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The influence of Total Quality Management on firms' intellectual capital

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Background: After carrying out an extensive literature review, it is clear that Total Quality Management (TQM) has a significant influence on many areas of companies. The development of quality management practices can lead to the generation of intellectual capital and thus become a key competitive factor.

Objectives: The purpose of this research was to explore whether TQM practices have a positive influence on a company's intellectual capital.

Method: We formulate three hypotheses considering the components of intellectual capital: human capital, social capital and organisational capital. This article develops an empirical analysis through the use of structural equation modelling using the partial least squares technique.

Results: The results show that TQM has a strong positive causal effect on intellectual capital.

Conclusion: This research, therefore, identifies a key determinant of one of the most important strategic variables for companies at present: intellectual capital.

Introduction

Grant (1991) considers that companies' competitive advantage originates from their intangible resources and capacities. When compared to tangible assets, intangible assets such as intellectual capital are equally if not more beneficial to an organisation's value creation (Barney 1991; Conner & Prahalad 1996). One reason for this outcome is that rival organisations find it more difficult to replicate intangible assets as opposed to physical or tangible assets. Some of the most important intangible assets organisations possess revolve around their different knowledge bases (Amit & Schoemaker 1993; Peteraf 1993). In this respect, a knowledge-based view of the firm has grown out of the general resource-based firm and provides a strong rationale concerning the role played by intellectual capital as regards enhancing organisational performance (Youndt, Subramaniam & Snell 2004). Other streams of literature, such as human capital (HC) or organisational learning, also indicate this inference. For example, HC theorists simply reason that an increase in worker knowledge, skills and abilities most likely translates into increased organisational performance. The literature related to organisational learning moves beyond HC to suggest that intellectual capital may, in general, provide organisations with a competitive advantage. We have, accordingly, been witness to a surge of writing and empirical studies examining the development, use and performance effects of intellectual capital (Firer & Stainbank 2003; Phusavat, Comepa, Sitko & Boon 2011; Pucar 2012; Vishnu & Gupta 2014; Wang, Wang & Liang 2014b).

Moreover, studies show that Total Quality Management (TQM) has a positive influence on a firm's competitive advantage (e.g. Powell 1995). Many researchers have focused on analysing the value of TQM as regards improving performance, suggesting that its implementation is positively associated with a firm's operational performance in terms of cost, flexibility and quality (Anderson, Rungtusanatham & Schroeder 1995; Powell 1995; Samson & Terziovski 1999). TQM is a holistic quality management approach that considers the entire value chain and emphasises human factors (Hietschold, Reinhardt & Gurtner 2014). Considering this definition as a reference point and the importance of intellectual capital as a current key factor in the process of achieving competitive advantage, we believe that the development of quality management practices can also lead to the generation of intellectual capital and thus become a key competitive factor.

The purpose of our research is to explore whether TQM practices have a positive influence on a company's intellectual capital. The gap in literature that we wish to cover is, therefore, the fact that numerous studies measuring the effect of TQM practices on business results exist, but few also consider the direct relationship between TQM and intellectual capital. If we are successful in

showing this relationship, then companies should include TQM in the management process and fit the intellectual capital work practices to the TQM strategy.

We formulate three hypotheses that consider the components of intellectual capital: HC, social capital (SC) and organisational capital (OC).

In order to achieve this objective, we shall proceed as follows. We shall firstly present detailed definitions of TQM and of intellectual capital and its subcategories of HC, SC and OC. We shall then go on to present the conceptual model, the research hypotheses and the variables, after which we shall present the sample and describe the manner in which the information was obtained and the variables were measured. This will be followed by the realisation of an empirical analysis through the use of the structural equation modelling (SEM) technique, and finally we shall present the main results and conclusions of this research.

Theoretical background

Total Quality Management

There are many definitions of quality. However, most of them have the following commonalities: (1) the fulfilment of requirements, in particular customer needs, (2) the focus on specific products, services or processes, (3) improved organisational performance, and (4) the absence of errors (Sila & Maling 2003). This concept is not, therefore, limited to products but also includes processes and other potentially important factors, such as technical and personal resources (Hietschold et al. 2014).

Quality management has, over the last few decades, evolved from being a result-orientated quality control to being an integrated company-wide approach. Researchers refer to this approach as TQM, which is a set of philosophies and methods used by an organisation to guide it in its continual improvement in all aspects of its business (Boon, Arumugam & Hwa 2005; Short & Rahim 1995).

According to many researchers, TQM produces value through a variety of benefits (Kaynak 2003; Lee & Lee 2015; O'Neill, Sohal & Teng 2016; Valmohammadi & Roshanzamir 2015; Zairi, Letza & Oakland 1994). With TQM, it is possible to achieve an improved understanding of customers' needs; improved customer satisfaction; better problem-solving, improved internal communication; stronger relationships with suppliers; reduced waste; greater employee commitment and motivation; and fewer errors. A resource-based analysis supports this conclusion, suggesting that TQM is not readily imitable owing to time compression diseconomies, causal ambiguity, connectedness of resources and social complexity. The success of TQM depends not only on adopting the TQM attributes, but also on complementary factors that are apparently unrelated to TQM but that are more difficult to imitate than TQM itself. This appears to require a culture that is receptive to change, leadership qualities and the motivation to improve (Kaynak 2003; Powell 1995). Without these tacit, intangible and difficult to imitate complementary resources, TQM programmes have no foundation for success (Anderson & Sohal 1999; Aquilani et al. 2017; Bouranta, Psomas & Pantouvakis 2017; Samson & Terziovski 1999).

At the core of TQM's ability to create value is its power to bring about an efficient creation and utilisation of valuable specific knowledge at all levels of the organisation. This contribution to knowledge creation leads to improvements in certain distinctive competencies, such as managerial competencies, employee know-how, external cooperation skills, the creation of a collective mind, organisational commitment, stimulation of the organisational learning process, speed and flexibility in the design of new products or services, and reputation (Bowen & Lawler 1992; Escrig, Bou & Roca 2001; Lemak & Reed 1997; Rao, Solis & Raghunathan 1999; Watson & Korukonda 1995; Webley & Cartwright 1996; Wruck & Jensen 1998; Youssef, Boyd & Williams 1996).

Intellectual capital

The term 'intellectual capital' is used as a synonym for intangible or knowledge assets (Stewart 1991). Its emergence in the context of business administration was first addressed in the early 1990s. 'Intellectual capital' is defined in several ways, and there is no common platform regarding these definitions, as discussed in the following.

Some of the definitions converge at the same point: the difference between the company's market value and the cost of replacing its assets. Some empirical works highlight a persistent gap between market value and book value, and intangible assets or intellectual capital could, perhaps, explain some of these gaps (Bontis 1996; Edvinsson & Malone 1997).

Stewart (1998) defines 'intellectual capital' as the intellectual material, including information, knowledge, intellectual property, experience and so on that can be put to use to create wealth. Subramaniam and Youndt (2005) conceptualise intellectual capital as the sum of all knowledge and knowing capabilities that can be utilised to give a company a competitive advantage.

As can be seen from some of the definitions, three key characteristics of the intellectual capital construct can be described as follows: its intangibility, its potential to create value and the growth effect of collective practice and synergies (Martín et al. 2010).

Having discussed the term 'intellectual capital', in the following we review the current body of knowledge regarding its dimensions.

The dimensions of intellectual capital

Various approaches concerning how intellectual capital can be classified and measured are available in the existent

literature, but one important hurdle has been detected: the lack of a common language. Keeping this in mind, Aisenberg et al. (2015) reviewed the relevant literature in order to identify models intended to measure and classify intellectual capital and the kind of new knowledge regarding the measurement of intellectual capital that has been produced between 2004 and 2014. A review of 83 articles resulted in the identification of 11 main dimensions of intellectual capital: customer, structural, innovation, relational, human, organisational, processes, relational–customer, business, social and technological. There are certainly divergent viewpoints as regards the different interest groups or disciplines, or the considerations of strategy and measurement, but in this research we have chosen the Youndt and Snell (2004) typology owing to its relevance in the following research works: Huang (2012); Subramaniam and Youndt (2005); Wang, Yen and Liu (2014a); and Youndt et al. (2004). These authors conceptualise intellectual capital as consisting of three distinct subcategories: human, social and organisational.

Human capital: HC includes knowledge, innovativeness, skills and the ability to meet the task at hand (Edvinsson & Malone 1997; Youndt & Snell 2004). It is made up of the people within an organisation and is the most important form of intellectual capital because the other two forms of capital originate from HC (Wang et al. 2014a). It shows a key characteristic: HC cannot be owned by the company. Using the literature review as a basis, Martín et al. (2010) consider three main dimensions: *knowledge*, which includes formal education, specific training, experience and personal development; *abilities*, which include individual learning, collaboration–teamwork, communication and leadership, and *behaviours*, which include a feeling of belonging and commitment, self-motivation, job satisfaction, friendship, flexibility and creativity.

Social capital: Nahapiet and Ghoshal (1998) state that SC consists of knowledge in groups and networks of people. The networks and potential assets obtained through the network are, therefore, key components of SC. Johnson (1999) introduces the notion of *relational capital*, which includes the value of all relationships, including those of customers. However, this concept is virtually identical to what sociologists and organisation theorists refer to as SC (Huang 2012).

Organisational capital: Organisational capital represents codified experience and institutionalised knowledge stored in patents, manuals, databases, routines, structures and the like (Youndt et al. 2004). While some may be apt to refer to this type of knowledge as 'structural capital' (Edvinsson & Malone 1997; Johnson 1999; Stewart 1997), Youndt et al. (2004) consider the term 'OC' to be more fitting because this is capital that the organisation actually owns. Whereas HC is possessed by the employees, thus making its management so difficult, OC is controlled, possessed and managed by the firm.

Model and hypotheses

In order to analyse whether TQM influences intellectual capital, we propose the model shown in Figure 1. Three hypotheses have been derived from this model by considering the dimensions of HC, SC and OC.

Relationship between Total Quality Management and human capital

Evans (1992) states that TQM has a *total systemic role*; that is, it influences the whole workforce of a company. Furthermore, human resources are one of the most important factors contributing to the long-term success of quality management in a firm (e.g. Shafiq, Lasrado & Hafeez 2017). In this respect, intensive and continuous training is an essential component of quality management. Maintaining high levels of quality depends on the best use of the abilities and talents of a firm's entire workforce (Rao et al. 1999).

Training is a prerequisite for the effectiveness of quality improvement activities. The usage of workers' knowledge is so important that training has become a fundamental requirement in all companies. It is one of the TQM dimensions, and having the management support and the necessary resources makes it possible to achieve the appropriate level of HC (Das, Paul & Swierczek 2008; Partlow 1996).

In this research, these lines of reasoning will be employed as a basis on which to test the following hypothesis:

H.1: TQM practices have a positive influence on HC.

Relationship between Total Quality Management and social capital

There are some dimensions of TQM that lead to an improvement in SC. Firstly, it is management that creates a work environment that is conducive to employee involvement and that encourages and facilitates open communication (Anderson et al. 1995; Wilson & Collier 2000). Involving employees requires communicating a clear quality improvement strategy to them (Kaynak 2003). Secondly, in

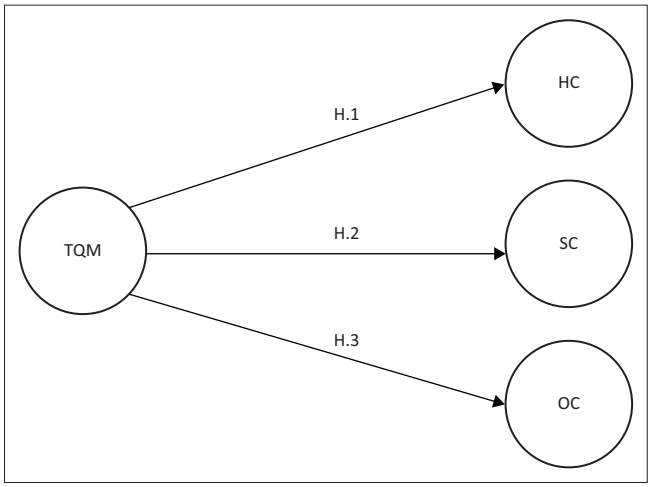


FIGURE 1: A model of the relationship between Total Quality Management and intellectual capital. TQM, total quality management; HC, human capital; SC, social capital; OC, organisational capital.

the context of TQM practices, work teams are said to facilitate information sharing, problem-solving and to develop the employees' responsibility for managing quality performance. Teamwork is seen to promote communication between employees and management and also promotes communication and cooperation between employees in different areas of the organisation (Cooney & Sohal 2004; Cordery 1996; Coyle-Shapiro 1995). Thirdly, in the area of the relation between the firm and its environment, TQM drives the practice of cooperation with both customers and suppliers (Samson & Terziovski 1999; Zylfijaj & Pira 2017). TQM increases the organisation's capacity to transfer knowledge, and according to Molina, Lloréns and Ruiz (2007), the results indicate that both internal knowledge transfers and those from suppliers and customers are related to the firm's performance. Therefore, considering all of these contributions, we think that TQM practices facilitate networks of people and knowledge in groups, which leads to an improvement in SC.

These lines of reasoning will be employed as a basis on which to test the following hypothesis:

H.2: TQM practices have a positive influence on SC.

Relationship between Total Quality Management and organisational capital

Hietschold et al. (2014) conduct a structured review of empirical studies in order to discover critical success factors when introducing TQM. They state that nearly all studies include process management, in addition to employee participation, teamwork and top management commitment. Internal operations and information processes represent a key part of the quality management infrastructure. If organisations are to maintain and continuously improve quality, they require a persistent flow of reliable information. In addition, it is not only the availability of information that is important to organisations but also its adequate usage by management and employees (Rao et al. 1999). The company is, therefore, able to maintain documented processes through the use of quality practices such as process management, and as a result, to increase the level of OC, that is, the knowledge stored in patents, manuals, databases, routines, structures and so on (Teece 1998).

Tóth and Jonás (2012), upon considering the European Foundation for Quality Management (EFQM) Excellence Model, state that excellent models are directly related to intellectual capital models. In this respect, they point out that processes include all knowledge assets accumulated by the organisation from its relationships with other stakeholders that interact in the organisational environment. They attain similar conclusions as regards the consideration of quality dimensions such as leadership and strategy, thus supporting H.1 and H.2.

These lines of reasoning will be employed as a basis on which to test the following hypothesis:

H.3: TQM practices have a positive influence on OC.

After offering a research model and related hypotheses, the following section describes the research methodology and explains the findings of our study.

Methodology

Sample and data collection

The sample used in our research was developed by choosing some companies from the SABI[1] database. Sampling was carried out on companies from Castilla–La Mancha (Spain) with at least 25 employees and belonging to different industrial sectors and services. Inactive companies were excluded; thus the final sample was made up of 876 firms. The data were collected through a questionnaire survey (see Appendix 1) carried out by mail, first in October and later in November 2016, and more responses were, in some cases, also obtained by means of personal and telephone interviews.

The questionnaires of our research were sent to the chief officer or coordinator of the Human Resources Department and Quality Department. Of the 876 questionnaires distributed, 142 were returned. However, some of them were incomplete; we eventually obtained 129 usable questionnaires, yielding a response rate of 14.7%.

Analysing the sample, the companies' employees had a mean age of 25.56 years (SD = 22.60) and the companies had a mean size of 74.97 (number of employees, SD = 127.20). We compared the sample with the rest of the firms in the population, analysing variables such as age and size. There were no significant differences between the sample and the population.

Harman's one-factor test and confirmatory factor analysis were conducted to test the presence of a common method effect. This single factor test examines the unrotated factor solution to determine the number of factors that are necessary to account for the variance in the variables. If a single factor emerges or one general factor accounts for the majority of the covariance among the measures, then it is concluded that a substantial amount of common method variance is present (Podsakoff & Organ 1986). We developed a principal components factor analysis with varimax rotation using the items from the questionnaire. There are five factors with an eigenvalue of over one, which explain 69.67% of the variance (16.94% of the variance for the first factor). We can, therefore, state that a substantial amount of common method variance is not present.

Variable measurement

The questionnaire employed a five-point scale from one (strongly disagree) to five (strongly agree). That is, the questions reflected the level of agreement with some statements related to TQM and intellectual capital (see Appendix 1 for a detailed listing of the items).

1.SABI (Sistema de Análisis de Balances Ibéricos) is a database that collects the economic and financial information of 3 200 000 Spanish and Portuguese companies.

Total Quality Management

TQM is based on nine items. The scale is based on the studies developed by Hayes, Wheelwright and Clark (1984), Skinner (1985), Hall (1987), Schonberger (1986) and Chenhall (1997) and considers elements such as employee, customer and supplier participation in quality programmes, business coordination, manager's commitment and the decrease in waste and defective products.

Intellectual capital (human capital, social capital and organisational capital)

Measurement of the three intellectual capital dimensions was based on the scale developed by Youndt and Snell (2004). This research has made a great impact in the field of strategic human resource management. The scale is composed of 14 items for the three dimensions (five for HC, five for SC and four for OC). These authors used research by Schultz (1961), Becker (1964), Walsh and Ungson (1991), Snell and Dean (1992), Nonaka (1994), Edvinsson and Malone (1997), Stewart (1997), Davenport and Prusak (1998), Nahapiet and Ghoshal (1998) and Adler and Kwon (2002). The scale includes human resource factors, such as training, employee aptitude and cooperation and organisational factors, such as company culture and the firm's knowledge-storing capacity.

Data analysis

The hypotheses were tested using SEM, which permits a simultaneous test of the causal relationships among multiple variables in a model and provides techniques with which to correct for measurement errors, which are potential problems in behavioural research.

In order to carry out a SEM analysis, it is necessary to choose between two statistical methods (Hair, Ringle & Sarstedt 2013): methods based on covariance analysis or methods based on variance such as Partial Least Squares (PLS). We chose PLS-SEM because it has fewer restrictions in relation to the size of the sample. In this respect, authors such as Reinartz, Haenlein and Henseler (2009) state that PLS-SEM is the most appropriate method when there are fewer than 250 cases. We introduced two control variables into the structural model – the company's age and the company's size (number of employees) – but we eventually decided not to consider these variables because they did not show significant effects.

Measurement model

When employing Cronbach's alpha, the standardised indicator loadings should be equal to or greater than 0.70 (Nunnally 1978). All of the constructs had acceptable values. The indicator of composite reliability should be greater than 0.8 (Nunnally 1978), a condition that was satisfied by all the constructs (Table 1).

Analysis of the convergent validity of the reflective variables follows three criteria: the size of the indicator loading, the average variance extracted (AVE) and the significance of the indicator loading. The TQM AVE is under 0.5 (0.495), and we therefore eliminated the indicator with the lowest loading, that is, TQM1 (0.641). Upon recalculating the AVE, we obtained values of up to 0.5 for all the constructs (Table 1).

TABLE 1: Internal consistency reliability and convergent validity.

Construct	Mean	SD	Range of loadings	α	ICR	AVE
TQM	3.81	1.03	0.659–0.776	0.866	0.895	0.517
HC	3.68	0.92	0.765–0.896	0.886	0.917	0.688
SC	3.67	0.96	0.804–0.892	0.901	0.927	0.717
OC	3.35	1.15	0.650–0.908	0.855	0.902	0.697

α, Cronbach´s Alpha; ICR, indicator of composite reliability; AVE, average variance extracted; TQM, total quality management; HC, human capital; SC, social capital; SD, standard deviation; OC, organisational capital.

Note: All loadings are significant with $p < 0.001$.

The analysis of discriminant validity follows three criteria, the first of which is Fornell and Larcker's criterion (Fornell & Larcker 1981). These authors suggest that the square root of AVE of each latent variable should be greater than the correlations among the latent variable.

The second criterion is to analyse the cross loadings, which should be higher for each construct than for the rest of the construct loadings (Götz, Liehr-Gobbers & Krafft 2010).

The third criterion is the heterotrait–monotrait correlations ratio. The values should be lower than 0.85 (Hair et al. 2017; Henseler, Ringle & Sarstedt 2014).

Upon considering the results it will be noted that all three criteria have a good adjustment, as the values obtained fall within the commonly accepted limits (Table 2).

Structural model

We shall first analyse the multicollinearity of the contructs, for which we require a variance inflation factor of five or lower to avoid the collinearity problem (Hair et al. 2017). We obtained a value of 1.967 for the three values, signifying that there are no collinearity problems.

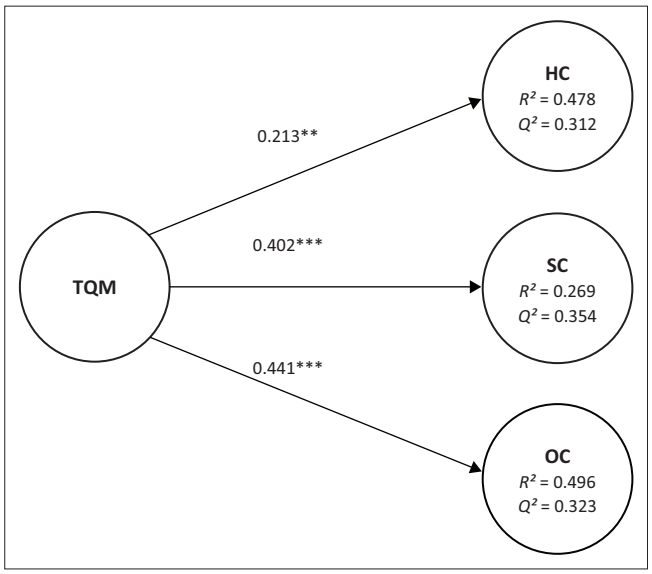
We evaluated the predictive relevance of the structural model by using the work of Falk and Miller (1992) as a basis to calculate the coefficient of determination (R^2), which should not be lower than 0.1. Geisser (1974) and Stone (1974) also recommend the Stone–Geisser (Q^2) test through the use of the blindfolding procedure. Chin (1998) states that Q^2 should be higher than zero if relevant constructs are to be attained (Figure 2). All the values are positive and higher than the 0.1 level, signifying that the model has predictive relevance.

The significance of the structural relationships was evaluated by calculating the path coefficient and using bootstrapping to assess significance. In this procedure, a large number of subsamples (in this case, 5000 and a sample size of 129) were taken from the original sample with replacement in order to obtain the bootstrap standard errors, which in turn provided approximate *t*-values for the significance testing of the structural path. As will be

TABLE 2: Discriminant validity.

Construct	Fornell–Larcker criterion				Construct	Heterotrait–monotrait ratio			
	TQM	HC	SC	OC		TQM	HC	SC	OC
TQM	**0.719**	-	-	-	TQM	-	-	-	-
HC	0.574	**0.830**	-	-	HC	0.637	-	-	-
SC	0.660	0.595	**0.847**	-	SC	0.743	0.668	-	-
OC	0.659	0.719	0.603	**0.835**	OC	0.740	0.803	0.684	-

TQM, total quality management; HC, human capital; SC, social capital; OC, organisational capital.
Note: The bold values in the table are the square root of AVE values.



***p < 0.001, ** p < 0.01 (based on t [4999], one-tailed test).
TQM, Total Quality Management; HC, human capital; SC, social capital; OC, organisational capital.
FIGURE 2: Structural model results.

observed, the three hypotheses we proposed were accepted with high levels of significance (Table 3).

TABLE 3: Hypothesis contrast.

Hypotheses	Influence between construct	Path coefficients (standardised β)	*t* (*bootstrapping*)	Hypothesis contrast
H.1	TQM→HC	0.213**	2.687	Accepted
H.2	TQM→SC	0.402***	6.205	Accepted
H.3	TQM→OC	0.441***	4.282	Accepted

TQM, total quality management; HC, human capital; SC, social capital; OC, organisational capital.
, t(0.01; 4999) = 2327; *, t(0.001; 4999) = 3092.

Conclusion

This article investigated the effect of TQM on intellectual capital in a sample of Spanish companies using the proposed model provided in Figure 1. We formulated three hypotheses considering the components of intellectual capital: HC, SC and OC. The findings of this study indicate that TQM has a strong positive causal effect on intellectual capital (Figure 2).

The results of various studies suggest that intellectual capital enhances organisational performance because the creation and development of employees' knowledge and abilities (HC), lateral relations (SC) and investments in information systems (OC) increase an organisation's capacity to efficiently and effectively process information. We have accordingly sought those company strategies that lead to an improvement in intellectual capital. TQM is one of these strategies. In this respect, we have analysed the relationship between TQM practices and the firm's HC, SC and OC.

With regard to the practical contributions of this research, given the direct influence of TQM on intellectual capital, the organisation's top management should conduct TQM programmes focusing on employee, customer and supplier participation, business coordination, manager commitment and a decrease in waste and defective products. Top managers should monitor their formal structures and systems in order to ensure that TQM is truly incorporated into the actual strategic business planning process. The empirical evidence in the shape of an association between TQM and intellectual capital performance shows that the companies that provide these practices with resources can make relevant improvements to aspects related to the three dimensions of intellectual capital, such as their employees' knowledge and abilities, their employees' aptitudes and cooperation with stakeholders, and the firm's knowledge-storing capacity. Authors such as Tóth and Jonás (2012) also state that investing in a single intellectual capital element will additionally have its effects on others, owing to the synergic effects between the subcriteria, which also demonstrates the overlap of intellectual capital categories. It is, therefore, important to encourage companies to develop TQM systems. The EFQM Excellence Model and ISO 9000, for example, are frameworks from which intellectual capital management principles and practices can be adopted as good management practice.

Several limitations are associated with this study. Firstly, it was conducted only in Spanish firms and it is thus difficult to generalise the findings to an international context. Secondly, cross-sectional research design was used to collect data for the current study; however, longitudinal research would provide more insights. Furthermore, the data was collected using a questionnaire technique and the information might not, therefore, be reliable and the research findings could be biased. We have attempted to, at least partially, overcome this limitation by using previously validated scales (see the sections 'Total Quality Management' and 'Intellectual capital [human capital, social capital and organisational capital]'), addressing the questionnaires to the top managers, and in some cases, carrying out personal interviews to assure more and better responses. Moreover, all the analyses confirm the validity and consistency of the model (see section 'Measurement model'). Finally, the study examines different sectors, but we have not included this variable in the model. This might also be considered in future research, in addition to data from other regions or countries.

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Competing interests

The authors declare that they have no financial or personal relationships which may have inappropriately influenced them in writing this article.

Authors' contributions

I.P. and J.D.S.P. were the project leaders. Moreover, I.P. and J.D.S.P identified the population. E.R. developed the questionnaire and data analysis through partial least square methodology. Furthermore, E.R. conducted the bibliographic review. Finally, R.M. developed the structure of work and the conclusions.

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Appendix starts on the next page →

Appendix 1

A: Questionnaire items

A1: *Total Quality Management*

When considering the company over the last 3 years, it is possible to state that (from 1 – strongly disagree to 5 – strongly agree):

- TQM1: The different company departments are coordinated.
- TQM2: Customers' necessities are a priority for the company.
- TQM3: Employees participate in the development of the quality strategy planning.
- TQM4: Employees participate in the quality improvement programmes.
- TQM5: The performance of production processes is monitored.
- TQM6: Proper systems are in place to eliminate the activities that do not add value to the production processes.
- TQM7: Proper procedures are established to decrease defective products.
- TQM8: Suppliers participate in the company's quality programmes.
- TQM9: Managers are committed to quality at all levels and in all areas of the firm.

A2: *Human capital*

Are you of the opinion that, in the company, and considering the last 3 years (from 1 – strongly disagree to 5 – strongly agree):

- HC1: Your employees are highly skilled?
- HC2: Your employees are widely considered the best in your industry?
- HC3: Your employees are creative and bright?
- HC4: Your employees are experts in their particular jobs and functions?
- HC5: Your employees develop new ideas and knowledge?

A3: *Social capital*

Are you of the opinion that, in the company, and considering the last 3 years (from 1 – strongly disagree to 5 – strongly agree):

- SC1: Your employees are skilled at collaborating with each other in order to diagnose and solve problems?
- SC2: Your employees share information and learn from one another?
- SC3: Your employees interact and exchange ideas with people from different areas of the company?
- SC4: Your employees partner with customers, suppliers, alliance partners and so on to develop solutions?
- SC5: Your employees apply knowledge from one area of the company to problems and opportunities that arise in another?

A4: *Organisational capital*

Are you of the opinion that, in the company, and considering the last 3 years (from 1 – strongly disagree to 5 – strongly agree):

- OC1: Your organisation uses patents and licenses as a means to store knowledge?
- OC2: Much of your organisation's knowledge is contained in manuals, databases and so on?
- OC3: Your organisation's culture (stories, rituals) contains valuable ideas, ways of doing business and so on?
- OC4: Your organisation embeds much of its knowledge and information in structures, systems and processes?