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THE CONNECTION OF THE TOTAL QUALITY MANAGEMENT SYSTEM (QMS) WITH INNOVATION MANAGEMENT (IM)

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ABSTRACT

The productivity of the Brazilian industry received a new lease of life with the quality movement and with the companies that invested in their QMS and gained in competitiveness. After that, another movement began, embracing government, companies and ICTs: the innovation movement. The purpose of this article is to present the importance of the Quality Management System (QMS), considering the pro-innovation agenda that is emblematic of the Brazilian industrial agenda. To identify, among the attributes of a QMS, which ones effectively refer to innovation. The methodology includes a critical analysis of the conceptions of Quality for Innovation. The authors point out that having a structured QMS is a common characteristic of innovative companies, which allows the organization to enjoy the dividends associated with creativity. Finally, the facts summarized in this article broaden the perception that there is an interesting and auspicious degree of alignment between quality and innovation. The former is an input to the latter, proving a biunivocal conjunction.

Keywords: Quality Management System; Innovation; Biunivocal Conjugation

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1. INTRODUCTION

Although the literature is scarce and somewhat controversial when it comes to the connection between quality management and innovation, some scholars of these institutes, following the thought of James Westphal et. al. (1997), such as Shahid Yamin et. al. (1997) and Juett Cooper (1998), consider Total Quality as a form of innovation. It can be reported that there is a perfect relationship between Quality and Innovation, constituting a fundamental component for the success of organizations. Quality stimulates and provides adequate tools for innovation while aiming at greater efficiency and the ability to meet expectations, as well as captivate customers. In turn, Innovation itself is assumed as a vital system for the success and sustainability of companies (Saraiva and D'Orey, 1999). Following the analysis of Bruce Han et. al. (2007), companies have adopted Total Quality Management System (QMS) practices as a strategy to respond to customer requirements. It is a management approach in which the primary concern is to meet customer needs and expectations through the integration of all functions and processes of the organization to achieve continuous improvement in the quality of goods and services.

The primary mission of a company is to create value, and it is essential to develop its activity efficiently, adequately combining the available resources. This is how the company operating in the market manages to survive and continue to operate, keeping costs under control and increasing revenues. Thus, Quality and Innovation emerge as vital concepts for the survival of companies in a generalized environment of great competitiveness, high change and enormous speed, in which only the most agile and creative will be able to subsist (Saraiva and D'Orey, 1999).

It is in this context that the Scientific and Technological Institutions (ICTs) present themselves as cooperative entities. Connecting to the productive system as suppliers of new products and processes prospected and developed by them, they spill knowledge and suggest innovations that start to provide the success and survival of the company. Perhaps the first indication of this interaction between Quality and Innovation can be found in one of the mantras of Quality that is "doing things right". Even if one seeks only to do "the right thing" (process), eventually, there is its intrinsic power to illuminate unusual aspects that also lead to new products.

The Quality Management System (QMS), history and contextualization

During World War II, Japanese companies and organizations, the birthplace of the current methods of Quality Management (QMS) in use today, based their quality control on British Normative Standards. This British standard, also adopted by the Americans, is recognized as the birthplace of Modern Statistics. However, under the influence of the administrative method created by Frederick Taylor (1856-1915), considered the most modern at the time, in which the workers should be guided by specifications determined by specialists, Japan competed on cost and price, but not on quality. The products were cheap and bad (ISHIKAWA, 1993). This problem brought great concern to the American occupation forces in Japan (1945-1952).

Through courses and training in Quality Control, constituted by the Quality Control Research Group (QCPG), given by American specialists, among them Dr Edward Deming (1900-1993), the system was approached focusing mainly on the improvement of quality management. It was even stated that around 85% of the problems came from managerial responsibility. Besides, his proposals would reveal a humanistic content regarding the valorization of "shop floor" employees and the search for commitment and awareness on their part. Soon after this creation, the members of the GPCQ started to write their texts and to avoid the use of translated works.

In the 1950s, the Quality Control Circle (QCC) was created, whose goal was quality improvement through self-motivation, thus obtaining the spontaneous contribution of the workers. The QCC was soon accepted in South Korea and Taiwan, arriving in Brazil in 1971 and the United States in 1976 (Chiavenato, 2002). While in Japan, since the end of World War II, quality control was evolving, simultaneously in the United States a time of great abundance and prosperity began. Carmen Fonseca (2004) visualizes in this post-war phase the occurrence of the great demand for American products and the consequent high production, but also bringing the consequent counterpart of reduced selectivity and, obviously, some noted loss in the quality of its products and processes. The lack of a more consistent focus on quality aspects was charged to the competitiveness of the United States economy from the end of the 1970s onwards, when compared to the nations with economies on the rise, especially Japan. One of the noticed effects was the occurrence of the first big strike in the centre of its auto industry, Detroit, resulting from the loss of competitiveness and, consequently, of market share to the Japanese similar companies. In the following decades, the competition with emerging China, South Korea, Taiwan, etc., which followed the Japanese recipe, that is, the focus on quality management, followed by the search for innovation, intensified. Within the recipe, we can highlight the actions to raise the level of education of their populations, the search for continuous technological development and the aforementioned innovation and quality management, all aiming to improve the competitiveness of their prod-

ucts, processes and services with the consequent opening of new markets.

As observed, Japanese managers since the post-war period have started to follow their model that can be summarized in quality control education for all levels of the company and long-term education. The first step in quality control is to know the customer's demand. When it is not adequately met, the cause must be sought, making room here for some tools. Among these, the Cause and Effect Diagram (also called Ishikawa Diagram or Fishbone Diagram) is an important tool. This Quality Control (QC) tool is of great importance. In the first moment, the tool lends itself to identifying the causes of the unexpected effect. However, it is almost a rule that, in this process of investigation, improvement actions associated with new processes and products will occur. And, of course, referring to pre-innovation attitudes. In this same vein, other tools, such as QFD (Quality Function Deployment) end up, in the end, giving rise to improvements and/or ideas for innovation.

In Brazil, the first experiences with quality control circles started at the end of the 1970s, at Walita and Volkswagen, so that, in the following years, several companies started to follow the system. By the 1990s, the Japanese model was no longer exclusive to that country, becoming the universal standard for companies that wanted to achieve and maintain the ability to compete on a global scale (Maximiano, 2000). Several of the tools and work methods that have been created and improved over the years come from the Japanese system, which is differentiated by the simplicity of its components: efficiency, quality, and employee participation in decisions. Some are widely applied, such as Kanban, Kaizen, Just-in-time, 5S, Quality Control Circles (QCC), ISHIKAWA Diagram (Cause and Effect or Fishbone), Method of Problem Analysis and Solution (MASP), Management by Guidelines (GDP), Kaizen, and others.

Quality in Brazil and its impact

The issues concerning the specification of standardization and quality criteria to be met by companies have existed since 1947, with the creation of the International Organization for Standardization (ISO), based in Geneva, Switzerland, which brings together national standardization bodies. The acronym ISO is a reference to the Greek word ISO, which means equality. The organization's main activity is to draw up standards for specifications and working methods in the most diverse areas of society. In these times of high competitiveness and customer demands, the market demands more and more performance from companies, requiring more effective and efficient production and management systems.

With Fernando Collor de Mello's government, which began on March 15, 1990, Brazilian companies had greater exposure due to the opening of the country's economy to the international market. This change in economic guidelines provoked in the local industries a fight for their survival, considering the competition that was configured. Consequently, the search for increased quality and competitiveness became vital. In line with this, it was sought to modernize and improve asset management (operational assets) and business management. The words "research", "development", and "innovation" began to frequent, albeit timidly, the conversation agenda of businessmen and entrepreneurs. It seemed that the right moment to consolidate the total quality management system, and with broader aspirations, had been outlined.

This new management method became the focus of various sectors of the economy, being the beginning of a new era in management and reinforced with the creation of the Brazilian Movement for Quality, the National Quality Award (PNQ) and the Brazilian Program for Quality and Productivity (PBQP). With this, the results started to appear, as well as the use of quality, combined with other factors, such as the State's mode of action in its intervention and control of the economy, the entrepreneur's demand for more qualification, the beginning in several companies of the implantation of their Research & Development departments, aiming at the creation of new products, processes or services and thus facing the challenges of an economy in a globalization phase. According to the Organization for Economic Cooperation and Development (OECD), the average annual rate of the Brazilian Industrial Productivity, which was -0.5% in the period 1985-1990, rose to + 8.3% from 1990 to 1995 (being -2.2% in 1990). According to Carmen Fonseca (2004, p. 43), the productive and service sectors already showed great gains in the first half of the 1990s; the assembly time for a vehicle was changed from 48 hours to 28 hours, as well as for televisions, from 100 to 25 minutes. The production of vehicles per employee increased from 9 to 20. Another indicator that demonstrates the effects of the use of the quality method was the rapid growth in the number of certificates by the ISO 9000 Series Standards (35 until 1991; 948 until 1995 and 5,285 until 1999).

Perhaps the greatest legacy of this movement - and here the hypothesis proposed in this article is reinforced - is the fact that many companies that have effectively adopted the Total Quality Management System, some of them competing and winning awards related to their practices, also figure as the most innovative companies in Brazil, such as Vale, WEG Motores, Votorantim and EMBRACO. The fundamentals that paved their upward trajectories, considering innovation management, will be portrayed in the following sections.

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Innovation in Brazil

Perhaps, in a more organized and systematic way, the management based on innovation in Brazil began at the turn of the threshold of the XX/XXI century. Indeed, it is from this period the LPI - Industrial Property Law, which will regulate the rights and duties to that citizen, resident or not, who presents a new product or process endowed with inventive activity.

The discussion with society and the academic community about the text that would become the Innovation Law dates from 2002-2003. Its wording is from the end of 2004 and the decree that regulated it is from the beginning of 2005. By the way, it is worth mentioning another important milestone of this period, Law 13243, considered the Legal Framework for Science, Technology and Innovation. In 2018, Decree No. 9,283, which regulates it, came out. According to José Cassiolato and Helena Lastres (2003, p. 24), the Innovation System

> "can be defined as a set of distinct institutions that contribute to the development of a country, region, or locality's capacity for innovation and learning. It consists of elements and relationships that interact in the production, diffusion and use of knowledge. The basic idea of the concept of innovation systems is that the innovative performance of an economy as a whole depends not only on the performance of specific organizations, such as companies and research organizations but also on how they interact among themselves and with the government sector, in the production, distribution and use of knowledge, for the sake of competitiveness, economic growth and social welfare". (Cassiolato e Helena Lastre, 2003, p. 24).

Effectively, one can observe the interrelationships and components of Brazil's National Innovation System (NIS) in Figure 1.

Studies related to the theory and management of innovation distinguish knowledge as the greatest of its fuels. At the same time, several dimensions of learnings are associated, as postulated by Arrow, Materba, among others. Of these dimensions, we call attention to *learning by Using and learning by Doing*. These were already present in the practices of Japanese companies, shortly before the twentieth century, and therefore foreshadowed the connections that the hypothesis of this article suggests.

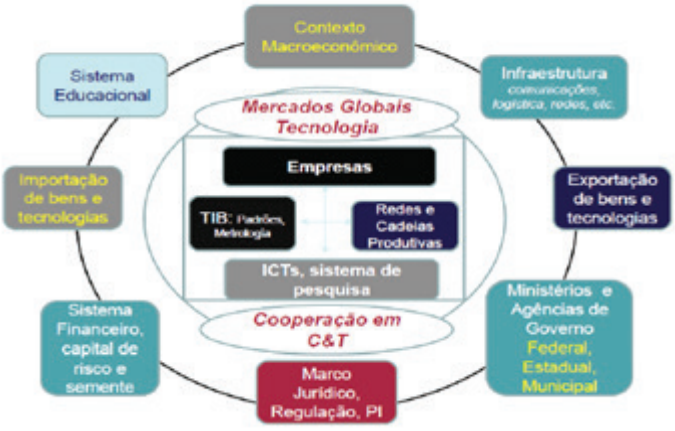

Figure 1. National Innovation System.
Source: Alvaro Diaz apud Salerno, 2012.

With the advent of new growth theories (endogenous) that emphasize knowledge, investment in human capital, and the historical-geographical context, new dimensions have emerged, such as *learning by Learning and learning by Interacting*, as well as *learning by Searching*. These are references, some inspired by the 1990s, which reinforce and approximate the two models. While the "using" dimension brings the company closer to the customer (and his needs; "this is quality"), the searching and interacting dimensions "may be going towards" surprising him, with the generation of the unusual ("innovation").

2. METHODOLOGY

The purpose of this article is to discuss the inter-relationship, often not fully decoded, between Quality Management and Innovation Management. Are there aspects of the former that can positively impact the latter? What are they? In what way? To answer these questions, the dissertation of the arguments follows.

The article makes use of a methodology that resorts to exploratory research in scientific databases in the recent past. In it, we have the following sections that address the history and contextualization of the QMS, its impact, Innovation in Brazil, the biunivocal conjugation of Quality and Innovation, and the results that have been obtained.

Quality and innovation, a two-way conjunction

According to Oliveira (2015), ISO 9001 2015 brought in its Improvement requirement, for the first time since the standard was created in 1987, the word "Innovation." It is there in a shy way in a note in requirement 10.1, as an example of improvement. It is not a requirement, but an acknowl-

edgement of ISO and that it is one of the possible forms of improvement. If it occurs in the company, it should be "captured" by the Quality Management System and treated as other types of improvements.

Together with risk analysis, root cause investigation, among others, the search for innovation can be an important strategy to reconfigure a business. A term inextricably linked to innovation, risk (its analysis) provides the "link" between the two systems in focus. Innovating presumes taking certain risks, which if not well analyzed, may result in undesired effects, and this is a lack of quality.

Nevertheless, studies show that companies that stand out for having a robust Quality Management Program (QMP) are also seen as innovative companies. They have innovation as a strong vector in their strategies. More than this, besides developing this competence, they have transformed it into a vital function. Thus, such companies have committees or even departments responsible for making innovation happen. Like the quality management areas (which are not responsible for achieving quality, but rather establish the conditions for the operation to produce quality), these innovation areas are not directly responsible for innovating, but rather for providing an environment conducive to the conception and course of innovation. The corporate area that deals with innovation, like the quality area, functions as a support to this end. Innovation itself is the effect of knowledge, whether accumulated or interactive.

These areas, among other attributions, may be responsible for knowledge management, for seeking external cooperation, for creating a network where knowledge is shared, for evaluating and, together with those responsible in other areas, taking risks, which are requirements of ISO 9001 2015.

To get an idea of the level of connection that associates the search for quality and innovation, it is interesting to point out a record repeatedly observed in PINTEC. Virtually in all editions of the survey, when asked about evidence of innovation in the company, entrepreneurs identify improvements in quality. By improving their QMS, the companies have the perception that they end up innovating. And they innovate.

As previously stated, the implementation of QMS principles creates an organizational culture favourable to the development of innovation activities, as Mohamed Zairi (1994) also deduces. According to Daniel Prajogo and Amtik Sohal (2004a, 2004b), the principles of Quality Management are similar to the principles of innovation. Therefore, Quality Management can drive and make the organization more committed to creating a sustainable climate for innovation (Zairi, 1994). Complementing the positive view between QMS and innovation, continuous improvement, participation in the decision-making process, support from top management, teamwork, and the "open" culture of the organization are key elements common to QMS and innovation, and the development of QMS practices translates into the incorporation of key ingredients to the establishment and development of innovation (Prajogo and Sohal, 2003, 2004).

Several companies illustrate the application of the QMS, among them LatAço, one of the Brazilian leaders in the metal packaging market (cans), they use a program of "idea generation", which is an activity that drives creativity and innovation in the company. It is a mechanism to generate ideas obtained by the company's R&D team but also involving the other employees, aiming at a connection to the paradigmatic order effects that light the way for innovation of a given product, process or service. Working with the generation of ideas is a great challenge for companies. In the innovation process, there must be a constant effort to generate a large flow of ideas, since this is the first stage of this process. To this end, techniques are structured to support the generation of ideas such as the Six Hat Method, Brainwriting - Method 6-3-5 and the 5W+1H Model.

The LatAço company, studied by Wander de Lima (2011), prioritizes an idea generation mechanism coming from the employees. This idea creation activity is considered the flagship of the company's innovation system, consisting of a stimulus program for employees in all areas and functions. Stimulus to give constant suggestions, criticism and ideas about products, work environment, administrative practices, manufacturing processes, day-to-day operations and ways of managing the company. Wander de Lima (2011) captures a phrase obtained from one of his interviewees in the company that defines well the impact of the idea generation activity on innovation: "creative ideas influence the increase of productivity and stimulate the internal innovative environment". This activity was born as a program of ideas about process improvements, but over time it became the main channel of dialogue between top management and operational staff and an important source of new ideas and innovation for products.

As observed, the search for the paradigmatic effect, that is, the breaking of paradigms was achieved with the QMS. In the search for innovation, there was a need for change, breaking bureaucratic and centralizing models that were the paradigms to be overcome, besides the occurrence of constant renewal that brought several benefits to management, such as decentralization, valuing of intellectual capital, valuing the impact of the human element.

Why can we say that the relationship between "Quality" and "Innovation" is biunivocal? When we conceive an innovation, something new - even if it is - the absence of quali-

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ty will make the uncertainty more critical. The insufficiency or absence of quality would translate to the customer into something "worthless", which would denote not being an innovation. The positive factor of using quality methodologies is that they allow the knowledge generated in the innovation process to be leveraged. Also, it allows the creation of a virtuous PDCA cycle (Plan - Do - Check - Act or Adjust), besides its capture in norms, or other references, which allow its widespread use and success in the market.

The two-way relationship between Innovation and Quality, therefore, combines efforts to increase productivity and competitiveness. Innovation and Quality share methodologies and concepts that must be viewed from a global perspective, based on the same foundations: processes, people, and organizations (Santos, 2013).

To innovate presupposes transforming knowledge into value. Having good ideas and knowledge base. However, not having the ability to manage in a planned and systematic way can result in discouragement or failure. Indeed, for these to be retained in the organization, besides the lack of resources for their conversion into value, the negative combination of these factors will lead to the non-creation of practical interest and wealth of the so-called good ideas.

3. RESULTS AND DISCUSSION

The yearbook "Valor Innovation Brazil 2018", published by *Valor Econômico*, presented the ranking of the 150 most innovative companies in the country. It also edited articles on initiatives, investments, and practical examples of the performance of the 10 most innovative companies and the leaders in each of the 21 sectors analyzed. Figure 2 below reveals part of the ranking, considering the ten most innovative companies.

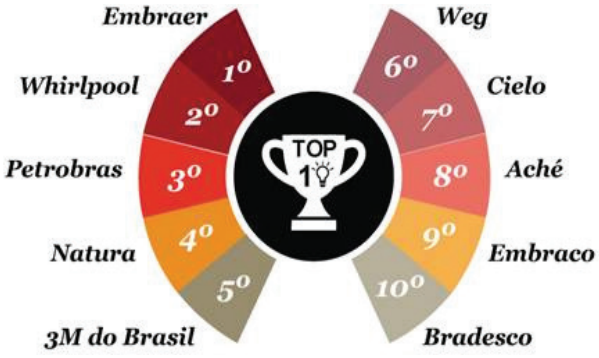

Figure 2. Ranking of the 10 most innovative companies.
Source: Valor Innovation Brazil, 2018.

Looking at the top 10 companies in this ranking, all are ISO 9001 certified. The implementation of quality processes in these companies and the market in general often comes from the market itself. Embraer, considered the most innovative Brazilian company, to be able to supply its products to the American market, was forced by the same to follow these standards and already in the 1980s created its QMS based on the MIL-Q-9858 system.

The second company in this ranking, Whrilpool, the largest manufacturer of household appliances and present in the country with the Brastemp, Consul and KitchenAid brands, is certified by the Integrated Management System (IMS) that accredits it with ISO 9001 (Quality), ISO 14001 (Environment) and OHSAS 18001 (Occupational Health and Safety) standards. Petrobras, the 3rd company in this ranking, in addition to being certified, requires the same certifications from its suppliers. The 4th company, Natura, is the leader in the Brazilian cosmetics market and has been certified since 2004. Recently, it acquired Avon and became globally the 4th company in its sector.

All these companies have in common a strong investment in the quality of their processes and products. In part, it seems to be suggested that part of their innovations came in an attempt to solve inherent quality problems to ensure customer satisfaction. Analyzing these two sets, QMS and Innovation, one can see that they are biunivocal, where quality impacts innovation management.

Quality management systems create standardized actions, generating a continuous improvement system focused on innovation. By planning and developing solutions that meet customers' requests, an environment is created that is auspicious for innovations, in various ways, and a continuous and sustainable improvement of its processes and control methods.

4. CONCLUSION

The present work focused on the study involving quality and innovation management. It sought to identify the aspects inherent to the impact of quality on innovation. Through its historical rescue and its contextualization in Brazil, it was possible, in an emphatic way, to position them through the chronology, the effects over the causes.

It was gathered objective evidence of the importance of some quality tools, as drivers of ideas, or even the role of stimulating innovative creations. In this line, the cause-and-effect diagram, the QFD, the quality control circle, and the idea generation function in the QMS as true innovative inputs.

On another angle, we observe the interaction with customers and suppliers, elements that are strongly present in Quality Management systems. They help insert themselves as agents that provide the genesis of desired effects, of a sequence of learning that demands more learning, based on interaction and research, aspects that are not only conjectural but pragmatically concur to innovation.

The analysis of the so-called most innovative companies in the Valor Economico ranking is emblematic; it can be observed that the historical context of acting in quality translates into innovative potential. The facts summarized in this article give the clear idea that there should be a desired, interesting, and auspicious degree of alignment between the two institutes, thus reinforcing the hypothesis of the article.

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