 281-283.

Keng-Boon, O., Voon-Hsien, L., Alain Yee-Loong, C. and Binshan, L., 2013. Does TQM improve employees' quality of work life? Empirical evidence from Malaysia's manufacturing firms. *Production Planning & Control*, 24, 72-89.

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

Klomp, L. and Leeuwen, G., 2001. Linking innovation and firm performance: A new approach.*International Journal of the Economics of Business*, 8 (3), 343-364.

Koys, D.J. and Decotis, T.A., 1991. Inductive measures of psychological climate. *Human Relations*, 44, 265-285.

Kristof, A.L., 1996 Person-organization fit: An integrative review of its conceptualizations, measurement, and implications.*Personnel Psychology*, 49, 1-49.

Leenders, M.A.M., and Chantra, Y., 2013. Antecedents and consequences of green innovation in the wine industry: The role of channel structure. *Technology Analysis & Strategic Management*, 25 (2), 203-218.

Lorente, A.R., Dewhurst, F. and Dale, B.G., 1999.TQM and business innovation.*European Journal of Innovation Management*. 2 (1), 12-19.

Lloréns-Montes, F.J., García-Morales, V.J. and Verdú-Jover, A., 2004. Flexibility and quality management in manufacturing: An alternative approach. *Production Planning and Control*, 15 (5), 525-533.

Lovelace, K., Shapiro, L. and Weingart, R., 2001. Maximizing cross-functional new product teams innovativeness and constraint adherence: A conflict communications perspective. *Academy of Management Journal*, 44 (4), 779-793.

McAdam, R. and Armstrong, G., 2001. A symbiosis of quality and innovation in SMEs: A multiple case study analysis. *Managerial Auditing Journal*, 16 (7), 394-399.

Mellat-Parast, M., Adams, S.G. and Jones, E.C., 2007. An empirical study of quality management practices in the petroleum industry. *Production Planning and Control*. 18 (8), 693-702.

Miles, R.E. and Snow, C.C., 1994, Fit, failure, and the Hall of Fame. New York: Free Press.

Miller, D. and Friesen, P.H., 1983. Strategy-making and the environment: The third link. *Strategic Management Journal*, 4 (3), 221-235.

More, R.A., 1992.Managing new technology adoption.*Business Quarterly*, 56, 69-75.

Oerlemans, L.A.G. and Knoben, J., 2010. Configurations of knowledge transfer relations: An empirically based taxonomy and its determinants. *Journal of Engineering and Technology Management*, 27, 33-51.

Oldham, G.R. and Hackman, J.R., 1981. Relationships between organizational structure and employee reactions: Comparing alternative frameworks. *Administrative Science Quarterly*, 26, 66-83.

Parasuraman, A., Berry, L.L. and Zeithaml, V.A., 1993. More on improving service quality measurement. *Journal of Retailing*, 69, 140-147.

Pekovic, S. and Galia, F., 2009. From quality to innovation: Evidence from two French employer surveys. *Technovation*, 29, 829-844.

Perdomo-Ortiz, J., González-Benito, J. and Galende, J. 2009. An analysis of the relationship between total quality management-based human resource management practices and innovation.*The International Journal of Human Resource Management*, 20 (5), 1191-1218.

Power, B. and Reid, G.C., 2005.Flexibility, firm-specific turbulence and the performance of the long-lived small firm.*Review of Industrial Organization*, 26, 415-443.

Prajogo, D. and Sohal, A.M., 2001. TQM and innovation: A literature review and research framework. *Technovation*, 21, 539-558.

Prajogo, D.J. and Sohal, A.M., 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), 1-35.

Sadikoglu, E. and 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, 13-26.

Samaha, H.R., 1996. Overcoming the TQM barrier to innovation.*HRMagazine*, 41, June, 144-147.

Shani, A.B. and Rogberg, M., 1994.Quality, strategy, and structural configuration.*Journal of Organizational Change Management*, 7 (2), 15-30.

Sitkin, S.B., Sutcliffe, K.M. and Schroeder, R.G., 1994. Distinguishing control from learning in Total Quality Management: A contingency perspective. *Academy of Management Review*, 19 (3), 537-564.

Tamayo-Torres, J., Ruiz-Moreno, A. and Lloréns-Montes, F.J., 2011. The influence of manufacturing flexibility on the interplay between exploration and exploitation: The effects of organisational learning and the environment. *International Journal of Production Research*, 49, 6175-6198.

Teece, D., Pisano, G. and Shuen, A., 1997. Dynamic capabilities and strategic management.*Strategic Management Journal*, 18 (7), 509-533.

Thompson, J.D., 1994. Organización en acción. Mexico: McGraw-Hill.

Van De Ven, A.H. and Ferry, D.L., 1980. Measuring and assessing organizations. New York: John Wiley and Sons.

Venkatraman, N. and Ramanujam, V., 1986. Measurement of business performance in strategy research: A comparison of approaches. *Academy of Management Review*, 11 (4), 801-814.

Vinodh, S., Devadasan, S.R. and Rajanayagam, D., 2008.The case of implementing innovative total quality function deployment for preventing the sticking of the latching star in electronic switches.*Production Planning and Control* 19 (8), 754-769.

Wan. D., Ong, C.H. and Lee, F., 2005.Determinants of firm innovation in Singapore, *Technovation*, 25 (3), 261-276.

Weeks, B. and Helms, M.M. and Ettikin, L.P. 1995. Are we ready for TQM? A case study.*Production and Inventory Management Journal*, 36 (4), 27-30.

Wruck, K.H. and Jensen, M.C., 1994. Science, specific knowledge and total quality management.*Journal of Accounting and Economics*, 18, 247-284.

Zwick, T., 2002.Employee resistance against innovations.*International Journal of Manpower*, 23 (6), 542-552.

Appendix A: Questionnaire

PART I: QUALITY

1. Has your company implemented any form of Quality Management System? __ YES __NO

2. If your company has developed some kind of Quality Management System, please let us know when you began the initiative:

__1 year ago __ 1-2 years ago __ 2-3 years ago __Over 3 years ago

3. If your company has developed some kind of Quality Management System, please indicate the degree of implementation:

Low implementation = 1	2	3	4	5	6	7= **High Implementation**

PART II: RESISTANCE TO CHANGE

1. Please indicate the degree to which you agree with the following statements related to the behavior toward change in your firm. To do so, circle the appropriate response, using the following scale:

Strongly disagree =1	**2**	**3**	**4**	**5**	**6**	**7= Strongly agree**

1.In our firm, employees perceive that change benefits the firm.	1 2 3 4 5 6 7
2. In our firm, employees try to support change	1 2 3 4 5 6 7
3. In our firm, employees generally support the new ideas	1 2 3 4 5 6 7
4. In our firm, most of the changes are interesting to employees	1 2 3 4 5 6 7
5. In our firm, employees perceive benefits from the changes	1 2 3 4 5 6 7

PART III: ORGANIZATION STRUCTURE

Complexity

1. Please indicate the number of main departments in your organization that are under top management: ________

2. Please indicate the number of different units that are subordinate to the main departments in your organization (on average): ________

3. Please indicate the degreeto which you agree with the following statements related to the level of professionalism in your firm. To do so, circle the appropriate response, using this scale:

Totally disagree =1	**2**	**3**	**4**	**5**	**6**	**7= totally agree**

1.People in your firm belong to professional organizations	1 2 3 4 5 6 7

2. People in your firm attend the meetings of professional organizations	1 2 3 4 5 6 7
3. People in your firm have leadership roles in professional organizations	1 2 3 4 5 6 7

Formalization

Please indicate the degree to which you disagree or agree with the following statements regarding your company's activities last year:

Strongly disagree = 1	2	3	4	5	6	7= **Strongly agree**

(1) Our firm has a large number of written rules and policies
(2) There are manuals for rules and procedures that are available in the firm
(3) There is a full written description of most of the jobs in this firm
(4) Our firm keeps a written record of almost all of the responsibilities to be fulfilled on the job
(5) Our firm has formal orientation programs for new employees
(6) The employees are monitored constantly so that they do not violate the rules and procedures of our firm
(7) In our firm, the employees follow standard procedures or operating practices in performing the main tasks
(8) In our firm, the different situations that emerge in performing work are directed by written procedures
(9) The employees are constantly observed so that they obey our firm's rules and procedures

Decentralization

For each of the following kinds of decision, indicate the frequency with which the firm's members participate in the decisions, using a seven-point Likert scale (1'never'; 7 'always').
Also indicate how influential your firm's contributions are in the following decisions, using a seven-point Likert scale (1'very little influence'; 7 'much influence'):
(1) For adopting new programs, policies, etc.
(2) For adopting new products or services
(3) For adopting new processes or technologies
(4) For adopting new organizational structures
(5) For opening new markets

PART IV: ORGANIZATIONAL CLIMATE

Orientation to innovation

Please indicate the degree to which you disagree or agree with the following statements regarding your company's activities last year:

Strongly disagree = 1	2	3	4	5	6	7= **Strongly agree**

(1) My boss encourages me to develop my ideas
(2) My boss likes me to try new ways of doing my job
(3) My boss encourages me to improve on his methods
(4) My boss encourages me to find new ways around old problems
(5) My boss "talks up" new ways of doing things

Cohesion

Please indicate the degree to which you disagree or agree with the following statements regarding your company's activities last year:

Strongly disagree = 1	2	3	4	5	6	7= **Strongly agree**

(1) (Company name) people pitch in to help each other out
(2) (Company name) people tend to get along with each other
(3) (Company name) people take a personal interest in one another

Pressure

Please indicate the degree to which you disagree or agree with the following statements regarding your company's activities last year:

Strongly disagree = 1	2	3	4	5	6	7= **Strongly agree**

(1) I have too much work and too little time to do it in
(2) (Company name) is a relaxed place to work
(3) At home, I sometimes dread hearing the telephone ring because it might be someone calling about a job-related problem

PART V: INNOVATION

Please, indicate the number of innovationsdeveloped by your company in last 3 years, using a seven-point Likert scale (1‘very little’; 7 ‘a lot of’).

(1) How many new products or services has your firm introduced?
(2) How many new markets has your firm entered?
(3) How many new production processes or kinds of services has your firm initiated?
(4) How many new raw materials have been introduced in your firm?
(1) How many new products or services have the excellent firms in your sector introduced?
(2) How many new markets have the excellent firms in your sector entered?
(3) How many new production processes or kinds of services have excellent firms in your sector initiated?
(4) How many new raw materials have been introduced by the excellent firms in your sector?

PART VI: PERFORMANCE

Please, indicate the performance of your company in contrast with competing firms, considering activities in last three years, exclusively, using a seven-point Likert scale (1‘Very bad’; 7 ‘very good’).

(1) Annual average growth in sales over the last three years
(2) Annual average growth in international sales over the last three years
(3) Growth of market share over the last three years
(4) Growth of profits over the last three years
(5) Growth of profitability over the last three years
(6) Workers’ level of satisfaction over the last three years
(7) Level of work absenteeism over the last three years