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QUALITY MANAGEMENT SYSTEMS FOR BUSINESS LOCATED IN SOUTHERN RIO GRANDE DO SUL

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Abstract

The quality management systems search to continuously improve standards of quality and productivity of an organization by providing it a competitive advantage. The present study is developed with the objective of knowing these systems in companies that are ISO 9001 certified in the area ofQuality Management, located in south of Rio Grande do Sul, and the use of statistical techniques in this context. Semi-structured interviews and questionnaires are use to characterize the four companies investigated, as well as evaluating its management system. The study find evidence that certification has brought good results, especially under the technical point of view, although it has not guaranteed improved economic performance. It is also find a little use of statistical techniques in the industry.

Keywords: Quality; ISO 9000 Certification; Quality management systems.

1. INTRODUCTION

The phenomenon of globalization has eliminated the boundaries and changed the organizational scenario in Brazil, increasing not only the amount of potential customers for the products and services offered, as well as the amount of competitors. To become competitive and remain in the marketplace, an organization must seek constantly to improve their standards of quality and productivity. This context highlights the importance of using Quality Management Systems (QMS).

For Pinto *et al.* (2005), most organizations have invested in quality, by the adoption of programs, including the Certification of Quality Systems ISO 9000, succeeded in performance indicators, although the authors acknowledge that there have been some failures. For Oliveira *et al.* (2011), the most common form of QMS adopted by organizations is based on ISO 9001. According to Valle et Bicho (2001) *apud* Pinto *et* Tomonitsu (2011), organizations that develop their activities and operate their production processes in accordance with harmonised standards and procedures and accepted as standards, will be on terms more favourable to

overcome possible non-tariff barriers and meet specific technical requirements. Already Maekawa *et al.* (2013) emphasise the need to develop and deploy technological and managerial instruments that provide consistent competitive advantages.

In implementing these QMS can be used various tools, where the measurement and interpretation of information found collaborate strongly to the decision. In this context, the statistical method is especially useful, and can assist in the development of various analyses, with his techniques to collect, organize, summarize, describe, interpret, correlate, model and inferred information.

Mattozo *et al*. (2013), for exemple, use regression models for structuring the satisfaction of an airport passengers. Although Henning *et al.* (2014) uses control graphics involving extended limits and the ARIMA model (integrated auto regressive models of moving average) to monitor water quality. Both studies consider the efficient and effective techniques. But in the planning and implementation of QMS, of companies that have ISO 9001 certification in Quality Management area, these tools tend to be used effectively?

This study, as well as present some thoughts on the ISO 9000 series of standards and on quality tools, is developed in order to meet the quality management system of companies with ISO 9001 certification in Quality Management area, located at the southern end of Rio Grande do Sul, as well as the use of statistical techniques in this context. The aim is to also find evidence of the implementation and operationalization of the various processes developed in the management of standards-based quality, picking up information also about quality management processes based on awards and processes based in basic knowledge.

Some work has already been developed for this purpose, however, Oliveira et al. (2010b) show that the successful implementation of the programs and quality tools used in these QMS is related to the human factor. In a study designed to identify the main difficulties, capabilities and benefits of using programs and quality tools, these authors found few differences between companies located in different regions of Brazil. These differences, due to climatic, economic, social and cultural changes justify this research. Spiegel *et al.* (2014) also agree with this idea, as evidence of the importance of considering the discussions surrounding management issues by proposing a management model of an operational support management of a research center.

This article is divided into five sections. Section 2 summarizes the theoretical discussion of the themes while section 3, the methodological approach adopted. Section 4 presents the results and discuss them. Finally, section 5 presents the final considerations.

2. 2. THEORETICAL FOUNDATION

2.1. The series of ISO 9000 standards

The *International Organization for Standardization* (ISO) was established in 1946 by representatives of 25 countries in order to facilitate the international coordination and unification of industrial standards. officially began operations the following year, establishing its headquarters in Geneva.

In 1987, this organization publishes the ISO 9000 series, consisting of three standards: ISO 9001, ISO 9002 and ISO 9003, in order to manage the quality systems in a standardized manner. Since then, these rules have three process improvement occurred in 1994, 2000 and 2008. Although they have been proposed initially for the industrial context, according to Morejon (2009), this series of standards is a proponent methodology of a quality system implementation model and can be applied to any type of company, with focus on quality assurance.

According to information available on the ISO website currently the ISO 9000 series for quality management system is composed of three major standards: ISO 9001: 2008 which provides the requirements for the certification process; ISO 9000: 2005, which presents fundamentals and vocabulary adopted by the standards of this series; and ISO 9004: 2000 which provides recommendations for improving performance beyond the requirements of ISO 9001, providing the obtaining of a management system that improves the organizational effectiveness and efficiency.

These standards are complemented by another 14 that provide guidance for: audits and quality management systems and / or environmental management (ISO 19011: 2002); code of conduct in organizations (ISO 1001: 2007); complaint handling in organizations (ISO 10002: 2004); external disputes to the organization (ISO 10003: 2007); quality plans (ISO 10005: 2005); quality management in projects (ISO 10006: 2003); configuration management (ISO 10007: 2003); requirements for measurement process (ISO 10012: 2003); documentation management systems (ISO 10013: 2001); obtain economic and financial benefits (ISO 10014: 2006); formation (ISO 10015: 2002); statistical techniques for quality (ISO 9001: 2000); selection of quality management system consultants and use of their services (ISO 10019: 2005) and specific requirements for application of ISO 9001: 200 in the automotive context (ISO / TS 16949: 2002).

The main standard for the certification process is ISO 9001, which specifies the requirements for obtaining a quality management system where an organization needs to show its production capacity, satisfying customers and meeting the applicable requirements. For Maekawa et al. (2013), this standard is a quality certifiable standard that focuses mainly on obtaining efficient processes and satisfied customers.

The latest version of the standard, published in 2008, to improve the wording of the published version in 2000 with regard to the terminology and expression, based on eight fundamental principles: customer focus, leadership, involvement of people, process approach, approach systemic to management, continual improvement, factual approach to decision making and mutually beneficial supplier relationships. The adoption of these principles enables the development of analytical capacity for making management decisions; ability to identify opportunities for improvement; agility in making management decisions; improved internal communication between the different levels of the company; standardization procedures; increased motivation and integration; lower costs and shorter cycle times for the execution of activities, among others.

Oliveira *et al.* (2010a), in a survey conducted with 22 companies in the city of Bauru, concluded that the greatest benefits found with the implementation of the ISO 9000 family are improvements in organizational culture, quality of processes and planning, reduction of waste during the process, positive influence on other internal management processes and greater awareness of employees in relation to quality. Are also quite cited by the companies investigated improvements in the company's image and internal communication, increased visibility of the company with customers and suppliers more easily in decision-making, increased customer satisfaction, greater competitive advantage and market access and reduction unconformities.

Oliveira *et al.* (2010b), in a survey conducted with 382 companies with ISO 9000 certification, distributed throughout all regions of the country, but predominantly in the Southeast (65%) found that after using the tools and quality programs, three benefits emerged: improved image company, improving the quality of processes and increased employee awareness regarding quality.

Santos *et Oliveira Neto* (2012) claim that the companies that make the quality or any ISO 9001 certification the difference for potentiating their effectiveness in search of growth and constant concern to satisfy and amaze your customers through the quality of their products or services, and especially for having in meeting its differential, loyalty customers.

Importantly, the ISO 9000 series standards are general and have been prepared on the basis of practices that an organization must have to fully meet total quality requirements. Because of its scope, it does not set targets to be achieved by the organizations. The organizations that wish to obtain certification is establishing these goals.

Unlike what happens in some countries, in Brazil this certification is not mandatory. Thus, not all Brazilian companies seeking this certification for the simple excellence. Have ISO 9000 certification means having a management system focused on quality, meeting the requirements of an international standard. However, many organizations now require this certification from their suppliers in order to reduce their inspection costs, because if your provider has a good system that controls the quality, the products do not need to be inspected very tightly.

Other organizations seek the certification as a way of marketing, because having your system recognized by an independent entity is very positive. However, according with Oliveira *et al* (2010b), in the South, the topic of improving the company's image is not named as a main benefit, unlike what happens in the rest of the country. There are also companies seeking certification as a great opportunity to reduce their internal costs.

So that the certification process succeeds it must be evaluated pros and cons of quality programs implantation, given its complexity. Some authors, including Van der Berghe (1998) cited Morejon (2009) suggest some minimal preconditions for organizations seeking to start a certification process, such as: good organizational structure, existence of a quality policy; stability; understanding of existing internal processes; documents and regulations up to date; economic strength; existence of an engineer with qualifications, dedication and credibility with their subordinates; top management commitment, among others.

They also suggest, especially if these requirements are met partially, hiring an outside consulting firm with experience in implantation of this standard. Oliveira *et al*. (2011) found no severe difficulties in development and implantation of these systems in survey done along the 236 companies, which might be explained by the high rate of use of consultants.

The presentation of ISO 9001: 2008 standard is made into chapters. After the preface and introduction, presents objective and scope, normative reference, terms and definitions and requirements, the latter being subdivided into quality management system, management responsibility, resource management, product realization and measurement, analysis and improvement.

According with Stevenson *et Barnes* (2002), ISO 9000 certification assumes that the creation of a product/service is the result of a system. The need of the customers generates the realization of a product/service offered to the customer, who can be or not satisfied. The company's management provides an assessment of customer satisfaction, as well as the productive process and the final product/service. This information provides subsidies for the administration to define the management of its resources, which directly affects the productive process, and investigate customer needs. This process is recursive, with some iterative stages, being in a continuous process of quality management system.

For this system to obtain the ISO 9001: 2008 certification, procedures required for its implantation are document control, product and service records, internal audits and implementing corrective and preventive actions. It is also necessary to define and implant a quality policy, prepare a quality manual, as well as defining responsibilities and authorities.

Sun *et al.* (2004) developed in Western Europe between 1992 and 2002, a study to investigate the pattern of implementation of ISO 9000 and Total Quality Management (TQM), noting that European companies have implemented ISO 9000 at a higher level than models TQM, although it has been checked intend to transition to TQM from the second half of the 1990s. Perhaps this migration trend has occurred

because of the fact that in the early stages of the implantation of these quality programs did not promote the apparent improvement of performance.

Pinto *et al.* (2006) found that the quality program most widely adopted among the 198 large Brazilian organizations surveyed is ISO 9001 (82.8%), similarly to the study of Sun *et al.* (2004), while 61.11% have adopted along with other program (ISO 14000, Six Sigma and TQM).

According with informations available in the website Brazilian Institute of Statistic and Geography (IBGE), in 2012 there were 5,318 business units with ISO 9001, with 152 business unit with normative standard ISO 9001:2000 and 5.233 with normative standard ISO 9001:2008. That same year, the Brazilian state that had more certified business units was São Paulo (34,19%), followed by Minas Gerais (13,63%), Paraná (8,50%), Santa Catarina (7,60%), Rio de Janeiro (6,04%) and Rio Grande do Sul (5,10%).

According with Pinto *et al.* (2006), the main causes of failure of quality programs in São Paulo were the lack of financial resources for the proper implantation of the program and the fragile support of company management. Oliveira et al. (2010b) found that the greatest difficulty for the implementation of tools and quality programs in Brazilian companies was the resistance of the employees, while the obstacle less perceived by the companies concerned was little involvement of senior management. These authors point out, however, divergence of opinion, depending on the location of the company. In South and Central West region of Brazil, the difficulty least perceived by companies was the lack of organizational structure. In the Southeast, the companies have had great difficulty in understanding the methodology and techniques involved, being touted as one of the main difficulties found, unlike companies in the northern region, which showed resistance from employees, little involvement of middle management and little support senior management as the main problems for the implementation of tools and quality programs.

There are some scholars who make some criticisms of the ISO certification. Stevenson et Barnes (2002) cite several authors who criticize him for his generality, irrelevance to the quality and complexity. Other important criticisms revolve around the costs of achieving dubious certification and benefits. The analysis carried out by these authors, however, reveals that this certification is important to improve competitiveness and the company's marketing, but at the time of its implantation should not save the money and time required for a successful implantation. Further notes that, for certain types of business, the benefits may not justify the costs.

There are as well nationals and internationals awards of quality that was created to estimulate quality improvement and development programs for their promotions. According with Miranda *et al.* (2012), these awards are used to encourage improvements in the quality of management and increasing the competitiveness of organizations, being considered the highest recognition for excellence in management. Although, for Santos *et* Oliveira Neto (2012), although it is undeniable the importance of certification in national and state awards, ISO 9001: 2008 is now considered a weapon for the organization become part of the national and international context and thus transform its certification into a competitive advantage.

2.2. Quality tools

The certification process may involve various methods. The best known in practice, based on the philosophy of continuous improvement, is the Planning, Execution, Control and Analysis (PDCA). It is a cyclic method for driving continuous improvement activities, which consists of four phases: plan, to establish the objectives and processes necessary to deliver results in accordance with customer requirements and the organization's policies; run, to implement the processes; evaluate, to monitor and measure processes and product against policies, objectives and requirements for the product and report the results; and act to take actions to continually improve process performance. Its implementation ensures improved, aiding in the diagnosis, analysis and prognosis of organizational problems (Carpinetti et al., 2009).

Another method, based on this first, has also been widely used: **Define, Measure, Analyze, Improve and Control (DMAIC)**. Its phases are: define, to identify the problem, define requirements, establish target; measure, to determine the location or focus of attention; analyze, to determine causal hypotheses, identify main cause; improve, to propose, evaluate and standardize solutions to remove every main cause; and control, to establish standard measures to maintain performance, correct problem when necessary (Pande et al., 2001). It is widely used as part of the Seis Sigma program.

At each step of these methods can be used various quality tools, both qualitative and quantitative. The most cited in the literature, used in quality programs, are presented below.

Cause-Effect Diagram - is a graphical tool used to represent the possible causes that lead to a particular problem or defect, grouping them by categories or similarities (Marshal Junior et al., 2010).

Brainstorming - is a disciplined way to engage groups of people in generating new and creative ideas/suggestions for

organizational problems (Eigeles, 2003; Costa Filho *et al.*, 2006).

Mode Analysis and Failure Effect (FMEA) - is an analytical method used in the development of products and processes for the development of improvement actions for minimizing or eliminating failures. It has a structured methodology that can be applied to the stage of development of both new products as well as new processes. Its application allows to reduce the chances of a process fails, increasing the reliability of the process and the final product (Carpinetti, 2012).

5 S - is a philosophy focused on the mobilization of employees through the implementation of changes in the workplace, including prevention and elimination of waste, making the workplace orderly, neat and clean. Its five stages are: seiri (organization / use / disposal); seiton (storage / sorting); seisou (cleaning / hygiene); seiktsu (standardization) and shitsuke (discipline) (Marshal Junior et al., 2010).

Quality Control Circles - are small groups of employees who meet regularly to monitor, identify, analyze and propose solutions to organizational problems (called projects), particularly those related to production (Gaither et Fraizer, 2001).

5W1H - it is used to allocate resources in order to develop an action plan in general in order to improve the quality of the company. 5W correspond to the following English words: what (what will be done); who (by whom will be done); where (where will be done); when (when it will be done); and why (why will be done), while the 1H corresponds to how (how will be done) (Abbas et Possamai, 2008).

Histogram - it is a type of graph used to summarize continuous or discrete quantitative variables with a lot of different values, especially useful for providing an idea of the shape of its distribution and its peaks, central tendency, dispersion and symmetry (Mattos *et al.*, 2015).

Box Plot – it is a type of graph used to summarize continuous or discretes quantitatives variables, giving an idea of central tendence, dispersion, symmetry and outliers (Mattos *et al.*, 2015)

Pareto's Diagram – is a graph in horizontal or vertical bars arranged in ascending or descending order of magnitude, widely used in the identification of problems that occur more often, helping define the priority of implementation of actions aimed at improving the quality (Mattos *et al.*, 2015).

Dispersion Diagram - it is widely used to allow a first assessment, albeit superficial, the relationship between two variables (Mattos *et al.*, 2015).

Hypoteses Test – it is an inferential statistical technique that aims to provide a methodology to assess whether sample data provide evidence supporting or not a hypothesis formulated (Bussab et Morettin, 2013). This hypothesis is an assumption about some property of a probability distribution.

Design of Experiments – is a test or series of tests, in which the input variables of a system are manipulated to be identified the reasons for the changes in output variables (Montgomery, 2005).

Statistical Process Control - enables to characterize and monitor the quality characteristics of interest, ensuring their maintenance within predefined limits, indicating when to take correction and improvement actions. Allows the systematic reduction of variability in the quality characteristics in an effort to improve the intrinsic quality, productivity and reliability than is being produced or provided, being operated by control charts (Henning *et al.*, 2014).

A program that has been widely used and employs a multitude of statistical techniques, basing itself on its principles, is the Seis Sigma. It is characterized as an improvement program that aims to reduce waste of non quality and, consequently, reducing costs and improving service customer requirements, such as product quality and delivery reliability. It is related to the capability of processes (Carpinetti, 2012).

According with Maekawa *et al.* (2013), many authors also consider the *Balanced Scorecard* (BSC) and the lean production as programs strongly linked to quality management. For these authors, the Quality Function Deploymet (QFD) and SERVQUAL model can be considered advanced tools of quality.

3. METHOD

This research is qualitative and quantitative exploratory nature. The target population is defined from the ISO 9000 certified company database, developed by Inmetro and ABNT / CB-25 (Brazilian Committee for Quality), which contains information of certified companies by certification agencies, accredited by Inmetro in the QMS area. The provision of information of a certified company on this site can take up to 40 days. For this study, the search was conducted in April 2012, been identified only five companies in the cities of Rio Grande and Pelotas. However, one of the companies did not provide your information.

Data collection was done through two instruments. Initially was a semi-structured interview with the head of the certification process before the Inmetro or someone appointed by him, where they sought information about the com-

pany and its certification process: motivation, faced difficulties, observed advantages and disadvantages, use of quality tools, among others.

At the end was given to the respondent a second instrument, an adapted translation of the instrument proposed by Singh *et* Smith (2006), to be answered within a maximum of one week term. This instrument aims to measure the quality of management on three approaches: standards-based management (standards) awards based management and implementation-based management of elementary procedures.

Featuring 135 items that include the following factors: leadership of managers, clients, suppliers, employees, processes, information and communication system, community, competitors, business conditions, quality of product / service, customer satisfaction, business performance and relationships with the community, distributed as shown in Board 1.

The various items, the expected responses by indicating the adoption of quality philosophy in their practices, associated with the alternative (1) are: strongly agree, very positively or very satisfactory. This instrument has been validated through various tests of reliability and validity, based on results from a survey carried out among 418 Australian organizations.

The organization and data analysis were carried out in two stages. The first was given a transcript of the recordings of the interviews, followed by a systematization of information. In the second, which deals with information obtained about the management systems, the information provided by those responsible for quality management in each company were organized in tables with absolute frequencies and percentages. These were built according to five levels defined in the instrument can vary from strongly agree (1) and strongly disagree (5), between very positively (1) and very negative (5) or between very good (1) and very poor (5), and does not apply (6). A similar procedure was carried out with items related to each of the 13 factors mentioned above, as well as every type of management: standards-based, based on awards and based on elementary knowledge.

Also, we used the nonparametric Kruskal-Wallis test, defined as based on the results of an exploratory analysis of information, to compare the distribution of the responses provided by the four companies, ie, check if there is evidence that the four distributions of answers come from identical populations with the same median, and adopted the significance level of 5%. This treatment is also applied to the data by factor and type of management. More details on this non-parametric statistical evidence can be found in Siegel *et* Castellan (2006).

4. RESULTS

The four investigated companies are presented below, as well as a brief report of some important points covered in the interviews.

The A company operates in the trading industry for 20 years and also produces handled products. Currently has 70 employees, using consultancy services only in special situations. The interviewee, Quality and Improvements Manager, has a degree in Business Administration and holds the position for 11 years, the same time engaged in this company. In the search for an effective management system and also for a competitive edge, in 2001, they were looking for the ISO 9001 certification. The implementation time was about four months, necessitating a consulting service. In this process were involved management, managers and other employees who participated in training to ensure adaptation to new methodologies. The main advantage of certification is quoted process control achieved through a systemic view to adopting a management based on monitoring with the use of indicators, and a constant quest for continuous improvement. Its main recommendation for those who want certification is the realization that this process requires an initial investment, involving everyone, not providing immediate feedback. Certification renewal was not necessary to use consulting service.

The B company operates in the sector of services in various segments for 20 years, has around 300 employees and uses consulting service only in special situations. The interviwee holds the position of Quality Coordinator for seven years, the same time engaged in the company, and a postgraduate degree in Project Management. In 2005, it certified its quality management system ISO 9001, keeping your company status certified until today. This search occurred as required by the main customer. After a first failed attempt, was hired a person to manage the process and the certification was obtained in about seven months. The interviewee considers that the advantages obtained with the certification are great, especially the organization of processes. For a company that wants to get it, considers it essential the involvement of senior management and the availability of time and resources.

The C company is providing service for 14 years and has a policy of integrated and sustainable management. Currently has 287 employees and uses consulting services in several areas. One of the interviewees, who holds the position of Sustainability Coordinator for two years, has a degree in Biology and Chemistry Engineering, while the other, who holds the position of Sustainability Analyst for one year, holds a degree in Accounting. The company was certified in 2006 by ISO 9001 and ISO 14000. The interviewees did not work in the company at the time of this certification, but the in-

Board 1. Factors addressed by the 135 items of the instrument

Factors	Itens	Reply requested
Leadership of managers	21	Circle the degree of agreement that best reflects the current situation in your organization: (1) Strongly agree; (2) Agree; (3) Neutral; (4) Disagree; (5) Strongly Disagree; (6) Not applicable.
Clients	13	
Suppliers	10	
Employees	19	
Processes	21	
Info. and communication system	14	
Community	3	
Competitors	3	
Business conditions	12	Circle how the organization is currently being affected by the following business environment factors: (1) Very positively; (2) Positively; (3) Neutral; (4) Negatively; (5) Very negative; (6) Not applicable.
Quality of product/service	4	Circle the satisfaction of the organization that best reflects your current situation (1) Very good; (2) Satisfactory; (3) Neutral; (4) Unsatisfactory; (5) Very poor; (6) Not applicable.
Customer satisfaction	4	
Business performance	10	
Relationship with the community	1	

Source: Singh *et* Smith (2006)

formation we have is that this time there was a culture of break: all embraced the idea and in the first ever audit it was achieved approval for certification. Currently, the quality culture in the company is evident. In 2011 also obtained the ISO 18000 certification as benefits provided by the certification are identified: the standardization of company documents, reducing rework, effective communication between areas and staff and user satisfaction with the services provided, etc. Recommend to a company that wants to get certified, do it as a managerial differential and not just for obtaining the seal.

The D company operates in the Industry and Trade sector, completing 75 years of operation. Currently has 297 employees, besides using consulting services in several areas. One of the interviewees, who holds the position of Health Coordinator, safety, environment and quality for 3 years, is a graduate in Chemical Engineering with a postgraduate degree in Occupational Safety Engineering, while the other holds the position of Technical Quality Standards Senior just six months ago and has a degree in Chemical Engineering. In April 2010 it started the certification process in the Certificartion in Integrated Management System (ISO 9001, ISO 14001 and OSHA 18001), being obtained in 2011 with the help of a consulting firm. The interviewees indicated a critical moment after the certification due to lack of communication between the sectors and certain resistance to accept the culture of quality. Recommend for companies that wish to obtain certification, the need for planning and dedication.

In view of the above it appears that most of the companies investigated are young (three of them have between 14 and 20 years) and has ISO 9001 certification for a relatively long time (between 2 and 11 years) compared to

their lifetime. In general, they have around 300 employees, use of consultancy services and those responsible for quality management have a good academic background. Interestingly, the oldest company (75 years) is the one that is certified for less time (two years). It was achieved on the first attempt in three of the four companies investigated. All companies agree that the certification process is not easy and requires hard work, dedication, persistence, and the involvement of all. All consider that they have obtained positive results with the ISO 9001 certification process, particularly those arising from the organization of processes, and advise companies to seek it as a managerial differential.

These findings agree with the results of Maekawa *et al.* (2013), which identify quality improvement in the processes and greater awareness of the employees regarding the quality as the main benefits derived from the implementation of this standard. Oliveira *et al.* (2011) also found improvement in resource management among the main benefits derived from the implementation of this standard.

Most of the investigated companies also is certified by other standards, disagreeing with the findings of Maekawa *et al.* (2013), which does not identify the effective conjunct use of ISO 9001 management systems, ISO 14001 and OHSAS 18001.

Board 2 shows the quality tools used in their management practices. It is observed that the qualitative tools, among which are Diagram Cause and Effect and 5S, are the most used, agreeing with Maekawa *et al.* (2013), in addition to these, also identify brainstorming among the most used. Oliveira *et al.* (2011) also identified them, besides PDCA and Pareto chart.

This board also shows the limited use of statistical techniques, and Diagram Pareto and Histogram, extremely basic graphic techniques, the most used. These findings agree with those reported by Oliveira *et al.* (2010b), contained many quality tools are not used with the expected frequency in Bauru companies. In this study, in addition to Ishikawa Diagram, 5S, Brainstorming, the authors identify the tools 5W1H, Benchmarking and Statistical Process Control as the most used.

Oliveira *et al*. (2011) draw attention to the fact that the most commonly used tools are the simplest, that create the foundation for development of the QMS and to programs and quality tools more complex.

In the assessment of the QMS, the information provided by those responsible for quality management in each company are presented in Table 1, where it is established that the most frequent items occur in scores 1 or 2, indicating a satisfactory result, ie, companies interviewed meet a greater or lesser extent almost all investigated topics.

In companies A and C, there were more items associated with a score of 1 (strongly agree / very positively / very good) with, respectively, 48.9% and 77.1%, while in the B and D companies, the score 2 (agree / positively / satisfactory) with respectively 48.1% and 45.2%. These results suggest that the companies A and C meet more fully the requirements.

The nonparametric Kruskal-Wallis test confirms these findings, it is evidence that the distributions of the scores given to items for each of the four companies do not come from the same populations with the same median ($\chi^2 = 195,64; gl = 3; valorp < 0,0001$).

New Kruskal-Wallis tests are used to compare the distributions of the responses provided to the items for each of the four companies in each of the 13 factors evaluated, and found evidence of a difference for items related to the lead of managers ($\chi^2 = 45,811$), customers ($\chi^2 = 23,347$), suppliers ($\chi^2 = 27,817$), employees ($\chi^2 = 35,056$), processes ($\chi^2 = 27,998$), information system ($\chi^2 = 25,625$) and business performance and communication ($\chi^2 = 22,422$), with $gl = 3$ and $valorp < 0,0001$ for all factors.

In frequency tables it was found that, in most of these factors, the difference was due to a predominance of items with a score of 1 (strongly agree / very positively / very satisfactory) for companies A and C and a score of 2 (agree / positively / satisfactory) for the B and D companies, suggesting a greater adaptation of the first to quality questions.

Different response pattern was found for the items relating to employees, where the A company agreed with the B and D companies providing greater number of responses associated with the score 2 (agree / positively / satisfactory). However, the second response most frequent of A company was associated with a score of 1 (strongly agree / very positively / very satisfactory), while for B and D companies was

Board 2. Quality tools used by the investigated companies

A Company	B Company	C Company	D Company
Planning, Executing, Controlling and Analysis (PDCA) Diagram of Causes and Effects Pareto Diagram 5S Program of Suggestion Descriptive statistics	Planning, Executing, Controlling and Analysis (PDCA) Diagram of Causes and Effects Pareto Diagram 5S Histogram	Planning, Execution, Analyses Control (PDCA) Histogram; Statistical Process Control (SPC) Define, Measure, Analyze, Improve and Control (DMAIC) 5S Analyze Mode and Failure Effect (FMEA) Program of Suggestion Quality Control Circles	Planning, Executing, Controlling and Analysis (PDCA) Diagram of Causes and Effects Pareto Diagram 5S Histogram Nonparametric tests

Source: own elaboration

Table 1. Distribution of responses by company

Responses	A		B		C		D		TOTAL	
	ni	%	ni	%	ni	%	ni	%	ni	%
1	66	48,9	18	13,3	104	77,1	13	9,6	201	37,2
2	50	37,0	65	48,1	10	7,4	61	45,2	186	34,5
3	5	3,7	41	30,4	1	0,7	31	23	78	14,5
4	4	3,0	7	5,2	-	-	13	9,6	24	4,4
5	4	3,0	-	-	-	-	2	1,5	6	1,1
NR/6	6	4,4	4	3,0	20	14,8	15	11,1	45	8,3

Source: own elaboration
OBS: responses 1, 2, 3, 4, 5 and 6 are described in Board 1

associated with the score 3 (Neutral). These results suggest a more adequacy of C company to quality of questions in relation to employees, which showed a predominance of responses associated with score 1 (strongly agree / very positively / very good).

Items related to processes also have a different pattern, because the responses provided to the B Company agreed with the A and C companies, providing more responses associated with score 1 (strongly agree / very positively / very good). Please note that Company B has also provided many answers associated with the score 3 (Neutral), while companies C and D have left many items unanswered or felt it does not apply. The findings suggest that Company D has a less appropriate behavior according to the requisites of quality.

With regard to business performance, the A company provided responses more similar to the responses of B and D companies, predominantly responses associated with the score 2 (agree/positively/satisfactory). Again, Company C seems to adopt practices more appropriate to quality questions by presenting more items with a score of 1 (strongly agree/very positively/very good).

By comparing the responses given by companies to items related to different types of management: standards-based (standards), based on awards and based on implementation of elementary procedures, the Kruskal-Wallis statistical test also found evidence that the distributions of responses does not come from populations with the same median ($\chi^2 = 9,125; gl = 2; valorp < 0,010$).

According to the data presented in Table 2, items related to standards-based management were more closely associated with score 1 (strongly agree, very positively or very satisfactory), corresponding to 45.5% of the total. Items related to management based on awards were more associated with the score 2 (agree, positively or satisfactory), corresponding to 36.1% of the responses. These results show that, according to those responsible for quality management, companies meet more the requisites of quality, in items related to standards-based management, which is relevant to the requirements of the certification obtained. For management based on basic knowledge, the percentage of items associated with scores 1 and 2 were very similar: 37.2% and 36.7%, respectively.

By applying the Kruskal-Wallis test data of each company, it is found evidence that the distributions of the scores given to the items do not come from the identical populations with the same median for the responses provided by the representatives of the companies B ($\chi^2 = 20,368; gl = 2; valorp < 0,0001$) and C ($\chi^2 = 10,134; gl = 2; valorp = 0,006$).

In company B, although a larger quantity of items received score 2 (agree, positively or satisfactory) for all types of management (53.8%; 50.0%; 51.1%), this was followed by score 1 (strongly agree, very positively or very satisfactory) for items related to management based on standards and the score 3 (neutral) to the others. Interestingly, the company C, a greater amount of items has been associated with a score 1 (strongly agree, very positively or very satisfactory) for all forms of management (69.2%, 71.6%, 91.5%), but items related to management based on elementary procedures obtained a much higher percentage rate (91.5%).

These findings show that although the companies do not use many programs and quality tools, especially the quantitatives that involve statistical method, its QMS have a reasonable performance, especially on questions relating to compliance standards.

5. FINAL CONSIDERATIONS

The present study investigates the QMS in four companies with ISO 9001 certification using two instruments: an interview and a questionnaire. In all companies the findings indicate that certification brings good results, especially from a technical point of view. There is a consensus among interviwee that the certified company works better, more organized and transparent manner, according to several studies already developed. However, they do not seem very sure of improved economic performance, as expressed concern about the quality costs. Those informations agree with Pinto (2012) which shows that many certified companies do not renew the certification for failing to improve their economic performance, and suggest that should remain with the certification only if it is a requirement of their customers.

For Stevenson *et* Barnes (2000), however, some studies indicate that some companies have been able to benefit in terms of profitability, communications, operations and market expansion. In this context, statistical techniques, so rarely used according to the respondents of this research can play an important role in the evaluation and control processes, assisting decision-making based on evidence and contributing to the success of the QMS. These findings go against study of Maekawa *et al*. (2013) which found that the degree of utilization of programs and quality tools for small and medium enterprises is far short of that link the research with data from large national and international companies.

With respect to quality management practices, general reviews were good. Company C was the best evaluated by their representatives. However, they were the only ones

Table 2. Distribution of responses per company for the different types of management

Management	Response	A		B		C		D		TOTAL	
		ni	%	ni	%	ni	%	ni	%	ni	%
Standard based	1	26	66,6	13	33,3	27	69,2	5	12,8	71	45,5
	2	9	23,0	21	53,8	4	10,2	21	53,9	55	35,2
	3	1	2,6	3	7,7	-	-	5	12,8	9	5,8
	4	1	2,6	1	2,6	-	-	5	12,8	7	4,5
	5	1	2,6	-	-	1	2,6	-	-	2	1,3
	NR/6	1	2,6	1	2,6	7	18,0	3	7,7	12	7,7
Awards based	1	35	47,3	4	5,4	53	71,6	6	8,1	98	33,1
	2	27	36,4	37	50,0	10	13,5	33	44,5	107	36,1
	3	3	4,1	28	37,8	-	-	18	24,3	49	16,5
	4	2	2,7	3	4,1	-	-	7	9,6	12	4,1
	5	3	4,1	-	-	-	-	2	2,7	5	1,7
	NR/6	4	5,4	2	2,7	11	14,9	8	10,8	25	8,5
Based on elementary knowledge	1	20	42,6	4	8,5	43	91,5	3	6,4	70	37,2
	2	23	48,9	24	51,1	-	-	22	46,8	69	36,7
	3	1	2,1	13	27,6	-	-	13	27,6	27	14,4
	4	2	4,3	4	8,5	-	-	3	6,4	9	4,8
	5	-	-	-	-	-	-	-	-	-	-
	NR/6	1	2,1	2	4,3	4	8,5	6	12,8	13	6,9

Source: own elaboration.
OBS: responses 1, 2, 3, 4, 5 and 6 are described in Board 1.

who were not directly involved in the certification process, so it may have been less rigorous in the evaluation. Among others, that provided a distribution of answers the best was Compan A that is certified longest and have the oldest employee as responsible for the QMS. It notes also that the major differences between companies occur between factors with items related to the human factor: managers, customers and suppliers, which are considered determinants of quality programs successful implementation.

The findings also agree with Stevenson et Barnes (2000), who claim that the certification process is difficult and time consuming and, being very general, often fails to solve some specific problems, but undeniably improves the operation of all organizational processes. Also agree with Borial (2011), which states that the ISO should not be considered as an end in itself but as a learning process with its own pitfalls, benefits and surprises, and may have positive and negative impacts that depend on factors specific.

Finally, there is evidence of a small number of companies found in the region with certification obtained by certification agencies accredited by Inmetro in the QMS area. This fact goes against the Fonseca et Ferman findings (2015) who identified even the lack of discussion around health management standards and work safety in Brazilian federal public institutions, suggesting the need to create public policies that encourage the implementation of QMS.

Thanks

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