

ANALYSIS OF QUALITY MANAGEMENT SYSTEMS USING STATISTICAL TOOLS

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ABSTRACT

The main objective of this paper is to analyze thirteen topics based on the literature associated to Quality Management System (QMS), identifying managerial gaps between the real and ideal situation in twelve enterprises. This has been accomplished conducting cases studies and interviews with their quality managers. Data were collected through a questionnaire validated by Cronbach's Alpha and analyzed through Multidimensional Scaling, Cluster Analysis, means and standard deviations. The results showed two distinct company groups, one of them composed by enterprises 1, 6, 10 and 11 presented better results compared to the group composed by enterprises 2, 3, 4, 5, 7, 8, 9 and 12. Among the thirteen questions initially proposed, three were excluded by the statistical techniques used, resulting in ten valid questions. The analysis of the valid questions showed that there are still many managerial gaps to be worked within the QMS by the companies in relation to the ideal situation considered. As a limitation of this study, the authors of this article mention that the research was conducted in a sample of companies selected for convenience, and therefore a larger sample or sector may be used in the future.

Keywords: Management, Quality Management System, Statistical Tools.

1. INTRODUCTION

Currently, the concept of Total Quality Management (TQM) goes beyond the need to simply have an effective enterprise, thus encouraging organizations from all sectors to continuously seek improvement of their performance. Analyzing papers of Prajogo and McDermott (2005), Ehigie and McAndrew (2005) and Baird et al (2011), it is possible to understand that TQM is characterized as a set of activities involving the entire enterprise, which fully contributes to achieve the overall company goals. In recent years the concept of Quality Management System (QMS) has approached more and more to the TQM concept, engaging employees to a higher goal.

The authors of this paper agree with the point of view mentioned by authors cited above, but understand that many enterprises are still far from those previously reported situation. It is possible to see clear gaps between what is expected in an efficient company in terms of quality management and what is observed in practice (Sadikoglu and Zehir, 2011). The same analysis, according Gilarski (2010), can be made to QMS, since many enterprises have managerial problems despite of having a QMS certification, such as ISO 9001 (2008). This reality leads us to a first question: is it possible still to find inefficiencies in QMS-certified companies?

Another point to be highlighted in relation to QMS requirements disseminated by ISO 9000 series is whether they still represent a managerial advantage or they are necessary factor, but not enough to achieve the enterprise success (Dick, 2000; Ehigie and McAndrew, 2005, Nair, 2006; Sadikoglu and Zehir 2011; Psomas, 2013). We remind here that the QMS gained great notoriety in 1987, when the International Organization for Standardization published the first ISO 9000 series, being later on revised and having its second publication in 1994, third publication in 2000, and fourth publication in 2008. It is expected to 2015 a new review and publication. And after 27 years from the first publication, the question is whether QMS remains as a market differential still.

According to the exposed, the main aim of this paper is to create an open wide academic debate about market differentiations provided by QMS and gaps between the provisions of ISO 9000 series and requirements allocated in the day to day activities. This has been done by analyzing 12 enterprises through studies cases and interviews with their Quality Managers.

Thirteen points associated with QMS requirements were selected from the literature to compose the main research instrument (questionnaire). These points were: market differentials, efficiency and improving processes, inclination towards excellence management, understanding how each employee can contribute to the company's overall objectives, top management participation, processes integration, efficient communication and training, human resources, infrastructure and work environment, documentation requirements and behavior close to audits. For those points, it was evaluated the agreement degree between the real and ideal situation, highlighting the gaps in company management systems.

2 LITERATURE REVIEW AND STATE OF THE ART

The literature review will provide a brief description of the research results used to compose this paper, focusing themes as Quality Management Systems (QMS), Total Quality Management (TQM) and implementation of other types of systems related to information presented by ISO 9000 series. Initially, it is useful to present the definition of QMS.

According to ISO 9000 (2005), the QMS is characterized as a system to manage and control an organization. This concept is directly related to synergistic processes, seeking the best results for the whole company (Qasaimeh and Abran, 2013). It is observed that this concept is related to the idea that to successfully lead and manage an organization it is necessary to manage it in a transparent and systematic manner, seeking to achieve the TQM level. In fact, in the last review, the QMS proposed by ISO 9000 series lines up with the concepts of TQM and excellence in management (Llach et al, 2011) and, therefore, the concepts related to TQM were indirectly analyzed as well.

In relation to its success when analyzing the number of ISO 9001 certifications, there were 1,129,446 certified companies in the world till 2013. Countries in economic growth and global economies have an increasing number of companies seeking for qualifications to enter in a highly competitive market (ISO, 2013). On the other hand, it should be noted that the implementation and certification of ISO 9001 require great efforts and capital by the organization, therefore it must be verified that the benefits provided outweigh the resources invested (Qasaimeh and Abran, 2013).

Focusing on papers that contributed to this research, we start the analysis by results observed in Krause (1996) that, despite publication date, still is the reality of many QMS implemented in Brazil. To this author, the certification doesn't guarantee the absence of problems such as lack of purpose, low commitment from top management, inadequate resources planning, inadequate audit and low comprehension of its purpose. When this occurs, the QMS becomes just a paper collection that doesn't lead to processes improvement.

Nair (2006) did a research in the same line of reasoning developed by Dick (2000), trying to verify the correlation between certification and performance. The author mentions that QMS when properly deployed and certified can provide improvements in business and reduce costs associated to monitoring tasks. However, factor analysis showed no direct correlation between the certification and the organization's performance.

Sadikoglu and Zehir (2011) analyzed the correlation between TQM practices and performance in terms of innovation and employees satisfaction/productivity through hypothesis test, which would directly lead to a better overall company performance. The findings showed a positive correlation between all analyzed elements.

In the same line of mentioned authors, Zatzick et al (2012) analyzed how the strategic sense in a organization is related to the performance after TQM implementation. Using data from 780 manufacturing organizations, these authors have found that management systems are positively correlated with performance leaders and cost reduction, but correlated negatively to the market differential aspects.

Psomas et al (2013) obtained different conclusions in their research when trying to define and measure the effectiveness of the system proposed by ISO 9001, focusing on service quality, operational and financial performance. This has been done analyzing a hundred service companies through factor analysis. The results showed that ISO 9001 system had a significant contribution to the performance of service companies. The service quality and operational performance were significantly influenced by the system and the financial performance was influenced indirectly by the operating performance.

Regarding the market relevance of the subject, stood out the research developed by Ehigie and McAndrew (2005), which tried to verify if TQM concepts are still a management theory being applied in companies and its relevance in academic research. The authors concluded that the number of papers presented at international basis fell significantly, decreasing from almost 1000 papers in 1995 to less than 200 in the early 2000. In other hand, they believe TQM concepts can be extremely useful for companies when applied as philosophical guide lines and not as standardized techniques for change management. Rather, they need to be adapted to specific organizational contexts, considering the employees characteristics, organizational leadership styles, reward system and other cultural practices.

Another interesting paper was presented by Wardhani et al (2009), at the time that authors tried to identify problems and facilitating factors in the QMS implementation in hospitals through a systematic review. It analyzed 533 publications on the subject and concluded that the organizational culture, emphasis on organization values, effective participation of top management, teamwork, innovation, change management and propensity to take risks are characterized as key factors to success. Despite the fact that the paper reports the reality of hospital environments, we believe that the information presented is still consistent with other sectors.

Simon et al (2012) presented the main difficulties related to the integration of QMS and EMS (Environmental Management Systems) in certified companies. Among the results presented, the authors focused their conclusion on documentation not appropriate to the processes reality and weaknesses in human resources training. Seven years earlier, Zutshi and Sohal (2005) analyzed the integration of management systems and also concluded that one of the main problems was related to gaps in human resources training.

The research developed by Ligarski (2010) presented a method to identify problems in QMS and evaluate their impacts in two groups of Polish certified companies, identifying non-conformities and weaknesses in each. This work became interesting because showed the main problems in these certified companies.

Mo-ching (2011) and Wickramasinghe and Gamage (2011) focused their research on organizational culture, communication and human resources. Mo-ching (2011) conducted a survey analyzing the relation between organizational culture and QMS adoption, through the application of 30 questionnaires in different countries. Among the results presented by the author, stands out the direct correlation between good internal communication to develop the organizational culture and understand the propose of required audit.

Finally, Wickramasinghe and Gamage (2011) conducted a research in order to evaluate the relationship between the practices of high involvement work, comprehension of quality objectives by employees and the role of the Human Resources to define correct positions, responsibilities and maintenance of a good working environment, using correlation and regression analysis. As result, they found that teamwork, communication, performance evaluation, training, rewards, recognition and skills development practices are positively correlated with the QMS results.

3 METHODOLOGICAL PROCEDURES

This section will present the elements and procedures used for data collection and analyzes, as well as the classification of the research and sample characterization.

3.1 Method

Initially, the research presented in this article was divided into two parts: first, conducting an extensive literature review to determine the main points of a Quality Management System (QMS) and second, visiting twelve enterprises to know the quality manager's perception in relation to quotidian activities linked to the thirteen points. We selected thirteen points according to the literature that represent delicate questions about QMS day to day aspects. It is important to note that some points presented in the literature were in a negative form and the papers authors decided pointing out the ideal situation, following recommendations of ISO 9001 (2008). Thus, we show as example situations reported by Simon et al. (2012) about the inadequate documentation which leads to flexibility loss. This problem have been transformed into an item as "The documentation is adequate and doesn't make the company processes to lose flexibility"

Regarding the choice of the twelve companies, it was done a non-probabilistic sample by judgment. This technique, according Selltitz et al. (1987), is used when the researcher through a good judgment and strategy selects the appropriate cases that he believes are necessary for the sample, usually defined as typical for the population. The sample by judgment is a form of convenience sample in which the researcher's judgment is used to select the sample elements (Hair, Jr. et al., 2009, p. 247).

Regarding the questionnaire, it was composed by thirteen items, as mentioned, and quality managers should select the agreement degree from 0% to 100% in relation to company day-to-day. Chart 1 shows the selected items that compose the questionnaire and the literature used. Chart 2 features examples of questions present to quality managers showing questionnaire format.

Chart 1. Items selected by the papers authors to compose the questionnaire presented to quality managers and literature used.

Question	Items to be analyzed by quality managers	Literature
1	The QMS implemented is a market differential for your company.	Ehigie and McAndrew (2005), Sadikoglu and Zehir (2011), Zatzick et al (2012) and Psomas et al (2013).
2	In the efficiency point of view, the processes of your company improved with the QMS implementation.	Dick (2000), Nair (2006), ISO 9001 (2008), Sadikoglu and Zehir (2011) Zatzick et al (2012) and Psomas et al (2013).
3	The QMS of your company leads to the excellence in management.	Prajogo e McDermott (2005), Ligarski (2010) and Sadikoglu and Zehir (2011).
4	Each employee understands how their activities contribute to the achievement of quality objectives at all levels of the organization.	Wardhani et al (2009), ISO 9001 (2008) and Sadikoglu and Zehir (2011).
5	Top managers in your organization have an effective participation in the QMS day-to-day.	Karuse (1996), ISO 9001 (2008) Ligarski (2010), Sadikoglu and Zehir (2011) and Mo-ching (2011).
6	All business processes of your company are integrated to achieve common QMS goals.	ISO 9001 (2008), Ligarski (2010), Sadikoglu and Zehir (2011), Llach et al (2011) e Qasaimeh and Abran, (2013).
7	The communication related to QMS in your company is efficient in all aspects	Zutshi and Sohal (2005), ISO 9001 (2008), Ligarski (2010), Mo-ching (2011), Baird et al (2011) and Simon (2012).
8	The training offered provides gains for QMS and lead to better business results.	Zutshi and Sohal (2005), Ligarski (2010), Sadikoglu and Zehir (2011) and Wickramasinghe and Gamage (2011).
9	The responsibilities and authorities defined in QMS really correspond to that observed in company day-to-day.	ISO 9001 (2008), Ligarski (2010), Wickramasinghe and Gamage (2011) and Simon (2012).
10	Human resources, infrastructure and work environment are appropriate to the QMS requirements.	ISO 9001 (2008), Ligarski (2010) and Simon (2012).
11	The documentation is adequate and doesn't make the company processes lose flexibility.	ISO 9001 (2008), Ligarski (2010), Simon (2012) and Qasaimeh and Abran, 2013.
12	The generated records have reliable data and are used as evidence base for decision-making	ISO 9001 (2008), Ligarski (2010) and Simon (2012).
13	The proximity of audits doesn't interfere in day to day activities and its function is understood by employees.	Karuse (1996), Ligarski (2010) and Mo-ching (2011).

Source: elaborated by this paper authors.

Chart 2. Example of questions presented to quality managers showing questionnaire format.

Question	Items to be analyzed by quality managers	Agreement degree					
		0%	20%	40%	60%	80%	100%
1	The QMS implemented is a market differential for your company.	0% ()	20% ()	40% ()	60% ()	80% ()	100% ()
2	In the efficiency point of view, the processes of your company improved with the QMS implementation.	0% ()	20% ()	40% ()	60% ()	80% ()	100% ()

Source: elaborated by this paper authors.

The visits occurred over two months, taking mean of four hours for each enterprise. In the same opportunity, quality managers answered the questionnaire and it is noteworthy that the paper authors were present to clarify possible doubts.

Finalized the visits, data were compiled and analyzed by statistical tools. In order to validate the internal consistency of collected data, we used the Cronbach's Alpha coefficient. The questionnaire reliability is denoted by a Cronbach's Alpha coefficient above 0.70, according to HAIR, Jr. et al. (2009).

For data analysis, we chose the Multidimensional Scaling technique (MDS). The MDS is a multivariate technique of interdependence, which help to identify the most important dimensions derived from assessments made by the respondents in a multidimensional space. His spatial map represents the relationships discovered by data representing similarity or preference (Hair, Jr., et al., 2009; Malhotra, 2012).

In MDS there are adequacy measures of adjustment in order to assess how the derived distances are close to dissimilarity data (distances obtained from the eigenvectors matrix) according to those originally provided by the respondents (FÁVERO et al., 2009;. Malhotra, 2012). These measures, to evaluate the data level adjustment, are:

- a) Stress (Standardized Residual Sum of Squares): represents the distances derived from dissimilarity data and the original distances. In the case of this research, the stress levels are presented with suitable adjustment level of approximately 30%;
- b) SStress (or Young's coefficient): the setting quality measure using quadratic data for calculation, and its output values are located between 0 and 1, being considered a good-quality adjustment values lower than 0.30 (30%). His calculations are found using the ALSCAL algorithm in SPSS 15 software;
- c) RSQ (R²): this index represent the quality of fit by a quadratic correlation between the original distances provided by the respondents and distances derived from dissimilarity data via the MDS, being interpreted as the ratio of the variance of dissimilarities. This index ranges from 0 to 1, being satisfactory when values are greater than 0.60 (60%).

Another important point to be noted is that the MDS analysis uses ALSCAL algorithm (Alternating Least Squares Scaling). According Favero et al. (2009), this algorithm is applicable to data whose scale is at any level of measurement and can be used in the case of treating both metric or non-metric analysis.

In addition to the MDS technique it was also used the Cluster Analysis, whose main objective is the classification of objects into relatively homogeneous groups based on the set of variables considered (Malhotra, 2012). Also according to the same author, these groups called clusters, tend to have objects to be similar to each other, but have differences of objects compared to other conglomerates. The Cluster analysis is a heuristic technique; they don't have rigorous statistical support in detriment to other techniques, and for this reason it has been used only as a complementary way.

The cluster analysis has some options for grouping, among which is the Ward method used in this research. This technique supports the loss of information resulting from the grouping of conglomerates, being measured by the sum of squared deviations of individual observations relative to the means of the groups that are classified (Malhotra, 2012).

With the statistical analysis, it is expected to determine if all the questions can be used in the analysis or if there are variables to be deleted. For validated questions, the papers authors will use the mean and standard deviation, even whe the scale has been characterized as interval. We believe that the analysis by frequencies would lead to significant results loss.

3.2 Research classification

From the broad methods point of view, this paper presents deductive characteristics, given that it has analyzed case studies and examined the perception of quality managers in relation of QMS aspects. Therefore, the conclusions are deducted.

Analyzing the approach to the problem perspective, this research presents a qualitative and quantitative approach, since it were described some characteristics of the studied companies and, subsequently, rated the agreement degree in relation to questions raised by an interval scale.

Regarding the technique procedures, this research can be classified initially as literature review, followed by case study and finally as survey using techniques of interviews and questionnaire. Initially, a broad literature review was done to create a theoretical basis to select the questions. Subsequently, the papers authors visited each company to know their QMS and interview quality managers.

Finally, focusing on the nature of the research, it can be classified as applied and descriptive, since it has the aim to analyze QMS using Multidimensional Scaling techniques and Cluster Analysis, not proposing to establish new theories.

3.3 Sample Characterization

In order to comprehend a little better the reality of each enterprise, this topic does a brief explanation about each company, focusing the sector of activity, size and implementation year of the first Quality Management System (QMS). The points below present the details mentioned.

- a) Enterprise 1: large-sized company; segment of automation solutions for the automotive industry and machinery; it has been certified since the first QMS version, in 1987.
- b) Enterprise 2: large-sized company; segment of home appliances (development and production); current financial situation is problematic; it has been certified since the first QMS version, in 1987.
- c) Enterprise 3: medium-sized company; segment of accessories and painting bases for construction; the first QMS implementation was in 2001.
- d) Enterprise 4: medium-sized company; segment of automotive parts; it has three plants in Brazil; the first QMS implementation was in 2001.
- e) Enterprise 5: medium-sized company; segment of accessories and paint bases for construction, competitor of company 3; the first QMS implementation was in 1994.
- f) Enterprise 6: large-sized company; segment of power and electricity; the QMS implementation occurred recently in 2013.
- g) Enterprise 7: medium-sized company; segment of automotive parts, more specifically fused auto parts; it has QMS certified since 1994.
- h) Enterprise 8: medium-sized company; segment of mechanical metal, operating in the development and manufacture of tractors mats and mining equipment; the first QMS implementation occurred in 1994.
- i) Enterprise 9: large-sized company; segment of ceramics tiles; located in São Paulo; the first QMS implementation occurred in 1994.
- j) Enterprise 10: large-sized company; research institute, development and innovation in the areas of software, hardware, systems, processes, electronics trials and tests; it has QMS certified since 1994.
- k) Enterprise 11: large-sized company; segment of cosmetics; the plant analyzed has QMS certified since 2001.
- l) Enterprise 12: medium-sized company; research center in the field of heaters, heat exchangers and industrial equipment manufacturing; the first QMS certification occurred at 2002.

4. RESULTS

As mentioned, twelve enterprises were asked about the agreement degree of their practices concerning the ideal requirements proposed by ISO 9001, through their quality managers. The agreement degree ranged from 0%, if the company judged that the item does not correspond to the reality observed, up to 100% maximum agreement degree. All data collected from the quality managers were compiled and are presented in Table 1.

Table 1. Compilation of agreement degrees for questions in function of company (agreement degrees expressed in percentages, Q = Question, E = Enterprise).

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
E1	60	60	60	80	80	80	100	60	80	80	80	100	80
E2	60	40	20	40	60	20	40	40	40	20	40	60	40
E3	40	40	20	20	40	40	60	20	40	20	40	60	40
E4	60	80	40	60	60	60	80	60	80	40	60	60	60
E5	40	40	20	40	40	40	60	20	60	20	40	60	60
E6	80	60	80	100	100	100	80	60	80	100	80	80	80
E7	60	40	20	60	40	60	40	40	40	40	60	40	60
E8	60	40	20	40	40	40	40	60	40	40	60	60	40
E9	40	60	40	40	60	40	60	40	40	40	40	60	60
E10	100	60	60	80	60	80	100	80	60	80	80	100	100
E11	100	80	80	80	80	100	100	80	80	100	80	100	80
E12	40	60	40	40	40	60	60	60	40	60	60	60	60

Source: elaborated by this paper authors.

After data compilation, the internal validation of the results was done using the Cronbach's Alpha technique. Using the Statistical Package for Social Sciences software (SPSS), it was obtained a value of 0.972. We remember that the data reliability of a set is denoted by a Cronbach's Alpha coefficient above 0.70 (Hair, Jr. et al, 2009), and this can be observed here.

The next step in the results analysis was the application of Multidimensional Scaling technique for companies and for the questions, and the Cluster Analysis only to the questions. The Multidimensional Scaling technique applied to the companies allowed to identify which enterprises have similar characteristics in terms of QMS and the same tool applied to the questions allowed us to check which ones present greater discrepancy regarding the Euclidean distances. Similarly, the Cluster Analysis applied to the questions allow to highlight which item was the last to conglomerate in the dendrogram.

Considering the analysis of the enterprises, the Multidimensional Scaling technique presented a Stress value of 0.02670, RSQ of 0.99746 and Young's coefficient of 0.01442 on sixth interaction. As mentioned, these values are within the expected range, which validate the analysis. Through Figure 1 it is possible to see the map of Euclidean distances and check how companies move away or approach in terms of QMS characteristics.

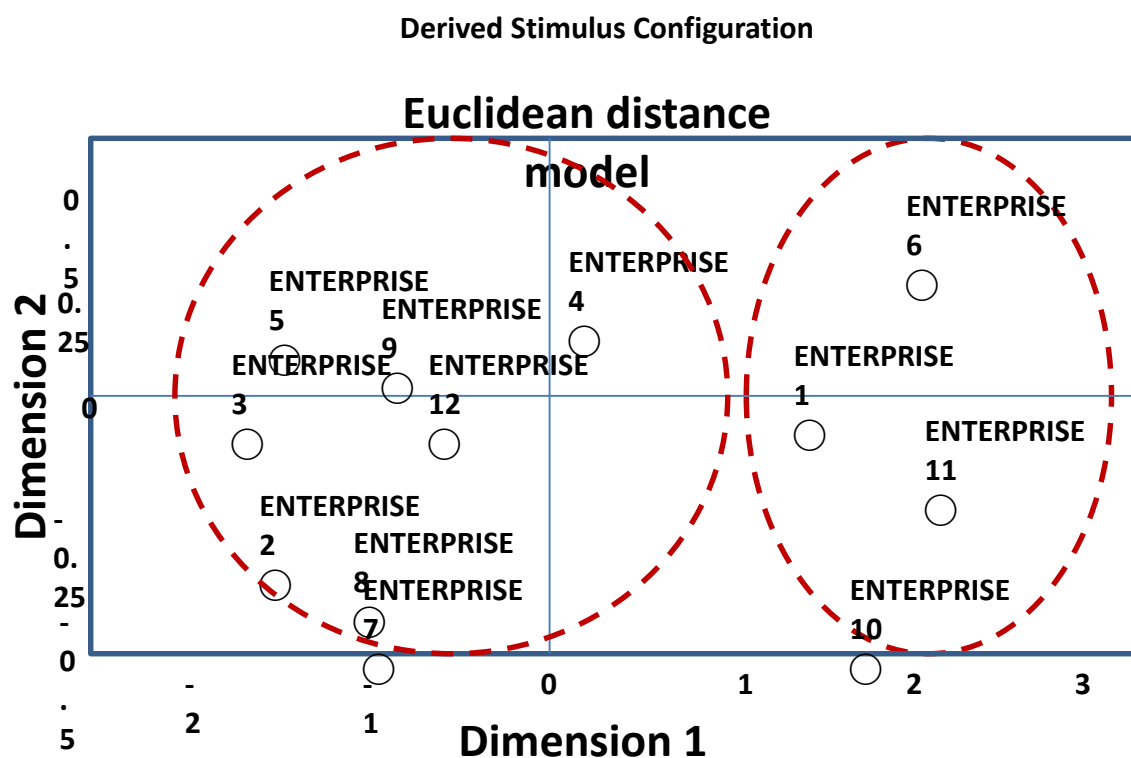


Figure 1. Euclidean distances obtained by Multidimensional Scaling technique for the analyzed companies.
Source: elaborated by this paper authors.

In terms of QMS questions it can be seen in Figure 1 the presence of two well-defined groups, the first one consisting of the enterprises 1, 6, 10 and 11, which will be called hereafter the "group 1" and the second one composed by companies 2, 3, 4, 5, 7, 8, 9 and 12, which will be called hereafter the "group 2". Looking at these companies, it is noted that the group 1 has enterprises more mature and with commitment in relation to the quality activities, whereas group 2 consists of companies that despite of their certification, require more care and attention still.

Executing an internal analysis in each group, it is observed in the group 1 that the Euclidean distance between enterprises 6 and 10 is considerable, leading to understand that some differences can be observed. In group 2, instead, there is an approach among companies 2, 8 and 7, leading to understand that some similarities can be observed. It should be noted, however, that the differences or similarities between this companies in QMS need to be studied more carefully and at the moment this is not the focus of our research.

In a second step, the Multidimensional Scaling technique was applied to the questions. In this occasion, it was observed the following parameters: Stress of 0.16205, RSQ of 0.86113 and Young's Coefficient of 0.1686 in the

fifth interaction. Again, these values are within the expected range and therefore they validated the analysis. In Figure 2, it is possible to see the Euclidean distances map and the behavior of the questions response in terms of statistical characteristics.

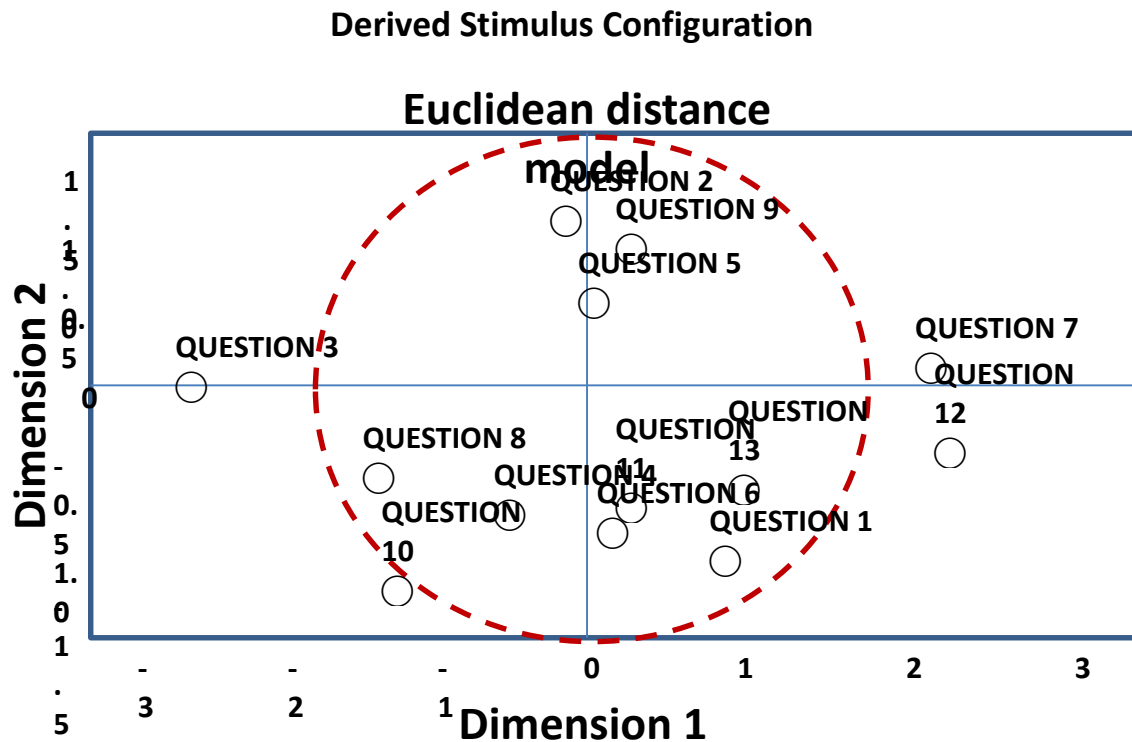


Figure 2. Euclidean distances obtained by Multidimensional Scaling technique for the analyzed questions.
 Source: elaborated by this paper authors.

When analyzing the Euclidean distances for the questions, it is observed that the relative distance to questions 3, 7 and 12 are bigger in relation to the group defined by this paper authors, which leads to understanding that they have a lower explanatory power in relation to what is being studied, i.e., perceptions about the daily activities of companies QMS. As a result, questions 3, 7 and 12 were removed of analysis at this moment. In order to strengthen the decision of paper authors to remove those questions, it was done a Cluster analysis using SPSS software. The dendrogram shown in Figure 3 presents the analysis results.

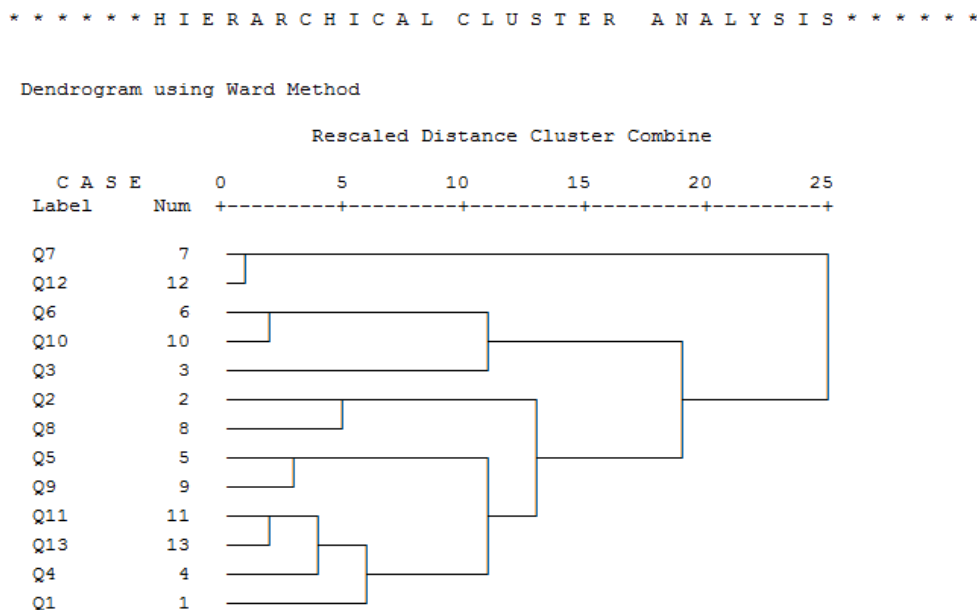


Figure 3. Dendrogram resulting from Cluster Analysis to questions.
 Source: elaborated by this paper authors.

Through the cluster analysis (dendrogram results) is observed that questions 7 and 12 rapidly compose a cluster, which will be joined to the other cluster only in the last iteration. In addition, question 3 delays to join a conglomerate, which reinforce the authors' decision about its exclusion.

Once decided by the elimination of questions 3, 7 and 12, it was done the analysis of means and standard deviations to the data associated to each question validated, as illustrated by Table 2. It should be noted that paper authors opted to analyze means and standard deviations instead of analysis frequencies, since this last one would lead to loss many significant results.

Table 2. Means and standard deviations observed for each validated question

	Q1	Q2	Q4	Q5	Q6	Q8	Q9	Q10	Q11	Q13
Mean	61.67	55.00	56.67	58.33	60.00	51.67	56.67	53.33	60.00	63.33
Standard deviations	21.67	15.08	23.87	19.92	25.58	19.92	18.75	29.95	17.06	18.75

Source: elaborated by this paper authors.

For the first question, when asked about if the QMS is a market differential for their companies, we observed a mean of 61.67% and a standard deviation of 21.67%. The paper authors believe that many quality managers interviewed analyze their QMS not as a differential, but as a necessary level of quality to achieve other goals. It is noteworthy, however, that two companies mentioned QMS as a market differential. The main recommendation for this item is that the quality managers identify clearly both the real purpose of their companies and the QMS purpose.

The second question focused on the relationship between the processes efficiency and standardization after the QMS implementation. The expected response was that the processes efficiencies increased through continuous improvement after ISO 9001 certification, but this relationship was not observed by all companies, as seen by an mean of 55% and a standard deviation of 15.08%, the lowest of all research.

The fourth question examined if there is the cascading of the quality goals from upper management into small objectives, so that all employees can understand how their activities contribute to the company. The mean observed was 56.67% with a standard deviation of 23.87%, the third bigger standard deviation observed. Through the mean, the authors believe that there is inefficiency in the process to dismember quality goals into small objectives, but also understand that the standard deviation allows us to identify companies in different agreement degrees in relation to this question. The paper authors recommend special care in this dismemberment, according to the importance of such item to the enterprise success.

The fifth question analyzed the top management participation in QMS day to day activities, not only in a formal document, but putting in practice while giving support when necessary. The mean observed was 58.33% with a standard deviation of 19.92%. This is a concerning result in the paper author's point of view, because the ideal mean would be over 80%, according to literature. The effective participation of top managers in QMS is characterized as one of the pillars to success, becoming QMS not only a set of documents and records, but an efficient way to manage a company.

The sixth question addressed the processes integration to achieve common goals, with mean of 60%. It is clear, however, by the second highest standard deviation (25.58%) that the agreement degrees vary widely, from 40% to 100%. The authors of this article believe that the processes integration is essential to achieve synergistic results. The eighth question was intended to evaluate the correlation between training and better results in the quality manager's point of view. The idea is that the training and capacitation offered within the QMS increase knowledge and provide a better critical thinking, becoming more prepared and productive employees. Observing the results, however, this does not seem to be the manager's perception in relation to happens in their companies, as showed the mean for the agreement degree of 51.67% and the standard deviation of 19, 92%. It is necessary that these enterprises give more emphasis in training and its effectiveness. The paper authors believe that a minimum agreement degree for this item would be 80%.

For the ninth question, quality managers were encouraged to analyze the agreement degree in relation to the current allocation of roles and responsibilities, since they can be formalized in a procedure differently to that observed in practice. This seems to be the reality observed in the analyzed companies day-to-day, since the mean was 56.67% and the standard deviation was 18.75%. The paper authors see this point as concerning as well, since

allocation problems in roles assignment can lead to discouragement and work overloads by some employees. Similarly, responsibilities assignments that do not correspond to reality can generate doubts and inefficiencies. The tenth question assessed the perception of managers in relation to Human Resources, infrastructure and work environment. Concordance rates varied widely, from 20% to 100%, which can be evidenced by the higher standard deviation observed, 29.95%. Mean for the agreement degree was 53.33%. It is worthy mentioning here that the paper authors viewed a large discrepancy between the companies, noting good structures and structures with wide possibilities of improvements in the visits done.

To the eleventh question the focus was related to the adequate documentation that doesn't lead the business processes to lose flexibility. We observed an mean of 60% and a standard deviation of 17.06%, the second lowest in the research. The paper authors believe that in a different level, all managers identified inadequate documentation and loss of flexibility, since this documentation have been implemented in a inconsistent way with reality or because the processes have been changed and the documentation has not been updated.

Finally, the thirteenth questions assess the agreement degree of quality managers about the fact that the proximity of audits doesn't interfere in day-to-day activities and if the audit purposes were understood by employees. Concordance rates were observed from 40% to 100%, with mean of 63.33% and the standard deviation 18.75%. It was observed that in almost all companies there are gaps in the continuum of activities close to QMS audits. It is usually necessary to do some adjustments to the day-to-day process to return to level obtained during certification.

5. CONCLUSIONS

As reported in the Introduction, the main objective of this research was to assess the perception of twelve quality managers for thirteen questions derived from the literature. Each quality manager should compare the ideal requirements with the situation observed in the day-to-day of Quality Management Systems (QMS). To this end, the papers authors drew on case studies and questionnaire application, an instrument that enabled us to verify the agreement degree between the quotidian practices and the ideal practices

The Multidimensional Scaling technique allowed to identify two enterprises groups, one of them composed by companies 1, 6, 10 and 11 with higher agreement degrees and other group composed by companies 2, 3, 4, 5, 7, 8, 9 and 12. It should be noted, however, that even the companies of first group have gaps and possibilities for QMS improvement.

When applied to Multidimensional Scaling technique for the thirteen questions, it was observed that the questions 3, 7 and 12 had lower adherence in relation to what was being researched and, therefore, were excluded from the analysis. In order to strengthen this decision, it was applied cluster analysis to confirm the exclusion.

For the questions validated, data were analyzed using mean and standard deviation, since analyses by frequencies would lead to the loss of significant results. As a general conclusion, it was noted that although some enterprises stand out, there are still gaps and wide opportunities for improvements in QMS, even companies being certificated by ISO 9001: 2008. Comparing the results found with literature, we remember that Ligarski (2010) also viewed gaps and improvement opportunities in companies of his research.

In general, the mean for agreement degrees were around 60%, demonstrating possibilities to improvement in all aspects investigated. Questions 8 and 10, respectively related to training and Human Resources, facilities and infrastructure, showed the smallest mean and, therefore, they deserve attention in the papers authors' point of view. Moreover, the question 6 and 10 had the highest standard deviations and, consequently, higher discrepancy of companies in relation to the investigation.

Finally, the papers authors present as limitations the fact that the research was conducted in a sample selected for convenience and, in future analyses, it may be applied in specific sectors or in a larger sample. It is noteworthy also that this research is extremely useful for enterprises that are critically analyzing their QMS, and for researchers, as a basis for future studies.

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