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A multicriteria approach for selecting consultancy and certification services related to Quality Management

Uma abordagem multicritério para a seleção de serviços de consultoria e certificação de Sistemas de Gestão da Qualidade

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Abstract: The implementation of a Quality Management System (QMS) in any organization requires efforts, planning, and everyone's involvement. The selection of consultancy services (if needed), and certification services through an Accredited Certification Body (ACB) has an important role in this process. This study aims to propose a structured model to support these two decisions by using a multicriteria focus (MCDA) to guide the design of a methodological framework. In addition, this study considers the maturity level of the organization, and the importance of continuous improvement after implementing ISO 9001. One of the differential points in this study is the detailed scientific technical foundation of the qualifying and selection criteria, of the consultancy and ACB by using ISO standards (9001, 10019, 17021, 19011), and the guidance document CB-25, which is related to quality. Finally, an application was made in a pharmaceutical industry using the PROMETHEE II method, and the GAIA plan. We adopted three scenarios.

Keywords: Quality management; Multicriteria decision; Certification; ISO standards.

Resumo: *A implantação de um Sistema de Gestão da Qualidade (SGQ) em uma organização demanda esforço, planejamento e envolvimento de todos. A etapa de seleção de serviços de consultoria (caso haja necessidade) e serviços de certificação, através de um Organismo Certificador Credenciado (OCC), tem um papel relevante nesse processo. O trabalho teve como objetivo a proposição de um modelo estruturado de apoio a essas duas decisões com enfoque multicritério (MDCA), através da elaboração de um framework metodológico. Esse leva em consideração a avaliação do grau de maturidade da organização em relação à qualidade, de acordo com um modelo de avaliação presente na ISO 10014, e a importância da melhoria contínua após a certificação ISO 9001. Um dos diferenciais do trabalho é o embasamento técnico-científico detalhado dos critérios qualificadores e de seleção para a consultoria e o OCC, através da utilização das normas ISO (9001, 10019, 17021 e 19011) e documento orientativo do CB-25 ligados à qualidade. E, por fim, foi efetuada uma aplicação em uma indústria farmacêutica, como também a análise de alguns cenários com a utilização do método Preference Ranking Organization Method for Enrichment Evaluation II (PROMETHEE II) e do plano Geometrical Analysis for Interactive Aid (GAIA).*

Palavras-chave: *Gestão da qualidade; Decisão multicritério; Certificação; Normas ISO.*

1 Introduction

The globalization of the economy, including the change to global markets, the creation of new trading blocs, and the advent of technology, prompted the growth of competitiveness. Therefore, as markets became increasingly competitive, organizations had to adapt to this new worldwide scenario. New strategies had to be implemented, and the organizational comfort has been replaced by a frantic and daily struggle pursuing a place in a mutual variable market, with increasingly demanding customers. The search for quality through continuous improvement using quality management systems (QMS) is unquestionably the strategy most used by old and new organizations, and certainly the one that offers the most significant results in this new business context. The implementation of a quality management system will result in improving the quality of processes and products, due to the meeting of the specifications required for certifications as well as improving the company's image and trust in it in the market place, thereby assisting the organization to achieve its goals. According to Garvin (1988), time, resources, and money must be invested in the search for quality, and its enthusiasts offer several reasons to do so, such as attending to environment

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issues, safety at work, achieving competitiveness, and improving quality to gain greater profitability. Implementing a quality management system requires effort, planning and everyone's involvement, efficient leadership, and the top management commitment (Valmohammadi, 2011; Laohavichien et al., 2011).

The initial stages of selecting consultancy services and certification services through an Accredited Certification Body (ACB) play an important role and are the focus of this study.

In order to select a quality consultancy and the most appropriate ACB for an organization, this study sought establish the need and the importance of adopting a structured model for decision support focused on multicriteria. (MCDM).

The methods applied in the research comprise a review of the literature on quality management, multicriteria and of the standards described on item 2.1.

Finally, a decision model with qualifying, and selection criteria based on the ISO standards is drawn up, and then a numerical application with realistic data is given in order to illustrate the use of the model. One of the differentials of this study is the use of ISO standards related to quality at the stage of establishing the criteria.

2 The role of the consultancy services and Accredited Certification Body (ACB)

According to the Brazilian National Classification of Economic Activities (CNAE, 2016), code 74.99-3, the consultancy is classified as an interactive process conducted by an external agent that brings changes for the company, and assumes responsibilities for supporting executives and professionals of the company and its customers in a decision-making process, but it has no control of the situations.

Therefore, a consultancy can be seen as a service that provides support to managers or business owners, thereby assisting strategic decision making and having a huge impact on the actual and future results of the organization. For Donadone et al. (2012) the consultancy gains new formats from the 1980s. Grew and acquired notoriety. Since then has obtained an increasingly important role within companies. At this time, influenced by Japanese companies, consultancy firms play a real important role in the implementation of management tools in companies. However, soon after, began to act in many different sectors in existing companies this through management packs covering the "Quality Philosophies", not saving more focus only on the functional characteristics of the Japanese practices. It also happens that decade interest in certifications, especially ISO standards. In this case, especially by ISO 9001 (ABNT, 2015).

However, according to Maekava et al. (2013), there are some barriers that have to be dealt with and must receive special attention when seeking to implement the QMS: the financial constraints, top management disengagement, bureaucratic processes, resistance to change, lack of knowledge about their own rules, and so on. These adversely affect the implementation and maintenance of the QMS and sometimes this leads to the abandonment of the implementation by the organization due to failure. We can define Continuous improvement as an organizational process based on a culture focused on incremental improvement, which demands behavioral changes and new organizational structures. These behavioral changes can be brought by a leader or induced by a slow process of organizational change (Oprime et al., 2012). That is, it is essential for the success of the organization, maintenance and improvement of the processes the we are talking about. According to Carpinetti (2012), the continuous improvement (CI) is characterized as an iterative process, cyclic, from the evaluation of the results, research and knowledge acquired with an improved action on a particular object of study, can propose and joing toghether new actions improvement for this metter.

In this case, consultancies very often play an important role inside organizations, for certification purposes, and to maintain the QMS.

According to O'Hanlon (2001), the role of an Accredited Certification Body (ACB) is to conduct audits to determine what adjustments a company needs to make to obtain certification, which is the process that a company undergoes to achieve certification based on ISO 9001.

According to the Brazilian Committee of Quality, through the guidance document (GD) (CB25, 2011), an ACB has to prove its accreditation to audit, and supply certification based on ISO 9001:2008. Therefore, it can demonstrate the competence of its auditors as well as proof that it complies with the regulations and standards of the International Accreditation Forum (IAF) and its criteria.

2.1 Related standards

In this section, the standards that will support the selection of the qualifying, and selection criteria, which deal effectively with the competitive factors of the organization, are set out and form part of the decision model proposed.

For Slack et al. (2009), the qualifying criteria do not necessarily indicate an organization's competitiveness. Their importance is attributed to competitive aspects where the performance of production must be above a determined level that the client can perceive. Thus, a performance lower than the "qualifying" degree

will probably disqualify the company from the consumer's point of view.

Slack et al. (2009) complement this by saying that the selection criteria significantly influence the realization of the business. Consumers consider those criteria as the main reasons why a product or service is provided successfully. What matters is that increasing the performance of a selection criterion increases the demand, or at least there will be the perspective that it will increase. These criteria are exhibited in Item 5.

It is worth mentioning that the standards followed do not have a certification purpose, except for ISO 9001.

- ISO 9001:2015 (ABNT, 2015) - **Quality management systems - Requirements**

This covers the adoption and approach of the methodology to implementation, practice and improvement of the efficacy of a QMS, in a way that prompts customer satisfaction to grow because the company complies with the specifications. There is evidence that the organization has the ability to offer products or services that comply not only with the applicable regulations but with satisfactorily meet customers' expectations. Moreover, continuous improvement processes are used to increase its customers' satisfaction while the company ensures that it does so in accordance with its customers' regulatory requirements.

- ISO 10014:2008 (ABNT, 2008) - **Quality management - Guidelines for realizing financial and economic benefits**

Its target is senior management, and its goal is to monitor the financial and economic components of the organization to generate benefits by the following of specific guidelines, allowing the perception for such purposes. It targets management, and its purpose is to communicate, facilitate, and execute the application of principles and to select tools that assure the sustainability of an organization. It relates the focus between the client, the leadership, people's involvement, systemic approach, continuous improvement, decision-making, and relationships with suppliers.

- ISO 10019:2007 (ABNT, 2007) - **Guidelines for the selection of quality management system consultants and use of their services**

This offers guidance on how to select QMS consultants as well as how to use their services. Its most important application is to support organizations in selecting a QMS consultant. It helps in the process to evaluate the capacity needed for a consultancy in QMS, thereby enabling the expectations and needs of organizations to be completely satisfied about how to construct a consultancy contract and how to best specify the services to be rendered.

- Guidance document from the Brazilian Committee of Quality: CB-25 - **Guidelines for the selection and hiring of consultancy, training and certification of QMS services – 2011**

This gives the necessary information to support those interested in acquiring a QMS certification for their organizations, with ISO 9001 being the one most sought after; then, it recommends how to best select and hire certification services (ACB), if the organization presents a certain level of maturity for this. Otherwise, this guidance document offers the positive recommendation that consultancy services should be hired and training given to staff in order to qualify the organization for a certification.

- ISO 17021:2011 (ABNT, 2011) - **Conformity assessment - Requirements for bodies providing audit and certification of management systems**

This standard covers the requirements for ACB companies that provide auditing, and quality management certification. Even though it is very general, it outlines auditing conditions for management systems and targets specifications in a reliable way so that they cover the applicable requirements.Using a consistent audit team, using the resources and processes in place for when we need, see cohesive e trustfull results of this work.

- ISO 19011:2012 (ABNT, 2012) - **Guidelines for auditing management systems**

This standard does not have the function or goal of establishing requirements; however, it provides guidelines about audit programs, planning, and implementation of a management system auditing as well as guidelines on evaluating auditors, the audit team and assessing their competences.

3 Proposing a decision model

The methodological framework shown Figure 1 provides guidelines on hiring consultancy services, and then an Accredited Certification Body (ACB) to certificate the QMS. Each element will be detailed below.

1. In order to implement the QMS correctly, an organization must understand what its maturity level is in relation to quality management to deal with the processes and practices required by the system. Therefore, it is very important to evaluate the maturity level of an organization. ISO 10014:2008 – Guidelines for the perception

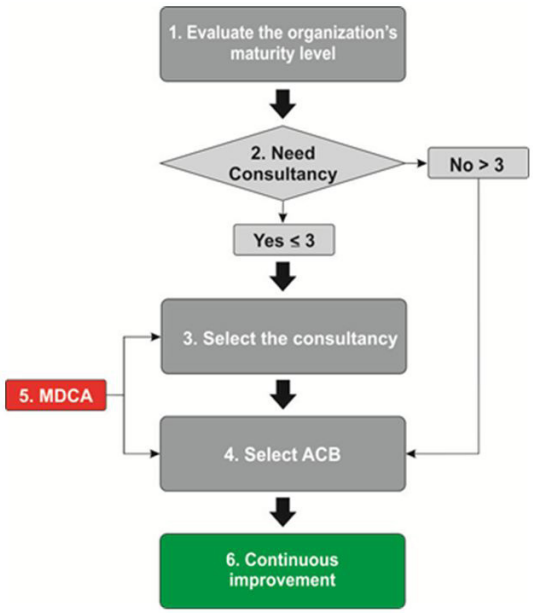

Figure 1. Decision model. Source: The authors (2015).

of the financial and economic benefits – assigns scores (from 1 to 5) to establish the organizational maturity level. According to ISO 9004:2010 (ABNT, 2010) - Managing for the sustained success of an organization - A quality management approach, any organization with a satisfactory maturity level achieves sustained success, because it can act in the crucial processes that maintain this level in an efficient and effective way. Thus, according to McLean & Antony (2014) e Bolboli & Reiche (2014), it is important to identify the company's maturity level to deal with the needs, satisfaction, and expectations of the interested parties. It is also important to monitor organizational changes, to define strategies and policies to promote motivation, commitment, trust, and organizational involvement, to consider possible areas of innovation and improvement, to define relevant goals, to establish solid relations with suppliers, and through partnerships to manage its resources and processes carefully.

2. The maturity level of the organization must be identified to establish whether or not there is a need to hire a consultant, in order to prepare for implementing a QMS. Considering and utilizing the organizational maturity scale stipulated by ISO 10014 (ABNT, 2008), which are described five maturity levels: level 1 the practice of quality management has not been implemented, so it is not found in the organization; 2-level quality management is present and visible on only certain areas, in approximately 25% of the organization; 3- practical level of quality management is commonly found, but not in most areas, about 50% of the organization involved; 4 level approximately 75% are involved in quality management, its practice is very common, only some parts of the organization do not participate; level 5 the entire organization is involved in the exercise of quality management, the practice is deployed throughout the organization, there are almost no exceptions, it is considered 100%. Therefore, for the decision model proposed in this study, the following points are considered: the organization that has a maturity level of ≤ 3 will need to hire a consultant for the QMS implementation process, because it does not have the enough maturity needed to deal with this practice. When an organization achieves a score of > 3, it will be able to implement a QMS without needing to hire a consultant, but simply support from its own employees. Then, selecting an ACB for the purposes of certification, according to the standard, a maturity level of >3 represents approximately 75% to 100% of occurrence, and with few exceptions adopting QMS practice is very usual.

3. The process for selecting a consultant will depend on qualifying, and selection criteria. These were prepared based on the ISO standards, and the document already introduced which gives guidelines.

4. Just as in the process for selecting a consultant, qualifying and selection criteria will be needed to select an ACB.

5. This study seeks to demonstrate the importance of a decision support model, which is the problematic choice, and proposes the most appropriate multicriteria method for these circumstances.

6. At this point, it is important to highlight that implementing a QMS as well as maintaining it are not finished after a certification auditing process, or even recertification. On the contrary, an organization needs to work in an uninterrupted and continuous way in order to not lose or decrease the levels that it has reached.

It is worth highlighting the importance of ISO 9004 in this stage. This ISO is about the needs and expectations of all relevant interested parties, and provides orientation for the systematic and continuous

improvement of an organization's global efficiency. In addition, this standard has an auto-evaluation tool that uses five maturity levels towards sustained success.

Thus, the multicriteria model helps in the difficult stage of choosing a consultancy properly (if needed) and an ACB, thus positively influencing the bedding down process of a QMS as shown in Figure 1.

4 Criteria

According to Almeida (2013), a consistent family of criteria must comply with many properties, such as being able to represent all aspects (goals) of the problem (exhaustively) with no redundancies.

For the author mentioned above, the criteria can be classified and divided into four categories:

- True Criteria: is one whose preference structure associated is a complete pre-order, corresponding to the traditional model;
- Semicritério: now preferred is a structure associated semiordem, with respect to the threshold model. That they have a blurring range in values for acceptance of preference relation;
- Interval criterion: it corresponds to the model that has variable threshold, and the preference structure associated is a range order;
- Truelly-not critério: has a truelly-not-order associated with preference structure, corresponding to the double threshold model. According to Gomes & Gomes (2012), consumers perceive some characteristics such as price, quality, durability, aesthetics, and so on. These characteristics receive the denomination of attributes. Also, when these attributes receive the minimum of information about consumers' preferences, these attributes become criteria.

The decision criteria may be quantitative, when corresponding to attributes such as price, speed, areas, etc. (which are evaluated with well-defined numerical scales) or may be qualitative such as comfort, quality, environmental impacts, and so on (for which there are no defined units of measurement). The criteria can have, in a specific problem, a maximization or minimization (Gomes & Gomes, 2012)

There are few applications of Multiple-criteria decision-making (MCDM) in total quality management (TQM) problems and contínuos improvement in the literature, especially in relation to consultancy services and quality certification. For instance, selecting technologies that will support the aims of strategic total quality management (Madu et al., 1996); Ranking of critical factors for TQM implementation in Shanghai manufacturing industry (Chin et al., 2002); Preference-ranking model for a quality evaluation of hospital web sites (Bilsel et al., 2006); decision process for selecting external consultant in TQM program in small and medium companys (Saremi et al., 2009); Selection of lean manufacturing systems (Gurumurthy & Kodali, 2008); Selecting improvement initiatives and quality management (QM) approaches in three companies in Thailand (Thawesaengskulthai, 2010); Quality Function Deployment (QFD) combined with decision support system (Andronikidis et al., 2009); Measuring quality service combined with multicriteria method (Jerônimo & Medeiros, 2014); Evaluation of retail service quality (Sreekumar & Satpathy, 2015).

Saremi et al. (2009) in their study entitled "A systematic decision process for selecting external consultant in TQM program" build a decision model for consultancy selection. The company and its directors decided to implement the TQM in order to obtain competitive advantages. Regarding weights, these should be determined using the decision maker's preference. However, regarding the criteria, the decision-maker's knowledge was not usually enough to choose them. It is worth highlighting in this study that Saremi et al. (2009) report that the five selection criteria were determined by the council, without showing any scientific basis or supporting standard for this. This also occurs with Kabir & Sumi (2014), the study is intended for total quality management consultant selection through integrating two multicriteria methods. However, there was not a scientific technical foundation of the criteria as well.

On the other hand, in this paper, besides selecting consultancy, selecting Accredited Certification Body (ACB) is performed. After a detailed study of the standards and analysis of the few journals related to the subject, we considered the following decision criteria according to Tables 1, 2, 3 and 4.

5 Choosing a multicriteria method

A Multicriteria Method, according to Almeida (2013, p. 20), "[...] consists of a methodological formulation or a theory, with a well-defined axiomatic structure that may be used to build a decision model that aims to find the solution to a specific decision problem."

It is important to highlight that in some multicriteria methods this is of huge relevance on observing the question related to the comprehension that may exist between the criteria in the aggregation model. Therefore, these methods can be classified as compensatory and non-compensatory. According to Almeida (2013), these methods have the following characteristics:

Compensatory: In these methods, what is sought is to compensate the lowest performance of an alternative in a specific criterion through a better performance in other criterion, taking into account the trade-offs between the criteria in the alternative evaluation.

Table 1. Qualifying criteria for consultancy.

QUALIFYING CRITERIA FOR CONSULTANCY		
Consultancy		
Criteria	**Theoretical foundation**	**Evaluation**
Management Practices	ISO 10019 (ABNT, 2007), topic 4.2.5.3, recommends that the QMS consultant has relevant knowledge about management practices in order to comprehend how the QMS integrates and interacts with the organizational global management, including its human resources, and thereby ensuring the company's goals	Number of consultancies conducted the Quality field: ≥ 3 Qualified < 3 Disqualified
Work experience	ISO 10019 (ABNT, 2007), topic 4.2.6, recommends that the QMS consultant has relevant work experience in professional, technical, and management aspects. These work experiences may involve the practice of judgment, solving problems, and communication with all the interested parties about the past important work experience: in practical work, management, quality management, quality management system audit, and experience in implementing a quality management system.	Work experience proven with time to market. (≥ 2 years) - Qualified (< 2years) – Disqualified
Ethical considerations	It is pertinent to note that the organization watch the importants ethical points to select the consultancy directed at the quality management system. As: • Conflicts of interest that may affect the work to be performed; • Maintain confidentiality; • Independence with certification organized, registration, accreditation; • To maintain impartiality in the selection by the organization of the certification body; • Provide realistic cost estimates of consultancy services; • Do not create unnecessary dependence on their services; • Do not provide services to which they do not own competence.	Does consultancy answer the relevant ethical questions? (yes) - Qualified (no) – Disqualified

Non-compensatory: We can say that a binary relation P is not compensatory when the preferences between x and y only depend on the subsets of criteria that benefit x and y. Observe then, that there is no dependence on the preferential relation between x and y among the many levels of each one of the criteria (Fishburn, 1999).

Although the use of these methods is constant and classic, there are a few criticisms. For example, Costa et al. (2014) say that the compensatory method under its logic can mask the results when a performance that is considered very bad in a determined criterion may be compensated for in a criterion which has a very good performance, thus creating a misleading impression about the overall good performance of a set of criteria.

However, when creating a decision model, choosing an appropriate multicriteria method is a very hard and important stage. This choice connects to several factors, for instance, the decision maker's preference structure.

The preference structure is so important that if it does not represent the decision maker's options very well, the chances of creating an inappropriate decision model are already high. Moreover, the decision maker's rationality must be evaluated adequately with the relation situation-problem, which must be aligned with the chosen method (Almeida, 2013).

In order to conduct this study based on the concepts introduced, the most appropriate method in this case, which is a selection problem, is the PROMETHEE II method. It is non-compensatory and based on using the net flow ϕ (a), which is obtained as follows:

$\phi(a) = \phi^{+}(a) - \phi^{-}(a)$. Having as base the indicator ϕ (a), we have the organization of the alternatives in a descending order, which establishes a complete pre-order between the alternatives (Almeida, 2013).

According to Oslo et al. (1995), PROMETHEE II calculates the positive and negative preference flows for each alternative. The positive flow happens when one alternative is dominated by the others. PROMETHEE II allows a complete ranking to be drawn up, totally based on the counterweight of the two preference flows. Thus, the ranking is influenced by the weights allocated to the criteria. The software Visual Promethee is the most recently developed one. It includes all standard

Table 2. Selection criteria for consultancy.

SELECTION CRITERIA FOR CONSULTANCY			
Consultancy			
Criteria	**Theoretical foundation**	**Evaluation**	**Type of criterion**
Costs (C_1)	The ISO standards do not mention the amounts to be charged by a related advice to its services. Sad that, this criterion is based on the average value of services (US$) charged by the consultants.	Price of the consultancy for 12 months (R$ 000's -Brazilian currency)	Limit-Criterion (q)
Payment methods (C_2)	There is no mention in any ISO standard on the payment methods practiced by consultants. Mentioned that, this criterion is based on the forms of payment that consultation takes. Since the payment in cash, to the greatest number of installments.	Likert scale: 1-payment at sight 2-two instalments 3-between three and six instalments 4-beteween seven and ten instalments 5- twelve instalments PS.: Consultancy process with duration of 12 months.	Usual Criterion
Contract condicion (C_3)	According to item 5.2 of NBR ISO 10019 (ABNT, 2007), it is important that the consultant provide the organization a contract that clearly defines the scope of their work, including results, realistic data and provide cost-effective for the organization. When concluding a contract, must include the following activities. a) establish agreed contract objectives that are specific, measurable, achievable, realistic and time-bound; b) to establish a detailed contract plan with milestones and cominados results; c) to communicate the plan to all stakeholders; d) to identify the training needs of employees so that they can conduct the assessment, maintenance and continuous improvement of the QMS; e) implement the plan; f) monitor and evaluate the effectiveness of the plan and implement unscheduled actions, as appropriate; g) to ensure that the agreed milestones are met or redefined; h) defining a process to approve the contract results.	Likert scale: Does consultancy offer the contract mentioned conditions? 5- Fully 4- Satisfactorily 3- Little satisfactorily 2- unsatisfactorily 1- It provides Obs .This criterion shall be demonstrated by providing the consultancy contract, which will be detailed all legal papers and procedures.	Usual Criterion

Table 2. Continued...

SELECTION CRITERIA FOR CONSULTANCY			
Consultancy			
Criteria	**Theoretical foundation**	**Evaluation**	**Type of criterion**
Consultant References (C_4)	According to the item B.2, Annex B of ISO 10019 (ABNT, 2007), the evaluation of the consultant's references should be based on an examination of objective evidence that includes: a) references to previous work; b) publication of books and articles that address quality management; c) references on professional ethics; d) QMS documentation developed by the consultant; e) interviews with organizations that have used the services of the consultant; f) Works of the time period in which the consultant has acquired professional experience; g) experience with knowledge of similar organizations; h) certifications and consultant's professional qualifications; i) interviews with the consultant to assess their competence	Likert Scale Does the evaluation of the consultant's references meet the specifications of the standard? 5- Fully 4- Satisfactorily 3 - Little satisfactorily 2 - unsatisfactorily 1- No reply Obs: This criterion will be proven by providing third party information (network). As well as copies of previous clients certifications. Declaration of working time and experience of the consultant and qualification certificates and professional development.	Usual Criterion
Specific Knowledge of Organization Business (C_5)	It is essential that the consultant has the expertise of the organization. The ISO 10019 (ABNT, 2007), item 4.2.5, provides the knowledge and skills that a QMS consultant should have for the organization, the following items: 4.2.5.1 statutory requirements and regulators; 4.2.5.2 Product requirements, process and organizational; 4.2.5.3 management practices.	Likert Scale Does Consultancy present the organization's specific knowledge about a QMS cited in the standard? 5- Fully 4- Satisfactorily 3 - Little satisfactorily 2 - unsatisfactorily 1- It has Obs. This criterion will be proven by providing the consultancy copies of certifications and declarations of previous work with customers of the same organization of business.	Usual Criterion

Table 2. Continued...

SELECTION CRITERIA FOR CONSULTANCY			
Consultancy			
Criteria	**Theoretical foundation**	**Evaluation**	**Type of criterion**
Disclosed expertise in Consultancy area (C6)	According to item 4.2.4 of ISO 10019 (ABNT, 2007), the consultants should have specific knowledge and skills for quality management. The item 4.2.4.1 inform the relevant rules that a QMS consultant should be able to understand and apply in organizations, they are: - ABNT ISO 9000, Quality management systems - Fundamentals and vocabulary; - ABNT ISO 9001, Quality management systems - Requirements; - ABNT ISO 9004 - Quality management systems - Guidelines for performance improvement; - ABNT ISO 19011 - Guidelines for audits of the quality management system and / or environmental; - And all the standards necessary to support the consultants should also be known by the consultants.	Likert Scale Does consultants have the specific knowledge and skills of standards for quality management necessary for the realization of the consultancy? 5- Fully 4- Satisfactorily 3 - Little satisfactorily 2 - unsatisfactorily 1- They have not Obs: This criterion will be proven by providing the consultancy copies of previous clients certifications regarding the standards included in the criteria.	Usual Criterion
Aggregation of knowledge (C_7)	The consultants should have the ability to aggregate knowledge and skills related to quality management, methodologies and techniques. As well as being able to apply them appropriately. According to item 4.2.4.3 of ISO 10019, the knowledge are: a) quality management -Principles; b) Tools and techniques for continuous improvement; c) Technical appropriate statistics; d) Techniques and audit methodologies; e) Principles on economic aspects of quality; f) Techniques for teamwork; g) PDCA Methodology; h) Policy identification methodology; i) process mapping techniques; j) Techniques for troubleshooting; k) Techniques for monitoring customer / employee satisfaction; l) Techniques to give or suggest ideas in free debate.	Obs: This criterion will be proven by providing the consultancy statements of previous work that comtemplaram the knowledge and skills required by criterion, as well as certificates and professional development of statements of consultants.	**Usual Criterion**

multicriteria characteristics: PROMETHEE rankings, a 2D and a 3D GAIA plan, tools for analyzes of sensibility, of weight, and data management. Furthermore, in order to improve the GDSS (group decision support system) capacities, the multi-scenario model was extended, this being a tool inherited from Decision lab software (Mareschal, 2012). For this study, we used this software because it is more complete.

5.1 Application of the decision model

The proposed model was applied in a company operating in the pharmaceutical industry, food supplements and cosmetics for 25 years. It has 350 employees, operates in all Brazilian states and exports to some countries in South America and the United States. The decision-maker in question works

Table 3. Qualifying criteria for an ACB.

QUALIFYING CRITERIA FOR AN ACCREDITED CERTIFICATION BODY (ACB): ACB		
Criteria	**Theoretical foundation**	**Evaluation**
Accreditation of the ACB	According to CB25 (2011), the ACB must: -Demonstrate to the potential client that it is accredited by an Accreditation Body which is a signatory to the mutual recognition agreement of the International Accreditation Forum-IAF; thus, it is in accordance with the standards and regulations that allow it to audit and grant QMS certifications based on ISO 9001.	Is the ACB accredited? (Yes) -Qualified (No)- Disqualified
Compliance with the AIF's criteria.	According to CB25 (2011), the ACB must: -Demonstrate that it complies with the AIF's criteria such as the dimensioning of the relation auditor/day of audits and the auditors qualification relative to the scope of the certification, providing and explaining the AIF guidelines to the client, in order to clarify all questions about the proposal.	Does the ACB comply with AIF's criteria? (Yes)-Qualified (No) – Disqualified
Demonstrate and prove the skills of its auditors	According to the O.D. CB25 ABNT ACB (CB25, 2011) shall demonstrate the competence of its auditors, who must meet the necessary qualification requirements stipulated by the Brazilian System of Conformity Assessment - SBAC. In addition to proving the technical expertise, specific training and experience of its auditors about the desired certification.	Does the ACB comprove the competence of auditors? (Yes) - Qualified (No) – disqualified
Impartiality	According to item 4.2 of NBR ISO / IEC 17021 (ABNT, 2011) requires that the certification body is impartial and perceived as such, so you can provide a certification that provides confidence. To obtain and maintain confidence, the decisions of a ACB should be based on objective evidence of compliance and non-compliance, obtained by the ACB, and that its decisions are not influenced by other interests or parties.	Does the ACB prove through document their impartiality in the certification process? (Yes) - Qualified (No) – disqualified
Confidentiality	The NBR ISO / IEC 17021 (ABNT, 2011), item 8.5 talks about confidentiality. According to the item 8.5.1, the ACB must necessarily present a confidentiality policy governed by law and existing agreements to safeguard the confidentiality of information obtained or created during the performance of certification activities at all levels of its structure.	Does the ACB provide Confidentiality Agreement? (Yes) - Qualified (No) – disqualified

in the company since its inception, holds the position of Director of R & D, its main duties, caring for the research of new products, follow and participate in its development, formalizing partnerships with universities and research institutions, to develop innovations technology of enterprise and take care of the regulatory part of these products.

In this article, we show only the process for choosing the consultancy.

We considered three scenarios for problem analysis, each scenario corresponds to a specific vector of weight that caters to different business needs, as follows:

- Scenario 1: The criteria weights were established by the decision maker;
- Scenario 2: All criteria assume the same weights, trying to get a result not influenced by the criteria but by the performance of the general advice. This does not happen often in practice.
- Scenario 3: Scenario ranging between scenario 1 and 2

Initially it was up a set of 9 consultancies, but these only 3 provided sufficient data and met the qualifying criteria. These data were obtained through telephone

Table 4. Selection Criteria for an ACB.

SELECTION CRITERIA FOR ACCREDITED CERTIFICATION BODY (ACB)			
ACB			
Criteria	**Theoretical foundation**	**Evaluation**	**Type of criterion**
Costs (C_1)	Standards ISO and OF CB-25 ABNT not comment on the amounts to be charged by an ACB relating to its audit services for certification of an organization. Thus, this criterion is based on the average value of services (R $) charged by ACB's.	Certification price (R$ 000's -Brazilian currency)	Quasi Criterion (q)
Payment methods (C_2)	There is no mention in any ISO standard on the payment methods practiced by the ACB. That way, this criterion is based on the forms of payment that the ACB adopts. Since the payment in cash, to the greatest number of installments.	Escala de Likert Likert scale: 5 -payment at sight 4-two instalments 3-between three and six instalments 2-beteween seven and ten instalments 1 - twelve instalments	Usual Criterion
Transparency (C_3)	According to ISO 17021 (ABNT, 2011), topic 4.5, a certification body needs to provide public access or published appropriate information about its audit and certification processes, and about the status of certification of any organization (Concession, extension, maintenance, renewal, suspension, reduction in scope, or withdrawal of certification) of any organization, in order to achieve confidence in the integrity and credibility of certification.	Likert Scale Does The ACB provide appropriate access to information for organizations? 5- Fully 4- Satisfactorily 3 - Little satisfactorily 2 - unsatisfactorily 1 - Not available Obs. This criterion shall be demonstrated by providing the documentation ACB containing information about all the certification process.	Usual Criterion
Ability of responses and complaints (C_4)	According to ISO 17021 standard (ABNT, 2011), topic 4.7, the parties that place their trust in the certification expect to have their complaints investigated and, if well founded, they want to make sure that the complaints will be dealt with adequately and with reasonable efforts made to solve them. The effectiveness of complaints responsiveness is an important means of protection for the ACB, its customers and other users of certification against errors, omissions or misconduct. Confidence in certification activities is safeguarded when complaints are handled properly.	Likert Scale What the responsiveness level of Tha ACB complaints? 5 - Very high 4 - High 3- East 2 - Low 1- Very Low Obs: This criterion will be proven by information from other organizations and history ACB regarding the terms that deal with the criterion.	Usual Criterion

Table 4. Continued...

SELECTION CRITERIA FOR ACCREDITED CERTIFICATION BODY (ACB)			
ACB			
Criteria	**Theoretical foundation**	**Evaluation**	**Type of criterion**
Certification proposal (C_5)	According to the guidance document CB25 from ABNT, companies must hire an ACB based on its proposal and on its record of certifications done, with a proposal that covers: Goals of the services to be reached, scope of the services to be provided, comprehensiveness of the process, organizational groups, company's areas, its accredited body, resources involved, - formalized evidence of compliance with the IAF criteria for the design of the audited scopes, in the form of a calculation memory based on NIT DICOR 054 INMETRO; - Plan of work and applied design; - price; - form of payment; relatedness of the last ten certifications held.	Likert Scale Are the requirements (described in Guidance Document) addressed in the certification proposal the ACB? 5- Fully 4- Satisfactorily 3 Little satisfactorily 2 unsatisfactorily 1- Not applicable Obs: This criterion shall be demonstrated by providing the certification proposal ACB comtemplando all existing criteria in items.	Usual Criterion

Table 5. Outranking flows for consultancies for scenario 1.

Rangking	$\phi^+(a)$	$\phi^-(a)$	ϕ
Consultancy A	0,60	0,20	0,40
Consultancy B	0,40	0,50	-0,10
Consultancy C	0,25	0,55	-0,30

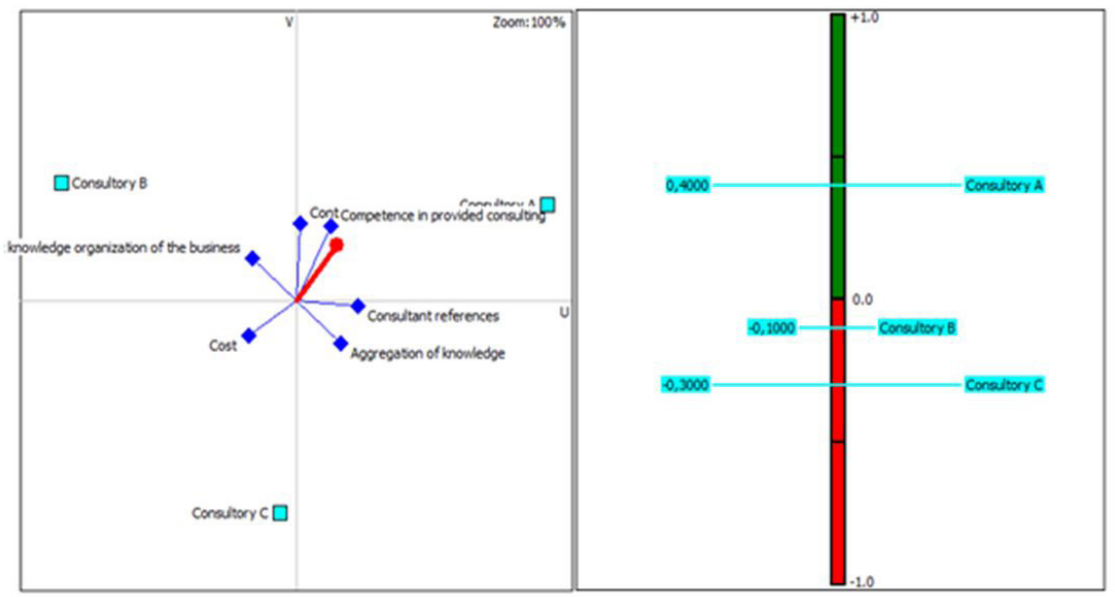

Figure 2. Gaia Plan, and Promethee rankings for consultancy for scenario 1.

Table 6. Decision Matriz for consultancies for scenario 1.

DECISION MATRIX							
Cenário 1	**C_1**	**C_2**	**C_3**	**C_4**	**C_5**	**C_6**	**C_7**
Likert scale	Unit	5 points	5 points	5 points	5 points	5 points	5 points
Preferences							
Min/Max	Min	Max	Max	Max	Max	Max	Max
Weight	0,10	0,10	0,10	0,20	0,20	0,20	0,10
Criterion	U-shape	Usual	Usual	Usual	Usual	Usual	Usual
threshold (q)	20.000,00	n/a	n/a	n/a	n/a	n/a	n/a
Statistics							
Minimum	40.000,00	2	3	3	3	3	3
Maximum	108.000,00	5	4	5	4	5	4
Medium	66.000,00	4	4	4	3	4	4
Evaluation							
Consultancy A	108.000,00	5	4	5	3	5	4
Consultancy B	50.000,00	2	4	3	4	4	3
Consultancy C	40.000,00	4	3	4	3	3	4

contact and document request. These consultancies were named as **consultancy A, B** and **C**. The organization A is in the market for 22 years, consultancy B for 4 years and last for 15, respectively.

Possession of the selection criteria, the alternatives and the data extracted from consultancies can generate a decision matrix.

In this scenario 1 the following results were obtained according to Table 5 and Figure 2.

The GAIA plan allows a visual analysis of the decision problem. Alternative Consultancy **A** presented the highest net flow as can be seen in Promethee rankings (right side of Figure 2), so this was the selected consultancy. This alternative is more distant to the origin and is in the direction of π decision shaft (thicker lines finished with a circle on the left side of Figure 2) with increased performance against criteria (payment form, Consultant of Reference and competence in the area of Consultancy provided). And, one can see that the alternative Consultancy **C** that had worst performance is in the opposite point of said axis.

And so it was generated two more arrays decision for scenarios 2 and 3, as well as the outranking flows and GAIA plan. In that work only scenario 1 data were detailed as Tables 5 and 6 and Figure 2. For scenarios 2 and 3, as a result, alternative Consultancy **A** continued getting the most liquid flow with 0.3571 and 0.4566 respectively.

6 Final considerations

The development of this study provided a new insight into the importance for selecting consultancy and certification services in order to implement QMS within organizations.

Moreover, this study is about the whole selection process in the light of knowledge, utilizing ISO standards, and the guidance document of the ISO quality CB-25 to establish the criteria for this goal. It also emphasizes organizational maturity, which will determine whether or not there is a need to hire a consultant. Then, what is emphasized is that decision-making should be guided by a structured model that uses a multicriteria method. This means that this study does not have precedents, which opens pathways for new studies. The model proposed provides a decision based on technical-scientific knowledge of detailed criteria. For most organizations adopt their criteria intuitively based only on the decision maker's experience. With this, the hiring steps management consultancy quality and / or Accredited Certification Body (ACB) will be strengthened. So as a suggestion for future work, the proposed decision model and its qualifying criteria and selection can be used in organizations in other market segments, but also of different sizes (small and medium), since the application was held in a large company in the pharmaceutical segment.

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