

TQM, knowledge management and collaborative commerce adoption: A literature review and research framework

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This article discusses the influence of total quality management (TQM) and knowledge management (KM) on collaborative commerce (c-commerce) adoption. An extensive review of literature was carried out to develop an integrated model of TQM and KM to examine the influence of TQM and KM on c-commerce adoption. The findings provide a basis for developing a model to advance the TQM, KM and innovation adoption research literature. This study proposes a new integrated model which includes practices from both TQM and KM theories to examine if these practices will result in an improvement in the adoption of c-commerce. Organisations intending to adopt or increase the level of adoption of c-commerce will be able to make managerial decisions based on TQM and KM practices from this research. The study makes a significant contribution by combining TQM and KM models as a methodological example which is useful for practitioners to track the degree of TQM and KM effects on c-commerce adoption. This model can be used by companies to do a pre-test baseline measurement, and then periodically reassess the effects of any TQM and KM change.

Keywords: total quality management; knowledge management; collaborative commerce; innovation adoption

Introduction

Shorter product life cycles, rising customer demands and the increasing spread of distribution, manufacturing, sourcing and engineering operations in different geographic locations have increased the competitive pressure in many industries. Many companies have strived to excel in this competitive environment through the implementation of supply chain management (SCM). Mentzer defined SCM as the ‘systemic, strategic coordination of the traditional business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performances of the individual companies and the supply chain as a whole’ (as cited in Chou, Tan, & Yen, 2004, p. 339).

Increasingly organisations are seeking to improve their supply chain by implementing collaborative SCM. Collaborative SCM is defined by Mentzer, Foggin and Golicic (2000, pp. 53–54) as follows:

... all companies in the supply chain are actively working together as one toward common objectives. (One individual, in fact, likened collaboration to all of the supply chain partners being under common ownership.) Participants felt strongly that collaboration was

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characterized by sharing information, knowledge, risk and profits. Sharing entails understanding how other companies operate and make decisions.

The implementation of collaborative SCM would put high requirements on the management of information. It is difficult to manage information manually through paper-based systems because they are slow in information flow, error prone, and difficult to update (Rudberg, Klingenberg, & Kronhann, 2002). As such, there has been an increase in the study of applying IT solutions to facilitate the sharing of information between supply chain members. Although prior literatures on the implementation of IT in SCM include electronic data interchange (EDI) and business to business (B2B), an emerging area of e-business applications in the supply chain is collaborative commerce (c-commerce) (Chou et al., 2004). According to Kim and Smari (2005) and Gartner Group (<http://www3.gartner.com>), c-commerce is different from existing e-commerce as it does not involve only the buying and selling of goods and services online. C-commerce enables collaborative interactions between an organisation, its suppliers, trading partners, customers and employees electronically through the web, and uses the web to create and maintain an interactive business community of employees, trading partners, suppliers and customers (Kim & Smari, 2005).

The successful adoption of e-business applications is recognised as a key concept for technological innovation and investment (Wei, Van de Ende & Lin, 2009; Wu, Lin, & Cheng, 2009). However, the adoption of e-business applications such as c-commerce in the supply chain is still relatively low. In order to address this issue, many researches have attempted to study the factors that can influence the adoption of technologies in the supply chain. Most existing literatures on the adoption of technologies have mainly focused on adoption issues derived from theories such as innovation diffusion theory (Rogers, 1995), and technology-organisation-environment model (Iacovou, Benbasat, & Dexter, 1995; Tornatzky & Fleischer, 1990). However, increasingly there have been studies on the relationships between TQM practices, KM processes and innovation. Past studies on TQM and innovation have focused mainly on the relationships in terms of the innovation of products in an organisation. Prajogo and Sohal (2003) for example, stated that there is a significant and positive relationship between TQM and product innovation performance. However, there is no known study that focuses on the relationship between TQM practices and the adoption of innovation such as e-business applications. With companies increasingly focused on product quality, there is a need to examine whether organisations that focus on product quality through TQM practices will actually make use of e-business applications in the supply chain such as c-commerce. As stated by Huang, Gattiker and Schroeder (2008), although TQM has been studied widely, these studies occurred before the development of e-business. Gunasekaran and McGaughey (2003) in their study of TQM in SCM stated that TQM has received little research attention in the evolving enterprise environments of integrated SCM and e-commerce. Huang Gattiker and Schroeder (2008) also stated that past researchers lack the understanding of whether e-business applications in the supply chain have become a part of TQM organisations' supplier management toolkit.

Knowledge management strategies have also been considered as an effective and efficient means of successful technological innovation (Martin & Matlay, 2003; Shang, Lin, & Wu, 2009). Studies have attempted to look at the relationships between knowledge management processes and e-business adoption (H.F. Lin & Lee, 2005). Although existing studies have looked at each of these concepts (TQM and KM) as a separate topic in their studies of innovation adoption, there is a lack of studies on the impact of these two factors on the adoption of innovation. In order to bridge the gap and provide organisations with

practical assistance in improving their c-commerce adoption through TQM and knowledge management, this paper proposes a set of TQM practices and knowledge management processes and develops an integrated model to examine whether the influence of TQM practices and knowledge management processes result in an improvement of c-commerce adoption.

This paper is structured as follows. In the next (second) section, we provide a review of the literature on adoption of c-commerce, factors affecting adoption of innovation, and the relationship between TQM and KM with innovation adoption. The conceptual model is then proposed as well as the development of hypotheses. The paper will then conclude with a summary of the new knowledge and contributions derived from this research study.

Literature review

Technological innovation

Technological innovation increasingly is getting more challenging for organisations owing to the competitive pressure, a globalised business environment and rapid technological changes. Research on technological innovation generally forms a huge body of research focused on problems of technology-based change in organisational and social settings (Allen, 2000).

As cited in H.F. Lin and Lee (2005), technological innovation adoption is the 'function of willingness to try new methods, processes, or productions systems' (p. 172). According to Kendall, past researches in the field of IT have stated that e-business systems adoption is one form of technological innovation (as cited in H.F. Lin & Lee, 2005). C-commerce is a type of e-business which ensures an improvement in the SCM processes as well as improved relationships between trading partners and is the technological innovation used in this study. Some of the benefits of c-commerce include lowering production costs, improving products and services quality, increasing innovation and optimising trading opportunities. C-commerce thus affects an organisation in terms of changes in its business processes, diffusion of innovation as well as transforming its business (H.F. Lin & Lee, 2005).

Adoption of c-commerce

C-commerce adoption is one of the main technological innovations in the area of IT. In general, the adoption of c-commerce refers to organisations which have used Internet technologies to share information and ideas between trading partners and within the organisations, and enable them to collaboratively design, develop, build and manage products through their life cycle. Examples of c-commerce tools used by organisations in their SCM include direct procurement tools, replenish tools, projected shortage tools, delivery and tracking tools, business strategy tools, capacity planning tools and forecasting tools (Cassivi, 2006; Pawlak & Malyszek, 2008). In order to investigate the adoption of c-commerce, technology adoption theories are fundamental. The following section presents a review.

Factors affecting the adoption of innovation in organisations

Theories of innovation have been used to explain the adoption patterns of e-business systems ranging from the adoption of EDI, e-commerce and B2B systems. Existing innovation adoption studies on e-business systems have drawn from theories such as diffusion

of innovation (DOI) theory (Rogers, 1995), and technology-organisation-environment (TOE) model (Iacovou et al., 1995; Tornatzky & Fleischer, 1990). These studies have focused on the technology, environment and attributes of the organisation that affect adoption. Rogers' DOI theory stated that the characteristics of the individual innovation can determine the rate of adoption. These innovation characteristics can be summarised as relative advantage, compatibility, complexity, trialability and observability and their definitions are shown in Table 1.

Tornatzky and Klein (1982) conducted a meta analysis of findings from existing researches on the relationships between the characteristics of innovation and the adoption of innovation and found that compatibility, complexity and relative advantage have consistently been found significant in affecting adoption of technology.

TOE model has three context groups, namely organisation, technological and external environment. The organisation context includes organisation attributes such as size, centralisation, formalisation, quality of its human resources, amount of slack resources available internally and complexity of the organisation's managerial structure (Shen, Hawley, & Dickerson, 2004; L.Y. Lin, Wu, & Lin, 2008). The technological context looks into the internal and external technologies which are relevant to the organisation. External environment is the arena in which the organisation conducts its business, such as the industry it is in, its competitors, and accessibility to the resources supplied by others (Shen et al., 2004). Patterson, Grimm and Corsi (2003) conducted a study on the adoption of supply chain technology based on factors such as organisational performance, environmental uncertainty, inter-organisational factors and organisation size (H.F. Lin & Lee, 2005; Patterson et al., 2003).

Table 1. Definitions of c-commerce tools.

C-commerce tools	Definitions
Direct procurement tools	Direct procurement tools that will forward purchase orders (POs) to pre-qualified suppliers.
Replenishment tools	The tool will drive an ordering system from the shop. When materials are needed on the production line, an order will be placed through the replenishment system.
Projected shortages tool	This tool will scan the buyer's production plan to project expected material shortages. The tool will also provide real-time information to manufacturing and supply management units.
Delivery and tracking tool	This tool will generate a payment and a delivery request automatically when a product goes from suppliers to its customers. It can also collect shipping information from third party logistics providers.
Design tool	Enables the use of interactive engineering drawing and storage of CAD designs by all the key stakeholders.
Supply chain planning forecasting tool	Exchanges the forecast information provided by both the buyer and supplier.
Capacity planning tool	Determines the amount of capacity required to produce.
Business strategy tool	Collects and shares the actions that need to be taken to support the objectives and mission of the supply chain.
RosettaNet standards	Standard that is based on XML and defines message guidelines, business processes interface and implementation frameworks for interactions between companies in the supply chain.
E-hub, e-marketplace, e-exchanges	Internet platform where firms register as sellers or buyers to communicate and conduct business over the Internet

Source: Cassivi (2006).

However, many researchers have stated the variables from classical adoption models are unable to predict the adoption for complex organisational technology as well as inter-organisational information systems such as c-commerce (Chau & Hui, 2001; Chong & Ooi, 2008; Perez, Sanchez, Carnicer, & Fimenez, 2004). Raymond (2001) stated that a model such as Rogers' DOI 'needs to be enriched when innovations relate to complex technologies with an interorganizational locus of impact, for which adoption decisions are linked (e.g. when imposed by business partners), and when innovations are adopted by organizations (as opposed to being adopted autonomously by individuals)' (Raymond, 2001, p. 412). Furthermore, although studies from DOI and TOE have provided insights into the relationships between these factors and the adoption of technologies, factors related to TQM practices and knowledge management processes and c-commerce adoption have received little understanding from past researchers. There is also a lack of empirical studies on the relationships between TQM practices and knowledge management processes and c-commerce adoption.

Relationships between TQM practices and innovation adoption

TQM by definition is the management of the entire organisation so that it excels in all dimensions of products and services that are important to customers (B. Lin & Ogunyemi, 1996; Wilkinson & Witcher, 1993).

TQM is an important component of manufacturing strategy for many organisations (Huang et al., 2008). In today's competitive business environment, organisations are increasingly embracing the concept of TQM. TQM has been shown to improve business performance (Claver-Cortes, Pereira-Moliner, Tari, & Molina-Azorin, 2008; Huang & Chen, 2002). Past studies also showed that TQM is a critical determinant in the success and survival of both manufacturing and service organisations in today's competitive environment (Demirbag, Koh, Tatoglu, & Zaim, 2006; Kumar & Antony, 2008; Su, Chen, & Cheng, 2001). Gunasekaran and McGaughey (2003) stated that the implementation of TQM practices can result in cost reduction, the creation of high quality goods and services, customer satisfaction, employee empowerment and the measurement of results.

As c-commerce supports collaborative SCM, it is important to establish the relationship between TQM and SCM. SCM has often been associated with 'modern materials management, advanced information technologies, rapid and responsive logistics service, effective supplier management, and increasingly with customer relationship management' (Gunasekaran & McGaughey, 2003, p. 361). In a collaborative supply chain environment, maintaining good inter-organisational relationships with the supply chain partners as well as collaboration and teamwork between the partners are considered as the cornerstone of TQM practices (Gunasekaran & McGaughey, 2003). Furthermore, TQM and SCM have common goals in terms of improving product quality and productivity.

Lee and Kincade (2003) in their study of SCM activities in US apparel manufacturers identified the six major dimensions of SCM, which are (1) partnerships; (2) information technology; (3) operational flexibility; (4) performance measurement; (5) management commitment; and (6) demand characterisation. According to Gunasekaran and McGaughey (2003), TQM practices such as training and education, customer focus, teamwork, etc. can have an influence on any of the six major SCM dimensions. C-commerce is part of both the partnership and information technology dimensions of SCM. Thus it can be argued that the role of TQM practices will have an influence on the usage of c-commerce among organisations.

Many existing researches have studied the relationships between innovation and TQM (Hoang, Igel, & Laosirihongthong, 2006; Lorente, Dewhurst, & Dale, 1999; Prajogo & Sohal, 2001, 2003; Singh & Smith, 2004). Prajogo and Sohal (2001) in their investigation of TQM and innovation relationships defined innovation as 'adoption of an internally generated or purchased device, system, policy, program, process, product or service that is new to the adopting organization' (Prajogo & Sohal, 2001, p. 540). Their study, however, only focused on product and process innovation. Nevertheless, Prajogo and Sohal (2001) did propose in their research model that there is a significant relationship between TQM practices and innovation. The study was then later empirically tested in Prajogo and Sohal (2003). TQM practices and innovation were found to have a significant and positive relationship. Similarly, Singh and Smith (2004) looked at TQM practices and their relationships with business and process innovation. Although the relationships were studied empirically, the research showed insufficient statistical evidence to support the relationships. Hoang et al. (2006) studied the relationships between TQM and innovation using a developing country as a case study. Similar to prior studies mentioned, the innovation was limited to product innovation. The model proposed 11 TQM practices such as top management commitment, employee involvement, teamwork, etc. and their relationship with the number of new products as well as the level of 'newness' in the products developed (Hoang et al., 2006). The study found that there is a positive relationship between certain TQM practices and a firm's innovativeness.

These studies, however, are focused on products and services innovation in an organisation. There is a lack of study in the relationships between TQM and innovation adoption for the SCM. These studies have also not looked at the innovation in terms of IT systems such as c-commerce. In this research, the innovation refers to c-commerce and its adoption in the area of SCM. C-commerce and SCM are both important research areas which have not gained much attention in terms of their relationships with TQM practices. As stated by Lorente et al. (1999), the application of TQM principles and practices has the potential to reduce wasteful investments in technology. According to Daughtrey (as cited in Lorente et al., 1999), although IT is able to lead to integration and collaboration between departments, it is also possible that TQM philosophy is not supported by the introduction of IT. Lorente et al. (1999) suggested that the effect of TQM on the successful adoption of business innovation in terms of IT should be studied, as TQM practices can potentially have both negative and positive impacts on the adoption of IT.

Knowledge management processes and innovation adoption

The relationship between knowledge management and innovation adoption has been examined in past studies such as H.F. Lin and Lee (2005) and Nonaka and Takeuchi (1995). Following Gupta, Iyer and Aronson (2000), the knowledge management implementation is supported by the fall of space or times boundaries owing to innovations in telecommunications technologies. These innovations promote information sharing among the departmental units in a firm, which is vital for continual growth and survival of a firm (Gupta et al., 2000; Wang, 2009). The firms which build and maintain the social and knowledge base of the organisational members will develop a competitive advantage (Kanji, 2005).

According to H.F. Lin and Lee (2005), efficient knowledge management processes such as knowledge acquisition, application and sharing are important for new technology adoption. Their study of impact of knowledge management on e-business adoption also showed that knowledge management processes have a significant and positive relationship with e-business adoption.

The relationships between e-business and knowledge management have also been studied by Du Plessis and Boon (2004), who provided a comprehensive list of the relationships between these two concepts. Some examples given by them include the fact that knowledge management can ensure the availability and accessibility of knowledge on issues which are strategic to business. These issues include the markets, customers, suppliers, products and services, processes and procedure and regulatory environment. Given that knowledge management is focused on knowledge which is strategic to business, it will thus tie business strategy and support the execution of business strategy. By providing the business with a better understanding of the market it plays in, knowledge management enables the e-business to match buyers and sellers in new value added markets and thus position itself in the market (Du Plessis & Boon, 2004).

Another relationship between knowledge management and e-business tools such as c-commerce is that as c-commerce involves the integration of the supply chain among business partners from different locations, thus knowledge management 'facilitates the flow of knowledge between the groups, e.g. through knowledge management processes, thus facilitating quicker and more effective integration' (Du Plessis & Boon, 2004, p. 79).

C-commerce involves collaboration between supply chain partners and an important aspect of c-commerce is the sharing of supply chain information. Examples of information shared include demand forecasts, business strategies and the design of products. Organisations with knowledge management will provide the necessary technology, processes and platforms that will aid this collaboration in terms of sharing supply chain information.

Thuraisingham, Gupta, Bertino and Ferrai (2001) also stated the knowledge management has a role in c-commerce. An example given by Thuraisingham et al. (2001) is that training is part of knowledge management, and knowledge management helps e-learning and eventually would help c-commerce. Thuraisingham et al. (2001) further stated that the organisation can learn from experienced experts through knowledge management when creating and managing c-commerce sites.

The relationships between innovation, collaboration and knowledge management were also discussed by Du Plessis (2007). Du Plessis stated that knowledge management 'allows collaboration across functional boundaries within organizations' (p. 27). More important, organisations with knowledge management practices in place will have the culture of sharing information. This culture of sharing information will be important for organisations that plan to adopt c-commerce. Kim and Smari (2005) proposed that knowledge management is one of the components of c-commerce as it 'improves seamless knowledge sharing among organizations and individuals by making their knowledge apparent to all of them with proper access control' (p. 283).

Research model and hypotheses

Given that past research has shown that there is a relationship between TQM practices and innovation as well as knowledge management and innovation, this research aims to develop an integrated model to examine whether the influence of TQM and knowledge management practices result in an improvement in the adoption of c-commerce in the supply chain. Although past studies have tried to provide a link between these practices, it should be noted c-commerce adoption is different from existing IT adoption as (1) c-commerce is implemented to support collaborative SCM; and (2) c-commerce requires the sharing of important supply chain information.

This research aims to examine TQM practices and knowledge management processes in facilitating the adoption of c-commerce. The research model for this study is shown in

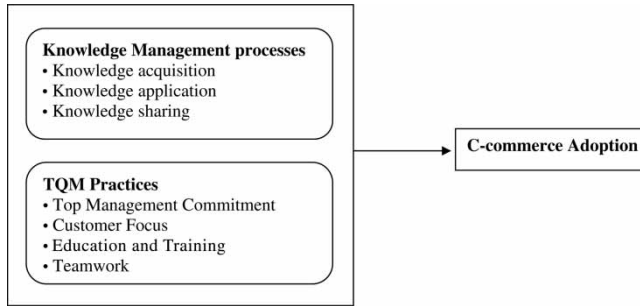


Figure 1. Conceptual model of the influence of knowledge management processes and TQM practices on the adoption of c-commerce.

Figure 1 which hypothesised that TQM practices (education and training, teamwork, customer focus and leadership) and knowledge management processes (knowledge acquisition, knowledge application and knowledge sharing) affect the c-commerce adoption level. The model suggests that the greater the extent to which these TQM practices and knowledge management processes are present, the higher will be the adoption of c-commerce.

C-commerce adoption level

The c-commerce adoption level is based on the composite score of the usage of c-commerce tools in the supply chain. The c-commerce tools in this study were derived from a study on e-collaboration tools by Cassivi (2006). Using seven main companies to form a case study and through a survey of 130 firms which were the supply chain partners of these seven companies, Cassivi classified these tools which are used for collaboration in the supply chain. The tools classified are the direct procurement tool, the replenish tool, projected shortage tools, the delivery and tracking tool, the business strategy tool, the capacity planning tool and the forecasting tool. Although the study was conducted in the telecommunications industry, the tools identified can be generalised and applied to other industries as well (Cassivi, 2006). The c-commerce tools will be adapted from Cassivi's definition of supply chain e-collaboration tools as shown in Table 1.

TQM practices

This study will examine whether the organisations have TQM practices and whether this will influence the adoption of c-commerce. The concept of TQM practices can be viewed from two dimensions: the 'hard' and 'soft' aspects of TQM. Although TQM has received much attention and a lot has been written about the hard or technical aspects of TQM, the 'soft' aspects have been neglected to a certain extent (Wilkinson, 1992). Prajogo and Sohal (2003) stated that many studies on TQM have shifted towards the soft aspects of TQM such as behavioural and cultural aspects due to the failure of many TQM implementations. Kekale and Kekale (1995) argued that perceiving TQM just from the hard aspects, as a set of tools and techniques, has proven to be one of the primary failures of TQM implementation. Ooi, Arumugam and Teo (2005) also stated that many past studies reveal that the soft aspects of TQM are essential to the success of TQM implementation.

Thus in order to understand whether organisations have TQM practices in place and whether this will influence the adoption of c-commerce, this study will look into the

soft aspects of TQM practices in organisations. The TQM practices selected, based on existing studies on TQM practices and innovation, are top management commitment (Hoang et al., 2006; Lorente et al., 1999; Singh & Smith, 2004), customer focus (Hoang et al., 2006; Lorente et al., 1999; Prajogo & Sohal, 2003; Singh & Smith, 2004), education and training (Hoang et al., 2006; Parker & Swatman, 1996; Sánchez & Pérez, 2003; Shapira & Rephann, 1996) and teamwork (Hoang et al., 2006; Prajogo & Sohal, 2001).

The implementation of TQM is highly dependent on the commitment of senior management (Kanji, 1996). According to Lorente et al. (1999), top management commitment is one of the most important determinants of successful TQM implementation. The top management of the organisation must be the first to apply and stimulate the TQM approach, and to be able to accept the responsibility for product and service offering. Furthermore, Lorente et al. (1999) also stated that top management should provide the leadership to motivate employees. The importance of top management as core to the success of TQM implementation is agreed by prior TQM gurus such as Deming (1986), Crosby (1996) and Reed, Lemak and Mero (2000). Hoang et al. (2006) stated that 'the degree of visibility and support that management provides in implementing a total quality environment is critical to the success of TQM implementation' (p. 1097). One of the main aims of TQM is to improve product quality and productivity. Therefore a top management that is committed to implement product quality and productivity through TQM will thus be more likely to invest and adopt c-commerce technology in the supply chain. Hence, the following proposition is formulated:

P1: Top management commitment will positively affect c-commerce adoption level.

Customer focus is defined by Zhang (2000) as the degree to which an organisation continuously satisfies its customer needs and expectations (Zhang, 2000). Philips (1995) stated that an organisation needs to recognise the need to place the customer as first priority in every decision made. An organisation which is customer focused will know the customers' current requirements and future expectations. The company 'actively seeks ways to improve the product (or service) in order to achieve greater customer satisfaction' (Hoang et al., 2006, p. 1097). If an organisation is customer focused, one way they can achieve it will be through c-commerce to form a collaborative SCM. Meeting customers' needs, and thus ensuring customer satisfaction, are ultimately the responsibility of management (B. Lin & Jones, 1997).

As stated by Fou (2001), c-commerce makes it possible to integrate the organisation's business processes, share customer relationships and manage knowledge across enterprise boundaries thus improving the quality of the customer experience. As stated by McCoy (2002), consumers now have more information than ever before, and with improvement in technologies and increased competitiveness, it is easier for consumers to change suppliers. This together with shortened product life cycles means suppliers are constantly under pressure to improve their ability to meet the demands of consumers. McCoy (2002) stated that the implementation of c-commerce will improve the ability to satisfy the demands of customers as it allows the integration of various supply chain processes from sales, marketing, finance and support in the context of the customer.

One of the best-known companies that has achieved success in customer satisfaction through c-commerce implementation is Dell computers (Chou et al., 2004). Through c-commerce, Dell connected with its suppliers and is able to send forecasts to suppliers and gets responses back about their ability to support the requirements from a supply/demand perspective (Chou et al., 2004). Dell's implementation of c-commerce allows it to improve customer satisfaction through improving its delivery time to customers,

ability to predict the demands of the customers, as well as allowing customers to customise their products.

Lorente et al. (1999) stated that customer focus can be useful in the application of IT to the company–client relationship. This is due to IT's capacity to 'facilitate customers' information processing and related communication and if these data are analysed using TQM principles and practices, the advantages that can be obtained from this could be considerable' (p. 17). Lorente et al. (1999) further stated that the same situation is applicable to supplier relationships and long-term partnering agreements. Thus the following proposition is formulated:

P2: Customer focus will positively affect c-commerce adoption level.

Training and education is another important dimension of TQM. Buckley and Caple (1992) defined training as a 'planned and systematic effort to develop knowledge through learning experience in order to achieve effective performance in an activity or range of knowledge management activities' (Buckley & Caple, 1992, p. 17). Well-trained employees in the organisation are also more ready to accept new ways of operating (Lorente et al., 1999). Lorente et al. (1999) also stated that when IT technologies are implemented, the result might be a need for more intellectual, autonomous and less mechanically controlled labour. Thus training becomes an important issue and the content of training should reflect the new knowledge needs. The adoption of c-commerce tools will also mean that the employees will need to embrace the new technology and thus be required to change some of the older way of doing things. Education and training is also stated to be an important determinant of technology adoption in technologies such as enterprise resource planning (ERP), EDI and e-business. According to Bradford and Florin (2003) in their study of ERP adoption, it is stated that there is a positive relationship between the level of training received by the organisations' employees with respect to ERP systems and the implementation success. Parker and Swatman (1996) also stated that EDI adoption among small and medium enterprises was low and education and training is able to raise the awareness of EDI and promote the adoption of the technology. Sánchez and Pérez (2003) in their study on EDI implementation for supply chain stated that the lack of knowledge of and training in EDI were major impediments to its adoption. Although ultimately c-commerce adoption might be an organisation decision, it is the organisation's employees using the technology which will determine whether c-commerce can be successfully adopted or not. Therefore we propose the following proposition:

P3: Education and training will positively affect c-commerce adoption level.

Teamwork is the extent to which an organisation's practices increase employees' control in their work and allow them to work together. Teamwork encourages people to work together in pursuit of total quality in different ways (Kanji, 1998). Essentially, teamwork allows employees at all levels to be more involved in the job and to work together company-wide (Noorliza & Zainal, 2000; Ooi, Bakar, & Arumugam, 2007). With a common goal in mind, it is likely that quality improvement becomes easier to communicate over departmental divisions (Kanji, 1998). Consistently, work teams could promote information sharing, problem solving and establish employee responsibility for managing quality performance (Cooney & Sohal, 2004). Teamwork is needed when the coordination of activities is required. Prajogo and Sohal (2001) also stated that 'cross-functional teamwork is one of the most effective channels of communication, and communication is recognised as the primary determinant in organizational innovation' (p. 546). Prajogo and Sohal (2003) found that there is a positive and significant relationship between

teamwork and an organisation's success in innovation. Singh and Smith (2001) also stated that teamwork is one of the critical factors in managing inter-organisational collaboration in innovation.

C-commerce involves collaborations between the company, its suppliers, trading partners, customers and employees. When implementing c-commerce, it is not only an organisation's internal functional teams (e.g. marketing, logistics, accounting) that need to work together; they will also need to work together with their partner's functional teams as well. Therefore for an organisation to adopt c-commerce, it is important that teamwork has been practised in the organisation. Therefore this study proposes that:

P4: Teamwork will positively affect c-commerce adoption level.

Knowledge management processes

Knowledge management is a systematic approach to improve an organisation's ability to mobilise knowledge to enhance decision-making in formulating business strategy (Horwitch & Armacost, 2002; Hsu & Shen, 2005). According to Cavusgil, Calantone and Zhao (2003), companies such as Xerox and Hitachi have worked collaboratively across organisational boundaries to ensure sustained innovation and competitive advantage. These collaborations are facilitated by knowledge management. As c-commerce involves collaboration through the Internet, it is possible that organisations with knowledge management practices can help the implementation of c-commerce.

Du Plessis (2007) stated that knowledge management plays an important role in innovation. As cited in Du Plessis (2007), 'acquiring knowledge and skills through collaboration is considered to be an effective and efficient way of successful innovation.' (p. 22). H.F. Lin and Lee (2005) also stated that efficient knowledge management process such as knowledge acquisition, application and sharing are vital for the adoption of new technology. Darroch (2005) in her empirical study of the relationships between knowledge management and innovation found that effective knowledge management is able to contribute to innovation.

Knowledge acquisition is the process by which existing knowledge is used and captures new knowledge. According to Gilbert and Cordey-Hayes (1996), knowledge acquisition is important for the success of technology innovation. According to Darroch and McNaughton (2002), an organisation's innovation increases with the extent of knowledge acquisition. In H.F. Lin and Lee's study of knowledge acquisition on the adoption of e-business, it was found that knowledge acquisition can positively influence the adoption of e-business. H.F. Lin and Lee (2005) further stated that knowledge accumulation allows employees to use existing knowledge to create new knowledge, which is important for e-business systems adoption. Darroch (2005) also stated that before an innovation can take place, it is important for managers to have knowledge about the internal and external forces that affect the organisation. As Darroch (2005) stated, 'the more knowledge, and the greater the variety of knowledge, the better' (p. 105). C-commerce involves the acquisition of new knowledge, especially that which is related to supply chain information. This knowledge can range from product information, existing customers' demand, product design, etc.

Therefore an organisation's knowledge acquisition capabilities are able to positively relate to c-commerce adoption. Accordingly the following proposition is developed:

P5: Knowledge acquisition will positively affect c-commerce adoption level.

Knowledge application is defined by H.F. Lin and Lee (2005) as the 'business processes through which effective storage and retrieval mechanisms enable a firm to access

knowledge easily' (p. 176). Ravichandran (2005) in his study of organisational assimilation of complex technology found that the application of knowledge is important for the deployment of the technology. Gilbert and Cordey-Hayes (1996) also proposed that knowledge acquisition is an important facilitator of successful technological innovation (Gilbert & Cordey-Hayes, 1996; H.F. Lin & Lee, 2005). Su, Chen and Sha (2005) stated that although the importance of knowledge management in innovation has been studied widely, there is a lack of research on the outcome of knowledge application and innovation. Du Plessis and Boon (2004) also stated that knowledge application has an influence on the implementation of e-business. Du Plessis and Boon (2004) stated that e-business is considered a business model that is more complicated than a traditional bricks-and-mortar business. Thus through managing the knowledge base and making relevant knowledge accessible, the adoption of an e-business model will be made easier and knowledge application allows knowledge to 'flow across boundaries, including interorganisational, intra-organisational and geographical boundaries' (p. 78).

According to Alavi and Leidner (2001), the speed of knowledge application could be improved by codifying and automating organisational routines through IT applications. For example, workflow automation systems could reduce the level of coordination required and facilitate optimal use of organisational routines via timely and automatic routing of information and activities (Alavi & Leidner, 2001). H.F. Lin and Lee (2005) also stated that companies are more likely to adopt new IT technologies if they stimulate and improve organisational application of knowledge. Their study of the influence of knowledge management processes on e-business adoption showed that if an organisation's knowledge management process is focused on making knowledge useful, it is more likely to increase its level of IT adoption. Accordingly, the following proposition is proposed:

P6: Knowledge application will positively affect e-commerce adoption level.

Knowledge sharing is the business process whereby the knowledge is distributed to all the individuals participating in the process activity (H.F. Lin & Lee, 2005; Phusavat, Anussornnitisam, Devahastin-Suthapreda, Kuljittiprasit, & Thamsatitdej, 2008). H.F. Lin (2007) stated that innovation involves a broad process of knowledge sharing that allows the implementation of new ideas, processes, products or services.

Ravichandran (2005), in his study of technology assimilation, defined knowledge sharing as the extent to which the technology vendors transfer the technical knowledge of the technology to potential adopters. By sharing this knowledge, the learning burden in adopting the new technology will be reduced for the potential adopters.

In the case of c-commerce, the knowledge sharing is important from several aspects. First, knowledge sharing should be considered in terms of the technical knowledge of the technology as suggested by Ravichandran (2005). As c-commerce is implemented across departments as well as with supply chain partners, it is important that the knowledge on the risks, problems and benefits of implementing c-commerce should be shared with all supply chain members. This is especially important as c-commerce requires the co-adoption by two or more supply chain partners. In a case study on the adoption of RosettaNet standards by Chong (2006), it is stated that the organisation that has knowledge on implementing RosettaNet standards chose to share with its suppliers information related to RosettaNet standards' features, and the skills and infrastructure needed to use the technology, to encourage them to adopt the technology. The organisation also shared information related to the risks and benefits of adopting RosettaNet standards with the potential adopters.

Secondly, knowledge sharing should be considered in terms of the sharing of supply chain information such as demand forecast, business plans, customer information,

marketing information, etc. Following von Krogh, Nonaka and Aben (2001), strategic partnerships allow mutual access to different firms' knowledge. If organisations have mechanisms to share this information, or are willing to share this information, then they are willing to adopt c-commerce which helps facilitate the sharing. However, if organisations are not prepared to share this knowledge, then the possibility of organisations adopting c-commerce will be low. Organisations that have been sharing supply chain information without using c-commerce in the past would have formed a culture of sharing information. Thus these organisations are also more likely to adopt c-commerce to improve the process of sharing this information. The following proposition is therefore formulated:

P7: Knowledge sharing will positively affect c-commerce adoption level.

Managerial implications

In today's competitive business environment, a collaborative supply chain allows organisations to gain competitive advantages over their rivals. Increasingly, organisations are starting to plan how they can implement c-commerce in their supply chain. Chou et al. (2004)'s study on web technologies in SCM stated that organisations are now moving towards c-commerce instead of e-commerce. However, the implementation of c-commerce is still relatively low. The managerial implication of this study is that research on c-commerce needs to fully incorporate different aspects of knowledge management and TQM in an organisation in order to advance a robust theory of c-commerce. Despite the considerable attention paid to various perspectives of c-commerce, little research integrates knowledge management and TQM. This model provides a more nuanced perspective on influences of knowledge management and TQM across subunits in an organisation with respect to c-commerce adoption. This study will be valuable to two parties: (1) administrators who wish to understand the supporting aspects for employees who are involved in the adoption of c-commerce; and (2) the labour relations practitioners who need to know whether implementation of knowledge management and TQM are the sources of c-commerce adoption in their supply chain. By adopting this model proposed, industrial practitioners can gain a fine-grained understanding of how different subsets of knowledge management and TQM in an organisation contribute to adoption of c-commerce.

Theoretical implications

C-commerce is an emerging area in the study of applying IT technologies to a collaborative SCM. Murphy (2001) stated that c-commerce is fast replacing e-commerce as the 'must have' strategy for organisations to gain competitive advantages. Although there are prior studies on the adoption of IT in the SCM, most of these studies have focused on technologies such as B2B and EDI. Existing studies on the adoption of these technologies have mainly drawn on models looking at the technology's characteristics and environment as well as organisational factors. Given that TQM, knowledge management and collaborative SCM are all important business strategies that are applied by organisations, it is important to study the relationships between these three areas. Although there have been separate studies on the relationships between innovation and TQM and knowledge management, these studies have looked at the relationships separately and there is still a lack of research into the relationship of both TQM and knowledge management with innovation adoption. Furthermore, many of the existing studies on innovation, TQM and knowledge management have concentrated on an organisation's product and

process innovation. There has been little focus on IT innovation adoption and TQM and knowledge management. This study proposed a new integrated model which includes practices from both TQM and knowledge management theories to examine if these practices will result in an improvement of c-commerce adoption. Researchers that would like to investigate the impact of these practices on the adoption of c-commerce in different industries, countries and organisations could use this framework to conduct a pre-test baseline measurement and periodically reassess the effects of any TQM and knowledge management change.

Conclusion

In conclusion, this study shows that the effects of c-commerce adoption can be conceptualised as consisting of two phases (i.e. knowledge management and TQM). The study should yield significant insights into how knowledge management and TQM govern the occurrence and effectiveness of c-commerce in an organisation. The model proposed that TQM practices such as top management commitment on TQM, customer focus by the organisation, training and education availability to its employees and teamwork in the organisation, together with knowledge management processes of knowledge acquisition of the organisation, knowledge application and the sharing of knowledge will improve the adoption level of c-commerce.

The study has contributed in advancing TQM, knowledge management, innovation adoption and c-commerce adoption research literature and develops a better understanding of the association between these different areas. In the next step in this investigation, the authors intend to explore a survey to empirically validate and improve the model.

References

- Alavi, M., & Leidner, D.E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, 25, 107–136.
- Allen, J.P. (2000). Information systems as technological innovation. *Information Technology & People*, 13, 210–221.
- Bradford, M.M., & Florin, F. (2003). Examining the role of innovation diffusion factors on the implementation success of enterprise resource planning systems. *International Journal of Accounting Information Systems*, 4, 205–225.
- Buckley, R., & Caple, J. (1992). *The theory and practice of training*. London: Kogan Page.
- Cassivi, L. (2006). Collaboration planning in a supply chain. *Supply Chain Management: An International Journal*, 11, 249–258.
- Cavusgil, S.T., Calantone, R.J., & Zhao, Y. (2003). Tacit knowledge transfer and firm innovation capability. *Journal of Business & Industrial Marketing*, 18, 6–21.
- Chau, P., & Hui, K. (2001). Determinants of small business EDI adoption: An empirical investigation. *Journal of Organizational Computing and Electronic Commerce*, 11, 229–252.
- Chong, A.Y.L. (2006). Migrating supply chain management online: A study in Malaysian companies. *INTI Journal, Special Issue*, 184–193.
- Chong, A.Y.L., & Ooi, K.B. (2008). Adoption of interorganizational system standards in supply chains: An empirical analysis of RosettaNet standards. *Industrial Management & Data Systems*, 108, 529–547.
- Chou, D.C., Tan, X., & Yen, D.C. (2004). Web technology and supply chain management. *Information Management & Computer Security*, 12, 338–349.
- Claver-Cortes, E., Pereira-Moliner, J., Tari, J.J., & Molina-Azorin, J.F. (2008). TQM, managerial factors and performance in the Spanish hotel industry. *Industrial Management & Data Systems*, 108, 228–244.
- Cooney, R., & Sohal, A. (2004). Teamwork and total quality management: A durable partnership. *Total Quality Management & Business Excellence*, 15, 1131–1142.
- Crosby, P.B. (1996). *Quality is free*. New York: McGraw-Hill.

- Darroch, J. (2005). Knowledge management, innovation and firm performance. *Journal of Knowledge Management*, 9(3), 101–115.
- Darroch, J., & McNaughton, R. (2002). Examining the link between knowledge management practices and types of innovation. *Journal of Intellectual Capital*, 3, 210–222.
- Deming, W.E. (1986). *Out of the crisis*. Cambridge: Cambridge University Press.
- Demirbag, M., Koh, S.C.L., Tatoglu, E., & Zaim, S. (2006). TQM and market orientation's impact on SMEs' performance. *Industrial Management & Data Systems*, 106, 1206–1228.
- Du Plessis, M. (2007). The role of knowledge management in innovation. *Journal of Knowledge Management*, 11(4), 20–29.
- Du Plessis, M., & Boon, J.A. (2004). Knowledge management in eBusiness and customer relationship management: South African case study findings. *International Journal of Information Management*, 24, 73–86.
- Fou, J. (2001). *Web services and collaborative commerce*. Retrieved from www.webservicesarchitect.com/content/articles/fou01.asp
- Gilbert, M., & Cordey-Hayes, M. (1996). Understanding the process of knowledge transfer to achieve successful technological innovation. *Technovation*, 16, 301–312.
- Gunasekaran, A., & McGaughey, R.E. (2003). TQM is supply chain management. *The TQM Magazine*, 15, 361–363.
- Gupta, B., Iyer, L.S., & Aronson, J.E. (2000). Knowledge management: Practices and challenges. *Industrial Management & Data Systems*, 100, 17–21.
- Hoang, D.T., Igel, B., & Laosirihongthong, T. (2006). The impact of total quality management on innovation: Findings from a developing country. *International Journal of Quality & Reliability Management*, 23, 1092–1117.
- Horwath, M., & Armacost, R. (2002). Knowledge management: Helping knowledge management be all it can be. *Journal of Business Strategy*, 23(3), 26–31.
- Hsu, S.H., & Shen, H.P. (2005). Knowledge management and its relationship with TQM. *Total Quality Management*, 16, 351–361.
- Huang, X., Gattiker, T.E., & Schroeder, R.G. (2008). Structure-infrastructure alignment: The relationship between TQM orientation and adoption of supplier-facing electronic commerce among manufacturers. *Journal of Supply Chain Management*, 44, 40–54.
- Huang, F., & Chen, Y.T. (2002). Relationships of TQM philosophy, methods and performance: A survey in Taiwan. *Industrial Management & Data Systems*, 102, 226–234.
- Iacovou, C.L., Benbasat, I., & Dexter, A.S. (1995). Electronic data interchange and small organizations: Adoption and impact of technology. *MIS Quarterly*, 19, 465–485.
- Kanji, G.K. (1996). Implementation and pitfalls of total quality management. *Total Quality Management & Business Excellence*, 7, 331–343.
- Kanji, G.K. (1998). An innovative approach to make ISO 9000 standards more effective. *Total Quality Management & Business Excellence*, 9, 67–78.
- Kanji, G.K. (2005). Sustainable growth and business excellence. *Total Quality Management & Business Excellence*, 16, 1069–1078.
- Kekale, T., & Kekale, J. (1995). A mismatch of cultures: A pitfall of implementing a total quality approach. *International Journal of Quality & Reliability Management*, 12(9), 210–220.
- Kim, S., & Smari, W.W. (2005, May). On a collaborative commerce framework and architecture for next generation commerce. In W. McQuay & W.W. Smari (Eds.), *Proceedings from the International Symposium on Collaborative Technologies and Systems* (pp. 282–289), Missouri, United States. doi:10.1109/ISCST.2005.1553324
- Kumar, M., & Antony, J. (2008). Comparing the quality management practices in UK SMEs. *Industrial Management & Data Systems*, 108, 1153–1166.
- Lee, Y., & Kincade, D.H. (2003). US apparel manufacturers' company characteristic differences based on SCM activities. *Journal of Fashion Marketing and Management*, 7, 31–48.
- Lin, B., & Jones, C.A. (1997). Some issues in conducting customer satisfaction surveys. *Journal of Marketing Practice: Applied Marketing Science*, 3, 4–13.
- Lin, B., & Ogunyemi, F. (1996). Implications of total quality management in federal services: The US experience. *International Journal of Public Sector Management*, 9(4), 4–11.
- Lin, H.F. (2007). Knowledge sharing and firm innovation capability: An empirical study. *International Journal of Manpower*, 28, 315–332.
- Lin, H.F., & Lee, G. (2005). Impact of organizational learning and knowledge management factors on e-business adoption. *Management Decision*, 43, 171–188.

- Lin, L.Y., Wu, S.H., & Lin, B. (2008). An empirical study of dynamic capabilities measurement on R&D department. *International Journal of Innovation and Learning*, 5, 217–240.
- Lorente, A.R.M., Dewhurst, F., & Dale, B.G. (1999). TQM and business innovation. *European Journal of Innovation Management*, 2, 12–19.
- McCoy, F. (2002). *CRM integration strategy is critical to c-commerce success*. Retrieved from www.articles.techrepublic.com/5100-10878-1039019.html
- Martin, L.M., & Matlay, H. (2003). Innovative use of the internet in established small firms: The impact of knowledge management and organizational learning in accessing new opportunities. *Qualitative Market Research: An International Journal*, 6, 18–26.
- Mentzer, J.T., Foggin, J.H., & Golobic, S.L. (2000). Collaboration: The enablers, impediments, and benefits. *Supply Chain Management Review*, September/October, 52–58.
- Murphy, J.V. (2001). *Forget the 'E'! C-commerce is the next big thing*. Retrieved from www.supplychainbrain.com/archives/8.01.c-commerce.htm?adcode=10
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge creating company*. Oxford: Oxford University Press.
- Noorliza, K., & Zainal, A.A. (2000). Quality practices that pay: Empowerment and teamwork. *Malaysian Management Review*, 35(2), 66–76.
- Ooi, K.B., Arumugam, V., & Teo, S.H. (2005). Does soft TQM predict employees' attitudes? *The TQM Magazine*, 17, 279–289.
- Ooi, K.B., Bakar, N.A., & Arumugam, V. (2007). Does TQM influence employees' job satisfaction? An empirical analysis. *International Journal of Quality & Reliability Management*, 24, 62–77.
- Parker, C., & Swatman, P.M. (1996, January). TREAT: Promoting SME adoption of EDI through education. In *Proceedings of the 29th Hawaii International Conference on System Sciences* (Vol. 4, pp. 387–396), doi: 10.1.1.109.1737
- Patterson, K.A., Grimm, C.M., & Corsi, T.M. (2003). Adopting new technologies for supply chain management. *Transportation Research Part E: Logistics and Transportation Review*, 39, 95–121.
- Pawlak, M., & Malyszek, E. (2008). A local collaboration as the most successful co-ordination scenario in the supply chain. *Industrial Management & Data Systems*, 108, 22–42.
- Perez, M.P., Sanchez, A.M., Carnicer, P.D.L., & Fimenez, M.J.V. (2004). A technology acceptance model of innovation adoption: The case of teleworking. *European Journal of Innovation Management*, 7, 280–291.
- Philips (1995). *Philips quality – let's make things better, corporate quality bureau*. Eindhoven, The Netherlands: Philips Electronics NV.
- Phusavat, K., Anussornnitisam, P., Devahastin-Suthapreda, V., Kuljittiprasit, P., & Thamsatitdej, P. (2008). Service satisfaction through external knowledge management. *International Journal of Services and Standards*, 4, 182–193.
- Prajogo, D.I., & Sohal, A. (2001). TQM and innovation: A literature review and research framework. *Technovation*, 21, 539–558.
- Prajogo, D.I., & Sohal, A. (2003). The relationship between TQM practices, quality performance, and innovation performance: An empirical examination. *International Journal of Quality & Reliability Management*, 20, 901–918.
- Ravichandran, T. (2005). Organizational assimilation of complex technologies: An empirical study of component-based software development. *IEEE Transactions on Engineering Management*, 52, 249–268.
- Raymond, L. (2001). Determinants of web site implementation in small businesses. *Internet Research: Electronic Networking Applications and Policy*, 11, 411–422.
- Reed, R., Lemak, D., & Mero, N. (2000). Total quality management and sustainable competitive advantage. *Journal of Quality Management*, 5, 5–26.
- Rogers, E.M. (1995). *Diffusion of innovations*. New York: The Free Press.
- Rudberg, M., Klingenberg, N., & Kronhamn, K. (2002). Collaborative supply chain planning using electronic marketplaces. *Integrated Manufacturing Systems*, 13, 596–610.
- Sánchez, A.M., & Pérez, M.P. (2003). The use of EDI for interorganisational co-operation and co-ordination in the supply chain. *Integrated Manufacturing Systems*, 14, 642–651.
- Shang, S.S.C., Lin, S.F., & Wu, Y.L. (2009). Service innovation through dynamic knowledge management. *Industrial Management & Data Systems*, 109, 322–337.

- Shapira, P., & Rephann, T. (1996). New technology adoption in West Virginia: Implications for manufacturing modernization policies. *Environment and Planning C: Government and Policy*, 14, 431–450.
- Shen, L., Hawley, J., & Dickerson, K. (2004). E-commerce adoption for supply chain management in US apparel manufacturers. *Journal of Textile and Apparel, Technology and Management*, 4(1), 1–11.
- Singh, P.J., & Smith, A.J.R. (2001). TQM and innovation: An empirical examination of their relationship. In M. Terziovski (Ed.), *Proceedings of 5th International and 8th National Research Conference on Quality and Innovation Management* (pp. 25–610). Australia: University of Melbourne.
- Singh, P.J., & Smith, A.J.R. (2004). Relationship between TQM and innovation: An empirical study. *Journal of Manufacturing Technology Management*, 15, 394–401.
- Su, C.T., Chen, M.C., & Cheng, G.C. (2001). TQM in Taiwan's computer and its peripheral industry. *Industrial Management & Data Systems*, 101, 357–362.
- Su, C.T., Chen, Y.H., & Sha, D.Y. (2005). Linking innovation product development with customer knowledge: A data mining approach. *Technovation*, 26, 784–795.
- Thuraisingham, B., Gupta, A., Bertino, E., & Ferrari, E. (2001). Collaborative commerce and knowledge management. *Knowledge and Process Management*, 9, 43–53.
- Tornatzky, L.G., & Fleischer, M. (1990). *The processes of technological innovation*. New York: Lexington Books.
- Tornatzky, L.G., & Klein, R.J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, 29, 28–45.
- von Krogh, G., Nonaka, I., & Aben, M. (2001). Making the most of your company's knowledge: A strategic framework. *Long Range Planning*, 34, 421–439.
- Wang, W.T. (2009). Knowledge management adoption in times of crisis. *Industrial Management & Data Systems*, 109, 445–462.
- Wei, J., Van der Ende, L., & Lin, B. (2009). Customer-focused e-business model for the oil industry. *Journal of Computer Information Systems*, 49(3), 11–21.
- Wilkinson, A. (1992). The other side of quality: Self issues and the human resource dimension. *Total Quality Management*, 3, 323–329.
- Wilkinson, A., & Witcher, B. (1993). Holistic total quality management must take account of political processes. *Total Quality Management*, 4, 47–56.
- Wu, W.Y., Lin, B., & Cheng, C.F. (2009). Evaluating online auction strategy: A theoretical model and empirical exploration. *Journal of Computer Information Systems*, 49(3), 22–30.
- Zhang, Z.H. (2000). *Implementation of total quality management: An empirical study of Chinese manufacturing firms* (Unpublished PhD thesis). University of Groningen, Groningen.

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