



TQM IMPLEMENTATION

How improving quality improves supply chain management: empirical study

Supply chain management

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Abstract

Purpose – Much has already been written about the effects of ISO 9000 standards on business performance, mostly supporting the notion that implementing a standardized quality management system is beneficial. That said, no studies have been made into the impact that the implementation of these regulations has had on improvements, if any, to supply chain management (SCM). This paper aims to give an initial outline on this subject.

Design/methodology/approach – Using the five strategies proposed by Chandra and Kumar in 2000 that aimed at stimulating the implementation of correct SCM, along with an empirical study carried out in nearly 400 companies certified to ISO 9000 standard, how this quality assurance standard contributes to successful SCM implementation is analysed.

Findings – From the obtained results, it is interesting to point out that not only those indicators which show clear improvements in the SCM have been found but also those aspects in which the companies themselves recognize their limitations.

Originality/value – This paper is one of the first to analyse the effects of the implementation of a Quality Management Standard such as the ISO 9000, through SCM.

Keywords Quality assurance, Supply chain management, ISO 9000 series

Paper type Research paper

Introduction

Since the 1980s, quality has become a major influence in the business world. Although, in general, for the major companies it all began with applying the theories of the quality gurus, especially doctors Deming and Juran, it is also true that the definitive push, especially for the small and medium-size companies, came about with the appearance of the quality assurance standard, ISO 9000. Without doubt, its increasing implementation in companies all over the world continues to be the main driving force behind improvements in quality management. At present, the drive to get this ISO 9000 certification is due not only to companies needing it as part of their competitive arsenal but also, simply to avoid being left out of their own markets.

On the other hand, in a more or less parallel development, in recent years, companies have also seen the advantages of working collaboratively with their suppliers and customers. This collaboration has led to the coining of the well-known concept of supply chain management (SCM).

The existence of a certifiable quality standard such as ISO 9000 has led to wide diffusion and repercussion of the concepts related to quality management, even concepts related to total quality management which, in principle, is somewhat far removed from quality assurance itself. In contrast, the fact that such an obvious tool



does not exist for SCM has led to exactly the opposite situation. Not only, as in many cases, to an ignorance of the implications and benefits of this business philosophy or culture, but even to an evident confusion of terms.

Nevertheless, even with the existing confusion in terms of the concepts of SCM, it is certainly more and more clear that the future is one of the interconnecting companies, communities and clusters of companies and users, permanent connection with suppliers and customers, total integration in applications, remote business and the continuous set up and dismantling of networks (IESE, 1999).

The main objective of this paper lies right at the integration of these two highly topical concepts, quality management and SCM. Basically, we asked ourselves whether a company involved in TQM improves its SCM. Evidently, the answer has to be yes; otherwise, we would not be interpreting total quality management in its widest and most correct sense. However, in the present business climate, in which most companies begin the total quality management adventure by means of quality assurance, which in practice means getting the ISO 9000 standard certificate, does the same thing happen? In other words, when a company gets the ISO 9000 certificate, does its SCM improve? In this case, the answer is no longer so clear, and deserves further analysis.

For this reason, with the main objective of evaluating the real effects of ISO 9000 certification on the supply chain, the Catalonian Quality Center funded an empirical study in 2002, which we present here in this paper. The study, in which nearly 400 companies participated, was conducted by the University of Girona, and is without a doubt, a pioneering study in its field.

This paper begins with a brief description of the main objective to be analyzed, followed by a review of the very few research articles available which investigate the effects of ISO 9000 on SCM. This is followed by an illustration of the methodology and the results of our survey of nearly 400 companies in Spain in 2002. Finally, the paper concludes with a discussion of results and a brief statement on future research.

Main objectives

The main objective of this investigation is to analyze how the implementation of a set of standards, which, in the case of ISO 9000 have been implemented to an enormous degree all over the world, can improve SCM.

Why did we study the implications for quality management in terms of ISO 9000 certification? In the first place, because it is the route chosen by the great majority of companies. In recent years, companies have continued to choose this route to improve quality management, and certification continues to increase in number. For example, in Catalonia, a Spanish region, where we carried out our survey, there were about 1,000 certifications in 1998. This increased more than fourfold, to about 4,500 in 2002. Another reason we chose the ISO 9000 standard is that certification is registered, which allows us to find out exactly which companies are included in this group and which are not.

The results of such an investigation, which, as will be seen, are obtained from empirical data, appear to be, *a priori*, somewhat uncertain. To begin with, there is already some uncertainty when analyzing the impact of the ISO 9000 standard in companies. Thus, while authors such as Vloeberghs and Bellens (1996) emphasize its positive effects, others, such as Berny and Peyrat (1995), blame it for increasing

bureaucratization. Could this bureaucratization be the cause of bad relations between customers and suppliers, and for this reason, one more difficulty in SCM?

In fact, the little we can be sure of is that this certification of quality brings benefits, since many companies continue to apply for certification. But, what kind of benefits? Do these benefits directly favor SCM? Because it could be the case that the only benefits are commercial ones. Various researchers have investigated the benefits arising from ISO 9000, for example, Brown and Van der Wiele (1995), Vloeberghs and Bellens (1996), Lee (1998) and Gotzamani and Tsiotras (2002). In many cases, the results obtained were quite different and sometimes even contradicted each other. One of the reasons for this discrepancy is that very different approaches were taken in these studies. However, regardless of the approach taken, it is clear from the available studies that at least some benefits are obtained from ISO 9000 implementation and certification. Despite this, the purpose of this paper is not to evaluate the benefits of adopting the ISO 9000 standard, but to evaluate the impact of its implementation on relations between companies, i.e. to find out whether the implementation of this standard brings some improvements to SCM.

Having detected already some uncertainty as to the benefits of ISO 9000, this uncertainty continues as we analyze more specifically its effect on improvement to SCM. This is an aspect that, as will be seen in the next section, has hardly been analyzed in the literature at a practical level. The few contributions we discovered are of a purely theoretical nature.

Literature review: supply chain management and ISO 9000

As we mentioned in the introduction, although the message of quality has, in the end, been very well received and understood by companies, the message of improvement of SCM continues to be relatively sparse (New, 1997; Chandra and Kumar, 2000). In fact, this concept has evolved and has not been limited to the analysis of the relationship with suppliers nor to a description of logistics (Lummus and Vokurka, 1999). Companies used to be considered as isolated agents: they sought profit for themselves only; they based their planning strategy on their own production programs and any connections they made were strictly necessary. In the very near future, two models will stand out:

- (1) a company with trading partners, where the company links up with selected partners and their planning is made up of programs set up to exchange transactions; and
- (2) a company with an integrated supply chain, capable of integrating relationships with suppliers and customers.

In both company models the relationship with the adjacent agents in the chain is not under discussion, but what is evaluated is the extent of the connection, from a simple transactional level up to total integration.

Two key aspects stand out that have helped to bring the concept of SCM to the fore. First, Business Process Re-engineering (BPR), as a method for continuous improvement in business processes, and second, the impact of enterprise resource planning (ERP) systems, as the basis for the implementation of the philosophy of work processes (Kennerly and Neely, 2001; Schniederjans and Kim, 2003). In fact, the

innovative approach of this concept was helped by the implementation of information technologies, which gave the entire chain an integrated character.

In any case, the key process of companies is the commercialization of products, and all other processes depend on the success of this process. For this reason, the true object of study in SCM is the flow of materials from the supplier to the customer, via all the agents involved – purchasing, raw materials storage, manufacture, assembly, storage of finished products, dispatch, distribution and delivery to the customer.

A recent study into the impact of SCM (IESE, 1999), classified the business trends, by analyzing their historical development. It was found that one of the catalysts of this transformation is attributable to the focus on work processes, as suggested in the new version of the quality assurance standard, ISO 9001/4:2000.

We say “new” because, a little more than two years ago, the world-renowned ISO 9001/2/3:1994 quality assurance standards were restructured into the ISO 9001/4:2000 series. The first official applications for the ISO 9001:2000 certificate began immediately after publication of the new standard on 15 December 2000, although there is no obligation to register for this version until a three-year transitional period has passed, that was on 15 December 2003. However, a general lack of knowledge about the new standard, relatively widespread satisfaction with ISO 9001/2/3:1994, the perception that there was little chance of any immediate benefits arising from ISO 9001:2000 and a sluggish global economy are but a few factors contributing to dismally low numbers of companies seeking the certificate during the first two years of the transitional period. As shown in Table I, taken from 10th cycle of the ISO Survey (ISO, 2002), one-year after the publication of ISO 9001:2000, no more than 9 percent of the total number of certified companies obtained ISO 9001:2000 registration.

What does this mean from the research point of view? It seems that the lack of ISO 9001:2000 certified companies is mirrored by a similar lack of empirical research on the topic. This is why there are no references in the literature linking implementation of ISO 9001:2000 (nor, in fact, the previous version of it) to improvements in SCM. All we have found are a few empirical studies concerning the implementation of quality systems, in no cases of the ISO 9000 standard, and later evaluation of these systems in the supply chain. The fact that there are no studies that can serve as a reference has led us to consider it a good idea to briefly comment on some of the more interesting empirical studies regarding the implementation of quality systems and their effect on SCM.

	ISO 9001/2/3:1994		ISO 9001:2000	
	Companies	Percentage	Companies	Percentage
Africa	18,693	95	1,058	5
Central and South America	13,843	96	580	4
North America	49,007	96	1,887	4
Europe	247,062	92	22,888	8
Far East	112,345	89	14,434	11
Australia and New Zealand	25,278	88	3,541	12
World total	466,228	91	44,388	9

Table I.
ISO 9000 certificates at
December 2001

Source: ISO 2002

One of the first studies we found (Forker *et al.*, 1997), demonstrates the relationship between the performance of the supply chain and the adoption of TQM practices. By means of a rigorous study in the electronic components industry, it spells out four aspects strongly related to quality management policies:

- (1) maintain and improve the quality control department;
- (2) provide the suppliers (and the suppliers of the suppliers) with incentives to encourage quality;
- (3) collect data on defects and get this information to all company employees; and
- (4) give employees training, recognition and incentives for their full cooperation in quality improvement.

Later, Salvador *et al.* (2001) carried out an empirical study in 164 industrial plants on their relationship with suppliers and customers. The study found that in those relationships to do with Quality Management, the organization would indirectly improve their time performances – delivery punctuality and speed of operations – as a result of full mediation via internal practices in: quality management; low management, inter-unit coordination and vertical coordination. On the other hand, in relationships to do with managing the flow of materials, the impact on time-related performances can either be completely or partially mediated via internal practices.

Romano and Vinelli (2001) published a study describing the case of a company from the textile sector, to help to understand how quality could be managed using an SCM perspective, and what the operative and strategic consequences were for the company under study and the chain to which it belonged. They showed how SCM improves the capacity of the companies to recognize the expectations of the end customers.

Also important in this sense are studies on the adoption of quality management systems in the logistics function (Millen and Maggard, 1997; Millen *et al.*, 1999; Sohal *et al.*, 1999).

Although our objective is to look at the influence of the implementation of quality assurance systems in improvements to SCM, the works mentioned above serve as a reference in the definition of the empirical work described in the next section.

Methodology

The research presented in this paper was funded by the Catalanian Center for Quality (CCQ). This center is run by the government of Catalonia, an autonomous region in the northeast of Spain.

The main objective of this paper is to evaluate the impact of the ISO 9000 standard on improvements to SCM. Since this is a pioneering study, in that, as we have said, there are no clear previous references, we were unable to base it on any previous methodology. Nonetheless, we have referred to the empirical works developed in 1995 by Vloeberghs and Bellens (1996), and in 1998 by Casadesús and Giménez (2000), which examined the impact on companies of involvement in the ISO 9000 standards in Belgium and Spain, respectively. Evidently, additional aspects from the studies discussed in the previous section have also been considered.

With the aim of adapting a questionnaire to the issue in question, we used the theoretical framework developed by Chandra and Kumar (2000), who proposed five strategies for implementing effective SCM. These strategies are as follows:

- (1) Manage inventory investment in the chain;
- (2) Establish supplier relationships;
- (3) Increase customer responsiveness;
- (4) Build a competitive advantage for the channel; and
- (5) Introduce SCM solutions and enable information technology.

Using these strategies as our starting point – and with the purpose of examining the real impact of implementing ISO 9000 – the empirical work developed evaluates the impact in each one of these five areas. To do so, two parallel analyses were carried out.

On one hand, and for each of the five strategies, we chose the indicators used by Vloeberghs and Bellens (1996) and Casadesús *et al.* (2001) which are considered representative of each strategy, and asked the companies to evaluate how each indicator had been affected. In other words, if the company considered that the indicator had improved substantially, had not improved or it had even been affected negatively by implementing the ISO 9000 standard.

On the other hand and in parallel, we characterized the certified companies by means of the indicators resulting from the survey. As we have mentioned, we have analyzed, for each strategy, those factors concerned with SCM in which, once the ISO 9000 has been implemented, the companies recognize there is still room for improvement.

In this way, by means of both indicators we will find out which factors related to the SCM improve once the quality assurance standard ISO 9000 is implemented, while at the same time, we will find out those aspects in which the companies themselves recognize they must improve considerably, in spite of having obtained certification.

In order to carry out this empirical study, we designed a survey in line with the parameters discussed above. The survey instrument was refined using a pre-test process. The questionnaires were sent to 1,300 of the 4,500 Catalonian companies that had been certified by December 2001. The companies were selected randomly, using the Spanish Industrial Codes (CNAE) for stratification, without considering for which of the two versions of the standard they had been certified. A total of 399 companies, represented by the person in the company responsible for quality, responded to the questionnaire. This represents a response rate of 30 percent. The survey profile is presented in Table II.

The number of companies that responded to the survey was very high (close to 400). Of these 32 (8 percent of the sample) were certified according to the new version of the

	ISO 9001/2/3:1994	ISO 9001:2000
Spanish certified companies (December 2001)	16,941	808
Percentage of Spanish certified companies	95	5
Surveyed companies		1,300
Received responses	367	32
Percentage of received responses	92	8
Average employees of the companies	162	157
Average time of implementation (years)	1.67	1.62

Table II.
Profile of the survey

standard. This is a small, but perfectly logical proportion. ISO 9001:2000 certification is still very infrequent compared to the total of number of certifications – not only in Spain (close to 5 percent in December 2001) but also in the rest of the world. In fact, the proportion of ISO 9001:2000 certified companies that participated in our survey was actually higher than the percentage in the population of all certified companies in Spain.

Having said that, it must be noted that, due to the relatively low number of responses from companies with the ISO 9001:2000 certification, we have to be very cautious with the results obtained. It does not seem appropriate to separate the two types of companies, since it may not be possible to compare the results. It is, nevertheless very difficult to obtain higher percentages of responses. In any case, as we shall discuss later, in our empirical work, we have not detected differences between the behaviors of the companies certified according to each version of the standards.

Impact of the ISO 9000 implementation in the Supply Chain items

As has been said, the objective of this study is to look into the effects of ISO 9000 implementation on improving SCM. The theoretical work is based on the work of Chandra and Kumar (2000) and an analysis of his five strategies discussed above.

The results come from the survey carried out in companies with ISO 9001/2/3:1994 and ISO 9001/4:2000 certification, although the results do not vary significantly from one to another version. It should be noted, nevertheless, that, given the low number of companies certified according to the new standard that have participated in the survey, the results obtained give a general guideline only.

The results obtained from the survey are shown in Figures 1 and 2. Figure 1 shows the indicators that have been associated directly to one of the five strategies while Figure 2 specifies the characterization obtained through the survey. From this

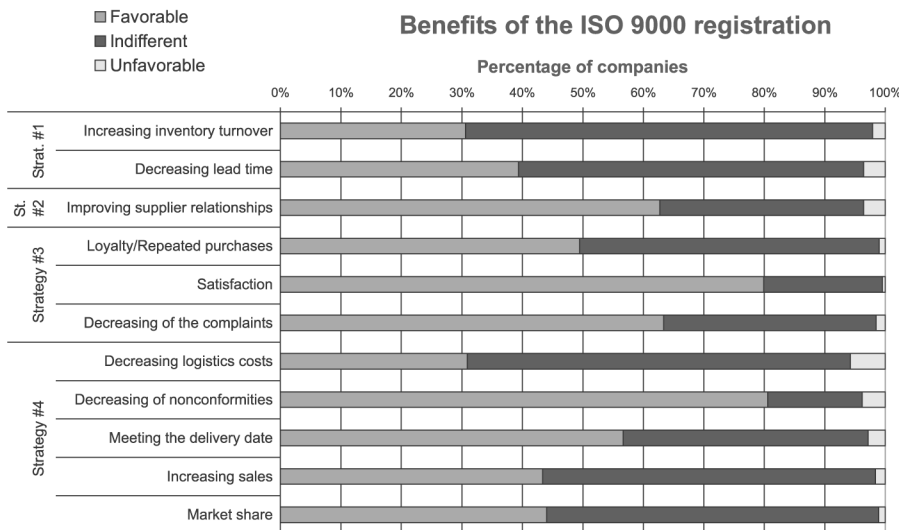


Figure 1.
Benefits of ISO 9000 registration

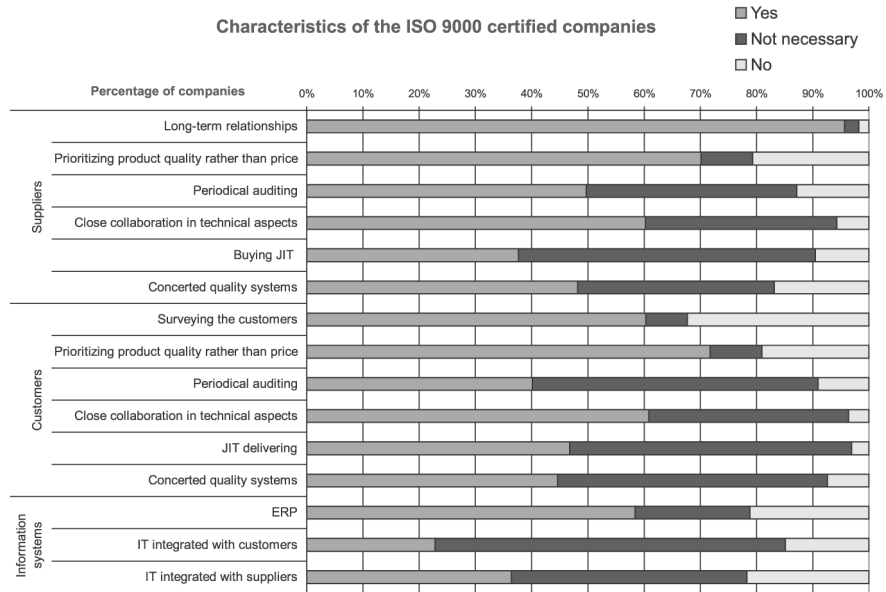


Figure 2.
Characteristics of the ISO 9000-certified companies

characterization, it has also been possible to draw conclusions related to each one of the strategies.

From the study characterizing the certified companies, it is possible to deduce which aspects need improvement, in spite of the implementation of the quality system, in order to take on the SCM philosophy.

Now we shall analyze the results in terms of the focus on the five strategies for improving SCM.

Strategy 1. Manage inventory investment in the Chain

With the aim of evaluating the impact of ISO 9000 implementation on the improvement in management of the inventory, we asked two questions about items we believe to be indicative of improvement in the management of the inventory:

- (1) Has implementation caused an increase in stock rotation?
- (2) Has implementation caused a decrease in lead times?

The aim of the two questions is to evaluate improvement in stock management in two areas: maintaining low stock levels by means of high product rotation or by means of shortened lead times. Analysis of the results shows that, for a very small proportion of the certified companies (2 and 4 percent), the effect of ISO 9000 implementation has been unfavorable on stock management. We also found that any improvement in management of the inventory was more a result of shortened lead times (39 percent of the cases) than of an increase in stock rotation (31 percent of the cases). Nevertheless, it must be pointed out that 62 percent of the cases (on average) said there was no difference in terms of improvement to management of the inventory through ISO 9000 implementation.

The characterization of the certified companies shows that the great majority of the certified companies (85 percent) use tools to control and manage stock, from which we deduce that they are able to implement inventory management strategies.

Strategy 2. Establish supplier relationships

With the aim of evaluating the impact of ISO 9000 implementation on establishing supplier relationships, we asked the following question about the certified companies' relationship with their suppliers:

- Has ISO 9000 implied an improvement in your relationship with your suppliers?

A total of 62 percent of responses were favorable and only 4 percent were unfavorable; which suggests that ISO 9000 implementation entails an improvement in relations with the suppliers in the great majority of cases.

With regard to the suppliers, it is interesting to note that the great majority (95 percent) of the certified companies establish long-term relationships with their suppliers. It is also noticeable that the companies prioritize product quality and service rather than price (70 percent), which reinforces the idea of SCM philosophy in which product commercialization is a key process, although 20 percent of the companies admit that they do not do it, even when they should do.

Finally, one area stood out in which the certified companies established close collaboration with their suppliers and that was in terms of the technical aspects of production. Only 6 percent of the certified companies admitted that they did not do this and should do so.

Some aspects deserving special attention are precisely those, which the certified companies admit not taking care of, because the ISO 9000 does not force them to, but which they admit would be well worth adopting. There are two cases of this: prioritizing product quality and service rather than price and not establishing agreed quality systems. Neither of these practices, both of which would be advantageous to an SCM – inspired system, has been significantly affected by ISO 9000 implementation.

Strategy 3. Increase customer responsiveness (predisposition)

With the aim of evaluating the impact of ISO 9000 implementation on increasing customer responsiveness the following questions were asked:

- Has implementation been favorable in terms of customer loyalty?
- Has implementation improved customer satisfaction?
- Has implementation decreased customer complaints?

We cannot say that ISO 9000 implementation has definitely contributed to an increase in loyalty in terms of sales, since 50 percent of the certified companies said ISO implementation made no difference in this respect.

However, in terms of customer satisfaction, we can definitely say that ISO 9000 implementation has been favorable in 80 percent of the cases, which implies that it improves relations with customers and favors the implementation of the third strategy (increasing customer responsiveness). On the other hand, with respect to decreasing customer complaints as an indicator of improvement in business relations with the customer, the impact of ISO 9000 implementation has not been quite so strong, although 63 percent of the companies agree there has been a positive effect.

The first thing that stands out in the characterization of the certified companies is the close similarity with the results concerning the company-supplier relationship in the factors where such a comparison is possible. This seems quite logical, and it confirms that the companies attempt to establish more or less similar bonds with their customers that they have made with their suppliers.

Hence, most of the certified companies (60 percent) say they carry out surveys to find out how satisfied their customers are, which is standard practice for establishing bonds throughout the chain. Nevertheless, what really stands out is that 32 percent of the companies say that they do not carry out these surveys but admit that they should do. Therefore, ISO 9000 implementation has not led to, at least not in these latter cases, a more formalized and systematized relationship with customers that such surveys provide.

Strategy 4. Build a competitive advantage for the channel

With the aim of evaluating the impact of ISO 9000 implementation on building a competitive advantage for the channel, we investigated a series of items:

- reducing logistics costs;
- decreasing nonconformity costs;
- meeting delivery deadlines;
- increasing sales; and
- market share.

Before going on to analyze each one of the items, we will first look at them together as a set. We would say it was rare to find cases where ISO 9000 implementation had been a disadvantage. The worst of the possibilities here – an increase of the logistic costs – has only occurred in 6 percent of the companies. This leads us to believe that ISO 9000 implementation does not have a negative effect on strategies designed to improve the implementation of SCM philosophies.

Having said that, only 31 percent of the companies have seen a reduction in their logistics costs thanks to ISO 9000 implementation, and in a majority of cases (64 percent), the ISO 9000 implementation has not led to a reduction in logistic costs.

In contrast, 80 percent of the companies said that, thanks to ISO 9000, they had reduced nonconformity costs. Such a reduction contributes enormously to improving the flow of materials promulgated by SCM philosophy.

As for meeting delivery deadlines, it is not possible to say categorically that ISO implementation has led to improvements. Fifty-six percent say it has resulted in improvement, but 42 percent said it made no difference.

The last two items relating to the fourth strategy are connected to improvement in economic aspects of the company for the success of the chain: increase in sales and market share. For both indicators, less than 50 percent of the companies said ISO 9000 implementation had had a favorable impact, so we cannot say that implementation brings a competitive advantage to the chain (Strategy #4) in terms of improving these economic aspects.

Strategy 5. Introduce SCM solutions and enabling information technology

There are several studies that have related the application of BPR to improvement in the processes and the implementation of information technology (IT) in companies

(Schniederjans and Kim, 2003). There exists a certain amount of discussion as to whether IT systems are integrated in the company or it is the company that adapts to the IT system that is chosen.

For this reason, in order to be able to establish a relationship between ISO 9000 implementation and the adoption of practices directed toward fulfilling this fifth strategy of the SCM philosophy, we have only been able to evaluate the proportion of companies that they have adopted IT systems or have IT available. We can envisage that adopting such practices will have led the companies to consider their processes (already established in the ISO 9000 standards) using the BPR approach which, as we mentioned earlier, makes up the basis of SCM-related theories.

Thus, with the aim of evaluating the impact of ISO 9000 implementation on the introduction of the IT improvements to SCM, we have taken three aspects from the characterization of the certified companies as indicators for the IT adoption.

- (1) The use of ERP software;
- (2) The integration of automatic management systems with customers; and
- (3) The integration of automatic management systems with suppliers.

With regard to the first item, a majority of the certified companies use ERP (58 percent), but more interesting is the fact that 20 percent admit that they do not use such management tools of management even if they might need them. These cases show that in spite of ISO 9000 implementation, the companies have not provided themselves with an integrated IT system.

We will take the next two items together, given the connection between them. Around 20 percent of the certified companies admit that they do not have systems integrated with their customers or suppliers, although they consider that they should have. However, the largest proportion of the certified companies surveyed (42 percent in terms of suppliers and 62 percent in terms of customers) say that they do not integrate the two IT systems because it is not necessary, thus saying, in a way, that they believe there is no need to integrate the different agents of the supply chain. This gives an idea of how far the certified companies have to go to get genuine integration in their production systems.

Despite the analysis of Strategy 1, in which we said ISO 9000 implementation brings about an improvement in relations with the suppliers in the great majority of cases, this last point implies, in a way, that it is not possible to say that ISO 9000 implementation brings about an improvement in relations with adjacent agents to the extent of integration of management systems.

Conclusions

The main purpose of this paper was to analyze the impact of ISO 9000 quality assurance implementation on adherence to strategies in favor of a SCM philosophy.

The study shows it is not possible to affirm that ISO 9000 implementation totally favors SCM strategies; however, there are precise areas that have been shown to be reinforced: 62 percent of the certified companies say the relationship with suppliers has improved, 80 percent say customer satisfaction has increased and 63 percent say customer complaints have decreased.

Nevertheless there are two aspects that stand out as disadvantages of ISO implementation: 62 percent say implementation has not led to an improvement in stock

management, in spite of having the necessary mechanisms in place, and only 31 percent have seen reductions in logistics costs.

Having analyzed the five strategies in the certified companies, we can conclude, similarly to Salvador *et al.* (2001), that relations with adjacent agents in the supply chain regarding issues of quality lead to improvements in terms of shortening and meeting delivery deadlines. However, the survey shows that the effect of ISO 9000 implementation is greater in terms of meeting delivery deadlines rather than shortening them. We can also say that the tendency is to create long-term relationships, which imply looking for strategies in which the different agents end up benefiting from.

As various authors have mentioned in their works (for example, Romano and Vinelli, 2001), and as this study confirms, quality management practices provide a great deal of help and support – Romano uses the term “glue” – for the relationships in the network of companies that make up the supply chain, allowing it to behave as a single system.

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