Study of supply chain management practices, integration and quality management: *The cases of three small organisations in Thessaly*

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M.Sc. in Management, 2011

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This dissertation is submitted in partial fulfilment of the requirements of Staffordshire University for the award of M.Sc. in Management

November 2011

Executive summary

Nowadays, the relation of an organization with its suppliers and customers is considered as pivotal in the pursuit of business excellence. Organizations' leaders have realized that optimizing operations within the company' boundaries, is not enough to succeed and to be competitive in the market. At the same time, customers have become more demanding and their expectations have rise to high levels. They are expecting flawless products and services delivered exactly on time. In a word they expect goods and services of superior quality. It is evident that quality depends not only on internal organizational procedures but also on the efficient collaboration with the external parties of the business environment. Hence, quality should penetrate focal processes and external entities in order to be achieved in a satisfactory extent which will, in turn, fulfill ultimate customers' demands.

The purpose of this study was to investigate and understand the impact of the implementation of a well-known quality assurance system (ISO 9000) in the supply chain management framework, by utilizing cased-based research and in-depth interviews of the managers of three small organizations in Thessaly, a geographical area in central Greece. Specifically, the study tried to provide answers concerning the effects of ISO 9001 implementation in the supply chain management context of the three companies, the role of the standard towards effective supply chain management, and the specific areas of supply chain management framework where ISO 9000 implementation have greatest influence.

The main findings demonstrate that it is not possible to assert that implementation of ISO 9000 quality assurance system completely promote supply chain management practices. Nevertheless, it can be concluded that there are specific sections where significant benefits were indentified and others where some kind of assistance can be acquired. Specifically, the greatest impact from the implementation of the standard in the three cases was identified in their relationships with customers. Implementation enabled all case organizations to significantly improve customer satisfaction and loyalty which in turn leads to improved customer responsiveness. Important benefits were also discovered for two of the cases concerning relationships with their suppliers, as implementation helped organizations in the establishment of positive and reliable relations and long term collaboration. In contrast, it was revealed that small organizations appear to be far behind in the adoption of technology systems solutions that enhance communication and collaboration among supply chain partners. Finally, implementation of standard seems that do not provides a base in organizations' effort to build a competitive edge across the supply network.

Acknowledgements

This dissertation would not have been possible without the invaluable help of several individuals who in diverse ways contributed towards its completion.

First of all, I would like to express my deepest gratitude to my supervisor, Dr. Vasiliki Kazantzi, for her assistance and excellent guidance throughout this study. I would, also, like to thank Dr. Panagiotis Trivellas for his comments and directions that helped me to understand many aspects of the research procedure better.

Furthermore, I gratefully acknowledge all managers and employees of the three organisations under investigation, for their participation and crucial contribution which made the research part of this study possible. Moreover, I would like to thank all professors in this Master's course for giving me inspiration and new insights into management science.

Last but not least, I would like to thank my parents, Kosta and Zoi, for their irreducible support, patience and love.

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1.Introduction

Nowadays, the relation of an organization with its upstream (i.e. suppliers) and downstream (i.e. customers) sides is considered as pivotal in the pursuit of business excellence. Organization leaders have realized that optimizing operations within the company boundaries, is not enough to succeed in the constantly changing market place (Azar et al. 2010 ; Christopher 2005 ; Hofmann and Locker 2009 ; Kanji and Wong 1999 ; Li et al. 2006 ; Siddiqui et al. 2009). They have totally understood the importance of working collaboratively with external entities in order to identify sources of competitive edges (Azar et al. 2010 ; McCarthy and Golicic 2005). This awareness has led to the coining and development of the renowned concept of supply chain management (SCM) (Casadesús and de Castro 2005 ; Hofmann and Locker 2009 ; Vaaland and Heide 2007), which intends to help companies to develop interactive and effective relationships with partners (Spekman et al., 1998 ; Theodorakioglou et al. 2006) with the intention of improving performance not only inside organizational boundaries but across the supply chain with ultimate aim to meet customers' needs.

At the same time, customers have become more demanding and their expectations have risen to high levels. Satisfaction of customers in the current era is not easy to be achieved. It takes much more than just providing goods and services. Customers are expecting flawless products and services delivered exactly on time (Mentzer et al. 2001). In a word, they expect goods and services of superior quality. The realization of this trend is not new. Since the early 1980s when quality gurus like Deming and Juran addressed quality necessity, organizations managers have realized that the improvement of quality in all aspects of organizational processes and products (Efstratiadis et al. 2000), is an issue of significant importance for competitiveness and prosperity of their companies (Tsiotras and Gotzamani 1996).

Taking into consideration the above inferences it becomes evident that quality depends not only on internal organizational procedures but also to the efficient collaboration with the external parties of the business environment. Hence, quality should penetrate focal processes and external entities in order to be achieved in a satisfactory extent which will, in turn, fulfill ultimate customers' demands.

In addition, as Nwankwo (2000) argues, ''small businesses have equally witnessed a resurgence of quality assurance initiatives''. Quality is significant to customer satisfaction and achievement of organizational aims in companies of all sizes (Deming 1986 ; Tan et al. 1999). Although, there is not a single acceptable definition of a small organization, most attempts towards this direction have used the number of employees

as the main indicative factor. With regard to quality awards, small companies in Europe are defined as companies with less than 250 employees (Gustaffson et al. 2001).

The decisive boost, especially for small and medium-size enterprises, to introduce quality in their organizational context, came with the launch of the quality assurance standard, ISO 9000 (Casadesús and de Castro 2005). In Greece, enterprises first began to implement quality assurance systems in the 1990s. In the beginning the spread of these systems was rather slow, due to lack of sufficient information about them and as a result, the first adopters were subsidiaries of foreign corporations that were forced to follow the quality direction of their mother organization (Tsiotras and Gotzamani 1996). But soon, as the restricted regional laws among European countries disappeared and competition became fierce, many companies considered registration to the standard as not an exaggeration any more, but as a necessity to successfully compete in the newly formed business environment. Other main causes were the inclusion of the ISO 9000 certification within the European Union procedures for the certification of industrial products, and the pressure of previously certified organizations to their suppliers, a procedure which was named ‘‘domino effect’’ (Tsiotras and Gotzamani 1996).

Although ISO 9000 has widespread international acceptance and despite the fact that many companies invest substantial resources to be certified against its requirements, the benefits obtained from the implementation of the system are surrounded by disagreements and extensive debate (Poksinska et al. 2006). In addition few studies concentrated on the effects of the system on SCM and especially on small organizations. This limited theoretical development along with subsequent limited theoretical testing resulted in incomplete understanding of ISO 9000 elaboration in the SCM context. Bearing in mind that a quality system should enhance not only an internal organization’s performance but an external one, the purpose of this study is to focus on the relationship between ISO 9000 quality standard and the organizational performance in the SCM context. The author aims to investigate and understand the impact of ISO 9000 implementation in the SCM framework, by utilizing cased-based research of three small organizations in Thessaly, a geographical area in central Greece. More specifically, the present study aims to provide answers to the following research questions:

(1) What is the impact of ISO 9001 implementation in the SCM framework?

(2) How ISO 9001 act on SCM practices?

(3) For which areas of SCM does the ISO 9001 implementation have greatest influence?

The remainder of this study is organized as follows. Chapter 2 includes a comprehensive review of the relevant literature where vital theoretical concepts such as supply chain, SCM, quality assurance and ISO 9000 series are presented, followed by a review of previous studies which addressed quality on a SCM framework. In Chapter 3 the theoretical framework and the methodology of the research are delivered along with the research instrument and the presentation of the companies under investigation. Chapter 4 delivers the research findings and further discussion, while in the ultimate Chapter 5 the study's conclusions and limitations are presented along with the implications for future research.

2.1 Supply Chain

A supply chain consists of all the participants that are involved, in a direct or indirect way, in the procedure of satisfying a customer request. Taking this into consideration, it is evident that, the supply chain not only contains the manufacturer and suppliers, but also distributors, retailers and the customers themselves (Chopra and Meindl 2001, 2004). These entities are "involved in the upstream and downstream flows of products, services, finances and information from a source to a customer user" (Mentzer et al. 2001). A portrayal of such a supply chain is given in Figure 1.

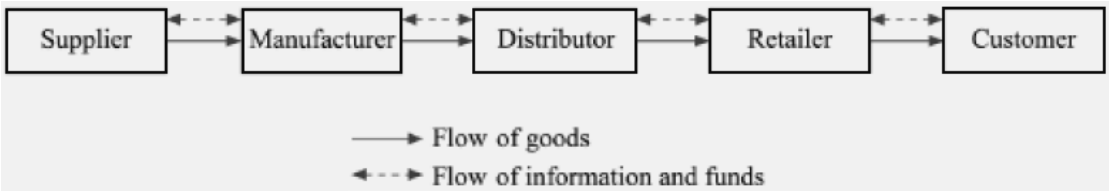

Figure 1. The basic supply chain (Chopra and Meindl, 2001)

Nevertheless, a supply chain contains a number of focal companies. This means that, the customer (expect for the ultimate one) is also supplier, and any supplier (with the exception of the very first one) is also a customer (Vaaland and Heide 2007). Every focal company has its own supply chain and the outcome is a rather complex web of systems, sub-systems, operations and activities that are all combined according to their relationships (Swaminathan et al., 1998). Thus, it cannot be described as a conventional chain (Vaaland and Heide 2007).

With this in mind, another more comprehensive definition is delivered by Aitken (1998), who describes supply chain as "a network of connected and interdependent organisations mutually and co-operatively working together to control, manage and improve the flow of materials and information from suppliers to end users".

In the aforementioned definition, the word "network" is properly stated instead of the word "chain", given that under regular conditions, there will be several suppliers and suppliers to suppliers combined with manufacturers, distribution centres and retailers in the route to the end costumer (Christopher 2005). Indeed, a supply chain network can be a rather complex web of divisions, sub-divisions, procedures and actions, with complicated interrelations between them (Chandra and Kumar 2000 ; Chen and Paulraj 2004). Figure 2 illustrates a contemporary supply chain network.

The focal firm (manufacturer) is incorporated in the core of the supply network, and its internal procedures need to be matched with the other parts of the chain. The flow of goods or/and services run from the left-demand side to right-product flow side. If everything is organized properly, the ultimate customer (to the extreme right of the network) is able to place orders, freely, whenever he or she likes. Then, the system takes over to fulfill the customer request (Chen and Paulraj 2004 ; Harrison and van Hoek 2008 ; Hofmann and Locker 2009). After all, as Chopra and Meindl (2007) argue, "the primary purpose of the existence of any supply chain is to satisfy customer needs, in the process generating profit for itself".

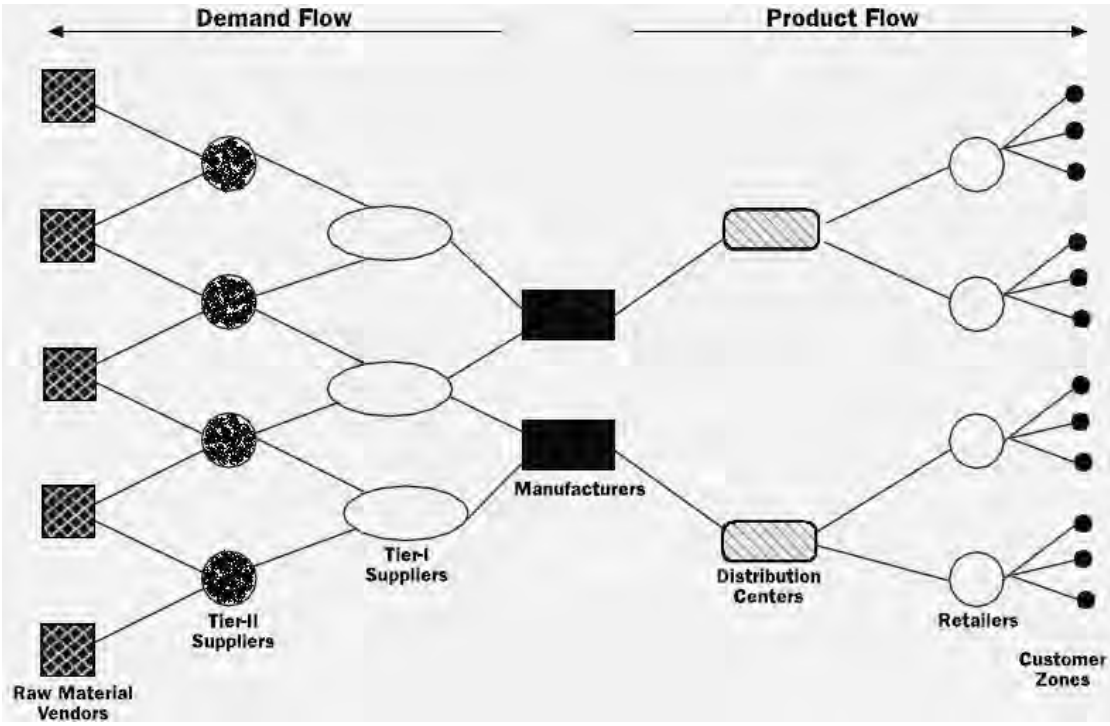

Figure 2. A supply chain network (Chandra and Kumar 2000)

Considering the previous inferences, it is understandable that, the individual activities of each member of the supply chain are part of an interdependent system where the cost or efficiency of one activity can influence the activities of the other members of the network. Through time and learning, the individual activities are finally adjusted and adapted to activities of the other members, aiming to increase their mutual productivity. Simultaneously, the interdependency of their actions is strengthened. Thus, networks of interdependent and at least semi-integrated activities are formed across organizations (Issar et al. 2004).

2.1.1 Supply Chain Drivers

Every supply chain aims to achieve a balance between responsiveness and efficiency in order to enhance the company's competitive strategy. This procedure is determined by the integration, coordination and high level of performance of the four supply chain drivers (Chopra and Meindl 2004 ; Hugos 2003), which are discussed in detail below

1. *Facilities* are the real physical locations across the supply chain where goods are stored, build or constructed. The two main types are production locations and storage locations. The performance of the supply chain is affected vitally from decisions regarding the role, site and capacity of facilities. For an instance, corporations can take advantage of economies of scale when a product is produced or stored in just one site. Hence, the efficiency is increased. On the other hand, this can negatively affect responsiveness considering that many of the firm's customers may be located in distant locations and vice versa (Chopra and Meindl 2004, 2007 ; Hugos 2003).

2. *Inventory* entails all raw material, work in process, and completed products in a supply network. The efficiency and responsiveness of a supply chain are radically depending on inventory practices. The variance in the supply-demand relation is the creator of inventory. Inventory is important because it can satisfy an unexpected upward shift in demand, or to reduce total cost by utilizing economies of scale during production and distribution (Chopra and Meindl 2004, 2007 ; Hugos 2003).

3. *Transportation* includes repositioning inventory from position to position in the supply chain, and affects the responsiveness and efficiency of the supply network vitally. Quicker transportation enhances responsiveness but it can negatively affect efficiency. Moreover, transportation dramatically impacts on the inventory and facility sites of the supply chain. The role of transportation in an organisation's strategy lies in the belief of the firm concerning the needs of its target group. Does the company aim to satisfy customers who claim high level of responsiveness, or is mainly concentrated on customers whose main decision criterion is lower prices? This choice is important because lower cost can be achieved at the expense of responsiveness. The right balance between the two is desired (Chopra and Meindl 2004, 2007 ; Hugos 2003).

4. *Information* includes of data and analysis about all previous supply chain drivers combined with costs, pricing and customers across the supply chain. Information is perhaps the most crucial driver of organisational performance in the chain, if we consider that directly influences all the supply chain drivers. It acts as the link between different stages of the supply chain, permitting them

to coordinate and increase profitability in the chain as a whole. Information also enhances production scheduling systems and warehouse management systems. However, even information companies have to find the ideal balance between efficiency and responsiveness (Chopra and Meindl 2004, 2007 ; Hugos 2003).

2.2 Supply Chain Management

As we saw in the previous chapter, effective cooperation and interaction among partners in the supply chain is a matter of vital importance in satisfying customers' needs. The importance of supply networks has induced a change in the way that companies act in the competitive environment. Competition has moved from "among organizations" to "between supply chains" (Foster 2008 ; Li et al. 2006). Companies do not seek to decrease cost, or increase profit at the expense of their partners in the supply chain, but rather try to enhance the competitiveness of the channel as a whole (Chandra and Kumar 2000 ; Romano and Vinelli 2001). Dependence on trading partners in bridging the supply-demand gap, reducing supply chain costs and achieving a competitive edge across the channel has become more significant (McCarthy and Golicic 2005). The performance of each associate in the supply chain affects the overall performance of the channel and the entire process has to be viewed as one entity (Siddiqui et al. 2009). The complexity of the relationship between the various parts in the network and the necessity for integration of all the associated activities and procedures into a seamless process has made organisations to adopt the practices of SCM.

SCM as an idea traces back to the late 1950s where Forrester (1958) presented a theory of distribution management that acknowledged the integrated nature of organizational relationships. Predicting some future developments Forrester proposed that after some stages of exploration in the field, a new management technique will emerge. This new form of management will give new insights about the benefits of the interrelationship between individual internal functions, and between the firm and its industry. Although these arguments were made more than fifty years ago, it is evident that Forrester traced key management subjects and illustrated important issues of the phenomenon that would later evolve into SCM (Mentzer et al. 2001).

SCM as a term, was introduced by consultants in the early 1980s and came into widespread use in the 1990s (Chen and Paulraj 2004), when it became a significant concern for all types of organisations in their race to improve quality and increase customer satisfaction (Chopra and Meindl 2001 ; Hugos 2003 ; Slack et al. 2007). SCM gives emphasis to the flawless interconnection of value-creating procedures across organizational borders. It aims to integrate the various structures and procedures of the supply chain, facilitating and synchronizing the flow of products and services and the information flow to deliver the value that clients request (Sridharan et al. 2005). Furthermore, it helps firms in a supply chain network to reduce waste, leverage synergies and contend in a more successful way in a deeply aggressive global marketplace. The advantages of SCM comprise of product and delivery process quality such as shorter delivery times, more reliable delivery

promises, fewer schedule disruptions, cost savings and risk reductions (Vaaland and Heide 2007). What is more, high quality of both products and services at each level of the supply network has been recognised as an essential part of successful SCM (Romano and Vinelli 2001).

Taking into consideration that SCM is a rather complex field of mixed theories and principles, its definition is not easy to be given and as a result there is no generally agreed definition (Bask and Juga 2001 ; Burgess et al. 2006 ; Habib 2010 ; Li et al. 2006 ; Storey et al. 2006 ; Vaaland and Heide 2007). Nevertheless, some researchers have managed to interpret SCM in a rather satisfactory way. According to Slack et al. (2007) SCM can be described as

> the management of the interconnection of organizations that relate to each other through upstream and downstream linkages between the processes that produce value to the ultimate consumer in the form of products and services. It is a holistic approach to managing across company boundaries.

Another definition is delivered by Mentzer et al. (2001), where SCM is defined as the strategic and tactical coordination of the established business functions and the procedures across these business functions in the internal part of a specific organisation and across businesses within the supply network, aiming to enhance the long-term performance of the organisational units and the entire supply chain.

Generally speaking, SCM includes all the information, financial and physical flows from supplier's supplier to the customer's customer and aims to fine-tune the decisions about the way that the various components in the supply chain should act in order to achieve the most desirable overall performance for the network in the long run (Li et al. 2006 ; Siddiqui et al. 2009). In addition, SCM aims to meet the requirements of the ultimate customers by providing appropriate goods and services timely and at a competitive cost (Miranbeigi et al. 2010 ; Novack and Simco 1991 ; Slack et al. 2007). This can be achieved only if all parts are coordinated and understand the requirements of the network as a sole entity. Towards this direction, the channel has to achieve satisfactory levels of the five operations performance objectives, which are quality, speed, dependability, flexibility and cost (Slack et al. 2007).

Proper implementation of SCM principles is delivering a range of benefits to organizations from a variety of business sectors (Horvath 2001). Researchers indicate

improvements in individual supply chain functions, enhanced process quality such as shorter delivery times, decrease in problems occurrences in the channel caused by more reliable delivery and fewer schedule disruptions, cost savings (for instance important inventory reduction), risk reductions and increased customer satisfaction (Arend and Wisner 2005 ; Bask and Juga 2001 ; Christopher 2005 ; Kannan and Tan 2005 ; Mentzer et al. 2001 ; New 1997 ; Poirier and Quinn 2004 ; Salvador et al. 2001 ; Sila et al. 2006 ; Vaaland and Heide 2007). Moreover, when an organisation interacts with other network entities, new opportunities for improvement in the organisational context may emerge, like changes in the way internal activities are performed (Salvador et al. 2001) or by leveraging the scalable competences of the organisation like innovative product design (Arend and Wisner 2005 ; Chan and Qi 2003 ; New 1997 ; Vaaland and Heide 2007). All these benefits can lead to improved organisational performance and to create a competitive edge (Li et al. 2006 ; Stanley and Wisner 2001).

2.2.1 Supply Chain Management Activities

Many researchers and academics have tried to identify the ways in which SCM differs from other similar concepts such as logistics management, purchasing and supply management, materials management and so on. In fact, SCM has developed into a concept with a broad span of interest and can be characterized as a holistic approach to managing across company boundaries (Romano and Vinelli 2001). It considers business as one continuous, seamless entity that absorbs distinct functions such as purchasing, manufacturing, distribution and sales into a continuous business interaction (Siddiqui et al. 2009). SCM is much more than an instrument to assess and improve a supply chain. It is a complicated, planned business connection model. It calculates all the important parts and events that are prerequisite for the delivery of the firm's products or services to the end consumer in the most competent and cost-effective way possible (Quiett 2002). Towards this goal, SCM boundaries includes several other management philosophies and functions in a single entity (Chen and Paulraj 2004 ; Mentzer et al. 2001), integrated with the necessary flow of information, in a customer oriented way (Mentzer et al. 2001 ; Slack et al. 2007). Figure 2 depicts some of the terms used to describe the management of separate segments of the supply chain in the SCM context.

Figure 3 illustrates that purchasing and supply, as well as physical distribution management are attributed to a sole segment of the whole supply chain, supply side and demand side respectively. Logistics and material management occupy larger areas of the supply network, while SCM occupies the network in aggregation. The different parts in the SCM context are analyzed below.

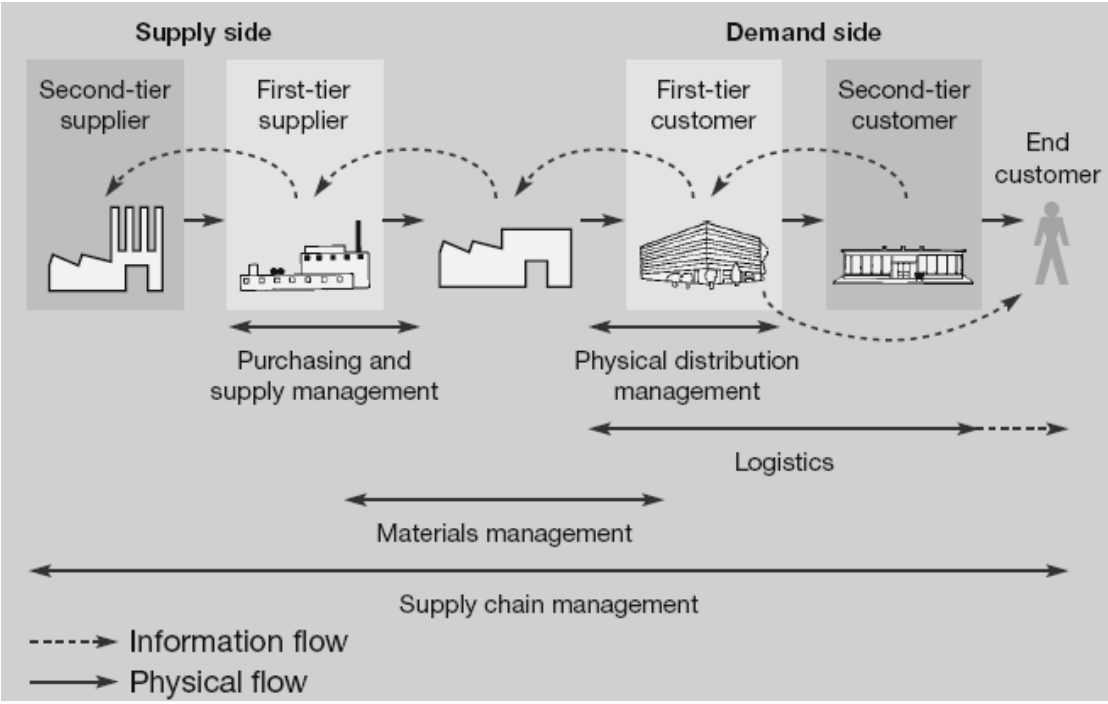

Figure 3. The activities of supply chain management (Slack et al. 2007)

- *Purchasing and supply management* is the process of acquiring products and services for operations from suppliers (Quinn 2005). Its aim is to ensure long-term availability of critical materials at competitive costs (Kraljic 1983, 1984). Purchasing managers must recognize the requirements of the internal processes and by evaluating the capabilities of their suppliers, to provide the necessary materials and services (Slack et al. 2007). They must learn to cope with uncertainties in supply and price disruptions. The greater the uncertainty of supplier relationships and/or physical availability of the required materials, the more important supply management becomes (Kraljic 1983, 1984).

- *Physical distribution management* is the procedure of supplying immediate customers by organizing the movement and storage of materials (Slack et al. 2007). It includes all business activities concerned with the transportation, inventory control, warehousing, and order processing of finished inventory and/or raw material in order to arrive in the right destination, timely and in usable condition (Bates and Dillard 1975 ; Bowersox 1969). Viewed in this light, physical distribution is the key link between manufacturing and demand creation. Hence, it has a great effect on the company's activities and consequently on the profitability of the company (Stewart 1965).

- *Logistics Management* is a term broadly analogous to physical distribution management. It can be said that logistics is an extension of physical distribution management and entails the management of products combined with the necessary information flow from a firm, down through the

distribution channel, beyond the immediate customers to the retailers or directly to consumers (Slack et al. 2007). Logistics, therefore, includes managing facilities, transportations, inventory, order fulfillment, and information (Mentzer et al. 2008 ; Novack et al. 1992). Obligation of logistics management is to ensure that the demanded quantity of products is in the right place at the right time (Chen and Paulraj 2004 ; La Londe 1983).

- *Materials management* is a limited term, originating from purchasing operations that traced the significance of integrating flow of materials and its connecting functions, both inside the organisation and to immediate external customers. Hence, it refers to the management of materials and information flows through the immediate supply chain. It contains inventory management, stores management, operating planning and control and physical distribution management (Slack et al. 2007).

2.2.2 Supply Chain Management Practices

SCM practices have been defined as the collection of activities undertaken in an enterprise to endorse effective management of its supply chain (Li et al. 2006). Tan et al. (2002) include supply chain integration, information sharing, quality and relations with customers in identification of the SCM practices in their research. Alvarado and Kotzab (2001) include in their list of SCM practices which focus on core competencies, use of cross-organizational systems, and minimization of inventory levels. On the other hand, Chen and Paulraj (2004) include restriction of suppliers' number, creation of long term relations, enhanced communication and participation of suppliers to the measurements of relationships of buyers and suppliers. Finally, Min and Mentzer (2004) include settled vision and common goals, sharing of efficiency gains and cost reductions, sharing of information, integration of processes and creation of long term relationships with supply chain partners. Although the literature depicts SCM practices from a range of dissimilar perspectives the common aim of ultimately enhancing organizational performance is always remaining (Li et al. 2006).

After reviewing and consolidating the literature the five practices of Chandra and Kumar (2000) for effective SCM, including inventory management, supplier relationships, customer responsiveness, information technology systems improvement and creation of competitive advantage for the chain, were selected as the basis of the present study as are identified as critical elements for both individual business units and the whole supply chain (Chandra and Kumar 2000). A more detailed discussion of these practices is provided below.

Inventory management improvement

Effective management of inventory across the supply chain has been recognized by SCM practitioners as one of the strategic success factors. Costs of holding inventories throughout the supply chain are a significant addition to the total material costs and should be minimized (Tummala et al. 2006). Each part of the supply chain wants to keep the exact amount of inventory that is needed so as to keep the cost of investment as low as possible. Taking into consideration that the life cycle of products is constantly being shortened, minimizing inventory investment in the chain is a significant matter. Lower cycle times are the result of a well organized inventory system which is characterized by swift responses to the customers' needs (Chandra and Kumar 2000).

Organizations that achieve integration of SCM strategies across the supply chain can reduce inventory costs by moving goods efficiently across the supply chain (Tummala et al. 2006). Inventory management techniques as like just-in-time (JIT) can be enhanced from quick and efficient communication of the supply chain members and introduction of state-of-the-art information systems. Holding excessive stock can be extremely costly but on the other hand, enough stock is needed to satisfy customers' demand and to reduce order cycle time (Mentzer et al. 2001), hence, companies should strategically and operationally investigate the quantity of stock that should be held and the exact location of storage (Tummala et al. 2006). In addition, trustworthy relationships are important in inventory management because different parties need to share information about stock levels.

What is more, development of reliable forecast should be seriously taken into consideration in managing inventory costs. According to Lee and and Billington (1995) forecast errors are the main source of inefficiency in the supply networks.

Establishment of supplier relationships

Establishment and maintenance of long lasting alliances across organization's boundaries is a decisive factor for the success of the supply chain (Chandra and Kumar 2000 ; Vaaland and Heide 2007). Corporations, with the aim of responding to new market dynamics try to collaborate with a limited number of suppliers, and particularly those who provide the firms with components that have an important effect on the quality of the final product (Chandra and Kumar 2000 ; Theodorakioglou et al. 2006). These close relationships with a core group of suppliers can guide to a more sound sustainable competitive advantage (Theodorakioglou et al. 2006), and to influence the strategic and operational capabilities of organizations (Mentzer et al. 2001 ; Vlachos et al. 2008).

There is a need for procedures and products that have been designed not only by a single organization but through the cooperation of all organizations in the supply chain (Chandra and Kumar 2000). Partners that participate early in the design process can give more cost effective options and to help in the selection of proper components and technologies (Tan et al. 2002). Moreover, aligned companies can work collectively and effectively and to share responsibility for the success of the end products (Mentzer et al. 2001), to share risks and efficiency gains (Tummala et al. 2006), and to minimize wasteful time (Chen and Paulraj 2004 ; Li et al. 2006 ; Tummala et al. 2006).

De Toni and Nassimbeni (1999) also argue that long term relationships between the buyer and supplier enhance the intensity of coordination between the two. Common goals are being created among the collaborating parts and compatible strategic objectives are highlighted (Tummala et al. 2006).

Collaboration in the fields of electronic supply systems and production schedules is also important. The effective sharing of information promotes more accurate communication between the companies which are then able to accurately correspond about their capability to meet costs, deadlines and logistics process requirements. This, in turn, provides an opportunity to manage the materials flow more effectively and to lower the inventory levels across the channel. Common understanding and shared information can replace much of the guesswork and to enhance efficiency (Tummala et al. 2006). Moreover mutual planning and problem solving are being propelled (Gunasekaran et al. 2001).

Customer responsiveness

According to Willis (1996), long term success of an organization is determined by its ability to react to customer needs rapidly and efficiently. Delivery of high quality, reliable products which are delivered timely, can increase customer responsiveness and loyalty to the entire supply chain. The capability to maintain a high quality level of service is vital to partnering efforts. The existence of a strong relationship with a supplier that is characterized by mutual trust and proper collaboration can end up in a satisfied customer (Chandra and Kumar 2000).

Customer satisfaction is considered among successful companies as an umbrella that covers all other activities as it is much more complex and costly to develop a new customer than to keep an existing one (Willis 1996). In addition, customer relationship management is considered as a vital section of SCM practices (Tan et al.

1999), as good relationships with all channel members is a prerequisite for proper implementation of SCM goals (Moberg et al. 2002). Development of mass customization and personalized services are developing at a time in which customer relations are of vital importance for business endurance (Li et al. 2006). What is more, committed relationships with customers can provide an opportunity for the organization to differentiate its products from the competition, enforce customer loyalty (Magretta 1998), to create inbuilt barriers to competition (Day 2000) and to generally enhance organizational performance to an important extent (Li et al. 2006).

Information technology systems improvement

Information technology is infusing supply chain at every point, more than ever, transforming the way activities are performed (Chen and Paulraj 2004 ; Palmer and Griffith 1998). This can be attributed to the importance of information exchange among the supply chain members which is decisive for the success of the whole supply network (Childhouse and Towill 2003). Efficient information exchange can help network partners to act as a single entity and to understand the needs of the end customer more quickly (Li et al. 2006).

The capability of an enterprise to communicate is enhanced by information technology systems which help partners of a supply chain to have direct access to common, frequently updated databases, regarding data of product availability, stock levels, shipments position and production necessities (Chandra and Kumar 2000 ; Chen and Paulraj 2004). These will provide assistance to managers in the fields of forecasting and production scheduling and shall benefit the collaboration and planning of all supply network parts (Chen and Paulraj 2004 ; Sridharan et al. 2005), which in turn will improve accuracy and efficiency of the processes (Chandra and Kumar 2000). Clear communications, disclosure of internal information and quick responses are key elements of successful supply chain management (Sridharan et al. 2005) and strategic alliances (Spekman et al. 1998).

A more modern perspective on the linkages between the supply chain members considers the position of inter-organizational systems, which are advanced information systems connecting separate companies (Chen and Paulraj 2004 ; Kumar and van Dissel 1996). Rapid technological development provides a variety of choices in information sharing software (Tummala et al. 2006). The ultimate goal of these systems is to replace stock with perfect information through electronic transactions and communication across the chain boundaries (Chen and Paulraj 2004). Electronic commerce (e-commerce) is being presented in the forefront of these novel opportunities (Sridharan et al. 2005). The timely and accurate information that is needed about capacities and costs, stage of product production, transportation and

customers' demand across the chain can be provided by e-commerce systems like enterprise resource planning (ERP), distribution resource planning (DRP) and electronic data interchange (EDI) (Tummala et al. 2006). These software systems can help all members of the network to review past performance data, monitor current procedures, predict future demand and be better prepared for changes in demanded levels of products (Sridharan et al. 2005). However, even if the most advanced and state-of-the-art systems are used, the main challenge is to be effectively coordinated among supply chain partners (Tummala et al. 2006).

Creation of competitive advantage for the channel

Building and maintaining a competitive advantage in an industry, constitutes a challenge for every organization (Chandra and Kumar 2000). As competition has moved from single entities to supply chains (Foster 2008 ; Li et al. 2006), it is understandable that, for a company to achieve a competitive advantage in its sector, it is needed to be part of an efficiently run supply chain (Hassini 2008 ; Markley and Davis 2007).

Competitive advantage constitutes the degree to which a company is able to build a defensible position over its competitions (Porter 1985). It entails the competences that permit a company to differentiate itself from its competitors and is the result of vital management choices (Li et al. 2006). The relevant literature identifies price/cost, quality, delivery and flexibility as the major competitive competences (Li et al. 2006). Additionally, a series of studies (Handfield and Pannesi 1995 ; Kessler and Chakrabarti 1996 ; Stalk 1988) include time as a significant source of competitive advantage (Li et al. 2006).

Competitive advantage is basically generated from the customer value an organization generates and intends to found a lucrative and sustainable position against the parties that constitute the business competition (Mentzer et al. 2001 ; Porter 1998 ; Sadler 2007). As it was discussed in prior chapters the ultimate goal of SCM is to satisfy the requirements that customers address. Hence, it is proposed that the implementation of effective SCM generates customer value and satisfaction, which in turn guide to a competitive edge for the supply chain, as well as each separate associate. This, eventually, increases the profitability of the channel and its parts (Mentzer et al. 2001).

2.3 Total Quality Management

Armand Feigenbaum back in the 1950s was the original proposer of the significance of assuring quality across operative areas. He argued that corporations could never create products of high quality if the manufacturing part was the sole undertaker of delivering quality. Conversely, quality had to be created by all parts of the organisation, who would share responsibility for all phases of quality (Feigenbaum 1956). This comprised product and process design quality plus quality generated from production (Forker et al. 1997). Feigenbaum (1956) proposed the "total quality control" which suggested that the organisation had to be concerned with quality of design, quality of received materials and quality influenced by shop-floor control. Control at all these three steps would better protect the end customer from collecting a defective product that a simple inspection of the finished product would deliver. The aim was to diminish defects higher up the supply chain than inspection and testing, which were the typical points in the production process where defects were inspected and amended (Forker et al. 1997).

Several years later, around THE 1980s the transition to a more holistic approach of organisational quality was completed. Organisations were willing to adopt the new approach to quality by understanding customer's problems and by focusing on the continuous improvement of products and services. It was a profound change, from internal focus to customer focus, in combination with changes in the internal processes of the organisation as well as in its culture (Conti 1999). A new approach to management and organisation as a whole resulted, which was named Total Quality Management (TQM). Nowadays, TQM has been identified as among the most important inputs for world-class corporations and has become a vital part for success in the global marketplace (Forker et al. 1997).

TQM is a holistic approach of management that necessitates the need for continuous search of improvement in every activity, function and procedure of the organisation (Laframboise and Reyes 2005). The latter requires the interaction between all parts and individuals of the enterprise (Siddiqui et al. 2009). TQM intends to achieve general efficiency that goes beyond individual output from the sub-systems, such as design, planning, production, distribution, customer focus strategy, quality tools and employee involvement. TQM tries to make the organisation to perform the ultimate possible outcome by making the most efficient use of all the available resources and opportunities. Satisfied customers and continuous improvement are the fundamental aims of the TQM philosophy (Hafeez et al. 2006 ; Kannan and Tan 2005 ; Pekar 1995 ; Siddiqui et al. 2009 ; van der Spiegel et al. 2005 ; Williams 1997). Also, towards TQM implementation, an organisation should apply fundamental changes to

every organisational aspect: workforce, management, structure and surely culture (Siddiqui et al. 2009).

Quality gurus such as Deming and Juran point out a variety of reasons to demonstrate the significance of quality to the companies. For instance, as quality improves there is elimination of waste and reduction in total cost and the overall performance of the company is getting better (Deming 1986 ; Juran and Godfrey 1999). Moreover, they advocate several practices towards failure prevention and they praise the significance of top management's commitment to quality improvement (Forker et al. 1997). It is also widely accepted that quality is not just meeting the specifications. Quality has to meet or even exceed the customers' expectations. It's about proper functioning of critical business procedures, timely deliveries, and friendly and accurate technical support (Juran and Godfrey 1999).

Most TQM researchers and academics suggest that the principles that lead to the implementation of quality in all parts of the organization, include: strong leadership from top management with the intention of making clear the of strategic importance of quality, willingness to listen to customers' needs and wants, cautious gathering of quality data such as rates of errors combined with detailed analysis and following corrective/preventive actions, total staff participation in quality improvement actions and non-stop improvement of quality performance (Forker et al. 1997 ; Williams 1997).

2.3.1 Total Quality Management Goals

According to Juran and Godfrey (1999) the almost universally accepted goals of TQM are lower costs, higher revenues, empowered employees and delighted customers (Figure 4). Each of these total quality goals is briefly analyzed below.

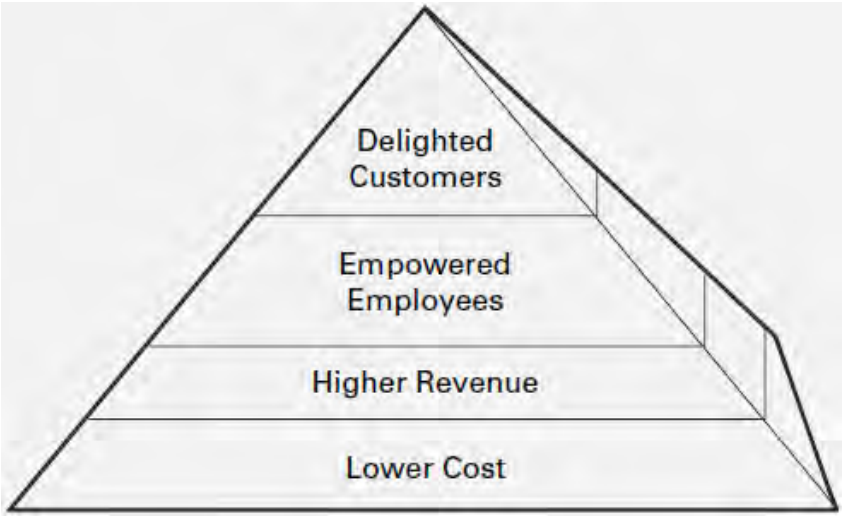

Figure 4. Goals of total quality management (Juran and Godfrey 1999)

- *Lower Costs* can be achieved by reducing errors, rework and non-value-added work. Costs connected to prevention of errors during the procedure of design are most times much less than correcting these errors in the production process or after final inspection (Juran and Godfrey 1999).

- *Higher revenues* are achieved by more satisfied customers, better customer retention, increased market share and premium prices that are justified by increased product quality. Furthermore, if companies succeed in meeting the expectations for quality in the marketplace, they will be able to gain new customers and to increase the loyalty on the existing clientele (Juran and Godfrey 1999).

- *Empowered Employees* are in self-control and there are able to measure the quality of their own work processes, to interpret and evaluate them in relation to the desired performance. Also, companies with this type of personnel are able not only to deal with present problems, but aim to solve, or even avoid future ones (Juran and Godfrey 1999).

- *Delighted Customers* are those customers that are characterized by their loyalty to the firm, who advertise the products and services of the organization and check your firm first when they intend to buy anything (Juran and Godfrey 1999). These customers will often intensify their purchases to the extent of choosing sole suppliers for specific products and services (Reichheld 2001).

2.4 Supply Chain Management and Quality

As it is already mentioned, there are a range of potential benefits that can be acquired from SCM including cost reduction, enhanced customer satisfaction, boosted profits (Christopher 2005 ; New 1997 ; Poirier and Quinn 2004), competitiveness (Chan and Qi 2003), streamlining of operations (Sethi et al. 2004), and many more. Bearing this in mind, it is understandable that the management of quality within the supply chain is a significant matter when accomplishment of such a broad series of important organizational goals is on line (Sila et al. 2006).

Quality is a pivotal factor in the value-adding process involved in the production and distribution of goods, and it has been recognized as an essential part of successful SCM (Forker et al. 1997 ; Romano and Vinelli 2001), not only within a single firm but also across the supply chain (Azar et al. 2010 ; Forker et al. 1997 ; Kannan and Tan 2005 ; Kaynak and Hartley 2008 ; Sila et al. 2006), since a product run from one supply chain member to another and its quality is determined by all members in the channel (Sila et al. 2006). The production of flawless components that satisfy the requirements of customers along the supply chain is pivotal for the quality of the final products (Beamon and Ware 1998 ; Sila et al. 2006). Quality efforts along the supply chain also have important impact in cost reduction (Forker et al. 1997). Moreover, by making management of quality an integral part of the supply network, organisations can be much more than just reactive to the requirements of their partners in the chain, and can struggle to fulfill their claims more proactively (Love et al. 2003 ; Sila et al. 2006). In addition, chain members also influence the quality of information and processes along the chain (Sila et al. 2006).

Furthermore, the correlation of SCM and TQM is obvious in the literature. The strategic objectives of both SCM and TQM include continuous improvement in the effectiveness and efficiency of an organization's operations functions (Kannan and Tan 2005), with the intention of achieving competitive advantage (Sila et al. 2006) and satisfying the ultimate customer. Also, their practices are being applied to all levels and functions of the organization (Siddiqui et al. 2009). TQM concepts can be used in SCM to improve the quality and distribution of goods and to reduce waste in the channel (Sila et al. 2006). Moreover, according to SCM concept, an enterprise has to rely on the performance of both suppliers and customers in order to perform well and to satisfy the end customer (Kanji and Wong 1999). This constitutes one of the significant components of TQM, which praises the cooperation with both the upstream and downstream sides (Anderson et al. 1994).

2.5 ISO 9000 Series

The International Organization for Standardization's (ISO) 9000 series was introduced in 1987, with the intention of setting standards for corporations wishing to apply a quality system and to provide quality assurance to their business complements or end customers, by illustrating their ability to design, produce and deliver products or services with the expected level of quality (Poksinska et al. 2002 ; Tsekouras et al. 2002 ; Tzelepis et al. 2006). ISO 9000 standards harmonized many different national quality standards and fulfill the need for a universal evaluation method in quality assurance systems. Despite the fact that they are not compulsory, their international acceptance made them a necessity for firms that want to stay competitive in demanding markets (Foster 2008 ; Theodorakioglou et al. 2006 ; Tsiotras and Gotzamani 1996), and is regarded as the most prevalent approach in quality management systems (Sroufe and Curkovic 2008).

The ISO 9000 series is a division of the family of ISO/TC 176 standards. It consists of four standards (ISO 9000, 9001, 19011, 9004). Together they shape a consistent set of quality management system standards enhancing common understanding in the national and international market place (Hoyle 2009). Figure 5 illustrates each standard context and relationship with the rest in the series

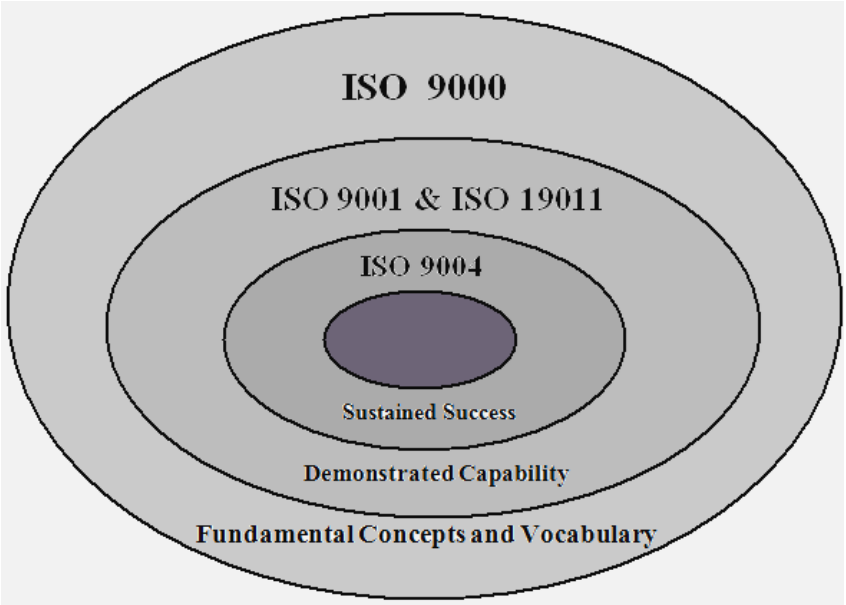

Figure 5. ISO 9000 standards context and relationships (Hoyle 2009)

At the core the company is placed in a setting in which it competes for sustained success. To accomplish this condition the fundamental concepts and vocabulary delivered by ISO 9000 have to be fully understood. ISO 9000 sets the stage for understanding the basics of quality management as described in the series. Then the

company demonstrates that it has the potential of pleasing customers through evaluation against ISO 9001 concluded in harmony with ISO 19011. ISO 9001 is used with the intention of establishing a standard that will ensure the organisation ability to provide the expected products and services. Against the requirements of this standard a quality management system can be certified by an external body. ISO 19011 gives an overview of how auditing should operate and how management system audits should apply. Effective audits guarantee that the implemented quality system meet the requirements specified in ISO 9001. Ultimately using ISO 9004 the company is managed repetitively as a system of processes, a guide to improvement beyond the requirements of ISO 9001, aiming to achieve sustained success by extending the benefits obtained from ISO 9001 to employees, suppliers, partners an society in general (Hoyle 2009 ; ISO 2009a ; Tsekouras et al. 2002).

Each one of the ISO 9000 series standards has a different purpose, intent, scope and applicability as indicated in Table 1.

2.5.1 ISO 9001

ISO 9001, is the flagship of the ISO 9000 series and the only one with requirements that an organisation have to fulfill in order to be certified. Although it does not provide technical requirements or specifications, it assures the quality of the product by presenting the details of a quality scheme for design, development, production and servicing actions. If a company meets the range of structural requirements set out by ISO 9001, the company may adopt the standard by applying and, in possible success, by registering by a certified external auditor (Sroufe and Curkovic 2008 ; Tsekouras et al. 2002).

The introduction of ISO 9001:2008 standard was made with the intention of clarifying some existing requirements of the standard and to improve compatibility with ISO 14001:2004. No new requirements were added nor does it change the general intention of the ISO 9001:2000 standard. ISO 9001 popularity is continually increasing since its foundation (Hoyle 2009), and this can be attributed to its widespread adoption that caused a “domino effect” of certifications on competitors and partners (Gotzamani et al. 2006), especially in smaller organisations (Poksinska et al. 2006).

With the exception of 2003, the annual growth of ISO 9001 certification is continually increasing from 1994. Until December of 2009, where data is available, 1,064,785 companies had been certified against ISO 9001:2008/2000 standard in 178 countries

around the globe. Europe has the dominant regional share (47%) with 500,319 certified organizations (ISO 2009b).

Table 1. Overview of the ISO 9000 series of standards (Hoyle 2009)

Attribute	**ISO 9000**	**ISO 9001**	**ISO 9004**	**ISO 19011**
Purpose	To facilitate common understanding of the concepts and language used in the family of standards	To provide an equitable basis for assessing the capability of organizations to meet customer and applicable regulatory requirements	To assist organizations achieve sustained success in a complex, demanding, and ever changing, environment	To assist organizations achieve greater consistency and effectiveness in auditing practices
Intent	For use in conjunction with ISO 9001 and ISO 9004. It is invoked in ISO 9001 and therefore forms part of the requirements	This standard is a prescriptive assessment standard used for obtaining an assurance of quality and therefore for contractual and certification purposes only	This standard is a descriptive standard and therefore for guidance only and not intended for certification, regulatory or contractual use	For use in internal and external auditing of management systems
Scope	Defines the principles and fundamental concepts and terms used in the ISO 9000 family	Defines the requirements of a quality management system, the purpose of which is to enable organization to continually satisfy their customers	Describes how organizations can achieve sustained success by application of the quality management principles	Provides guidance on the principles of auditing, managing audit programmes, conducting management system audits and guidance on the competence of management system auditors
Applicability	Applies to all terms used in the ISO 9000 family of standards	Applies where an organization needs to demonstrate its ability to provide products and services that meet customer and regulatory requirements and aims to enhance customer satisfaction	Applies to any organization, regardless of size, type and activity seeking sustained success	Applies to all organizations needing to conduct internal or external audits of quality and/or environmental management systems or to manage an audit programme
Facts and figures	84 Definitions	8 Sections; 51 Clauses; 263 Requirements	8 Sections; 64 Clauses; No requirements	7 Sections; 45 Clauses; No requirements

There are five sections in the standard in which the activities are specified and need to been taken into consideration in the implementation process.

- Overall requirements for the quality management system and documentation
- Management responsibility, focus, policy, planning and objectives
- Resource management and allocation
- Product realization and process management, and
- Measurement, monitoring, analysis and improvement.

With the exception of the product realization section which can be tailored to meet the need of each company, all other requirements are applicable to all types of companies. Jointly, these five sections will define what a company should do to steadily provide goods that meet the customer and legal requirements. Moreover, continual improvement of the quality management system will boost customer satisfaction further (ISO 2009a).

2.5.2 ISO 9000 in Small Enterprises

According to studies, motivation for smaller companies to acquire ISO 9000 certification stems mainly from advertisement-marketing related reasons (Brown et al. 1998 ; Mo and Chan 1997 ; Poksinska et al. 2006). Moreover external pressure is much heavier for registration in small firms (Corbett 2006 ; Poksinnska et al. 2002). Also, motivation reasons include the need to stay competitive in the market and to get a bigger market share (Poksinska et al. 2006). In addition, Nwankwo (2000) argues that smaller enterprises need an external motivation to seek registration.

Just like bigger companies, there is a general confusion and controversy regarding the effectiveness of the standards and their contribution to small firms in the long run (Gotzamani and Tsiotras 2001). Two conflicting views are prevailing. The positive and the negative view (Poksinska et al. 2006).

The *positive view* maintains that smaller companies after implementation of the standard have improved quality and management control (Brown et al. 1998 ; Gustafsson et al. 2001 ; Poksinska et al. 2006), improved quality knowledge (Brown et al. 1998 ; Nwankwo 2000 ; Poksinska et al. 2006), reduced poor quality expenses (Brown et al. 1998 ; Gustafsson et al. 2001 ; Nwankwo 2000 ; Williams 1997), make a better impression on external parties (Nwankwo 2000), and have in general, more benefits than larger companies (Sun and Cheng 2002).

On the contrary the *negative view* argues that smaller companies after registration face deteriorated quality practices compared to the time prior to implementation and greater than before paper work (Sanders 1994). In addition, same companies cannot inspect a sole change after registration to the standard (Gustafsson et al. 2001). What is more, Bryde and Slocock (1998) found that the majority of small enterprises have generally a negative opinion on certification. The latter can be attributed to the external pressure for registration. When external parties obligate firms to obtain certification, then it is logical that the standard will be viewed in a negative way (Douglas et al. 1999 ; Meegan and Taylor 1997), and will not be further extended (Guilhon et al. 1998 ; Lee and Palmer 1999).

2.6 Quality Assurance

As it has been described in the previous chapter continuous improvement and achievement of total quality in all activities and functions of an organisation is the ultimate goal, which can yield satisfaction for both stakeholders (lower costs, higher profit) and customers (better products). But achieving total quality is an extremely difficult, demanding and elaborating procedure which can be achieved only gradually. For most enterprises, Quality Assurance (QA) is considered as the pre-condition, the basis and initial step towards sound quality improvement (Conti 1999 ; Gotzamani et al. 2006 ; Gotzamani and Tsiotras 2001 ; Tsiotras and Gotzamani 1996).

Customers and managers need an assurance of quality because they cannot oversee procedures for themselves. They need to be confident for the operational processes in order to avoid continuous intervention (Hoyle 2009). Tricker (2010), defines QA as

> that part of quality management focused on providing confidence that quality requirements are fulfilled. In other words, QA refers to all those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality. QA ensures that a product has achieved the highest standards and that its production, modification or repair has been completed in an efficient and timely manner

QA activities are designed to gain confidence in the capability of predetermined requirements (Hoyle 2009). QA covers all activities, including design, development, production, servicing, and documentation (Deming 1986 ; Garvin, 1986, 1987 ; Sroufe and Curkovic 2008), and is significant to the competitive competences of any enterprise or supply chain. The significance of assuring quality necessitates that quality not be dealt with on an informal basis. Only an appropriately implemented quality management system within an enterprise and throughout the supply chain can protect from short-term acts the do not enhance log-term initiatives. For most organisations, gaining acceptable grade of quality comes with the registration of a quality management system (Sroufe and Curkovic 2008).

QA has many similarities to quality control (QC). Each evaluates actual quality and performance. Their difference is the main purpose to be served. QC is evaluating performance during operations and intends to serve those who are directly responsible for operations (Juran and Godfrey 1999). QA evaluate performance after operations, serve to build confidence in results, claims, predictions (Hoyle 2009) and serve those who are not directly responsible for conducting operations but who have to be notified (Juran and Godfrey 1999).

A “QA system” includes the process, organizational structure, procedures, and resources that companies use with the intention of managing the variables on which quality of the products is based. This system includes examination, standardization and documentation of every repeated procedure in the life cycle of a good, from the initial stage of design and production to packaging and distribution. It also contains check and measurement actions (Tsiotras and Gotzamani 1996). The application of a QA system enhances enterprises to better control and coordinates their operations by documenting their processes, clarifying uncertainties and clearly defining duties and employee’s tasks (Gotzamani and Tsiotras 2001).

In a successful QA system, all of the aforementioned points are appropriately followed resulting in goods and services that respond to their requirements. The QA system constitutes a dynamic sub-system of the overall organisational system of the enterprise (Tsiotras and Gotzamani 1996). Its major benefit is that it presents a preventive way of managing quality, by concentrating on the prevention of errors, rather than their afterward detection and correction. The importance of prevention is highly appreciated by the relevant literature since the modern competitive challenge is the mixture of high quality and competitive price, which means the combination of quality and productivity. The sole means for organisations to respond to this challenge is by using preventative rather than corrective techniques of quality management, since the latter causes more costs and reduce productivity, without adding actual value to the products. Taking all these into consideration, the implementation of a QA system presents an excellent prospect for firms that wish to respond to the challenge (Gotzamani and Tsiotras 2001).

2.6.1 Quality Assurance through ISO 9000

The ISO series aims to quality assure the particular customer requirements as specified in the contract. This means that the organisation tries to do these specified things right (Dahlgaard et al. 2005). The standards only suggest the vital elements of an appropriate QA system, without suggesting the exact ways to apply them (Gotzamani 2005). It gives the requirements that had to be met, it does not state how they will be met. It ensures that a quality system is in place but cannot guarantee its functionality within a specific enterprise or supply chain (Gotzamani, 2005 ; Sroufe and Curkovic 2008). Each enterprise will develop its own system by taking into consideration its special necessities and requirements of the standard. The ISO series do not certify the quality of products themselves, but it certifies the QA system that produces them (Foster 2008 ; Tsiotras and Gotzamani 1996). It makes sure the existence of documented procedures which are firmly followed by the organization. Hence, it makes sure that the final product that the customers obtain is always in accordance to specifications. The series ensure quality consistency, but not higher quality of a registered enterprise’s products (Tsiotras and Gotzamani 1996).

ISO registration contains important foundations for QA (Sroufe and Curkovic 2008). This does not mean that the certification itself will improve quality in an organization (Efstratiadis et al. 2000 ; Hoyle 2009). An important point is the way that the organizations deal with the standard requirements, as a result of the actual motives for certification (Gotzamani and Tsiotras 2002 ; Gotzamani et al. 2006 ; Poksinska et al. 2006). Enterprises that seek certification for advertising reasons, or are forced to registration by external parties, will possibly fail to achieve substantial benefits, because of their narrow focus and short-term oriented rationale (Casadesús et al. 2001 ; Gotzamani and Tsiotras 2001, 2002). For many companies, registration means "business as usual" (Williams 1997). In contrast, organizations that seek certifications with the intention of developing a system to enhance quality and customer satisfaction, may considerably benefit from the registration to the standard, by adding actual value to their operations (Gotzamani and Tsiotras 2001, 2002 ; Williams 1997). For this reason, registration motive of often characterized as key determinants for the overall performance of the ISO 9000 standards (Casadesús et al. 2001 ; Gotzamani and Tsiotras 2001, 2002).

2.7 Previous Research

Despite the well documented importance of the relationship between a company and its suppliers and customers, studies addressing the quality concept on a SCM framework are relatively finite (Azar et al. 2010 ; Kanji and Wong 1999 ; Kaynak and Hartley 2008). Generally, studies of SCM have concentrated mostly on the control of inventory and the effects of SC integration on inventory levels (Forker et al. 1997). In this chapter, a series of empirical studies which address quality concept on a SCM framework are presented. Although it cannot be described as a comprehensive list, it includes representative studies which reveal the rationale of the research of quality in the SCM context, along with valuable findings that can serve as a reference for the present study.

One of the first studies that investigated the relationship between the supply chain and quality was conducted by Forker et al. (1997). The authors conducted a rigorous research in the electronic components sector and concluded that that adoption of TQM practices in the supply chain context can significantly enhance the encouragement of quality in the channel, considerably improve the data collection about defects and shortcomings in all organizational levels and give personnel proper training and incentives for their sound activation in the improvement of quality.

Salvador et al. (2001) conducted a survey among 164 plants with the intention fo highlighting the impact of interactions between suppliers and customers across the supply chain. Their study found that interactions on quality issues would improve time performances of the company (punctuality and speed), as a result of total mediation by internal practices for quality management, low management, inter-unit and vertical coordination. On the other hand, concerning material flow management issues, the impact on performances that have to do with time can either be totally or to some extent mediated by internal practices.

Romano and Vinelli (2001) elaborated a case study of an important textile and apparel company in Italy, to provide useful insights about the importance of quality on a SCM environment. They compared the quality practices in two different kinds of supply network in the context of the focal firm, the one using a traditional customer-supplier approach and the other a more co-ordinated perspective. It was found that in the latter case that the whole supply network could enhance its ability to satisfy the end customer in terms of quality through the same identification and common management of quality practices and procedures.

Kaynak and Hartley (2008) used a structural equation model illustrating the relations between practices of quality management and supplier and customer sides in the supply chain. By using survey data gathered from firms operating in the U.S. they found a direct relationship between leadership, customer focus and supplier quality management. In addition to this, leadership was proved important to guide human resources and cultural practices. Moreover, it was revealed that suppliers' role in assuring low levels of defect incoming materials, affects both downstream quality and inventory management practices.

Casadesús and de Castro (2005), investigated the ISO 9000 series' role in the SCM context, by conducted a survey in 399 certified Spanish companies. They concluded that even implementation of the standard cannot assure that it will definitely cause benefits that will promote the supply chain to exceptional level, there are some specific parts that according to the survey, ISO 9000 has been beneficial to. These improved parts included enhanced customer satisfaction, improvement in meeting delivery deadlines, improved relationships with suppliers and fewer complaints from the customers' base.

Lo et al. (2007) conducted a survey of 138 leading manufacturing companies in Pearl River Delta region in southern China, aiming to investigate the extent to which competitiveness is being driven by the interaction of strategic supply chains and quality management systems. By using path analytic techniques, they examined the impact of contextual factors like size, process, ISO 9000 series and quality management on supply management. Moreover strategic supply management effects were studied on organizational performance concerning efficiency and customer satisfaction. The survey's findings support that strategic supply management is extensively related to the implementation of quality management practices but not to ISO 9000. Another finding is that the implementation of quality management might enhance strategic supply management. Quality management proved as a pivotal part of supply management and a prerequisite for continuous improvement across the supply chain. Moreover, a very important finding is that implementation of ISO 900 was not helpful concerning activities like cycle time improvement and timely delivery.

Sroufe and Curkovic (2008) investigated the effectiveness of ISO 9000:2000 in a SCM framework in the automotive industry. They were based in the Miles and Snow (2003) strategic typology, to examine the case studies of 14 automotive plants. They found that corporations that are motivated to seek certification for advertisement reasons will not gain the real advantages of certification. It was argued that ISO 9000 implementation itself does not provide a competitive edge and that, those who are

characterized as prospectors have more chances to achieve this goal. Also, it is demonstrated that differences in implementation lead to differences in the supply chain QA among a supply base that is mandatory to have registration. Furthermore, organizations with lower integration rate are characterized as reactors which customers will avoid.

Theodorakioglou et al. (2006) conducted a survey among ISO 9000 certified manufacturing companies in Greece intenfing to identify possible relationships between supplier management in the SCM framework and intra-firm quality management implementation. Research findings which represent buyers' point-of-view, demonstrate a positive correlation between supplier management practices and quality management practices and verify that intra-firm adoption of the quality philosophy can provide assistance towards the improvement of supplier management in the SCM framework.

Gotzamani et al. (2006) investigated the ISO 9000 series' role towards TQM and performance improvement, in a research that conducted among Greek certified enterprises. Even the research findings reveal that ISO certification can serve as a fair first step towards TQM and can help organizations to achieve an initial improvement in quality performance, it also reveals negative statistically significant differences between the organizations' overall performance and their relations with suppliers and particularly in subjects that relate the organization's collaboration with a restricted number of suppliers. The main barriers for close collaboration between suppliers and buyers are identified in the overall complexities that firms face in the implementation and in the risk of potential manipulation and reliance that are related to a restricted number of partners.

Finally, the study of Romano (2002) examines whether the diffused adoption of knowledge/confidence in the ISO 9000 quality system requirements by diverse supply chain members can influence the quality management practices and operational performance of firms across the supply chain. These subjects are investigated through the analysis of data obtained from a survey of 100 certified manufacturing organizations in Italy. The findings demonstrate that companies with the most sophisticated quality systems tend to buy widely from certified suppliers and to be more reliable concerning the quality of their deliveries. Nevertheless, this trust seldom causes the implementation of long term cooperative agreements. Furthermore, the effects of supply chain sensitiveness seem to be important on precision, delivery speed and volume flexibility. On the contrary, the impact on quality and cost performance is not important.

3.1 Theoretical Framework

In previous chapters it was analyzed that according to the literature, ISO 9000 series can provide a first step towards sound quality improvement. However, a lack of consensus exists regarding the impact of quality management systems and especially ISO standards on SCM (Sroufe and Curkovic 2008). This is the result of the limited number of studies focused on the relationship between the aforementioned variables (Azar et al. 2010 ; Golicic et al. 2005 ; Kanji and Wong 1999 ; Kaynak and Hartley 2008 ; Sila et al. 2006). In addition, as it has already been discussed, the effects of ISO series in small organizations remains vague as contradictory studies demonstrate.

What is more, the impact of ISO series in the SCM context of small organizations remains undiscovered. Relevant research among small organizations and particularly in Greece has not been undertaken. The present study aims to fill this gap as it intends to investigate the effects of the implementation of ISO 9001:2008 regarding potential improvement in the SCM context of small organizations in central Greece.

Moreover, an important point in defining SCM phenomenon is in specifying what can be included within the orbit of SCM (Chen and Paulraj 2004 ; New 1996). As it has already been pointed out, the present study utilizes the five practices proposed by Chandra and Kumar (2000) to address supply chain improvement.

The conceptual basic model of the present study is illustrated in Figure 6, where SCM practices are penetrated by ISO 9001 quality standard.

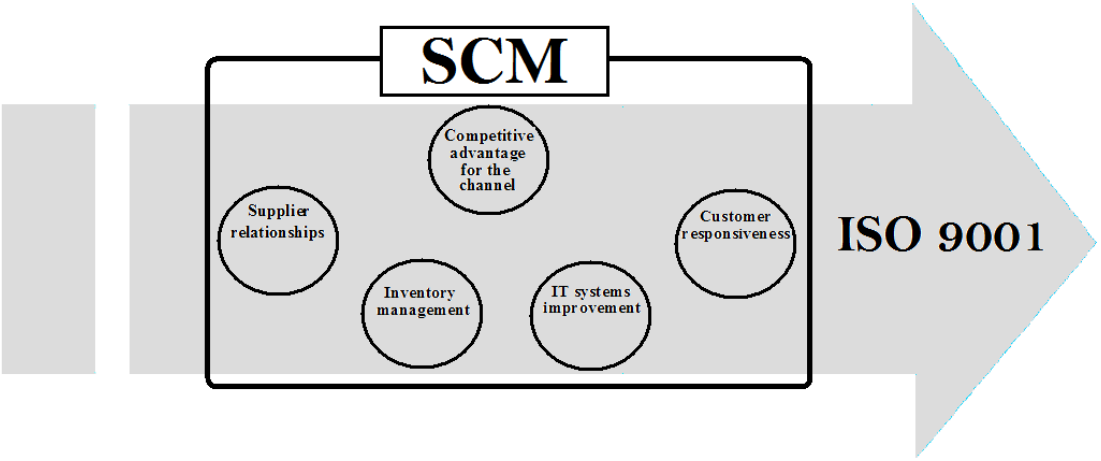

Figure 6. Conceptual model: ISO 9001 penetration in SCM practices

3.2 Research Methodology

Due to the lack of relevant research concerning the effects of ISO implementation in the SCM context of small organizations, there is an incomplete understanding of the why and how of such interaction's impact. Additionally, taking into consideration that the implications of the standard in such an environment have not been fully described and documented, the qualitative, case study method was chosen as the most appropriate. According to Yin (2003), case study methodology is particularity suitable in investigating the why and how questions among variables. Also, Hirshman (1986) argues that the aim of case study research is to "understand the phenomenon in its own terms", thus, perceptions and beliefs of the managers about the issues under study has to be fully understood.

Qualitative research is designed to go into the deep structure of the phenomenon from the informants' point of view and to explore the multiple dimensions and characteristics of it (Golicic et al. 2005). Qualitatitive research also helps to gain an understanding of why specific concepts are significant (Eisenhardt 1989). In addition, Samkin and Schneider (2008) argue that qualitative research can be as rigorous as the quantitative one. There are methodologies to ensure that the analysis of qualitative data by different researchers would lead to similar findings. The analysis of data can lead to objective and coherent explanation of the issues under study.

Moreover, a potential questionnaire survey would provide a limited investigation of the exact context and particularities that the implementation of a QA system includes. ISO 9000 is in fact only a framework for recognizing the managing activities that affect quality, and is being applied to a board range of companies, which, in turn, adjust its requirements to their particular needs. Hence the standard differ from firm to firm to a significant extent (Poksinska et al. 2006 ; Stuart et al. 2002).

In order to get more useful insights and to gain a deeper understanding of the connection between the standard and the practices of SCM the multi-case study method was followed (Yin 2003). The multiple case study approach is well suited for empirical development of testable theories (Eisenhardt 1989 ; Salvador et al. 2002 ; Voss et al. 2002). By applying the multiple case study approach it is possible to gain better and richer insights of the matter under investigation and to identify possible patterns emerging from the cases. Findings from multiple cases are considered more compelling, with higher external validity and generalizability of findings is increased (Eisenhardt 1989 ; Voss et al. 2002 ; Yin 2003).

Case selection and research instrument

A significant point in case research is to select cases from an appropriate population with the intention of avoiding, to a satisfactory extent, extraneous variations (Eisenhardt 1989 ; Koulikoff-Souviron and Harrison 2005). This includes bearing in mind, the potential impact of industry, size and internal processes (Stuart et al. 2002). Contrary to survey design, the selection of case studies should follow theoretical rather than statistical reasons. Thus, cases frequently aimed to be exemplary rather than representative (Koulikoff-Souviron and Harrison 2005).

The sample intended for qualitative research should be focused and selected on theoretical underpinnings and criteria (Eisenhardt 1989 ; Miles and Huberman 1994). Hence, in the present study by using replication rather than sampling logic (Yin 2003) the author builds a sample of cases that should fit a series of selection criteria. First, companies should be small, meaning that their number of employees could not exceed 249. Concentrating on small companies controls for variance due to size certain conditions. Secondly firms should represent different operative areas. The rationale for this criterion lies in the conception that investigating more than one industry would reduce the risk of discovering findings that are bounded to a specific industry or a specific type of product (Salvador et al. 2002). Also, external generalizability would increase (Sroufe and Curkovic 2008). Thirdly, case companies were not to be ISO 9001:2000 certified in order to be inexperienced about the standards' procedures and to provide more substantial and reliable answers concerning the transition from a non-QA period to the present one, and highlighting its changes. Forthly, the time from the registration was not to exceed three years. This reassures that participants would have recent memories about the transition process, while on the other hand would have a relatively good experience of implementing the standard. Nevertheless, after the completion of the two case studies, a need for investigating a company with some more experience of implementing the standard was emerged. It was considered that it would be interesting to explore a more quality experienced company in order to highlight possible differences and implications. Thus, a company which had implemented the previous version and was recently updated to the new was chosen. Fifth, the companies should be within the geographical scope of central Greece. Last but not least, the firms should be willing to articulate the issues under study and to reveal key issues about their activities. The selected cases can be characterized as typical (Miles and Huberman 1994) of small organizations in their operative area and relevant to the conceptual frame and research questions.

The technique used was face-to-face semi-structured in depth interviews with the managers responsible for the quality and SCM strategy of each firm. Originally, the research design was to address the issues under study to the SCM, quality, production

and IT managers. But, in fact and especially in small organizations, the organizational structure and job titles vary. This was the case especially, when identifying the SCM respondent. In addition, most of interviewees were often in charge of several functions of interest. Hence, while the research design called for a minimum of three different responders of each firm, two different interviewees per case can be characterized as satisfactory and reliable samples as most of the respondents had multiple responsibilities. Thus, the number of interviews was reduced but their breadth was increased.

The questionnaire is based on the five practices for effective SCM provided by Chandra and Kumar (2000). The selection of questions was based on the examination of relevant studies on the subjects under investigation. Most of the questionnaire items were adopted from the studies of Casadesús and de Castro (2005) and Tummala et al. (2006) which proposed similar research objectives and could be used as references. An overview of the questions asked in the interviews is given in Table 2. The entire questionnaire is provided in Appendix.

Table 2. Overview of the questions asked in interviews

Area of research	**Kind of questions asked**
Inventory Management	What is the impact of ISO implementation concerning stock rotation? What is the impact of ISO implementation in forecasting?
Supplier Relationships	Did ISO registration induce a change in your relationship with your suppliers? In what ways? Has implementation helped you to develop and maintain a trustworthy/positive relationship with your suppliers?
Customer responsiveness	What was the impact of ISO implementation concerning customer loyalty? Is there an improvement concerning customer satisfaction after registration? In what ways?
IT improvement	What type of IT systems does your company use concerning your suppliers/customers? Did implementation of ISO induce changes in this field? Do you use compatible information systems with your suppliers/customers? What are the changes in this field after ISO implementation?
Building of competitive advantage	What is the impact of ISO implementation in meeting delivery deadlines? Is there a change (increase or decrease) in total sales between the period before registration and now? To what extent/ways do you think that this can be attributed to registration?

Note: This Table presents a summary, and not the complete questions asked

The questionnaire included semi-structured questions which allowed respondents to talk about related issues in a broader context aiming to gain a more comprehensive insight about the issues under study (Abernethy et al. 1999). The questionnaire was divided into sections as follows: Firstly, general company and respondent information was covered. Perceptions before obtaining the ISO certificate were addressed in the second section. Subsequent sections contained the five practices of SCM under study, whereas, the final section addressed one closing and one clarifying question.

Furthermore, data were also gathered from personal observation, involving visits to stores and storage areas and companies' web sites.

Interviews and analysis

Interviews were conducted in October 2011 and the majority of them lasted between 40 and 70 minutes. They were generally conducted on site, while two of them were conducted in affiliates' offices. All interviews were recorded. Queries arising from interviews were answered through follow-up phone calls. In few cases, where inconsistencies between data sources arise, the respondent's view was adopted. The interviewees were allowed to study the questionnaire in advance and to check the case notes and conclusions. Feedback to respondents is recommended as a way to check validity and to get deeper understanding about the case (Miles and Huberman 1994 ; Nwankwo 2000).

All interviews were transcripted and analyzed. Within case analysis, the included research for central themes and reduction of long statements without affecting the respondent's point (Miles and Huberman 1994). Cross case analysis included searching for patterns across companies boundaries and data reduction through categorization that emerged from the data and predicted patterns (Miles and Huberman 1994 ; Yin 2003).

3.3 Data Quality

According to Yin (2003), four elements must be considered during the design and implementation of case study research in order to reassure its high quality and overall validity. The integration of these four elements in the present study is analyzed below. An overview can be seen in Table 3.

Construct validity ensures that the measures being used are sufficient and match the research concepts. It is delivered through triangulation of multiple data sources and chain of evidence (Yin 2003). The present research uses interviews, field notes, informal conversations and websites as multiple sources of data. Moreover, interviewees reviewed the draft case and final reports.

Internal validity necessitates investigators to establish if the right cause and effect relationships have been verified (Yin 2003). A common tactic to increase internal validity entails cross-case analysis of the findings (Voss et al. 2002), which is delivered in the present study. Moreover validating assumptions through pattern matching is also given.

External validity deals with the matter of generalizability of the results beyond the case sample. Replication of findings supports external validity in multiple case design where pattern matching approach is implemented. Replication of findings in multiple case research accomplish analytic instead of statistical generalization (Yin 2003). The author adopts replication logic in the multiple case design. Also, comparison of findings with similar studies is delivered (Eisenhardt 1989).

Reliability is the ability to systematically deliver similar findings across similar situations even by different researchers (Mentzer and Kahn 1995 ; Yin 2003). Reliability is delivered in the research design with the use of a specific case study protocol in all interviews and a mutual database for all collected data (McCarthy and Golicic 2005). In the present study, a specific case study protocol was followed in each case and database with the cases data was created.

Table 3. Quality and substantiation criteria of the present study

Element	**Quality criteria**	**Quality measures of present study**
Cunstruct validity	Repetitive and constant comparison (Eisenhardt 1989 ; Yin 2003) Multiple sources of evidence (Yin 2003) Establishment of chain of evidence (Eisenhardt 1989 ; Yin 2003)	Interviewees review the draft case and final report Use of multiple sources and collection methods Database with the case studies data
Internal validity	Cross-case analysis of findings (Yin 2003) Pattern matching, explanation building (Yin 2003)	Cross-case analysis delivered Search for patterns and explanations delivered
External validity	Use replication logic (Yin 2003) Comparison to similar literature (Eisenhardt 1989)	Replication logic adopted through multiple- case design Comparison of findings with similar studies
Reliability	Use case study protocol (Yin 2003) Develop case study database (Yin 2003)	Case study protocol followed in each case Database containing all cases data created

3.4 Presentation of Cases

In this chapter a brief description of the three cases under study is undertaken. For anonymity reasons, the names Alfa, Beta and Gamma were assigned to the organizations.

ALFA

Alfa is a plastics packaging company located in the industrial zone near Karditsa, Greece. The main activities of the company are the production and distribution of plastic caps for PET bottles which are utilized for liquid packaging. The company delivers a variety of cups for still drinks, carbonated drinks, milk and food oil which are produced against food contact legislations. Alfa's activities are addressed solely to companies (B2B) in the food and drinks sector. The company's customers' list includes mineral water producers, beverage companies and dairy products companies, which many hold significant market shares. The company was founded in 2007 and since then it holds a rather competitive market share in respect to its size. Alfa's personnel are seven people in total. ISO 9001:2008 certification was obtained in August 2010.

BETA

Beta is an electromechanical and energy works company located in Karditsa, Greece. It was founded in 1995 and its fields of operation include the study, construction and maintenance of electrical and energy systems as well as the trading and installation of relevant products. The company is focused on providing studies in the fields of water supply, drainage, heating/cooling, air conditioning and electrical installations. In the trading sector, the company provides products for heating (boilers, burners, radiators), air conditioning (central systems, fan coils, split units), natural gas (boilers), ventilation (axial, centrifugal and ceiling ventilators), pumping stations (pumps, submersible pumps), solar energy (solar water heaters) and photovoltaic systems (frames, inverters). The company addresses its activities to both companies and individuals and holds a significant market share. The company counts nine people in total as its workforce while ISO 9001:2008 registration was completed in July 2009.

GAMMA

Gamma is an IT systems company founded in 1985. Its activities include the trade, installation and support of personal computers, fax machines, cash registers and photocopiers. Moreover the company's operations expand to the development and support of custom made electronic systems and applications, the design and

application of electronic shops and the design and development of wireless networks. Gamma is addressing its activities in both individuals and companies in the private and public sector and holds an important market share. Its headquarters and one branch are located in Karditsa, while the second branch is located in Larissa. Gamma's workforce includes managers, technicians and employees, a total of 28 people. ISO registration was first obtained in 2002, while the latest version was acquired in June 2010.

4.1 Findings

Perceptions before obtaining the ISO certificate

Standardization of processes mentioned from all respondents across the three cases as a main motive for acquiring the ISO certification. Assurance of quality in procedures, in general, was mentioned by the people of Alfa and Gamma, while these of Beta believed that enhanced quality was needed in procedures which were characterized by poor performance (i.e. inventory documentation). ISO certificate was considered as a powerful marketing tool for Beta, as it would be the first local firm in its sector that would be certified. Gamma's managers thought that registration would be a positive addition to the firm's image while these of Alfa emphatically pointed out that did not seek registration for advertisement reasons in advance, but finally standard was proved beneficial in this field.

Externally generated motivation, mostly from customers was recognized by Alfa and Beta. Alfa sought conformity with existed customers that demanded the certificate and potential new ones that had as a prerequisite the standard for their suppliers, while in Beta, certification was asked from potential future customers of big size. Gamma did not recognize external motivation but improvement of the customers' perception about the organization was addressed:

> Our intention was to create a positive perception to our customers about the organization in total (Quality manager, Gamma).

All three cases connected the perceived operational field where registration would have the greater impact, with their motives for registration. Moreover, Alfa's managers pointed quality and standardization of production as the fields that they thought that the registration would be beneficial in. Beta indicated improved cooperation with partners, while Gamma addressed suppliers' increased confidence.

As far as relationship with suppliers is concerned, Beta's perception was that its suppliers would feel that the company's reliability is increased. It was considered as a good opportunity to differentiate itself in demanded suppliers and to be positioned as a company that can deal with big quantities of products and increased expenses. Similarly, Gamma's managers thought that transactions with suppliers would significantly improve as a result of the improved organization's credibility. On the contrary, Alfa expected no differences in the relationship with their suppliers.

Relationships with customers constitute an area where all cases awaited significant improvement after ISO implementation. Assuring quality of the products for Alfa is pivotal as its merchandise is used in bottling of drinks. It was thought that declared product quality would constitute a decisive point for the continuation of collaboration with existing customers and creation of new ones. Beta's perception was that the certification would prove beneficial for big organizations and plants which would potentially perceive registration as assurance of efficient products and tasks, whereas Gamma's people awaited improvement in the field as a result of improved internal procedures that would untimely enhance customers' satisfaction.

Impact of ISO implementation on inventory management

Stock rotation was considerably improved after ISO implementation in all case organizations. Better control of the stock and efficient documentation of processes in transportation of goods were particularly pointed out by most managers.

> Prior to ISO implementation transportation of products had no standardized procedure and was implemented on opportunism and convenience basis. After registration the procedure has been standardized to a quite satisfactory extent. It is better in the sense that enable us to implement a FIFO inventory procedure of departures in stock, which in turn provides price safety (CEO, Alfa).

The main raw material that Alfa uses is plastic. Plastic is not a perishable material but its price is market sensitive, meaning that is daily changed according to stock market of mercantile exchange. FIFO inventory system provides a relative assurance that the selling product is sold in efficient cost.

Implementation of the standard helped all three companies to develop more clear and precise documentation of the stock in store, thus enhancing monitoring and efficiency of flows.

> Before registration, inventory management procedures were implemented on a self-impression basis. There was no sufficient documentation but the work was completed because all data were in our mind. We cannot say that inventory procedures are different now. But we can say that are better organized. We wanted to clear our minds. We wanted to create some routine-procedures because of the increase in the production (Vice CEO, Alfa).

The same benefits were addressed by the other two cases. Beta's quality manager highlighted the improved data availability.

> The firm now has a clear view about stock levels of each and every different component and can place orders exclusively for components that are of limited number. This is particularly important because the firm's operations demand a huge number of different components like

> screws, wires, switches etc. Prior to implementation frequent visits to storage areas were necessary to inspect stock levels and to place orders. Departures of stock were in many occasions not documented or documented in informal forms that were easy to be overlooked or lost. This caused limited or excessive stock in many cases (Quality manager, Beta).

Similar benefits were addressed in Gamma where the standard proposed ways of recording and control of the products through documentation and electronic inspection, which allowed Gamma to apply more efficient monitoring and distribution of goods across the company's three stores. Lack of products is rarely appearing due to these procedures.

All case companies apply a mixture of anticipation and safety stock inventory system. This means that orders are placed on seasonal demand and when demand can be predicted but at the same time a part of inventory is kept for possible sudden increase in demand. These sudden changes on demand affected inventory levels and caused inventory shortages especially in Beta where the components are much more and easy to lose track. Enhanced monitoring and documentation procedures helped the companies to have a more close view of their storages, thus taking fast and timely decisions about the replacement of products and raw materials.

Lead times were considerably reduced in Beta after implementation of the standard. This is attributed to better control of the human resources.

> Through the documentation of all procedures and tasks that the standard require we are aware of the exact position and task of our external human workshops. Thus we can direct them much more efficiently and without delays. We have minimized lost working hours to a great extent, perhaps more than 30% (Quality manager, Beta).

According to the managers of Gamma, ISO implementation did not induce a shift in lead times but enabled the firm to keep control and to check the stages of deliveries in a most efficient way through the improved traceability.

> We can monitor and supervise the delivery much better now and we directly intervene where potential problems emerge (Purchasing manager, Gamma).

From this argument, it can be concluded that lead times were improved even though Gamma's managers do not clearly declare this. As far as Gamma is concerned, no changes were observed in lead times. Orders were completed always on a specific time schedule as is the case now.

In the forecasting field no changes were identified by the people of Alfa and Gamma. This is quite logical because no requirement that can be connected to forecasting was added to the standard in the first place, by the two firms. In Beta, it is considered that forecasting was enhanced by the documentation of past data that can be used as a reference for future demand.

Enhanced monitoring and documentation also proved beneficial in the activities taken after shipments delay, loss or destruction. Beta's people declare that after registration, appropriate actions are easier to be taken. Prior to certification, lack of formal documentation was the cause for no further investigation of such cases. Similar statements are addressed from Alfa.

> We now have more reliable and efficient data that can be used as proof in potential cases of shipment delays or destruction. By using traceability as proof we can ask for compensation in such possible cases. We can also monitor our partners in the logistics section much better by keeping records and by using this feedback to evaluate their performance and reliability in the long run (Vice CEO, Alfa).

Gamma is applying exactly the same procedures as in the period prior to registration, but through monitoring can act in a more direct and swift manner.

Impact of ISO implementation on relationships with suppliers

The implementation of the standard provided significant assistance to Beta and Gamma in creating more positive, reliable and professional relations with their suppliers. Suppliers of Beta improved their efficiency and have developed a more professional attitude. This can be attributed to the more formalized way of doing business, because it became much more professional and standardized to place an order.

> Suppliers respond in a much more formal and efficient way because they receive a well documented, formal order and they feel that more attention has to be paid. This is totally different than just making a phone call (Quality manager, Beta).

The standard enhanced relationships with suppliers in Beta not only externally but concerning internal procedures too. Prior to registration, orders were placed in a convenience oriented and rough basis. There was no control of the deliveries because the firm did not have proof to intricate exact orders to suppliers. Several times, the company ended up receiving products with different specifications than the ones that it had ordered. Traceability and documentation of the orders helped Beta to improve professionalism of its suppliers.

Similar statements were addressed by managers of Gamma. ISO certification was proved beneficial in terms of deeper recognition and appreciation from suppliers. Suppliers are now more careful and formal in transactions and orders of products and/or additional services. The company's status was improved and is considered among partners, as a highly professional operating firm among the supply network.

Improved company image among suppliers was a benefit for Alfa too. This can be attributed to the improved quality in the daily procedures, although the managers of Alfa do not recognize that this can generate better relationships with suppliers in general.

> Our image is getting better for our suppliers not only by the registration itshelf (which does play an important role in suppliers that are not our partners) but by noticing the improved quality of our procedures (...). On the other hand trustworthy and positive relations with suppliers can be achieved mainly by reliable financial relations and not certifications (Vice CEO, Alfa).

In addition, Alfa's people pointed that the monitoring that was applied after registration has made it easier to trace back in data concerning suppliers. This will help them to understand some important points about their suppliers' performance better. That was not easy to do prior to implementation. Hence, they can now evaluate their suppliers better in order to decide if their collaboration should continue. This was the case for Beta too, as identification of suppliers' shortcomings and advantages through documentation helped the company to create continuous collaboration only with the suppliers that, according the data, were proved efficient.

Furthermore, registration helped Beta to create relationships with bigger companies that perceived non-registration as a quality barrier. The firm's goal was to expand its operations and cooperation with larger companies was important. According to the people of Beta, the firm managed to remove the ''small company'' label.

All companies maintain long-term relationships with its suppliers. Relationships with existing suppliers were tightened for Beta and Gamma even the firms had long term collaborations with their suppliers in the period prior to registration. According to the people of the firms, the registration stabilized their collaboration with powerful and sophisticated suppliers even more, a fact of considerable importance in the highly mutable and demanding markets where they both operate. For Alfa, ISO registration was not seen as an enhancement in this field.

> Our main goal is to avoid shortness of material, so long-term relationship with our suppliers is important. But I do not think that this has anything to do with the implementation. We had trustworthy relationships even before registration (CEO, Alfa).

As far as the field of problem solving with suppliers is concerned, the matter of traceability was once again mentioned by most of the managers. Traceability, monitoring and formalization of the procedures can clarify possible arguments with suppliers and will help them to solve possible conflicts more easily and in much less time. Only one respondent had a different view on this.

> We have financial issues with our suppliers. Problem solving has nothing to do with ISO implementation (CEO, Alfa).

Impact of ISO implementation on customer responsiveness

Registration is considered by all cases as beneficial in the customer satisfaction and loyalty fields. Alfa in general, had loyal customers even before ISO 9001, but implementation made their relationships even more stable because the majority of customers were pleased after registration. They thought that their supplier is getting organized in a much more professional basis. They feel much more secure now, because they consider the whole production process is more controlled and inspected by better means. Hence, they consider the final product better in quality terms. They feel that the quality of the product is reassured through a more sophisticated inspection process.

Beta's people are recognizing enhanced customer satisfaction as a result of the improved performance of internal and external procedures of the company.

> Most of the small customers do not care if we implement a QA system. But, on the other hand there are critics of our performance. Our performance has been improved from the implementation of the standard and customers are more satisfied. In this rationale, implementation of the standard improved customer satisfaction and royalty (Quality manager, Beta).

A similar statement is delivered by Gamma.

> Individual customers are probably not aware that our organization is certified against ISO standard. Nevertheless, the standard provides to us some valuable tools to upgrade our procedures and responsiveness to them (Purchasing manager, Gamma).

In addition, according to Gamma's managers, standard's requirements provide useful insights into the improvement of product display in stores, better packaging and enhanced product installation in both storages and stores' facades. Furthermore, the needs for price labels in all products and instant replacement of reduced ones on display were indicated from the standard. In Beta all workers are now formally evaluated and possible weaknesses are documented. Hence, in a similar task in the future the same worker will be excluded and a more efficient one will be preferred. It can be said that all these actions enhance the companies' immediacy to the customers and in turn customer satisfaction.

Moreover, some of the principal customers of Alfa had asked for the registration in order to continue to do business with the company. They were not skeptical about the quality of the product but they asked for certification in order to comply with the international trends that ask for registered supply chains. It can be said, that this is a sound example of the ''domino effect'' which is mentioned largely in the literature.

In the fields of problem solving and management of conflicts, the implementation of the standard proved beneficial for all case organizations. Formal documentation and enhanced documentation of transactions with customers are addressed as means for gentle management of conflicts. Furthermore, conversations with customers are encouraged and most important points are documented for further analysis. This is addressed in the following statement.

> In case where a customer point out that he or she found a product at a cheaper price or in better after sales support, we document this and try to find out the reason of the differentiation. For instance, perhaps a specific product hit the market at a promotional price and we were not aware of. Moreover, it is another good way to get informed about the market (Quality manager, Gamma).

After registration, customer complaints are easier to be addressed in all three organizations. There was a lack of formal procedures concerning customer complaints, which were addressed with informal talks. Moreover, no official documentation was in place. The implementation introduced a formal complaint form which gave the customers the opportunity to address their complaints in a more formal way. Thus, customers feel that attention is paid to their opinions and desires and companies can gain valuable feedback about their performance. Complaints' figure was slightly increased for Alfa and Gamma but this was attributed to the lack of formal complaint procedures in the past and not to changes resulted from implementation of the standard.

IT systems improvement

Even the introduction of IT solutions across the supply chain is considered as critical these days, only Gamma is applying some IT tools to enhance interactions in the upstream and downstream sides. Gamma is applying EDI/ERP systems with its suppliers. Nevertheless, the size of the company demonstrates that its major suppliers, which are huge multinational corporations, do not keep track at its inventory levels. So, it is concluded that the relationship is not bidirectional. Even so, Gamma has direct access to the suppliers' available stock and can place orders at any time in order to secure the desired product. By securing the demanded item the firm can take fast decisions and to provide direct answers to customers' claims, which in turn improve customer satisfaction. Nevertheless, these tools cannot be characterized as state-of-the-art or sophisticated ones.

What is more, specific ISO requirements lead the company to utilize software applications which enables everyone in the company to have access to data regarding inventory levels and identification of products in every store, but these software systems are addressed for internal organizational procedures and cannot be characterized as beneficial for channel elaboration as a whole.

In contrast, Alfa and Beta do not use compatible information or/and management systems with its customers and suppliers. They place their orders via fax machines on the standardized ISO form, and a copy is kept for future reference.

Building of competitive advantage

ISO implementation did not induce a change concerning the logistics costs in Alfa and Beta but in Gamma a moderate decrease appeared. Better documentation and editing of inventory levels and customers' orders helps the company to place bigger, and thus, more cost efficient orders when time is not an issue.

In Alfa and Gamma, delivery deadlines were not affected by registration, in a positive or negative way.

> We tried to form a light assurance system by minimizing the needed bureaucracy and paper work to the lowest accepted level. We wanted a flexible and easy-to-use system that would not cause unwanted delays and would keep us concentrated on work and not on paper procedures (CEO, Alfa).

Conversely, implementation of ISO led Beta in considerable improvement concerning delivery deadlines. This is attributed to the enhanced allocation of human resources. Specific workers undertake tasks that according to records are more effective on. Hence task's demanded time is reduced.

In the fields of total sales and market share, Alfa's managers acknowledge significant increases by 44% and 5% respectively, compared to prior the period prior to implementation. According to Alfa's CEO this could have been the case even without the registration.

> We achieved an increase in our total sales and market share but this could have been done even without the implementation of the standard, if we had addressed our product to more small customers. We had this chance. The standard proved beneficial in that we were able to increase our total sales and market share by addressing our product to less but much bigger customers. They are the key players in the field. In a sense, we feel much more secure now. We cannot base our sales on small customers in the long run. There are not durable in difficult financial circumstances like the present one (CEO, Alfa).

Important increases are addressed by managers of Beta too. Total sales and market share were both increased by 35% and 10% respectively from the period prior to implementation. According to the people of Beta this is the outcome of increased market demand, especially in the photovoltaic systems sector. The organization acknowledges the contribution of ISO quality standard in these increases to some extent, as the improvement in human resource management, documentation and monitoring fields are extensively highlighted.

As far as Gamma is concerned, total sales have been increased by 100% from the period prior to implementation, but this increase took place over a much longer time period in comparison to the other two cases since Gamma has obtained registration since 2002. The role of the standard is moderately acknowledged as it provides assistance in a range of important subjects, which have already been discussed, but the sales boom is attributed to a great extent to the general development of the IT market and dominance of the internet in recent years. On the other hand, total market share has decreased from 40% to 30% which can be characterized as an acceptable rate, considering the aggressive expansion of IT related companies to the area in the last decade.

4.2 Discussion

The general impression generated from the research findings indicates that after implementation of the standard, case organizations were improved in a range of important fields towards SCM excellence. Data reduction and categorization process created Table 4 in which an overview of improvement areas among the five research entities is presented for each organization.

Table 4. Overview of cases' improvement areas

Improvement areas		Alfa	Beta	Gamma
Inventory Management	Stock rotation	●	●	●
	Lead times		●	●
	Forecasting		●	
	Activities after shipments delay, loss or destruction	●	●	●
Supplier Relationships	Development of positive and reliable relations		●	●
	Long term collaboration		●	●
	Problem solving/management of conflicts	●	●	●
Customer responsiveness	Customer satisfaction	●	●	●
	Customer loyalty	●	●	●
	problem solving/management of conflicts	●	●	●
IT improvement	Compatible IT systems with supplier/customers			●
	Use of EDI/ERP systems			●
	Use of automatic management systems			
Building of competitive advantage	Logistics costs			●
	Meeting delivery deadlines		●	
	Increase/decrease in total sales	44%	35%	100%
	Increase/decrease in market share	5%	10%	(10%)

Legend: ●: To a great extent ●: To some extent

After the implementation of the standard all three cases indentified improved stock rotation through more efficient documentation, monitoring and traceability of products and data. This is in agreement with the study of Forker et al. (1997), which also addressed improvement of data collection in the supply chain that resulted from

the adoption of TQM practices. Product flows become easier to be handled through standardized procedures and electronic inspection. Minimizing variance in internal processes is also addressed by Sroufe and Curkovic (2008) as significant advantage of ISO implementation. Also lead times improved in Beta and Gamma while they remain unvaried in Alfa. This can be characterized as important assistance even in Alfa, where although lead times remained the same, the whole procedure has been improved in quality terms and generate valuable feedback. Salvador et al. (2001), also identified enhanced time performances resulted from interaction among suppliers and customers on quality issues across the supply chain. In forecasting, only Beta identified a moderate improvement and this can be attributed to the lack of relevant requirements in the design stage of the standard. Moreover, ISO implementation proved beneficial in the activities taken after shipments delay, loss or destruction for all organizations. This is attributed to the monitoring and documentation that an ISO system provides which can provide a source of substantiation.

More positive, reliable and professional relations with suppliers were addressed by Beta and Gamma which resulted from improved attitudes and appreciation from suppliers. This conclusion is also delivered from the study of Casadesús and de Castro (2005). Also, improved company image for their suppliers was pointed by the people of Alfa and Gamma. Relationships with existing suppliers were tightened for Beta and Gamma which can be attributed to reliable documentation that companies now hold and can be used as a tool to detect and consequently solve possible problems and emerging conflicts. Sroufe and Curkovic (2008) also praise the importance of documentation process in discovering and solving problems. Companies use documentation processes to discover and solve problems while introducing enhanced visibility in transactions with suppliers. Without an efficient performance measurement system it is not easy to evaluate, manage and lead people accountable for their actions.

In the field of customer responsiveness, registration to the standard proved beneficial for all companies, as is the case in the research of Casadesús and de Castro (2005). Customer satisfaction and loyalty was improved from better organizational performance and additional activities taken to highlight that customers are considered important for the organization and their opinions are taken under consideration. Enhanced traceability and formal documentation of procedures and transactions were addressed as helpful concerning problem solving and management of conflicts from all managers. What is more, improved customer complaints procedure was another important benefit acquired for the implementation of the standard.

Conversely, implementation of the standard did not induce improvements in the introduction of IT solutions in the three case organizations. Alfa and Beta, continue to implement the same procedures and software systems as in period prior to implementation. There are two points that can be identified as causes for this. First cause is the size of case organizations which can justify a comparatively low IT knowledge. Vaaland and Heide (2007), confirm this point as they conclude that smaller companies have difficulty concerning adoption of modern technology systems. Second cause is the non-adoption of such systems from their suppliers and customers. Gamma is applying a range of EDI/ERP systems across the channel boundaries, but these can be characterized as solely the first step towards superior IT systems collaboration across the supply chain.

ISO implementation was proved beneficial in the field of logistics costs only for Gamma which changed their policy concerning placement of orders. Better documentation and editing of inventory levels led the company to place bigger and more cost efficient orders. On the other hand, improved human resource management was the cause for improved delivery deadlines by Beta, but it must be considered that this is the outcome in manual tasks and not delivery of goods. Hence, it can be said that the standard did not prove beneficial in delivery of actual products and this comes to line with Lo et al. (2007) conclusions.

Total sales revenue was significantly increased for all case organizations in comparison to prior to registration period. Furthermore, market share was increased for Alfa and Beta and decreased for Gamma. Nevertheless, it must be argued that these figures can only be used as indicators of financial performance in the periods prior and after registration to the standard. It is not possible to directly connect these economic aspects with the implementation of ISO standard. Economic growth is connected to a variety of factors and the general strategic orientation of the companies which cannot be described in a QA system context.

From the research findings it can be said that most of the managers' expectations which motivate them to obtain registration, were fulfilled. Standardization of processes which was a motive for all case organization was achieved to a quite satisfactory level along with the upgraded company image which Beta and Gamma desired. Furthermore, Beta achieved to improve collaboration with partners and Gamma enhanced their confidence. Finally, all cases improved their relationships with customers, an initial motive which was fulfilled to a great extent.

5.1 Conclusions

The long-term success of a company is extensively depended on the successful collaboration with suppliers and the satisfaction level of customers (Chandra and Kumar 2000). Taking this into consideration the purpose of this study was to investigate the effects of ISO 9000 quality standard implementation in the SCM framework of three small organizations in central Greece.

Similarly to the conclusions of Casadesús and de Castro (2005), the present study shows that it is not possible to assert that implementation of ISO 9000 QA system completely promote SCM practices. Nevertheless, it can be concluded that there are specific sections where significant benefits were indentified and others where some kind of assistance can be acquired.

Specifically, the greatest impact from the implementation of the standard in the three cases was identified in their relationships with customers. Implementation enabled all case organizations to significantly improve customer satisfaction and loyalty which in turn leads to improved customer responsiveness. Important benefits were also discovered for two of the cases concerning relationships with their suppliers, as implementation helped organizations in the establishment of positive and reliable relations and long term collaboration. Fewer benefits where identified in the inventory management section where, nevertheless, stock rotation was considerably improved for all cases.

In contrast, it was revealed that small organizations appear to be far behind in the adoption of technology systems solutions which is considered an issue of considerable importance for effective supply chain collaboration. This conclusion comes to verify the findings of Vaaland and Heide (2007), which also addressed smaller organizations' poor adaption of sophisticated IT systems.

What is more, implementation of ISO 9000 seems that do not provides a base in organizations' effort to build a competitive edge. Although, some benefits were addressed, we cannot directly connect the overall economic growth of the three cases to registration. Their financial performance is mainly attributed to the expanding markets in which they operate and their overall aggressive development.

In accordance with other studies (Conti 1999 ; Sroufe and Curkovic 2008 ; Williams 1997), it can be concluded that an ISO system provides a valuable framework towards performance improvement along the supply chain, and can provide foundations in specific external areas. Furthermore, it provides adopters a range of valuable tools to stay focused on the ultimate objectives of SCM (Mentzer et al. 2001). But, it definitely cannot be considered as a panacea for every organizational disadvantage or deficiency. Furthermore, the desired outcomes and benefits from the implementation of an ISO standard depend considerably on the devotion that every company shows in quality matters (Poksinska et al., 2006) and its willingness to apply procedures that will enhance the supply network (Casadesús and de Castro 2005). A quality standard, when used under the right conditions, has the power to improve quality across the supply chain but cannot provide a competitive advantage on itself. The mode of implementation and use in regard to the other supply chain members, constitute the decisive factors that can lead to excellent channel performance.

5.2 Research Limitations and Implications for Future Research

The author acknowledges that the present research is subject to a number of limitations, which can be overcome in future research attempts. First, the apparent limitations of the case study research methodology are recognized. Even though a relative generalization can be attributed which stems from the multiple case study method that was used and the fact that case organizations have several generic characteristics, the external validity of the findings needs to be empirically tested on a larger sample. Secondly, the focus on small organizations for the case organizations, significantly affects the results due to size particularities. Future research can cross this boundary by addressing the research questions to companies of multiple sizes. Furthermore, this study relied on the perceptions of the respondents, which means that there is a possibility of introducing bias into the research findings and, in turn, affecting reliability. Future research endeavors could use (where applicable) quantitative research and hard data measures to address changes resulted from ISO implementation in the SCM context.

Also, even though the SCM practices proposed by Chandra and Kumar (2000) and used in present study, illustrate major aspects of the SCM context, they cannot be considered comprehensive as the concept of SCM is very extensive. Other important areas of SCM literature can be addressed in future research. Finally, this study was addressed to Greek companies in a restricted geographical scope. Perhaps results would be diverse in other countries, where quality and SCM practices are more sophisticated. Comparison of the present findings with results of similar studies conducted in other countries would be an interesting development in search of common international trends or discriminations.

5.3 Reflection on Learning

The present study is expected to contribute to the body of knowledge by delivering valuable insights regarding quality assurance in the SCM context of small organizations. To the author's knowledge this is a pioneer study, as it addresses these issues in the Greek business environment and especially in Thessaly region. Implications for practitioners and academics can be detected, and include evidence of how ISO quality assurance standard acts on a SCM framework and the specific areas in which ISO implementation proved beneficial for the companies and them where more rigorous effort is needed. Nevertheless, it is recommended that caution has to be used in generalization of the findings as restrictions emerge from the research limited sample and specific geographical scope.

Abbreviations and Acronyms

B2B	Business-to-business
e-commerce	Electronic commerce
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
ISO	International Organisation for Standardization
ISO/TC 176	The ISO Technical Committee responsible for the ISO 9000
JIT	Just-in-time
PET	Polyethylene terephthalate
QA	Quality Assurance
QC	Quality Control
SCM	Supply Chain Management
TQM	Total Quality Management

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Appendix

A. Questionnaire

This questionnaire was formed in order to be used as the main research instrument on a research, conducted by a postgraduate student of Staffordshire University, as part of his dissertation, and aims to examine the perceptions of managers on the potential benefits of ISO 9001 quality standard with respect to SCM improvements before acquiring the ISO certificate, as well as to explore the actual impact of the ISO implementation on the SCM practices.

The questionnaire consists of two main parts. The first part includes open-ended questions aiming to discover the basic interviewees' perceptions concerning SCM before obtaining the ISO 9001 registration, while the second part examines the actual impact of the ISO 9001 implementation in the fields of (1) inventory management, (2) supplier relationships, (3) customer responsiveness, (4) IT improvement and (5) building of competitive advantage for the company.

OPENING QUESTIONS

- What is/are your job titles?
- Number of years in current position?
- Number of employees in company?
- What are the primary products produced by your company?
- Please, briefly describe and explain the management system you currently use in your firm and the supply chain

PART I: Perceptions before obtaining the ISO certificate

- What are the primary reasons that motivated your company to seek ISO certification?
- In which sector of your company you thought that the implementation would have the greater impact?
- What changes did you expect from the ISO implementation in the SC/SCM context?
- What changes did you expect from ISO implementation concerning the relationship with your suppliers?
- What changes did you expect from ISO implementation concerning your customers?
- What changes did you expect from ISO implementation in the overall performance of your company?

PART II: Impacts of ISO implementation on SCM

1. **Inventory Management**

- What is the impact of ISO implementation concerning stock rotation?
- Has implementation caused a change in lead times? In what ways?
- What is the impact of ISO implementation in forecasting?
- Is there a change, after ISO implementation, in the activities taken after shipments delay, loss or destruction?

2. **Supplier Relationships**

- Did ISO registration induce a change in your relationship with your suppliers? In what ways?
- Has implementation of ISO helped you to solve problems concerning your suppliers? In what whays?
- Has implementation helped you to develop and maintain a trustworthy/positive relationship with your suppliers?
- Are you maintaining long-term commitment with your suppliers? How implementation of ISO acted on this?
- Is there a change, after implementation of ISO, in the fields of problem solving and managing conflicts with your suppliers? Describe this change

3. **Customer responsiveness**

- What was the impact of ISO implementation concerning customer loyalty?
- Is there an improvement concerning customer satisfaction after registration? In what ways?
- Has implementation caused a change concerning customer complaints?
- Has implementation helped you to develop and maintain a trustworthy/positive relationship with your customers? Describe how
- Is there a change, after ISO implementation, in the fields of problem solving and managing conflicts with your customers? Describe this change

4. **IT improvement**

- What type of IT systems does your company use concerning your suppliers/customers? Did implementation of ISO induce changes in this field?
- Do you use compatible information systems with your suppliers/customers? What are the changes in this field after ISO implementation?
- Has implementation been favorable in the use of EDI/ERP systems? In what ways?

5. **Building of competitive advantage**

- Has implementation of ISO induced a shift in logistics costs?
- What is the impact of ISO implementation in meeting delivery deadlines?
- Is there a change (increase or decrease) in total sales between the period before registration and now? To what extent/ways do you think that this can be attributed to registration?
- Is there a change (increase or decrease) in market share between the period before registration and now? To what extent/ways do you think that this can be attributed to registration?

CLOSING QUESTIONS

- Do you have any final comments that you would like to make before we finish this interview?
- Can we use your name in the context of this research?