Developing a knowledge management policy for ISO 9001: 2015

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Abstract

Purpose – *International Organization for Standardization (ISO) 9001: 2015 quality management systems places an obligation on organizations to consider the role of organizational knowledge as a resource. The purpose of this paper is to systematically relate the key fundamentals of knowledge management to the seven quality management principles of ISO 9001: 2015. It is the first to consider this relationship.*

Design/methodology/approach – *The paper traces the history of quality standards and the background to the inclusion of an organizational knowledge clause in ISO 9001: 2015. It then systematically considers the seven quality management principles in relation to knowledge management principles.*

Findings – *The core elements of the knowledge management standard are incorporated with the organizational knowledge clause. Explicit and tacit knowledge are addressed by the ISO standard. Knowledge and its management will become increasingly important in organizations driven by ISO certification requirements.*

Research limitations/implications – *ISO 9001: 2015 was released in September 2015 which means that organizations have yet to apply the organizational knowledge clause. This paper is a conceptual one which needs to be complemented with empirical research.*

Practical implications – *This paper identifies the role of knowledge management principles as they apply to ISO 9001: 2015 and the seven quality management principles. More than 1.1 million organizations are certified to ISO 9001, plus many others who use the standard informally. Those involved with organizational quality will need to understand the role of knowledge in the organization.*

Social implications – *Quality services and products need to be underpinned with strategic knowledge management.*

Originality/value – *This paper is the first to discuss knowledge management in relation to the seven quality management principles which assist the development of policy for quality management.*

Keywords *Quality management, Knowledge management systems, Standards, ISO 9001: 2015*

Paper type *Conceptual paper*

Introduction

In September 2015 a new version of International Organization for Standardization (ISO) 9001: 2015 *Quality Management Systems – Requirements* was released which contained for the first time an obligation for organizations to consider the role of organizational knowledge as a resource. This specification will position knowledge more centrally within the quality management policies of more than one million certified organizations worldwide (ISO, 2014a) and require them to systematically consider all the stages of the knowledge management cycle. There are also many other organizations which use the ISO 9001 standard to enhance their quality systems but do not seek certification, and these, too, will increasingly consider the role of organizational knowledge.

This paper is the first to systematically relate the key fundamentals of knowledge management to the seven quality management principles (QMPs) of ISO 9001: 2015. It will begin with a discussion of the development of ISO 9001 standards and then examine the

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> **"The incorporation of knowledge within the ISO 9001: 2015 standards will position it as a key organizational resource which may lead to substantial organizational changes."**

development and stages of the knowledge management cycle and then extend it to consider suppliers and customers. The paper will then explore the relationship of knowledge to each of the QMPs paying particular attention to explicit and tacit knowledge. Finally, it will draw some conclusions to assist organizations as they integrate knowledge within their quality management systems.

The development of International Organization for Standardization 9001 quality standards

As manufactured products became increasingly sophisticated, it became more challenging to inspect their final quality and also more costly for manufacturers if products were rejected. Moreover, large customers were independently conducting inspections and duplicating effort and cost. To address these challenges, the US Department of Defense (1959) issued a specification for quality – *Quality Program Requirements* (MIL-Q-9858) (US Department of Defense, 1959), and in 1973, the UK Defence Standards DEF STAN 05-21/1 – "Quality Control System Requirements for Industry" (Ministry of Defence, 1973) was published and based on earlier North Atlantic Treaty Organization (NATO) quality standards issued at the end of the 1960s. In effect, all these standards changed the emphasis from post-production quality inspection and control to ensuring that quality was built into the manufacturing processes from the beginning, i.e. quality assurance. For the purposes of clarification:

> A standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose (ISO, 2015).

Subsequently, many organisations established their own quality requirements for suppliers, but these individual specifications were neither universal nor consistent. In 1971, the BSI published BS 9000, a quality assurance standard for the electronics industry and then, in 1974, BS 5179 "Guidelines for Quality Assurance". These guidelines were not presented as a standard because of "misgivings in many sectors of industry about the reissue of defence standards" (BSI, 1979, p. 2) with the result that there was a proliferation of quality assurance standards and inspectors from purchasing and third party organizations. To mitigate this, Warner's (1977) report "Standards and specifications in the engineering industries" recommended that these be rationalized through a common standard and, following further consultation, BSI published quality standard BS 5750 in 1979 (British Standards Institute, 1979). Essentially, there were few differences between BS 5179 and BS 5750 with the main ones being that they were requirements rather than recommendations, and it was published in three parts:

1. specification for design, manufacture and installation;
2. specification for manufacture and installation; and
3. specification for final inspection and test.

Another driver for the implementation of quality standards was competitive advantage and a literature review of the economics of standardization conducted in Australia, Canada, France, Germany and the UK maintained that the growth of the standards catalogue might be responsible for between one-eighth and one-quarter of economic growth during the preceding decade (Swann, 2010). Swann (2010, p. 2) identified eight purposes of

standardization: codified knowledge; compatibility and interoperability; environmental; health and safety; measurement standards; quality and performance; variety reduction; and vision. "Codified knowledge" had intermediate economic effects on the: division of labour, competencies and barriers to entry, which had subsequent economic effects on: productivity, market entry, competition, innovation, trade and outsourcing.

In 1987, BS 5750 was adopted by the ISO and was titled ISO 9001: 1987. It was revised in 1994 (and at other intervals, see Table I) and contained 20 elements which guided the quality process. These elements were simplified in ISO 9001: 2000 to eight QMPs: customer focus; leadership; involvement of people; process approach; system approach to management; continual improvement; factual approach to decision-making; and mutually beneficial supplier relationships. In the most recent 2015 iteration, the terminology was slightly amended and the principles were reduced to seven: customer focus; leadership; engagement of people; process approach; improvement; evidence-based decision-making; relationship management. It was explained in the standards that these QMP can be used as a foundation for quality policy, and these will be used later to explore how knowledge can be incorporated within the policy.

Standards for different areas of management were originally developed independently which resulted in there being no clear compatibility between them thereby increasing the level of bureaucracy for organizations which wanted to operate a single or "integrated" management system applying two or more standards. For this reason, a "high-level structure" (also called Annex SL) was developed by ISO (2014, p. 120) to: "enhance the consistency and alignment of ISO management systems standards (MSS) by providing a unifying and agreed upon high level structure, identical core text and common terms and core definitions". ISO 9001: 2015 follows this high-level structure as do other management standards, e.g. ISO 22000 Food Safety Management; ISO 14000 Environmental Management; ISO 50001 – energy management; ISO/IEC 27001 – Information Security Management; ISO 30301: 2011 Information and Documentation – Management System for Records, thus making it easier to integrate multiple standards in an organization. Importantly, this high-level structure may have particular relevance for the knowledge management standards which have been submitted to ISO for consideration (American National Standards Institute, 2013). These knowledge management standards which are in their development stages will be discussed in a subsequent article.

In 2011, the technical committee responsible for the ISO: 9000 quality management system standards conducted a worldwide survey of existing and potential users of ISO 9001 and 9004 in 122 countries. Its purpose was to identify user needs, opportunities for improvement and focus long-term quality management strategy. A total of 11,722 responses were received, and there were 6,299 specific responses to Question 10 which asked: "How important is it to incorporate the following concepts into ISO 9001?" (Jarvis and MacNee, 2011). The following received the highest scores:

Table I Development of quality management standards

Year	*Conformance standard*	*Title*
1979	BS 5750: 1979	Quality systems: Part 1. Specification for design, manufacture and installation
1987	BS 5750: 1987; ISO 9001: 1987; EN 29000; ANSI/ ASQC Q91	ISO title: Quality systems – Model for quality assurance in design/development, production, installation and servicing
1994	ISO 9001: 1994: ANSI/ASQC Q9001-1994	Quality systems – Model for quality assurance in design, development, production, installation and servicing
2000	ISO 9001: 2000	Quality management systems – Requirements
2008	ISO 9001: 2008	Quality management systems – Requirements
2015	ISO 9001: 2015	Quality management systems – Requirements

Resource management 75 per cent

Voice of customers 74 per cent.

Integration of risk management 73 per cent.

Systematic problem solving and learning 73 per cent.

Measures (e.g. Performance, satisfaction, return on investment) 72 per cent.

Knowledge management 72 per cent.

The high ranking of knowledge management resulted in it being considered for inclusion within the updated ISO 9001: 2015 standards. To ensure that ISO standards remain current, they are subject to regular review going through a series of development stages before they become "statutes": i.e. working draft; committee draft; draft international standard; final draft international standard; and, finally, international standard. In September 2015, a new clause involving organizational knowledge as a resource was introduced for the first time:

> 7.1.6, Organizational Knowledge – The organization shall determine the knowledge necessary for the operation of its processes and to achieve conformity of products and services. This knowledge shall be maintained and be made available to the extent necessary. When addressing changing needs and trends, the organization shall consider its current knowledge and determine how to acquire or access any necessary additional knowledge and required updates.

Knowledge management and quality management

There is a growing body of literature connecting knowledge and quality, and one early discussion was Shewhart's (1986/1939) book: *Statistical Method from the Viewpoint of Quality Control*, which maintained that the three steps of mass production resembled the scientific method, i.e. making a hypothesis, undertaking an experiment and testing the hypothesis. Shewhart (1986/1939, p. 45) stated: "The three steps constitute a dynamic scientific process of acquiring knowledge". In a similar vein, quality guru Deming (1994, p. 1) wrote in, *The New Economics for Industry, Government and Education*, that best efforts and hard work would not achieve improvement unless they were "guided by knowledge".

More recent discussions about knowledge management (KM) and quality management (QM) describe the sharing of common elements to enhance organizational performance (Asif *et al.*, 2013; Loke *et al.*, 2012; Ribière and Khorramshahgol, 2004) and their complementary nature (Linderman *et al.*, 2004; Ooi, 2014; Waddell and Stewart, 2008) in supporting improvement and competitive advantage (Stewart and Waddell, 2008). Most authors regard KM as a helpful means to support quality initiatives (Akdere, 2009; Johannsen, 2000; Ju *et al.*, 2006; Martín -Castilla and Rodriguez-Ruiz, 2008; Stewart and Waddell, 2008; Yang, 2008; Zhao and Bryar 2001); however, Linderman *et al.* (2004, p. 603) suggested an opposite perspective that: "Quality management practices should be bundled around knowledge creation processes" and Zhao and Bryar (2001, p. 1) maintained that both perspectives were possible with KM incorporating QM and vice versa. Essentially, both KM and QM are tools subsumed within the broader concept of organizational development (Zetie, 2002) and Galandere-Zile (2009, p. 138) finessed the two by suggesting that QM specifies "what" should be done and KM "how" it should be

"The failure to distinguish between tacit and explicit knowledge in the standard will possibly require organizations to make the distinction clear for employees."

done (Sveiby and Lloyd, 1987). With regard to this discussion, it is KM which will be situated within ISO 9001: 2015.

Both QM and KM are closely associated with a systems approach and when Wiig (1990) first coined the term "knowledge management", it was in a systems context. Similarly, Linderman *et al.* (2010) maintained that a knowledge management framework underpinned process management systems such as Six Sigma, total quality management (TQM), lean and business process engineering. The USA's Malcolm Baldridge National Quality Award 2015-2016 (NIST, 2015) contains seven criteria for performance excellence including: "Measurement, analysis and knowledge management" and, in Europe, the European Foundation for Quality Management model was described as an appropriate framework for governance of organizational knowledge (Martín-Castilla and Rodriguez-Ruiz, 2008, p. 135).

The knowledge management cycle

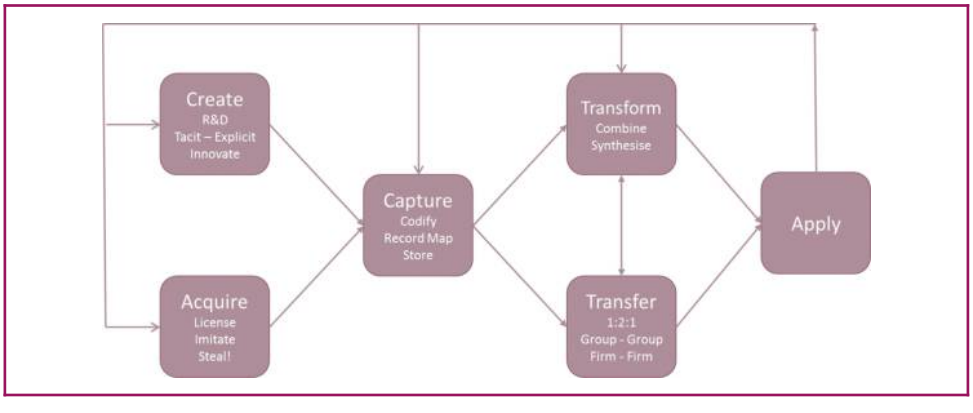
Agreement on the core elements of knowledge management has progressed slowly with authors describing a variety of elements required in knowledge management Wiig (1993) identified creation and sourcing, compilation and transfer, dissemination and value realization, and Davenport and Prusak (1998) described the processes of knowledge generation, codification and coordination and transfer. This lack of accord was reiterated by Rubenstein-Montano *et al.* (2001) who explored the existing frameworks and maintained that the KM field had been slow in developing an accepted framework. Eight years later, Heisig (2009) conducted a detailed study of 160 KM frameworks and combined this with other research (Helm *et al.*, 2007; Holsapple and Joshi, 1999; Lai and Chu, 2000; Liebowitz and Megbolugbe, 2003) and concluded that a KM framework should, at least, consist of five core components: identify, create, store, share and apply.

The KM framework consisting of core elements, concepts and principles has been described also as the knowledge development cycle which contains knowledge creation, knowledge adoption, knowledge distribution and knowledge review and revision (Bhatt, 2000). Increasingly, there is a growing tendency to describe the KM framework/knowledge development cycle as the knowledge management cycle, and this term will be used throughout this paper to represent the main elements of: acquire/create, capture and store, transfer and transform and apply (Figure 1), which will be related to the seven ISO 9001: 2015 QMPs.

International Organization for Standardization 9001: 2015 and knowledge management

The specification of knowledge as a resource (Andreeva and Kianto, 2012; Kianto and Ritala, 2010; Grant, 1996; Van der Speak *et al.*, 2002) in ISO 9001: 2015 has finally

Figure 1 The knowledge management cycle



acknowledged earlier views that "a resource-based theory of the firm thus entails a knowledge-based perspective" (Conner and Prahalad, 1996, p. 477), and that for organizations: "to succeed they have to view knowledge as an asset and manage it effectively" (Lim *et al.*, 1999, p. S616).

In the discussion above it was noted that the KM community had slowly settled upon a core framework of knowledge management activities – the KM cycle, and a closer examination of the ISO knowledge clause reveals that it contains the main elements of the KM cycle, i.e. creation and acquisition, capture and storage, distribution and application (Table I) (Table II).

In addition to the specification of the core dimensions of the KM cycle, the main elements of the knowledge pyramid – data, information and knowledge, with the exception of wisdom (Ackoff, 1989) – have also been described by ISO albeit not within a hierarchy. ISO defined knowledge as the: "available collection of information being a justified belief and having a high certainty to be true", and information was also defined as "meaningful data" (ISO 9000: 2005: 3.7.1), thus providing the core elements of the knowledge pyramid (Figure 2).

Clause 7.1.6 "organizational knowledge" is not the only place where knowledge is recognized in the standard. The detailing of processes and procedures in the various evolutions of ISO 9001 represents a capturing of organizational experience and knowledge. Mosch (2007, p. 2) maintained that: "Standards are codified knowledge. They express the work and experience of generations", and an organization's quality manual is the depository of its process knowledge (Zetie, 2002). Recognition of this view is described in the Annex to ISO 9001: 2015 which encourages the acquisition of knowledge through learning from experience, mentoring and benchmarking.

Section 4.4 of the new standard stated that risks and opportunities should be assessed, and a note about risk defined uncertainty as the effectiveness of information linked to the level of "understanding or knowledge". Moreover, the importance of managing risk is also associated with safeguarding the organization from the loss of knowledge which arises from employee turnover and the "failure to capture and share information" (ISO, 2015: Annex A.7). Surprisingly, there is no direct mention protecting knowledge, although an earlier draft version stated: "knowledge shall be maintained, protected". Given the importance of protecting data, information and knowledge it appears unusual not to use the term, although it can be argued that this is contained in "knowledge shall be [. . .] made

Table II The knowledge management cycle and ISO 9001: 2015 Clause 7.1.6

Knowledge management cycle	*ISO 9001: 2015 Knowledge specification*
Creation and acquisition	"Acquire or access the necessary additional knowledge"
Capture and storage	"Knowledge shall be maintained"
Distribution	"Knowledge shall be . . . made available as necessary"
Application	"The organization shall determine the knowledge necessary for the operation of the quality management system and its processes"

Figure 2 The knowledge pyramid

available as necessary", and in Clause 6.1 it states there should be "Actions to address risks and opportunities".

Clause 7.4 "Communication" states that organizations should determine the internal and external communications of who, what, when and how which are relevant to the quality management system. In other words, the knowledge needs to be distributed effectively and efficiently to relevant parties inside and outside the organization. This requirement also draws attention to the necessity of involving stakeholders in quality processes.

Explicit knowledge is also addressed in what ISO 9001: 2008 described as "documents and records" which have now been replaced with the term "documented information" in Clause 7.5 of ISO 9001: 2015. This clause stipulates that information needs to be maintained and retained to support quality procedures. In effect, organizations need to capture and store knowledge so that it can be used appropriately.

There is no overt distinction in the standards between explicit and tacit knowledge; however, the ISO 9001: 2015 organizational knowledge clause focusses on knowledge which can be created, acquired, captured, stored, distributed and applied, in other words – explicit knowledge. Tacit knowledge, by its very nature, is relatively intangible, and this makes it more difficult to manage and incorporate with processes and systems. However, it can be argued that Clause 7.2 "Competence" does address tacit knowledge stating that: "The organization shall determine the necessary competence of person(s) doing work under its control that affects its quality performance". It also adds that competence is based on suitable education, training or experience, and where there are competence shortfalls, corrective actions should be implemented and evaluated together with relevant documentary evidence.

The following discussion will now consider the role of knowledge in the development of a knowledge management policy for ISO 9001: 2015.

Developing a knowledge management policy for International Organization for Standardization 9001: 2015

Although there has been a relatively extensive discussion of the relationship between QM and KM, only a limited number of articles have discussed the connection between ISO 9001 and knowledge (Heng, 2001; Bénézech *et al.*, 2001; Lin and Wu, 2005; Molina *et al.*, 2004; Sivakumar *et al.*, 2014). Some of these articles were structured using the clauses, core elements or principles of the standards, e.g. 20 core elements of ISO 9001: 1994 were used to map critical knowledge and intellectual capital in a company; however, it was argued that the standards were inadequate to capture critical knowledge about markets, customer base and product opportunities (Heng, 2001). Also, five major ISO 9001: 2000 clauses relating to quality system, management responsibility, resource management, product realization and measurement analysis and improvement were used to support the development of a KM portal (Sivakumar *et al.*, 2014: 33).

In essence, the ISO standards are a codebook which codifies knowledge and captures tacit knowledge (Bénézech *et al.*, 2001) through the use of Nonaka and Takeuchi's (1995) socialization, externalization, combination and externalization (SECI) model. Combined with the development of processes and systems, the transmission of knowledge is enhanced thereby flowing more easily and effectively throughout the organization (Molina *et al.*, 2004; Lin and Wu, 2005).

"A consideration of the needs and expectations of interested parties such as customers, suppliers and others involved in the supply chain is specified in ISO 9001:2015."

ISO 9001 has changed with each updated version and the number of core elements decreased from 20 to a more manageable eight core principle, and in ISO 9001: 2015, these were reduced to seven QMPs: customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision-making and relationship management. ISO 9001: 2015 stated that these seven principles could be used as the basis for the quality policy, and each will now be considered in relation to knowledge and how this can contribute to policy development.

Customer focus

Meeting customer requirements and exceeding their expectations is considered the primary purpose of quality management (ISO, 2015) and to achieve these from a knowledge perspective requires clear lines of communication and consultation. The KM cycle, described above, is too tightly bounded to accommodate the requirements of this principle, and, therefore, an adapted knowledge management supply chain model based on Wilson and Cattell (2005) has been selected to extend the KM cycle to include customers and suppliers within a broader process framework (Figure 3). This figure illustrates the essential nature of the communication channels feeding external knowledge from customers (Garcia-Murillo Annabi, 2002), interested parties and suppliers into the internal knowledge management cycle.

Leadership

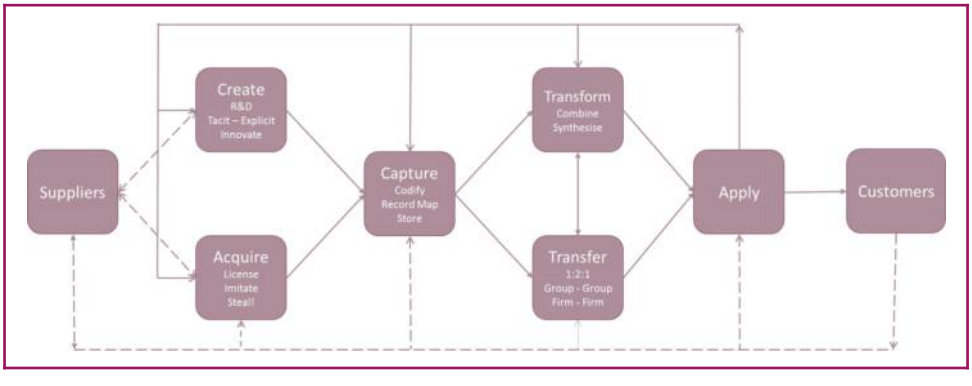
This principle addresses the need for leaders to establish the direction and environment which enable people to apply the policies, processes and resources towards achieving the organization's quality goals. A knowledge leader should provide strategic vision, communication, motivation, deliver change and drive the knowledge agenda (Cleveland, 1985; Debowski, 2006). Moreover, to be successful, knowledge management must begin at the top and permeate throughout the organization (DeTienne *et al.*, 2004), and the CEO should be involved with the knowledge sharing process (Von Krogh, 1998; Liebowitz, 1999; Kluge *et al.*, 2001).

Engagement of people

The third principle maintains that all people in an organization need to be competent and engaged, and that enhancing their "skills and knowledge" enables organizational objectives to be achieved. Competence was defined as the "ability to apply knowledge and skills to achieve intended results" (ISO, 2015, 3.3.10), and organizations are required to ensure that competence is based upon suitable education, training or experience (ISO, 2015, 7.2) and that suitable evidence of competence is documented.

There is a danger that ISO 9001: 2015 standards might rigidify knowledge codification and accumulation (Bénézech *et al.*, 2001) and a strict prescriptive approach may constrain

Figure 3 The knowledge management supply chain



employees and reduce their autonomy to act differently using tacit knowledge outside the previously codified areas. It is true that the previously constraining prescriptions of ISO 9001: 1994 have been reduced; however, this does not fully eliminate the fact that quality systems need to balance the requirements of systematic control to ensure consistent quality outcomes with the flexibility to apply subjective tacit knowledge by employees.

The "knowledge" clause, unsurprisingly, focusses on explicit knowledge within the processes and systems, and there is no overt recognition of tacit knowledge. Yet, when competence, knowledge and skills are discussed, there is automatically an implicit recognition of tacit knowledge. In some respects, this consideration partially balances the main focus on explicit knowledge, although more needs to be done through recognition of tacit knowledge in its various forms as is indicated below.

A further consideration is that the creation of knowledge is not a linear process but one which is an interactive system involving beliefs, judgements, messages and representation, values and wisdom, which enable collective learning and mutual language (Bénézech *et al.*, 2001). Competence is based upon knowledge and skills which are continually changing and evolving as a result of personal development and also operational requirements.

Allied to this interactive knowledge creation are the notions of single and double loop learning (Argyris and Schon, 1974). Detailed specifications of required knowledge may lead to constrained single loop learning, whereas more open and flexible quality requirements will encourage double loop learning which can assist kaizen – continuous improvement.

Process approach

This principle describes how the achievement of consistent performance and quality requires all the various controls, interactions, processes and resources to be understood and managed as one complete quality management system. As was discussed above, the KM cycle provides a complementary and systematic process which is relatively comprehensible to employees and which can also be assessed as part of the certification process by organizations such as BSI, DNV GL and Lloyds Register. Indeed, both KM and QM use a process approach which should provide common ground for the design of integrated and effective systems.

Organizations which are more mechanistic and use explicit knowledge would appear to be more compatible with ISO 9001 certification than those which are more organic and use tacit knowledge. Abdullah and Ahmad (2009, p. 750) used a four quadrant model with two axes of organic – mechanistic and control – creativity and concluded that mechanistic and controlling organizations will be a "perfect fit" for ISO 9000. In contrast, organizations in the opposite organic and creative quadrant will be a "perfect misfit", e.g. high customization services. Where there are high levels of tacit knowledge being used, there may be a lack of comprehensive documentation and thus quality auditors may judge these systems weak.

The main challenge facing quality auditors and more importantly organizations themselves is to address the difficulty of accurately and systematically organizing and measuring deeply embedded tacit knowledge whether that be in organizational systems and processes or within the heads of employees. Polanyi (1966, p. 7) who explained the distinction between tacit and explicit knowledge, argued that: "While tacit knowledge can be possessed by itself, explicit knowledge must rely on being tacitly understood and applied". In effect, just as ISO has found it necessary to provide definitions of key terms, an organization's quality manual(s) might need ever more detailed descriptions to try and capture underpinning tacit knowledge. Indeed, a definition of knowledge would assist organizations and individuals in the design and implementation of their processes; one commonly accepted definition of knowledge is provided by Davenport and Prusak (1998, p. 5):

> Knowledge is a flux mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms.

This potential requirement for more extensive documentation might drive quality systems back towards the overly rigorous specifications of ISO 9001: 1994 which were subsequently relaxed due to excessive bureaucratization and the creation of inflexible and unresponsive systems. The fact that ISO quality standards are less about prescriptive methods and practices and are, in reality, more about process should mitigate many of these concerns.

Improvement

This principle explains that to ensure successful survival, it is necessary for an organization to be responsive to internal and external change. One of the challenges facing formalized systems is that they create path dependency, i.e. systems can channel and restrict consideration of other directions and options. QMP 5 encourages flexibility, but there is an almost inevitable rigidity and tension with prescribed approaches and systems. An openness to knowledge from outside as occurs with open innovation (Chesbrough, 2006) combined with internal learning should assist in minimizing path dependency.

Another consideration is that organizations tend to focus on explicit knowledge because it is easier to manage, but success in process improvement projects is significantly related to the combination of technical and socially oriented knowledge creation (Anand *et al.*, 2009). Moreover, in most industries, explicit knowledge is only a "qualifier" in continuous improvement strategies, e.g. TQM, lean production and Six Sigma (Anand *et al.*, 2009). To gain commercial success, organizations require competitive advantage which is achieved through knowledge which is not easily imitated, i.e. tacit knowledge (Dooley, 2000) and, thus, quality management systems increasingly need to focus attention on tacit knowledge (Linderman *et al.*, 2004). The SECI model of Nonaka and Takeuchi (1995) illustrates how organizations can encourage the development of both tacit and explicit knowledge to gain competitive advantage.

Tacit knowledge which is captured in operational manuals and processes becomes explicit enhancing its ease of transfer; however, tacit knowledge which is more elusive may possess greater value. This *unarticulable* knowledge founded upon past experiences may be more valuable in identifying operational failures than restrictive processes and procedures (Bénézech *et al.*, 2001). Indeed, an excessive focus on codification may: "kill innovation and creativity" (Ribière and Khorramshahgol (2004, p. 40) both of which arise from effective KM practices.

Evidence-based decision-making

This QMP states that decision-making should be based upon the objective examination and evaluation of "data and information". Both data and information provide the foundations for knowledge in the KM pyramid, and this principle especially integrates both QM and KM principles.

QMP 6 also recognizes that decision-making is complex and uncertain sometimes requiring subjective interpretation. In effect, this recognition of the role of subjective interpretation gives a positive affirmation that tacit knowledge can assist and support decision-making.

Yet, focussing on tacit knowledge or even explicit knowledge presents a challenge for quality improvement projects because, "Knowledge is not fixed or stable, but quite the opposite, in that it is fluid and emergent" (Waddell and Stewart, 2008, p. 33). For this reason: "It is when quality systems err toward the technical conception of knowledge as

something that is fixed rather than, in addition, being something contested and epistemic, that they run the risk of failure" (Jayawarna and Holt, 2009, p. 784).

It should be stressed that data and information are not knowledge. Both data and information should be objective measures, but they only become knowledge when they are mentally processed and applied. Kelley (2002, p. 26) stated that knowledge exists within the user and that "knowledge itself happens only when human experience and insight is applied to data and information". To make informed judgements through evidence-based decision-making using data and information, there should be a consideration of the ontological (what is reality), the epistemological (how we know something) and the methodology (how do we find something out) (Guba, 1990). Whether these philosophical terms are used in organizations, good practice requires that these dimensions are considered.

Relationship management

This principle relates to the need for building relationships with interested parties such as suppliers, partners, stakeholders, etc. The discussion in QMP 1 "Customer Focus" stressed the importance of exploring beyond the boundaries of the organization to acquire knowledge and suppliers have long been recognized as valuable sources of insight and guidance (Kotabe *et al.*, 2003). Stakeholders are also valuable sources of knowledge which can guide policy making (Riege and Lindsay, 2006). The knowledge management cycle is too narrow in its current conceptualization and does not expressly consider customers and suppliers. For this reason, a broader systematic consideration of knowledge is required particularly for the ISO quality management system which requires the consideration of customers, suppliers and stakeholders (Figure 3).

Note 2 in the standard described how knowledge can be based on internal sources of knowledge including capture and distribution of undocumented experience and knowledge; experiential knowledge; from improvements to products, processes and services; intellectual property; and lessons learned from failed and successful projects. Sources of external knowledge include academia, conferences, knowledge from customers and external providers and standards.

Traditional supply chain models predominantly only consider suppliers; however, this is not the case for knowledge management which also needs to consider customers as a repository of knowledge. Indeed, knowledge needs to be identified wherever it may provide constructive benefits which is why research needs to be conducted to enable invention and innovation (Christensen, 2013). Capturing both tacit and explicit knowledge is required not only internally within an organization but also externally across the value chain, as organizations benefit from the knowledge of suppliers, customers and other interested parties. To achieve this, Ju *et al.* (2006) recommended that each TQM critical factor be supported through the application of KM value chain activities.

Conclusions

Summary of findings

Some 36 years after the publication of British Standard BS 5,750: 1979, the strategically important role of knowledge as a resource (Andreeva and Kianto, 2012; Kianto and Ritala, 2010; Grant, 1996; Van der Speak *et al.*, 2002) has been acknowledged in ISO 9001: 2015. This is significant and signals the increasing importance of knowledge within organizations.

This paper is an exploratory one which has considered the conceptual underpinnings of knowledge management (the knowledge cycle, knowledge pyramid, SECI model, tacit and explicit knowledge) and how these might be related to the seven QMPs in the development of quality policy. Given that ISO 9001: 2015 has only recently been published, it is too early to explore how the knowledge clause has been implemented in practice; however, it is hoped that the following conclusions will assist organizations to commence this process:

- From being a relatively esoteric and obscure concept in many organizations, the incorporation of knowledge within the ISO 9001: 2015 standards will position it as a key organizational resource which may lead to substantial organizational changes. It is likely that there will be an enhanced appreciation of knowledge management and a growth in the number of KM departments and chief knowledge officers.
- It is also important to note that the failure to distinguish between tacit and explicit knowledge in the standard will possibly require organizations to make the distinction clear for employees.
- The philosophical distinction between knowledge and information and knowledge management and information management may not need to be understood by all employees, but there will be a need for key individuals involved with policy making and quality organization to understand the major differences.
- Knowledge management and quality standards are both systems approaches which complement one another. The ongoing development of ISO knowledge management standards might be incorporated alongside other ISO management systems standards, e.g. ISO 30301: 2011 Information and Documentation – Management System for Records; and, ISO/IEC 27001: 2013 Information Security Management which addresses employee details; financial information; information from third parties; and intellectual property. These various standards complement one another; however, the incorporation of the knowledge cycle within ISO 9001: 2015 and the specification of "documented information" may reduce the attractiveness of certification in a number of standards when one, ISO 9001: 2015, essentially incorporates the others.
- A consideration of the needs and expectations of interested parties such as customers, suppliers and others involved in the supply chain is specified in ISO 9001: 2015. QM is a driver for building relationships and enhancing knowledge transfers from these sources is significantly related to a firm's performance (Molina *et al.*, 2007). Moreover, knowledge creation and transfer assist supply chain members to develop new products and services and improve operational efficiency (Loke *et al.*, 2012). The QMPs which stress the importance of customers, suppliers and other interested parties are likely to encourage the expansion of the knowledge management cycle to include suppliers and customers in a knowledge management supply chain.
- ISO standards are a codebook which formalizes codified knowledge (Bénézech *et al.*, 2001) and chief knowledge officers and related staff should draw upon these explicit knowledge resources to support knowledge creation, innovation and transfer. Knowledge and its management are increasing in importance, although it is unlikely, as Adamson (2005) suggests that it might supplant TQM as a quality approach measurement tool. Instead, there would appear to be a convergence of the both quality systems and knowledge management which increasingly complement one another.

Limitations of the research and findings

This paper has considered how knowledge management relates to the seven QMPs and because the ISO 9001: 2015 standards have only recently been published it has not been possible to practically apply specific techniques. Further empirical research is now required to assess how organizations have responded to the inclusion of the knowledge clause.

Implications for practitioners and researchers

ISO 9001: 2008 certified organizations have three years in which to comply with the new ISO 9001: 2015, and both they and the standards inspectors will be learning about how knowledge as a resource is managed within quality systems. Organizations which have a clear and explicit framework for managing knowledge will greatly enhance their chances of

commercial success (Drucker, 1994) and being successfully recertified. It is hoped that this article will provide some early conceptual foundations for this process.

Possible areas for future research

This paper has provided some conceptual and practical foundations for developing a knowledge management policy for ISO 9001: 2015. A possible area for future research might be to operationalize these foundations in practice and evaluate the applicability of the framework. Another area for empirical research might be to identify knowledge management strategies related ISO 9001: 2015 certification in a range of organizations from primary, secondary and tertiary industries.

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