
16. Defining the Supply Chain Quality Management concept

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1. INTRODUCTION

Society, in general, is becoming more and more demanding of those that embrace the challenge of serving it, whether through products, services or even information – and not only regarding those elements, but in terms of sustainability, technology, management skills, leadership, communication, entrepreneurship and relationships as well. In the service and manufacturing industry, these demanding requirements have gained significant relevance (Zeng, Tse and Tang, 2018; Gu, Song and Chen, 2017; Mellat-Parast, 2013; Carmignani, 2009; Vanichchinchai and Igel, 2009; Robinson and Malhotra, 2005; Ross, 1998). As a consequence, society expects that a company not only serves their customers well, but also expects it to be able to fulfil a series of requirements that range from product and service variability, quality and availability, all according to customers' desire, conditions and timings (Zhong et al., 2016; Mellat-Parast, 2013; Rashid and Haris Aslam, 2012; Talib, Rahman and Qureshi, 2011; Carmignani, 2009; Vanichchinchai and Igel, 2009; Ross, 1998).

Since the quality movement began in the 19th century, improvements in this area have been enhancing results in others, as quality management and supply chain management are mutually supportive of each other. As an example, continuous quality improvements have a positive impact on supply chain performance (such as inventory levels, product and process variation, cycle times, responsiveness, flexibility) and, consequently, final customer satisfaction (Zhong et al. 2016; Fish, 2011; Talib et al., 2011; Kuei, Madu and Lin, 2008; Foster and Ogden, 2008; Sila, Ebrahimpour and Birkholz, 2006).

As companies face the challenge of increasing their responsiveness capacity, this leads to their growth in terms of their supply chains (internally and externally) and in terms of complexity (Rashid and Haris Aslam, 2012; Kuei et al., 2008; Kuei, Madu and Lin, 2011; Vanichchinchai and Igel, 2009). Simultaneously, the competition between enterprises has shifted from single enterprises to the supply chain to which the enterprise belongs (Hu and Zhao, 2018; Zeng et al., 2018; Gu et al., 2017; Carmignani, 2009).

So companies now need to come up with new approaches, concepts, practices, strategies, decision-making processes and performance measurements, revolving around a shift from product-oriented (internal) supply chains to supply chain approaches based on external processes and customer focus (Huo et al., 2016; Hu, Flynn and Zhao, 2014; Mellat-Parast, 2013; Zeng, Phan and Matsui, 2013; Fish, 2011; Robinson and Malhotra, 2005), without disregarding quality.

For example, as mentioned by Huo et al. (2016) and by Robinson and Malhotra (2005), Dell launched the Critical Supplier Partnership Program in order to improve its quality metrics and

supply stability. As a result, 37% of early field failures were eliminated and the production line defects decreased from 15,000 to 3,000 defective parts per million.

As a response to these new challenges, in the past two decades, the concepts of quality management (QM) and supply chain management (SCM) gave place to the concept of Supply Chain Quality Management (SCQM), where both QM and SCM are seen as partially overlapping management concepts. Although starting from different approaches, both integrate and influence each other's performance in seeking the goal of customer satisfaction (Hu and Zhao, 2018; Fernandes et al., 2017; Soares, Soltani and Liao, 2017; Zhong et al., 2016; Mellat-Parast, 2013; Wu et al., 2013; Rashid and Haris Aslam, 2012; Vanichchinchai and Igel, 2009; Kaynak and Hartley, 2008; Sila et al., 2006; Ross, 1998).

Current managerial thinking is advancing its notions of SCM and QM, as today's organisations need to shift from the traditional SCM model where quality is built through quality in purchasing and processes, through a new integrative, competent SCQM model leading to a new design and management concept of an innovative quality supply chain (Fish, 2011; Foster and Ogden, 2008; Sila et al., 2006). As Mahdiraji, Arabzadeh and Ghaffari (2012: 2463) mentioned, "this approach created new challenges for the quality management, in such a way that the term 'my quality' has been substituted by a new term called 'our quality'", where supply chain quality becomes an important competence of the supply chain core.

Studies have been undertaken regarding the close relationship of QM and SCM and how they cooperate, leading researchers to study their relationship, similarities, complementary tools and practices in order to understand how the SCQM concept can be defined and used by practitioners (Hu and Zhao, 2018; Fernandes et al., 2017; Zhong et al., 2016; Hu et al., 2014; Huo, Zhao and Lai, 2014; Mellat-Parast, 2013; Zeng et al., 2013; Rashid and Haris Aslam, 2012; Talib et al., 2011; Kuei et al., 2008; Foster Jr, 2008; Sila et al., 2006; Robinson and Malhotra, 2005; Kuei, Madu and Lin, 2001; Ross, 1998).

The purpose of this chapter is to provide some insights on the relationship between the QM and SCM concepts and how they lead to the SCQM concept. In Section 2, QM and SCM are analysed in order to identify how they are related and provide support to the SCQM concept. Section 3 shows details and benefits highlighted by other researchers regarding the SCQM concept. Section 4 presents and discusses some proposed definitions of this concept. Closing remarks and considerations, along with suggestions for future research in the field, are proposed in Section 5.

2. HOW QUALITY MANAGEMENT AND SUPPLY CHAIN MANAGEMENT LEAD TO SUPPLY CHAIN QUALITY MANAGEMENT

Providing a good product or service is not enough nowadays. Customers' expectations are higher than ever as customers demand to be continuously surpassed. Whether for a hotel, a restaurant or an airline, it is necessary to provide the customer with a good product, good service and good customer support (Zeng et al., 2018; Huo et al., 2016, 2014; Zhong et al., 2016; Ross, 1998). Whether for a sports gear manufacturer or an automotive company, besides the good quality of the product, manufacturers also need to provide additional features and services, during and after sales.

2.1 Quality Management (QM)

In general, customers' primary considerations are product quality and service quality, as they demand high-quality products, fast delivery and sufficient flexibility (Mahdiraji et al., 2012; Vanichchinchai and Igel, 2009; Lin et al., 2005; Robinson and Malhotra, 2005). Achieving this, companies can ensure customer loyalty and consideration, which can be expected to lead to future commercial relationships, positive feedback and recommendations, transforming them into future business revenues.

Following the work of Fish (2011), the American Society for Quality Online Glossary (2019) defines quality as "A subjective term for which each person or sector has its own definition. In technical usage, quality can have two meanings: 1. the characteristics of a product or service that bear on its ability to satisfy stated or implied needs; 2. a product or service free of deficiencies." According to Joseph Juran, quality means "fitness for use"; according to Philip Crosby, it means "conformance to requirements".

In the American Society for Quality Online Glossary (2019) QM is defined as "the application of a quality management system in managing a process to achieve maximum customer satisfaction at the lowest overall cost to the organisation while continuing to improve the process". QM practices such as the Six Sigma programme, Kaizen methodology, benchmarking tools, value-stream mapping, value analysis and performance measurement, among other tools and programmes, have proven to be valuable best practices during design, marketing, purchasing, production, delivery and support (Zhong et al., 2016; Mellat-Parast, 2013; Fish, 2011; Robinson and Malhotra, 2005).

QM can be seen as the supervision of the manufacture and production process of products to ensure that a product complies with the designer's or customer's intentions, as this supervision begins from placing an order for raw materials and their delivery until the final phase of aftersales service (Hu and Zhao, 2018; Fernandes et al., 2017; Mahdiraji et al., 2012; Vanichchinchai and Igel, 2009). A proof of this is the fact that the ISO 9001 standard stresses the continual improvement of business processes while interacting with suppliers and customers. An example of this is the material lot traceability process that is universally required in the automotive industry (Carmignani, 2009; Robinson and Malhotra, 2005). The mentioned ISO standard, as well as other QM programmes, recommend that the quality focus is not only on the product but also on the processes. Such programmes and standards, when applied to the processes from the supplier to the customer, aim to provide process stability (throughout variance reduction), using monitoring as a way to achieve stability and consistency along the supply chain (Fish, 2011; Carmignani, 2009; Sila et al., 2006; Robinson and Malhotra, 2005).

ISO standards such as ISO 9001, the European Foundation for Quality Management Model, the Malcolm Baldrige National Quality Award, the Deming Prize and similar programmes are vital factors when selecting a business partner, be it a supplier, a service provider or other type of organisation (Fish, 2011; Carmignani, 2009; Robinson and Malhotra, 2005). Based on the QM principles (customer focus, leadership, engagement of people, process approach, continuous improvement, evidence-based decision making and relationship management) and guided by the final customer requirements, QM improvements are mainly reflected in reducing process variation, which has a direct impact on several supply chain performance measures (Mahdiraji et al., 2012; Rashid and Haris Aslam, 2012; Fish, 2011; Carmignani, 2009; Kaynak and Hartley, 2008). For example, as process variation is reduced, leading to more quality units and fewer defective units moving through the supply chain, not only will the cycle time

improve, but the reliability of deliveries also improves, which means that schedules and customers' demands can be met faster (Fish, 2011).

On the other hand, when integrating customers into the QM process, communication both from and to customers is critical to the availability of timely and accurate quality information (Mahdiraji et al., 2012; Rashid and Haris Aslam, 2012; Xu, 2011; Flynn and Flynn, 2005), as customer feedback over product and process quality can have a considerable impact on performance in terms of both products and processes. Involving customer participation as early as possible can turn out to be a significant advantage for a company. By doing this, the company can at an early stage identify customers' requirements, which will impact aspects such as expected level of quality, costs of quality, overall process capability in terms of delivery capacity, and adaptability to customer and markets conditions (Mahdiraji et al., 2012; Xu, 2011; Sila et al., 2006; Flynn and Flynn, 2005).

So, it is clear that in order for every business partner in the supply chain to gain competitive advantage, traditional quality programmes and practices must be transformed to create an integrated perspective – a supply chain perspective (Huo et al., 2016; Foster Jr, 2008; Flynn and Flynn, 2005; Robinson and Malhotra, 2005).

2.2 Supply Chain Management (SCM)

SCM is a set of synchronised activities for integrating suppliers, manufacturers, transporters and customers efficiently so that the right product or service is delivered in the right quantities, at the right time, to the right places, where all related functions across the supply chain (SC) must work in an integrated and cooperative manner (Fernandes et al., 2017; Fish, 2011; Carmignani, 2009; Foster Jr, 2008; Kannan and Tan, 2005; Lin et al., 2005). The various partners within the SC must be efficient and effective in all aspects, including quality management, increasing collaboration, integration and the resilience of the SC (Xu, 2011; Robinson and Malhotra, 2005).

In other words, it is an active back-and-forth network of information flow, product and capital in which the customer is an engaged and internal partner of a SC, where the main objective is to meet customers' requirements in order to achieve customer satisfaction and generate profit for the entire supply chain (Zeng et al., 2018; Mahdiraji et al., 2012; Sila et al., 2006). Based on the work of Mahdiraji et al. (2012), Figure 16.1 shows the kind of issues that usually are related to SCM.

As a result of customers' increasing requirements regarding supply (availability, delivery and flexibility, among others) and the increasing competition in the world market, companies have started to recognise not only the need for continuous quality improvement, but also the importance of reacting to customers' requirements and tackling increasing competitiveness, using SCM inter-organisational operational capabilities and strategies to achieve higher business excellence, performance and profitability (Fish, 2011; Vanichchinchai and Igel, 2009; Sila et al., 2006; Flynn and Flynn, 2005; Lin et al., 2005; Robinson and Malhotra, 2005).

As SC competitions are based on cost, time and responsiveness, SC managers prefer to use tools such as benchmarking, complaint resolution, enterprise resource planning, supplier development and change management for improving performance (Fish, 2011). However, both supply chain and operations managers recognise that QM programmes such as Six Sigma, Kaizen or even ISO 9000 extend the focus from internal supply towards the relationship with external (both up and downstream) partners, aligning the focus of SCM towards promoting



Source: Adapted from Mahdiraji et al. (2012).

Figure 16.1 The issues related to SCM

cooperative relationships between SC members, achieving higher quality and rapid responsiveness (Fernandes et al., 2017; Huo et al., 2016; Fish, 2011; Carmignani, 2009; Sila et al., 2006; Flynn and Flynn, 2005; Robinson and Malhotra, 2005; Ross, 1998).

This means that an organisation that intends to further develop its capabilities regarding SCM and QM needs to start interacting closely with its SC partners, resulting in an effort where its resources are capable of working with QM and SCM practices and methodologies, combining them and influencing external relationship partners to follow the same path as well.

That leads companies to new challenges where they need to start developing trust and collaboration among the SC partners, identifying various ways to facilitate the alignment and integration of SC processes, successfully applying collaborative tools that allow them to exchange goods easily, utilising services and information that can drive efficiency, and improving performance and quality throughout the entire SC (Rashid and Haris Aslam, 2012; Foster and Ogden, 2008; Robinson and Malhotra, 2005; Ross, 1998).

Although QM integration in the SC may not influence the product quality directly, its impacts can be reflected in several other aspects related to QM and SCM. This integration can positively influence service-related quality, the costs of quality across the entire supply chain, delivery performance, stock levels, the quality and quantity of information to exchange, problem-solving time (as well as the quality of solutions), agility and flexibility throughout the SC (Huo et al., 2016; Fish, 2011; Flynn and Flynn, 2005; Lin et al., 2005).

For this, human resource management requires a different set of skills to manage this constant relationship between supplier and customer (internally and externally) effectively, efficiently and strategically (Fish, 2011; Kaynak and Hartley, 2008; Robinson and Malhotra, 2005). Top management not only needs to provide guidance for internal and individual company efforts, but also encourage participation and cultivate a culture of quality and continuous improvement among all SC members. In addition, managers should try to positively influence relationships and operations through leadership, searching to improve overall SC performance, raise product and service quality, and reduce costs, all while working towards the main objective of customer satisfaction (Huo et al., 2016; Fish, 2011; Carmignani, 2009; Robinson and Malhotra, 2005).

Therefore, as quality requirements play a key role in SCM, the integration of QM with SCM is required to expand the perspective of SCM beyond its traditional purview of costs and competitive relations and focus on the relation among the members of the SC. QM and SCM strategic goals and initiatives need to be pursued simultaneously, using customers' satisfaction to drive initiatives, resulting in improvements in the performance of the SC (Zeng et al., 2018; Mahdiraji et al., 2012; Rashid and Haris Aslam, 2012; Fish, 2011; Xu, 2011; Vanichchinchai and Igel, 2009; Flynn and Flynn, 2005; Ross, 1998).

One key element common to both management philosophies and that plays a vital role in the integration of QM and SCM concepts is information (Xu, 2011). The quality and continuous exchange of information between all partners (internal and external) is relevant for the coordination of all activities, and can ensure proper alignment in supplier–customer relationship strategies, as well as bringing improvements in SC and quality costs, SC agility, sustainability and resilience, thus impacting the overall SC performance.

3. SUPPLY CHAIN QUALITY MANAGEMENT (SCQM)

As previously shown, many authors have demonstrated that although QM and SCM have different approaches and ways of pursuing customer satisfaction, both management philosophies correspond in ways that affect each other's performance positively, and where the goal of reaching customer satisfaction can only happen when product quality, service and value is achieved in every part of the SC (Fernandes et al., 2017; Huo et al., 2016; Hu et al., 2014; Rashid and Haris Aslam, 2012; Fish, 2011; Carmignani, 2009; Vanichchinchai and Igel, 2009; Sila et al., 2006; Kannan and Tan, 2005; Robinson and Malhotra, 2005; Ross, 1998).

As this is now well understood, researchers have shifted their attention to understanding how SCM and QM can be integrated under a single concept, how SCM will change and adapt to the incorporation of QM tools and philosophies, and how it will impact managers' decision-making processes (Hu and Zhao, 2018; Fernandes et al., 2017; Soares et al., 2017; Huo et al., 2016; Zhong et al., 2016; Hu et al., 2014; Mellat-Parast, 2013; Wu et al., 2013; Rashid and Haris Aslam, 2012; Fish, 2011; Vanichchinchai and Igel, 2009; Kaynak and Hartley, 2008; Foster Jr, 2008; Sila et al., 2006; Robinson and Malhotra, 2005; Ross, 1998).

The main goal of the integrated concept named SCQM is to develop more extended and coordinated QM practices with partners all along the SC, implementing a cooperative and compatible system that can promote operational and quality strategies and culture, and encourage cooperation and coordination between interested parties upstream and downstream through sharing vital and timely information (Fernandes et al., 2017; Soares et al., 2017; Huo

et al., 2016; Zhong et al., 2016; Rashid and Haris Aslam, 2012; Xu, 2011; Sila et al., 2006; Robinson and Malhotra, 2005).

Within this concept, the quality function shifts to a broader view where quality is a matter of interest to all partners, achieving not only product quality but process quality as well (Fernandes et al., 2017; Huo et al., 2016; Hu et al., 2014; Flynn and Flynn, 2005; Lin et al., 2005; Robinson and Malhotra, 2005). For example, the costs of quality, delivery and flexibility can be improved as a result of coordination and cooperation between partners (Huo et al., 2016).

Taking customer satisfaction as the the main factor, researchers have identified the following additional practices as best practice for the development and implementation of the SCQM concept: strategic supply chain management, a cooperative culture between buyers and suppliers, continuous encouragement of improvements throughout the supply chain, training and empowerment programmes, close inter-organisational communication, and partners' involvement in product and process development (Mellat-Parast, 2013; Mahdiraji et al., 2012; Fish, 2011; Xu, 2011; Azar, Kahnali and Taghavi, 2010; Kuei et al., 2008; Flynn and Flynn, 2005; Lin et al., 2005; Robinson and Malhotra, 2005).

Previous studies have shown that both SCM and QM, despite their different backgrounds, approaches and tools, can be integrated into the SCQM concept based on their values and dimensions (Vanichchinchai and Igel, 2009).

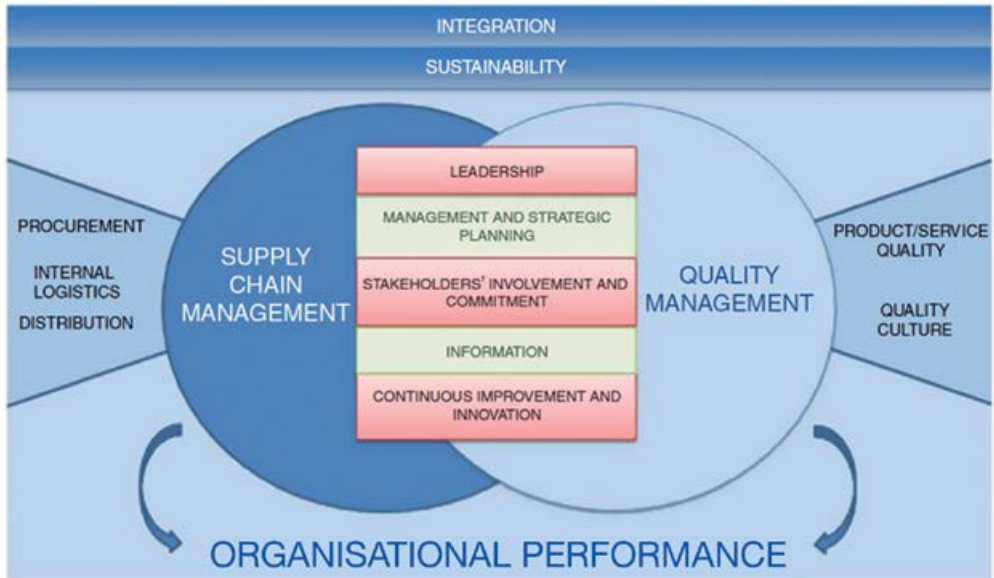
Based on the work of Hu and Zhao (2018), Fernandes et al. (2017), Soares et al. (2017), Soares, Soltani and Liao (2012), Carmignani (2009), Foster Jr. (2008), Kaynak and Hartley (2008) and Robinson and Malhotra (2005), it can be stated that leadership, management and strategic planning, stakeholders' involvement and commitment, continuous improvement and innovation, and information are shared dimensions in both concepts.

Figure 16.2 shows the SCQM conceptual model presented by Fernandes et al. (2017). It can be seen at the core of the proposed model that the dimensions previously mentioned as being common to both SCM and QM, complemented by procurement, internal logistics and distribution from the SCM side and product/service quality and culture of quality from the QM one, with shared interests and impacts on integration concept, sustainability and organisational performance of both SC partners and overall SC.

For example, SCQM leadership can have a direct impact through human resource management, strategic planning, customer focus and supplier quality management (Rashid and Haris Aslam, 2012; Fish, 2011; Carmignani, 2009; Vanichchinchai and Igel, 2009), ensuring that SC partners are putting effort into achieving the goal of supplier–customer satisfaction in a coordinated and cooperative manner, in order to meet final customer needs and expectations, with impacts on processes and SC performance.

In the framework presented on Figure 16.3, proposed by Hu et al. (2014), the authors proposed, the authors proposed that SC leadership for quality should be the first element to be established, as leaders will influence the development and improvement of the SCQM system, namely strategic design and management of the SC focus on quality and the integrative QM system of the entire SC, which involves downstream and upstream members.

From the mentioned dimensions and values, one key element has a significant impact on organisations and is seen as a key element for the successful implementation of the SCQM concept. For an SC based on a supplier–customer relationship to function in a proper and coordinated manner that reacts to customers' demands, it is necessary that accurate and valuable information is displayed through appropriate information-sharing systems and architecture



Source: Fernandes et al. (2017).

Figure 16.2 SCQM conceptual model

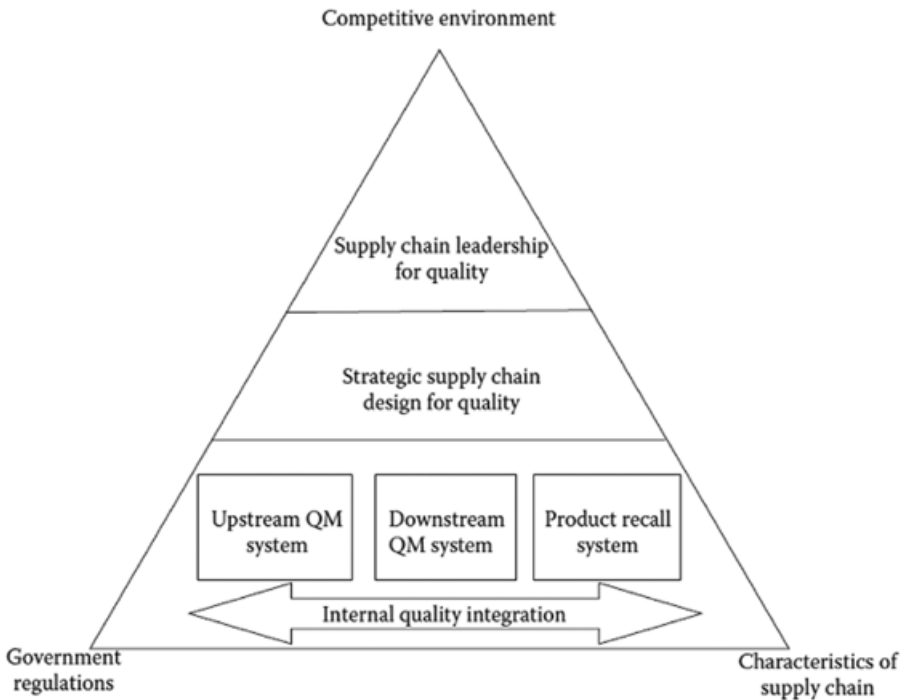
(Soares et al., 2017; Rashid and Haris Aslam, 2012; Xu, 2011; Carmignani, 2009; Lin et al., 2005).

SCQM encourages effective information and data collection systems for customer feedback and requirements, with impacts on product and service design, process management and performance (Huo et al., 2016; Fish, 2011; Xu, 2011; Flynn and Flynn, 2005).

As mentioned by Fish (2011), once components account for over 55% of the cost of the goods, supplier–customer relationships become important in providing the right goods, in the right quantity, at the right price, at the right place, at the right time, to the right customer. However, if at the same time there are defective products among the parts provided by upstream partners, these defective parts will be delivered, leading to quality fluctuation (Hu and Zhao, 2018; Hu et al., 2014; Fish, 2011). Timely available quality and SC information could allow for rapid identification of the causes of quality problems (Xu, 2011).

With the development of new information technology tools, combined with existing technologies from SCM and QM, it is expected that future developments can contribute considerably to the gathering, analysis and dissemination of relevant information that will enable improvement in companies' and SCs' performance in terms of quality and SC issues. As mentioned by Xu (2011), the combination of the Internet of Things (IoT) with Radio Frequency Identification (RFID), among other technological combinations, will have a greater impact on QM processes, allowing more accurate and more reliable information to be collected more quickly and used by managers in their decision-making processes.

For example, Chen et al. (2017) proposed a blockchain-based SCQM framework that collects data from IoT sensors and that will allow the control, monitoring and management of production processes and product quality, as well as business contracts, in real time.



Source: Hu et al. (2014).

Figure 16.3 Holistic SCQM framework proposal

In summary, the integration of QM values, practices and tools with SCM should result in a situation in which it is expected that all interested parties in a given SC continually work towards improving the supplier–customer relationship. In a collaborative and coordinated approach, all parties work continuously for the common goal of achieving customer satisfaction and continuous improvement of the SC, to achieve the highest possible quality of product and service, the best overall performance and the lowest possible costs.

4. DEFINING THE CONCEPT OF SUPPLY CHAIN QUALITY MANAGEMENT

After identifying and characterising the integrating concept of SCQM, authors have undertaken the task of defining it. As with QM and SCM, and to the best of our knowledge, no unique and broadly accepted definition has yet been proposed. So the question remains as to how to define the SCQM concept.

Table 16.1 presents some formal definitions that have been proposed by authors researching this topic over the past 20 years.

The first and the oldest definition presented in Table 16.1 was proposed by Ross (1998). It focuses on cooperative work between all SC members in order to achieve the driving goals

Table 16.1 Supply Chain Quality Management definitions

Author(s)	SCQM definitions
Ross (1998: 250)	“As the participation of all members of a supply channel network in the continuous and synchronized improvement of all processes, products, services, and work cultures focused on generating sources of productivity and competitive differentiation through the active promotion of market-winning product and service solutions that provide total customer value and satisfaction.”
Kuei and Madu (2001), cited in (Kuei et al., 2008: 1127)	Using a simple three-equation model, where each equation characterises the initials of SCQM: “SC = a production-distribution network, Q = meeting market needs correctly, and achieving customer satisfaction rapidly and profitably; and M = enabling conditions and enhancing trust for supply chain quality.”
Shucheng Ma (2002), cited in Lin (2009: 862)	“Based on member enterprises internal quality management activities, supply chain system implements the coordination, integration and optimization of quality function and quality activities among member enterprises, manages product quality and its formation process effectively in order to improve market share, customer satisfaction and competence.”
Robinson and Malhotra (2005: 319)	“SCQM is the formal coordination and integration of business processes involving all partner organizations in the supply channel to measure, analyze and continually improve products, services, and processes in order to create value and achieve satisfaction of intermediate and final customers in the marketplace.”
Foster Jr (2008: 461)	“A systems-based approach to performance improvement that leverages opportunities created by upstream and downstream linkages with suppliers and customers.”
Mellat-Parast (2013: 515)	“The coordination and integration of inter-firm processes involving all partners (firms) in the supply chain through continuous improvement of inter-organizational processes to enhance performance and achieve customer satisfaction through emphasis on cooperative learning.”
Hu et al. (2014: 130)	“as a holistic management system to improve quality in a supply chain, which includes supply chain leadership for quality, strategic supply chain design for quality, upstream quality management system, downstream quality management system, internal quality integration, and product recall strategy.”
Zhong et al. (2016: 2447)	“...in a hotel is the formal coordination and integration of business processes involving all partners along the hotel’s supply chain to accommodate customer-introduced variability, to analyze and continually improve products, services and processes to create value and achieve satisfaction of intermediate and final customers in the marketplace.”

of meeting customer values and satisfaction, using continuous improvement of products, services and processes to gain competitive advantage over other SCs. The mindset behind this definition is a driving culture where all members work to improve and develop business opportunities that, in the most effective, efficient and profitable way, create value and attend to customers’ expectations.

However, one key element of all SCs is information (and its purpose), something that is implicitly assumed in the proposed definition but is vital for the regular activities of any SC.

Although not referring to the supplier–customer relationship between all SC members, Kuei and Madu’s (2001) definition suggests an approach where all interested parties work towards a single goal that will benefit the entire SC, namely, customer satisfaction. In the definition presented in Table 16.1, although the first equation focuses on the physical aspects of an SC, the second element details key characteristics usually associated with SC performance – speed, meeting market needs and profitability. Another key characteristic the authors mention is trust, a concept which is also built on information.

The definition proposed by Shucheng Ma (2002) (cited in Lin, 2009) denotes an alignment between the quality functions of all SC members in order to implement effective and efficient processes, impacting organisational and SC performance, customer satisfaction and profita-

bility. Although the emphasis is on product quality, the author recognises that the alignment between all quality functions involved in the SC is only possible if information is shared between all members.

Developed upon Ross's (1998) definition but more focused on processes, the definition proposed by Robinson and Malhotra (2005) calls attention to the constant customer–supplier relationship, where all members of the SC are expected to comply with their customers' expectations, also addressing their own suppliers in order to inform them of their expectations. The measurement and analysis of such expectations will be vital to the management and improvement of the overall SC performance.

Recognising that SCQM entails a higher level of coordination among all SC partners, from suppliers to distributors, producers, retailers and final customers, Foster Jr's (2008) definition recognises the involvement of all interested parties, acting as a system that is continuously improved in a coordinated way to achieve higher performance. Although not explicit, that coordination between all interested parties can only be achieved by the continual exchange of information between all parties.

Like the definitions presented by Robinson and Malhotra (2005) and Ross (1998), Mellat-Parast's (2013) definition also focuses on the process approach point of view, but does so in order to reinforce the learning perspective, which is crucial for the continuous improvement process.

The definition proposed by Hu et al. (2014) introduces other relevant elements. According to the authors, an SCQM system will not work properly unless there is SC leadership on quality, and a strategic SC design targeted towards quality with the capability to handle reverse SC cycles if recalls are necessary. It also requires a quality management system that is not only capable of involving and developing suppliers, but that can also capture and spread the voice of the customer throughout the supply chain, promoting quality integration on all internal functions of an organisation.

Also supportive of Robinson and Malhotra's (2005) definition, Zhong et al. (2016) proposed a specific definition for the tourism industry, more specifically the hotel industry. Understanding that not all hotel customers are alike, the author recognises that customer satisfaction is dependent on the customer experience, therefore requiring from the hotel SC the flexibility and capacity to adapt to each customer in the most profitable and satisfactory way possible for all elements of the SC.

As observed, all the above definitions share some similarities, core values and dimensions. They all mention the need for coordinated and collaborative actions in order to achieve higher organisational and SC performance in which processes, products and services are continuously improved, with the ultimate goal of achieving customer satisfaction.

However, what is not clearly mentioned in all the definitions presented above is the fact that nowadays, the mid- and final customer strives to obtain value in the form of products, services and information, the last of these being a crucial element in any given SC (internal or external), as it is an element that will help to regulate another essential requirement that customers value: time.

One can easily understand that time plays a crucial role. Most business opportunities are regulated by this factor, which, along with cost, can be decisive for a customer in selecting between two equal competitors with similar levels of product and service quality.

For that reason, and having in consideration the above definitions, one can define SCQM as:

The ability of an organization to provide products, services and information in the business conditions that the customers require across all the supply chain.

The expression “business conditions” refers to the fact that the supplier needs to provide products, services or information that corresponds to the quality level the customer desires, combining that with a level of supply service that meets the customer’s expectations regarding quantity, timing, location and conditions, all at a cost the customer is willing to support.

Regardless of the chosen definition, it seems clear that customer satisfaction should be a shared goal and the reason and motivation for coordinated action.

5. SUPPLY CHAIN QUALITY MANAGEMENT IMPLEMENTATION FRAMEWORK

Based on the proposed definition and taking into consideration the model presented by Fernandes et al. (2017), an operational framework is presented in Figure 16.4. In this framework, customer requirements regarding business conditions, products, services and information needs are translated into an effective SC Collaborative Plan.

This SC Collaborative Plan serves as a roadmap for all members to coordinate their business activities and customer expectations, with a special focus on quality and logistics activities. All members should develop their work according to, or as close as possible to, the plan, as well as provide information regarding its accomplishment. In this way, a Collaborative Plan can act as a measurement and control instrument for the performance of the entire SC.

Since the SC Collaborative Plan considers all the mentioned activities of all members of the SC, it will also support the integration and coordination of SC processes (source, make, deliver and return). Macro-activities and customer-oriented key performance indicators (KPIs) would have to be derived from SC principles (Anderson, Britt and Favre, 1997), QM, the logistics and business perspectives, ensuring that final customer satisfaction and overall SC sustainability is achieved.

Regarding SC sustainability, the plan should also consider information regarding SC and logistics costs, quality costs and overall business costs that might somehow affect customer satisfaction or SC partners’ performance.

The SC Collaborative Plan should be managed by the leading partner in the SC. That partner will perform the tasks of moderating, coordinating and managing all activities aimed towards customer satisfaction and SC sustainability.

From the activities roadmap and the macro-KPIs, sets of operational metrics should then be stratified for each phase and partner of the SC. The operational metrics should include QM and logistics KPIs that would be shared between all SC partners, supporting coordination between them.

As an example, the seven rights of fulfilment could be the core set of KPIs shared between all partners, complemented by the relevant QM operational KPIs required in each SC phase and derived from the final customer quality requirements. This set of operational metrics would contribute to the assessment and management of the continuous supplier–customer relationship along the SC.

Information being shared directly between all SC members based on supplier–customer relationship type, and also being traced back on both the collaborative and the sustainability



Figure 16.4 SCQM operational framework proposal

plans, ensures a good overall understanding of organisational, SC and QM performance. Although this may seem a complex and overwhelming information system, it supports the traceability of products, services, SC and QM performance, and business operations.

6. FINAL REMARKS AND IDEAS FOR FUTURE WORK

Although QM and SCM are management philosophies that have been around for a long time, the integrated concept of SCQM was only developed in the past 20 years. It is expected that the most recent developments in information technology will provide opportunities for the further development and implementation of this concept, especially by enabling real time QM and control in the SC (Xu, 2011). The final goal of these efforts is to create and sustain SC quality and excellence through the effective utilisation of human, physical and intangible resources (Fish, 2011).

Although the presented work has some limitations regarding the literature used, namely the lack of an extensive literature review of practical applications and case studies about the implementation of SCQM, a general overview of the concept and its background has been presented. Moreover, an analysis of the definitions presented by other authors represents a valuable contribution and a foundation for our proposed definition of SCQM, which includes the factor of time management – a factor that is not implicit in other authors’ definitions.

Although the authors mentioned in this chapter have presented extensive and detailed information about this concept, few have provided guidelines on how SCQM can be approached and implemented in companies. This leads us to the following research questions: Are the current metrics used in SCM and QM enough and appropriate for the SCQM concept, or should they be revised and adapted to this new concept? Further developing the work of

Carmignani (2009) regarding SCQM and ISO 9000:2001, can ISO 9001:2015 be a starting point for the implementation of the SCQM concept? Considering the current fashion for industry digitisation and the concept of Industry 4.0, how will the SCQM concept be adapted to, implemented and benefit from it?

ACKNOWLEDGEMENTS

This work has been supported by FCT – Fundação para a Ciência e Tecnologia within the R&D Units Project Scope: UIDB/00319/2020 and the doctoral scholarship grant: PD/BDE/142911/2018.

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