THE FOUNDATIONS FOR AN IS QUALITY CULTURE IN THE CONTEXT OF ISO 9001

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Abstract

This paper aims to: (1) review the concept of IS Quality in the context of ISO 9001; (2) propose a definition of IS Quality Culture; (3) suggest cultural synergies between IS Quality and ISO 9001 principles; and (4) propose a framework for the development and audit of an IS Quality Culture. We conducted a systematic literature review, followed by exploratory interviews with eight ISO 9001 auditors, whose focus is on data and administrative quality, missing other essential dimensions such as information quality, software quality, infrastructure quality, and service quality. In the context of ISO 9001, an IS Quality Culture must integrate all these dimensions and an improvement effort with shared quality principles. However, IS Quality Culture requires more attention in future revisions of ISO 9001. The development of an IS Quality Culture may improve the ISO 9001 audits and give more confidence that quality is truly managed as it should be.

Keywords: Information Systems, Quality, IS Quality Culture, ISO 9001, Synergies.

1   INTRODUCTION

ISO 9001 is a global model for the implementation of quality management systems. By the end of 2011, 1.111.698 ISO 9001 certificates had been issued in 180 countries (ISO, 2012). To be certified by an external audit, organizations must provide evidences of compliance with the standard requirements. ISO certification requires the creation of documented procedures, specifications, templates, and other support information to ensure that processes are properly executed (Cunha & Figueiredo, 2005). There is also a need for a quality measuring and monitoring system (ISO, 2008b). For these reasons, quality depends on the organizational IS (Khalil, 1995; Matta et al., 1998; Barata & Cunha, 2013) and on the efficacy of the IS function (Keith, 1994). In spite of the importance that data and information technology (IT) have for ISO 9001 requirements, we gathered evidence that the traditional approaches to setting up a quality management system based on this standard do not assist companies on the development of a holistic IS Quality.

IS Quality is a multidimensional concept (Stylianou & Kumar, 2000; Nelson, 1996). Information quality, software quality, and other aggregated dimensions, can be evaluated by managerial and engineering viewpoints (Von Hellens, 1997). This field of research can combine IS and quality theory (Levis et al., 2007), having an increasing impact on organizational compliance with standards and regulations. Furthermore, there are challenges to IS Quality that include much more than technical aspects of the system or IT (Dahlberg & Jarvinen, 1997; Palvia et al., 2001; Ozkan, 2006b). We focused our attention on cultural aspects that are common to the IS Quality and quality management

approaches such as ISO 9001 and TQM – Total Quality Management (Levis et al., 2007). For example: customer satisfaction, the goal of continuous improvement, and leadership, are key principles for creating a quality culture (ISO, 2005; Kanji & Yui, 1997). Nevertheless, some questions remain unanswered. How can ISO 9001 enable the development of IS Quality? How can IS Quality contribute to the ISO 9001 implementation and quality principles? Are the ISO 9001 auditors aware of the potential of IS Quality to improve enterprise quality? Enterprise quality is not attainable without considering both the quality management system (QMS) and the quality of the IS itself (Stylianou & Kumar, 2000): there is a need to create an IS Quality Culture.

The remainder of the paper is organised as follows: section 2 presents the research design; section 3 summarizes the literature review on the topics of IS Quality, ISO 9001, and the cultural synergies among these systems; then, IS Quality Culture is defined in subsection 3.3. Section 4 presents the exploratory interviews with eight ISO 9001 auditors and exposes their perspective on IS Quality. Based on the obtained insights, we propose a framework for the development and audit of IS Quality Culture, in the context of ISO 9001. Section 5 offers some conclusions and point out the limitations of the study.

2   RESEARCH DESIGN

First, we conducted a systematic literature review (Webster & Watson, 2002; Kitchenham, 2004; Okoli & Schabram, 2010) in the fields of IS and quality management. The research space included journals and conference proceedings, using the search engines of Google Scholar, EBSCO, Science Direct, IEEE, and Mendeley. The search terms included the combination of IS Quality, ISO 9001, and quality culture. The search was refined for each principle of ISO 9001 that could represent the cultural aspects of the standard. The principles defined by the ISO 9001 are customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision-making, and mutually beneficial supplier relationships (ISO, 2005). We explored how the IS could support the quality principles and conversely, how those principles could support the IS. The main outcomes of this stage were: (1) a review of the concept of IS Quality in the context of ISO 9001; (2) the proposition of a definition of IS Quality Culture; and (3) an indication of potential cultural synergies between IS Quality and ISO 9001 principles.

In a second stage, we have conducted exploratory semi structured interviews (Myers & Newman, 2007), with eight ISO 9001 qualified auditors: [AUD1] to [AUD8]. They had over 8 years of auditing experience. The objective was to understand the auditors' notion of IS Quality, and identifying gaps in the revised literature (Walsham, 2006). Finally, we propose a framework for developing and auditing IS Quality Culture, drawn from the literature review and from the auditors' insights.

3   BACKGROUND

This section introduces the ISO 9001, IS Quality concepts, and a definition of IS Quality Culture. Next, we review the literature concerning the mutual influence of IS and quality principles.

3.1   ISO 9001

Quality management is now consolidated in standards, but is not easy to find in the literature a unanimous and objective definition for it. Reeves and Bednar (1994) synthesised four possible views:
- Quality as excellence, suggesting that quality is assessed on some specific standard;
- Quality as value, extending the excellence view and introducing the cost - benefit of quality implementations (Nelson et al., 2005);
- Quality as conformance with specifications, requiring one to consider whose needs are being satisfied and through which product (Kanungo & Bhatnagar, 2002);
- Quality as meeting expectations, consisting in the most pervasive perspective (Reeves & Bednar, 1994; Nelson et al., 2005; Kanungo & Bhatnagar, 2002), including the conformance with specifications (Kahn et al., 2002).

ISO 9000 series is made up of three basic standards. The ISO 9000:2005 (ISO, 2005) contains the vocabulary and the principles of quality management. The ISO 9004:2009 (ISO, 2009) establishes guidelines to support the achievement of sustained success by a quality approach. The ISO 9001:2008 (ISO, 2008b) is the reference by which organizations establish, document (ISO, 2008a), implement, and optionally certify their quality management systems.

The quality principles have their roots in the work of Demming (1988), Juran (1974), Feigenbaum (1991), Garvin (1998), and Crosby (1979). The ISO 9001 principles are shown in Table 1.

Quality Principle	Description
Customer focus	Organisations depend on their customers and therefore must understand their present and future needs, satisfy their requirements, and make an effort to exceed their expectations
Leadership	Leaders establish the unity of purpose and orientation of organisations. They must create and maintain an internal atmosphere in which people can become fully involved in the achievement of organisational objectives
Involvement of people	People at all levels are the essence of the organisation and their total commitment promotes the use of their skills to the benefit of the organisation
Process approach	A result is achieved more effectively when the related activities and resources are managed as a process
System approach to management	Identifying, understanding, and managing interrelated processes as a system contributes to the effectiveness and efficiency of an organisation in the achievement of its objectives
Continual improvement	Continual improvement of the organisation's overall performance must be a permanent objective
Factual approach to decision-making	Effective decisions are based on data analysis and information
Mutually beneficial supplier relationships	An organisation and its suppliers are interdependent and a mutually beneficial relationship increases their chances of creating value

Table 1.   Quality management principles (adapted from (ISO, 2008b)).

3.2   IS Quality

Quality is a multi dimensional concept in IS, as Figure 1 illustrates.
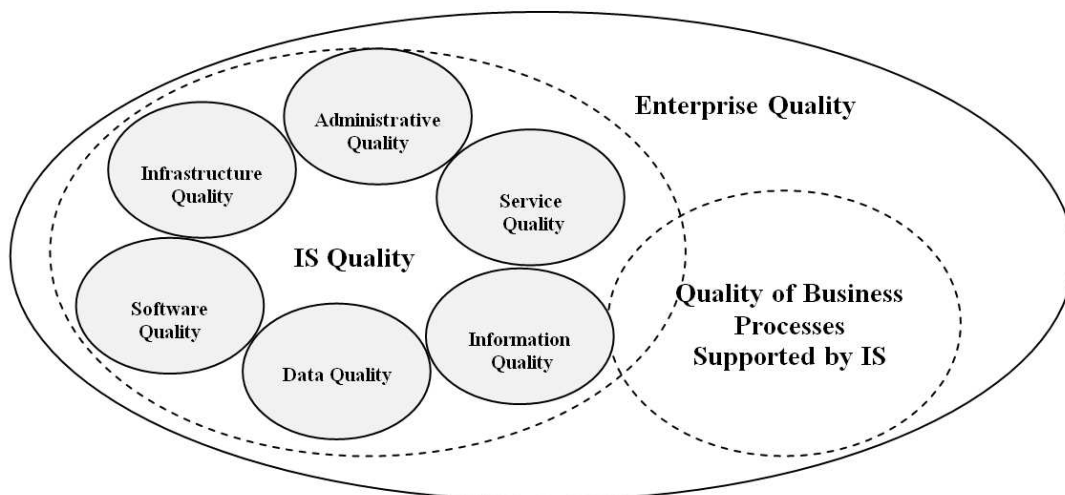

Figure 1.   Distinct dimensions of IS Quality (adapted from Stylianou and Kumar, (2000)).

According to (Stylianou & Kumar, 2000), the dimensions of IS Quality are described as:

- Infrastructure Quality: The quality of the infrastructure (hardware and enabling software) that is fielded and maintained by the IS function- includes, for example, the quality of the networks and systems software;
- Software Quality: The quality of the software applications built, maintained, or supported by IS;
- Data Quality: The quality of the data entering the various information systems (input);
- Information Quality: The quality of the output resulting from the IS. In many cases, the output of one system becomes the input of another. In that respect, information quality is related to data quality;
- Administrative Quality: The quality of the management of the IS function - includes the quality of budgeting, planning, and scheduling;
- Service Quality: The quality of the service component of the IS function - includes the quality of customer support processes such as those related to a helpdesk.

IS Quality combines data and information quality, IT quality, people, and organization (Nelson, 1996). Stylianou and Kumar (2000) frame "enterprise quality" as an holistic perception of IS and quality in the continuous improvement of the organization. They highlight that some of the viewpoints in IS Quality overlap considerably, for instance, information with data; administrative quality and service quality; software quality and infrastructure quality, that, in turn, influences service quality. In addition, the viewpoints are usually researched individually, making it difficult to explore their connections (Salmela, 1997; Wang, 1998; Stylianou & Kumar, 2000; Ozkan, 2006a).

According to Wang (1998), the terms "data" and "information" are often used interchangeably in practice. Managers differentiate information from data intuitively and describe information as data processed in some manner. In the beginning of the process, information is the form/sign of what is known, expressed on media material by author; at the end, is the form/sign that we can receive (Hsieh, 2006). Information quality, as described by Stylianou and Kumar (2000), has a parallel with Zachman (1982)'s distinction: data as input and information as a useful output of processed data. Also, in many cases, the output of one system becomes the input of another, mixing information quality and data quality together (Wang, 1998; Nelson et al., 2005). The intrinsic view of information quality considers the properties of information largely in isolation from a specific user, task, or application. Thus, the intrinsic view reflects a measure of agreement between the data values presented by an IS and the actual values that data represents in the real world. A contextual view extends the notion of information quality, underlying the need to define it based on the user of the information, the task being completed, and the application being employed (Nelson et al., 2005), which is similar to the ISO 8402 (ISO, 1994) proposal, and Juran (1974)'s definition of quality as "fitness for use". The context view also expands information quality beyond accuracy, including elements such as relevance, completeness, and currency of the information that shape perceptions of quality in the context of use – user involvement (Wang, 1998). An example of a study relating user involvement and satisfaction with the system is presented by Baroudi, Olson, and Ives (1986). In addition to the intrinsic and context-based dimensions of information quality, Wang and Strong (1996) also suggest that there is a representational view, reflecting the degree to which information presentation effectively facilitates interpretation and understanding. Lee, Strong, Kahn, and Wang (2002) present a methodology to assess information quality, aligned with TQM principles, that includes a forth view: accessibility.

Von Hellens (1997) presents a distinction between the managerial, organizational, and engineering viewpoints. Software engineers centre their attentions on the requirements, development cycle, and quality attributes of the software as a product. Software quality is a specific area in IS that concerns both product - its quality attributes - and process development related with managerial activities (Tian, 2005). The managerial viewpoint is concerned with the effectiveness of the firm and the way that the development and use of information systems contribute to its profitability. In turn, the organisational viewpoint is interested in the impact that systems and IT have on the way organisations work and compete. However, even within the same perspective, the user's perception of quality may vary and is difficult to measure (Arazy & Kopak, 2011). These perspectives, although not mutual exclusives, do emphasise different activities and the different methods available to control and improve IS Quality. Von Hellens (1997) concludes for the need of more flexible and integrative methods.

The IS Quality dimensions reinforce and support each other. A study developed by Gorla, Somers, and Wong (2010) has shown a positive relation between system quality and information quality. These two dimensions, together with service quality, are linked to a significant positive influence on organizational impact either directly or indirectly. As proposed in the DeLone and McLean (2003)'s model, information, system, and service quality are dimensions that influence the IS organizational impact.

IS Quality has already proven its relevance for business quality. Salmela (1997) defines business quality "as the net value of an information system for the user organisation. Thus, it is affected by both the cost of planning, developing, maintaining and using the system and by the benefits achieved through systems use". This conception of quality has no parallel in traditional QMS theory as proposed by Demming (1988), Juran (1974), or the ISO 8402 (ISO, 1994) standard. Salmela (1997) explores the value of information and articulates the notion of IS sustainability, acquired by flexibility to change both business and IS. Salmela (1997) corroborates that IS continuous improvement is a key element of business quality. Levis et al. (2007) conclude that high information quality is an enabler of TQM and serves as a key to quality success. In organizations certified with ISO 9001, the decisions must be based on data analysis and information. Nevertheless, Dahlberg and Jarvinen (1997) state that IS Quality is still in an immature level in organizations. Minimizing its weaknesses may enhance the confidence in audits and ISO certification.

3.3 From the organizational culture to an IS Quality Culture

There is no unanimous definition for organizational culture. Some scholars describe culture as "shared values", another group as "way of working", and others consider a combination of both (Gallear & Ghobadian, 2004).

> *"Culture can now be defined as (a) a pattern of basic assumptions, (b) invented, discovered, or* developed by a given group, (c) as it learns to cope with its problems of external adaptation and internal integration, (d) that has worked well enough to be considered valid and, therefore (e) is to be taught to new members as the (f) correct way to perceive, think, and feel in relation to *those problems"*   (Schein, 1990)

Barney (1991) defines organizational culture as "a complex set of values, beliefs, assumptions, and symbols that define the way in which a firm conducts its business". Those values delineate the rules or context for the social interaction, having an impact on the behaviour of firm members (Leidner & Kayworth, 2006). Culture is a socially negotiated and dynamic process, that can be studied at different interrelated levels, such as the national, organizational, and individual (Ali & Brooks, 2008).

Quality culture requires a combination of the organizational culture, individual culture, and quality principles (Kanji & Yui, 1997; Hildebrandt et al., 1991). A strong quality culture involves customer orientation, continuous improvement, using data and analysis to support decisions, and the involvement of people in quality problems (Briscoe et al., 2005; Ishikawa, 1984; Bahzad & Irani, 2008). ISO 9001 defines a pattern of common quality principles that certified companies must learn and internalize in their daily practices performed by all the stakeholders. Those principles are similar in TQM and ISO 9001. Figure 2 illustrates the mutual influence of the quality principles in the organizational and quality culture.
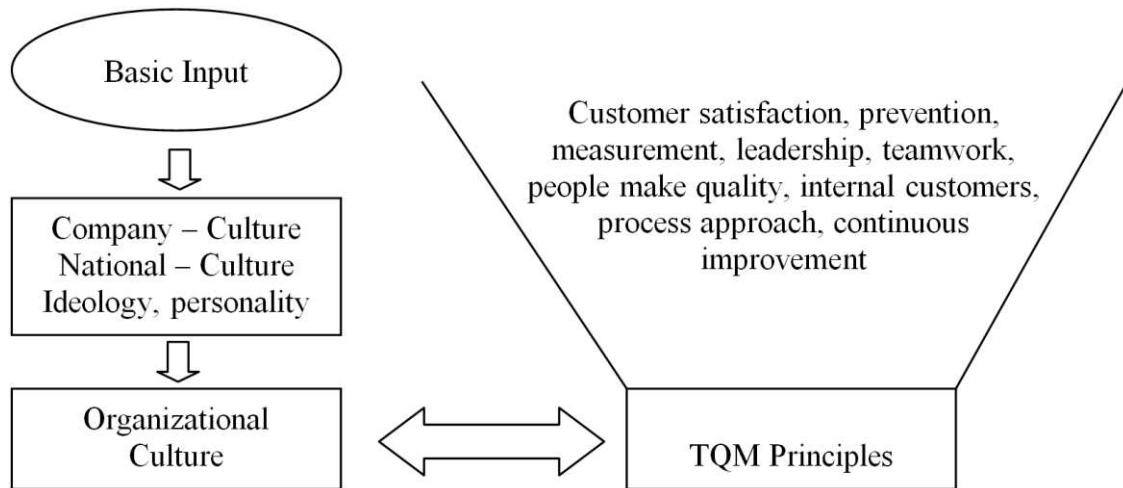
Figure 2.   The creation of a quality culture (adapted from Kanji and Yui (1997)) .

> The cultural stream of analysis leads to a different perspective on quality. The objective of introducing a quality management system is not necessarily the direct improvement of quality; the aim might be to change the culture in such a way that the introduction of a quality management system becomes culturally feasible.   (Vidgen et al., 1993)

A comprehensive review of culture in IS research is presented by Leidner and Kayworth (2006). The authors start by discussing the divergent definitions of culture, including the aspects of basic assumptions, values, and artefacts. A total of 82 articles are studied in the themes of culture and IT, at national and organizational level. There are studies that point to the mutual influence between the IS and cultural quality principles. For instance, quality and improvement of information lead to changes in the customer orientation, flexibility, quality focus, and empowerment and integration (Doherty & Doig, 2003; Doherty & Perry, 2001). However, most of the studies address the impact of cultural aspects in IS development, IT adoption and management (Leidner & Kayworth, 2006).

A definition for a holistic IS Quality Culture cannot be found in the literature. For example, according to Caballero et al. (2004), the IS Quality Culture exists when all organisational processes take into account data quality issues in order to improve it. To propose an holistic IS Quality Culture definition, in the context of ISO 9001, we must take in consideration the distinct IS quality dimensions, and the ISO 9001 principles for a quality culture, as illustrated in Figure 3.
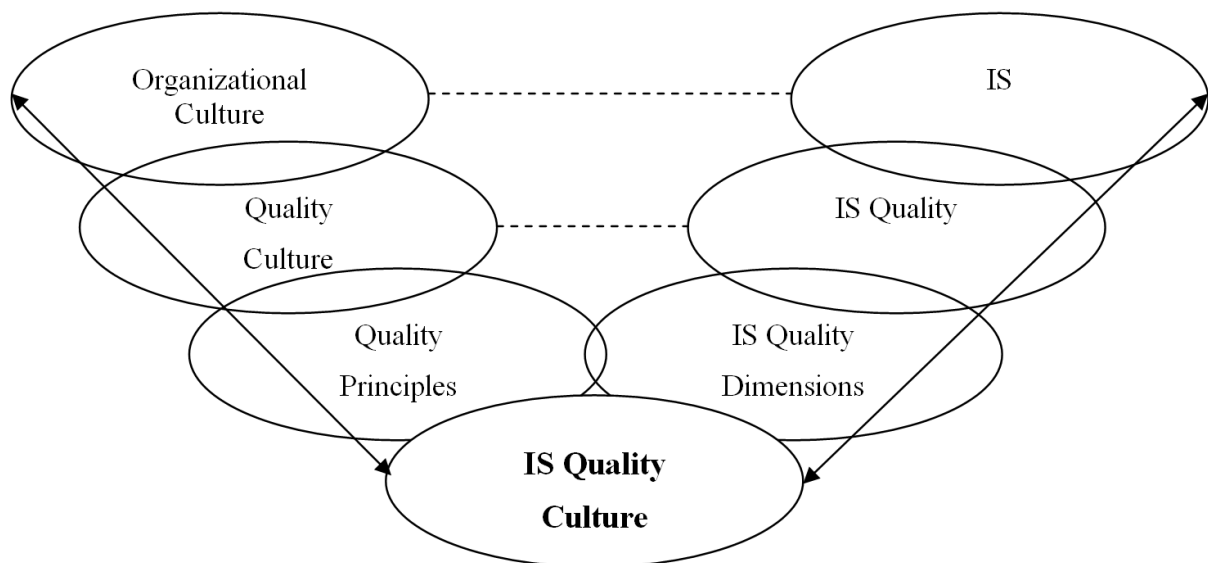

Figure 3.   Researching IS Quality Culture.

Inspired by the above literature contributions, we define IS Quality Culture as the set of values, beliefs, assumptions, and symbols that an organization develops in order to improve the distinct IS Quality dimensions and quality principles. The IS Quality dimensions include the administrative, information/data, software, service, and infrastructure.

3.4   IS Quality and ISO 9001 synergies: The principles for a cultural change

There are synergies between business quality management and IS Quality. For example, Wang (1998) proposes TDQM - Total Data Quality Management, a methodology for IS development in TQM contexts. The author uses an approach similar of Deming's PDCA cycle, aiming the continuous improvement of the information product. Chou et al. (1998) propose a TQM-based IS auditing framework, based on ISO 9001 auditing requirements. Worthington (2000) presents the approaches and techniques used by U.S. Environmental Protection Agency to build an information quality system. The method starts by (1) selecting a standard quality system model (e.g. ISO 9001), (2) identifying the information product of the organization, (3) assessing and determining all individual processes in the information quality value chain, (4) identifying quality indicators, (5) establishing the measurement methodology for those indicators, and (6) applying the quality system model elements, including quality policies and procedures. Lin (2010) found that the combination of IS Quality and management commitment, as proposed by ISO 9001, affects ERP system usage through user perceptions of usefulness and satisfaction. Leadership is an example of a quality principle that influences both quality and IS (Quaadgras et al., 2011).

Quality and IS may require similar organizational cultures (Ku, 2010; Fok et al., 2001), for instance, concerning the mutual benefits of quality and ERP implementations (Sánchez-Rodríguez & Martínez-Lorente, 2011; Sánchez-Rodríguez et al., 2006; Li et al., 2008). TQM maturity contributes to improve IS development areas like the achievement of goals, system design concepts, assumptions made by IS professionals about system user expectations, and the involvement of users in development activities (Fok et al., 2001). Increasing the TQM maturity also increases the users perception of organizational performance and service quality (Hartman et al., 2002). Also, IT is crucial for the quality infrastructure, so synergies among both systems are expected to occur (Fok et al., 2001). Philip and McKeown (2004) describe a highly successful business transformation case study, regarding the privatization process of an engineering/aerospace company. Cultural changes have been brought about through the combined development of managerial and organizational competencies, IS, and quality management.

A number of scholars have researched the mutual support provided by IS and quality principles. Table 2 summarizes their contributions. The first column describes the quality principle selected from ISO 9001. For each principle we searched for the support provided by the IS, presented in column 2. Then we have searched for the benefit of that principle in IS theory. The literature coding did not include the principle of system approach, because the concept is intrinsic to both the IS and ISO 9001.

Quality Principle	IS in support of the Quality Principle	Quality Principle in support of the IS
Customer focus (related terms: customer service; service quality; customer relation; feedback)	(Ray et al., 2005); (Daghfous & Barkhi, 2009); (Dong, 2010); (Banker et al., 2006); (Sánchez-Rodríguez et al., 2006; (Sánchez-Rodríguez & Martínez-Lorente, 2011); (Dewhurst et al., 2003); (Anh & Matsui, 2011); (Zahedi, 1998); (Wu & Gu, 2009); (Mithas et al., 2011); (Forza, 1995b); (Lobo & Ramanathan, 2005); (Berry & Parasuraman, 1997)	(Baroudi et al., 1986); (Prybutok et al., 2008); (DeJarnett, 1991); (Pearson et al., 1995); (Paper & Rogder, 1996); (Stylianou & Kumar, 2000); (Kanungo & Bhatnagar, 2002); (Molina et al., 2004); (Von Hellens, 1997); (Hartman et al., 2002); (Aggarwal & Rezaee, 1996); (Ravichandran & Rai, 2000b); (Ravichandran & Rai, 2000a); (Li et al., 2008); (Ku, 2010); (Morabito et al., 2010); (Fok et al., 2001)

Quality Principle	IS in support of the Quality Principle	Quality Principle in support of the IS
Leadership (related terms: top management support; supervision; coordination; planning)	(Sánchez-Rodríguez et al., 2006); (Anh & Matsui, 2011); (Keramati & Albadvi, 2009); (Lobo & Ramanathan, 2005)	(Lin, 2010); (Quaadgras et al., 2011); (Prybutok et al., 2008); (Pearson et al., 1995); (Paper & Rogder, 1996); (Stylianou & Kumar, 2000); (Kanungo & Bhatnagar, 2002); (Siddiqui & Rahman, 2006); (Von Hellens, 1997); (Chow & Lui, 2003); (Ravichandran & Rai, 2000b); (Ravichandran & Rai, 2000a); (Li et al., 2008); (Schniederjans & Kim, 2003)
Involvement of people (related terms: human resource utilization; workforce management; teamwork; employee development and training; inter-departmental information flow; cross-functional communication; employee suggestion)	(Ang et al., 2001); (Sánchez-Rodríguez et al., 2006); (Sánchez-Rodríguez & Martínez-Lorente, 2011); (Dewhurst et al., 2003); (Anh & Matsui, 2011); (Wu & Gu, 2009); (Keramati & Albadvi, 2009); (Lobo & Ramanathan, 2005); (Kock & McQueen, 1997; Kock & McQueen, 1998)	See customer focus (in the revised IS literature, involvement of people is concerned with user – customer involvement)
Process approach (related terms: process design, process management, process control)	(Dong, 2010); (Sánchez-Rodríguez & Martínez-Lorente, 2011); (Dewhurst et al., 2003); (Anh & Matsui, 2011); (Mithas et al., 2011); (Wu & Gu, 2009); (Lobo & Ramanathan, 2005)	(Stylianou & Kumar, 2000); (Pearson et al., 1995); (Kanungo & Bhatnagar, 2002); (Von Hellens, 1997); Walgenbach (2001); (Aggarwal & Rezaee, 1996); (Ravichandran & Rai, 2000b); (Ravichandran & Rai, 2000a); (Schniederjans & Kim, 2003); (Morabito et al., 2010);
Continual improvement	This principle appears in the literature as an achievement of other principles adoption, such as the involvement of people (Ang et al., 2001), the process approach (Casadesús & Castro, 2005), feedback from the customers (Forza, 1995a; Taylor & Wright, 2006) or from the quality indicators (Sánchez-Rodríguez & Martínez-Lorente, 2011), as a consequence of leadership (Aggarwal & Rezaee, 1996; Dewhurst et al., 2003), in process improvement groups (Kock & McQueen, 1997; Kock & McQueen, 1998)	This principle appears in the literature as an achievement of other principles adoption. A number of authors specifically address this principle, namely, (Wang, 1998); (Stylianou & Kumar, 2000); (Pearson et al., 1995); (Aggarwal & Rezaee, 1996); (Bartel, 1995)
Factual approach to decision-making (related terms: information and data analysis; quality data and reporting; quality cost; decision process; benchmarking; quality tracing and control; timely and correct decisions; process metrics)	(Taylor & Wright, 2006); (Ang et al., 2001); (Sánchez-Rodríguez et al., 2006); (Sánchez-Rodríguez & Martínez-Lorente, 2011); (Dewhurst et al., 2003); (Wu & Gu, 2009); (Mithas et al., 2011); (Anh & Matsui, 2011); (Jiao et al., 2007); (Lobo & Ramanathan, 2005); (Mjema et al., 2005); (Zhao et al., 2008)	(Stylianou & Kumar, 2000); (Pearson et al., 1995); (Kanungo & Bhatnagar, 2002); (Chow & Lui, 2003); (Mandke & Nayar, 2004); (Ku, 2010); (Bartel, 1995); (Zahedi, 1998); (Tort-Martorell et al., 2011)
Mutually beneficial supplier relationships (related terms: vendor participation)	(Dong, 2010); (Banker et al., 2006); (Sánchez-Rodríguez et al., 2006); (Sánchez-Rodríguez & Martínez-Lorente, 2011); (Dewhurst et al., 2003); (Anh & Matsui, 2011); (Forza, 1995b); (Lobo & Ramanathan, 2005)	(Ravichandran & Rai, 2000a); (Ravichandran & Rai, 2000b)

Table 2.   Literature classification of quality principles and IS mutual support.

The review in Table 2 proves that the IS can support the principles for a quality culture. For example, Ang et al. (2001) found that the information system benefits the dimensions of important innovations, information and analysis, output quality assurance, and human resource utilization. Dong (2010) found that IT could enable quality initiatives such as process design and innovation with the supply chain partners.

There is also evidence that the enunciated principles can support IS Quality. According to Hartman et al. (2002), the IS adoption will be more user-centred and participative. L. Li, Markowski, Xu, and Markowski (2008) found that customer satisfaction, top management support, and life-long learning, have a positive impact preceding ERP implementations. Other examples include the support for administrative and service viewpoints of the IS (Paper & Rogder, 1996; Pearson et al., 1995).

IS Quality Culture must combine the IS and the quality literature, in a way that improves and reinforces each other in daily practice.

4 DEVELOPING AN IS QUALITY CULTURE FRAMEWORK

This section presents the preliminary results of an investigation with ISO 9001 auditors with the purpose of understanding their view of IS Quality. Next, we present the framework for developing and auditing IS Quality Culture.

4.1 Exploratory interview results

The interviews with the auditors have highlighted the contextual dimension of IS quality (Nelson et al., 2005), similar with the "fitness for use" (Juran, 1974), and the organizational perspective of IS quality (Von Hellens, 1997). Sample statements say that IS Quality: "aims to reduce the duration of the daily tasks; ensure information accessibility to the entire organization, with proper permissions, intuitively, and answering all the organization needs, without data duplication" [AUD6]; and "the IS ability of being useful, reliable and timely updated, for the desired purpose" [AUD5].

When compared with contextual dimension, the auditors paid less attention for the intrinsic view of IS quality, such as the information quality attributes, and software quality (except for clause 7.6 of ISO 9001, about the control of monitoring and measuring equipment). The interviewees also did not emphasise the managerial perspective of IS quality, for example: the measurement of IS service performance; how infrastructure is managed to ensure that exists a proper support to each process; and how information quality is monitored and improved in daily practice.

According to [AUD1] "without IS quality, the ISO 9001 certification fails, because quality must be based in facts […] we must ensure: reliability, that data must reflect reality, without errors or omissions; protection against intrusions, manipulation or failures; and availability, ensuring that data can be recovered in case of problems". A similar perception was mentioned by [AUD2] [AUD3], [AUD4], and [AUD7]. IS Quality has impact in the process approach of ISO 9001, because it "allows the process documentation, accurate standardization, and consequent predictability" [AUD2]. IS Quality is also external to the organization, "because quality fails if it is not seen systemically and it does not involve other entities such as the suppliers. For instance, we need proper documentation of our safety equipment and dangerous chemicals, or we can have accidents for that reason." [AUD8].

The eight auditors view the IS Quality importance at a level that is not exclusively technological. However, their definitions point to the purpose and relevance of IS Quality, lacking a multidimensional perspective. Curiously, the need to continuously improve the IS Quality was not mentioned. We also could not find other principles reflected in the auditors comments, such as the customer focus (IS users), involvement of people (e.g. IS Quality surveys), leadership (e.g. procedures or practices directly aiming IS Quality), and a process approach to IS Quality (e.g. actions to improve the quality of process indicators). Not surprisingly, the auditors reinforced the idea of the IS as a support of ISO 9001. However, the converse is also true, by the adoption of quality to the IS. The interviewed ISO 9001 auditors do not show awareness of these potential synergies, but we suggest that they could be key players for the organizational IS Quality Culture.

4.2 A framework for IS Quality Culture

The development and auditing of an IS Quality Culture must have an holistic perspective, combining social, technical, and organizational dimensions (Nelson, 1996). There are distinct dimensions to consider: administrative, information/data, software, service, and infrastructure (Stylianou & Kumar, 2000). The development and audit of the distinct IS Quality dimensions can be done by each quality principle: customer focus, leadership, involvement of people, process approach, system approach to management, continual improvement, factual approach to decision-making, and mutually beneficial supplier relationships (ISO, 2005).

An IS Quality Culture is not a set of rules to ensure the quality of the IS; it must be learned and developed by the organizational users (Schein, 1990). The benefits of IS Quality must be understood by the entire organization, and then be used to aid in creating the most suitable practices. Each element of the organization must be aware that IS Quality is critical for the decisions made, for the image that a customer has of the organization, and for a truthful measurement of process results. IS Quality affects the individual work, the organization, and the outside environment, and thus cannot be the single responsibility of the IS departments. A framework for IS Quality Culture is represented in Figure 4.
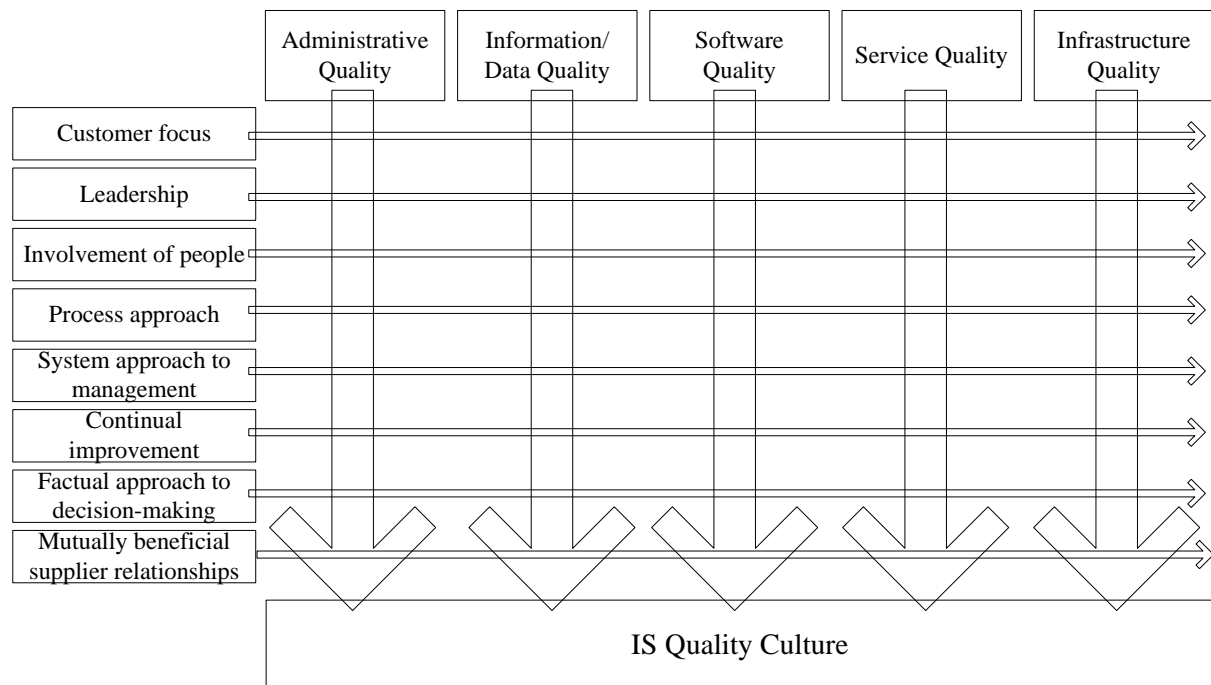

Figure 4.   Framework for IS Quality Culture in the context of ISO 9001.

The framework suggests a synergistic interrelation among the IS Quality dimensions (represented on the top of Figure 4) and the eight quality principles of ISO 9001 (on the left of Figure 4). The IS Quality Culture is a dynamic concept of improvement, therefore it must be developed and adopted in daily practice. Our future research will use the discussed framework to create a guide for developing and auditing the IS Quality Culture in ISO 9001 contexts. A second round of interviews are already planned to investigate what items should be included in a comprehensive audit checklist able to address all the quality principles, for each IS Quality dimension. One of the main challenges is to keep the audit checklist simple enough to be used by IS non-experts. After the auditors validation, we intend to collect evidences from field studies, to assess the impact of the framework in the IS Quality Culture. Then, we will focus our research on the auditing process, in order to ensure that the checklist is significant for practice.

Further contribution aims at expanding the IS Quality viewpoint that we have found trough the interviews. These are the first steps to increase IS Quality awareness in the certified organizations worldwide, promoting the internalization of IS Quality Culture values and practices (Lascelles & Dale, 1990; Briscoe et al., 2005).

5   CONCLUSIONS

This paper proposes an IS Quality Culture definition, in the context of ISO 9001. We conducted a systematic literature review, followed by exploratory interviews with eight ISO 9001 auditors. As a result, we present a framework for developing and auditing an IS Quality Culture.

Both IS Quality and ISO 9001 require an organizational joint effort to be developed and audited. There are cultural synergies in IS Quality and ISO 9001. IS Quality is an holistic concept, not limited by technology. In turn, IS Quality Culture must evolve by the development of values, beliefs, assumptions, and symbols, concerning the multiple dimensions of IS Quality. Both, the organizational quality culture and the IS Quality Culture, must be developed by a combination of principles. Quality is a journey (Chang et al., 1993) that needs to be internalized in and highlighted in daily practice.

The ISO 9001 has several benefits to the foundations of an IS Quality Culture. First, it indicates principles to develop a quality culture. Second, more than one million companies already adopt ISO 9001, hence small improvements can reach companies worldwide, diffusing knowledge much faster. Third, due to the regular internal and external audits of ISO 9001, IS Quality can become a central concern for organizations, acknowledging that it is not possible to have organizational quality without IS Quality. Nevertheless, the ISO 9001 requirements could give more attention to IS Quality, what can be observed, for instance, in clause 7.6 (ISO, 2008b). There are opportunities for improvement in the next revision of the standard, expected to be published in 2016.

Our research has limitations that are important to point out. A literature review has natural boundaries due to the selection of the keyword terms and search engines. We have restricted the investigation of IS Quality Culture to the ISO 9001 context. The IS Quality Culture framework is proposed for specific principles to develop a quality culture at the organizational level; other values, practices and principles for cultural development may be further considered. Although we have adopted rigorous practices for our research, the qualitative interview was exploratory and included only eight participants. Cultural research is complex, so our work contributes for the foundations of the thematic in IS quality.

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