

Quality Management practices, absorptive capacity and innovation performance

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Abstract

Quality Management practices (QMP) are a potentially useful tool for increasing a company's innovation performance. However, the empirical evidence regarding the impact of QMP on innovation performance has been mixed. The purpose of this study is to extend understanding of the impact of QMP on innovation performance by investigating the mediating effect of absorptive capacity on this relationship. A proposed research model and hypotheses are tested using cross-sectional survey data from a sample of 230 leading Spanish firms. The results indicate that QMP enable the development of absorptive capacity, contributing to innovation performance.

Keywords: Quality Management practices, Absorptive Capacity, Innovation Performance, Structural Equation Modeling

Introduction

In today's business environment characterized by continuous changes and a greater turbulence and complexity, the survival of firms in the long-term is based on the development of activities related to innovation (Galanakis, 2006).

Quality Management (QM) is one of the most prevalent and well-established set of operations-related organizational practices and many studies have stated that QM practices (QMP) are a potentially useful tool for increasing a company's innovation performance. However, the empirical evidence regarding the impact of QMP on innovation performance has been mixed. Some studies show the existence of a positive relation between QMP and innovation performance (Naveh and Erez, 2004; Kim et al. 2012), while others show that this relationship is negative (Williams et al., 2006). Still others find no empirical evidence to justify this relationship (Prajogo and Sohal, 2006). Thus the relationship between QMP and innovation performance needs further empirical examination.

One of the key elements in developing a culture of innovation is knowledge (Jensen et al., 2007). According to Murovec and Prodan (2009), knowledge and innovation are two interrelated capacities: new knowledge arises from the processes of innovation. In turn, the application of this new knowledge leads to change and innovation. Therefore, learning capability can promote innovation capability and maintain a competitive

advantage in turbulent environments (Hung et al., 2011). Given the great importance attributed to knowledge management in the development of innovation capacity, it is important to study the firm's ability to absorb new knowledge, its determinants and its impact on innovation. Firms which are able to acquire, assimilate, and exploit new external knowledge have a greater chance of achieving a high level of innovation performance (Zahra and George, 2002; Murovec and Prodan, 2009).

Recent studies show how QM can promote learning orientation (Molina et al., 2007; Hung et al., 2011). However, Choo et al. (2007) indicate the lack of studies that examine how QMP lead to learning and knowledge creation.

The purpose of this study is to extend the understanding of the impact of QMP on innovation performance by investigating the mediating effect of absorptive capacity on this relationship. Therefore, this study focuses specifically on the following goals: a) analyzing the direct and indirect relationship between QMP and innovation performance (Hypothesis 1) and b) examining the same relationship, with absorptive capacity acting as a mediator (Hypotheses 2 and 3). To achieve these objectives, QMP and innovation performance are defined as second-order factors.

This paper is structured as follows. First, we review the literature, present our conceptual framework of QMP, absorptive capacity and its influence on innovation performance, and develop hypotheses. Next, we describe the research methodology (survey) used to empirically test the proposed model. We then present the results of the empirical analysis. Finally, we discuss the implications of the results and conclusions.

Literature review and hypotheses

Quality Management Practices and Innovation Performance

QM has been defined as an approach to management made up of a set of mutually reinforcing principles, each of which is supported by a set of practices and techniques (Dean and Bowen, 1994). Sousa and Voss (2002) determine that, at the empirical level, QM implementation should be based on analysis of the firm's practices, since "principles are too general for empirical research and techniques are too detailed to obtain reliable results".

QMP have been investigated extensively and reviews of these studies are developed by Nair (2006) and Sousa and Voss (2002), among others. These studies show the use of seven QMP: leadership, strategic planning, customer focus, human resource management, supplier management, information and analysis, and process management. Recent research determines that the successful implementation of QM can be attributed to the strong support of a combination of a series of practices (Kim et al., 2012).

On the other hand, innovation is defined as adoption of an internally generated or purchased device, system, policy, program, process, product or service that is new to the adopting organization. Prior literature shows that there are numerous typologies of innovation. One of the most widely used classifications is the one that distinguishes between product and process innovation (Murovec and Prodan, 2009). Product innovation refers to changes in design of established products or the development of new products, while process innovation means changes in the method of producing products or services.

Prior literature contains mixed arguments about the relationship between QMP and innovation performance (Sadikoglu and Zehir, 2010; Kim et al., 2012). On the one hand, QM represents practices that are congruent with innovation and provides a fertile environment for the development of both product and process innovations. On the other hand, some QMP only focus on current products, services, and customers' needs. Moreover, the standardization and formalization associated with QM could hinder

creativity and steer firm's efforts towards cost efficiency innovation (Prajogo and Sohal, 2001).

Therefore, although the impact of QMP on innovation performance can be measured directly, we are proposing that QMP has more of a mediated effect (through absorptive capacity) rather than a direct effect on innovation performance. Kim et al. (2012) determined that the relationship between a set of QMP and innovation performance is mediated by process management practices. Hung et al. (2011) conducted a study to determine the relationships between Total Quality Management (TQM), organizational learning and innovation performance. Sadikoglu and Zehir (2010) found empirical support for the positive relationships between TQM, employee performance and innovation performance. Based on this literature, we put forward the following hypothesis:

Hypothesis 1: QMP has more of a mediated effect (through absorptive capacity) rather than a direct effect on innovation performance.

Quality Management practices and absorptive capacity

Absorptive capacity is defined as a firm's ability to recognize the value of new, external information, assimilate it, and exploit it to commercial ends (Cohen and Levinthal, 1990). Zahra and George (2002) propose a new stage in this outline concerning transformation: the firm's capacity to develop and redefine routines that facilitate combining existing knowledge with the acquired and assimilated knowledge. The description of the main antecedents of absorptive capacity and its justification in the literature appear in Table 1.

Table 1 – Antecedents of Absorptive Capacity

Antecedents	Definitions	Citations
Relevant prior knowledge <i>Common language</i>	A language that can be understood by all business units improves a firm's absorptive capacity through knowledge transfer.	Cohen and Levinthal (1990); Van den Bosch et al. (1999); Gupta and Govindarajan (2000).
<i>Knowledge complementarity</i>	The diversity of exposure and the degree of overlap between the knowledge bases of the external source and the firm.	Lane and Lubatkin (1998); Meeus et al. (2001); Zahra and George (2002).
<i>Experience</i>	Firms search for new information in fields where they had past successes. Therefore, experience influences the search and the development of path-dependent capabilities of absorption new knowledge.	Cohen and Levinthal (1990); Szulanski (1996); Lane and Lubatkin (1998); Gupta and Govindarajan (2000); Zahra and George (2002).
R&D activities	R&D expenditure/total sales, level of R&D investment and the existence of an R&D lab.	Cohen and Levinthal (1990).
Organizational structure (level of centralization, organizational flexibility...)	The success and efficiency of knowledge assimilated depend on whether the organization has a divisional or functional organizational structure.	Cohen and Levinthal (1990); Lane and Lubatkin (1998); Van den Bosch et al. (1999); Lane et al. (2001); Meeus et al. (2001); Lane et al. (2006).
Human Resource Management	Job rotation or participation in decision making can facilitate the transfer of knowledge. Human resource management can also help to stimulate the absorption of new knowledge through reward systems or/and training.	Lane and Lubatkin (1998); Lane et al. (2001); Daghfous (2004); Lane et al. (2006).
Social integration mechanisms	Social networks and social integration initiatives (job rotation, participation in decision making, cross-functional interfaces, and teamwork) influence knowledge-seeking behaviors.	Meeus et al. (2001); Zhara and George (2002); Jansen et al. (2005); Todorova and Durisin (2007).
Another	Activation triggers (events that encourage a firm to respond to specific stimuli, these can	

antecedents	intensify a firm's efforts to learn new skills and to develop new knowledge than increase absorptive capacity, e.g., Zahra and George, 2002); Trust (Lane et al., 2001); Top Management Support (Lenox and King, 2004); Intensity of efforts to learn (Zahra and George, 2002).
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The study of specific antecedents of absorptive capacity has received little attention to date (Jansen et al., 2005). In this connection, Van den Bosch et al. (1999), Todorova and Durisin (2007) and Murovec and Prodan (2009) noted that future research may incorporate additional antecedents of absorptive capacity.

Recent studies show how QM can promote learning orientation. Molina et al. (2007) concluded that QM has a positive influence on knowledge transfers. Gutierrez et al. (2012) showed that teamwork and management process in six sigma lead to the development of a greater absorptive capacity.

With regard to each QMP, leadership facilitates the creation of work environments that encourage the involvement and participation of all members of the organization in the process of change and organizational learning (Wilson and Collier, 2000). According to Senge (1999), leadership is vital to construct shared vision in a learning organization, since it should promote the necessity of learning. Lenox and King (2004) propose top management support as an antecedent of absorptive capacity: managers establish links and relationships with other firms and within their own business units, so the information they provide will be associated with better adoption of new knowledge.

Strategic planning refers to the development and implementation of strategies and plans that focus on quality and on the analysis of performance data oriented to directing organizational improvements (Samson and Terziovski, 1999). This practice will improve the firm's existing knowledge base and thus, prior related knowledge, achieving greater diversity of information and facilitating the superimposition of external information sources, key antecedents of absorptive capacity (Cohen and Levinthal, 1990, Zahra and George, 2002).

Customer focus involves having direct and continuous contact with customers, gathering information on their tastes and needs, and using the information acquired to improve the products and services offered (Dean and Bowen, 1994). It will therefore be a source of information, improve the complementarity of the firm's knowledge base (Hansen, 2002), and provide experience (Nonaka and Takeuchi, 1995). According to Hill and Rothaermel (2003), the relationships of the firm with its customers represent a type of power relationship that influences the absorption of knowledge.

Information and analysis refers to the reach, management and use of information and other data concerning the firm to maintain customer focus, lead the organization toward excellence in quality, and improve performance (Samson and Terziovski, 1999). Because this practice will be a source of knowledge and enable the identification of possible points for improvement, it is related to the determinant of absorptive capacity "management of prior knowledge" (Zahra and George, 2002).

The implementation of human resource management practices allows the tacit component of knowledge to be managed indirectly (Sparkes and Miyake, 2000). The smaller this component is, the easier its acquisition and assimilation will be (Zahra and George, 2002). Human resource management includes (among other techniques) job rotation, teamwork and training, all of which are determinants of absorptive capacity (Meeus et al., 2001). For example, teamwork favours the assimilation of the different components of knowledge and their integration into the existing knowledge base (Jansen et al., 2005) and employee participation in decision making can facilitate the flow of knowledge (Daghfous, 2004).

Process management and statistical control generate and store information on the functioning of organizational processes so that they can then be improved (Rungtusanathan et al., 1997). This practice will enable the creation of a knowledge base that builds on prior knowledge, as well as subsequent complementing of the new knowledge acquired. Thus, the use of structured procedures and techniques facilitates knowledge acquisition (Choo et al., 2007) and the relationship between prior knowledge and new knowledge that will be absorbed (Todorova and Durisin, 2007; Gutierrez et al., 2012).

Finally, QM advocates that relations with suppliers be characterized by a high level of trust, fluid communication, high levels of shared information, and long-term development of the relationship (Langfield-Smith and Greenwood, 1998). These characteristics should encourage the development of common or related knowledge and its superimposition on the firm's knowledge base (Hansen, 2002). Absorptive capacity is determined by the degree of overlap between external knowledge and the firm's knowledge base (Lane and Lubatkin, 1998).

Based on these theoretical arguments, we put forward the following hypothesis:

Hypothesis 2: There is a positive relationship between QMP and absorptive capacity.

Absorptive capacity and innovation performance

The relation between absorptive capacity and innovation capacity has been treated extensively in the literature. However, several papers identify innovation with R&D investment. Cohen and Levinthal (1990) relate absorptive capacity positively to innovation capacity and its performance. Zahra and George (2002) point out that absorptive capacity is a necessary condition for achieving a competitive advantage in innovation. Lane et al. (2006) determine that innovation is a result of organizational learning and that absorptive capacity will help in the speed, frequency and magnitude of innovation. Further, both variables feed back into each other, since innovation will produce new knowledge, which will come to form part of the firm's absorptive capacity. Fosfuri and Tribo (2008) analyze how the firm's ability to recognize external knowledge and adapt this knowledge to its routines is reflected in the innovation process. The study of Murovec and Prodan (2009) is also significant, as it determines that, for product and process innovation to succeed, it is crucial for the firm to seek and use information from all available sources. Thus, we put forward the following hypothesis:

Hypothesis 3: There is a positive relationship between absorptive capacity and innovation performance.

Figure 1 summarizes the research model and hypotheses.

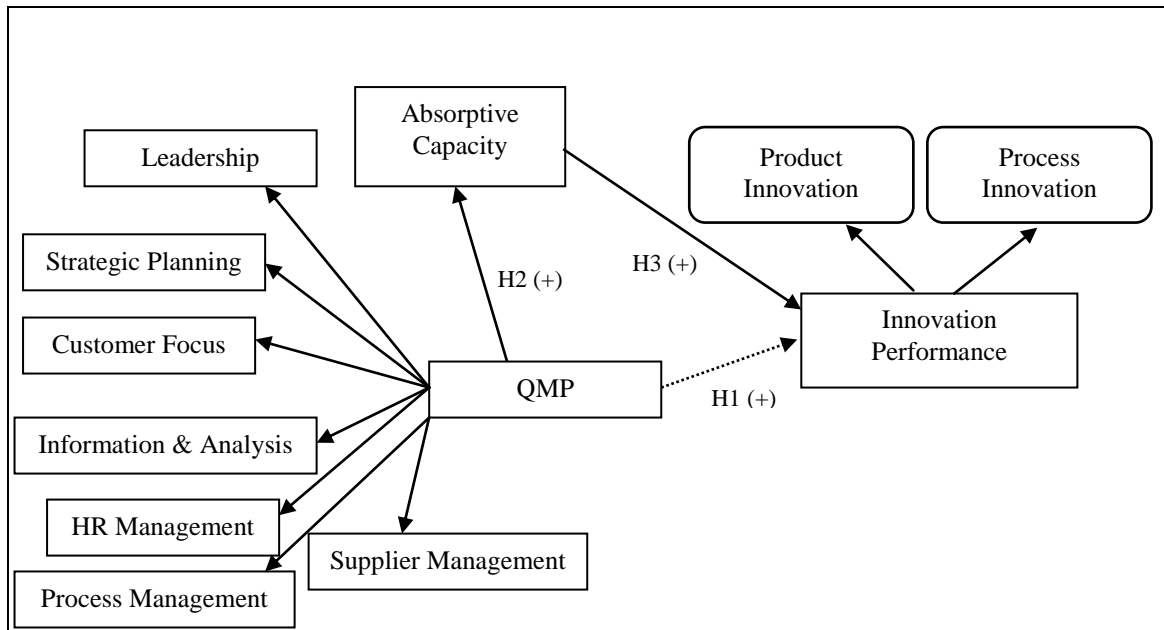


Figure 1 – Research Model

Methodology

The hypotheses were tested based on a survey study. The sample of firms was randomly selected from the SABI database, which includes the 50,000 largest manufacturing and service companies operating in Spain. The final sample contained 2133 firms, a number that corresponds to the firms that provided full, current, real contact information (telephone number and contact information for the informants whose profiles were appropriate for our study). Contact with the informant from each firm was established by phone, as was the response to the questionnaire. 230 responses were collected, giving a response rate of 10.78%. In all of the cases considered valid, the informants were the CEO, the quality manager or other top-level executives familiar with QM.

Table 2 provides a summary of the measurement items used in this study and their sources. After analyzing the unidimensionality and the internal consistency of the scales, we performed a confirmatory factor analysis using the EQS software package. The validity and reliability of the scales are included in Table 3.

Table 2 – Measurement sources for research constructs

Constructs	Summary of measurement items	Sources
Leadership	Creation of unity of purpose, encouragement of change, management of the environment, and use of operator's ideas in improving the business.	Adapted from Samson and Terziovski (1999)
Strategic planning	Have a mission statement which has been communicated, have a comprehensive and structured planning process, plans focus on achievement of 'Best Practice', incorporate customer/suppliers requirements, manufacturing operations are effectively aligned with the central business mission	Adapted from Samson and Terziovski (1999)
Customer focus	Use and aware of customer satisfaction surveys, use of customer complaints, actively seek of ways to improve the main product, customer focused for the last years	Adapted from Ahire et al. (1996)
Information and analysis	Benchmarking, the company's strategy in measuring performance, the availability of data and information about performance, the use of information in decision-making processes	Adapted from Prajogo and Sohal (2003)
Human resource management	Use of the concept of "internal customer", have an organization-wide training and development process, effective communication process, employee satisfaction is measured, have safety practices, multi-skilling is actively used, focus on quality importance	Adapted from Samson and Terziovski (1999)
Process	Degree of automation of the process, stability of production/work	Adapted from Kaynak

Management	schedule, process design is fool-proof, employees are authorized to solve quality problems, use of statistical techniques.	and Hartley (2005)
Supplier Management	Long-term relationships with suppliers, they are involved in our new product development process, quality as criterion in selecting suppliers, small number of suppliers, they are qualified for quality	Adapted from Flynn et al. (1995)
Absorptive Capacity	The managerial and technical competence to absorb new knowledge, exploit new information, common style of communication, necessary skills to complete tasks	Adapted from Szulanski (1996) and Matusik and Heeley (2005)
Product innovation	Level of novelty of new products, use of latest technological innovations, speed of new product development, number of new product introduced to the market, early market entrants	Adapted from Prajogo and Sohal (2006)
Process Innovation	Technological competitiveness, novelty of technology used in process, speed of adoption of the latest innovations in processes, the rate of change in processes, techniques and technology	Adapted from Prajogo and Sohal (2006)

Table 3 – Measurement analysis

Construct	Number of items	Items reliability	Cronbach's alpha	AVE	Composite reliability
Leadership (LID)	6	0.760-0.890	0.925	0.690	0.930
Strategic Planning (SP)	4	0.721-0.937	0.937	0.710	0.907
Customer Focus (CF)	3	0.877-0.924	0.931	0.860	0.95
Information and Analysis (IA)	4	0.747-0.936	0.923	0.760	0.93
Human Resource Management (HRM)	5	0.715-0.849	0.873	0.58	0.87
Process Management (PM)	3	0.728-0.992	0.828	0.630	0.847
Supplier Management (SM)	5	0.703-0.821	0.883	0.604	0.88
Absorptive Capacity (AC)	5	0.702-0.849	0.947	0.750	0.930
Product Innovation (PRODUCTINN)	5	0.744-0.808	0.911	0.799	0.952
Process Innovation (PROCESSINN)	4	0.735-0.841	0.909	0.722	0.912

Results

Two models were tested: a direct model which analyzed the relationship between QPM and innovation performance (Model 1: direct model), and the partial model, which examined the mediating role of absorptive capacity (Model 2: partial model). To check the mediating effect, we develop the approach used by Singh et al (1994) by performing four steps: (1) the partial model explains more variance in performance than the direct model; (2) the relationship between QMP and innovation performance is diminished or eliminated in the partial model (with respect the direct model); (3) there is a significant relationship between QMP and absorptive capacity and finally, (4) there is a significant relationship between absorptive capacity and innovation performance.

Table 4 – Results of direct model and mediation effect (structural equation modeling)

Parameter	Direct effects model	Partial mediation model
<i>Hypothesized paths</i>		
QMP → IP (H1)	0.594** (7.073)	0.271* (2.602)
QMP → AC (H2)	---	0.734** (9.556)
AC → IP (H3)	---	0.304** (3.092)
<i>Measurement Model and second-order factors</i>		
QMP → LID	0.800** (11.025)	0.797** (9.185)
QMP → SP	0.729** (10.075)	0.722** (8.914)
QMP → CF	0.680** (8.667)	0.678** (7.563)
QMP → IA	0.821** (11.021)	0.829** (12.403)
QMP → HRM	0.750** (9.061)	0.740** (8.982)
QMP → PM	0.646** (8.106)	0.648** (7.387)
QMP → SM	0.685** (8.723)	0.694** (7.816)

IP → PRODUCTINN	0.915** (11.979)	0.960** (11.070)
IP → PROCESINN	0.866** (11.710)	0.861** (10.499)
<i>Goodness-of-fit statistics</i>		
χ^2 /d.f. =	2.04028	1.86046
NFI	0.836	0.856
NNFI	0.926	0.934
CFI	0.935	0.942
RMSA	0.048	0.042
SMRM	0.070	0.066
IFI	0.931	0.943
AGFI	0.827	0.836
(**) Significant at 0.01		
Parameter estimates are standardized with t-values shown in parentheses		

The main findings show that (Table 4): (a) QMP has a positive effect on innovation performance ($\beta = 0.594$, $t = 7.073$, $p < 0.01$, direct model), (b) QMP has a positive effect on absorptive capacity ($\beta = 0.734$, $t = 9.556$, $p < 0.01$, hypothesis 2), (c) absorptive capacity has a positive effect on innovation performance ($\beta = 0.304$; $t = 3.902$; $p < 0.01$, hypothesis 3). Finally, (d) the significant relationship between QMP and IP in the direct effects model ($\beta = 0.594$, $t = 7.073$) is greatly diminished in the partial mediation model ($\beta = 0.271$, $t = 2.602$; hypothesis 1). Thus, the partial effects model represents a significant improvement over the direct effects model, although the mediation effect is partial, not total. In sum, all the hypotheses are supported.

Discussion, conclusion, and limitations

From the analysis of a sample of 230 Spanish manufacturing and service firms, the results indicate that a set of QMP has a great impact on the firm's ability to identify, assimilate, and exploit the new information. Likewise, absorptive capacity of a firm is listed as a key determinant of innovation performance improvement. Our study provides insights on specific antecedents of absorptive capacity, an issue absent in the research literature and whose exploration has been requested by previous studies (Jansen et al., 2005). Van den Bosch et al. (1999) and Todorova and Durisin (2007) noted that future research may incorporate additional antecedents of absorptive capacity. This research has also provided insights on the controversial relationship between QM and innovation (Kim et al., 2012). In this sense, QMP can significantly enhance innovation performance. This result is consistent with those obtained by Naveh and Erez (2004) and Sadikoglu and Zehir (2010).

This study appears to be one of the first papers to simultaneously explore relationships between QMP, absorptive capacity and innovation performance. It answers calls for the examination of mediating (indirect) relationships among QMP, organizational capabilities and various performance measures (Sadikoglu and Zahir, 2010). The study extends the work of Hung et al. (2011) who confirmed that QM has a positive effect on innovation performance and organizational learning partially mediate such effect.

For managers this study reinforces the relevance of these three major disciplines (quality, knowledge management and innovation management) in Management. Managers must be conscious that adaptation to the environment depends on the correct development of a set of organizational practices that enables them to reorganize their resources and strategies in the face of new competitive scenarios. The implementation of QM oriented to obtaining dynamic capabilities constitutes an excellent framework for competing in current markets. First, our results suggest that the deployment of QMP will increase firms' ability to acquire, use and exploit new external knowledge. Second, absorptive capacity is an important intermediate organizational capability through

which the benefits of implementing a QM program are converted into innovation performance.

Our study does have some limitations, which in themselves provide opportunities for future research. First, the study is cross-sectional in nature, and its results can only be generalized to Spanish firms. Second, this study explores absorptive capacity using a one-dimensional construct. Possible extensions of this paper could test the proposed relationships using a multidimensional construct of absorptive capacity. Finally, this study does not address the effects of the environmental conditions of the absorptive capacity - innovation performance relationship. The environmental factors determine the effectiveness of these activities in providing the firm with a competitive advantage.

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