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INNOVATION QUALITY: DISCUSSION AND A MODEL FOR MEASUREMENT

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ABSTRACT

This article deals worth Innovation Quality (or Quality of Innovation) instead of Quality Innovation (or Innovation in Quality). It is recognized that innovations along with knowledge must be part of any kind of organization strategy as relevant tools in order to obtain competitive advantage. To associate quality and creativity to these factors makes the results more significant. The goal of the current study is to discuss innovation as a positive or negative factor for quality improvement and try to measure such relation through an indicator that is open to numerical determination with application in several practical conditions, especially in the productive activity. A set of dimensions is proposed for the innovation quality as a way to achieve such goal. It is proposed and discussed an index called Innovation Quality as a goal to quantify the real contribution of innovation in each case, so aiming to open a thorough discussion about this concept.

Keywords: Quality; Innovation; Dimensions; Measurement; Process

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1. INTRODUCTION

The search for innovation became the object of desire and need of the modern organizations (SANTOS *et al*, 2014). The innovation associated to quality and other concepts now integrate a relevant competitive strategy for the companies. Innovation became a vital factor for the organizations survival, attributing to it the organizational success and growth, and so may be considered as a main economic development conductor (LOW; KALAFUT, 2003; SANTOS *et al.*, 2014) However, in general literature, quality and innovation are seen as different factors, unlikely of what is considered in the present work.

The innovation became an alternative in the organizations development with the purpose to meet the internal and external changes for the organizational performance improvement compared to competitors, giving them important competitive advantage (BEDANI, 2012), maybe the most distinguished pioneer to understand the innovation importance, mentions that the real competitive advantage of the company in the condition of the innovation holder is not placed in the opportunity to operate as a monopoly, but in the shield obtained due to the temporary disorganization of the market, and even more in the time it makes necessary to develop a long term plan (SCHUMPETER, 1942).

The organizations must try to search for creativity, but mainly they should be able to turn this creativity into an effective innovation through the value of their worker's knowledge that will be its greatest intangible asset. Innovation is characterized as the finding, search, and development of new products, processes and improvement of the organizational management. It's an interactive procedure in which there is the participation of economic and social agents, including different kinds of information and knowledge that mandatorily have a direct relation with regional agents (JACOSKI; COSTELLA; RIGON, 2014).

The performed a research on innovation quality with focus an innovation awards, particularly in Finland, showed that this kind of incentive for the promotive of innovation still weak and the main motivation of enterprises for a competition award is the increase of credibility, reputation and visibility in indices. It is not refereed in this research a specific method for metering innovation quality in an objective way somehow similar with what is presented in this paper (MAKKONEN; INKINEN, 2014).

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To direct resources to innovation more than competitors, enabling to add value to the brand (CARVALHO; BARBIERI, 2013), otherwise a due to technological changes and opening of new markets, companies are more conscious of the innovation importance and are investing in skilled labor and improvement of processes and products (SILVA *et al.*, 2013).

Therefore, to characterize innovation quality shall be relevant, once the products, services and processes life cycles are getting smaller. Evaluate innovation quality that is offered to client, either internal or external, allows the organization to explore the gap between the clients' needs and the meeting of these needs in order to provide better satisfaction and loyalty (SILVA *et al.*, 2013).

This article gives sequence to the idea developed in a previous reference by the same authors going further in the proposal of establishing ways to characterize and measure the innovation quality concept. The authors don't intend to cover every aspect of the issue, because it can be complex, and it would be a very long discussion. Through a practical approach that can be enhanced and suitable to other situations, it is tried to establish the possibility of consolidating the concept of quality innovation through its characterization by a measurable index. The purpose of the current work is so to move forward from the initial idea, providing to other interested researches discussions and prepositions through the continuity of this study.

There is lack of explanatory models and theoretical proposals about the innovation processes elaborated from the organizations reality (CENTURIÓN *et al.*, 2015). This finding justifies the effort developed in the current work, where it is moved going besides the already explored models for innovation itself, but to its quality, which is discussed and measured so exploring a gap in the literature.

It is assume that innovation does not necessarily provide improvement in products, services and processes quality, or even in people's quality of life (COSTA NETO; MORAIS, 2016). This may occur in cases of highly innovative products, although subject to failures, but very powerful to clients' attraction (REIS, 2015). The study had a qualitative/quantitative approach; the samples were taken from companies of the automotive branch, white line, lighting, education, services provider and connectors from June to July, 2017. Coordinators and managers from these companies were interviewed.

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2. THEORETICAL BACKGROUND

2.1. Innovation Process Characteristics

Innovation is taken into consideration by many as one of the major factors for the organizational and human development, becoming the main creator of competitive advantage, searching for more and more distinction among competitive companies, as the main key for the sustainability of the highly aggressive market (RABECHINI JÚNIOR; CARVALHO; LAURINDO, 2002; CLOSS; FERREIRA, 2012).

One of the theoretical pioneers about this issue, innovation leads to economic development and can impose the speed of the growth of a country, beyond the innovation can be taken into consideration as a new possibility for the creation of products and processes, but also for the use of components that already exist (SCHUMPETER, 1942).

There are distinguish between innovation of products, services and processes applicable to their respective areas (CLOSS; FERREIRA, 2012). Shows several ways in which innovation can be classified, such as technological innovation (related to process or product) or organizational (related to management or business model), incremental innovation (result of small and successive improvements that characterize the continuous performance improvement) or radical (result of new technologies or research planned effort), among others (VASCONCELOS, 2015).

The technological resources implemented in the organizations lead to operational efficiency and effectiveness, so that the companies improve the quality of their products and services (GALLAUGHER, 2007). This position will probably give more importance to technological innovation rather than the others, which can be inadequate in many cases.

According to Christensen and Wessel (2012), innovation processes can be formal or informal. Formal processes are the ones that are organized, documented and executed consciously by the organization. The informal ones are carried out from usual routines and in a non-systematized way.

The organizations that do not incorporate any kind of innovation process will become more and more obsolete. For Bagno (2014), the lack of understanding about what innovation is can lead to expressive difficulties in the management, affecting the

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enterprise survival in the market where it is placed. One of the main goals of innovation is to create value to the business, regardless of the segment it belongs.

2.2. Product Innovation

The product innovation can be seen as the introduction of a new product or significantly improved regarding its characteristics or previous use by the company (FINEP, 2004). The success of new products can be measured by functionality aspect as, for example, the quality of the new product that refers to the capacity of the product to carry out its functions, the current technological knowledge improvement compared to the competitors, the functionality and higher advantage acquisition (KOHLI; JAWORSKI; KUMAR, 1993; PALADINO, 2007).

Rothweel and Gardiner (1995) state that innovation of product is a central and necessary element for long term success in an organization. This process becomes the essential element for the survival and maintenance of the organizations (VERMELEULEN, 2005; SILVA NETO, A. T.; TEIXEIRA, 2014).

2.2.1. Product Quality

Maximiano (2010) takes into account some of the quality approaches when he states that managing the product quality starts by the specifications definitions in terms of its performance expected by customers, but the quality issue is also significant to the stakeholders interests on the entire productive process, inside and outside the company.

About the tangible products quality, Garvin et al. (1984) proposed the existence of eight quality dimensions, shown in Table 1.

The authors of the current work consider such products quality dimensions a good reference to establish an evaluation of the new products innovation quality.

Table 1: Products Quality Dimension

PRODUCT QUALITY DIMENSIONS	
DIMENSIONS	**CONCEPT**
Performance	Concerning the correct performance of the main activities for which the product was designed.
Complements	Referring to items that add to the accomplishment of the main functions, contributing to improve performance.
Reliability	Concerning safety in use, absence of risks and no occurrences of failures.
Conformity	Concerns the fulfillment of project specifications.
Durability	Related to product life.

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Technical assistance	Regarding after-sales support and maintenance facilities in case of failure.
Aesthetics	Regarding the good appearance, the good taste and the pleasant sensations provided by the product.
Perceived quality	Subjective dimension, related to the opinion of each client, influenced by specific aspects of the product.

Source: Garvin (1984)

2.3. Service Innovation

Djellal and Gallouj (2007) and Hipp (2008) argue that the services sector, due to their characteristics of intangibility, heterogeneity and simultaneous production with the consumption, is different in terms of organizations and execution compared to the tangible products that adopt more traditional management models.

The innovation issue in services is often associated to the adoption of technical systems (especially computerized systems) coming from the industrial sectors invention, rather than other ways of less tangible innovation (GALLAUGHER, 2007).

2.3.1. Service Quality

Service quality has been broadly discussed in literature of services management in several industrial sectors and many researchers have tried to characterize it by agreeing that it has to be studied from the clients' perspective (LEBLANC; NGUYEN, 1997; CLEMES *et al.*, 2008; NAGATA; SATOH; KYTOMAKI, 2011), being possible to state that que service quality is the clients' evaluation about the superior service performance provided by the company (YUSOFF; ALI, 2010).

The customers' perception about the service quality can be influenced by what is expected from the service and how the service is seen by whom receives it. Parasuraman, Zeithaml and Berry (1990) developed a prestigious model of five gaps that characterized the factors that interfere in this difference between the expected service and the one persevered by the clients.

The same authors still have proposed a set of quality dimensions in services presented in Table 2. However, Costa Neto, Costabile and Romano (2013), calls the attention to the fact that such dimensions are related to the services providing process, but they don't consider the quality of the associated product when applicable, what in many cases can influence the clients' opinion about the provided service.

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The same way the aspects in Products Quality Dimension, such services dimensions can offer a suitable basis to evaluate innovation quality that provides a new way to carry out a service.

Table 2: Services Quality Dimensions:

DIMENSIONS OF QUALITY OF SERVICES	
DIMENSIONS	**CONCEPT**
Tangible aspects	Physical evidences of service, appearance of premises, people, materials, objects and tools.
Reliability	Consistency and demonstrated ability to provide service.
Responsiveness	Willingness to help the client, with the specified deadlines.
Competence	Specific skills and knowledge needed to perform the service.
Courtesy	Finesse, respect, consideration and kindness in personal contact.
Credibility	Trust, honesty and integrity transmitted by the service provider.
Safety	No risk, danger or doubt.
Access	Proximity and ease of contact.
Communication	Keep the client informed in an understandable way and listen to it.
Client knowledge	Effort to know and meet the client's needs.

Source: Adapted from Parasuraman *et al.* (1990).

2.4. Processes Innovation

The process innovations allow the company to structure its activities so that the manager does not need to monitor simple activities, concentrating the efforts in other areas such planning and development.

The innovation management in processes simplifies the actions that must be taken in the organization, and it brings the need to pass on responsibilities and tasks, making them simpler to the company and turning the company into a more independent organization, which will not need the intervention of the Board in its processes, and the process is not only composed of its activities; when a process is identified it's important that there are controls of measures and time, in order to make sure whether they are fundamental or not for the achievement of the expected result (BALZANI, 2008).

2.4.1. Process Quality

In 2.2.1 and 2.3.1 were presented consolidated propositions related to tangible products and services quality dimensions existing in the literature. However, something similar is not available in relation to processes quality, and to projects quality either.

For Araujo (2009) the industrial processes are operational manufacturing flows which depend on input entries (raw material, components, fuel, electric power,

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manpower) for the effect of transformation from subdivided items to the output of the finished product of the process that must be monitored and controlled to allow the quality assurance of the process carried out and, by consequence, of its results.

Projects and processes have several similarities, and the main difference between these two concepts is the factor that a project is a time-limited activity which has beginning, middle and end, while a process is meant to operate indefinitely.

Therefore, it can be adapted to the processes in general, either industrial or administrative, the consideration about the two aspects of projects quality identified (MAXIMIANO, 2010), as shown in Figure 1.

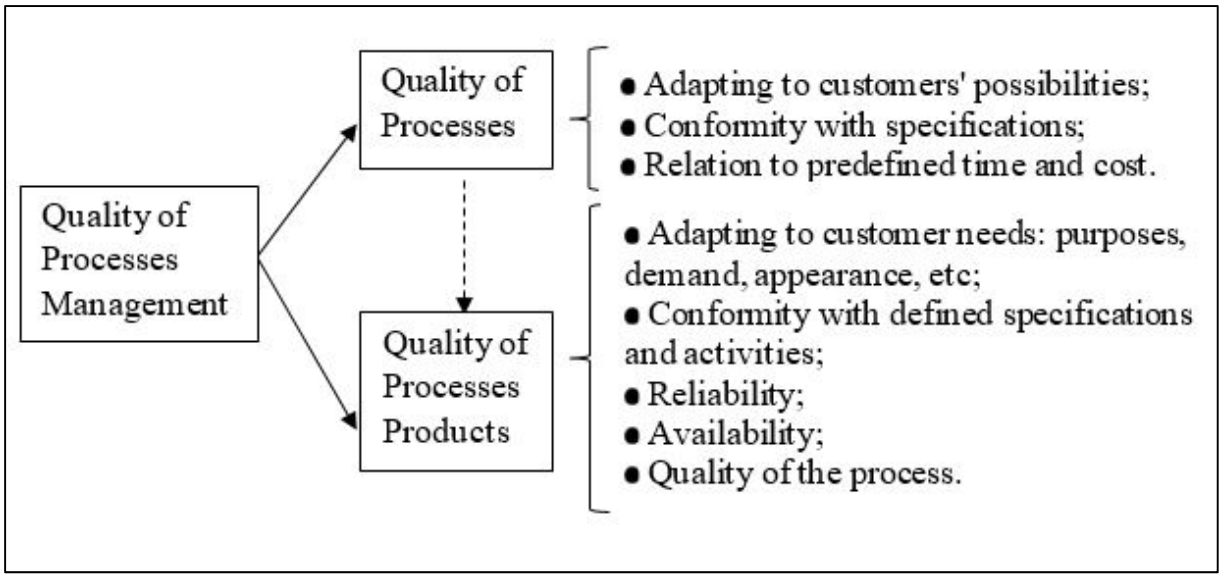

Figure 1: The two aspect of processes management quality.
Source: Adapted from Maximiano (2010)

The processes products can be tangible items, services and also other results, as softwares and other standardized projects. Whichever they are, the respective dimensions of quality are applied to them, but its excellence will depend on the good quality of the process itself, which has all to do with the quality of management. In Figure 2 it is presented the conceptual sequence that must be followed regarding the processes quality which lead's to the client's satisfaction. In the authors' of the current work opinion, this is an open-ended discussion (BOTELHO; NETO; VENDRAMETTO, 2012).

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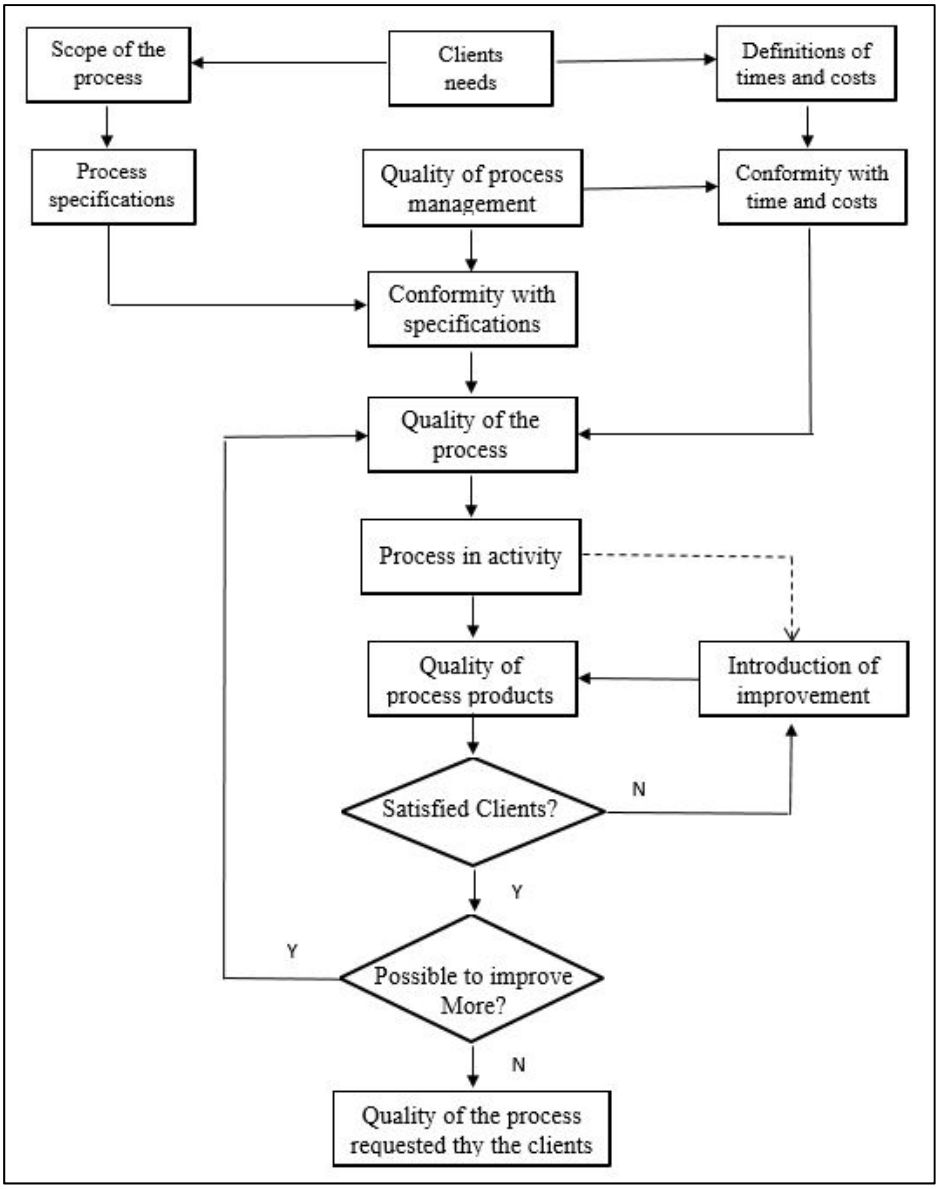

Figure 2: Process quality and its management.
Source: Adapted from Botelho, CostaNeto and Vendrametto (2012)

The concern about quality is implied in the production techniques development and new processes in development. The need of evolution and judgment of processes quality has become more relevant for the organizations. The operations are processes that have an input of entries, which pass though transformations and result in an output, as exit services and products which must be analyzed and controlled daily (SLACK; CHAMBERS; JOHNSTON, 2015).

2.5. Innovation Quality

In their article Innovation and Quality, the authors recognize the unquestionable importance of innovation as a propelling element of the process in modern times, but they also point out situations in which innovation has brought problems and difficulties

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for better life conditions of people in modern society. Thus, innovation in processes generates high productivity, but also causes unemployment, innovations in activities of police investigation make easy the clarification of crimes, but cause privacy loss; the modern arms give more military power, but may cause more destruction, and so on (COSTA NETO; MORAIS, 2016).

This finding made the authors interested in the concept of innovation quality, or quality of innovation, which they think necessary, but very little explored.

The researched literature does not fully address the innovation quality concept present in the current work, however, the article offered by Haner (2002) deserves special attention in which the author established clearly the distinction between innovation quality and quality innovation. Three levels are set up in which the innovation quality can occur: in products/services, in processes and business. The author presents for each level a set of factors that can influence the innovation quality, but does not create an indicator that offers effectively a way to measure the concept.

Going further, Costa Net and Morais (2016) suggest the creation of an index of innovation quality (IQ) varying between -1 e +1, that would be a measure of benefits and inconvenients which innovation might bring to individuals and society. Negative values of IQ are associated with situations in which innovation was considered harmful from the analyzed point of view.

The mentioned authors have proposed two theorems:

1. IQ value is a function of the time of use of the innovation;
2. The IQ time value depends on the long term planning for the innovation use.

The authors also present factors that can affect the innovation quality; such as level of innovation use, market amplitude, user satisfaction, ethical aspects, contribution to sustainability, facility of use and advantage effectively provided.

In the current work, it is tried to move forward in the search process for the characterization of such indicator. It is possible to consider that its use may be in different situations such as:

- **Identify a specific innovation quality**, of either a tangible product, service or process.

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- **Identify the innovation quality itself**, generically considered, taken into account from the point of view of a group of individuals, a company, an entity or an institution, or a group of companies, entities or institutions.]
- **Identify a specific innovation quality** applied to case “b”
- **Other** possible situations.

2.5.1. Innovation Quality in the Organization

Quality innovation is, also and mainly, the improvement of the existing limits of performance, meeting the expectations and enabling the innovation quality to develop itself Haenr (2002)

The innovation quality concept inside the organization is seen as a resource for the execution of an improvement process that comprises people, material and equipment. To integrate such factors it is of extreme relevance to enable the additional value creation for the clients inside or outside the organization.

Therefore, the innovation quality is related to a range of activities that have as goal to create results through the daily processes of the companies. An applicative which the authors of the current work have carried out, obviously subject to debates, took into consideration the factors presented in Figure 3.

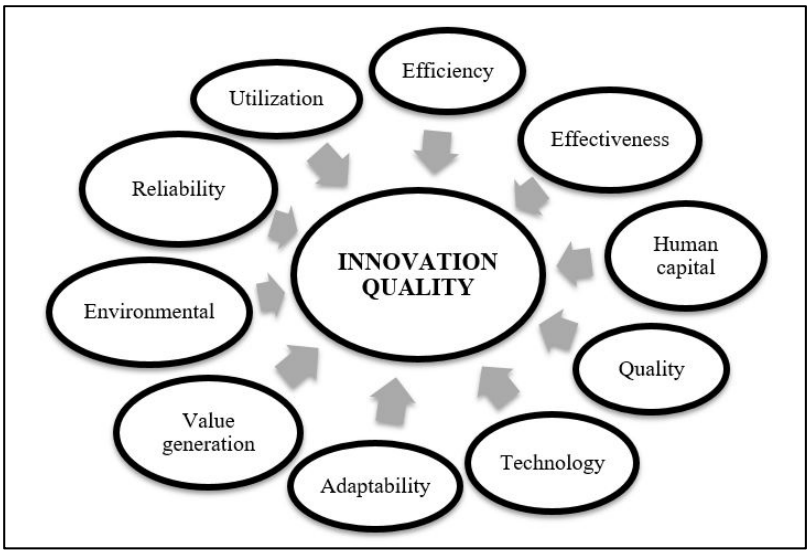

Figure 3: Influent factors in Innovation Quality.
Source: authors

As identified in Figure 3, several factors, which can be tangible or intangible, contribute to the existence of innovation quality, representing dimensions of this concept. Such dimensions are detailed in Table 3.

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Note that in Picture 3 there are tangible and intangible aspects. The dimensions of innovation quality proposed are based on the quality innovation of products presented by Garvin *et al.* (1984), in Table 1 and in the dimensions of services quality proposed by Parasuraman, Zeithaml and Berry (1990) in Table 2.

Through this analysis, it was tried to set the innovation quality dimensions suggested in the following research. This is, of course, another expert of the whole problem that is proper for a deeper discussion.

Table 3: Dimensions of innovation quality.

DIMENSIONS OF INNOVATION QUALITY	
DIMENSIONS	**CONCEPT**
Efficiency	Related to product performance, process, planned and executed service.
Effectiveness	Related to resource savings, optimization of existing risks in the market.
Human capital	Qualification, compromise, quality of life, management of the processes involved and decision-making.
Quality	Related to benefits and transformations achieved, client's specifications.
Technology	Concerns with the technical properties acquired for the composition, creation or improvement presented.
Adaptability	Related to ease in technical and operational handling.
Value generation	Provision of growth for the organization as well as for society.
Environmental	Related to the possible impact and its regeneration.
Reliability	Related to the lack of operational risks, physical or economic.
Utilization	Period that allows obtaining competitive advantage for the organization.

Source: The authors, based on Parasuraman, Zeithaml and Berry (1990)

3. METHODOLOGY

The current work comprises the literature review and an exploratory part in which an indicator of innovation quality is proposed and a possible way to describe it in numbers is set up in an application for which a research was done involving interviewees in six companies from the metal sector.

From the point of view of technical procedures, a multiple cases study was carried out, because six companies were researched, although not deeply investigated. According to Yin (2015), a case study in an empirical investigation of a contemporary phenomenon. The research in fact was done about the professionals' opinion on a matter of work interest.

The investigations can be classified according to their purpose in terms of means and ends (VERGARA, 2000). In this study, an exploratory research was used,

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which provides more acquaintance with the problem, and also a descriptive one, that exposes the characteristics of a certain population establishing correlation between variables and defining their nature.

According to Gil (2007), in the exploratory research it is intended to develop, clarify and change concepts and ideas in order to formulate more accurate problems and searchable hypotheses for further study. So, through research data obtained out in production environment, it was possible to collect informations which allowed the work goals to be fulfilled and made possible an evaluation for the index of innovation quality.

The Likert scale was used to measure the importance of production engineer skills associated with innovation processes. For Cunha (2007), a Likert scale is composed of a set of exclusive items so that the interviewee shows his/her agreement in each case. The data were collected between June and July 2017, through interviews carried out with managers and specialists of the companies. It was decided not to publish the name of the companies, as some of them are competitors in the same segment and products.

Each interviewee stated about the importance of the innovative activities related to each of the dimension of innovation quality according to the scale as follows in Table 4.

Table 4: The importance of the innovative activities

Strongly disagree	Partially disagree	Not agree or disagree	Agree partially	Totally agree
1	**2**	**3**	**4**	**5**

Source: The authors

For each of the influent factors in innovation quality presented in Figure 3, each interviewee was required to answer whether that factor was determinant for the innovation quality. Therefore, each interviewee evaluated the propositions that are presented in 5.2. For the effect of the following use of the research results in the IQ index calculation, the values 1; 0.5; 0; -0.5; -1 were respectively associated with these above possibilities.

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Eighteen specialists were selected for this research at the metallurgic industries all having in their scope a department of products development with the innovation as a differential. These companies work in several segments such as household appliances, automotive, white line and lighting. All the companies are Brazilian and located in São Paulo state, with up to 75 workers.

- **Company "A"** - Metallurgical company of casting of aluminum under pressure, offering services to the automotive segment, has not own product, all the developments are done in partnership with its clients. It has about 70 employees. Founded in 1965.
- **Company "B"** - Metallurgical foundry company of aluminum under pressure, offering services for companies of the automotive segment and white line. Has areen of development of its own products. It has about 60 employees. Founded in 1999.
- **Company "C"** - Metallurgical company of injection of plastics. Provider of services for the segments of white line and electro-electronics. Acts in development of products with its clients, with sectors of engineering of products and processes. It has about 75 employees. Established in 1982.
- **Company "D"** - Metallurgical company of injection of plastics and assembly of electronic equipments. It has area of development of products its own products certified by Inmetro, (Brazilian official organization). Makes assembly and distribution of its products to the wholesale market. It has about 70 employees. Founded in 1991.
- **Company "E"** - Metallurgical company manufacturing reflectors for civil construction and street lighting, with development and manufacturing department of own products. Also resales imported products. It has about 75 employees. Founded in 1985.
- **Company "F"** - Metallurgical company of machining of serial parts with the help of numerical computerized control (CNC). Has its own products and is services provider, with department of development of projects (own and for others). It has about 60 employees. Founded in 2001.

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4. RESULTS AND DISCUSSION

In this section the field research results are presented with the interviewed specialists about each of the dimensions of the innovation quality considered, besides the processing used for the value calculation involved in the numerical determination of innovation quality.

In Table 4 are presented the research application results in absolute number of answers and in Table 5 the respective percentage values. Based on these data the following considerations are performed.

Table 5: Results of the application in absolute numbers.

DIMENSIONS	Strongly disagree	Partially disagree	Not agree or disagree	Agree partially	Totally agree	Number of respondents
Efficiency	0%	6%	11%	28%	55%	100%
Effectiveness	6%	6%	11%	38%	39%	100%
Human capital	6%	6%	11%	33%	44%	100%
Quality	0%	0%	11%	22%	67%	100%
Technology	11%	6%	11%	39%	33%	100%
Adaptability	6%	6%	11%	38%	39%	100%
Value generation	6%	6%	11%	39%	38%	100%
Environmental	17%	22%	28%	22%	11%	100%
Reability	6%	6%	22%	33%	33%	100%
Utilization	6%	11%	28%	22%	33%	100%

Source: Authors

Table 6: Results of application in percentage numbers:

DIMENSIONS	Strongly disagree	Partially disagree	Not agree or disagree	Agree partially	Totally agree	Number of respondents
Efficiency	0	1	2	5	10	18
Effectiveness	1	1	2	7	7	18
Human capital	1	1	2	6	8	18
Quality	0	0	2	4	12	18
Technology	2	1	2	7	6	18
Adaptability	1	1	2	7	7	18
Value generation	1	1	2	7	7	18
Environmental	3	4	5	4	2	18
Reability	1	1	4	6	6	18
Utilization	1	2	5	4	6	18

Source: Authors

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4.1. Construction of the Indicator of Innovation Quality

In order to measure the innovation quality from the obtained informations by following the assumptions established for the IQ index, the below operations were carried out. It is emphasized that it is an evaluation of this value in accordance with case “b” considered in 2.5, so it is generically determined the importance given to innovation by a group of companies with certain productive characteristics.

Initially, at the authors’ criteria were attributed to each of the dimensions of innovation weights from 0 to 1 trying to describe comparatively its relative importance as shown in Table 6. How and why such weights should be attributed is open to discussion in future researches.

Next, the average evaluations of innovation quality qi were calculated for each dimension of innovation quality by the Equation 1.

$$\bar{q}_i = \frac{\sum_{i=j}^{5} r_j q_{ij}}{5} = \sum_{j=i}^{5} r_j q'_{ij} \qquad (1)$$

where:

q_i = average evaluation of innovation quality provided by dimension i, i = 1, 2, 3, ... 10.

q_{ij} = frequency (Table 4) of the interviewees’ indications regarding the j possibility in the Likert scale for of the dimension i

q'_{ij} = respective relative frequencies (Table 5).

r_j = attributed value to the j possibility in the Likert scale being, in increasing agreement terms, -1; -0.5; 0; 0.5; 1.

The calculations carried out for the values q_i determination are presented in Table 6.

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Table 7: Values of pi, rj, qi and qi

DIMENSIONS	Weights (pi)	Calculations					$\overline{qi}$
Efficiency	0,7	0,00	-0,03	0,00	0,14	0,56	0,670
Effectiveness	1	-0,06	-0,03	0,00	0,20	0,39	0,495
Human capital	0,8	-0,06	-0,03	0,00	0,17	0,44	0,515
Quality	1	0,00	0,00	0,00	0,11	0,67	0,780
Technology	0,7	-0,11	-0,03	0,00	0,20	0,33	0,385
Adaptability	0,7	-0,06	-0,03	0,00	0,20	0,39	0,495
Value generation	0,9	-0,06	-0,03	0,00	0,20	0,39	0,495
Environmental	0,9	-0,17	-0,11	0,00	0,11	0,11	-0,060
Reability	1	-0,06	-0,03	0,00	0,17	0,33	0,405
Utilization	0,7	-0,06	-0,06	0,00	0,11	0,33	0,325

Source: Authors

At last, the general IQ assigned to the innovation quality concept by the interviewees of the researched companies is calculated by the weighted average shown in Equation 2 where pi are the weights attributed to the dimensions of innovation.

$$IQ = \frac{\sum_{t=1}^{10} p_i \bar{q}_i}{\sum_{t=1}^{10} P_i} = 0,405 \qquad (2)$$

4.2. Comments

Here are presented the propositions made and the comments referring to each of the quality innovation dimensions evaluated by the interviewees.

Efficiency: "It is important the innovation that enhances the efficiency assigned to the performance of the product, service or process planned and executed in the organization".

Innovation will bring more quality to contribute to better products production or services with more efficiency in the processes, better productivity, costs reduction and waste elimination. It is an issue in which incremental innovation, which provides continuous improvement, or radical innovation as a result of new technologies can occur with different quality evaluations. This dimension was the second best

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considered by the interviewees, who agreed in 84% about the importance of innovating processes for a better productivity.

Effectiveness: "The innovation related to the effectiveness of the organization is important because it prevents the client's loss risk and fosters the competitive advantage in the market".

In an aspect it was tried to measure the innovation importance for the global result of the organization represented by its success in the achievement of market, prestigious and financial-economic stability. The agreement index was 78%, lower than the previous one; possibly due to the more operational than management nature of the interviewees.

Human capital: "Innovation can positively affect the qualification and skill of the human capital and, as a consequence, the organization performance".

The importance of this dimension is undeniable and recognized more and more by the organizational leaders. Innovation is expected to represent improvement of the human capital of the organizations by giving to such organizations better and more suitable ways to be recognized by knowledge and ability to solve problems. 77% of the interviewees agreed with this proposition, perhaps less than expected, maybe for not seeing how innovation can contribute for the human capital enhancement.

Quality: "Innovation can work positively on quality of processes, products and services related to the organization clients".

This requirement measures how the innovation contributes to the quality of the organization (what can be done with more or less quality). It was the best dimension evaluated in terms of agreement, with 89% and 0% of non-agreement. An expected result, because average level workers in modern organizations are aware of the quality importance.

Technology: "To obtain new technologies affects directly the organization performance".

We live in a time when technology is often the main factor for the success of the companies. However, the agreement with this requirement was 72% by the interviewees of the current research. This may reflect the feeling that technology must

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be suitable to its purpose and technological innovations not always achieve their purpose.

Adaptability: "Innovation can be adjusted to meet the organization's needs".

The agreement with this proposition was 78%, as high as in other cases, certainly due to its practical importance.

Value Generation: "Innovation is an important factor in value generation for the organization".

The dimension of value generation, also with 78% of agreement, had its importance recognized in the research. It is a comprehensible outcome, maybe because it has less visibility than quality (of which is an integrating component) and efficiency.

Environmental: "Innovation is a factor of reduction on the negative environmental impacts produced by the company".

The environmental issue was the one with the worst result compared to the others, with the lower agreement of 33% and non-agreement of 39%. This suggests that the possibility of innovation contribute to environmental problems reduction is not the main concern of the interviewees. Maybe it makes sense because the researched companies are not directly concerned about the importance of the tripod formed by social-economic-environmental aspects considered essential for the sustainability of the planet.

Reliability: "Innovation promotes greater reliability to actions of the organization, such as reduction of failures occurrence in products, services and processes, as well as of the involved risks".

However, this requirement was the third worst evaluated with agreement of 66% and non-agreement of 12%, and evaluated by the indicator qi = 0.405. More applicable to tangible products, maybe the time distance among conception, process of production and the use of the product has determined the low recognition of its importance.

Utilization: "Innovation favors the use of products and services of the organization with aspects as suitability, durability and lack of failures and risks".

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This proposition was the second worst evaluated, with 55% of agreement and 12% of non-agreement, by reasons possibly also related to the difficulty of seeing its advantages.

4.3. Discussion

How to interpret the value IQ = 0,405 found in the current application? It is a positive and intermediate value showing clearly that the interviewees recognize the importance of innovation, what is certainly not new, but they have attributed a lower value than perhaps should be expected. The reason for that is certainly not due to the weights scale used, since it why provides an average value according to these weights, assuming different importance to the various dimensions, but the weighted average value must not be very distant from the arithmetic one.

However, a reason for not having a higher value for the target index may be in the variability of the answers given by the interviewees. It is noted that the decreasing importance attributed by them (see Table 7) was in the following order: quality; efficiency; human capital; effectiveness, adaptability and value generation; reliability; technology; utilization; environmental. Such classification does not necessarily match the innovation potential shown in Table 2, but it calls the attention to some points that deserve reflections.

(a) The environmental issue to which was assigned importance weight 0.9 was evaluated negatively in terms of innovation quality. This may point out a worrisome lack of awareness in the researched companies about the importance of this aspect, which is basic for the sustainability of the planet. It probably happened because it is not presented as such for the kind of activities carried out in the sample companies.

(b) The efficiency, second best evaluated dimension, overcame clearly the effectiveness placed in fourth place. This was possibly because the interviewees are more involved with manufacturing processes of the company than to aspects linked to business.

(c) It is worthy to note the awareness about the quality dimension by the interviewees with 89\% of favorable agreement, which was the most outstanding evaluated dimension.

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(d) Besides the environmental dimension, utilization and technology were the less scored dimensions, what was also surprising and there is no reasonable explanations for this.

(e) The authors feel reasonable to suppose that a considerable reduction in variance in the opinions of interviewees in such kind of research may be obtained, possibly with the use of more directly constructed propositions.

5. CONCLUSIONS

In the current work it was tried to go further is the establishment of an indicator for innovation quality as proposed by Costa Neto e Moraes (2016).

A literature review about innovation and quality was done, concluding that ideas about these issues were thoroughly discussed, but no attempt of establishing numerically an indicator for the innovation quality was found.

In view of these considerations, a research was carried out involving eighteen specialists from the metal sector and they were asked to give their opinion about question limited with ten dimensions of innovation quality proposed by the authors. The outcome was submitted to unprecedented methodology to reach the establishment of a measurement for innovation quality.

The authors are aware that what was done is possibly not near of reaching a more solid formalization about this issue, but they believe that a first important step has been taken in this direction. Of course, other either theoretical or applied researches must be performed to have more advanced procedures in the direction of the proposed the discussion. Any contribution or discussion about what was presented in this work will be welcome and considered for further studies.

The aim of this work was to promote the importance of innovation quality through the elaboration of an indicator that, although theoretical, allows its practical use even though there may still be some adjustments to be made, being suitable for discussion.

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