

The Relationship Between Quality Management and Innovation*

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The purpose of this study is to understand the relationship between quality management and innovation, since although quality and innovation issues are dealt with extensively, there is still little information on this relationship. For this study, an exploratory bibliographic research was conducted in order to extract the most important ideas from the literature. Most studies suggest a positive link between quality management practices and innovation performance in firms, although there are also studies suggesting a neutral or negative relationship. The focus on quality as a competitive tool is crucial but insufficient, and innovation emerges as a new way of meeting customer requirements and expectations. The coexistence of quality management practices and innovation management practices seems to be important although difficult to achieve. The literature review was limited to a database. The implementation of quality management systems in parallel with innovation poses enormous challenges, as the philosophy governing the two areas can be contradictory. This requires that companies have well-structured and knowledgeable teams. This study contributed to a better perception and systematization of the relationship between quality and innovation.

Keywords: innovation, quality, relationship of innovation with quality, review

Introduction

The introduction of total quality management has played an important role in the development of contemporary management practices. Quality is considered an essential strategic factor to achieve success in companies' businesses. To improve the competitive position in the market and improve business performance, most companies around the world, whether large or small, have applied the principles of total quality (Hoang, Igel, & Laosirihongthong, 2006). However, in a knowledge-based society, high quality alone is not enough. Quality is not a basis for sustainable competitive advantage and needs to be complemented by innovation practices.

Innovation has been a major concern for researchers and professionals, as the literature provides conflicting theoretical arguments on the relationship between total quality management and innovation. It is not certain whether total quality management practices support or hinder the development of innovation (Prajogo & Sohal, 2001). The contribution of total quality management to innovation, although it attracts considerable attention, has not been sufficiently exploited in previous research, so that there is still not enough information about the relationship between the two (Perdomo-Ortiz, González-Benito, & Galende, 2006).

This study aims to investigate, in an exploratory way, the relationship between quality management and the innovation performance of a company, as well as the contribution of specific practices that quality

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management may have. There are two distinct thoughts on the relationship between quality management and innovation. Some believe that quality management supports innovation, implying that organizations that have implemented a quality management system will succeed in innovation. Others argue that a quality management system hinders innovation (Kim, 2010). The intention is to explore the nature of this relationship.

Methodology

This study is based on a bibliographic search, initially made through the reading of books related to the subject and then through a search and selection of articles in the Google Academic database, focused on the relationship between quality and innovation. The keywords used during the search of the articles were: innovation, quality, technology, relationship between quality and innovation, impact of quality and innovation, link between quality and innovation. The criterion used in the selection of articles was the choice of those articles that directly addressed the relationship between quality and innovation and where this was the central theme of the article.

Basic Concepts

This section will address the basic concepts related to quality and innovation, as well as the respective standards on which they are based.

Quality

There is no single definition of quality, since it is a subjective concept that is directly related to the perceptions of each individual. Its meaning is not always clear and objective, being a term difficult to define but easy to recognize, being associated with something good or exceptional. Thus, the quality of a product and/or service is related to its attributes and characteristics that may or may not satisfy the needs of an individual.

As defined in NP EN ISO 9000 (IPQ, 2015a), Quality is understood as the “degree of satisfaction of requirements given by a set of intrinsic characteristics of an object” and the success of any organization depends directly on its ability to mobilize and organize the means and resources necessary for the realization of products and/or services that meet the requirements, needs, and expectations of its customers. Therefore, quality is the “engine” of any organization’s success, and its recognition is the distinguishing factor for the choice of products and/or services. The development of a culture based on quality principles and its consequent values will pave the way for the effectiveness and continuous improvement of methods and processes (Pinto & Soares, 2018).

In 1980, total quality management spread globally as a management philosophy (Goldman, 2005). Total quality management is defined as

an integrated approach to achieve and sustain high quality results, with a focus on maintenance and continuous process improvement and defect prevention at all levels and in all functions of the organization, in order to meet or exceed customer expectations. (Flynn, Schroeder, & Sakakibara, 1994, p. 1050)

Quality standards are published by national or international agencies and serve two main purposes. They constitute a systematic repository of knowledge about quality management and are a multi-purpose management tool. A standard is a document of voluntary application, unless there is a legal document that makes it mandatory. Standards are considered a suitable reference for the market for which they are intended and are therefore used in processes of legislation, accreditation, certification, metrology, technical information, and commercial relations (IPQ, 2020a).

In the area of quality, three standards stand out:

1. International Organization for Standardization (ISO) 9000 describes the concepts and fundamental principles of quality management that are applied globally, i.e., this standard specifies the terms and definitions that are applicable to all quality management and quality management systems standards that are developed by ISO/TC 176, the largest technical committee of ISO (IPQ, 2015a).

2. ISO 9001 is the most widely used management system standard worldwide and is the international reference for the certification of quality management systems. This standard was created in international terms in order to define the best quality practices to be adopted, with a central focus on customer and other stakeholders' expectations of the organization. ISO 9001 adopts a process approach, which incorporates the Plan-Do-Check-Act (PDCA) cycle of continuous improvement (a methodology that promotes continuous improvement, developed in four phases [planning, executing, verifying, and acting] and can be applied to each process and to the whole system) and integrates risk-based thinking, allowing not only customer loyalty but also the competitiveness of the organization based on the pillars of sustainability (IPQ, 2015b).

3. ISO 9004 provides guidelines that enable any organization to achieve sustained performance in a complex, demanding and continually changing environment through a quality management approach. It can be used to assess the maturity of a quality management system and is aimed at organizations wishing to achieve excellence (defined as a high degree of execution of requirements and satisfaction of expectations), in addition to meeting the requirements of ISO 9001 (IPQ, 2011).

Quality management is a holistic management philosophy that promotes all the functions of an organization through continuous improvements and organizational changes (Kaynak & Hartley, 2005).

Innovation

Innovation can be understood as the development and implementation of new ideas over time and is based on four factors: new ideas, people, transactions, and institutional context (Van de Ven, 1986).

Innovation does not exist without invention. The invention is a new idea, a model, or a prototype that appears for a new product or process, while innovation consists in putting that idea into practice, either an economic or a social application of the invention (Fagerbeg, 2009). Innovation and invention are clearly related, since innovation arises from invention, from the combination of several inventions or the adaptation of something that has already been invented in other circumstances. In short, innovation is a multidimensional and systemic process.

The definition of innovation is somewhat ambiguous. There is an approach that views the concept in dual terms, according to the level of novelty, considering as radical innovation the discovery of a new idea and incremental innovation as the exploitation of an existing idea (Negas, Carvalho, & Sousa, 2020).

Another duality of the definition has to do with the technological and non-technological dimension. Technological innovation is often associated with technology-based product and process innovation. This technological vision of innovation has been the target of some criticism, namely not being able to capture innovation in services, and innovation in companies does not relate only to the development of technological applications, but also to organizational restructuring and the adoption of relations with the market through new marketing practices. The importance of product, process and organizational system integration for the implementation of new ideas and new business opportunities in the market is highlighted. For these reasons, the concept of innovation should encompass the non-technological dimension (Negas et al., 2020).

In the study conducted by Crossan and Apaydin (2010), the authors confront the types of innovation by mentioning another duality: a process to create ideas and implement them properly; and the results, that is, the final results of implementation, which can be a product or a process. According to Bon and Mustafa (2013), the process is the way and techniques by which an idea is created and implemented, while the results are the products, services, or business processes. There are two main inputs that are essential to the results performed. First, an organization's team must be able to create and sustain the configurations that support innovative ideas, and second, decide which ideas have potential. Understanding and knowing the types of innovation is essential for organizations. Each type of innovation needs specific treatment and responses from the organization.

The Oslo Manual (OECD/Eurostat, 2018) tries to clarify and standardise these concepts. The term innovation can be used in different contexts to refer to a process or an outcome. To avoid this confusion, this manual uses the term "innovation activities" to refer to the process and the term "innovation" limited to outcomes (OECD/Eurostat, 2018). Innovation activities include all research, development, production, financial and commercial activities carried out by a company that results in innovation in the companies. The document proposes two main categories of innovation:

- Product innovation: It is a new or improved good or service that differs significantly from previous goods or services of the company and has been introduced to the market;
- Business process innovation: It is a new or improved business process for one or more business functions that differs significantly from previous business processes of the company and that have been used in the company.

Product innovation is divided into two types (goods and services) and business process innovation is divided into six broad types (production of goods or services, distribution and logistics, marketing and sales, information and communication systems, administration and management, and product and business process development).

In the area of innovation, there have been efforts to produce innovation management standards which are inspired by quality standards. Spain was the first country to implement an innovation management standard, followed closely by Portugal (IPQ, 2006a; 2006b; 2006c; 2006d). The European Union is currently studying the possibility of implementing a European standard.

Relationship Between Quality and Innovation

Positive Relationship Between Quality Management and Innovation

Most of the articles obtained in this study suggest a positive relationship between quality management and innovative performance. Several articles present empirical results that positively relate a set of quality management practices to innovation (Prajogo & Hong, 2008; Kim, V. Kumar, & U. Kumar, 2012; Martinez-Costa & Martinez-Lorente, 2008; Bourke & Roper, 2017; Perdomo-Ortiz et al., 2006; Hoang et al., 2006; Baldwin & Johnson, 1996; Flynn et al., 1994; Samson & Terziovski, 1999). The studies highlight that quality management practices can provide opportunities to apply quality management principles and techniques in innovative activities, allowing for the efficient detection of customer needs, originate knowledge sharing and foster systems and processes improvement. The adoption of a quality management system helps companies to innovate according to customer needs, minimizing activities without value and reducing the time and costs of developing new products. Quality management conceives customer satisfaction, innovation and the improvement of the performance of most businesses. These articles are briefly described below.

A study (Kim et al., 2012) analysed eight different quality management practices to see which of these practices related directly or indirectly to five types of innovation. Using a sample of ISO 9001-certified product

and/or service companies, the authors verified that process management is directly and positively related to incremental, radical, and administrative innovation. The organizational capacity to manage processes plays a vital role in identifying routines, establishing a learning basis and supporting innovative activities.

In an empirical study of 451 companies, the authors found that the use of quality management tools leads to product and process innovation (Martinez-Costa & Martinez-Lorente, 2008). Implementing quality management tools can help identify potential areas for innovation, develop innovation plans, and produce innovative products and processes (Martinez-Costa & Martinez-Lorente, 2008).

Another study (Perdomo-Ortiz et al., 2006) analyses the links between the broader concepts of total quality management and entrepreneurial innovation capacity. The study involved 102 companies from the machinery and instruments sectors for measurement, analysis and control. The study suggests that both concepts are compatible and allow identifying which dimensions of total quality management explain the creation of entrepreneurial innovation capacity.

Bourke and Roper (2017) used data from a group of Irish companies to verify the influence of adopting quality improvement methods on the performance of innovation in the short and long term. The temporal effects are complex but there appears to be destabilising effects in the short term but beneficial in the long term. The results suggest that maximising the return on innovation and quality improvement requires an adaptive implementation of quality improvement methods, time, and sequence of their adoption.

Studies have identified a positive relationship between total quality management and innovation in terms of market speed (Flynn et al., 1994) and the level of innovation in organizations (Baldwin & Johnson, 1996).

Most studies agree that quality will always be critical for competitiveness, but innovation is likely to continue to grow as a key element of competitive strategy (Leavengood, Anderson, & Daim, 2014). One of the challenges of today's companies is to determine how to integrate the two.

The study of D. Schniederjans and M. Schniederjans (2015) seeks to address the relationship between social and technical quality management and innovation. The authors argue that social and non-technical quality management practices are positively associated with innovation. The positive relationship between quality management and innovation is moderated by the effects of the organisational dimension, task, and ethics of the manager. However, there is no significant relationship between technical quality management and innovation.

The strength of the relationship between total quality management practice (independent variables) and organizational performance (dependent variables) was tested by Samson and Terziovski (1999). The authors consider innovation as a dependent variable that represents the organizational performance measured by the number of new products produced. Total quality management has a significant positive relationship with product quality and product innovation performance, although the magnitude of the relationship seems to be greater in relation to product quality. The study does not confirm a significant positive effect on innovation. However, the correlation between the two variables seems to depend on the specific sector under study.

Zhao (2011) addressed key issues of innovation and quality, helping to develop strategies to improve the integration between innovation and quality, suggesting that the critical factors of successful innovation management incorporate and are interrelated to the main concepts associated with quality management. The challenge for organizations to gain competitive advantage in the marketplace is to exploit innovative opportunities and deliver what the customer wants in the fastest, most effective and economically viable way.

In general, and to conclude this section, there are two general arguments put forward by studies suggesting a positive relationship between quality and innovation. One argument is that innovation is the result of

combining different activities, such as research and development, process development, design, marketing, organizational restructuring, resource management and employee development and is therefore likely to be supported by total quality management practices that enhance the combination of multifunctional activities. The other argument is that total quality management practices help create an environment and culture that supports innovation. One of the main requirements of total quality management is customer satisfaction. Companies implementing a total quality management system need to explore and find ways to best meet customer needs and expectations and this makes companies innovative in developing and launching new products and/or services to meet customer needs (Hoang et al., 2006).

Negative Relationship Between Quality Management and Innovation

Although a minority, there are studies which argue that total quality management can hinder innovation (Kim & Marbougne, 1999; Prajogo & Sohal, 2001). The main argument is that the customer focus is on product conformity (product quality) but not on product novelty (product innovation), and that these perspectives are in practice conflicting or do not feed off each other (Atuahene-Gima, 1996).

The study of Singh and Smith (2004) does not find sufficient statistical evidence to suggest that total quality management is related to innovation performance in enterprises. They suggest that the relationship between these concepts may be more complex than suggested by the mentioned studies. However, they do not completely reject the arguments that total quality management can support innovation and admit that total quality management can facilitate innovation, but only to a very limited extent.

While admitting evidence of a positive influence on innovation, advocates of the opposite view believe that the implementation of total quality management is likely to create more disadvantages for innovation over time than advantages (Prajogo & Sohal, 2001).

A Negative Relationship Between Quality Management and Green Innovation

The study of Li, Zhao, Zhang, Chen, and Cao (2017) identified a negative relationship between quality and green innovation, which seems to give additional substance to the arguments presented in the previous section. The study analysed the impact of quality management on green innovation, considering the moderating role of environmental regulation. With a sample of 407 observations obtained from the top 100 listed companies in China from 2008 to 2014, the results indicate that quality management was significantly correlated negatively with green technological innovation and green innovation management. In addition, environmental regulation significantly mitigates the negative impact of quality management on green innovation management and green technology innovation. The results seem to indicate that quality management limits corporate focus on developing existing production and management systems rather than exploiting green innovation geared towards sustainable development. Thus, quality management tools and practices may not necessarily be in line with sustainability considerations (Maxwell & Vorst, 2003; Luttrupp & Lagerstedt, 2006) and may not be properly integrated with more environmentally sustainable business models (Asif, Searcy, Zuthi, & Fisscher, 2013). The significant mitigating effect of environmental regulation illustrates the importance of better institutional design and implementation (Ford, Steen, & Verreyne, 2014). Appropriate environmental standards and strict environmental monitoring can trigger green innovations within companies and can thus reduce compliance costs (Li et al., 2017).

Summary of Results

Table 1 summarizes the essential points (objectives and conclusions) of the studies analyzed for this work.

Table 1

Summary of Objectives and Conclusions of the Various Studies Analyzed

Authors	Objective	Conclusions
Prajogo & Hong (2008)	Demonstrate the effect of total quality management practices on research and development performance in terms of product quality and innovation.	Total quality management, as a set of generic principles, can be adapted in environments of different manufacturing or production areas.
Kim et al. (2012)	Analyse the different quality management practices and investigate which of these practices related directly or indirectly to five types of innovation.	A set of quality management practices, through process management, have a positive relationship with five types of innovation under study. Process management is directly and positively related to incremental, radical and administrative innovation.
Martinez-Costa & Martinez-Lorente (2008)	Clarify the relationship between total quality management and organizational innovation.	Evidence that total quality management promotes innovation in companies. Evidence that companies that apply total quality management and therefore develop organizational innovation get more benefits. Firms where innovation is continuous can see total quality management not only as a good way to improve quality, but as a way to facilitate the innovation process.
Perdomo-Ortiz et al. (2006)	To study the relationship between quality and innovation through the analysis of the existing links between the broader concepts of total quality management and the capacity for business innovation.	Total quality management favours the development of entrepreneurial innovation capacity. The study revealed that both concepts are compatible and make it possible to identify which dimensions of total quality management explain the creation of entrepreneurial innovation capacity.
Bourke & Roper (2017)	Highlight the short and long term beneficial effects of adopting quality improvement methods on product innovation performance.	Maximizing the return on innovation and quality improvement requires an adaptive consideration of the nature of quality improvement methods, the time and the sequence of their adoption.
Leavengood et al. (2014)	Research quality and performance management practices in relation to quality and innovation of forest product manufacturers.	Companies that focus only on quality saw innovation as an end and not as a means to achieve a certain business goal. The main result was based on the way companies interact with customers, i.e., companies focused on innovation proactively seek to identify and meet the needs demanded by customers, while companies focused on quality mainly emphasize responding to customer complaints.
Zhao (2011)	To contribute to the theory and practice of research and development management in order to develop strategies for integrating innovation and quality	Effective innovation management, combined with the principles of total quality management, improves the quality of research and development by promoting cutting-edge applications of the results researched.
Schniederjans & Schniederjans (2015)	Address the relationship between social and technical quality management and innovation.	Social quality management practices and non-technical practices are positively associated with innovation. The positive relationship between quality management and innovation is moderated by the effects of organisation dimension, task and ethics of the manager. However, there is no significant relationship between technical quality management and innovation.
Hoang et al. (2006)	To investigate the relationship between total quality management practices and innovation performance.	It confirms that total quality management has a positive impact on the company's ability to innovate, but not all total quality management practices increase the company's ability to innovate. Only leadership and people management, strategic and process management and open organization have shown a positive impact on innovation performance.
Li et al. (2017)	Highlighting the preliminary impact of corporate quality management on green innovation and the moderating role of environmental regulation in this relationship.	Quality management is significantly correlated negatively with green technological innovation and green innovation management. In addition, environmental regulations significantly mitigate the negative impact of both.

Conclusion

This article contributes to enrich the literature on the relationship between quality management and innovation, a topic which, although pertinent, is still under researched.

Two main arguments are put forward by studies suggesting a positive relationship between quality and innovation. One argument is that innovation, as a process, is made up of various business activities and, as such, total quality management practices have a positive impact on those activities that lead to innovation. The other argument is that total quality management practices help to create an environment and culture that supports innovation.

The main argument of studies suggesting a negative relationship is the finding that the two practices (quality and management) are based on different assumptions and objectives, which are by nature antagonistic or conflicting, and which will lead to problems sooner or later.

Most of the articles selected in this literature review and cited in this study point to a positive relationship between quality and innovation, but there are articles that point to a marginal, negative or non-existent positive relationship between both terms. All sides present empirical evidence.

It seems pertinent to point out from this review that the integration of the two dimensions, more or less explicitly or in a more or less intense way, seems to be a necessity dictated by the competitive contingencies of the current market. Quality without innovation does not give the company a sustainable competitive advantage, and innovation without quality does not allow the maintenance of the competitive advantage that innovation gives. On the one hand, quality is an essential requirement for market acceptance and reputation, and on the other hand, innovation confers sustainability and long-term vision. Thus, the interconnection between the two concepts seems irrefutable. However, it is still not well understood, and the limited available literature that directly addresses the relationship between quality and innovation seems to indicate an area that needs further study.

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