

An extensive structural model of supply chain quality management and firm performance

Huy Truong

Systems and Production Department, University of Minho, Braga, Portugal

Paulo Sampaio,

Systems and Production Department, University of Minho, Braga, Portugal

Maria do Sameiro Carvalho,

Systems and Production Department, University of Minho, Braga, Portugal

Ana Cristina Fernandes,

Systems and Production Department, University of Minho, Braga, Portugal

Duong Thi Binh An

Systems and Production Department, University of Minho, Braga, Portugal

Abstract:

Purpose: This study was carried out to create a research model investigating the impact of supply chain quality management (SCQM) practices on firm performance.

Design/methodology/approach: Based on a comprehensive literature review, the practices were suggested. These SCQM practices will be analyzed and categorized into 4 dimensions: **upstream** (supplier assessment, supplier quality management), **downstream sides of a supply chain** (customer focus), **internal process** (product/service design, process management and logistics) and **support practices** (top management support, human resource management, information and supply chain integration). The measurement instrument of firm performance was developed including three aspects: operational performance, customer satisfaction and financial performance.

Findings: A conceptual framework and a structural model were proposed as well as the development of hypotheses on the paths.

Research limitations/implications: It is necessary to test the rationality of this model by empirical studies in different contexts.

Originality/value: The research considers integration of quality and supply chain management still remains limited in the literature. Therefore, it is necessary to have a more focused approach in assessing quality management issues within the internal and external supply chain contexts. This study concentrates on the practices which improve quality aspects of supply chain, known as SCQM practices. Proposed structural model in this paper not only fills the voids in the literature but contributes a parsimonious conceptual framework for theory building in SCQM and firm performance. It also expects to offer a useful guidance for measuring and implementing SCQM practices as well as facilitate further studies in this field.

Keywords: Quality management, Supply chain management, Supply chain quality management practices, firm performance.

Article Classification: Conceptual paper

1. Introduction

As competition moves beyond a single firm into the supply chain, organizations began to realize that it is not enough, if they only pay attention to improve performance within their own company. According to Li et al. (2006), the development and implementation of Supply chain management (SCM) can maximize customer value and gaining a competitive advantage in the marketplace and getting a good profit as well. Thus, SCM becomes increasingly important.

The concept of SCM has attracted the attention from academicians and business managers. Many organizations have started recognizing that SCM is the main factor to create a sustainable competitive edge for their products and/or services in an increasingly crowded marketplace.

In supply chain, quality plays an important role. Establishment of a quality-based culture can improve operational performance, customer satisfaction, financial performance, etc. along the supply chain (Kaynak and Hartley, 2008).

Several researchers have suggested to integrate quality and supply chain management. However, this implementation still remains limited (Robinson and Malhotra, 2005). Therefore, it is necessary to have a more focused approach in assessing quality management issues within the internal and external supply chain contexts.

This study will concentrate on the practices which improve quality aspects of supply chain, known as supply chain quality management (SCQM) practices. Also, a structural model will be proposed to investigate the relationship between SCQM practices and performance.

Examining these relationships is very important because it allows us to understand deeply how SCQM practices impact on performance in supply chain. And this study also expects to offer the useful guidance for measuring and implementing SCQM practices as well as facilitate further researches in this field.

The structure of this paper is as follows: the next section is literature review that previous studies concerning SCQM are documented. In section 3, the SCQM practices and firm performance were described. Then, research model and hypotheses are suggested. Implications and directions for further research are mentioned at the end of this paper.

2. Literature review

This section is separated into 2 parts. Firstly, various definitions of SCQM are documented. Then, an appropriated one is suggested. Next, empirical studies are reviewed to explore research gaps in the literature.

2.1 Definitions of SCQM

There are some previous studies to define SCQM in different perspectives. According to Ross (1998), it is the participation of all members in a supply chain to improve all processes, products, services, and work cultures, etc. It will result in increasing productivity, competitiveness and customer satisfaction.

Kuei et al. (2001) defined SCQM in the three following equations:

- 1.** SC = a suppliers – manufacturers – customers network;
- 2.** Q = meeting market demands correctly, and improving operational performance, customer satisfaction, financial performance; and
- 3.** M = facilitating, encouraging the quality processes and activities, increasing trust for supply chain quality.

SCQM is the coordination, integration and optimization of quality activities among members in a supply chain. It manages product quality and processes effectively in order to gain competitive advantage, customer satisfaction and market share (Robinson and Malhotra, 2005).

SCQM is an SCM extension that is designed to help firms to establish a competitive supply chain through application of quality management practices (Kuei et al., 2008).

In sum, SCQM is the orientation, coordination and implementation of all activities taking place in supply chain smoothly. It is helpful to improve operational quality and product quality as well as to increase customer satisfaction.

2.2 Research gaps

There are some empirical studies to investigate the impact of SCQM on firm performance. However, they still remain some limitations that need to further explore. Based on extensive literature review, the research gaps are indicated, including:

- Lack of a research model covers upstream, internal process and downstream activities.
- Role of information has not yet fully examined.
- The inconsistency is in results of previous studies.
- The mutual interaction among practices has not been taken into account.
- Various dimensions of firm performance have not yet evaluated simultaneously.

For more detail, these research gaps will be discussed as follows.

SCQM has a significant impact on firm performance throughout practices along the entire supply chain that cover upstream, internal process and downstream activities (Kaynak and Hartley, 2008). It, however, has not been sufficiently examined in the literature. Some of previous studies focused only on the upstream side of the supply chain (Akamp and Müller, 2013; Hollos et al., 2011; Kumar et al., 2014; Wu et al., 2010). While others investigated the impact of downstream on performance (Danese and Romano, 2011; Mokhtar, 2013; Mukerjee, 2013). Vachon and Klassen (2006) examined integration between upstream and downstream. Conversely, other authors tested effects of internal process on performance (Adam et al., 1997; Ahire and Dreyfus, 2000; Ahire and O'Shaughnessy, 1998; Anderson et al., 1995; Choi and Eboch, 1998; Powell, 1995; Samson and Terziovski, 1999; Saraph et al., 1989). In sum, each study showed some different perspectives in a wide picture about relationship between SCQM practices and firm performance.

According to Kaynak and Hartley (2008), the implementation of SCQM is not only internal practices, which are contained within an organization, but external practices, which cross organizational boundaries integrating a company with its customers and suppliers, are also examined (figure 1).

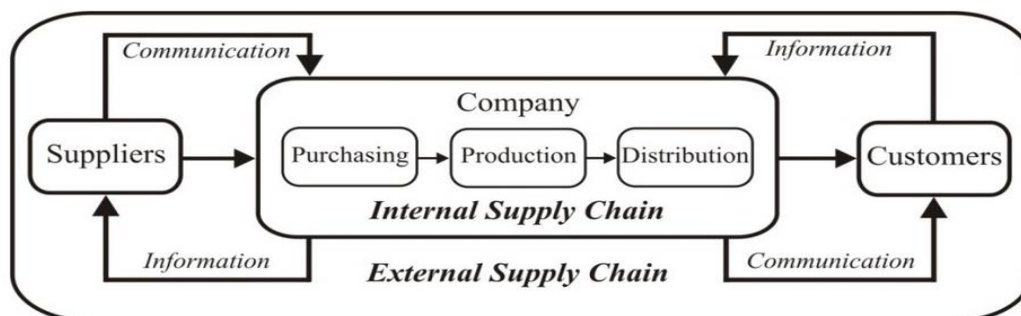


Figure 1: Internal and External Supply Chain

In the study of Romano and Vinelli (2001), performance of two different supply chains in garment industry was investigated. One is a traditional chain with no formal integration, and the other has involvement of upstream and downstream partners in activities of the focal firm. The study found that the supply chain which has integration and cooperation among members is better able to meet expectations of customers.

On the other hand, for this successful integration, information plays an extremely important role (Ding et al., 2014; Inderfurth et al., 2013; Qrunfleh and Tarafdar, 2014; Wu et al., 2014; Zhou et al., 2014). Lack of information or distorted information passed from one end of the supply chain to the other, can create significant problems, including, but not limited to, excessive inventory investment, poor customer

service, lost revenues, misguided capacity plans, ineffective transportation, and missed production schedules. These are not deliberate attempts to sabotage the performance of fellow supply chain members. Rather, distorted information throughout the supply chain will result in bullwhip effect (Handfield and Nichols, 2008). A further study which covers four major dimensions of SCQM including: internal process, upstream, downstream and information is essential to provide more macro guidance for quality integration in whole supply chain network.

Additionally, in QM or SCM literature, the results of previous studies are inconsistent in order to consolidate the statement of the influence of SCQM practices on firm performance (Kaynak and Hartley, 2008). For instance, in the relationship between customer focus and performance, the direct impact of customer focus on performance is supported by Prajogo and Brown (2004), Feng et al. (2006), Fening et al. (2008), Terziovski (2006), Samson and Terziovski (1999), Lakhali et al. (2006), Dow et al. (1999). However, according to Tari et al. (2007), Zu (2009), Su et al. (2008), customer focus indirectly effects on performance through the relationship with other practices. Also, Rahman and Bullock (2005) pointed out that there are indirect and direct relationship between them. Otherwise, between process management and performance, the direct influence of process management on performance have been identified in several studies (Feng et al., 2006; Fening et al., 2008; Kaynak, 2003; Kaynak and Hartley, 2008; Prajogo and Brown, 2004; Sila and Ebrahimpour, 2005; Terziovski, 2006; Zu, 2009). However, Tari et al. (2007) argued that they have an indirect relationship. Conversely, Flynn et al. (1995) proved that process management has negative direct impact on performance, or even they are not associated as the studies of Powell (1995), Samson and Terziovski (1999).

Also, it is more important that these investigations are mainly to concentrate on the directly relationships, there is a lack of examining interactions among SCQM practices (Dow et al., 1999). According to Kaynak (2003), it is not comprehensive if a research model does not show relationship among practices. In other words, further studies need to identify the direct and indirect impact of SCQM practices on firm performance at multiple levels.

So far, few studies have considered the effect of SCQM practices on various dimensions of firm performance. Most of them are to focus on the relationships between SCQM practices and **a single performance measure**, such as: financial performance (Li et al., 2006), operational performance (Bayraktar et al., 2009; Devaraj et al., 2007; Fawcett et al., 2007; Wong et al., 2011), supplier/buyer performance (Shin et al., 2000), customer satisfaction (Power et al., 2001), etc.

It is hoped that by addressing diversified aspects of SCQM practices simultaneously as well as examining the direct and indirect impact of these practices on various firm performance, this study will provide a parsimonious conceptual framework for theory building in SCQM and firm performance.

3. Identification of SCQM practices and firm performance

3.1 Methodology

SCQM practices were documented based on extensive literature review in both areas of QM and SCM. Then, they were divided into four groups: upstream, internal process, downstream and support practices. The next step was to refine these practices that the similar ones were deleted. It is hope that the remaining practices will cover four above aspects.

Traditionally, firm performance was primarily evaluated by financial indicators such as sales revenue, market share, return on investment or return on sale. (Li et al., 2006). It is not comprehensive because firm performance is also reflected by other goals. In 1993, Kaplan and Norton introduced balanced scorecard including four different perspectives of performance indicators: financial, customer, internal processes and innovation and learning. Based on them, the measurement scales for firm performance were designed.

3.2 SCQM practices

As discussed, a comprehensive implementation of SCQM needs to cover four major dimensions including: upstream, internal process, downstream and information.

Based on an extensive literature review, the most relevant SCQM practices are identified (see Table 1). The classification adopted in this study (Flynn et al., 1995) assumes three main categories:

- Upstream: supplier management consists of supplier assessment and supplier quality management.
- Downstream: customer focus.
- Internal process: product/service design, process management and logistics.

Moreover, to ensure that activities in the entire supply chain are performed smoothly, the practices of human resource management, top management support, supply chain integration and information, known as support practices, are suggested.

Table 1: Description of SCQM practices.

SCQM practices		Description
Supplier management	Supplier assessment	Formal supplier assessment system. Clear metric for measuring supplier performance. Monitoring closely supplier performance. Comparison with other suppliers. (Prajogo et al., 2012)
	Supplier quality management	Reliance on a few suppliers. Supplier selection based on quality. Use of certified suppliers. Reliance on supplier process control. Communication with suppliers about quality considerations. Conformity of required quality attributes by suppliers. Clarity of specifications to suppliers. Decrease in amount of inspection for incoming quality. (Li et al., 2005)
Customer focus		Determination of customers' needs and wants. Understanding of products or services by employees. Use of information from customers in designing products and services. Commitment to satisfy customers. (Lakhal et al., 2006)
Internal process	Product/service design	Use of modular design of component parts. Use of standard components. Simplification of products. Review of new product/service design. Clarity of product/service specifications. (Kannan and Tan, 2005)
	Process management	Use of fool-proof for process design. Use of statistical techniques. Use of automatic processes. Auto-control inspection. Use of the preventive equipment maintenance. Clarity of work or process instructions. Identification of problem's location. (Forker, 1997; Kaynak, 2003; Saraph et al., 1989)
	Logistics	Selection of facility location. Response to anticipated delivery dates. Response to desired quantities. Modification of order size. Response to delivery times for specific customers. (Stank et al., 2001)
Human resource management		Employee development objectives based on strategic objectives. Effectiveness of employee problem/grievance resolution program. Measurement of employee satisfaction. Work environment. Empowerment. Promote of employee motivation. Training programs. Involvement in determining training needs. (Adam, 1994; Choi and Eboch, 1998; Park et al., 2001; Powell, 1995; Samson and Terziovski, 1999)
Top management support		Offer of innovation and continuous improvement policies. Provision of necessary resources for processes. Promotion of partners' involvement in firm's activities. Participation of top management in supply chain quality improvement process. Review of supply chain quality issues in top management meetings. Perception of importance of supply chain quality improvement. Responsibility for firm performance. (Flynn et al., 1995; Kaynak, 2003; Saraph et al., 1989)
Supply chain integration		Development of a long-term relationship. Participation in company's activities. Participation in activities of trade partners. Share of knowledge about core business processes. Share of improvement benefits, risks and rewards. Joint problem-solving. Participation in continuous improvement programs. Support for

		trade partners to improve product quality. Common goals. Evaluation relationship periodically.(Vanichchinchai and Igel, 2010)
Information	Information Sharing	Share of proprietary information. Announcement about issues affecting company's business. Share of business knowledge about core business processes. Information exchange to establish business planning. Announcement about events or changes. Face-to-face planning/communication.(Li and Lin, 2006; Li et al., 2006; Li et al., 2005)
	Information quality	Exchange of relevant information. Exchange of timely information. Exchange of accurate information. Exchange of complete information. Exchange of confidential information.(Cao and Zhang, 2011; Li and Lin, 2006; Li et al., 2005)
	Information Management	Data collection about trade partners' activities. A common standard for information sharing. Evaluation of formal and informal complaints and satisfaction. Information sharing among functions. Important information transmission to employees. Use of information to improve key processes, products and services.(Vanichchinchai and Igel, 2010)
	Information technology	Direct computer-to-computer links. Inter-organizational coordination based on electronic links. Use of information technology-enabled transaction processing. Electronic mailing capabilities. Use of electronic transfer of purchase orders, invoices, and/or funds. Use of advanced information systems to track and/or expedite shipments.(Prajogo et al., 2012)

3.3 Firm Performance

Firm performance is defined as how a firm achieves its market goals, and also its overall goals (Yamin et al., 1999). This study defines the set of measures for firm performance according to the four dimensions of balance scorecard. In which, financial perspective is measured by financial performance, customer satisfaction represents for customer perspective and finally, operational performance consists of internal processes, innovation and learning. Detail description of each dimension is in table 2.

Table 2: Description of firm performance dimensions

Dimensions of firm performance	Description
Customer satisfaction	Response to customer standards. Customer evaluation to firm performance. Continuity to use firm's product/service. Recommendation of firm's product/service to others. (Bozarth et al., 2009; Taylor and Baker, 1994)
Financial performance	Material acquisition costs. Non-quality costs. Warehousing costs. Manufacturing unit costs. Cost of carrying inventory. Logistics costs. Transportation costs. Sales revenue. Market share. Return on investment. Return on sale. (Beamon, 1999)
Operational performance	Delivery of inputs on-time. Material inventories. Quality inputs. Inspection of incoming materials/components/products. Set-up time. Lead-time. Inventory levels. Rate of defect products. Level of utilization at plant. Product/service quality. Rate of new product development. Level of absenteeism. Employee's productivity. (Beamon, 1999)

From above, the conceptual framework is suggested in Figure2.

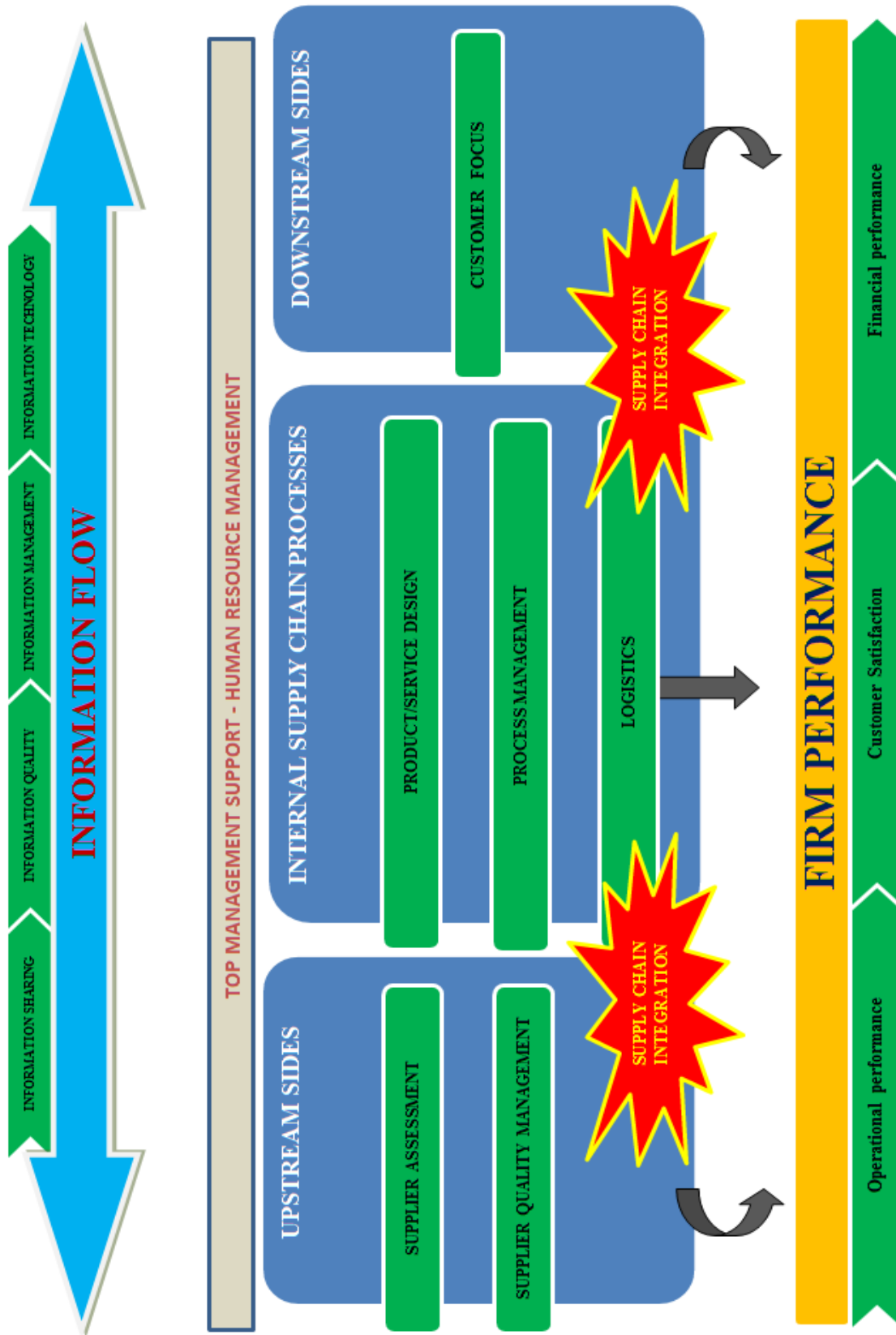


Figure 2: Conceptual framework

4. Structural model and hypotheses

From literature review, we can see that previous studies suffered incomplete consideration of SCQM dimensions as well as insufficient examination of the direct and indirect impact of these practices on various firm performance. This study will try to fill this void by proposing a comprehensive framework covering all suggested dimensions and developing related hypotheses as follows.

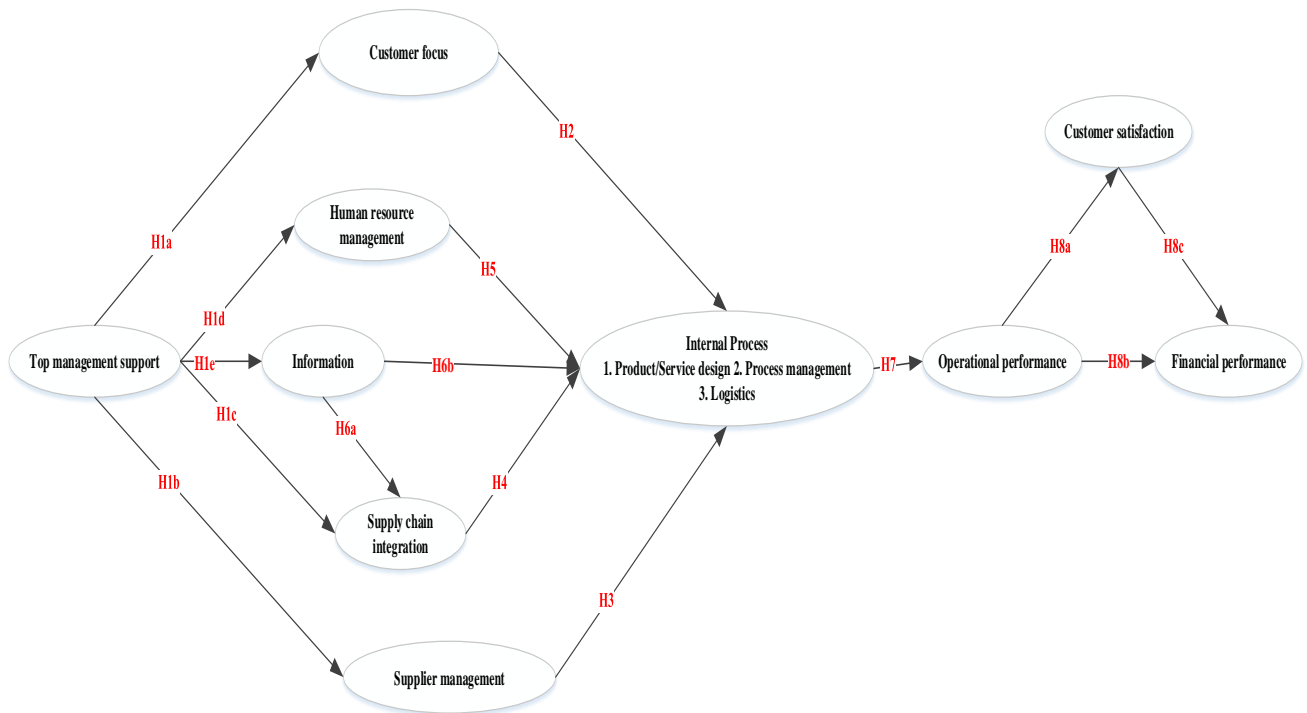


Figure 3: Structural model

Figure 3 describes the proposed structural model. In this model, internal process, supplier management and information are presented as second-order latent constructs. The structural relationships are depicted by arrows and will be discussed as follows.

4.1. Top management support

The support of top management is the main motivation that drives companies towards an effective and successful implementation of SCQM (Abraham et al., 1999; Ahire and Dreyfus, 2000; Ahire and O'Shaughnessy, 1998).

In any companies, customer satisfaction is the key driver of all activities. Therefore, customers' needs must be properly addressed not only by top managers but all employees also (Lakhal et al., 2006). Top management support is essential in ensuring that necessary resources are provided to carry out market studies to determine customers' needs and wants as well as making all efforts to meet them (Kaynak, 2003).

Additionally, in the SCM perspective, customer involvement in firm's activities plays an important role in the success of the whole supply chain (Robinson and Malhotra, 2005). Top management can promote customer involvement from the earlier stages of development until the commercialization stage (Flynn et al., 1995). Top management, further to define companies' mission and goals, creates the working environment in which all employees are encouraged to focus on addressing customer requirements (Ahire and Ravichandran, 2001).

As traditional approaches, supplier management is seen as a mere administrative activity that mainly focuses on supplier selection. In this activity, price is the main criterion to evaluate suppliers. This can result in poor quality materials or even delayed orders. In new perspective, supplier management refers

not only to the selection of quality suppliers, but to the development of long-term relationship with suppliers and assessment of suppliers' performance also (Li et al., 2005). However, to ensure that this implementation is successful, it is necessary to have support from top management (Kaynak, 2003; Kaynak and Hartley, 2008; Sila and Ebrahimpour, 2005; Singh, 2008; Zu et al., 2008). Top management actively participates in this process and selection will be based on review of more demanding criteria, e.g. quality, reliability in delivery activities and service. It ensures that firm has a reliable and high quality suppliers (Flynn et al., 1995; Trent and Monczka, 1999). Moreover, effective supplier management is considered as a strategic area by top managers promoting higher levels of integration and collaboration (e.g. design, production, marketing, sales and customer service) with key suppliers. Thereby, communication, relationship, and cooperation among parties in the supply chain are improved (Ellram, 1995). Hence, we propose the following hypotheses:

H1a: Top management support positively impacts on customer focus.

H1b: Top management support positively impacts on supplier management.

H1c: Top management support positively impacts on supply chain integration.

Top management creates an environment conducive to the development of all employees and promotes the motivation of employees. By empowering, employees could make their own decisions in their tasks. Top management, moreover, supports employees to involve in determining training needs and have training program to improve quality-related skills and knowledge for employees. There are some studies that found a positive relation of top management support to human resource management (Kaynak and Hartley, 2008; Ou et al., 2010; Sila and Ebrahimpour, 2005; Singh, 2008; Tari et al., 2007). Hence, the following hypothesis is proposed:

H1d: Top management support positively impacts on human resource management.

To operate a supply chain smoothly, information needs to be shared among partners. However, this leads to a concern that information disclosure is as a loss of power (Mason-Jones and Towill, 1997). Thus, to ensure that information practice is applied successfully, top management support has a significant role. They are those who can decide types of shared information and extent to which critical and proprietary information is communicated to supply chain partners as well as transmitted to employees within their company. Moreover, the accuracy, timeliness, adequacy, and credibility of information exchanged are also determined by top management. Furthermore, top management makes decisions to invest necessary facilities to apply information technologies in daily activities. Hence, we suggest the following hypothesis:

H1e: Top management support positively impacts on information.

4.2. Customer focus

Customer focus is considered as a key element for successful enterprises. All activities such as the development of new product/services, production, marketing, distribution and after-sales services should be concentrated on customer requirements. Each department and every employee should share customer-focused vision alike (Ahire and O'Shaughnessy, 1998; Ahire and Ravichandran, 2001; Flynn et al., 1995; Forza and Filippini, 1998; Lakhali et al., 2006; Nair, 2006; Sila and Ebrahimpour, 2005).

The implementation of customer focus practice helps companies to better understand customer expectations and market opportunities (Lakhali et al., 2006). Based on them, firms can be active in planning for design, purchasing, production, delivery, etc. For instance, firms can balance supply and demand, reducing variance in processes (Lee et al., 1997). In production activities, by understanding customer's demand, company can coordinate effectively machines, equipment and human resources to minimize process complexity and variance.

Furthermore, employees know attributes of products/ services which bring benefits for customers can enhance the efficiency of their jobs. As a result, errors are minimized as well as improvements in design, production, delivery, etc., are also suggested. Moreover, since customer's needs and wants are determined, firms concentrate their efforts on responding them. It is helpful to increase productivity of internal process (Dow et al., 1999; Fening et al., 2008; Lakhal et al., 2006; Rahman and Bullock, 2005; Samson and Terziovski, 1999; Zehir and Sadikoglu, 2010). Hence, the following hypothesis is proposed:

H2: Customer focus positively impacts on internal process.

4.3. Supplier Management

The successful implementation of supplier management ensures that input materials meet standards and quality requirements in order to produce quality products (Chen and Paulraj, 2004; Kaynak, 2003; Kaynak and Hartley, 2008; Li et al., 2005; Ou et al., 2010; Robinson and Malhotra, 2005; Vickery et al., 2003). High quality inputs, provided at the right time with the required quantity, helps firm to avoid downtime incidents, to reduce variance in processes and the rate of damaged materials (Flynn et al., 1995; Forza and Filippini, 1998). Moreover, effective supplier management can cut off inventory, waste and safety inventory level (Easton and Jarrell, 1998; Yeung, 2008). Hence, we suggest the following hypotheses:

H3. Supplier management positively impacts on internal process.

4.4. Supply chain integration

From a supply chain perspective, integration of trade partners in firm's activities can increase the efficiency of internal process (Robinson and Malhotra, 2005). For instance, suppliers can offer the most appropriated components or parts for designing new products (Hoegl and Wagner, 2005), and help purchasers buy inputs that can be used most efficiently in manufacturing processes and delivery (Flynn et al., 1995; Forza and Filippini, 1998; Shin et al., 2000; Tan, 2001; Trent and Monczka, 1999).

In another perspective, by participation on cross-functional design teams, contribution of new ideas, selection of ideas and features for further product/ service development or choosing components for new products, etc., customer involvement directly increases the effectiveness of product/ service design (Ulwick and Teitelbaum, 2005). In activities of production and distribution, moreover, suggestions of customer is a base to identify underlying issues.

Furthermore, Flynn et al. (2010) proved that share of knowledge about core business processes among members in supply chain improves the operations in internal process of each firm. Hence, the following hypothesis is offered:

H4. Supply chain integration positively impacts on internal process.

4.5. Human resource management

Human resource is considered as the most important resource in any firms, it is also a key factor deciding the success of companies. This is right even when a company has good technologies and equipment. Because all activities in a firm always require human interaction (APO, 2000). Human resource management refers to create a good environment for employees that they are trained and empowered to implement their tasks (Adam, 1994; Choi and Eboch, 1998; Park et al., 2001; Powell, 1995; Samson and Terziovski, 1999).

Employees are those who transfer market and consumer needs into designs. Quality-related training programs ensure that employees have knowledge and skills to design products/services as required. In addition, it also helps employees know how to use quality improvement tools, such as, statistical techniques, fool-proofing for process design, etc. in their daily tasks (Ahire and Dreyfus, 2000; Ho et al., 1999). Employees could reduce unnecessary or excess motions and process complexity (Sila and

Ebrahimpour, 2005; Tari et al., 2007; Zu et al., 2008). Moreover, empowerment allows employees actively suggest innovations at their plant. Hence, we suggest the following hypothesis:

H5. Human resource management positively impacts on internal process.

4.6. Information

For integration of members within the supply chain, information systems plays an important role (Zhao et al., 2002). According to Stein and Sweat (1998), supply chain partners who exchange information regularly are able to work as a single entity. Together, they can understand the needs of the end customer better and hence, can respond to market change quicker. Many researchers have suggested that the key to the seamless supply chain is making available undistorted and up-to-date marketing data at every node within the supply chain (Childerhouse and Towill, 2003). Moreover, by taking the data available and sharing it with other parties within the supply chain, the negative impact of the bullwhip effect on a supply chain can be also reduced or eliminated (Yu et al., 2001). On the other hand, Bayraktar et al. (2009) argued that relevant information is transmitted timely to employees can improve efficiency of internal activities.

With the growing popularity of e-business and e-supply chain, information technology is a crucial factor in a successful organization and its supply chain. By using direct computer-to-computer links, electronic links or electronic mailing capabilities, etc., information technology can increase communication among members in supply chain network as well as departments in a firm. Effectiveness of internal process is also enhanced by applications of advanced information systems in transaction processing, electronic transfer of purchase orders, invoices, funds or track and expedite shipments (Prajogo et al., 2012). Hence, we proposed the following hypotheses:

H6a. Information positively impacts on supply chain integration.

H6b. Information positively impacts on internal process.

4.7. Internal process

Internal process refers to all activities in a firm. This concept, therefore, is considered as a second-order latent construct including 3 practices: product/service design, process management and logistics. The successful implementation of internal process throughout three these practices has a significant impact on operational performance.

Product/service design refers to simplify products, reduce component parts per product and increase the level in the use of standard components (Chase et al., 2006; Kannan and Tan, 2005). Reduction of component parts per product and high level of standardization make employee's tasks easier. They quickly get acquainted with their works that makes low rate of errors, lead-time is shorter and output is increased (Tan, 2001). The cost of repair and rework is also significantly reduced (Ahire and Dreyfus, 2000; Anderson et al., 1995). Moreover, simple components and products make delivery easier. As a result, rate of late delivery is decreased.

Process management refers the use of statistical techniques, increasing automatic level of processes and fool-proof in designing process (Flynn et al., 1995; Forker, 1997; Kaynak, 2003; Saraph et al., 1989). These activities are helpful in decreasing process variance (Flynn et al., 1995) and minimizing chances of employee errors (Forker, 1997; Kaynak, 2003; Saraph et al., 1989). Consequently, output increases and uniformity of products is higher (Anderson et al., 1994; Forza and Flippini, 1998). Furthermore, the use of preventive equipment maintenance make manufacturing process smoothly by improving reliability of equipment and restricting disruption in production (Ho et al., 1999). The relation of process management to operational performance is founded in the studies of Ahire and Dreyfus (2000); Forza and Filippini (1998).

One of logistics implementation refers to select facility location close to suppliers and customers as well as modify order size (Stank et al., 2001). It ensures that distribution activities are fast and more

effective. As a consequence, rate of late delivery and damaged materials in transportation are minimized (Kenneth et al., 2008). All above, the following hypothesis is recommended:

H7. Internal process positively impacts on operational performance.

4.8 Firm performance

Operational performance refers to the ability of a company in reducing management costs, order-time, lead-time, improving effectiveness of using raw material and distribution capacity (Heizer et al., 2008). Kaynak (2003) indicated that a high operational performance firm is able to produce quality products/services that increase customer satisfaction (Choi and Eboch, 1998; Ou et al., 2010), revenue and profit for companies (Ahire and Dreyfus, 2000; Kaynak, 2003; Kaynak and Hartley, 2008; Yeung, 2008).

Furthermore, since unnecessary costs are reduced, firms are able to offer lower prices for their products/services. Consequently, market share and sales revenue are also increased (Maani et al., 1994). Moreover, improving efficiency in the use of machines, equipment, warehouses, etc. will increase return on assets (Kaynak, 2003). Otherwise, as a firm has ability to offer high quality products/ services, higher price can be charged, which, can increase return on sales (Kaynak, 2003). Last but not least, a high quality product/ service offered at the low price will make customer more satisfied (Choi and Eboch, 1998). Hence, two following hypotheses are proposed:

H8a. Operational performance positively impacts on customer satisfaction.

H8b. Operational performance positively impacts on financial performance.

According to Buchanan and Gillies (1990), customers who are content with products/services of a company are less likely to switch to competitors, thereby, market share is maintained. Moreover, they tend to be less price sensitive or even willing to pay at a higher price, this can result in increasing sales and return on sales. Likewise, a satisfied customer will introduce to other potential customers. As a consequence, market share is increased.

H8c. Customer satisfaction positively impacts on financial performance.

5. Conclusion

This paper proposed a structural model to consider the integration between quality and supply chain management which is still limited in the literature. Based on extensive literature review, the research gaps in previous studies were indicated. Those are: (i) lack of integration among internal process, upstream and downstream side of SCQM, (ii) role of information in this integration is not emphasized, (iii) insufficient examination of various dimensions of firm performance and (iv) the causative links among SCQM practices. These things lead to detract from benefits of the SCQM implementation in previous results (Li et al., 2006).

Proposed structural model in this study not only fills the above voids but contributes a parsimonious conceptual framework for theory building in SCQM and firm performance. It covers diversified aspects of SCQM practices and firm performance as well as presents the direct and indirect effects of these practices on various firm performance simultaneously. Investigating these relationships is very important because it allows us to understand deeply how SCQM practices impact on performance in supply chain. And we also expects that research models suggested in this paper can offer a useful guidance for measuring and implementing SCQM practices as well as facilitate further studies in this field. For future researches directions, it is necessary to test the rationality of these models by empirical studies in different contexts.

Acknowledgment

This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

This work was also financed with FEDER funds by Programa Operacional Fatores de Competitividade (COMPETE) and national funds by Fundação para a Ciência e Tecnologia (FCT) through Project: FCOMP-01-0124-FEDER-022674.

References

Abraham, M., Crawford, J., Fisher, T., 1999. Key factors predicting effectiveness of cultural change and improved productivity in implementing total quality management. *International Journal of Quality & Reliability Management* 16, 112-132

Adam, E.E., Corbett, L.M., Flores, B.E., Harrison, N.J., Lee, T.S., Rho, B.-H., Ribera, J., Samson, D., Westbrook, R., 1997. An international study of quality improvement approach and firm performance. *International Journal of Operations & Production Management* 17, 842-873

Adam, J.E.E., 1994. Alternative quality improvement practices and organization performance. *Journal of Operations Management* 12, 27-44

Ahire, S.L., Dreyfus, P., 2000. The impact of design management and process management on quality: an empirical investigation. *Journal of Operations Management* 18, 549-575

Ahire, S.L., O'Shaughnessy, K.C., 1998. The role of top management commitment in quality management: an empirical analysis of the auto parts industry. *International Journal of Quality Science* 3, 5-37

Ahire, S.L., Ravichandran, T., 2001. An innovation diffusion model of TQM implementation. *Engineering Management, IEEE Transactions on* 48, 445-464

Akamp, M., Müller, M., 2013. Supplier management in developing countries. *Journal of Cleaner Production* 56, 54-62

Anderson, J.C., Rungtusanatham, M., Schroeder, R.G., Devaraj, S., 1995. A Path Analytic Model of a Theory of Quality Management Underlying the Deming Management Method: Preliminary Empirical Findings*. *Decision Sciences* 26, 637-658

APO, A.P.O.-. 2000. Productivity in the new millennium. *APO News*,

Bayraktar, E., Demirbag, M., Koh, S.C.L., Tatoglu, E., Zaim, H., 2009. A causal analysis of the impact of information systems and supply chain management practices on operational performance: Evidence from manufacturing SMEs in Turkey. *International Journal of Production Economics* 122, 133-149

Beamon, B.M., 1999. Measuring supply chain performance. *International Journal of Operations & Production Management* 19, 275-292

Bozarth, C.C., Warsing, D.P., Flynn, B.B., Flynn, E.J., 2009. The impact of supply chain complexity on manufacturing plant performance. *Journal of Operations Management* 27, 78-93

Buchanan, R.W.T., Gillies, C.S., 1990. Value managed relationships: The key to customer retention and profitability. *European Management Journal* 8, 523-526

Cao, M., Zhang, Q., 2011. Supply chain collaboration: Impact on collaborative advantage and firm performance. *Journal of Operations Management* 29, 163-180

Chase, R.B., Jacobs, F.R., Aquilano, N.J., 2006. *Operations management for competitive advantage*. McGraw-Hill/Irwin

Chen, I.J., Paulraj, A., 2004. Towards a theory of supply chain management: the constructs and measurements. *Journal of Operations Management* 22, 119-150

Childerhouse, P., Towill, D.R., 2003. Simplified material flow holds the key to supply chain integration. *Omega* 31, 17-27

Choi, T.Y., Eboch, K., 1998. The TQM Paradox: Relations among TQM practices, plant performance, and customer satisfaction. *Journal of Operations Management* 17, 59-75

Danese, P., Romano, P., 2011. Relationship between downstream integration, performance measurement systems and supply network efficiency. *International Journal of Production Research* 50, 2002-2013

Devaraj, S., Krajewski, L., Wei, J.C., 2007. Impact of eBusiness technologies on operational performance: The role of production information integration in the supply chain. *Journal of Operations Management* 25, 1199-1216

Ding, M.J., Jie, F., Parton, K.A., Matanda, M.J., 2014. Relationships between quality of information sharing and supply chain food quality in the Australian beef processing industry. *International Journal of Logistics Management*, The 25, 85-108

Dow, D., Samson, D., Ford, S., 1999. Exploding the myth: Do all quality management practices contribute to superior quality performance? *Production and Operations Management* 8, 1-27.

Easton, G.S., Jarrell, S.L., 1998. The Effects of Total Quality Management on Corporate Performance: An Empirical Investigation. *The Journal of Business* 71, 253-307

Ellram, L.M., 1995. A Managerial Guideline for the Development and Implementation of Purchasing Partnerships. *International Journal of Purchasing and Materials Management* 31, 9-16

Fawcett, S.E., Osterhaus, P., Magnan, G.M., Brau, J.C., McCarter, M.W., 2007. Information sharing and supply chain performance: the role of connectivity and willingness. *Supply Chain Management: An International Journal* 12, 358-368

Feng, J., Prajogo, D.I., Tan, K.C., Sohal, A.S., 2006. The impact of TQM practices on performance: A comparative study between Australian and Singaporean organizations. *European Journal of Innovation Management* 9, 269-278

Fening, F.A., Pesakovic, G., Amaria, P., 2008. Relationship between quality management practices and the performance of small and medium size enterprises (SMEs) in Ghana. *International Journal of Quality & Reliability Management* 25, 694-708

Flynn, B.B., Huo, B., Zhao, X., 2010. The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of Operations Management* 28, 58-71

Flynn, B.B., Schroeder, R.G., Sakakibara, S., 1995. The Impact of Quality Management Practices on Performance and Competitive Advantage. *Decision Sciences* 26, 659-691

Forker, L.B., 1997. Factors affecting supplier quality performance. *Journal of Operations Management* 15, 243-269

Forza, C., Filippini, R., 1998. TQM impact on quality conformance and customer satisfaction: A causal model. *International Journal of Production Economics* 55, 1-20

Handfield, R.B., Nichols, E.L., 2008. *Supply Chain Redesign: Transforming Supply Chains Into Integrated Value Systems*. Financial Times Prentice Hall

Heizer, J.H., Render, B., Weiss, H.J., 2008. *Principles of Operations Management*. Pearson Prentice Hall

Ho, D.C.K., Duffy, V.G., Shih, H.M., 1999. An empirical analysis of effective TQM implementation in the Hong Kong electronics manufacturing industry. *Human Factors and Ergonomics in Manufacturing & Service Industries* 9, 1-25

Hoegl, M., Wagner, S.M., 2005. Buyer-Supplier Collaboration in Product Development Projects. *Journal of Management* 31, 530-548

Hollos, D., Blome, C., Foerstl, K., 2011. Does sustainable supplier co-operation affect performance? Examining implications for the triple bottom line. *International Journal of Production Research* 50, 2968-2986

Inderfurth, K., Sadrieh, A., Voigt, G., 2013. The Impact of Information Sharing on Supply Chain Performance under Asymmetric Information. *Production and Operations Management* 22, 410-425

Kannan, V.R., Tan, K.C., 2005. Just in time, total quality management, and supply chain management: understanding their linkages and impact on business performance. *Omega* 33, 153-162

Kaynak, H., 2003. The relationship between total quality management practices and their effects on firm performance. *Journal of Operations Management* 21, 405-435

Kaynak, H., Hartley, J.L., 2008. A replication and extension of quality management into the supply chain. *Journal of Operations Management* 26, 468-489

Kenneth, W.G.J., Whitten, D., Inman, R.A., 2008. The impact of logistics performance on organizational performance in a supply chain context. *Supply Chain Management: An International Journal* 13, 317-327

Kuei, C.-H., Madu, C.N., Lin, C., 2001. The relationship between supply chain quality management practices and organizational performance. *International Journal of Quality & Reliability Management* 18, 864-872

Kuei, C.-H., Madu, C.N., Lin, C., 2008. Implementing supply chain quality management. *Total Quality Management & Business Excellence* 19, 1127-1141

Kumar, S., Clemens, A.C., Keller, E.W., 2014. Supplier management in a manufacturing environment: A strategically focussed performance scorecard. *International Journal of Productivity and Performance Management* 63, 127-138

Lakhal, L., Pasin, F., Limam, M., 2006. Quality management practices and their impact on performance. *International Journal of Quality & Reliability Management* 23, 625-646

Lee, H., P. Padmanabhan, Whang, S., 1997. The bullwhip effect in supply chains. *Sloan Management Rev* 38, 93-102.

Li, S., Lin, B., 2006. Accessing information sharing and information quality in supply chain management. *Decision Support Systems* 42, 1641-1656

Li, S., Ragu-Nathan, B., Ragu-Nathan, T.S., Subba Rao, S., 2006. The impact of supply chain management practices on competitive advantage and organizational performance. *Omega* 34, 107-124

Li, S., Rao, S.S., Ragu-Nathan, T.S., Ragu-Nathan, B., 2005. Development and validation of a measurement instrument for studying supply chain management practices. *Journal of Operations Management* 23, 618-641

Maani, K.E., Putterill, M.S., Sluti, D.G., 1994. Empirical Analysis of Quality Improvement in Manufacturing. *International Journal of Quality & Reliability Management* 11, 19-37

Mason-Jones, R., Towill, D.R., 1997. Information enrichment: designing the supply chain for competitive advantage. *Supply Chain Management: An International Journal* 2, 137-148

Mokhtar, S.S.M., 2013. The effects of customer focus on new product performance. *Business Strategy Series* 14, 67-71

Mukerjee, K., 2013. Customer-oriented organizations: a framework for innovation. *Journal of Business Strategy* 34, 49-56

Nair, A., 2006. Meta-analysis of the relationship between quality management practices and firm performance—implications for quality management theory development. *Journal of Operations Management* 24, 948-975

Ou, C.S., Liu, F.C., Hung, Y.C., Yen, D.C., 2010. A structural model of supply chain management on firm performance. *International Journal of Operations & Production Management* 30, 526-545

Park, S., Hartley, J.L., Wilson, D., 2001. Quality management practices and their relationship to buyer's supplier ratings: a study in the Korean automotive industry. *Journal of Operations Management* 19, 695-712

Powell, T.C., 1995. Total quality management as competitive advantage: A review and empirical study. *Strategic Management Journal* 16, 15-37

Power, D.J., Sohal, A.S., Rahman, S.-U., 2001. Critical success factors in agile supply chain management - An empirical study. *International Journal of Physical Distribution & Logistics Management* 31, 247-265

Prajogo, D., Chowdhury, M., Yeung, A.C.L., Cheng, T.C.E., 2012. The relationship between supplier management and firm's operational performance: A multi-dimensional perspective. *International Journal of Production Economics* 136, 123-130

Prajogo, D.I., Brown, A., 2004. The Relationship between TQM Practices and Quality Performance and the Role of Formal TQM Programs: An Australian Empirical Study. *The Quality Management Journal* 11(1), pp. 31-42.

Qrunfleh, S., Tarafdar, M., 2014. Supply chain information systems strategy: Impacts on supply chain performance and firm performance. *International Journal of Production Economics* 147, Part B, 340-350

Rahman, S.-u., Bullock, P., 2005. Soft TQM, hard TQM, and organisational performance relationships: an empirical investigation. *Omega* 33, 73-83

Robinson, C.J., Malhotra, M.K., 2005. Defining the concept of supply chain quality management and its relevance to academic and industrial practice. *International Journal of Production Economics* 96, 315-337

Romano, P., Vinelli, A., 2001. Quality management in a supply chain perspective: Strategic and operative choices in a textile-apparel network. *International Journal of Operations & Production Management* 21, 446-460

Ross, D.F., 1998. *Competing Through Supply Chain Management*. Springer

Samson, D., Terziovski, M., 1999. The relationship between total quality management practices and operational performance. *Journal of Operations Management* 17, 393-409

Saraph, J.V., Benson, P.G., Schroeder, R.G., 1989. An Instrument for Measuring the Critical Factors of Quality Management. *Decision Sciences* 20, 810-829

Shin, H., Collier, D.A., Wilson, D.D., 2000. Supply management orientation and supplier/buyer performance. *Journal of Operations Management* 18, 317-333

Sila, I., Ebrahimpour, M., 2005. Critical linkages among TQM factors and business results. *International Journal of Operations & Production Management* 25, 1123-1155

Singh, P.J., 2008. Empirical assessment of ISO 9000 related management practices and performance relationships. *International Journal of Production Economics* 113, 40-59

Stank, T.P., Keller, S.B., Daugherty, P.J., 2001. SUPPLY CHAIN COLLABORATION AND LOGISTICAL SERVICE PERFORMANCE. *Journal of Business Logistics* 22, 29-48

Stein, T., Sweat, J., 1998. Killer supply chains. *InformationWeek* 708, 36 – 46.

Su, Q., Shi, J.-h., Lai, S.-j., 2008. Study on supply chain management of Chinese firms from the institutional view. *International Journal of Production Economics* 115, 362-373

Tan, K.C., 2001. A framework of supply chain management literature. *European Journal of Purchasing & Supply Management* 7, 39-48

Tarí, J.J., Molina, J.F., Castejón, J.L., 2007. The relationship between quality management practices and their effects on quality outcomes. *European Journal of Operational Research* 183, 483-501

Taylor, S.A., Baker, T.L., 1994. An assessment of the relationship between service quality and customer satisfaction in the formation of consumers' purchase intentions. *Journal of Retailing* 70, 163-178

Terziovski, M., 2006. Quality management practices and their relationship with customer satisfaction and productivity improvement. *Management Research News* 29, 414-424

Trent, R.J., Monczka, R.M., 1999. Achieving world-class supplier quality. *Total Quality Management* 10, 927-938

Ulwick, A., Teitelbaum, J., 2005. *What Customers Want : Using Outcome-Driven Innovation to Create Breakthrough Products and Services: A Proven Program for Eliminating Chronic Pain Now*. McGraw-Hill

Vachon, S., Klassen, R.D., 2006. Extending green practices across the supply chain: The impact of upstream and downstream integration. *International Journal of Operations & Production Management* 26, 795-821

Vanichchinchai, A., Igel, B., 2010. The impact of total quality management on supply chain management and firm's supply performance. *International Journal of Production Research* 49, 3405-3424

Vickery, S.K., Jayaram, J., Droge, C., Calantone, R., 2003. The effects of an integrative supply chain strategy on customer service and financial performance: an analysis of direct versus indirect relationships. *Journal of Operations Management* 21, 523-539

Wong, C.Y., Boon-itt, S., Wong, C.W.Y., 2011. The contingency effects of environmental uncertainty on the relationship between supply chain integration and operational performance. *Journal of Operations Management* 29, 604-615

Wu, I.-L., Chuang, C.-H., Hsu, C.-H., 2014. Information sharing and collaborative behaviors in enabling supply chain performance: A social exchange perspective. *International Journal of Production Economics* 148, 122-132

Wu, Z., Choi, T.Y., Rungtusanatham, M.J., 2010. Supplier-supplier relationships in buyer-supplier-supplier triads: Implications for supplier performance. *Journal of Operations Management* 28, 115-123

Yamin, S., Gunasekaran, A., Mavondo, F.T., 1999. Relationship between generic strategies, competitive advantage and organizational performance: an empirical analysis. *Technovation* 19, 507-518

Yeung, A.C.L., 2008. Strategic supply management, quality initiatives, and organizational performance. *Journal of Operations Management* 26, 490-502

Yu, Z., Yan, H., Cheng, T.C.E., 2001. Benefits of information sharing with supply chain partnerships. *Industrial Management & Data Systems* 101, 114-121

Zehir, C., Sadikoglu, E., 2010. The relationship between total quality management (TQM) practices and organizational performance: An empirical investigation. *International Journal of Production Economics* 101, 1-45.

Zhao, X., Xie, J., Zhang, W.J., 2002. The impact of information sharing and ordering co-ordination on supply chain performance. *Supply Chain Management: An International Journal* 7, 24-40

Zhou, H., Shou, Y., Zhai, X., Li, L., Wood, C., Wu, X., 2014. Supply chain practice and information quality: A supply chain strategy study. *International Journal of Production Economics* 147, Part C, 624-633

Zu, X., 2009. Infrastructure and core quality management practices: how do they affect quality? *International Journal of Quality & Reliability Management* 26, 129-149

Zu, X., Fredendall, L.D., Douglas, T.J., 2008. The evolving theory of quality management: The role of Six Sigma. *Journal of Operations Management* 26, 630-650.