Using the FITradeoff Decision Support System to Support a Brazilian Compliance Organization Program

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Abstract

The technology can support multi-criteria decision-making processes, allowing managers to identify efficient solutions to complex problems in a structured and rational way. Specially, in time of crises, the use of Decision Support System (DSS) is useful since these situations demand greater accuracy in the decision-making process. Therefore, this study shows the usefulness of the Decision Support System constructed for the FITradeoff method in a practical context involving a decision-making in time of crisis. In special, in this study, the applicability of the FITradeoff DSS is discussed to solve an important problem involving a Brazilian Company. The FITradeoff DSS was employed for a compliance-program problem, in which a company sought to improve its performance in relation to the program. This problem is particularly significant in Brazil where the search for compliance programs has been increasing since the adoption of the anticorruption law. Thus, twenty-eight alternatives were created, and these alternatives were evaluated against five criteria. As a result, most of the alternatives in the top of the ranking are related to Internal Communication aspect. Hence, the DM considered that these alternatives are sufficient to direct the efforts to execute the Compliance Program, and in special this theme can be the focus in this company. Furthermore, in view of recurring crises around the world, companies must identify ways to ensure their internal processes support the sustainability of their business. For decision making in times of crisis, the DSS of the FITradeoff method is an effective tool allowing decision makers to handle complex decisions.

Keywords Multi-Criteria Decision-Making/Aiding (MCDM/A) · Decision support system · FITradeoff Method · Compliance program

1 Introduction

Technology is constantly evolving, with new technologies created or improved daily, and many of these are yet to be fully exploited. In the business environment, technology can support decision-making processes, allowing managers to find efficient solutions to complex problems.

Organizations throughout society continually face problems requiring multicriteria decisions. According to de Almeida et al. (2015), multicriteria decision problems, known as Multi-Criteria Decision Making/Aiding (MCDM/A), are defined by the presence of at least two alternatives of action which must be evaluated in two or more attributes /criteria. The main objective of the MCDM/A approach is to rationally solve problems according to decision-maker (DM) preferences.

Several decision-support methods have been developed to assist DMs in solving MCDM/A problems, one of which is the FITradeoff (Flexible and Interactive Tradeoff) method proposed by de Almeida et al. (2016). This method is based on the additive aggregation and use partial information to elicit scaling constants (de Almeida et al., 2016, 2021).

The purpose of this work is to demonstrate how FITradeoff Decision Support System (DSS) can help DMs in times of crisis, when situations demand greater accuracy in the decision-making process. In special, in the study the FITradeoff method has been applied to support a Compliance-Program in a Brazilian Organization. Using the

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FITradeoff method, twenty-eight alternatives, evaluated against five criteria, have been ranked according to compliance importance.

In organizations, especially during crisis, companies need to make more correct decisions and expose themselves to less risky situations. In this context, in Brazil the law number 12.846, also known as the anticorruption law was developed. This law strongly impacted companies and boosted the search for compliance programs. In 2015 a famous anticorruption operation named Lava-Jato (Car Wash, in English) started in Brazil. This special operation accused 144 people, including many politicians, in special two former presidents. The operation stated with the investigation of the Brazilian State Oil Company and some biggest construction companies (The Economist, 2015).

Therefore, this study shows the efficacy of FITradeoff DSS to support the development of a Compliance-Program in a Brazilian Organization. As a result, the complete ranking is obtained and the alternative "to disseminate the idea of the compliance program through lectures, courses, and meetings" is indicated as the first one to be implemented in the Compliance-Program.

The paper is divided as follows. Section 2 presents a Literature Review about the Compliance Program. Section 3 the FITradeoff Method. Section 4 demonstrates the FITradeoff Decision Support System (DSS). Section 5 illustrate the practical application about the Compliance-Program. Finally, Section 6 discuss the results of the Compliance-Program application. Finally, Section 7 remarks the conclusions and future studies.

2 Compliance Program

The Compliance Program has been studied by many authors in recent years. In the context of public administration, the authors Silva et al. (2018) presented a literature review regarding the main bidding practices and how the compliance program could be used to combat fraudulent practices. Also in this context, De Araújo et al. (2019) studied the adoption of Compliance Programs by the Brazilian Public Administration based on the laws applicable in the country. In addition, the study presented the conditions for building an effective public compliance program.

Authors Biron and Manirabona (2020) presented a literature review that addresses the means to achieve Compliance Program goals, as well as obstacles that may impede its effectiveness.

The author Zentay (2021) carried out a study that dealt with measures applicable in Italy to product exports, highlighting the importance of the concept of Compliance for private companies and research institutions.

Marcovici and Noked (2020) presented a proposed voluntary program for individuals and investment funds based on existing Compliance Programs for large corporations. Thus, it would be possible to analyze with greater precision whether an individual is in full compliance with their tax obligations or if there is any concern about money laundering.

Author Pieth (2018) presented how large corporations seek to prevent human rights violations through Compliance Programs. The author states that the Compliance Program has increasingly established itself as a fundamental requirement to prevent corporate responsibility.

Articles dealing with the Compliance Program along with a multi-criteria decision approach have not been found yet in literature, suggesting a gap and making this research important for the development of the subject. Therefore, this paper deals to use the FITradeoff method to support a Compliance Program in a Brazilian company.

3 FITradeoff Method

Several decision-support methods have been developed to assist Decision-Makers (DMs) in solving MCDM/A problems, one of which is the FITradeoff (Flexible and Interactive Tradeoff) method. The FITradeoff method was originally developed by de Almeida et al. (2016).

This method is in the scope of Multi-Attribute Value Theory (MAVT) (Keeney & Raiffa, 1976), considering that DMs presents a compensatory rationality concerning the performance of alternatives. Thus, using methods in the MAVT context, such as the FITradeoff method, for DMs are acceptable to made tradeoffs between a lower performance for an alternative in a criterion for a better performer of the same in another criterion (de Almeida et al., 2015).

To solve an MCDM/A problem in the context of MAVT theory, the most obstacle is to obtain the scaling constants. The constant scales are required to obtain the global value for each one of the alternatives, as illustrated in Eq. (1).

$$V(A_i) = \sum_{j=1}^{m} k_j v_j(A_i) \tag{1}$$

In Eq. (1), $v_j(A_i)$ is the marginal value function for the consequence of alternative Ai in criterion Cj, k_j is the constant scale for the criterion Cj, and V(Ai) is the global value for the alternative Ai. The alternative with the highest global value (score) is the best one for the problem.

Hence, to elicit the scaling constants procedures have been developed. The FITradeoff method is based on the Tradeoff Procedure (Keeney & Raiffa, 1976). The Tradeoff procedure has a robust axiomatic structure to model the preferences express during the decision process. Using this procedure, the value function can be linear or non-linear, i.e. DMs preferences for the consequences within each criterion can be adjusted for a linear or not linear value function.

On the other hand, this procedure requires complete information for DMs concerning their preferences. In other words, in the Tradeoff, DMs have to define indifference relations for each comparison of consequences in adjacent criteria. Hence, as define the exact point of indifference is a difficult task, its deal to 67% of inconsistent results (Weber & Borcherding, 1993).

In this context, most of the methods in the MAVT context do not use the Tradeoff procedure to elicit scaling constants. The Swing (Edwards & Barron, 1994) is other procedure with is incorporated in some methods to obtain the constants. However, Swing only admits linear value function and made a direct elicitation of constants, which deal to 50% of inconsistent results (Weber & Borcherding, 1993).

Therefore, different for the Tradeoff, in the FITradeoff method, DMs do not have to express all their preferences during the decision process. In this view, the FITradeoff method uses partial information about DMs preferences. Hence, the FITradeoff incorporates the Tradeoff procedure, with admits linear and non-linear value function, but incorporate partial information about DMs preferences during the preference modelling process.

According to Salo and Hämäläinen (1992), partial information approaches for MCDM/A were developed primarily because the information required by traditional methods, such as the Tradeoff, can be tedious and time consuming. In addition, these approaches are useful if DMs are unwilling to provide information in complete way (Weber, 1987).

Additionally, other features have been included in the FITradeoff preference modelling process (de Almeida et al., 2021). Now, using the FITradeoff method for choice and ranking, DMs can express their preferences combining two perspectives for preference modelling: the elicitation by decomposition and the holistic evaluation. Thus, during the decision process, DMs can express preferences between pairs of consequences, in elicitation by decomposition, or DM can express dominance relations between alternatives, in holistic evaluation.

It is an interesting advantage for FITradeoff since, in general, MCDM/A methods are typically based on only one of these two paradigms of preference modeling, such as the SMARTS (Edwards & Barron, 1994) and Macbeth (Bana e Costa et al., 2005). Therefore, the FITradeoff method has the flexibility to consider both perspectives for modeling preferences. Now, during the FITradeoff decision process,

DMs can use the perspective that judges most adequate with their cognitive style.

The FITradeoff is also interactive, since each preference expressed, in decomposition or holistic evaluation, is transformed in an inequality which is inserted in a Linear Programming Problem (LPP). Thus, the LPP model runs, seeking for a solution.

For instance, for ranking problematic, which is the problematic investigated in this paper, the LPP model runs for each pair of alternatives seeking for dominance relations. At each step, for each alternative pair (Ai, Ak), the following LPP model is tested, as illustrated in Eqs. (2, 3, 4, 5, 6 and 7).

$$Max\ D(A_i, A_k) = \sum_{j=1}^{m} k_j v_j(A_i) - \sum_{j=1}^{m} k_j v_j(A_k) \tag{2}$$

s.t

$$k_1 > k_2 > \cdots > k_m | \sum_{j=1}^{m} k_j = 1 \tag{3}$$

$$k_j v_j(x'_j) > k_{j+1}\ j = 1\ to\ m-1 \tag{4}$$

$$k_j v_j(x'_j) < k_{j+1}\ j = 1\ to\ m-1 \tag{5}$$

$$\sum_{j=1}^{m} k_j v_j(A_i) > \sum_{j=1}^{m} k_j v_j(A_k) \tag{6}$$

$$k_j \geq 0\ j = 1\ldots m \tag{7}$$

The objective function of this LPP model seeks to maximize the difference between the global value of the alternatives (Ai, Ak), as illustrated in Eq. (2). The Eq. (3) presents the ordering of scaling constants. Equations (4) and (5) express the preferences expressed during the elicitation by decomposition, in which DMs express preferences between intermediate consequences $v_j(x'_j)$ or $v_j(x''_j)$ in the criterion j, and the best consequence (equal to 1) in the adjacent criteria (j + 1). Equation (6) represents the preference expressed during the holistic evaluation, in which the alternative Ai dominates the alternative Aj, i.e. presents the highest global value, as defined by Eq. (1). Finally, Eq. (7) is about the nonnegativity of scaling constants.

It is worth to mention that in the elicitation by decomposition, the pairwise comparison is defined by a heuristic presented in the original paper about the FITradeoff method (de Almeida et al., 2016). These consequences are not chosen in a random way, but it follows a heuristic developed by the authors to minimize the number of comparisons made by decision-makers during the

process. This heuristic begging with the intermediate consequence (0.5), and after that updates the consequence value concerning the answer that has been made by decision-makers.

Based on this LPP model, it has been possible to establish or not a dominance relation between the alternatives of the problem. During the FITradeoff decision process, as DMs answer questions, more constraints are obtained and it is inserted in the LPP model. Hence, the LPP runs, and some alternatives are dominated. As result, an available space scaling constants are obtained in the final of the decision process. Instead of the exact values of scaling constants which are obtained in the Tradeoff and Swing procedures.

The decision process stops when a solution has been found, in this case a complete ranking, or when DMs decide to stop the process and use the partial results obtained (the partial ranking).

Originally the FITradeoff has been developed to solve choice problems (de Almeida et al., 2016). Now, the method has been expanded for ranking problematic (Frej et al., 2019), for sorting problematic (Kang et al., 2020), and for portfolio problematic (Frej et al., 2021). Moreover, this method is implemented in a Decision Support System (DSS). In the next section the FITradeoff DSS has been presented, and the decision process using the DSS has been discussed.

4 FITradeoff Decision Support System

The FITradeoff Decision Support System (DSS) has be constructed to implement the FITradeoff method. This DSS become a useful resource to aid DMs in the decision process using the FITradeoff, and it is available for free at www.fitradeoff.org.

The general phases to conduct the decision process within the FITradeoff DSS has been described below.

Firstly, when DMs use the FITradeoff DSS, they order the criteria according to their relative importance, based on the range of consequences. It is possible to perform the ordering of criteria scaling constants through either global evaluation or pairwise comparisons. Figure 1 shows the DSS screen during the ordering of criteria scaling constants for global evaluation.

Based on the ordering of the scale constants, it is possible to obtain the first inequality, illustrated in Eq. (8), in which n in the total number of criteria presented in the problem. The inequality will be inserted in a Linear Programming Problem (LPP). In some cases, the solution is reached with just this inequality, and the process is complete (Mendes et al., 2020). Otherwise, it is necessary to continue the decision process.

$$k_1 > \cdots > k_i > k_{i+1} > \cdots > k_n \qquad (8)$$

Thus, DMs can express preferences between pairs of consequences of adjacent criteria, in the elicitation by decomposition, or between alternatives, in a holistic way. During the elicitation by decomposition, DMs are asked to
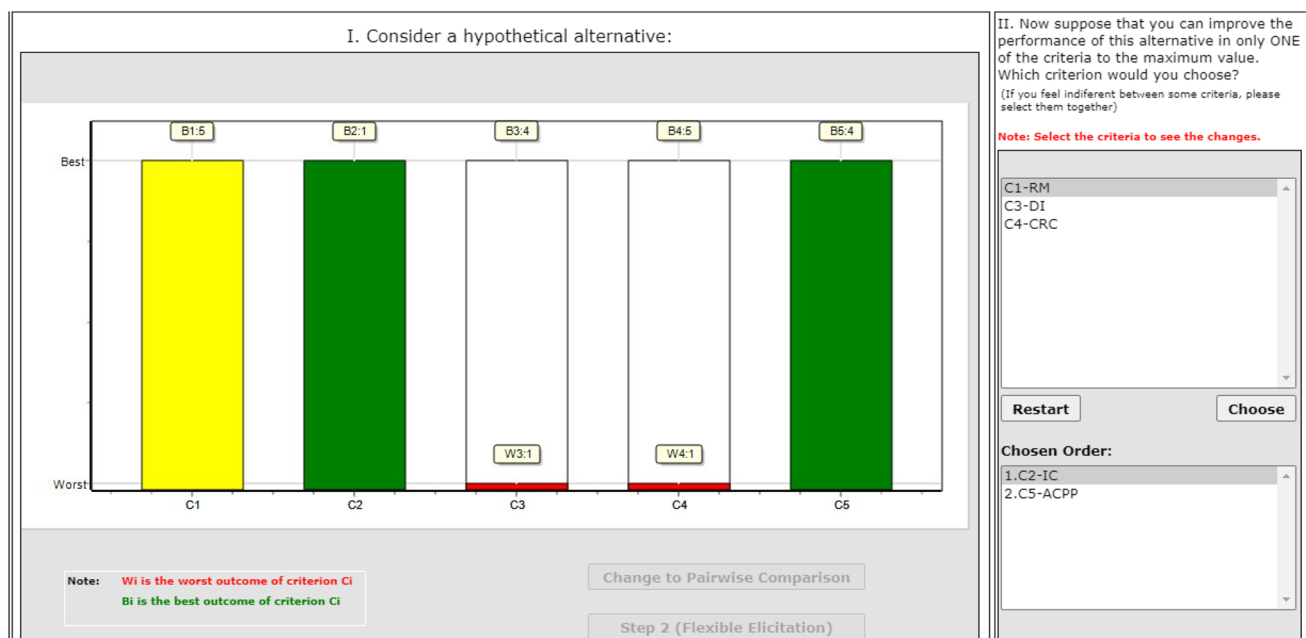

Fig. 1 Order of criteria scaling constants

choose between two consequences. As illustrated in Fig. 2, DMs compare an intermediate consequence in the Criterion 3 and the best consequence in the criterion 4. After that, DMs can respond in one of the following ways: preferential response (consequence A or consequence B), indifference or no Answer.

For instance, if DMs answer Consequence A, the inequality (9) will be inserted in the LPP model. On the other hand, if DMs answers Consequence B, the inequality (10) will be included. For indifference between the two consequences, the inequality (11) will be inserted in the LPP model.

$$k_j v_j(x'_j) > k_{j+1} \tag{9}$$

$$k_j v_j(x''_j) < k_{j+1} \tag{10}$$

$$k_j v_j(x''_j) = k_{j+1} \tag{11}$$

As information is provided to the model, partial results can be verified, as shown on the right side of Fig. 2. Partial results in the choice problematic are a set of Potentially Optimal Alternatives (POA), which continue in the decision process. In the rank problematic, partial results are the partial ranking of alternatives.

When DMs click on "Show Current Results," they can observe the performance of these alternatives using graphical (bar graphic, bubble graphic, and spider graphic) and tabular visualizations. In holistic evaluation, graphics and tables are used to support DM to compare alternatives. Thus, if DMs desire, they can also choose "Perform the Holistic pre-analysis" to express dominance relations between them (Fig. 3).

Concerning the holistic evaluation, several behavioral studies have been performed using neuroscience tools (Pessoa et al., 2021a, b; Roselli & de Almeida, 2020a, b; Roselli et al., 2019a, b; da Silva et al., 2021). These studies have resulted in the Success-Based Decision Rule (SBDR), which represents an important improvement for the DSS (Roselli & de Almeida, 2021). This rule provides recommendations for the analyst, and consequently DMs, of whether or not to use visualizations to define a dominance relation between alternatives. The SBDR is available in the FITradeoff DSS in the Analyst Login.

In addition, for the rank problematic, the DSS allows the user to view partial results in a table or Hasse diagram (Fig. 4). The diagram represents the positions in which the alternatives are presented in the ranking, highlighting the peer-to-peer dominance relations established throughout the process by means of arcs. In this diagram, the directed arrows indicate the dominance relations, and the non-directed arrows indicate the indifference relations.

Finally, FITradeoff DSS also provides a chart containing the range of admissible values for the scale constants of each criterion (Fig. 5). This chart updates with each question answered, which permits DMs to monitor weight space throughout the process. Moreover, the FITradeoff DSS allows DMs to perform sensitivity analysis, in which

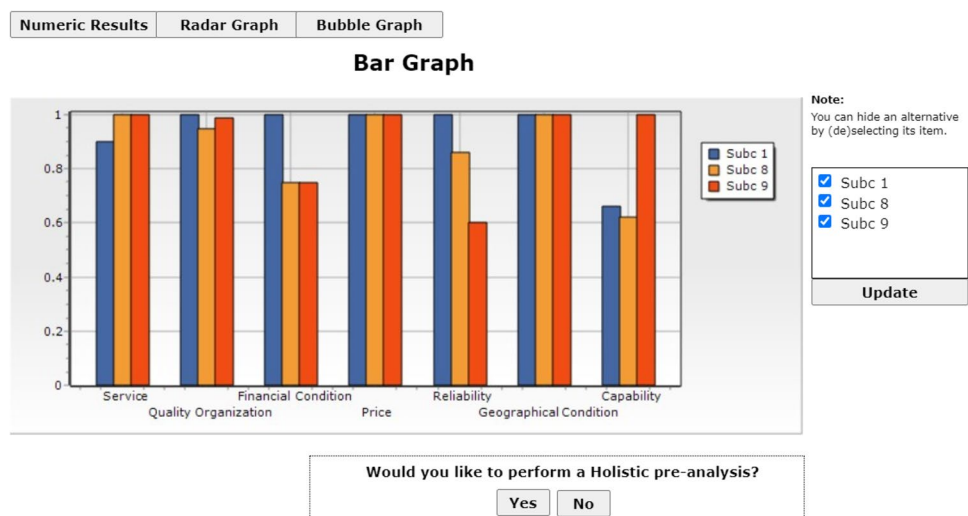**Fig. 2** Elicitation by decomposition

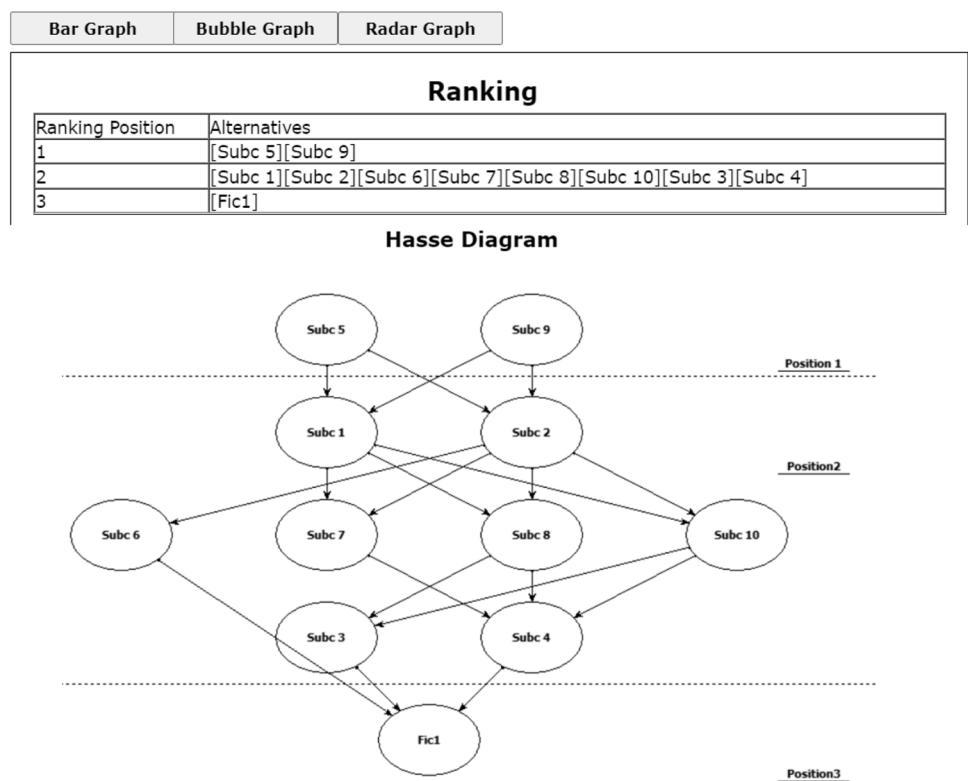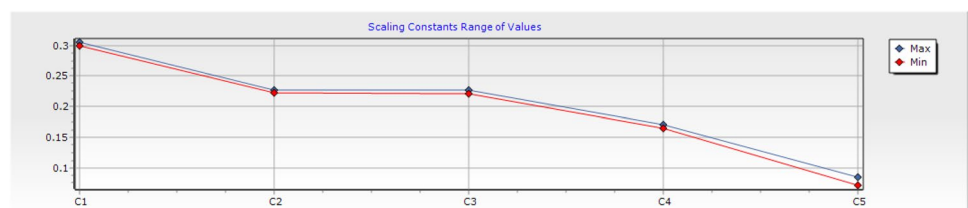**Fig. 3** Bar graph

Fig. 4 Table and Hasse Diagram

Fig. 5 Scaling constants range of values

different scenarios are generated to test the robustness of solutions.

Concerning the FITradeoff DSS, it is worth to mention that this DSS is not new or developed to compose this paper. It can be used to solve similar MCDM/A problems in MAVT scope.

Several applications using the FITradeoff Method, and consequently it DSS, are already present in the literature. Carrillo et al. (2018) used the method to select better technologies for the agricultural sector. Monte and Morais (2019) used the method to support water management. In Frej et al. (2017) FITradeoff method is used to select suppliers. In the energy context, the FITradeoff method was used to select the best type of renewable energy for Brazil (Fossile et al., 2020), as well as to evaluate the best technology for generating electricity (Kang et al., 2018). To indicate the best location for the construction of a security unit for the Military Police (Silva et al., 2019).

The application solved in this study is original, being the focus of this paper. In the next section, the ranking of twenty-eight actions involved in a Compliance Program is discussed. The questions presented during the decision process within the DSS, and the answers provided by the responsible of compliance program are unique. If another problem has been solve using this DSS, with other DMs, the decision process will be completely different, since the method is conducted according to DMs preferences.

5 Solving a Compliance Decision Problem with the FITradeoff Method

5.1 Compliance Problem Description

The concept of compliance program refers to processes by which compliance decisions are made within an organization with the aim to set up control structures that guide individual action so that the various stakeholders can act in line with the organization's interests (Biron & Manirabona, 2020). In Brazil, law number 12.846 (Anticorruption law) was enacted in 2015. This law impacted companies and boosted the search for compliance programs, which are a useful approach to confronting this situation and solving problems with greater agility.

With this background, this application addresses the situation of a company that needs to improve the performance of its compliance program, taking into account the resource restriction generated by the crisis. Therefore, this study aims to define the order of execution of actions which compose a Compliance Program in a Brazilian Company, to define which one the order of importance to execute these action in the company.

This problem is started to investigate in Pessoa et al. (2021), however, after a more detailed investigation, it was noted the need to expand the study because once the set of alternatives was changed and the number of criteria expanded, the decision maker reported a change in their preferences.

The DM is a representative of the company's management. In this problem, four objectives were identified as follows:

Prevent, detect, and punish unethical business conduct. Assess the risks associated with the business that could cause legal sanctions, financial losses, and damage to the organization's image. The variable considered to assess the achievement of this objective is risk management (RM).

Facilitate the implementation of actions. This objective is important in view of the fact that organizations have budgetary restrictions. The variable considered to assess the achievement of this objective is implementation cost (IC).

Promote an ethical and wholesome business environment. This objective is related to reducing potential conflicts of interest between employees and the company in addition to providing a work environment free from harassment, discrimination of any kind, and other practices that endanger the well-being of members, employees, and partners in society. The variables considered to assess compliance with this objective are Diversity and Inclusion (DI) and Communication and Reporting Channels (CRC).

Demonstrate the company's commitment to the compliance program. This objective is related to disseminating values, policies, and procedures pertaining to company conduct. The variable considered to assess the achievement of this objective is Incorporation of Compliance Program Principles (ICPP).

As discussed, five criteria were established assessing the decision objectives. These criteria can be described as:

Risk Management (RM). Indicates the degree to which an alternative can contribute to identifying and mitigating risk situations (Table 1).

Implementation Cost (IC). Indicates the amount disbursed from the budget for an alternative to be implemented (Table 2).

Diversity and Inclusion (DI). Indicates the degree to which an alternative can contribute to the diversity and inclusion of the staff.

Communication and Reporting Channels (CRC). Indicates the degree to which an alternative can contrib-

Table 1 Description of the levels of the attribute Risk Management

Levels	Description
1	It contributes negatively to the organization's risk management, making it difficult to identify risk situations.
2	It contributes weakly to the organization's risk management such that it only helps in the identification of risk situations.
3	It does not influence the organization's risk management.
4	It contributes moderately to the organization's risk management such that it helps in the identification and measurement of risk situations.
5	It contributes strongly to the organization's risk management, assisting in the identification, measurement, and monitoring of risk situations in addition to establishing an action plan to mitigate such situations.

Table 2 Description of the levels of the attribute "Implementation cost"

Levels	Description
1	The implementation cost is very low, less than 20% of the total budget allocated to the project.
2	The implementation cost is low, greater than 20% but less than 40% of the total budget allocated to the project.
3	The implementation cost is moderate, greater than 40% but less than 60% of the total budget allocated to the project.
4	The implementation cost is high, greater than 60% but less than 80% of the total budget allocated to the project.
5	The implementation cost is very high, greater than 80% of the total budget allocated to the project.

Table 3 Description of the levels of the attribute "Diversity and inclusion"

Levels	Description
1	It contributes weakly, as it does not clarify how much the issue of diversity and inclusion is valued by the organization, which could foster disrespect of the organization's principles.
2	There is no interference in the issue of diversity and inclusion.
3	It contributes in a moderate way, as it supports the idea of discussing diversity and inclusion.
4	It contributes strongly, as it allows employees to better perform their duties regardless of personal choices or characteristics, making the corporate environment respectful and welcoming. Thus, the principles of diversity and inclusion are widely discussed, disseminated, and respected.

Table 4 Description of the levels of the attribute "CRC"

Levels	Description
1	It contributes weakly to increasing the efficiency of the communication and reporting channels, as it does not guarantee security and anonymity.
2	It does not interfere with reporting channels.
3	It contributes moderately to increasing the efficiency of communication and reporting channels, ensuring security and anonymity.
4	It contributes strongly to increasing the efficiency of communication and reporting channels, positively impacting security, anonymity, and impartiality.
5	It contributes very strongly to increasing the efficiency of the communication and reporting channels, positively impacting security, anonymity, impartiality, and response time.

ute to increasing the efficiency of communication and reporting channels.

Incorporation of Compliance Program Principles (ICPP). Indicates the degree to which an alternative can contribute to proving the company's commitment to the compliance program (Tables 3, 4 and 5).

Continuing the construction of the model, it is necessary to identify the alternatives. For this problem, the alternatives are the actions that the company can execute for its performance in the compliance program improves. Thus, twenty-eight alternatives were identified, which were organized into nine groups according to their relevant themes. The

Table 5 Description of the levels of the attribute "ICPP"

Levels	Description
1	It does not make clear the company's commitment to the compliance program.
2	It weakly incorporates the principles of the compliance program but fails to clarify their proper practice.
3	It moderately incorporates the principles of the compliance program but fails to address some questions related to company conduct.
4	It strongly incorporates the principles of the compliance program, clarifying their proper practice and helping to disseminate values, policies, and procedures related to company conduct.

Table 6 Decision Matrix

Criteria Alternatives	RM	IC	DI	CRC	ICPP
A1	5	2	3	5	4
A2	3	1	4	4	4
A3	5	3	3	5	4
A4	5	1	4	4	4
A5	5	3	4	5	4
A6	4	4	4	5	3
A7	3	3	4	3	3
A8	5	2	4	3	2
A9	3	2	4	3	2
A10	3	4	4	2	2
A11	5	1	4	3	3
A12	4	1	4	2	4
A13	4	1	2	2	4
A14	4	1	3	2	3
A15	5	1	2	2	3
A16	5	1	2	2	4
A17	5	1	4	2	4
A18	4	1	3	2	2
A19	4	1	4	2	3
A20	5	2	2	5	3
A21	5	1	4	2	3
A22	5	1	3	4	3
A23	5	3	3	2	4
A24	5	5	3	5	3
A25	5	4	2	2	2
A26	4	5	4	2	1
A27	3	4	4	2	1
A28	5	4	4	5	4

performance of each alternative against problem criteria is presented in the Table 6.

Group1: Internal communication.

- A1: Expand reporting channels for different media, for example e-mail, telephone, website, etc.
- A2: Disclose the code of conduct on the organization's website.
- A3: Periodically monitor complaints that reach the denouncement channels.
- A4: Disseminate the idea of the compliance program through lectures, courses, and meetings.
- A5: Create an independent and autonomous conduct committee to handle issues related to the code of conduct and reporting channels.
- A6: Provide adequate communication between the institution's areas, ensuring clear understanding between them.

Group 2: Human Resources.

- A7: Develop more inclusive human resources policies.
- A8: Identify areas with specific training and capacity-building needs.
- A9: Invest in continuous development of employees.
- A10: Invest in technologies that support working with physical disabilities.
- A11: Define the training and qualification plan applicable to employees and relevant outsourced service providers.
- A12: Ensure that employees are aware of their roles and responsibilities.

Group 3: Suppliers.

- A13: Encourage suppliers to commit to the organization's code of conduct.
- A14: Verify information and reputation of potential business partners.

Group 4: Legislation.

- A15: Create a survey of the legislation regulating company activities and monitor updates to current legislation.
- A16: Analyze the current state of the company in relation to legislation and regularize pending issues.
- A17: Prepare opinions on compliance topics to ensure the correct assessment of any risks and strategies for control and mitigation.
- A18: Review the content, adequacy, and compliance of materials and documents.

Group 5: Ethics.

- A19: Investigate employees who may be involved in public cases of corruption.
- A20: Monitor transactions and media to detect unusual transactions and prevent business with disreputable parties that are suspected of involvement in illegal activities or may damage the institution's reputation.
- A21: Eliminate the practice of loans and guarantees that favor any employee.
- A22: Prepare specific documentation to inhibit and punish the misuse of information.

Group 6: Management.

- A23: Perform internal audits to analyze opportunities for improvement and highlight possible failures.
- A24: Conduct external audits to certify the integrity and veracity of a company's accounts.
- A25: Technically assess the security infrastructure and cyber-security risks that permeate the busines

Group 7: Social responsibility

- A26: Assess and reduce the environmental impact of the company's use of natural resources.
- A27: Encourage projects that help in the development of local communities.

Group 8: Organizational environment

- A28: Establish a permanent, effective, independent compliance area with access to any information or facet of the institution and with adequate resources (A28).

5.2 Using the FITradeoff Method to Support the Compliance Program

In this study, the FITradeoff method has been applied since the responsible for the compliance program presents compensatory rationality about the consequences in the decision matrix (Table 6) and your preference structure is in MAVT scope (Keeney & Raiffa, 1976).

In the FITradeoff DSS, the DM chose to order the weights of criteria in a global evaluation. As a result, the following order was obtained (Eq. 12). At this moment, only two positions have been defined in the ranking. Thus, the DM continues the process expressing preferences in elicitation by decomposition.

$$k_{IC} > k_{ACPP} > k_{RM} > k_{CRC} > k_{DI} \qquad (12)$$

During the elicitation by decomposition, eight questions have been answered by the DM, in the format of question showed on Fig. 2. For instance, in the first elicitation question, it was compared an intermediate consequence for the criterion "Implementation Cost" and the best consequence for the criterion "Diversity and Inclusion". The DM informed that the consequence A was preferable to B, so the following inequality (Eq. 13) was inserted into the LPP model.

$$k_{IM} * 0{,}5 > k_{DI} \qquad (13)$$

As the DM answers questions in FITradeoff, more constraints are obtained such that the weight space gets tightened. In this context, after eight questions were answered, the LPP model managed to generate seven ranking levels (Fig. 6). Table 7 summarizes the application of the FITradeoff method. In cycle 0 we have only one ranking level because only the ordering of the scale constants was done by the decision maker. From cycle 1 onwards, the number of ranking levels will change as more questions are answered. So, the number of ranking levels changes over time dynamically as can be seen in the last column of Table 7.

In the seven-position ranking, there are some incomparability relations between the alternatives in positions 2 and 3 (Fig. 6). In position 2, there is an incomparability between the alternatives A1, A17, A2, A6, A16, A22, A11, A12, A5, A13, A3, A20, A21, A15, A19, A14, A28, A8, A18, and A23.

Hence, at this point in the decision process, the DM wished to perform the holistic evaluation in order to better explore these alternatives. The system allows the DM to choose which ranking position he wants to undergo the holistic assessment (Fig. 7). In this case, the DM decided to perform the holistic evaluation for the second position in the ranking and compare alternatives A1 and A17. The DM chose to perform the analysis in tabular form.

From the holistic evaluation, the DM decided that A1 is preferable to A17, since A1 presents highest performance in criteria "RM" and "CRC", and higher performance than A17 in criteria "IC". Thus, based on DM preferences, A1 dominates A17 in this problem. Thus, after the holistic evaluation, a new pre-order was obtained. From that moment on, the alternatives A1 and A17 occupied the second and third position in the ranking, respectively, according to the DM's preferences.

The DM chose to continue the decision-making process by performing a new holistic assessment for the fourth position in the ranking. This time the evaluated alternatives were A6 and A22. So, from the holistic evaluation, the DM decided that A6 is preferable than A22. That is, A6 dominates A22 in this problem. After that, these alternatives occupied the fourth and fifth positions in the ranking,

Fig. 6 Hasse diagram after eight elicitation questions
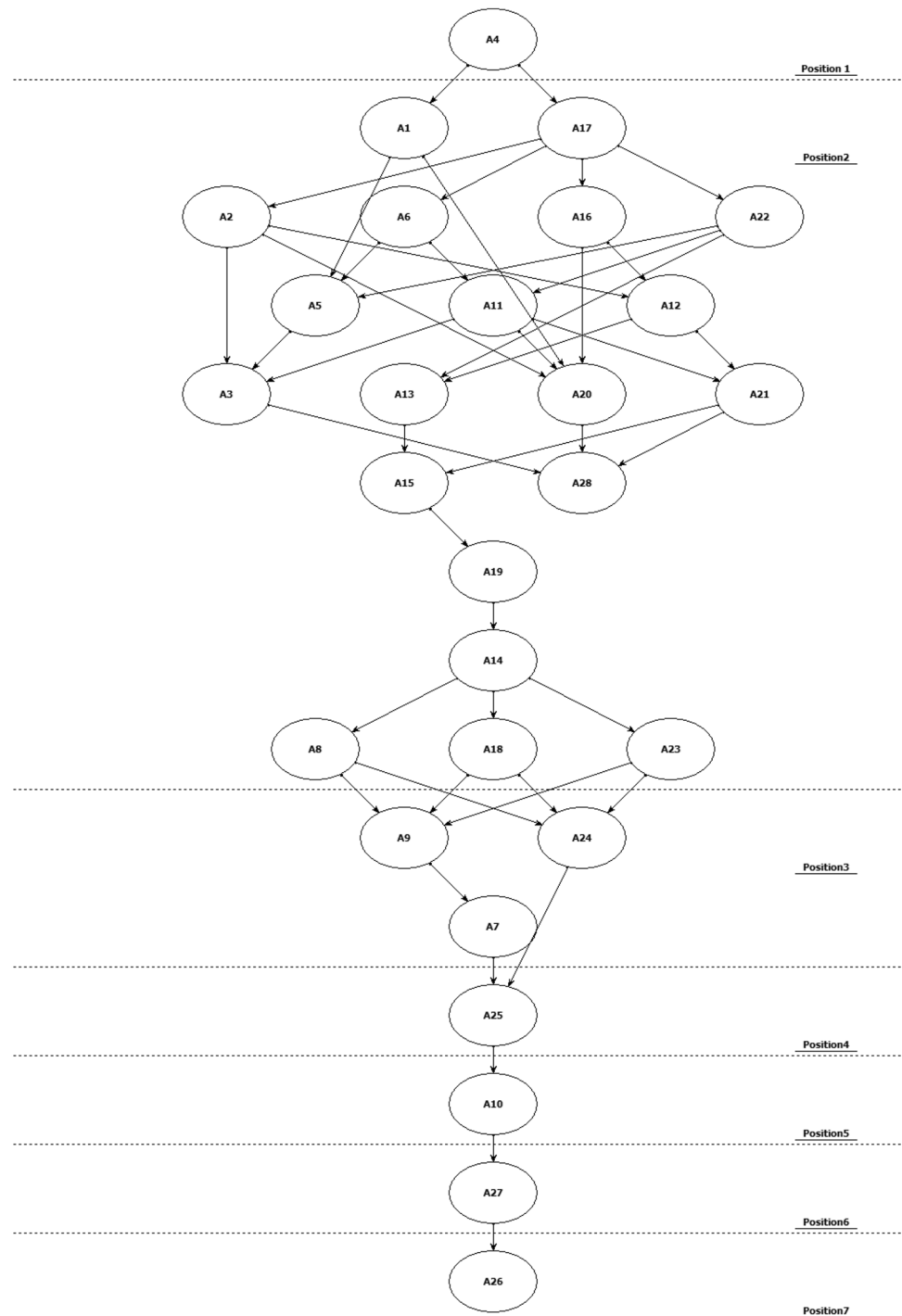

respectively. The new ranking is shown in Fig. 8. Directed red arrows indicate dominance relations defined by holistic evaluation. Non-directed grey arrows indicate indifference relations; it is possible to identify these relationships in the sixth, eighth, and fourteenth positions.

Finally, alternative A4 (Disseminate the idea of the compliance program through lectures, courses, and meetings) occupied the first position in the ranking, followed by alternative A1 (Expand reporting channels for different media, for example e-mail, telephone, website, etc.). At this point of the decision process, the DM chose to finish the process since judges the information obtained as sufficient.

Table 7 Summary of the application of FITradeoff

| Cycle	Consequence A	Consequence B (best of)	Answer	# Ranking levels
0	-	-	Ordering	3
1	50%: Implementation cost	Diversity and inclusion	A	3
2	50%: Implementation cost	Incorporation of Compliance Program Principles	B	4
3	50%: Incorporation of Compliance Program Principles	Risk management	B	4
4	50%: Risk management	Communication and reporting channels	B	5
5	75%: Communication and reporting channels	Diversity and inclusion	A	6
6	75%: Implementation cost	Incorporation of Compliance Program Principles	A	7
7	75%: Risk management	Communication and reporting channels	A	7
8	75%: Communication and reporting channels	Diversity and inclusion	B	7

Fig. 7 Holistic evaluation screens
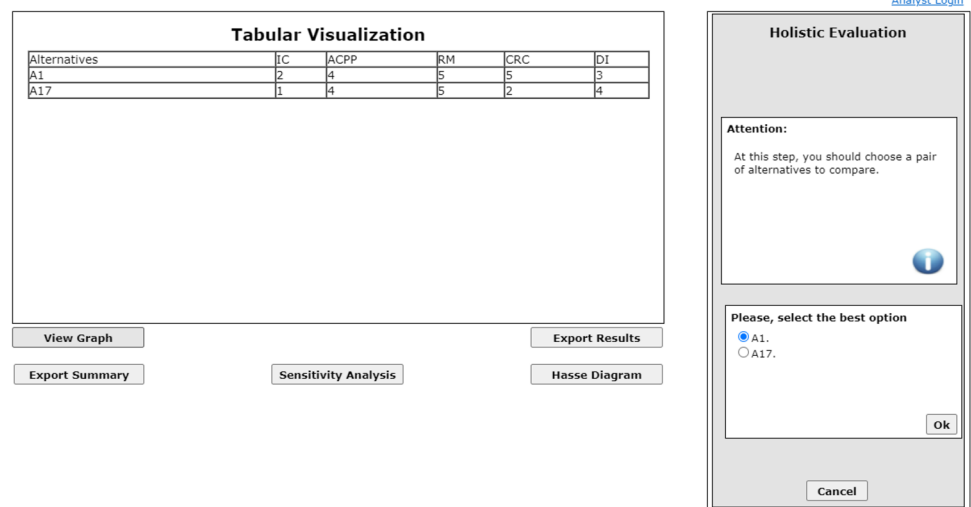
6 Discussion of Results

This study aimed to rank the actions (alternatives) that support a Brazilian company in performing a Compliance Program. Hence, twenty-eight alternatives were created considering eight groups of themes. Also, four objectives have been defined for the Compliance Program by the decision-Maker (DM), and five criteria were established to measure these objectives.

Since DM preference structure is in accordance with the MAVT concepts (Keeney & Raiffa, 1976), the FITradeoff method has been considered to support this ranking problem. During the decision process, the DM interacts with the FITradeoff Decision Support System (DSS) and conduct the alternatives ordering using this DSS. The process is conducted in eight cycles involving the elicitation by decomposition and three comparisons of alternatives using the holistic evaluations.

After that, the DM decides to stop the process since judges the partial ranking as sufficient. As result, five alternatives have been defined in the first five positions of the ranking:

- A4: Disseminate the idea of the compliance program through lectures, courses, and meetings (Group1: Internal communication).
- A1: Expand reporting channels for different media, for example e-mail, telephone, website (Group1: Internal communication).
- A17: Prepare opinions on compliance topics to ensure the correct assessment of any risks and strategies for control and mitigation (Group 4: Legislation).
- A6: Provide adequate communication between the institution's areas, ensuring clear understanding between them (Group1: Internal communication).

Fig. 8 Final ranking
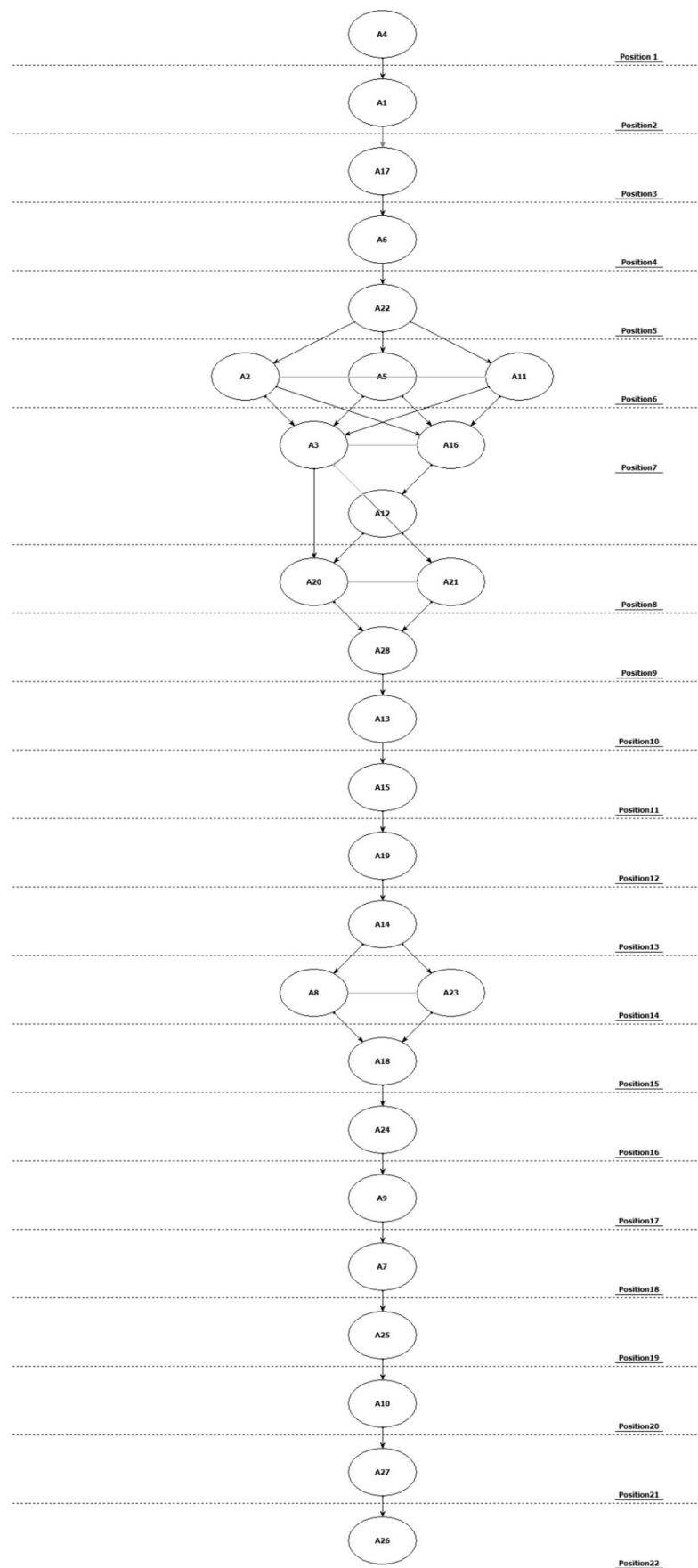
- A22: Prepare specific documentation to inhibit and punish the misuse of information (Group 5: Ethics).

Thus, it is possible to observe that most of the alternatives are related to Internal Communication. Hence, the DM considered that these alternatives are sufficient to direct the efforts to execute the Compliance Program, and in special this theme can be the focus to start the Compliance Program in this company. It is worth to mentioning that one of the limitations of this applications is considered only one decision-making. In practice, the actions generally are defined by a group of decision-makers.

7 Conclusions

The technology can support decision-making processes that allow managers to identify efficient solutions to complex problems. This paper has shown how FITradeoff DSS is useful to decision makers in times of crisis, particularly as these situations demand greater accuracy in the decision-making process.

To better demonstrate its efficacy, a practical application of the method was performed using its DSS. The application addressed a problem situation involving an organization attempting to improve its performance in relation to its compliance program. This problem has a particular significance in Brazil where the search for compliance programs has been increasing since the adoption of the anticorruption law.

Thus, twenty-eight alternatives were created, and these alternatives were evaluated against five criteria. The ranking of the alternatives was obtained by the FITradeoff method, combining the two preference-modeling paradigms—the elicitation by decomposition and the holistic evaluation. The results show the first alternative in the ranking to be the dissemination of the idea of the compliance program through lectures, courses, and meetings.

For future studies, this study can be performed considering a portfolio problematic, in order to obtain the best alternatives in the group subjected to a monetary constant. Also, a group decision-making problem can be either considered. Moreover, other problems can be developed considering the crises scenarios, such as the global crisis caused by the COVID-19 pandemic.

The COVID-19 pandemic affected not only health but all areas of society, companies have had to reinvent themselves to ensure the sustainability of their activities. For example, the need for remote work in most organizations has increased risks for companies without well-defined standards and procedures. Employee misconduct poses a threat to business integrity, which can damage an organization's reputation, and company image may be difficult to repair. Consequently,

financial losses may be incurred, or the very survival of the company jeopardized.

Declarations

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