

Efficient information-related practices in companies committed to EFQM

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Abstract

Purpose – The purpose of this paper is to explore whether or not companies committed to quality management within the European Foundation for Quality Management (EFQM) Excellence Model framework use and manage the information in an efficient way, i.e., they have developed information capability. In particular, this research investigates the links between information capability and the EFQM Excellence Model.

Design/methodology/approach – This study is an extension of previous work by Zárraga-Rodríguez and Álvarez (2013), which was a first qualitative approach to the subject. In that work the EFQM Excellence Model criteria were analysed to see if somehow they illustrate practices associated to a company's information capability, self-analysis reports of a set of quality award winners were reviewed and interviews were conducted with members of those companies. The present research adopts a quantitative approach to gain deeper knowledge. Through a questionnaire survey the perceptions of managers in companies committed to the EFQM Excellence Model with respect to information capability-related practices and about the information they managed are captured.

Findings – The analysis shows evidence that many information practices are common practices among companies committed to the EFQM Excellence Model and reveals information practices that should be improved.

Originality/value – Practices that lead to efficient use and management of information have not been studied in detail in companies committed to quality management within the EFQM Excellence Model framework. Companies that are aware of the importance of handling quality information when making the decisions will find in this study a set of practices they can implement in order to achieve excellent performance based on the use and management of information.

Keywords Total quality management, Information systems, Information management, European Foundation for quality management

Paper type Research paper

Introduction

Effective implementation of information-related practices is likely to result in improved performance (Sila and Ebrahimpour, 2005; Ooi *et al.*, 2011; Laosirihongthong *et al.*, 2013; Yang, 2008; among others) and a company with a total quality management (TQM) model should manage and use information effectively and with excellence because TQM models are information-intensive management models (Taylor and Wright, 2006; Hemsworth *et al.*, 2008); in fact, information capability-related practices are to some extent taken into account within the European Foundation for Quality Management (EFQM) Excellence Model

The authors would like to thank the editor and the anonymous reviewers for their helpful comments and criticism. The authors would also like to acknowledge the support of Euskalit (the Basque Foundation for Excellence founded by the Basque Government's Department of Industry and Energy) and those companies that participated in the study.



framework (which is the TQM model mainly adopted in Europe), as evidenced by self-analysis reports (Zárraga-Rodríguez and Alvarez, 2013), and information is one of the most commonly mentioned TQM factors (Sila and Ebrahimpour, 2003, 2005). Based on this idea, one of the goals of this study is to corroborate the findings of previous work by Zárraga-Rodríguez and Alvarez (2013) using a quantitative approach, i.e., substantiate whether companies committed to quality management within the EFQM Excellence Model framework really use and manage information in an efficient manner.

It is also important to consider that information quality is an expected output when information is used and managed in an efficient way. According to DeLone and McLean (1992) and Petter *et al.* (2008), we understand information quality as the desirable characteristics of information system outputs. It is essential for business in today's competitive environment to take a strategic approach to their information needs if they wish to be competitive (Sen and Taylor, 2007), and according to Laosirihongthong *et al.* (2013), the role and importance of timely and accurate information has already been well established in the TQM literature. This study also analyses the information managed in companies committed to the EFQM Excellence Model using the set of dimensions of information quality most intensively studied.

Therefore, the main goal of this study is to explore the perceptions of managers in companies committed to the EFQM Excellence Model with respect to information capability-related practices and to explore the perceptions of those managers regarding the information they managed.

The paper is organised as follows. Section 2 introduces the conceptual framework of this study and presents a set of practices that will lead the organisation to efficient use and management of information and a set of dimensions of information quality to be considered when assessing the information managed. Section 3 details the methodological procedures used for collecting and analysing data. Section 4 presents the results and discusses them in light of the literature. Lastly, Section 5 presents conclusions drawn from the study.

Conceptual framework

The use and management of information under the EFQM Excellence Model framework

TQM is a business management model focussed on the continual improvement of processes and the satisfaction of customer needs. Employee involvement in continuous improvement, the use of data, and effective communication are also important characteristics of TQM.

TQM is an information-intensive management model (Matta *et al.*, 1998) and it is not unreasonable to assume that companies committed to TQM models should be efficient when managing information. Therefore, companies committed to TQM can be expected to have an effective information system and use information and communication technologies (Fok *et al.*, 2001; Claver-Cortés *et al.*, 2008; Dewhurst *et al.*, 2003; Matta *et al.*, 1998; Chang 2006a, b; Sánchez-Rodríguez *et al.*, 2006). There is no question about the need to invest in information technology when information-intensive initiatives such as TQM are implemented in a company (Sriram *et al.*, 1997). Moreover, an organisation's culture, i.e., behaviours and values assumed by employees with regard to the use and management of information, is also a key factor when reaching levels of excellence in using and managing the information.

The EFQM Excellence Model is the TQM model most widely applied in Europe, and provides organisations with a framework that allows them to assess their performance

by measuring their situation in terms of target excellence. The elements of the EFQM Excellence Model are configured in such a way that once the model has been properly implemented, it will provide very useful and valuable information that helps organisations in their decision-making processes (Alfaro-Saiz *et al.*, 2011). The fundamental concepts and criteria of the EFQM Excellence Model recognise that information flows play a key role in organisations; hence, the self-assessment instrument contains statements which refer to the management of the information system and information availability (Cragg, 2005; Zárrega-Rodríguez and Alvarez, 2013).

In the EFQM Excellence Model, business process management is controlled by information flows, so the model is closely associated with performance indicators, which is not possible without an efficient reporting system (Elg and Kollberg, 2012; Chang *et al.*, 2012). System quality is positively associated with information quality. A well-integrated information system, which is commonly adopted in companies committed to the EFQM Excellence Model, provides information which meets the dimension of information quality (Gorla *et al.*, 2010). Moreover, nowadays the information system is commonly supported by information technology-related tools.

All this leads us to conclude that information quality is critical to the success of quality efforts. Thus, we are interested in exploring whether companies committed to TQM models (in particular the EFQM Excellence Model) show excellence with regard to the use and management of information and whether the information managed by these companies meets the dimensions of information quality required.

The use and management of information is a source of competitive advantage: practices that evidence this fact

In order to explore whether or not a company really uses and manages information in an efficient way, we first have to delimit which of the practices commonly adopted by a company deal with the use and management of information. A practice is a set of socially defined ways of doing things, in a specific domain with a clear specified benefit-oriented aim (Ashurst *et al.*, 2008). Marchand *et al.* (2000) point out several information practices that are pooled into three major groups, which in this study are referred to as the information management group, the information technologies group and the information culture group. The information management group comprises practices related to the management of the information life cycle; the information technologies group comprises practices related to the integration of information technology into day-to-day business; and the information culture group comprises practices that show behaviours and values assumed by employees in relation to the use and management of information.

Marchand *et al.* (2000) proposed a set of 15 practices that can be observed and measured in a company. From this proposal Zárrega-Rodríguez and Alvarez (2013) incorporated inputs from other authors and addressed a total of 18 practices to be taken into account when assessing the use and management of information within a company. In order to acquire deeper knowledge, we decided to further split some of these proposed 18 practices, since their working definition comprised more than one idea.

The final set of practices that we used help us to explore the use and management of information in a company is shown in Table I. There is a total of 25 practices, pooled into the above mentioned three groups.

Based on this set of practices that evidence efficient use and management of information, one of the goals of this study is to corroborate the assumption that companies committed to quality management within the EFQM Excellence Model

Group	Practices: the organisation...	Code ^a	
Information management	...defines processes that address competitive and technology surveillance	IM_S1	
	...defines processes that facilitate the detection and identification of information to anticipate problems with suppliers and partners	IM_S2	
	...cares about knowing the information needed by employees, customers, suppliers and other stakeholders and systematically collects it	IM_C1	
	...systematically gathers information from the environment (competitors, legislation, markets) and the inner workings, filtering it to prevent overload	IM_C2	
	...defines processes to ensure that the information is available to stakeholders as needed (people can easily find it)	IM_O	
	...defines processes to transform data into useful information that can be used for decision making	IM_P	
	...defines processes to have updated databases so as to ensure that people are using the best information available	IM_M	
	...defines processes that ensure the distribution and exchange of information and the scope covered	IM_D	
	Information technology	...uses information technology (IT) to support daily operations in order to improve individual productivity	IT_OS
		...uses IT to automate and integrate the management of business processes	IT_BPS1
...uses IT to facilitate the management of people (training, knowledge management, development plans, etc.)		IT_BPS2	
...uses IT to interact and strengthen relationships with stakeholders (suppliers, customers, partners, employees, etc.)		IT_BPS3	
...uses IT to facilitate the development and exchange of new ideas. This also includes new products and services		IT_IS	
...uses IT to facilitate the monitoring and analysis of internal or external business aspects (indicators) to assist decision making		IT_MS	
...uses IT to anticipate possible outcomes of decisions before they are made, to predict values of indicators, etc.		IT_SS1	
...uses IT in competitive and technology surveillance		IT_SS2	
...uses IT to facilitate the sharing and exchange of information		IT_ISS1	
...uses IT to automate document location		IT_ISS2	
Information culture	...values people who share sensitive information rather than manipulate or hide it for their own benefit	IC_I	
	In the organisation there are formal and reliable sources of information and the organisation members use them	IC_F	
	...reveals information about the performance of the company to all employees to influence and direct individual performance and consequently the company's performance	IC_C	
	In the organisation the free exchange of sensitive and non-sensitive information in a collaborative way is a common practice among team members and between areas	IC_S1	
	In the organisation the free exchange of sensitive and non-sensitive information in a collaborative way with outside (customers, partners, suppliers, society, etc.) is a common practice	IC_S2	
	Members of the organisation trust each other enough to talk about failures and mistakes made in an open and constructive manner and without fear of unfair repercussions	IC_T	
	Members of the organisation show concern and preoccupation with obtaining and applying new information that enables them to respond quickly to changes and that enables them to promote innovation in products and services	IC_P	

Notes: ^aKey to Code, IM, information management group practice; IM_S, sensing; IM_C, collecting; IM_O, organising; IM_P, processing; IM_M, maintaining; IM_D, dissemination; IT, information technology group practice; IT_OS, operational support; IT_BPS, business process support; IT_IS, innovation support; IT_MS, management support; IT_SS, strategy support; IT_ISS, information sharing support; IC, information culture group practice; IC_I, integrity; IC_F, formality; IC_C, control; IC_S, sharing; IC_T, transparency; IC_P, proactiveness

Table I.
Information practices

framework really use and manage the information in an efficient way; that is, the use and management of information is a source of competitive advantage in companies committed to the EFQM Excellence Model.

Information quality: dimensions to be met

Information quality is a multi-dimensional construct. Since we want to evaluate the information quality dimensions that are already met by the information managed by EFQM-committed companies, it is important to understand what information quality means and how it can be measured. As we have pointed out before, according to DeLone and McLean (1992) and Petter *et al.* (2008), information quality is understood as the desirable characteristics of information system outputs and we assume that quality means fitness for use. Numerous attempts have been made to define information quality and to identify its dimensions (studies cited by DeLone and McLean, 2003; Lee *et al.*, 2002; Gorla *et al.*, 2010; Nelson *et al.*, 2005, among others). In this exploratory study we have selected the set of information quality dimensions that have been the most extensively studied. Table II presents this set of dimensions and their working definition for this study.

As we have already pointed out in the Introduction, the main goal of this study is to explore the perceptions of managers in companies committed to the EFQM Business Excellence Model with respect to information capability-related practices and to explore the perceptions of those managers of the information they managed. Hence, two research questions were defined:

- RQ1.* Do the companies committed to EFQM Excellence Model show excellence in relation to the use and management of information?
- RQ2.* Does the information managed by companies committed to EFQM Excellence Model meet the dimensions of information quality?

Methodology

Data collection

This study was carried out in the Basque Country. The survey was focussed on companies that have adopted the EFQM business excellence model and which have exceed 400 points in their external evaluation, according to the scoring system of the European Model of Excellence. The Basque Government provides two quality awards related with management quality: the distinctive “silver Q” to all those organisations that exceed 400 points in the external evaluation, according to the scoring system of the European Model of Excellence, and the “gold Q” - Basque Prize for Management Quality

Table II.
Information quality
dimensions

Dimension	Definition: the extent to which information...	References
Accuracy	...is precise, free from error, unambiguous	Huh <i>et al.</i> (1990), Wand and Wang (1996), Gable <i>et al.</i> (2008), Sadera and Gable (2004), Wang and Strong (1996), Doll <i>et al.</i> (1994), DeLone and McLean (1992), Nelson <i>et al.</i> (2005), Gorla <i>et al.</i> (2010), Lee <i>et al.</i> (2002)
Consistency	...is solid, objective, free from bias	
Believability	...is accepted as true, real and credible	
Relevance	...is exactly what is needed for the task at hand	
Completeness	...comprises all the relevant data	
Accessibility	...needed is always available	
Timeliness	...is timely for use	

those over 500 points. Companies in this study have been “gold Q” or “silver Q” – Basque Prize for Management Quality winners.

It is important to note that the methodology in this research differs from the one adopted in previous work by Zárrega-Rodríguez and Alvarez (2013). In previous research self-analysis reports were used as data sources. We were focussed on quality award winners which scored above average on sub-criterion 4e (management of information and knowledge) of the EFQM Excellence Model. In an arbitrary manner we limited the case study to the previous three years, i.e., quality award winners which scored above average on sub-criterion 4e from 2009 to 2011. Self-analysis reports from a set of 12 companies were taken into account for the study.

In this study we employed a questionnaire survey to capture the perceptions of managers in companies committed to the EFQM Excellence Model. We were focussed on quality award winners regardless of scores obtained in particular items and our target population were all the companies that had received a quality award from 1998 to 2011.

An e-mail with the link to the on-line questionnaire was sent to 262 companies. One of the most important disadvantages of self-administered surveys is their low-response rate which was 16 per cent. This low-response rate can lead to bias and undermine the generalisability of the results.

The most commonly used methods to assess non-response bias are the comparison of respondents and non-respondents and the comparison of early to late respondents using a statistical test (Miller and Smith, 1983; Forza, 2002; Lindner *et al.*, 2001; King and He 2005; Clotey and Grawe, 2014; among others). However, in this study it is difficult to assess the non-response bias because relevant data which allows us to sample non-respondents are not available and the small size of the groups of early and late respondents threatens the statistical power of the test to detect differences between them.

The instrument designed to collect the data was a questionnaire with 32 statements pooled in four main sections: information quality dimensions, practices related to the management of the information life cycle, practices related to the integration of information technology in day-to-day business, and practices related to behaviours and values assumed by employees and displayed when using information. The results were categorised using a Likert scale from 1 to 10 (1 strongly disagree; 10 strongly agree). (A part of the questionnaire given out to companies can be found in the Appendix.) The instrument was tested previously in order to avoid misunderstanding effects.

The goodness of the measures is evaluated in terms of validity and reliability. We conducted an exploratory factor analysis to assess constructs validity. We have four constructs in the study: information quality (information quality dimensions), information management (information management group practices), information technology (information technology group practices) and information culture (information culture group practices). The test extracts only one component with eigenvalue > 1.0 for each construct (information quality: eigenvalue = 5.8264, 84.2 per cent of common variance; information management: eigenvalue = 5.9266, 74.1 per cent of common variance; information technology: eigenvalue = 7.1954, 72 per cent of common variance; information culture: eigenvalue = 4.7517, 67.9 per cent of common variance). Therefore, the exploratory factor analysis (principal component analysis) supports unidimensionality of each construct we explore in the study. Reliability is assessed using the most popular test within the internal consistency method which is the Cronbach coefficient α (Forza, 2002). The α value was always within the acceptable range (0.94, 0.95 and 0.91, respectively) and therefore the measure is very reliable.

Analysis of data

As a random sample was selected, the data analysis process involved the use of statistical techniques. The research questions were evaluated using statistical hypothesis tests, and the Minitab 16[®] software package was used to analyse the results. A non-parametric test was applied because the ordinal responses are not normally distributed.

In order to check whether the proposed quality of information dimension and information-related practices were commonly adopted by companies, a one-sample Wilcoxon signed rank test was applied. This technique is a non-parametric alternative method to the one-sample *t*-test. This test also requires the data to come from a symmetric distribution, which was found to be fulfilled in both cases.

In all the statistical tests applied in this study, the criteria established in order to reject the null hypothesis was *p*-value < 0.05.

Results

Table III presents a summary of the scores given to each statement by the respondents.

In order to address question *RQ1* we decided that a practice has an excellent level of implementation when more than 50 per cent of the companies evaluate it at more than 7.5 on a 1-10 scale. The following statistical hypothesis was defined:

H0. The median is 7.5.

H1. The median is less than 7.5.

Table IV shows the median and mean value obtained from companies' assessments according to the 25 practices studied and the results of applying the Wilcoxon test to the 25 practices. Significance is indicated by asterisks next to each value.

The analyses show evidence that there are five practices which do not have an excellent level of implementation as we have defined it. Observe that for two of these practices, IM_S2 and IC_T, the criteria accepted in order to reject the null hypothesis was *p*-value < 0.1.

In order to answer question *RQ2*, we decided that managed information already meets a specific dimension of information quality if more than 50 per cent of the companies evaluate that specific dimension at more than 7.5 on a 1-10 scale. Therefore, the following statistical hypothesis was defined:

H0. The median is 7.5.

H1. The median is greater than 7.5.

Table III.
Quantitative results:
mean (\bar{x}) and
deviation (σ) of the
questionnaire scores

	IM_C1	IM_C2	IM_S1	IM_S2	IM_O	IM_P	IM_M	IM_D		
\bar{x}	7.93	7.32	6.34	6.89	7.43	7.34	7.36	7.43		
σ	1.59	1.84	2.11	2.05	1.72	1.71	1.83	1.61		
	IT_OS	IT_BPS1	IT_BPS2	IT_BPS3	IT_IS	IT_MS	IT_SS1	IT_SS2	IT_ISS1	IT_ISS2
\bar{x}	8.00	7.77	7.64	7.20	7.14	8.02	7.32	6.36	7.66	7.55
σ	1.49	1.60	1.70	1.89	1.69	1.45	1.75	1.94	1.57	1.66
	IC_I	IC_F	IC_C	IC_S1	IC_S2	IC_T	IC_P			
\bar{x}	8.23	8.09	8.30	7.43	6.45	6.91	7.48			
σ	1.83	1.57	1.76	1.73	2.01	1.94	1.70			
	IQD_ACCE	IQD_CON	IQD_RE	IQD_COM	IQD_ACCU	IQD_BE	IQD_TI			
\bar{x}	7.70	7.45	7.05	7.98	7.66	8.11	7.61			
σ	1.75	1.81	1.78	1.44	1.63	1.47	1.56			

Practices	Median	Mean	<i>p</i> -value (Wilcoxon test)
IM_C1	8	7.9	0.993
IM_C2	7.5	7.3	0.495
IM_S1	7	6.3	0.001*
IM_S2	7	6.9	0.098*
IM_O	8	7.4	0.758
IM_P	8	7.3	0.61
IM_M	8	7.4	0.675
IM_D	8	7.4	0.722
IT_OS	8	8.0	0.999
IT_BPS1	8	7.8	0.976
IT_BPS2	8	7.6	0.935
IT_BPS3	7	7.2	0.344
IT_IS	7	7.1	0.202
IT_MS	8	8.0	1.000
IT_SS1	8	7.3	0.507
IT_SS2	7	6.4	0.001*
IT_ISS1	8	7.7	0.962
IT_ISS2	8	7.5	0.904
IC_I	9	8.2	1.000
IC_F	8	8.1	1.000
IC_C	8	8.3	1.000
IC_S1	8	7.4	0.698
IC_S2	7	6.5	0.001*
IC_T	7	6.9	0.080*
IC_P	8	7.5	0.885

Information-related practices in companies

805

Table IV. Results of Wilcoxon tests for scores of the companies' adoption level of information-related practices

Table V shows the median and mean values obtained from companies' assessments according to the seven dimensions of information quality studied and the results of applying the Wilcoxon test to the seven dimensions (significance is indicated by asterisks next to each value). The analyses show evidence that the information managed by the companies meets all the dimensions of information quality except consistency, relevance and timeliness.

Discussion

Our first research question was:

RQ1. Do the companies committed to the EFQM Excellence Model show excellence in relation to the use and management of information?

Practices	Median	Mean	<i>p</i> -value (Wilcoxon test)
IQD_ACCE	8	7.7	0.009*
IQD_CON	8	7.5	0.161
IQD_RE	7	7.0	0.859
IQD_COM	8	8.0	0.000*
IQD_ACCU	8	7.7	0.061*
IQD_BE	8	8.1	0.000*
IQD_TI	8	7.6	0.107

Table V. Results of Wilcoxon tests for scores of the companies' dimensions of information quality

The analysis reveals that there are five practices which do not have an excellent level of implementation as we have defined it. Two of these practices belong to the information management group (IM_S1, IM_S2), one of them belongs to the information technology group (IT_SS2) and two belong to the information culture group (IC_S2 and IC_T).

In terms of information management-related practices, most of the reports analysed in Zárraga-Rodríguez and Alvarez (2013) contained evidence of the practices related to the information management group. However, this study provides more in-depth knowledge and reveals that the practices dealing with information sensing did not attain an excellent level of implementation, unlike the other aspects of information management.

Sensing information is the first step in the information life cycle. Sensing influences information collection and the definition of new information requirements, and is thus a critical practice. However, when sensing information, individuals have to make a value judgement as to whether potentially collectable information will be useful for the company; hence, this practice has a strong cognitive component that is more difficult to define as a set of information management practices (Marchand *et al.*, 2001). To the extent that these practices are less structured and more tacit, it seems reasonable that they do not achieve the level of implementation of other more institutionalised information practices. Furthermore, Marchand *et al.* (2001) statistically determined that sensing information seems to be the least developed or formalised information life cycle management practice in the minds of senior managers; in this study, the respondents of the survey were, in fact, managers.

Practice IM_S1 means that the organisation has defined processes for competitive and technology surveillance. The results show that the level of implementation of this practice is below the rest of the practices under the information management domain. This result is somewhat surprising because it is expected that at least processes for competitive and technology surveillance are commonly implemented in companies committed to TQM models, and indeed their existence is well supported in the companies' self-analysis reports within the EFQM framework (Zárraga-Rodríguez and Alvarez, 2013). In any case, if a company is committed to bettering its business processes, it is required to improve its information, knowledge and communication systems by using processes for competitive and technology surveillance (Lobo *et al.*, 2012).

Practice IM_S2 means that the organisation has defined processes that facilitate the detection and identification of information in order to anticipate problems with suppliers and partners. The results show that the level of implementation of this practice is also below the rest of the practices under the information management domain, which is consistent with findings from Zárraga-Rodríguez and Alvarez (2013).

We can assume that sensing practices are implemented and are considered important by the companies, but due to the difficulty of implementing them in a structured way and the companies' perception of the high cost of information sensing relative to benefits, the level of implementation of these practices is lower than for other practices. Therefore, higher levels of implementation could be achieved.

Regarding information technology-related practices, Zárraga-Rodríguez and Alvarez (2013) found little evidence in the reports analysed in relation with the use of information technologies as innovation support, as management support and as strategy support. As mentioned in the conclusions of that study, the lack of evidence in the reports does not mean that the practices do not exist but rather that they are probably not systematically implemented. In fact, there are studies that refer to the key role of information technologies within quality management models (Sadeh *et al.*, 2013; Wai *et al.*, 2011; Sanchez-Rodríguez and Martínez-Lorente, 2011, among others), and

the role of information technologies to enhance the organisational performance in companies committed to TQM has been widely researched (Khanam *et al.*, 2013; Martínez-Lorente *et al.*, 2004).

According to the results of this study, just one of the practices in the information technology group, i.e., IT_SS2, did not reach a level of implementation as excellent as the other practices. IT_SS2 is related to the use of information technologies as support for a company's strategy; specifically it is associated with the use of information technologies as support for competitive and technological surveillance. This practice is closely linked with the existence of well-implemented processes for competitive and technology surveillance, and thus, to the extent that it is empirically confirmed that those processes have not achieved an excellent level of implementation, this result could be reasonably expected.

In any case, there are many studies that analyse the relationship between information technologies and organisational strategy. Piccoli and Ives (2005) reviewed the abstracts of 648 papers from the information systems, strategic management, and marketing literatures, and categorised 117 relevant studies that support the idea that considerable opportunity exists for using IT to enable sustained competitive advantage through IT-dependent strategic initiatives. Wiengarten *et al.* (2013) analysed 26 studies that empirically examine the performance impact of the relationship between IT resources and organisational strategy. From the analysis, they conclude that IT resources can support organisational strategy, and a company's IT strategy needs to be in alignment with its overall organisational strategy in order to enhance performance in the long term. The impact of IT use depends on several factors, such as the company's operating environment. Therefore, companies might be able to gain significant performance improvements if IT resources are in alignment with organisational strategy.

In terms of information culture-related practices, Zárraga-Rodríguez and Alvarez (2013) found little evidence in the reports analysed related to practices where values such as integrity, control or transparency in the use and management of information are shown. According to the managers' opinions collected in this study, practices that reveal values such as integrity and control have reached an excellent level of implementation. Zárraga-Rodríguez and Alvarez (2013) pointed out that this is to be expected since managers would not have been comfortable with scoring those practices lower than others. However, according to the scores reported here, transparency (IC_T) did not reach an excellent level of implementation. Marchand *et al.* (2001) defined this practice as openness in reporting information on failures, which allows organisational members to learn from mistakes, and thus high levels of personal and organisational integrity are required. Organisational culture is a defining influence on how companies see information on failures, which can be perceived either as negative information or as opportunities to learn and improve. When the organisational culture makes mistakes that may be seen as bad news, transparency is reduced.

This study also reveals that there is a final practice, IC_S2, which did not reach a level of implementation as excellent as the other practices, although in Zárraga-Rodríguez and Alvarez (2013) some evidence was found in the reports reviewed. IC_S2 deals with the collaborative exchange of information with people outside the company. The flow of information exchange is driven by mutual interest between the agents involved in the exchange and by the tasks to be performed by them. There is an association between task interdependence and information exchanges, and when task interdependence increases, partners exchange a higher quantity of

information (Caglio and Ditillo, 2012; Tomkins, 2001). Internally this exchange is a requirement to achieve operational efficiency, but it is not so much the case externally. However, it should not be forgotten that collaborative information exchange is a mechanism that generates trust, and at the very beginning of the agreement it may consolidate the inter-organisational relationship. Marchand *et al.* (2001) point out that although one of the key management reforms in recent years deals with the sharing of information, the importance of this information sharing is mostly emphasised within teams and across functional boundaries, while sharing information with suppliers, customers and partners could be perceived quite differently by senior managers. Nevertheless, over the last few years, collaboration between companies has emerged as an important business trend and information openness is needed for the functioning of these collaborative relationships (Caglio and Ditillo, 2012).

Our second research question was:

RQ2. Does the information managed by companies committed to the EFQM Excellence Model meet the dimensions of information quality?

As was expected, the analyses show evidence that information managed in those companies already meets many dimensions of information quality. However, it is not empirically confirmed that this managed information has also attained three information quality dimensions: consistency, relevance and timeliness. This may be interpreted as follows.

Consistency can be understood as the extent to which information is solid, objective, unique and free from bias. When information meets this dimension, conflict between different sources should not arise. However, Hasselbring (2000) points out heterogeneity as one of the problems that arise when we try to integrate information systems. This problem is enhanced by the fact that the speed of technological change does not allow time for total replacement and therefore, the evolution and migration of new application systems is required. Bridging heterogeneity is one of the most difficult tasks of information system integration and could be seen as the reason why the conflict between different sources of information arises.

Relevance can be understood as the extent to which information is exactly what is needed for the task at hand; that is, the information is useful, value-added, appropriate and current or up-to-date. The fact that information managed has not already met this dimension reveals that not all information that people receive or to which they have access is considered relevant enough; that is, people receive or have access to information which is not exactly what is needed for the task at hand. The literature refers to this as information overload, which is described as the inability of people to cope with an increasing amount of available information regardless of whether the information consumer wants or needs it (Edmunds and Morris, 2000; Eppler and Mengis, 2004). Allen and Shoard (2005) point out that the use of information technologies is associated with increasing information availability, which has intensified information overload. The use of information technologies has become increasingly common, and according to Lee *et al.* (2010) the use of IT facilitates information sharing and information integration. Therefore, it could be expected that access to information is becoming easier, and so more information than what is needed for the task at hand is received. In fact, Alfaro-Saiz *et al.* (2011) point out that all the information that the EFQM business excellence model provides to management is not fully exploited. Hence, this information overload could explain why managed information has not achieved this dimension of information quality.

Timeliness can be understood as the extent to which information is timely for use. It could be assumed that the low level of information consistency, together with the information overload that people are exposed to, leads to information not being timely for use.

Conclusions

The aim of this quantitative study is to explore the perceptions of managers in companies committed to the EFQM Excellence Model with respect to information capability-related practices and to explore the perceptions of those managers regarding the information they managed. According to the results only 5 of 25 information-related practices were implemented at levels below excellent and information meets many dimensions of information quality.

Correctly applying the EFQM Excellence model involves monitoring the overall performance of the quality system which leads to the need of being efficient when managing information. As expected, the analyses show evidence that companies committed to that model have developed information capability.

Companies aware of the need of being efficient when managing information should design their information system by taking the set of proposed information-related practices into account. Furthermore, given that the technological change leads to the need to integrate different information systems and also allows to increase the amount of information provided by the information system, companies must take special care to avoid the lack of relevancy and the lack of consistency in the information managed.

As for research limitations, the first one is that the questionnaires were answered by managers, which could have introduced a bias. Given that information flows throughout the company and involves everyone's work, it would be better to know the perception of all employees. The second limitation is the low-response rate.

The practices that lead to the efficient use and management of information and the dimensions of information quality met by the managed information have not been studied in detail in companies committed to quality management within a TQM model framework. This study is focussed on companies that have won a quality award under the EFQM Excellence Model. A future line of research could be to compare companies with different TQM models.

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QUESTIONNAIRE

Information Orientation

The efficient use and management of information is key to any organization and it is a source of competitive advantage. It will be conditioned by the way the information life cycle is managed, by the use of information technologies and by the culture of the organization. This survey aims to evaluate how information is managed in the organization and users' perceptions about the information they receive.

I consider that(1= totally disagree; 10= totally agree)

Information life cycle management	
My organization has defined:	
<ul style="list-style-type: none"> processes competitive and technology surveillance 	
<ul style="list-style-type: none"> processes that facilitate detection and identification information to anticipate problems with suppliers and partners 	
<ul style="list-style-type: none"> processes to ensure that the information is available to stakeholders as needed (the people can easily find) 	
<ul style="list-style-type: none"> processes to have updated databases so as to ensure that people are using the best information available. 	
<ul style="list-style-type: none"> processes to transform data into useful information that can be used and serve for decision making 	
<ul style="list-style-type: none"> processes that ensure the distribution and exchange of information and the scope to be covered 	
My organization cares about knowing the information needed by employees, customers, suppliers and other stakeholders and systematically collected it.	
My organization systematically gathers information from the environment (competitors, legislation, markets) and the inner workings filtering it to prevent overload.	

.....

Perceptions about information received	
I locate and access information without difficulty.	
The information is well integrated and coordinated (even if the information comes from different sources, it is always the same).	
The information is relevant, clear, concise, and not just a list of data.	
I receive the adequate information needed to perform my job.	
The information I receive is accurate.	
I can trust the information that I receive.	
I receive information in a timely manner.	
I feel well-informed.	

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