PAPER PUBLISHED IN

TOTAL QUALITY MANAGEMENT & BUSINESS EXCELLENCE (TQM & BE)

Gutierrez-Gutierrez, L.; Tamayo-Torres, I and Barrales-Molina, V. (2012): "Quality Management Initiatives in Europe: an Empirical Analysis according to Their Structural Elements". *Total Quality Management & Business Excellence. Vol.21, n.6, pp.577-601.*

DOI: 10.1080/14783363.2010.483064

Quality Management Initiatives in Europe: an Empirical Analysis according to Their Structural Elements

L.J. Gutierrez-Gutierrez[1], I.Tamayo-Torres, V. Barrales-Molina

Department of Business Administration, Cartuja s/n 18071,

University of Granada, Spain

ABSTRACT
In recent years, managers have opted for implementing Quality Management in their firms. The market offers different alternatives for QM implementation, such as EFQM model, ISO standards, Malcolm Baldrige or the recent Six Sigma methodology. Implementation difficulty of each initiative varies from case to case. This article designs a criterion for choosing among four alternatives (Quality Control, EFQM, Six Sigma and ISO 9000), according to the degree of development required for the elements that structure the alternatives. To do so, using an ANOVA analysis and mean comparison T-tests, it analyses 234 organizations in Europe that have implemented the four alternatives mentioned and observes the degree of development of nine of the elements that compose them. From the research, one can conclude that Quality Control is the simplest initiative, followed by ISO 9000 and, finally, the EFQM model and Six Sigma methodology.
KEY WORDS: Quality Management initiatives, difficulty of implementation, structural elements, EFQM model, Six Sigma methodology, ISO, Quality Control.

1. INTRODUCTION

The great evolution that QM has undergone in the last few years has led to the current existence of different options proposed for implementing the practices that this philosophy proposes (García-Bernal et al., 2004). In the quality movement, there are numerous methods and tools. They vary from an orientation to the customer or process to those oriented to the human dimension or to the system dimension, and finally those that involve a change of culture and of learning (Handfield et al., 1998). Familiar examples of these are Quality Control, the American Malcolm Baldrige Model, the European EFQM model, ISO Standards and the most recent Six Sigma methodology.

As a result, managers face a wide range of possibilities for implementing QM in their organizations. In general, firms share the desire to implement some initiative, seeking to minimize the difficulty that this process involves. The goal of this article is to offer organizations a criterion for choosing among the different initiatives of quality management, based its difficulty of implementation.

The difficulty of implementing each initiative may depend on many factors. We will focus here on the difficulty associated with the degree of development required for each of the elements that composes the initiatives. Complications can emerge in the implementation, if the organization has in the past had negative experiences in significant elements of the initiative in question (Fallon, et al., 2003), if the employees lack motivation (Calisir et al., 2005), or if the firm does not give them sufficient attention (Huq, 2005, Leonard and McAdam, 2002), as well as for many other reasons (Al-Zamany et al., 2002; Calisir et al., 2005). Specifically, Huq (2005) writes about problems in organizations that implement QM caused by a poor focus on processes, deficient information flows or incomplete preparation of the employees. The difficulty associated with each initiative will vary, according to the importance of the elements and the effort that their implementation involves for the firm. If, for example, one initiative requires strong teamwork and this practice has been developing successfully for some time in the organization, its implementation will be easier. However, if the initiative requires strong statistical

[1] Corresponding author. Email: leogg@ugr.es

knowledge and the firm has had or has problems in developing this element, implementation would be more complex.

The literature on quality management shows that ISO Standards lead to higher levels of QM elements implementation (Gotzamani and Tsiotras, 2001; Rao et al., 1997), a phenomenon accentuated in the literature that analyzes the new version from the year 2000 (Gotzamani, 2005; Vouzas and Gotzamani, 2005). However, elements such as employee involvement (Casadesús and De Castro, 2005) and employee work attitude (Van der Wiele et al., 2005) have created some controversy. Still, some authors present the EFQM model or the Six Sigma methodology as possibilities for implementing TQM (Green, 2006; Lloréns and Molina, 2006; Oger and Platt, 2002). Some studies rank TQM above ISO Standards (Bendel, 2000), although others argue that the 2000 version of ISO Standards has some quite close to TQM (Boulter and Bendell, 2002; Gotzamani, 2005; Vouzas and Gotzamani, 2005). This study will enable us to observe empirically the differences between quality control and ISO Standards to confirm whether the ISO Standards really constitute a step beyond quality control. We will also, however, confirm whether the 2000 version of ISO Standards comes close to TQM initiatives like the EFQM model or Six Sigma. Finally, since both cases are presented as options for implementing TQM, this study will enable us to confirm whether there are differences between the structural elements of the EFQM model and the Six Sigma methodology

To achieve its goal, after this introduction, the article begins with a brief review of the QM initiatives chosen: Quality Control, ISO 9000, EFQM model and Six Sigma methodology. Next, it presents the QM structural elements and a theoretical explanation for differences between the four initiatives chosen. The third and fourth parts collect the methodology followed for performing the empirical research and the results obtained, respectively. We identify the elements that support each initiative, compare them to each other, and seek differences in their degrees of development. These will be the elements that give the firm a vision of the difficulty of implementing the initiative. After this, we discuss the results obtained and their implications. The last section presents the conclusions, limitations and future lines of research.

2. CURRENT QUALITY MANAGEMENT INITIATIVES

2.1. QUALITY CONTROL

Quality control can be identified as one of the stages in QM evolution (Dale, 1999; Garvin, 1988; Gehani, 1993; Saad and Siha, 2000). This stage is usually placed at approximately 1931, when W. A. Shewhart published "Economic Control of Quality of manufactured products." This author speaks of the statistical control of quality, with which he associated the concept of the variation of processes, identifying the reasons why two goods produced in the same factory by the same process may not be the same. The result is that one of the two products is of lower quality. Shewhart recognizes that the production process is subjected to some degree of variability and that the goal is not to eliminate this variability but rather to maintain it within an acceptable range. A phenomenon is said to be controlled when, through the experience undergone, we can predict, at least within certain limits, how we expect it to vary in the future (Shewhart, 1997). Shewhart developed both statistical tools to set the limits of change and control charts to show the results.

Later, Feigenbaum (1986), whose research coincides with the trips made by Deming and Juran to Japan in 1951, designed the concept of Total Quality Control (TQC). Feigenbaum argued that the systems of quality control in use until that time were very limited and only focused on specific functional areas. For him, Total Quality Control should include all the important activities in the organization and, he identified, eight phases in the industrial cycle: marketing, engineering, purchases, production engineering, production supervision and sales operations, mechanical inspection and functional testing, delivery, installation and service. Besides, he pointed out that it is the client who determines quality, not anyone belonging to the organization, and added that the greatest improvements in product quality could be made by means of product design, basic production processes and the extent of service.

2.2. ISO 9000 STANDARDS

Currently the most widely QM initiative used is the implementation of ISO Standards. Without these, it is nearly impossible to compete in international markets (Magd and Curry, 2003; Withers and Ebrahimpour, 1996). These standards represent a significant initial step for manufacturing organizations on the way to QM, since they involve a lower initial degree of commitment to their principles (Anderson et al., 1999; Magd and Curry, 2003; Najmi and Kenoe, 2000). However, another, less optimistic, vision argues that firms that implement ISO Standards seek only to obtain a certification that they can benefit in their business without really committing themselves to QM (Johannsen, 1995; Stephens, 1994; Van der Wiele et al., 2005).

Since their origin in 1987, ISO Standards have undergone modifications, first in 1994 and then in 2000, the latter being the modification that produced the greatest changes. Recently in 2008, another version of ISO Standards requirements has come up. Our case focuses directly on 2000 version, since the goal is to observe the current situation of this initiative and determine the elements of quality management on which they are based, and most companies still have this standards implemented. Thus, this version of ISO is based on the following eight QM elements: (1) organization focused on the client, (2) leadership, (3) involvement, (4) process management, (5) focus of the system toward management, (6) continuous improvement, (7) realistic focus toward decision-making and (8) mutually beneficial relations with the supplier (Jensen, 2001; Senlle, 2001). Most of these principles are included in the elements analysed in our research, making it possible to extract an image very close to the degree of development required for their implementation.

In 2004, the new ISO 9000 Standards had completely replaced the 1994 version (Casadesús and De Castro, 2005), as organizations with the 1994 certification were given a deadline of the end of 2003 to satisfy with the requirements of the 2000 version. Failure to satisfy with the new requirements meant that the organization's prior certification would be cancelled. The new version incorporates a series of changes that help to achieve better results (Boulter and Bendell, 2002; McAdam and Fulton, 2002). Mezher et al., (2004) argue that the 2000 version of the ISO Standards improves quality management relative to the prior 1994 version.

A great quantity of research has studied the ISO Standards. Some studies are related to performance, finding positive results of ISO Standards on financial performance (Corbett et al., 2005; Naser et al., 2004), operational performance (Naveh and Marcus, 2005; Mann and Kenoe, 1994), or customer satisfaction (Sun, 2000). However, other studies have criticized the norms for different reasons, such as their high cost, excessive paperwork or insufficient customer or supplier focus (Brown et al., 1998; Jaideep et al., 1996; Struebing, 1996). In fact, negative effects of ISO certification on organizational performance also have been tested (Beirao and Cabral, 2002; Corbett et al., 2005)

2.3. THE EFQM MODEL OF BUSINESS EXCELLENCE

The following initiative to be studied is the EFQM model of business excellence. In 1988, under the auspices of the European Commission, the *European Foundation for Quality Management (EFQM)* was founded. It was composed of 14 presidents of the most important companies in Europe, such as Bosch, Fiat, Nestlé or Renault. The first model created by the organization was the *"European Model for Business Excellence"* in 1991. This model has undergone different modifications, up to the version in effect since 1999. This version emphasizes the importance of issues related to business excellence, now called the EFQM Model of Business Excellence. Like other models, such as American Malcolm Baldridge Model or the Japanese Deming Prize, this model introduces criteria that allow selection for the so-called European Prize for Quality. To compete for this prize, companies must show that excellence in their quality management is their fundamental process of continuous improvement (Shergold and Reed, 1996; Wongrassamee et al., 2003).

The EFQM model is based on nine criteria that attempt to evaluate the evolution of the firm in its path toward excellence. These nine criteria are divided into *enablers*, which represent the way in which the firm puts each of its subcriteria into practice, and the *results*, which represent what the firm is achieving in the different fields in it influences (See Figure 1). The EFQM model defines and describes QM in the easiest way for managers to understand (Coleman and Douglas, 2003) and constitutes an ideal structure of management and continuous improvement for organizations (Sandbrook, 2001).

Insert Figure 1 about here

According to Samuelsson and Nilsson (2002), the EFQM model of excellence, together with the National Malcolm Baldridge Prize, are the best-known examples of self-evaluation. Studies analyse its positive effect on performance (Calvo-Mora et al., 2005; Kristensen et al., 2000; Saizarbitoria and Heras, 2006), its structure and functioning (Bryde, 2002; Eskildsen et al., 2001; García-Bernal et al., 2004; George et al., 2003), its relationship with employee satisfaction (Ehrlich, 2006; Eskildsen and Dahlgaard, 2000), and its application for small and medium-sized firms (Wilkes and Dale, 1998).

2.4. THE SIX SIGMA METHODOLOGY

The Six Sigma methodology is the most recent initiative we have chosen to discuss. Interest in this methodology is growing, as is reflected in its application in both the entrepreneurial and the academic worlds with the publication of numerous papers that analyse its operation (DeMast, 2006; Lloréns and Molina, 2006). We find studies related to stock price performance (Goh et al., 2003), to quality management of its suppliers (Dasgupta, 2003), to effects on customers (Behara et al., 1995; Kuei and Madu, 2003), to organizational learning (Wiklund and Wiklund, 2002), and to human resource management (Lanyon, 2003; Wyper and Harrison, 2000). Some of Six Sigma benefits are decreased work in progress, improved capacity and output, improved customer satisfaction and process flow, improved inventory turns, increased productivity and reduced cycle time (Dedhia, 2005).

The concept of Six Sigma was originated in Motorola in the U.S. around 1985. The increase in competitiveness of Japanese products threatened the rest of the electronics industry, and sparked the need to achieve dramatic improvements in the levels of quality (Harry and Schroeder, 2000). From the success of Motorola, many firms put this methodology into practice, seeking to improve their results. Some examples are General Electric, Honeywell, Telefónica (Pande et al., 2002), IBM, American Express and Citibank (Kuei and Madu, 2003). "Six Sigma has generated a tremendous amount of interest in many organizations and many countries around the world" (Lloréns and Molina, 2006, p.486).

Linderman et al., (2003, p.195) offer the following definition : "Six Sigma is a systematic and organized method for improving strategic processes and is based on a statistical and scientific methodology to achieve drastic reductions in the rates of failure defined for clients." From this definition, one can grasp one of the most important elements: the statistical methodology.
The Six Sigma methodology is based on the idea of striving to achieve goals. The name itself refers to a specific goal, 3.4 defects per million opportunities (DPMO), where "defect" is understood as an error in the process that is critical for the client. The goal of this model is to reduce the number of defects generated in the organization progressively, increasing perfection of the processes to reach the level Six Sigma.

The path proposed to put this methodology into practice is based on the realization of very concrete improvement projects supported in some specific elements, such as teamwork and design. Another important element, associated with teamwork, is training, which is intensive and differentiated for the firm's personnel (Breyfogle, 2003) Thus, managers create positions associated with the management, promotion, and cooperation of the improvement projects that arise in the organization (Champions, Master Black Belts, (MBB) Black Belts, (BB) and Green Belts (GB)), (DeMast, 2006; Pande et al., 2002; Lowenthal, 2002).

2.5. QM INITIATIVES AND THEIR STRUCTURAL ELEMENTS
Quality Management elements are practices that should be carried out to achieve the success of its implementation. Dean and Bowen (1994) define these as the path for implementing the principles of QM. Clearly, this is an issue of greatest importance for the firms, since a direct relation has been established between the elements implemented, the form and intensity with which they have been implemented, and the organization's performance (Ahire et al., 1996; Anderson et al., 1995; Flynn et al., 1994; Ho et al., 1999; Kaynak, 2003; Nair, 2006; Powell, 1995; Ravichandran and Rai, 2000; Waldman, 1994). Sila and Ebrahimpour (2002) perform an extensive bibliographical review of the research on QM. One of their main objectives is to examine and enumerate the different elements of QM. The result is 76 studies that focus on the elements of QM. Analysing these studies, they propose 25 elements as the most common in the literature.

Insert Table 1 about here

This paper seeks to determine whether there are differences in the implementation of the QM elements among the initiatives observed. First, as mentioned above, the 2000 version of the ISO certification leads to higher levels of TQM elements (Gotzamani, 2005; Vouzas and Gotzamani, 2005). The first empirical results of the benefits of implementing the 2000 version of the ISO 9000 Standards (Boulter and Bendell, 2002; Costa and Martínez-Lorente, 2003; Liebesman and Mroz, 2002; Van der Wiele et al., 2005) show a positive change (Gotzamani, 2005). Liebesman and Mroz (2002) studied the effect of the ISO 9001:2000 certification in 227 North American firms and finds significant improvements in consumer satisfaction, quality of products and services, and productivity. Other studies have also found improvements in customer focus (Casadesús and De Castro, 2005; Gotzamani, 2005; Van der Wiele et al., 2005), customer satisfaction (McAdam and Fulton, 2002), continuous improvement (Boulter and Bendell, 2002; Casadesús and De Castro, 2005; Gotzamani, 2005; McAdam and Fulton, 2002; Van der Wiele et al., 2005), leadership and managerial support (Boulter and Bendell, 2002; Gotzamani, 2005), process management (Conti, 1999; Gotzamani, 2005; Van der Wiele et al., 2005), and suppliers relationships (Casadesús and De Castro, 2005). However, the results for human resource practices are not as clear. Casadesús and De Castro, (2005) observed that the participation and involvement of teams decrease from the 1994 to the 2000 version. Van der Wiele et al., (2005) found improvements in training, involvement, teamwork and leadership, although the authors established that both versions (1994; 2000) have little impact on employees' attitudes and behaviour. McAdam and Fulton, (2002) affirmed that improvement in employee performance is one of the main benefits of the new version. In any case, the new elements modified in the 2000 version of the ISO 9000 Standards, called "*soft-elements*" of TQM (Gotzamani, 2005), have a significant impact on the firm's results (Costa and Martínez-Lorente, 2003), one approaching excellence (Boulter and Bendell, 2002).

The review performed presents the new ISO 9000 Standards as a following path that comes very close to TQM. By comparison, quality control falls behind; there will be less implementation of structural elements with this form of quality control than with the ISO 9000 Standards. According to Khan and Hafiz (1999), the most striking aspect of the ISO Standards is that it goes a step beyond mere assurance through final inspection of the products, involving a study of the entire process of design, development and manufacture, including subsequent distribution and other services.

The improvements pursued in the EFQM model are directly associated with or even identical to those proposed by TQM (Van Marrewijk et al., 2004). According to Oger and Platt (2002), both the EFQM model and the Malcolm Baldrige Prize emerge from TQM, since both start from a similar structure based on leadership, strategy, resources and processes. Yang et al., (2001) assert that the implementation of the EFQM model leads us to choose from among the five kinds of TQM proposed by Dale and Lascelles (1997). This enables us to affirm that the EFQM model proposes a structure for implementing TQM in organizations. Likewise, according to Lucas (2002), the implementation of the Six Sigma initiative in an organization incorporates nearly all of the elements associated with TQM. Green (2006) observes that Six Sigma is constructed on five key components of TQM: customer focus, employee involvement, continuous improvement, leadership and fact based decision-making. The three basic principles of TQM— customer orientation, continuous improvement and teamwork (Dean and Bowen, 1994; Prajogo and Sohal, 2003; Ravichandran and Rai, 2000; Sitkin et al., 1994)—are reflected in the principles cited by Lloréns and Molina, (2006) as the basis of the Six Sigma philosophy: customer focus, improvement of processes and/or design of new products and teamwork. Thus, both the EFQM model and the Six Sigma methodology (Lucas, 2002; Green, 2006; Lloréns and Molina, 2006) are options for implementing TQM. Although the 2000 version of the ISO 9000 Standards seems to have come close to these options, there may still be differences (Bendel, 2000). As a result, the structural elements and their degree of implementation will be greater in TQM initiatives like the EFQM model or the Six Sigma methodology than in the ISO Standards. For example, Lupan et al., (2005) demonstrate some ways in which Six Sigma provides a way to improve the ISO 9000 Standards in the firm, and Saizarbitoria (2006) contrasts how the implementation of the EFQM model obtains better results in market share, profitability and sales than does the 2000 version of the ISO 9000 Norms. According to the review performed, we can construct a continuum from the most basic quality management, corresponding to quality control, via the ISO Norms, to TQM, associated with the EFQM model or the Six Sigma methodology (figure 2). This theoretical development leads us to think that there will be differences in the implementation of the structural elements in the different initiatives studied.

Insert Figure 2 about here

3. RESEARCH METHODOLOGY

The data for this research were drawn from a cross-sectional study conducted to investigate the current situation of QM in Europe, analysing its implementation alternatives and their structural elements in different countries from European continent. Using data collected through cross-sectional e-mail surveys is appropriate because the research questions posed in this study lend themselves to investigating the relationships between multiple variables. Issues pertaining to the construction of the instrument and measures, the survey procedure, the sample, and the tests for reliability and validity are reviewed in the following sections.

3.1. CONSTRUCTION OF THE INSTRUMENT AND CONTENT VALIDITY

Churchill's (1979) work provided the basis for the construction of the instrument and measures utilised in this study. Items and scales for constructs measurement were identified in a thorough literature review. This empirical analysis was performed on a set of QM elements. To select these, we started from the main studies of QM elements (Ahire et al., 1996; Anderson et al., 1995; Flynn et al. 1995; Powell, 1995), extracting from them nine elements as the most representative of quality management. Although all are not present in each of the studies, they are present in the majority and also form part to a greater or lesser extent of the initiatives studied. Table 2 shows the elements chosen, a definition of each, and some of the research studies that analyse them as structural elements of QM. Thus, top management support, training, supplier management and teamwork practices were measured using items from scales included in Flynn et al., (1995). Continuous improvement and process management scales were obtained from Anderson et al., (1995). Employee empowerment and Statistical Process Control (SPC) scales were originally from Ahire et al. (1996) study. Finally, benchmarking was measured using items from Powell (1995). The list of scales and items is presented in Appendix A. Anderson et al. (1995) and Flynn et al. (1995) used a discrete Likert-type scale of five items, and Ahire et al. (1996) used a discrete Likert-type scale of seven items. In this study, we use a Likert-type scale of seven items, as research shows, as the number of scaling points decreases, the amount of information lost increases (Martin, 1978; McClelland and Judd, 1993; Russell and Bobko, 1992).

Insert Table 2 about here

Once designed, the questionnaire was tested by five quality managers, belonging to different sectors. We tested the study using these responses because the test sample was similar to our actual sample. This pilot test enabled the clarification of possible ambiguities, correction of errors and solution of formatting problems. After a thorough observation of the questionnaire the quality managers pointed out some recommendations to facilitate questions comprehension and, thus, a few minor changes in wording were done.

3.2. TARGET POPULATION AND SURVEY PROCEDURE

Target sample was composed by 3024 manufacturing and services firms in Europe. The firms contacted were chosen randomly from the Amadeus database and the publication *Actualidad Económica* (2004). The procedure for data collection consisted of sending a letter by email explaining the research project to quality managers of European firms. After explaining the reasons for and purposes of the research, the letter included a direct link to a questionnaire available on-line. Once, clicked that link, respondents could access to the questionnaire, filled out online and, once finished, sent automatically to a central computer, where all responses were saved. Following a three-step procedure, 254 replies were received. Forty-four were unusable because they were incomplete, contained an error or were duplicated. Finally, we had 237 usable surveys, 8.4% response rate.

By testing the difference of the interest variables between early and late respondents, an estimate of non-response bias was calculated (Armstrong and Overton, 1977). To test the non-response bias, an independent sample T-test was conducted for QM elements. Test result did not indicate any significant difference between the two response waves on the means of the variables. χ^2 tests were run to find out whether there was a significant difference in the two demographic variables (number of employees and total sales) between early and late respondents. Results indicate that no significant differences on demographics existed between the two waves of responses. Eight respondents returned a letter by e-mail to explain why they chose not to participate in the study. The results of statistical tests and qualitative data indicate that non-respondents did not differ significantly from respondents.

3.3. SAMPLE DEMOGRAPHICS

Replies came from eleven European countries: Spain, Italy, United Kingdom, Switzerland, Romania, Chez Republic, Denmark, Austria, Belgium, Sweden and Germany. Spain (62.87%) and Italy (17.72%) were the countries where more responses came from. The rest of sample (20.41%) was distributed in similar proportions between other sample countries. As we explained above, the original sample was composed by manufacturing and services firms. According to activity sectors, the 237 firms used in this research, are distributed as follows: 23.11% belong to machinery and components, 21.01% to different activities in the service sector, 13.06% to construction, 12.56% to the food industry, 8.04% to electricity and electronics, 7.53% to the metal industry, 7.03% to the chemistry sector and the remaining 7.53%, to miscellaneous sectors. Our cross-industry sample is appropriate, as Pannirselvan and Ferguson (2001) suggest, because distinctions between manufacturing and services have become blurred as manufacturers are more responsive to customers and service organizations more concerned about quality process and output. Approximately, 12.06% of the firms had 50 or fewer employees, 45.72% of the firms employed between 51 and 250 workers, 29.64% of the firms had 251-1000 on the payroll, and 12.56% of the firms had more than 1000 employees. About 2% of the firms reported annual sales of 1 million of euros or less, and 13.56% of the firms had annual sales between 1 and 7 million of euros. The firms that had annual sales between 7 and 40 million of euros comprised about 45.22% of the final sample, and approximately 39.19% of the firms had annual sales of more than 40 million of euros.

3.4. SCALES VALIDATION

Reliability of each scale of QM elements was estimated by calculating Cronbach´s α. Several items in QM elements were eliminated, because they did not contribute to reliability scale (see Appendix A). To establish the unidimensionality of elements, using program SPSS 15.0, an exploratory factor analysis using principal component extraction with varimax rotation was performed. Finally, LISREL 8.3 software was employed to test scales validity. Through confirmatory factor analysis, standard errors, t-values and factor loadings were observed (see Appendix A). Once, all scales were validated, we observed the goodness of fit in QM measurement models. The fit indices used in this study to estimate the measurement model are the ratio of $\chi 2$ to degree of freedom, the Gooness-of-Fit Index (GFI), Root Mean Square Error of Approximation (RMSEA), the Parsimony of Gooness-of-Fit Index (PGFI), the Parsimony Normed Fit Index and the Comparative Fit Index (CFI). Observed and recommended values of these fit indices for satisfactory fit of a model to data are presented in Table 3. Resulting values of these indices establish a positive fit of the measurement model.

Insert Table 3 about here

3.5. ANALYSIS PROCEDURE

Once we confirmed that all scales were valid, we classified them into their corresponding groups according to the initiative implemented. To identify the initiatives implemented by each of the organizations, we offered the respondent a list of these initiatives, selecting for each case the one or ones that had been developed in his or her firm. The sample is structured as follows: Group 1, "Quality Control," is formed of firms that have not implemented any specific QM initiative but do develop activities related to this form of control. Group 2, "ISO 9000", is composed of firms that have implemented ISO 9000 and no other initiative. In Group 3, "Six Sigma," and Group 4, "EFQM", the organizations have implemented these initiatives respectively as the main alternatives, having or not ISO standards or quality control implemented. Table 4 collects sample distribution between the four differentiated groups. We chose these four initiatives and not others, such as the Deming model or Lean Manufacturing, due to the fact that they are the four most common among the responses received. It is thus probable that they are also the most extensively used on the European continent. Then, using SPSS 15.0 program, we performed a comparison of means using an ANOVA analysis (Table 5). This analysis will facilitate us the identification of those QM elements that generate significant differences between the four groups created. Once these elements were identified, a set of T-tests of means comparison for independent samples, were performed (Table 6). These tests enabled us to establish differences between each couple of initiatives according to those cases where the differences of means of development of each element implemented were statistically significant.

Insert Table 4 about here
Insert Table 5 about here
Insert Table 6 about here

4. RESULTS

Means and standard deviations of each of the nine elements analysed for each initiative are included in Table 7. For each element, we performed an ANOVA analysis, which showed which of these elements generated significant differences between the four initiatives (Table 6). As a result of the ANOVA analysis, we observe that all the elements, excepting "supplier management", generate significant differences between the four initiatives. However, this does not imply that there are differences in each of the possible comparisons between the initiatives studied. Observing Table 7, for example, mean values of the element "top management support" for groups 2, 3, and 4 are not very different from each other, and the most important differences existing between these three groups and group 1. As we tested above, this element generates significant differences for all of the four groups, but when we look at it specifically, it is probable that the reason for this is only the differences between group 1 and the rest. To solve this problem, we performed a new comparison of means, through a mean comparison t-tests for independent samples, in which the differences between the elements in each possible pair of groups were contrasted. The results obtained are shown in Table 6. As expected, in spite of the fact that "top management support" was one of the elements that generated significant differences between the means in all four groups, these differences emerge only between group 1 (Quality Control) and groups 2 (ISO), 3 (EFQM) and 4 (Six Sigma), and between groups 2 (ISO) and 4 (Six Sigma), but not in other cases, ISO and EFQM, and EFQM and Six Sigma.

Insert Table 7 about here

Graphically, figures 3 and 4 show those elements generating significant differences between the four groups. Observing figure 3, we conclude that firms belonging to group 1 (QC) develop to a lesser extent four of the QM elements, than firms belonging to group 2 (ISO). Also, firms belonging to group 1 (QC) develop to a lesser extent another two QM elements, than firms belonging to group 3 (EFQM), added to the four previous elements. Finally, firms belonging to group 1 (QC) develop to a lesser extent all the QM elements observed, than firms belonging to group 4 (Six Sigma). Figure 4 shows how firms belonging to group 2 (ISO) develop to a lesser extent only two of the QM elements, than firms belonging to group 3 (EFQM). When firms belonging to group 2 (ISO) are compared with firms belonging to group 4 (Six Sigma), we observe that they develop to a lesser extent the two previous elements and another three of them. Finally, firms belonging to group 3 (EFQM) develop to a lesser extend "process management" element, than firms belonging to group 4 (Six Sigma).

Insert figure 3 about here

Insert figure 4 about here

5. DISCUSSION

Results obtained enable us to discuss a series of issues related to each of the groups that have been created. First, it has been shown that firms belonging to group 1 (Quality Control) develop to a lesser degree all the QM elements observed (Table 7). Statistically, there are significant differences with firms belonging to group 2 (ISO) in four elements, with firms belonging to group 3 (EFQM) in six elements and with firms from group 4 (Six Sigma) in all nine elements. All of these differences are negative for Group 1, that is, this group is characterized by developing these elements at a lower level than do other initiatives. We can thus conclude that this initiative would be the simplest to implement in an organization, as it is less demanding for all the nine elements studied. This enables us to corroborate the statement that establishes that this initiative is the easiest of the four studied, according to its structural elements implementation.

The only elements, in which group 1 differs from the other three simultaneously are training, top management support, empowerment and continuous improvement. Training, top management support and continuous improvement are common QM practices (Ahire et al., 1996; Anderson et al., 1995; Kaynak, 2003; Ravichandran and Rai, 2000; Soltani, 2005). We can observe that, although these three elements are developed to a lesser degree in group 1, the levels at which they occur, (means around medium-high level), are sufficiently important to eliminate the possibility that they are unimportant elements. By the other side, empowerment is a more advanced QM practice and it demands "shifting the responsibility for quality decisions to workers and also providing supporting framework, such as the necessary resources and technical support to assist them in such decision making" (Ahire et al., 1996, p.31). This strong commitment demanded, could be an explanation for the lesser implementation of this element in firms that only have developed quality control practices. In any case, these four elements enable us to establish a first criterion to differentiate between the four initiatives, such that if the organization seeks to minimize the managerial commitment, employee empowerment, training or the continuous improvement orientation, the initiative of quality control would be the best.

The literature review concerning quality control discusses Shewhart's statistical control of quality, of the variation of the processes and statistical methods to manage them. If one accepts these arguments, it seems logical to think that this initiative attributes great importance to the study of the processes and to their statistical control. However, if we observe the elements associated with this activity, such as process management or statistical processes control, it can be confirmed that the mean value of this group for these elements is very low, and we have obtained some important negative differences with respect to the mean. Thus, as we have observed, when organizations think of quality control, they do not think of the corresponding phase of the practices of studying variation of processes and their statistical control, but rather envision a concept of lesser extent. Therefore, we can confirm that quality control, as it is understood in current organizations, does not correspond to the stage of evolution called by this name. Today, this initiative could be defined as an initial step in quality management of organizations, but that it remains far from initiatives of greater scope, such as ISO Standards, EFQM model or Six Sigma methodology.

In the case of the second group (ISO), we see that it remains near the average in all the elements. This fact enables us to identify these values as the minimum values required to have a significant development of QM in the organization. Besides, firms belonging to group 2 (ISO) develop to a greater extent, elements such us training, top management support, empowerment and continuous improvement, than group 1 firms. As we have mentioned, ISO standards constitute an important first step toward QM (Anderson et al., 1999; Magd and Curry, 2003; Najmi and Kenoe, 2000). In spite of this, results obtained lead us to confirm that quality control can take the place of this initial step, surpassing ISO Standards to occupy a subsequent position. As to the rest of the significant differences, we see that groups 2 (ISO) and groups 3 (EFQM) and 4 (Six Sigma) are distinguished by training and teamwork in the organization, both being more powerful in the latter cases. Related with EFQM model, Oakland et al., (2002) affirm the need to establish teams to achieve the improvement of processes that the EFQM model proposes. These teams should be formed of people trained in the use of techniques of improvement of processes and of developing creativity and innovation. Examples observed by Samuelsson and Nilsson (2002) remark the importance of training and teamwork for EFQM model successful implementation. Calvo-Mora et al., (2005) tested empirically the positive effect of people management, including teamwork and training on process management, included in EFQM model structure. Six Sigma also attributes great importance to teamwork in achieving improvements in processes (Breyfogle, 2003; Lowenthal, 2002; Pande et al., 2002). According to Lloréns and Molina, (2006), the third principle of Six Sigma methodology is teamwork. Six Sigma is supported by a team structure and the successes of this methodology in the firm depend on the role played by the team members (Shamji, 2005). Also, Six Sigma differs from other QM initiatives because it creates specialized positions for these teams, such as Black Belts, Champions or Green Belts (Breyfogle, 2003; Lloréns and Molina, 2006; Pande et al., 2002). For these reasons training becomes an essential factor for Six Sigma implementation (Lloréns and Molina, 2006). Firm must improve its members understanding of the policies implemented, team dynamic, tasks or statistical tools to ensure Six Sigma success (Green, 2006; Lee and Choi, 2006). Thus, both initiatives EFQM model and Six Sigma methodology require a deep implementation of teamwork and employee training, justifying the significant differences with other initiatives such as ISO 9000 or Quality Control.

Between groups 2 (ISO) and 4 (Six Sigma), differences also appear in the elements top management support, process management and SPC, which are more developed in Group 4. In Six Sigma, "the CEO is usually the driving force" (Green, 2006, p.1284). According to Eckes (2004), Six Sigma is an administrative philosophy and top management must be involved on it, to be successful. On the other hand, Six Sigma, as the name itself indicates, is based on a series of statistical tools that will be used by the members of the organization in their projects to seek improvement in the different processes of the organization (Breyfogle, 2003; Pande et al. 2002). For this reason, SPC constitutes one of the most distinctive practices of this methodology. Process management in Six Sigma is analysed below.

All the differences observed lead us to establish that both, EFQM model and Six Sigma methodology, constitute more strong initiatives than quality control and ISO 9001:2000, as they remain above the mean of the market in QM elements implementation, particularly in the elements previously mentioned. For example, the need associated with the EFQM model allows strengthening the competitive position of the European firms in world markets (García-Bernal, et al., 2004), more than do quality control and the ISO Standards. To apply for the prize that the organization of this model gives, companies must show that, as mentioned above, the excellence in their quality management is their fundamental process of continuous improvement (Shergold and Reed, 1996; Wongrassamee et al., 2003). Also, Six Sigma has been understood as a "strategy for organizational excellence" as it impacts on seven of the nine criteria of the business excellence model, such as EFQM (Thawani, 2004).

Finally, examining comparisons between firms belonging to groups 3 (EFQM) and 4 (Six Sigma), we can observe that there is only one element generating significant differences, process management. Six Sigma firms tend to develop to a greater degree "process management" than EFQM firms. As we observed in section two, Linderman et al., (2003, p.195) conceptualized Six Sigma methodology as a "method for improving strategic processes". Lloréns and Molina (2006) also remarks Six Sigma orientation to business processes. Both definitions show that Six Sigma is directly focused on processes (DeMast, 2006). Six Sigma projects are focused on identify and clarify the core processes of the firm and improve, redesign or develop them (Lloréns and Molina, 2006). Our results support this statement, as they show that Six Sigma is the strongest initiative of those analysed, referring to process management.

6. CONCLUSIONS

The goal of the present study was to provide a criterion that would enable organizations to choose among different quality management initiatives as a function of the degree of development required for some of the structural elements that compose them. The greater the development required, the greater the complexity for implementing the initiative. The initiative of quality control would thus be the simplest, constituting a very basic initial step toward QM. However, if we seek greater development, it is necessary to advance, for example toward the ISO standards, required for competing in international markets. However, this advance requires a greater development of some QM elements, making the implementation of this initiative more complex than the previous one. If the choice to attempt more ambitious and more developed initiatives is made, with the resulting greater complexity, we see that the EFQM model and Six Sigma methodology require greater development of most QM elements. The main difference between both initiatives is that Six Sigma methodology requires a deeper implementation of process management, complicating its implementation process. In any case, and in spite of the increase in complexity that both initiatives involve, their positive effects on performance have already been proven (Eskildsen and Dahlgaard, 2000; Kristensen et al., 2000; Kuei and Madu, 2003; Wyper and Harrison, 2000).

Among the limitations of this study, we see first that we have grouped the organizations that implemented the corresponding initiative independently of the time they have been undertaking this implementation. There may be organizations that have implemented the initiative recently and still have not developed the elements studied sufficiently. Second, the study is based on a cross-sectional and not a longitudinal study. Finally, the replies were obtained from a single polled, with the subjectivity of the replies this approach implies. Future lines of research could try to (1) introduce new initiatives, among them the following most widely used among the organizations: Total Quality Management (TQM), to confirm where it is situated according to the complexity it involves. (2) It would also be interesting to relate the study to organizational performance. This would allow us to determine the effect of each of the elements on organizational performance, making it possible to establish a relation between degree of development and result obtained, creating a new classification of the initiatives and a more comprehensive criterion of choice.

REFERENCES

ACTUALIDAD ECONÓMICA (2004): "Cuáles son, cuánto venden y quién manda en las 5.000 mayores empresas". *Octubre 2004*, n.2419.

AHIRE, S.L., GOLHAR, D.Y. and WALLER, M.A. (1996): "Development and Validation of TQM Implementation Constructs". *Decision Sciences*. Vol.27, n.1, pp.23-56.

AL-ZAMANY, Y., HODDELL, S. and SAVAGE, B. (2002): "Understanding the difficulties of implementing quality management in Yemen". *The TQM Magazine*. Vol.14, n.4, pp.240-248.

AMSTRONG, J.S. and OVERTON, T.S. (1977): "Estimating nonresponse bias in mail surveys". *Journal of Marketing Research*, Vol.14, pp.396-402.

ANDERSON, J.C., RUNGTUSANATHAM, M., SCHROEDER, R.G. and DEVARAJ, S. (1995): "A Path Analytic Model of a Theory of Quality Management Underlying the Deming Management Method: Preliminary Empirical Findings". *Decision Sciences*. Vol.26, n.5, pp.637-658.

ANDERSON, S.W., DALY, J.D. and JOHNSON, M.F. (1999): "Why firms seek ISO 9000 certification: regulatory compliance or competitive advantage?". *Production and Operations Management*. Vol.8, n.1, pp.28-43.

BEHARA, R.S., FONTENOT, G.F. and GRESHAM, A. (1995): "Customer satisfaction measurement and analysis using Six Sigma". *The International Journal of Quality and Reliability Management*. Vol.12, n.3, pp.9-18.

BEIRAO, G. and CABRAL, S. (2002): "The reaction of the Portuguese stock market to ISO 9000 certification". *Total Quality Management*, Vol.13, n.4, pp.465-475.

BENDELL, D. (2000): "The implications of the changes to ISO 9000 for organisational excellence". *Measuring Business Excellence*, Vol.4,n.3, pp.11-14.

BLACK, S. and PORTER, L. (1996): "Identification of the critical factors of TQM". *Decision Sciences*. Vol.27, nº1, pp.1-21.

BOULTER, L. and BENDELL. T. (2002): "How can ISO 9000:2000 help companies achieve excellence?" *Measuring Business Excellence*, Vol.6, n.2, pp.37-41.

BREYFOGLE, F.W. (2003): "Implementing Six Sigma: Smarter Solutions Using Statistical Methods". Hoboken, *New Jersey: Ed. Wiley*.

BROWN, A., WIEL, T. and LOUGHTON, K. (1998): "Smaller enterprises' experience with ISO 9000". *International Journal of Quality & Reliability Management*, Vol. 15, N..3.

BRYDE, D.J. (2002): "Modelling project management performance". *The International Journal of Quality and Reliability Management*. Vol.20, n.2, pp.228-253.

CALISIR, F., KULAK, O. and DOGAN, I. (2005): "Factors influencing Turkish Textile Companies´ Satisfaction with ISO 9000". *Total Quality Management*. Vol.16, n.6, pp.1193-1204.

CALVO-MORA, A.; LEAL, A. and ROLDÁN, J.L. (2005): "Relationships between the EFQM model criteria: a study in Spanish universities". *Total Quality Management & Business Excellence*, Vol.16, n.6, pp.741-770.

CASADESÚS, M. and DE CASTRO, R. (2005): "How improving quality improves supply chain management: empirical study". *TQM Magazine*, Vol.17, n.4, pp.345-357.

CHILES, T.H. and CHOI, T.Y. (2000): "Theorizing TQM: An Austrian and Evolutionary Economics Interpretation". *Journal of Management Studies*. Vol.37, nº2, pp.185-212.

CHURCHILL, G.A.Jr. (1979): "A paradigm for developing better measures of marketing constructs". *Journal of Marketing Research*, Vol.16, pp.64-73.

COLEMAN, S. and DOUGLAS, A. (2003): "Where next for ISO 9000 companies". *The TQM Magazine*. Vol.15, n.2, pp.88-92.

CONTI, T. (1999): "Vision 2000: positioning the new ISO 9000 standards with respect to total quality management models". *Total Quality Management & Business Excellence*, Vol.10, n.4/5, pp.454-464.

CORBETT, C.; MONTES-SANCHO, M. and KIRSCH, D. (2005): "The Financial Impact of ISO 9000 Certification in the United States: An Empirical Analysis". *Management Science*, Vol.51, n.7, pp.1046-1059.

COSTA, M. and MARTÍNEZ-LORENTE, A. (2003): "ISO 9000: the past, the present and the future. A case study in the Spanish Industry". *Proceedings of the 8th International Conference on ISO 9000 and TQM*, Montreal, Canada: National Quality Institute.

DALE, B.G. (1999). "Managing Quality". 3rd Edition. *Blackwell Business*, Oxford.

DALE, B.G. and LASCELLES, D.M. (1997): "Total Quality Management adoption; revising the levels". *TQM magazine*, Vol.9, pp.418-428.

DASGUPTA, T. (2003): "Using the six-Sigma metric to measure and improve the performance of a supply chain". *Total Quality Management*. Vol.14, n.3, pp.355-366.

DE MAST, Jeroen (2006): "Six Sigma and Competitive Advantage". *Total Quality Management*. Vol.17, n.4, pp.455-464.

DEAN, J.W. Jr. and BOWEN, D.E. (1994): "Management Theory and Total Quality: Improving research and practice through theory development". *Academy of Management Review*. Vol.19, n.3, pp.392-418.

DEDHIA, N.S. (2005): "Six Sigma basics". *Total Quality Management and Business Excellencce*. Vol.16, n.5, pp.567-574.

DOUGLAS, T.J. y JUDGE, W.Q. Jr. (2001): "Total Quality Management Implementation and Competitive Advantage: the role of structural control and exploration". *Academy of Management Journal*, Vol.44, nº1, pp.158-169.

EBRAHIMPOUR, M. (1985): "An examination of quality management in Japan: implications for management in the United States". *Journal of Operations Management*. Vol. 5, nº4, pp. 419-31.

ECKES, G. (2004): "Six Sigma para todos". Editorial GRANICA, Barcelona.

EFQM (2006): European Foundation for Quality Management: www.efqm.org

EHRLICH, C. (2006): "The EFQM model and work motivation". *Total Quality Management and Business Excellencce*. Vol.17, n.2, pp.131-140.

ESKILDSEN, J.K and DAHLGAARD, J.J. (2000): "A causal model for employee satisfaction". *Total Quality Management*. Vol.11, n.8, pp.1081-1094.

ESKILDSEN, J.K., KRISTENSEN, K. and JUHL, H.J. (2001): "The criterion weights of the EFQM excellence model". *The International Journal of Quality and Reliability Management*. Vol.18, n.8/9, pp.783-795.

FALLON, G., BROWN, R. and ALLEN, J. (2003): "The dead hand of the past: the implementation of new quality standards in a business support organization". *Measuring Business Excellence*. Vol.7, n.1, pp.63-71.

FEIGENBAUM, A.V. (1986). "Control total de la calidad". *McGrawHill. México: Cecsa.*

FLYNN, B.B., SAKAKIBARA, S. and SCHROEDER, R.G. (1995): "Relationship between JIT and Total Quality Management: practices and performance". *Academy of Management Journal*. Vol.38, n.5, pp.1325-1360.

FLYNN, B.B., SCHROEDER, R.G. and SAKAKIBARA, S. (1994): "A Framework for Quality Management Research and n Associated Measurement Instrument". *Journal of Operations Management*. Vol.11, n.4, pp.339-366.
FUENTES, F. M., LLORENS, M.F.J. and MOLINA, F.L.M. (2006): "Total Quality Management, strategic orientation and organizational performance: the case of Spaninsh companies". *Total Quality Management and Business Excellencce*. Vol.17, nº3, pp.303-323.
GARCÍA BERNAL, J., GARGALO CASTEL, A., PASTOR AGUSTÍN, G. and RAMÍREZ, M. (2004): "Total Quality Management in Firms: Evidence from Spain". *The Quality Management Journal*. Vol.11, n.3, pp.20-34.
GARVIN, D.A. (1988): "Managing Quality: The Strategic and Competitive Edge". *New York: The Free Press.*
GEHANI, R.R. (1993): "Quality value-chain: a meta-synthesis of frontiers of quality movement". *Academy of Management Executive*. Vol.7, n.2, pp.29-42.
GEORGE, C., COOPER, F. and DOUGLAS, A. (2003): "Implementing the EFQM excellence model in a local authority". *Managerial Auditing Journal*. Vol.18, n.1/2, pp.122-127.
GOH, T.N., LOW, P.C., TSUI,K.L. and XIE, M. (2003): "Impact of Six Sigma implementation on stock price performance". *Total Quality Management and Business Excellence*. Vol.14, n.7, pp.753-763.
GOTZAMANI, K.D. (2005): "The implications of the new ISO 9000:2000 standards for certified organizations". *International Journal of Productivity and Performance Management*, Vol.54, n.8, pp.645-657.
GOTZAMANI, K.D. and TSIOTRAS, G.D. (2001): "An empirical study of the ISO 9000 standards´ contribution towards total quality management". *The International Journal of Quality & Reliability Management.* Vol.21, n.10, pp.1326-1342.
GREEN, F. (2006): "Six Sigma and the revival of TQM", *Total Quality Management & Business Excellence*, Vol.17, n.10, pp.1281-1286.
HACKMAN, J.R. and WAGEMAN, R. (1995): "Total Quality Management: Empirical, Conceptual, and Practical Issues". *Administrative Science Quarterly*. Vol.40, nº2, pp.309-342.
HAIR, J.F.; ANDERSON, R.E.; TATHAM, R.L. y BLACK, W.C. (2004): "Análisis multivariante". 5ª Ed. *Madrid: Prentice Hall.*
HANDFIELD, R.B., GHOSH, S. and FAWCETT, S. (1998): "Quality driven change and its effects on financial performance". *Quality Management Journal*, Vol.5, n.3, pp.13-30.
HARRY, M.J. and SCHROEDER, R. (2000): "Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations". *Doubleday, New York*.
HO, D.C., DUFFY, V.G. and SHIH, H.M. (1999): "An Empirical Analysis of Effective TQM Implementation in the Hong Kong Electronics Manufacturing Industry". *Human Factors and Ergonomics in Manufacturing*. Vol.9, n.1, pp.1-25.
HUQ, Z. (2005): "Managing change: a barrier to TQM implementation in service industries". *Managing Service Quality*. Vol.15, n.5, pp.452-469.
JAIDEEP, M., ASHOK, K. and CHENG, C.H. (1996): "A roadmap to implementing ISO 9000". *The International Journal of Quality and Reliability Management*. Vol.13, n.1, pp.72.
JENSEN, P.B. (2001): "ISO 9000 Guía y comentarios". *3ªedición. AENOR.*
JOHANSEN, C.G. (1995): "Application of the ISO 9000 standards of quality management in professional services: an information sector case". *Total Quality Management*. Vol.6, n.3.
KAYNAK, H. (2003): "The relationship between total quality management practices and their effects on firm performance". *Journal of Operations Management*, Vol.21, pp.405-435.
KHAN, M.K. and HAFIZ, N. (1999): "Development of an Expert System for implementation of ISO 9000 quality systems". *Total Quality Management*, Vol.10, n.1, pp.47-59.
KRISTENSEN, K., JUHL, H.J. and ESKILDSEN, J.K. (2000): "The excellence index as a benchmarking tool". *MAAOE Conference Proceedings*, Estes Park, Colorado, USA.
KUEI, C.H. and MADU, C.N. (2003): ""Customer-centric six Sigma quality and reliability management". *The International Journal of Quality and Reliability Management*. Vol.20, n.8, pp.954-964.
LANGFIELD-SMITH, K., and GREENWOOD, M.R. (1998): "Developing co-operative buyer-supplier relationships: a case study of Toyota". *Journal of Management Studies*. Vol.35, nº3.
LANYON, S. (2003): "At Raytheon Six Sigma works, too, to improve HR Management processes". *Journal of Organizational Excellence*. Autumn 2003, pp.29-42.
LASCELLES, D. and BARRIE, D. (1990): "Quality Management: The Chief Executive's Perception and Role". *Journal of European Management*. Vol.8, pp.67-75.
LEE, K. y CHOI, B. (2006): "Six sigma management activities and their influence on corporate competitiveness". *Total Quality Management & Business Excellence*, Vol.17 n.7, pp.893-911.
LEONARD, D. and McADAM, R. (2002): "The role of the business excellence model in operational and strategic decision making". *Management Decision*. Vol.40, n.1/2, pp.17-26.
LIEBESMAN, S. and MROZ, J. (2002): "ISO 9000:2000 Experiences: First Results are in". *Quality Progress*, Vol.35, n.4, pp.52.
LINDERMAN, K., SCHROEDER, R.G., ZAHEER, S. and CHOO, A.S. (2003): "Six Sigma: a goal-theoretic perspective". *Journal of Operations Management*. Vol.21, pp.193-203.
LLORÉNS MONTES, F.J. (1996): "Procesos, Contenido y Efectividad de la Calidad Total: Una aproximación desde la Dirección de Empresas". *Revista Europea de Dirección y Economía de la Empresa*. Vol.5, nº3, pp.163-180.
LLORÉNS MONTES, F.J. and MOLINA, LUIS M. (2006): "Six Sigma and Management Theory: Processes, Content and Effectiveness". *Total Quality Management*, Vol.17, n.4, pp.485-506.
LOWENTHAL, J.N. (2002): "Guía para la aplicación de un proyecto Seis Sigma". *Madrid: Ed. FC Editorial.*
LUCAS, M.L. (2002): "The essential Six Sigma: how successful six sigma implementation can improve the bottom line", *Quality Progress*, Vol.35, n.1.
LUPAN, R.; BACIVAROF, I.; KOBI, A. and ROBLEDO, C. (2005): "A Relationship Between Six Sigma and ISO 9000:2000". *Quality Engineering*, Vol.17, n.4, pp.719-725.
MAGD, H. and CURRY, A. (2003): "ISO 9000 and TQM: are they complementary or contradictory to each other?" *The TQM Magazine*, Vol.15, n.4, pp.244-256.
MANN, R. and KENOE, D. (1994): An Evaluation of the Effects of Quality Improvement Activities on Business Performance. *The International Journal of Quality and Reliability Management*, Vol.11, n.4, pp.29-44.
MARTIN, W.S. (1978): "Effects on scaling on the correlation coefficient: additional considerations". *Journal of Marketing Research*, Vol.15, pp.304-308.
McADAM, R. and FULTON, F. (2002): "The impact of the ISO 9000:2000 standards in small software firms". *Managing Service Quality*, Vol.12, n.5, pp.336-345.
McCLELLAND, G.H. and JUDD, C.M. (1993): "Statistical difficulties of detecting interactions and moderator effects". *Psychological Bulletim*, Vol.114, pp.376-390.
MEZHER, T.; AJAM, M. and SHEHAB, M. (2004): "The Historical Impact of ISO 9000 on Lebanese Firms". *Quality Assurance*, Vol.11, n.1, pp.25-42.

NAIR, A. (2006): "Meta-analysis of the relationship between quality management practices and firm performance-implications for quality management theory development". *Journal of Operations Management,* Vol.24, pp.948-975.
NAJMI, M. and KEHOE, D.F. (2000): "An integrated framework for post-ISO 9000 quality development". *The International Journal of Quality and Reliability Management*. Vol.17, n.3, pp.226.
NASER, K.; KARBHARI, Y. and MOKHTAR, M. (2004): "Impact of ISO 9000 registration on company performance: Evidence from Malaysia". *Managerial Auditing Journal,* Vol.19, n.4, pp.509-516.
NAVEH, E. and MARCUS, A. (2005). "Achieving competitive advantage through implementing a replicable management standard: Installing and using ISO 9000". *Journal of Operations Management,* Vol.24, n.1, pp.1-26.
OAKLAND, J., TANNER, S. and GAAD, K. (2002): "Best practice in business excellence". *Total Quality Management.* Vol.13, n.8, pp.1125-1139.
OGER, B. and PLATT, D.E. (2002): "Value Measurement and Value Creation Models in Europe and the US: A comparison of the EFQM Excellence Model and the Baldrige Award Criteria". *Compatibilite, Controle, Audit,* May, pp.99-116.
PANDE, P.S., NEUMAN, R.P. and CAVANAGH, R.R. (2002): "Las claves de Seis Sigma: La implantación con éxito de una cultura que revoluciona el mundo empresarial". *Madrid: Ed. McGraw Hill.*
PANNIRSELVAM, G.P. and FERGUSON, L.A. (2001): "A study of the relationships between the Baldrige categories". *The International Journal of Quality and Reliability Management*, Vol.18, n.1, pp.14-34.
POWELL, T.C. (1995): "Total Quality Management as Competitive Advantage: A review and empirical study". *Strategic Management Journal*. Vol.16, n.1, pp.15-37.
PRAJOGO, D.I. and SOHAL, A.S. (2003): "The relationship between TQM practices, quality performance, and innovation performance: An empirical examination". *International Journal of Quality and Reliability Management*. Vol.20, n.8, pp.901-918.
PRICE, M.J. and CHEN, E.E. (1993): "Total Quality Management in a Small, High-technology company". *California Management Review*. Spring 1993. Vol.35, nº3, pp.96-118.
RAO, S.S.; RAGHUNATHAN, T.S. and SOLIS, L.E. (1997): "Does ISO 9000 have an effect on quality management practices? An international empirical study". *Total Quality Management,* Vol.8, n.6, pp.335-346.
RAO, S.S., SOLIS, L.E. and RAGHUNATHAN, T.S. (1999): "A framework for international quality management research: Development and validation of a measurement instrument". *Total Quality Management*. Vol.10, nº7, pp.1047-1075.
RAVICHANDRAN, T. and RAI, A. (2000): "Quality management in systems development: an organizational system perspective". *MIS Quarterly*. Vol.24, n.3, pp.381-415.
RUNGTUSANATHAM, M., ANDERSON, J.C., and DOOLEY, K.L. (1997). Conceptualizing organizational implementation and practice of statistical process control. Journal of Quality Management, 2, 113–137.
RUSELL, C.J. and BOBKO, P. (1992): "Moderated regression analysis and Likert scales: too coarse for comfort". *Journal of Applied Psychology,* Vol.77, pp.336-342.
SAAD, G.H. and SIHA, S. (2000). "Managing quality: critical links and a contingency model". *International Journal of Production and Operations Management*. Vol.20, n.10, pp.1146-1163.
SAIZARBITORIA, I. (2006): "How Quality Management models influence company results–Conclusions of an empirical study based on the Delphi method". *Total Quality Management & Business Excellence*, Vol.17, n.6, pp.775-794.
SAIZARBITORIA, I. and HERAS, I. (2006): "How Quality Management models influence company results–Conclusions of an empirical study based on the Delphi method". *Total Quality Management & Business Excellence*, Vol.17, n.6, pp.775-794.
SAMUELSSON, P. and NILSSON, L.E. (2002): "Self assessment practices in large organizations: Experiences from using the EFQM excellence model". *The International Journal of Quality and Reliability Management*. Vol.19, n.1, pp.10-23.
SANDBROOK, M. (2001): "Using the EFQM Excellence Model as a framework for improvement and change". *Journal of Change Management*. Vol.2, n.1, pp.83-90.
SARAPH, J.V., BENSON, P.G., and SCHROEDER, R.G. (1989). An instrument for measuring the critical factors of Quality Management. Decision Sciences, 20, 810–830.
SENLLE, A. (2001): "ISO 9000:2000 Calidad y Excelencia". *Barcelona: Ediciones Gestión2000.*
SHAMJI, N. (2005): "Six Sigma Basics". *Total Quality Management & Business Excellence*, Vol.16, n.5, pp.567-574.
SHERGOLD, K. and REED, D.M. (1996): "Striving for excellence: how self-assessment using the Business Excellence Model can result in step improvements in all areas of business activities". *The TQM Magazine*. Vol.8, n.6, pp.48-52.
SHEWHART, W.A. (1997), [1931]. Control económico de la calidad de productos manufacturados [Economic control of quality of manufactured product]. Madrid: Ed. Díaz de Santos.
SILA, I. and EBRAHIMPOUR, M. (2002): "An investigation of the total quality management survey based research published between 1989 and 2000: A literature review". *International Journal of Quality and Reliability Management*. Vol.19, n.7, pp.902-970.
SITKIN, S.B., SUTCLIFFE, K.M. and SCHROEDER, R.G. (1994): "Distinguishing control from learning in Total Quality Management: a contingency perspective". *Academy of Management Review*. Vol.19, n.3, pp.537-564.
SOLTANI, E. (2005): "Top management: A threat or an opportunity for TQM?". *Total Quality Management and Business Excellencce.* Vol.16, n.4, pp.463-476.
STEPHENS, K.S. (1994): "ISO 9000 and total quality". *Quality Management Journal*. Fall 1994, pp.57-71.
STRUEBING, L. (1996): "9000 standards". *Quality Progress.* Vol.29, pp.23-28.
SUN, H. (2000): "Total quality management, ISO 9000 certification and performance improvement". *The International Journal of Quality and Reliability Management*. Vol.17, n.2, pp.168.
THAWANI, S. (2004): "Six Sigma- Strategy for Organizational Excellence". *Total Quality Management & Business Excellence*, Vol.15 n.5, pp.655-664.
VAN DER WIELE, T.; VAN IWAARDEN, J. and WILLIAMS, R. (2005): "Perceptions about the ISO 9000 (2000) quality system standard revision and its value: the Dutch experience". *International Journal of Quality and reliability Management*, Vol.22, n.2, pp.101-119.
VAN MARREWIJK, M.; WUISMAN, I.; DE CLEYN, W.; TIMMERS, J.; PANAPANAAN, V. and LINNAEN, L. (2004): "A Phase-wise Development Approach to Business Excellence: Towards an Innovative, Stakeholder-oriented Assessment Tool for Organizational Excellence and CSR". *Journal of Business Ethics,* Vol.55, pp.83-98.
VOUZAS, F.K. and GOTZAMANI, K.D. (2005): "Best practices of selected Greek organizations on their road to business excellence. The contributions of the new ISO 9000:2000 series of standards". *The TQM Magazine,* Vol.17, n.3, pp.259-266.
WALDMAN, D.A. (1994): " The contributions of Total Quality Management to a theory of work performance". *Academy of Management Review*. Vol.19, n.3. pp.510-536.
WIKLUND, H. and WIKLUND, P.S. (2002): "Widening the Six Sigma concept: an approach to improve organizational learning". *Total Quality Management*. Vol.13, n.2, pp.233-239.
WILKES, N. and DALE, B.G. (1998): "Attitudes to self-assessment and quality awards: A study in small and medium-sized companies". *Total Quality Management*. Vol.9, n.8, pp.731-739.

WITHERS, B.E. and EBRAHIMPOUR, M. (1996): “An examination of ISO 9000 registration practices of American, German and Japanese firms operating in the USA”. *The International Journal of Quality and Reliability Management*. Vol.13, n. 7; pp.8.
WONGRASSAMEE, S., GARDINER, P.D., and SIMMONS, J.E. (2003): “Performance measurement tools: the Balanced Scorecard and the EFQM Excellence Model”. *Measuring Business Excellence*. Vol.7, n.1, pp.14-29.
WYPER, B. and HARRISON, A. (2000): “Deployment of Six Sigma methodology in Human Resource function: a case study. *Total Quality Management and Business Excellence.* Vol.11, pp.720-727.
YANG, J.B.; DALE, B.G. and SIOW, C.H.R. (2001): “Self-assessment of excellence: an application of the evidential reasoning approach”. *International Journal of Production research,* Vol.39, n.16, pp.3789-3812.

Table 1- The 25 most common factors in the QM literature according to Sila and Ebrahimpour (2002)

Top Management commitment of upper management	Social responsibility (environment, employee security, etc.)	Strategic planning	Customer focus and satisfaction	Quality information and performance measurement
Benchmarking	HR Management	Training	Involvement	Empowerment
Employee satisfaction	Teamwork	Employee's recognition	Process management	Control of processes
Product and service design	Supplier Management	Continuous improvement and innovation	Quality assurance	"0 defects"
Quality culture	Communication	Quality systems	"Just in time"	Flexibility

Source: Adapted from Sila and Ebrahimpour (2002).

Table 2- QM structural elements studied

Element	Definition	References
Supplier management	A greater level of confidence, information shared in both directions, direct attendance of the buyers to the suppliers to help them to improve the products, long-term contracts, formal evaluation of the supplier's performance, and involvement of the suppliers in the development of new products and processes of the buyers (Langfield-Smith and Greenwood, 1998).	Ahire et al., (1996), Anderson, et al. (1995), Black and Porter (1996), Flynn et al., (1995), Hackman and Wageman (1995), Ho et al., (1999), Lloréns (1996), Powell (1995), Rao et al., (1999), Ravichandran and Rai (2000), Saraph et al.,(1989), Waldman (1994).
Benchmarking	Analysis of the best processes and products of the leading competition in the same industry or of the leaders of other industries that use similar processes, in order to use this knowledge to improve one's products and processes (Ahire et al., 1996).	Lloréns (1996), Powell (1995), Price and Chen (1993), Rao et al., (1999), Waldman (1994).
Training	Endowment of employees with knowledge of the concepts and tools of quality so that they can understand the issues related to it (Ahire et al., 1996).	Ahire et al., (1996), Anderson, et al. (1995), Dean and Bowen (1994), Douglas and Judge (2001), Flynn et al., (1995), Fuentes et al., (2006), Hackman and Wageman (1995), Ho et al., (1999), Lloréns (1996), Powell (1995), Price and Chen (1993), Rao et al., (1999), Ravichandran and Rai (2000), Saraph et al., (1989), Waldman (1994).
Top Management support (Leadership, commitment).	The element required to create values, objectives, and systems that satisfy the needs of clients and improve the performance of the organization (Ebrahimpour, 1985).	Ahire et al., (1996), Anderson, et al. (1995), Black and Porter (1996), Douglas and Judge (2001), Flynn et al., (1995), Fuentes et al., (2006), Ho et al., (1999), Lloréns (1996), Powell (1995), Prajogo and Sohal (2003), Price and Chen (1993), Rao et al., (1999), Ravichandran and Rai (2000), Saraph et al., (1989), Waldman (1994).
Empowerment	The practice that enables the employees to control their own work and to be capable of participating in the business of the organization (Rao et al., 1999).	Ahire et al., (1996), Fuentes et al., (2006), Powell (1995), Price and Chen (1993), Ravichandran and Rai (2000), Waldman (1994).
Teamwork	Encouragement of workers to participate and to use their creative skills to suggest new ways of improvement and to share their expert knowledge related to their immediate work tasks (Chiles and Choi, 2000).	Black and Porter (1996), Dean and Bowen (1994), Flynn et al., (1995), Fuentes et al., (2006), Hackman and Wageman (1995), Ho et al., (1999), Price and Chen (1993), Saraph et al., (1989).
Continuous improvement	A continuous effort to seek improvements in the products and services offered to these clients (Lascelles and Barrie, 1990).	Chiles and Choi (2000), Dean and Bowen (1994), Fuentes et al., (2006), Lloréns (1996), Prajogo and Sohal (2003), Ravichandran and Rai (2000), Sitkin et al., (1994).
Process Management	A set of practices that combine HR management with methodological issues to manage and improve the processes that generate goods and services (Anderson et al., 1994)	Fuentes et al., (2006), Hackman and Wageman (1995), Lloréns (1996), Powell (1995), Prajogo and Sohal (2003), Saraph et al., (1989).
Statistical Process Control (SPC)	The adoption of specific policies and performance of specific actions that support the development of different cognitive and statistical procedures that seek to facilitate vigilance, the fit and improvement of processes, (Rungtusanathan et al., 1997).	Ahire et al., (1996), Anderson et al., (1995), Black and Porter (1996), Dean and Bowen (1994), Douglas and Judge (2001), Flynn et al., (1995), Hackman and Wageman (1995), Ho et al., (1999), Lloréns (1996), Powell (1995), Prajogo and Sohal (2003), Price and Chen (1993), Ravichandran and Rai (2000), Saraph et al., (1989), Waldman (1994).

Table 3- Test Results of the measurement model

Goodness-of-Fit Statistics	Measurement model for QM elements	Recommended values[a] for satisfactory fit of a model to data
χ^2/df	1.6	< 3.0
Goodness Fit Index (GFI)	0.98	> 0.95
Root Mean Square Error of Approximation (RMSEA)	0.05	< 0.08
Parsimony Goodness-of Fit-Index (PGFI)	0.79	> 0.50
Parsimony Normed Fit Index (PNFI)	0.84	> 0.50
Comparative Fit Index (CFI)	0.99	> 0.90

[a] Hair et al., (2004)

Table 4- Sample distribution

Group	Quality Management Initiative	Size
GROUP 1	Quality Control	45
GROUP 2	ISO 9000	117
GROUP 3	EFQM model	38
GROUP 4	Six Sigma methodology	37

Table 5- Results of ANOVA analysis of comparison of means

QM element	F	Signif.
Supplier Management	2.322	0.076
Benchmarking	3.021	0.031 *
Training	7.358	0.000 **
Top Management support	3.694	0.013 *
Empowerment	4.767	0.003 **
Teamwork	7.917	0.000 **
Continuous improvement	3.898	0.010 *
Process Management	5.349	0.001 **
SPC	5.651	0.001 **

Significance level α≤0.01 (**), α≤0.05 (*)

Table 6- T-values and significance degree of T-tests for comparison of means for independent samples

	Group 1 (Control) Group 2 (ISO)	Group 1 (Control) Group 3 (EFQM)	Group 1 (Control) Group 4 (Six Sigma)	Group 2 (ISO) Group 3 (EFQM)	Group 2 (ISO) Group 4 (Six Sigma)	Group 3 (EFQM) Group 4 (Six Sigma)
Benchmarking	-1.670 (.099)	-2.884 (.005) **	-2.306 (.024) *	-1.581 (.166)	-1.101 (.275)	.469 (.640)
Training	-2.199 (.029) *	-3.153 (.002) **	-3.704 (.000) **	-2.307 (.025) *	-3.404 (.001) **	-.343 (.733)
Top Management Support	-2.031 (.044) *	-2.061 (.043) *	-2.938 (.004) **	-.596 (.553)	-2.092 (.040) *	-1.301 (.197)
Empowerment	-2.473 (.014) *	-2.985 (.004) **	-2.964 (.004) **	-1.549 (.126)	-1.511 (.135)	.089 (.929)
Teamwork	-1.645 (.104)	-4.156 (.000) **	-3.585 (.001) **	-3.185 (.002) **	-2.868 (.005) **	.566 (.573)
Continuous improvement	-2.537 (.012) *	-2.633 (.010) **	-2.386 (.019) *	-1.039 (.301)	-.809 (.421)	.220 (.827)
Process Management	-.829 (.408)	-.630 (.530)	-3.471 (.001) **	-.082 (.935)	-3.634 (.001) **	-2.644 (.010) **
SPC	-.686 (.495)	-.1846 (.069)	-3.618 (.001) **	-1.537 (.129)	-3.638 (.001) **	-1.748 (.085)

Significance level α≤0.01 (**), α≤0.05 (*)

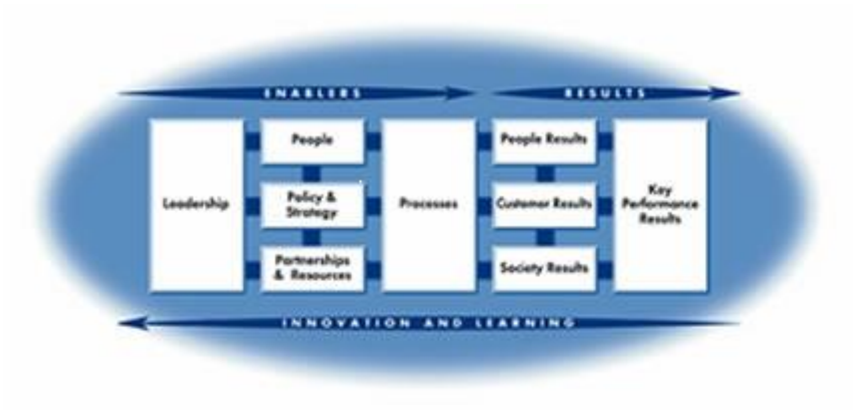
Table 7- Descriptive statistics

QM Elements	Group	N	Mean	Standard. dev.	QM Elements	Group	N	Mean	Standard dev.
Supplier Management	1	45	4.8056	1.35039	**Teamwork**	1	45	4.1200	1.52935
	2	117	5.2094	1.04632		2	117	4.5521	1.41315
	3	38	5.1351	1.14503		3	38	5.3568	1.06681
	4	37	5.4189	.85605		4	37	5.2108	1.14886
	Total	237	5.1536	1.10943		Total	237	4.6992	1.40873
Benchmarking	1	45	3.4667	1.54952	**Continuous improvement**	1	45	4.3111	1.75256
	2	117	4.9174	1.50981		2	117	4.9316	1.23160
	3	38	4.3423	1.10690		3	38	5.1622	.97933
	4	37	4.2072	1.35708		4	37	5.1081	1.13122
	Total	237	3.9435	1.45755		Total	237	4.8771	1.32318
Training	1	45	4.8111	1.57858	**Process Management**	1	45	3.2944	1.76075
	2	117	5.2949	1.10671		2	117	3.5171	1.43379
	3	38	5.7973	1.16940		3	38	3.5405	1.75744
	4	37	5.8784	.83670		4	37	4.5743	1.57549
	Total	237	5.3729	1.23286		Total	237	3.6441	1.61802
Top Management Support	1	45	4.8593	1.62755	**SPC**	1	45	3.1889	1.82638
	2	117	5.3419	1.23523		2	117	3.4081	1.81398
	3	38	5.4595	.97926		3	38	3.9189	1.74509

	4	37	5.7568	.98648
	Total	237	5.3333	1.27236
Empowerment	1	45	4.4356	1.59048
	2	117	5.0239	1.25648
	3	38	5.3514	1.07435
	4	37	5.3297	1.00799
	Total	237	5.0110	1.29735

4	37	4.6351	1.78009
Total	237	3.6388	1.85328

Figure 1- The EFQM model of business excellence



SOURCE: EFQM

Figure 2- Continuum from QM to TQM

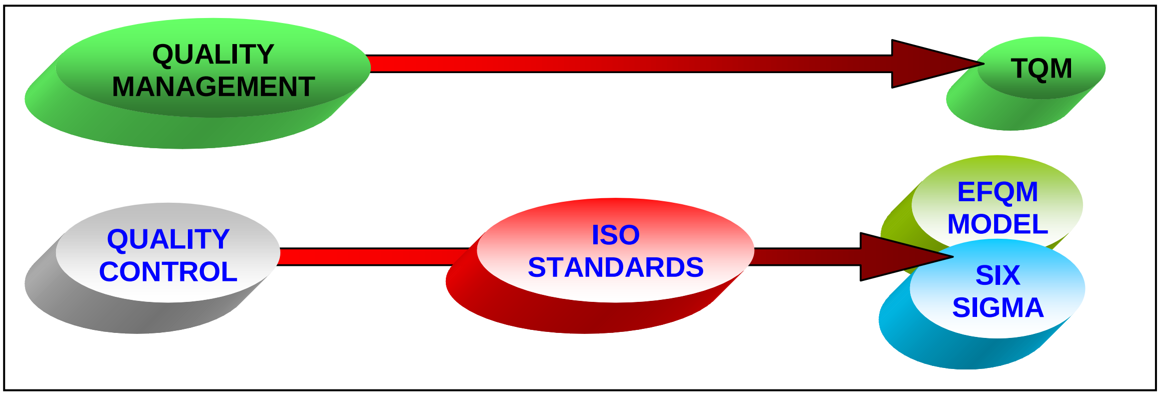


Figure 3- Significant differences in structural elements implementation degree between QM initiatives

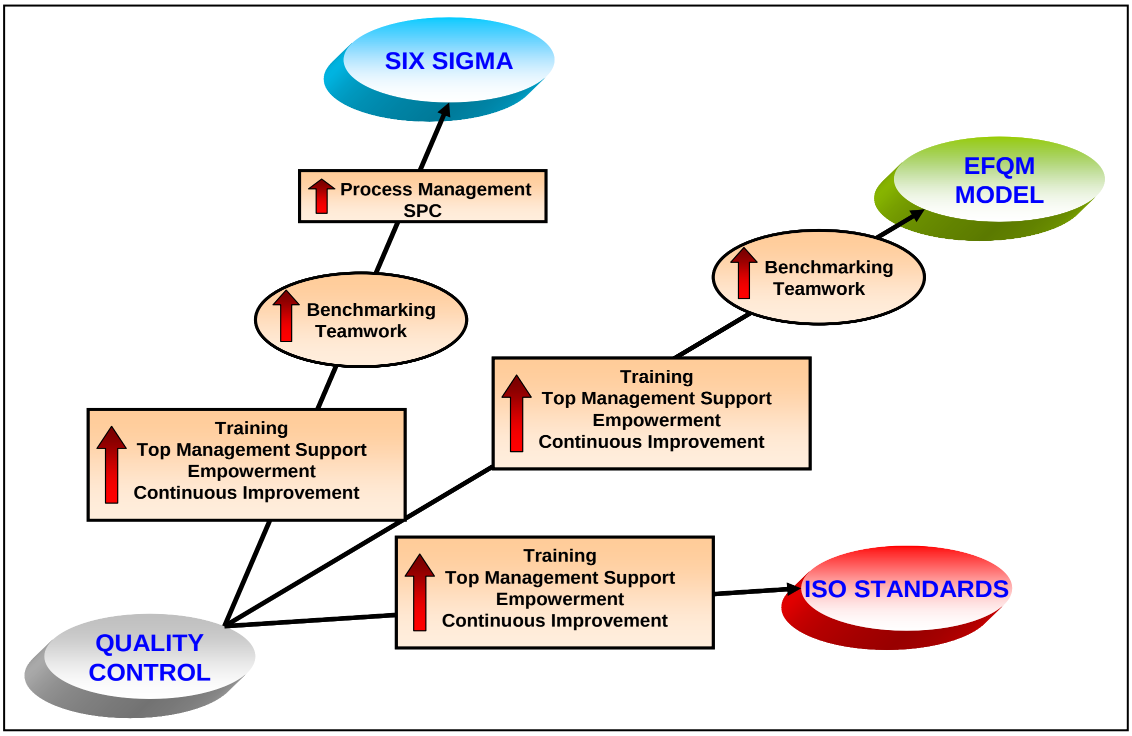
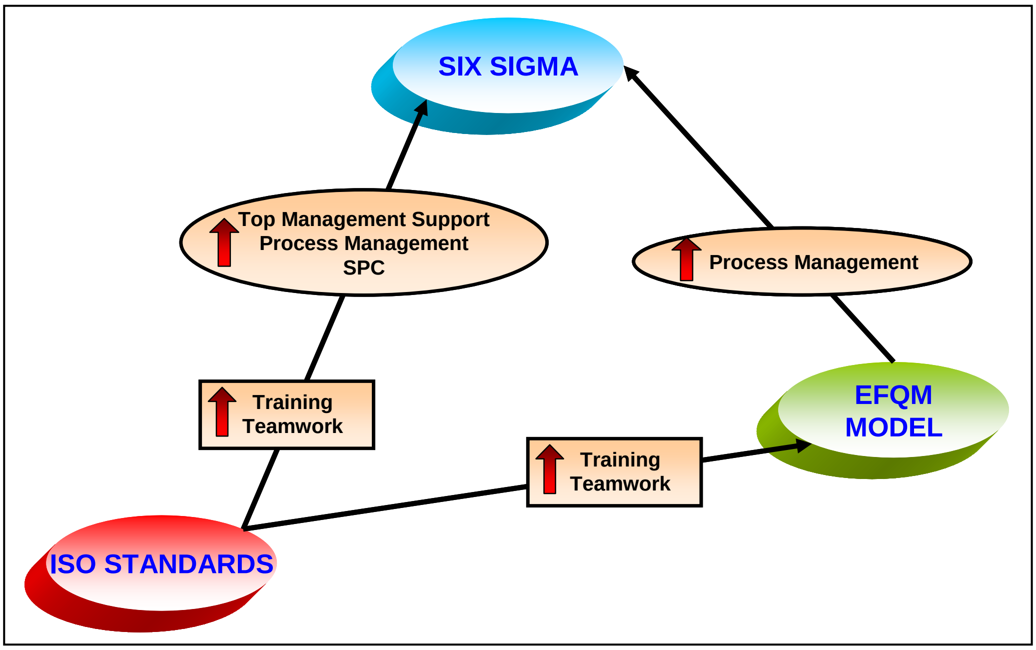


Figure 4- Significant differences in structural elements implementation degree between QM initiatives



Appendix A

The items market with the symbol (*) were retained after testing the measurement. The first value in table for each retained item indicates the standardized factor loadings. The second value represents the t-value resulting from testing each item's coefficient. The final column includes the source of the corresponding scale.

A. Quality management elements

A.1. Top management support (Cronbach's α = 0.880) (Flynn et al., 1995)

1. (*) All major department heads within our plant accept their responsibility for quality (0.95, t-value=55.97).
2. (*) Plant management provides personal leadership for quality products and quality improvements (0.94, t-value=59.55).

3. (*) Our top management strongly encourages employee involvement in the production process (0.95, t-value=61.59).
4. Management outside of the plant is primarily concerned with short-range financial performance (reverse coded).

A.2. Training (Cronbach's α = 0.750) (Flynn et al., 1995)
1. (*) Direct labor undergoes training to perform multiple tasks in the production process (0.90, t-value=37.36).
2. Plant employees are rewarded for learning new skills.
3. Our plant has a low skill level, compared with our industry (reverse coded).
4. (*) Direct labor technical competence is high in this plant (0.92, t-value=40.33).

A.3. Supplier management (Cronbach's α = 0.785) (Flynn et al., 1995)
1. (*) We strive to establish long-term relationship with suppliers (0.81, t-value=29.86).
2. Our suppliers are actively involved in our new product development process.
3. (*) Quality is our number one criterion in selecting suppliers (0.96, t-value=48.46).
4. (*) We rely on a small number of high-quality suppliers (0.72, t-value=24.70).
5. (*) Our suppliers are certified, or qualified, for quality (0.87, t-value=33.85).

A.4. Teamwork (Cronbach's α = 0.889) (Flynn et al., 1995)
1. Our plant is organized into permanent production teams.
2. (*) Our plant forms teams to solve problems (0.82, t-value=31.95).
3. (*) In the past three years, many problems have been solved through small group sessions (0.96, t-value=72.65).
4. (*) Supervisors encourage the persons who work for them to exchange opinions and ideas (0.93, t-value=61.36).
5. (*) Supervisors encourage the people who work for them to work as a team (0.91, t-value=41.04).
6. (*) Supervisors frequently hold groups meetings where the people who work for them can really discuss things together (0.96, t-value=43.74).

A.5. Continuous improvement (Cronbach's α = 0.837) (Anderson et al., 1995)
1. (*) All employees believe that it is their responsibility to improve quality in the plant (0.94, t-value=47.13).
2. (*) Continuous improvement of quality is stressed in all work processes throughout our plant (0.94, t-value=48.60).

A.6. Process Management (Cronbach's α = 0.808) (Anderson et al., 1995)
1. (*) Charts showing defect rates are posted on the shop floor (0.96, t-value=81.85).
2. (*) Charts plotting frequently of machine breakdowns are posted on the shop floor (0.99, t-value=102.73).
3. We have standardized process instructions which are given to personnel.
4. (*) A large percent of the equipment or process on the shop floor are currently under statistical quality control (0.91, t-value=52.79).
5. (*) We make extensive use of statistical techniques to reduce variance in processes (0.95, t-value=49.96).

A.7. Employee empowerment (Cronbach's α = 0.862) (Ahire et al., 1996)
1. (*) Our line workers inspect the quality of their own work; inspection is not the responsibility of an inspector (1.00, t-value=82.71).
2. (*) Line workers are encouraged to fix problems they find (0.98, t-value=140.28).
3. (*) Line workers are given the resources necessary to correct quality problems they find (0.97, t-value=125.06).
4. (*) Line workers have technical assistance available to them to help them solve quality problems (0.97, t-value=107.80).
5. (*) A problem solving network is available to line workers in solving quality related problems (0.94, t-value=57.86).

A.8. Statistical Process Control (Cronbach's α = 0.938) (Ahire et al., 1996)
1. (*) SPC is used extensively in our plant (1.00, t-value=70.19).
2. (*) SPC has been effective in improving the quality of our primary product (0.89, t-value=46.82).
3. (*) We will continue to use SPC in the manufacture of our primary product (0.89, t-value=45.17).
4. (*) Production workers are well-trained in SPC (0.96, t-value=52.47).

A.9. Benchmarking (Cronbach's α = 0.792) (Powell, 1995)

1. (*) We have an active competitive benchmarking program (0.93, t-value=40.68).
2. (*) We research best practices of others organizations (0.92, t-value=51.60).
3. (*) Usually we visit other organizations to investigate best practices (0.91, t-value=34.58).