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ARTICLES

PROPOSAL OF A NEW MULTI-CRITERIA METHODOLOGY SAPEVO-WASPAS-2N APPLIED IN PRIORITIZING THE IMPLEMENTATION OF COMPLIANCE PROCESSES

L. Vitorino[1*], C. F. S. Gomes[2], F. Silva[3], M. Santos[4] and S. F. Lucas[5]

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ABSTRACT. Processes that establish Compliance at first do not seem to add to the value chain of companies. However, the need to address legislation or issues related to corporate governance, social management, and the environment, lead large corporations to adopt such processes. This article aimed to establish a plan for prioritizing the implementation of compliance processes in an electric power generation company, through the method Value-Focused Thinking (VFT) of structuring problems, and the application of the new hybrid multicriteria method SAPEVO-WASPAS-2N, derived from the unprecedented junction of SAPEVO-M (Simple Aggregation of Preferences Expressed by Ordinal Vectors – Multi Decision Makers) and WASPAS-2N (Weighted Aggregated Sum Product Assessment) with two standardization techniques. The application of the hybrid model SAPEVO-WASPAS-2N proved to be consistent and robust, generating two possibilities of ordering priorities aligned with the strategic situation of the organization based on the criteria established through the opinion of the decision makers.

Keywords: MCDM, compliance, VFT, SAPEVO-WASPAS-2N, multi-criteria decision analysis, electric power.

1 INTRODUCTION

Electricity has become a fundamental element for the survival, comfort, and quality of life of the human being and the development of any country. We cannot visualize the current world without

*Corresponding author
[1]Universidade Federal Fluminense, Niterói, RJ, Brazil – E-mail: lucasvitorino.ep@gmail.com – https://orcid.org/0000-0001-6568-8529
[2]Universidade Federal Fluminense, Niterói, RJ, Brazil – E-mail: cfsg1@bol.com.br – https://orcid.org/0000-0002-6865-0275
[3]Eletrobras, Brazil – E-mail: fernandocas@id.uff.br – https://orcid.org/0000-0002-9236-7170
[4]Instituto Militar de Engenharia, Rio de Janeiro, RJ, Brazil – E-mail: marcosdossantos_doutorado_uff@yahoo.com.br – https://orcid.org/0000-0003-1533-5535
[5]Unirio, Rio de Janeiro, RJ, Brazil – E-mail: solangefortunalucas@gmail.com – https://orcid.org/0000-0001-9247-0410

the electric energy. The company to be studied in this paper is a leader in the electricity generation market in Brazil. Its energy matrix is clean and renewable and contributes to research and energy efficiency programs. It has shares listed on the Brazilian, Spanish, and North American stock exchanges. Because it is a holding company, it controls power generation companies in various parts of the country, having national coverage.

The Brazilian power system presents an integrated supply network with a total installed capacity of 180 GW and a dominant hydroelectric component (67%). Power plants are scattered across the country and after generation the electricity flows through a complex,100,000 Km long interconnected network operated under a centralized management (Matelli *et al*, 2020).

The use of Multiple Criteria Decision Making (MCDM) methods has played an important role in assisting or supporting people and organizations to make decisions, under the influence of multiple criteria, to select (sort, prioritize, classify) among a series of viable alternatives/solutions, in real-life decision-making problems (Gomes and Gomes, 2019; Mishra and Chatterjee, 2018).

Despite the diversity of MCDA approaches, methods and techniques, the basic ingredients of MCDA are a finite or infinite set of actions (alternatives, solutions, courses of action, etc.), at least two criteria, and at least one Decision-Maker (DM) (Costa *et al*, 2022).

There is a prevalence of studies using unique MCDM methods in the literature. Entertaining the use of hybrid methods combining more than two techniques has received attention more recently due to its flexibility (Nguyen *et al*., 2014). As Stated by Zimmer *et al*. (2016) using a hybrid method compensates for the possible disadvantage of each method used. Each method uses its own approaches and assumptions, which can generate different orders for the ranking (Fakhrzad, Firozpour, and Hosseini Nasab, 2021).

A bunch of multi-criteria decision-making methods that have arisen in the scientific literature are used to solve selection problems. (Gottwald *et al*, 2022). Many multi-criteria decision-making techniques have been introduced by scholars throughout the world, and have successfully been applied in solving numerous decision-making problems in different areas (Stanujkic *et al*, 2021)

The objective of this paper is to establish a plan for prioritizing the implementation of compliance processes in an electric power generation company, through the value-focused thinking (VFT) problem structuring method, which enables understanding of the problematic situation, aiming to define the objectives, alternatives, and criteria, to be implemented in the SAPEVO-WASPAS-2N, a new hybrid method, derived from the unprecedented combination of SAPEVO-M (Simple Aggregation of Preferences Expressed by Ordinal Vectors – Multi Decision Makers) and WASPAS-2N (Weighted Aggregated Sum Product Assessment) with two standardization techniques.

Combinations analogous to this can be found in the studies by Silva *et al*. (2018), who used a methodology combining the TOPSIS method, using two standardization methods, MACBETH for the transformation of qualitative data, thus calling it TOPSIS-MACBETH-2N. Gomes *et al*. (2020) developed a combination of the AHP method for weight generation and the TOPSIS method for ordering alternatives, tied to two normalizations – AHP-TOPSIS-2N. Maêda *et al.* (2021) applied this method to the selection of aircraft by the Brazilian Navy.

Recent literature reviews on MCDM methods have presented several combinations between methods, including the WASPAS method: Zolfani *et al.* (2022) identified some with Fuzzy Logic, COPRAS; SWARA, BWM, TOPSIS and WASPAS integration with Pythagorean fuzzy numbers (PFN) was performed by Sivri *et al.* (2022); Turskis, *et al.* (2015) proposed the new fuzzy multi-attribute performance measurement (MAPM) integrating fuzzy WASPAS and fuzzy AHP for selection of the best shopping centre construction site; Ghorshi Nezhad, *et al.* (2015) integrated the methods SWARA, to find the weights of the criteria, and WASPAS, to rank the alternatives, in the high technology selection; Kumar *et al.* (2022) propose an integrated combination between the step-wise weight assessment ratio analysis (SWARA) and combined compromise solution (CoCoSo) methods to classify, and thus identify, the most apposite spray painting robot for an automobile industry based on seven criteria quantitative evaluation; (Karabasevic *et al.*, 2016) develop a framework, based on the combination of SWARA and Additive Ratio Assessment (ARAS) methods, applied in the selection of candidates during the recruitment and selection process of personnel in a company. A search was conducted in the Scopus and ScienceDirect databases, and the proposed combination - SAPEVO-WASPAS-2N - was not found, highlighting the relevance of this article.

The paper is structured as follows. In section 2, the definition of the term compliance and the characteristics associated with it, the VFT approach and the MCDM SAPEVO-M and WASPAS methods are presented. In Section 3 the characteristics, research contributions of the proposal of the new hybrid method SAPEVO-WASPAS-2N and the standardization procedures adopted are presented. In section 4, the application of the SAPEVO-WASPAS-2N method to the decision-making model is shown and the results are analysed. Authors' considerations and conclusions are presented in section 5.

2 THEORETICAL FOUNDATIONS

Governance, Risk and Compliance (GRC) is one of the ways to organize compliance by aggregating risk management and environmental governance concepts to comply with legislation and standards within and outside an organization. GRC is an integrated and holistic approach to organization-wide governance, risk and compliance, ensuring that an organization is ethically correct and in line with its risk appetite, internal policies, and external regulations, through the alignment of strategy, processes, technology, and people, thereby improving efficiency and effectiveness (Racz *et al.*, 2010).

2.1 Compliance

Economists consider regulation to be a coercive force that requires firms to reduce negative externalities (Broeka, Veenstra, 2018). Compliance is an approach that brings together concepts that aim to align various practices of an institution or company with existing standards, laws, and rules, to generate value for the productive processes of a business. This provides a healthy corporate environment, as relationships occur on ethical bases that strengthen the company's culture and brand before society. This reduces the risk of losses and expenses with fines, penalties, and judicial charges. Compliance generally describes the processes that ensure an organization's adherence to regulatory, legal, contractual, and other types of obligations (Racz *et al.*, 2011).

Regulation may stimulate firms to improve their technology, may increase corporate awareness of the negative externalities, may reduce regulatory uncertainties of technological investments by providing a level playing field and may even trigger innovation. (Broeka, Veenstra, 2018). To highlight the average return on shares of publicly traded companies that own these values, the Corporate Sustainability Index of the São Paulo Stock Exchange (ISE B3) was created. According to Kocmanová and Šimberová (2014), the definition of appropriate key indicators for the framework for measuring sustainable business performance that supported decision-making by managers, investors, and other sustainability stakeholders is the objective of determining ESG (environmental, social and governance) performance indicators at the corporate level.

2.2 Value Focused Thinking (VFT)

VFT is part of the Problem Structuring Methods (PSM). The decision-making process must be guided by the definition of the values that are intended to be achieved, as well as by the hierarchy between them, distinguishing between two types of objectives: the fundamental ones, which establish the essential reasons or objectives of the decisions to be taken; and the means objectives, which allow the fundamental objectives to be achieved (Keeney, 2009).

VFT is based on two fundamental phases, developed through meetings, interviews, and structured brainstorming with stakeholders. The first is the divergent phase, in which the intermediate and fundamental objectives of the problem or issue to be addressed are identified. Also in this phase, the problem is delineated, with the view of the environment and stakeholders. In the second, the convergent phase, there is the sequencing of activities, the choice of processes to be implemented and the criteria that will be used for classification, as well as the choice of MCDM methods to be used to prioritize the implementation (Abuabara *et al.*, 2019). Figure 1 shows in graphic form the application of the VFT.

The objectives defined by VFT through the established values were listed in Figure 2. These objectives become action plans, or activities to be carried out to solve the problem in question and achieve the strategic objective. There is a division between intermediate and fundamental objectives, organized according to their order of execution. In this way, the team that will deal with the problem can organize the work packages.

2.3 SAPEVO-M

In real-world decision-making problems, we usually need to evaluate some alternatives with respect to multiple criteria. To deal with such problems, MCDM techniques and methods are applied (Keshavarz-Ghorabaee *et al*, 2018). The SAPEVO-M method (Gomes *et al.*, 2020), is an

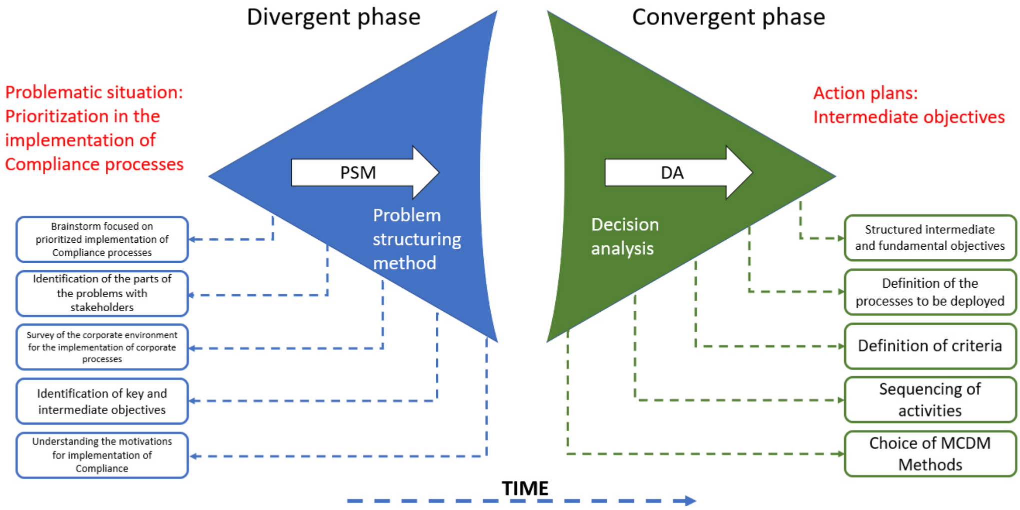

Figure 1 – VFT - Convergent and divergent phases.

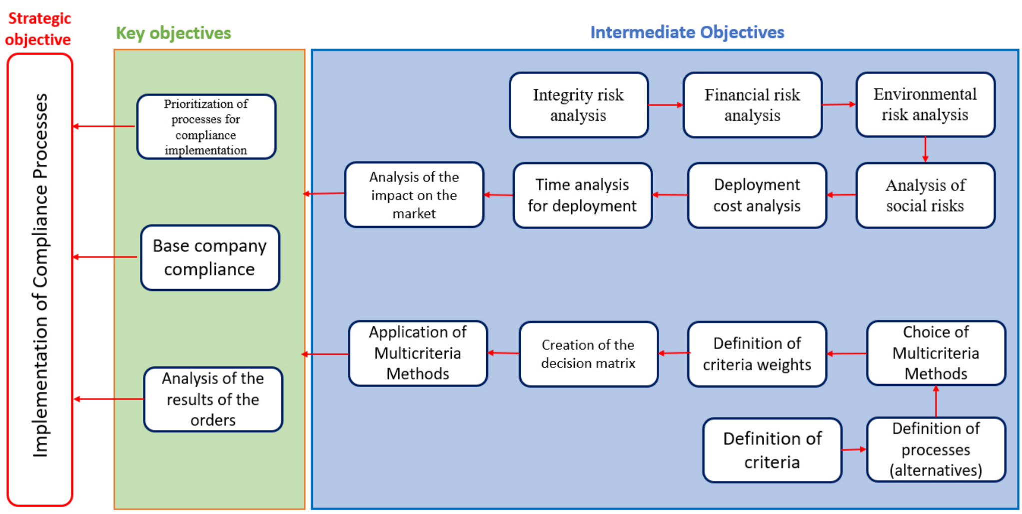

Figure 2 – Hierarchy of objectives.

evolution of the SAPEVO ordinal MCDM method, initially proposed by Gomes *et al.* (1997), for P.γ. (ordering) problems (Costa *et al.*, 2020; Maêda *et al.*, 2021).

The method can be divided into four stages: 1) transformation of ordinal preferences of criteria into a vector of criterion weights; 2) integration of the vector criteria of each DM; 3) ordinal transformation of preference between alternatives within a given set of classification criteria into a partial weight of alternatives; 4) determination of global preferences of alternatives (evaluation matrix) (Gomes *et al.*, 2020).

In step 1, having defined the criteria and alternatives to be used, degrees of preference are established for all ordered pairs of criteria (c_i, c_j), where ci and c_j are two criteria within a set of criteria C = {c_1, c_2, ... c_i, ..., c_j, ...}. The degree of preference between them is given by $\delta c_i\ c_j$, such as:

- $\delta c_i\ c_j = 1 \leftrightarrow c_i \cong c_j$, i.e., c_i is as important as c_j;
- $\delta c_i\ c_j > 1 \leftrightarrow c_i > c_j$, i.e., c_i is more important than c_j; and
- $\delta c_i\ c_j < 1 \leftrightarrow c_i < c_j$, i.e., c_i is less important than c_j.

To represent the preferences of the criteria, the SAPEVO-M method uses a semantic relationship scale (Table 1).

Table 1 – Table of preferences.

Relationship (symbol)	Relation	Scale
$\prec\prec< 1$	Absolutely worse / Absolutely less important	- 3
$\prec\prec 1$	Much worse / Much less important	- 2
$\prec 1$	Worse / less important	- 1
1	Equal or equivalent / as important as	0
$\succ\succ 1$	Better / most importantly	1
$\succ\succ 1$	Much better / Much more important	2
$\succ\succ> 1$	Absolutely better / Absolutely more important	3

In step 2, the relationship associated with this scale allows to transform the matrix $DM_k = [\delta c_i\ c_j]$, for the *k-th* decision maker, into a column vector [v_i], in such a way that (1):

$$\sum_{m}^{i=1}(c_i)\ for\ i = 1,\cdots,m\ and\ k = 1,\ldots,n \tag{1}$$

At the end of this step, the resulting vector is normalized (2). To ensure the non-generation of negative values in weights, the authors propose the use of 1% of the weight of the next lower weight criterion (least preferred penultimate). Where a_{ij} represents the alternative $i = 1,\ldots,m$ in the criterion $j = 1,\ldots,h$.

$$\bar{c_t} = \left(\frac{a_{ij} - \min a_{ij}}{\max a_{ij} - \min a_{ij}}\right) \tag{2}$$

In step 3, each decision-maker evaluates the alternatives according to the criteria, resulting in a matrix E_i for each decision-maker and each criterion.

Finally, in step 4 the lines of the E_i matrix are summed and normalized (2), as performed in the second stage. Vector *V*, resulting from normalization, represents the preferences for the alternatives of each DM, and will make up the evaluation matrix *M* ($n \times m$) associated with the sum of each criterion evaluated by each decision-maker.

2.4 WASPAS

The Weighted Aggregates Sum Product Assessment (WASPAS) method, developed by Zavadskas *et al.* (2012), is a compensatory method, considered simple, that uses a single combination of two well-known MCDM approaches, the Weighted Sum Model (WSM) and the Weighted Product Model (WPM) (Chakraborty and Zavadskas, 2014; Zavadskas *et al.*, 2013). By combining these two methods, the alternatives are evaluated and prioritized. The accuracy in aggregating the two methods is much higher compared to individual accuracy (Zavadskas *et al.*, 2012).

To use the method, some input information is required: the decision matrix (alternatives and criteria) and the weight of the criteria, which are based on the information received from the decision-taker (Alinezhad and Khalili, 2019; Chakraborty, Zavadskas, and Antucheviciene 2015). Information cannot be distorted (Oliveira *et al,* 2019).

The STAGES OF WASPAS are defined as follows (Zavadskas *et al.*, 2012):

1. Elaboration of the decision/evaluation matrix: composed taking x_{ij} as the element of the decision matrix for the alternative *i* by the criterion *j*.

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix}_{mxn} \tag{3}$$

   Where *m* is the number of alternatives, *n* is the number of evaluation criteria and x_{ij} is the performance of the *i*th alternative in relation to the *j*th criterion. In addition, it is necessary for the decision-taker to provide the weight of the criteria $[w_1, w_2, ..., w_n]$.

2. Decision Matrix Normalization: The application of the WASPAS method, at first, requires linear normalization of the elements of the decision matrix using the following two equations:

   - For monotonic benefit criteria (MAX), i.e., the higher the better (4).

$$\bar{x}_{ij} = \frac{x_{ij}}{\max_i x_{ij}}. \tag{4}$$

   - For monotonic cost criteria (MIN), i.e., the lower the better (5).

$$\bar{x}_{ij} = \frac{\min_i x_{ij}}{x_{ij}} \tag{5}$$

   where $\bar{x}_{ij}$ is the normalized value of x_{ij}.

3. Calculation of Total Relative Importance: it is calculated based on the WSM method (MacCrimmon, 1968; Miller and Starr, 1969), in the weighted standard data of each alternative, as follows (6):

$$Q_i^{(1)} = \sum_{j=1}^{n} \bar{x}_{ij} w_j, \tag{6}$$

   Where wj indicates the weight of the j-th criterion and $Q_i^{(1)}$ indicates the relative importance additive in the i-th alternative.

4. Calculation of Multiplicative Relative Importance: it is calculated based on the WPM method (Triantaphyllou and Mann, 1989; Miller and Starr, 1969), to determine the relative multiplicative importance of the weighted standard data of each alternative, using the following equation (7):

$$Q_i^{(2)} = \prod_{j=1}^{n} (\bar{x}_{ij})^{w_j}. \tag{7}$$

where $Q_i^{(2)}$ indicates the relative multiplicative importance of the i-th alternative.

5. Calculation of the Generalized Criterion Set (Q): it is proposed to generalize and integrate the additive and multiplicative methods, defined as (8):

$$Q_i = 0.5Q_i^{(1)} + 0.5Q_i^{(2)} \tag{8}$$

In equation (8) a total importance of the alternative is determined, equal to WSM and WPM for a total evaluation.

In addition, a new equation has been proposed to increase the accuracy of the ranking (9):

$$Q_i = \lambda \sum_{j=1}^{n} \bar{x}_{ij} w_j + (1-\lambda) \prod_{j=1}^{n} (\bar{x}_{ij})^{w_j}, \lambda = 0, \ldots, 1. \tag{9}$$

Where λ can range from 0 to 1. When λ=0, WASPAS is transformed into WPM; and when λ=1, WASPAS is transformed into WSM. Therefore, it is recommended to start from an initial analysis with λ=0.5.

Obtaining the final ranking of the alternatives: finally, the alternatives are classified based on the Q_i value, that is, the higher the qi value the better positioned the alternative *i*.

3 SAPEVO-WASPAS-2N APPROACH

According to Silva *et al.* (2018), different approaches and techniques of MCDM can be proposed depending on various schools of thought and/or demands of specific situations. There is no better or worse method, what one has are several methods that can suit different situations. Wang *et al.* (2016) report that the combination of different MCDM techniques to build a hybrid model has been widely used and has also shown very expressive results. This path can be a good choice to overcome the limitations of each method.

The proposal of the hybrid method SAPEVO-WASPAS-2N meets some limitations/disadvantages found in the WASPAS method, to be compensated by the SAPEVO-M method.

The WASPAS method requires some elements to be able to start its application: the weights of the criteria and the decision matrix (alternatives and criteria), elements that must be established by the decision-taker. However, often the decision-taker is not sure to assign this data directly and accurately. Besides that, the method does not establish any process when there are qualitative criteria.

This statement is found in (Chakraborty and Zavadskas, 2014; Zavadskas *et al.*, 2012, 2013), where the attributions of weights are calculated in several ways: by the entropy method (proposed by Zeleny in 1982); the AHP method; equal attribution between the criteria, or directly by the decision-taker. Regarding the evaluation of alternatives in qualitative criteria, it is necessary to use other techniques so that the analysis can be expressed quantitatively. In these studies, several forms were found to evaluate qualitative criteria, the most common are direct attribution of DM through a Likert scale (created by Rensis Likert in 1932) converted into 5 or 7 posts, and/or linguistic variables converted into scores.

The ELECTRE-MOr hybrid method uses an adaptation of the SAPEVO-M method to obtain the weights and evaluate qualitative criteria, transforming the ordinal preferences of the criteria (De Araújo Costa *et al.*, 2022). A similar approach is used in the SAPEVO-WASPAS-2N method.

Thus, the SAPEVO-WASPAS-2N method allows the use of quantitative and/or qualitative criteria, generating at the end two orders through different standardization processes.

The main reasons for integrating the two methods are:

- **SAPEVO-M is used to treat ordinal data**, transforming ordinal values into cardinal (qualitative into quantitative).
- **WASPAS uses the criteria to order alternatives** (including qualitative data processed by SAPEVO-M).
- **Aggregation uses two standard methods** (allowing to generate different matrices associated with each normalization method, thereby increasing the robustness of the method and enabling a sensitivity analysis of the results).

3.1 Standardization Procedures: Application of WAPAS-2N

The second part of the method, WASPAS-2N, is so named because it performs two normalization procedures used during its execution. (Gomes and Gomes, 2019) present the four main normalization procedures commonly used and their calculation formulas (N_1), (N_2), (N_3) and (N_4) (Figure 3).

All four normalization procedures in Figure 1 were tested, however only two of them presented consistent results in terms of order of alternatives. Thus, the method developed and proposed in this article, WASPAS-2N, considers the standardization procedures N_1 and N_4.

We can identify that the N_1 normalization process is equal to the original normalization process established by the WASPAS method.

At the end, the Generalized Criterion Set (Q) is calculated for the two normalization procedures, N_1 and N_4, and thus the priority orders of the alternatives are obtained based on the Q_i value.

Procedure	Formula	Generic v-value normalized vector	Keep proportionality?
N_1	$\frac{a_{ij}}{max(a_{ij})}$	$0 < v \leq 1$	YES
N_2	$\frac{a_{ij} - min(a_{ij})}{max(a_{ij}) - min(a_{ij})}$	$0 < v \leq 1$	NO
N_3	$\frac{a_{ij}}{\sum a_{ij}}$	$0 < v \leq 1$	YES
N_4	$\frac{a_{ij}}{\sqrt{\sum a_{ij}^2}}$	$0 < v \leq 1$	YES

Figure 3 – Main normalization procedures Source (Gomes and Gomes, 2019).

4 APPLICATION OF SAPEVO-WASPAS-2N METHOD

In strategic decision-making situations, large companies like this one need to reduce the inherent subjectivity of human beings.

4.1 Description of criteria

Following the VFT approach, based on the values identified, the criteria were defined together with the authors and with the help of the teams involved in the problem. The selected criteria were:

- C_1 - Improvement of the company's reputation.
- C_2 - Ease of obtaining resources.
- C_3 - Minimization of legal and financial risks.
- C_4 - Positive impact on the market.
- C_5 - Cost of implementation.
- C_6 - Deployment time.

All criteria were evaluated qualitatively.

4.2 Definition of Alternatives

The alternatives were also obtained by the VFT method based on processes already widely disseminated in the literature on Compliance and based on the specific knowledge of the team of specialists involved. These alternatives were validated by the team involved and the decision-takers. Table 2 presents the alternatives and categories associated with compliance.

Table 2 – Alternatives raised in VFT.

Categories	Alternatives
ESG	A_1 - Corporate impact management in society
ESG	A_2 - Corporate impact management on the environment
GRC	A_3 - Internal Audit
GRC	A_4 - Internal Controls Management
GRC	A_5 - Risk management
GRC/ESG	A_6 - Corporate Governance
Integrity	A_7 - Management of anti-corruption, anti-bribery and fraud prevention compliance
Integrity	A_8 - Corporate ethics management
Integrity	A_9 - Management of investigation and investigation of complaints

4.3 Definition of criteria weights in each scenario

Scenarios are platforms for strategic discussions that lead to continued organizational learning regarding its key decisions and priorities (Oliveira *et al*, 2018).

The weights of the criteria were obtained by applying the SAPEVO-M method, in its steps 1 and 2, considering the point of view of two DMs. The DMs are specialists in the compliance area, one of them works in the utilities company in the field of electricity. The second DM operates in a company in the financial market sector and works in compliance of this organization, thus bringing more external and financial view of the market (Table 3).

The results show the highest importance attributed to criteria C_2 - Ease in obtaining resources and C_3 - Minimization of legal and financial risks - a result consistent with the company's concerns in carrying out processes that may result in risk minimization and facility to obtain investments that bring benefits to the organization. On the other hand, criteria C_5 - Deployment Cost and C_6 - Deployment time - were considered less important for the installation of compliance processes in the organization.

Table 3 – Weight of criteria of each DM after the paritarian evaluations of the criteria and the integration of the criteria.

Decision Maker	Weight of Criteria					
	C_1	C_2	C_3	C_4	C_5	C_6
DM_1	0,7273	1,0000	0,8636	0,4545	0,2273	0,0023
DM_2	0,3889	0,8889	1,0000	0,7222	0,3333	0,0033
Final Weight	1,1162	1,8889	1,8636	1,1768	0,5606	0,0056

4.4 Evaluation of alternatives on the point of view of each criterion

In this stage, for qualitative criteria, such as those presented in this article, steps 3 and 4 of the SAPEVO-M method are applied (Table 4).

Table 4 – Example of the paritarian evaluation of alternatives in criterion C1 by DM1.

Criterion 1 - Improving the company's reputation											
DM1	A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	Sum	Normalized vector
A_1	0	0	3	3	1	3	2	1	2	15.0	1.0000
A_2	0	0	3	3	1	3	2	1	2	15.0	1.0000
A_3	-3	-3	0	0	-1	-2	-2	-1	-2	-14.0	0.0000
A_4	-3	-3	0	0	-2	2	-2	-2	-2	-12.0	0.0690
A_5	-1	-1	1	2	0	2	0	-1	1	3.0	0.5862
A_6	-3	-3	2	-2	-2	0	-2	-1	-2	-13.0	0.0345
A_7	-3	-2	2	2	0	2	0	3	0	4.0	0.6207
A_8	-1	-1	1	2	1	1	-3	0	-1	-1.0	0.4483
A_9	-2	-2	2	2	-1	2	0	1	0	2.0	0.5517

In case of quantitative criteria, the DMs simply inform the monocity of the criteria (benefit or cost) and assign the values of the alternatives for each criterion directly in the decision matrix. From this, the SAPEVO-WASPAS-2N method allows the entry of quantitative and/or qualitative data in its application.

After evaluating the alternatives in each criterion, vector *V*, resulting from normalization, which represents the preferences of the alternatives of each DM, will make up the decision matrix $M\ (n \times m)$ associated with the sum of each criterion evaluated by each decision-maker (Table 5).

In qualitative criteria, because it is a paritarian evaluation among the alternatives, the values of the resulting vector are established in order of magnitude, that is, the higher the value, the better the alternative will be. Thus, the normalization process is applied as if the qualitative criteria were monotonic for benefit, the higher the better.

Table 5 – Decision matrix.

Weights	16.88%	28.57%	28.19%	17.80%	8.48%	0.08%
Kind	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative	Qualitative
Monotonicity	$\mathbf{C_1}$	$\mathbf{C_2}$	$\mathbf{C_3}$	$\mathbf{C_4}$	$\mathbf{C_5}$	$\mathbf{C_6}$
$\mathbf{A_1}$	2.0000	1.1148	0.8253	1.8519	2.0000	0.5152
$\mathbf{A_2}$	2.0000	1.2000	0.8253	1.8519	2.0000	0.0909
$\mathbf{A_3}$	0.0000	0.0741	0.4483	0.6250	0.8667	1.6818
$\mathbf{A_4}$	0.2118	0.5093	1.5172	0.8843	0.6444	1.3788
$\mathbf{A_5}$	1.4433	0.8463	1.7241	1.2176	0.5333	1.3788
$\mathbf{A_6}$	0.3559	1.0000	1.0000	1.0000	0.4963	1.6364
$\mathbf{A_7}$	1.1207	1.3815	1.8322	1.2292	0.5852	1.7576
$\mathbf{A_8}$	0.9483	0.7944	1.6966	0.9815	0.0000	0.8030
$\mathbf{A_9}$	1.0517	0.6426	1.0000	0.9213	0.4741	1.4394

4.5 Analysis of the results of the orders

Having established the weight of the criteria and the decision matrix, from this stage the WAPAS-2N method is applied to obtain the prioritization of compliance processes to be implemented, based on the established criteria.

The first step in the application of the WASPAS-2N method is the normalization of the decision matrix, through the two normalization procedures (N_1 and N_4), established in section 3.1.

After the normalization of the decision matrix, the Weighted Sum Model (WSM) and the Weighted Product Model (WPM) are calculated (Table 6).

Table 6 – Calculation of WSM and WPM for each alternative to the two standardization procedures.

Alternatives	Normalization 1 (N_1)		Normalization 4 (N_4)	
	WSM (Q_1)	WPM (Q_2)	WSM (Q_1)	WPM (Q_2)
A_1	0.7893	0.7504	0.4088	0.3814
A_2	0.8068	0.7653	0.4175	0.3889
A_3	0.1819	0.0000	0.0934	0.0000
A_4	0.4696	0.3886	0.2323	0.1975
A_5	0.7024	0.6709	0.3517	0.3409
A_6	0.5086	0.4573	0.2538	0.2324
A_7	0.8060	0.7596	0.4022	0.3860
A_8	0.6001	0.0000	0.2961	0.0000
A_9	0.4848	0.4751	0.2444	0.2414

Finally, the generalized criterion set (Q_i) is calculated using equation (3), and the ranking of alternatives is established based on the Q_i value, that is, the higher the qi value, the better positioned the alternative. Initially, a λ=0.5 was used as suggested by Zavadskas *et al.* (2012) (Table 7).

Table 7 – Generalized criterion set (Qi) and ranking of alternatives for each standardization procedure.

λ=0.5	**Normalization 1 (N1)**		**Normalization 4 (N4)**	
Alternatives	Output (Q)	Ranking	Output (Q)	Ranking
A_1	0.7699	3	0.3951	2
A_2	0.7860	1	0.4032	1
A_3	0.0910	9	0.0467	9
A_4	0.4291	7	0.2149	7
A_5	0.6867	4	0.3463	4
A_6	0.4830	5	0.2431	5
A_7	0.7828	2	0.3941	3
A_8	0.3000	8	0.1480	8
A_9	0.4799	6	0.2429	6

It can be observed from the results, that the process for implementation of Compliance, A_2 - Management of corporate impact on the environment, was ranked first in the two standardization processes. This is followed very closely by processes A_1 - Corporate impact management in society and A_7 - Anti-corruption compliance management, which has inverted positions when compared to the two standardization processes: A_1 rose to 2nd in the rank in the N_4 standardization procedure and A_7 dropped to 3rd in the rank in the N_4 normalization procedure. Thus, these alternatives are presented as processes that should be prioritized in the implementation of Compliance in the organization.

In an opposite analysis, the processes for implementation of Compliance, A_8 and A_4, presented the worst results among all alternatives, equally in the two standardization procedures. Thus, they should have a lower prioritization among the analysed processes.

When evaluating the ordering resulting from the two separate normalization techniques, it is observed that the ranking of the alternatives changes just once, indicating the method's robustness and stability, despite the differences in weights between the DMs. To test the robustness and performance of the method, in the following section a λ variation is performed in the N_1 normalization data.

4.6 Effect of λ variation

Table 8 shows the effects of the change in λ values (λ =0, 0.1, 0.2, ..., 1) on the result of the generalized criterion set (Q_i) of each alternative using the data of normalization N_1, and Figure 4 presents the order of classification of the alternatives, compared to the generalized criterion.

Table 8 – Generalized criterion set (Q_i) and ranking of alternatives for each standardization procedure.

λ	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
A_1	0.7504	0.7543	0.7582	0.7621	0.7660	0.7699	0.7738	0.7777	0.7816	0.7855	0.7893
A_2	0.7653	0.7694	0.7736	0.7777	0.7819	0.7860	0.7902	0.7943	0.7985	0.8026	0.8068
A_3	0.0000	0.0182	0.0364	0.0546	0.0728	0.0910	0.1091	0.1273	0.1455	0.1637	0.1819
A_4	0.3886	0.3967	0.4048	0.4129	0.4210	0.4291	0.4372	0.4453	0.4534	0.4615	0.4696
A_5	0.6709	0.6741	0.6772	0.6804	0.6835	0.6867	0.6898	0.6930	0.6961	0.6992	0.7024
A_6	0.4573	0.4625	0.4676	0.4727	0.4779	0.4830	0.4881	0.4932	0.4984	0.5035	0.5086
A_7	0.7596	0.7643	0.7689	0.7735	0.7782	0.7828	0.7874	0.7921	0.7967	0.8013	0.8060
A_8	0.0000	0.0600	0.1200	0.1800	0.2400	0.3000	0.3600	0.4200	0.4800	0.5401	0.6001
A_9	0.4751	0.4760	0.4770	0.4780	0.4790	0.4799	0.4809	0.4819	0.4829	0.4839	0.4848

It is interesting to note that for the variable values of λ, the positions of the first six alternatives remain entirely unchanged. The only variation is between the two worst alternatives, and only happens when λ is equal to or greater than 0.8. For a λ value of 0.8 the order of classification of alternatives is reached as: $A_2 > A_7 > A_1 > A_5 > A_6 > A_9 > A_8 > A_4 > A_3$.

Although the classifications of the last two alternatives change slightly, it is observed that the general classification of the first six compliance implementation processes in the organization, is currently independent on the value of λ. Results similar to this, can be found in Chakraborty

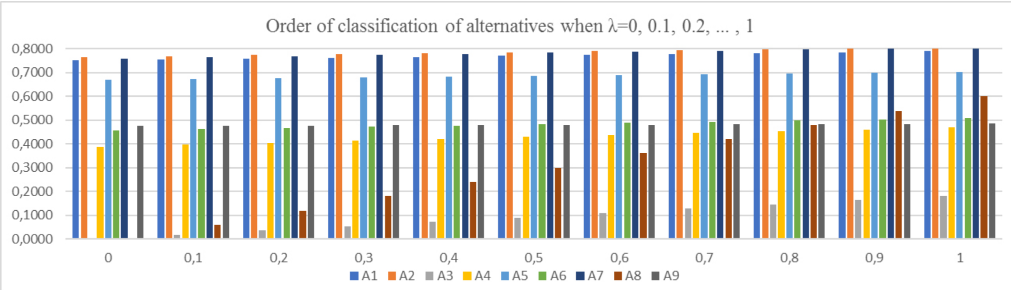

Figure 4 – VFT - Order of classification of alternatives when λ=0, 0.1, 0.2, ..., 1.

and Zavadskas (2014), where the authors present results with little or no variation of the order of alternatives even varying λ.

5 FINAL CONSIDERATIONS AND CONCLUSIONS

This study can serve as a guide for companies and organizations that want to use a hybrid approach of multi-criteria techniques in their decision-making models for prioritizing processes for implementing compliance.

The SAPEVO-WASPAS-2N method is a proposal for a new hybrid method consisting of the unprecedented junction of two new MCDM methods: SAPEVO-M and WASPAS. This method enables the transformation of a qualitative analysis into a quantitative analysis, through the paritarian comparison of alternatives into qualitative criteria and the use of criteria weights through SAPEVO-M, and the ordering of alternatives by a new version of the WASPAS method, which uses two standardization techniques (WASPAS-2N).

The application of the new SAPEVO-WASPAS-2N method, which was the use of the VFT problem structuring method, made it possible to structure the problem with its analysis focused on values and to find the objectives, criteria and set of alternatives that led decision makers in the decision-making process. Breaking an approach typically focused on the alternative normally used, where the alternatives are defined first and only then the criteria and objectives of the analysis.

Given the results obtained and the consistency analysis, the hybrid method SAPEVO-WASPAS-2N proved to be a consistent and robust tool for problems of prioritization of compliance implementation process, besides being little affected by the variable values λ.

For future research, the authors suggest new applications of the MCDM SAPEVO-WASPAS-2N method to test its consistency and robustness, in different problems of different areas.

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