Organizational Mindfulness Assessment and Its Impact on Rational Decision Making

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Abstract: Ever since its appearance in the organizational research literature, the importance of organizational mindfulness has consistently increased. For this reason, this study has the following two research objectives: first, to explore the positive effect of organizational mindfulness (OM) on the rationality of the decision-making process and second, to propose a framework to assess the extent of its presence in organizations. For the first objective, exploratory partial least square structure modeling (PLS-SEM) was conducted, while for the second goal, an evaluation framework based on the Analytic Hierarchy Process (AHP) was developed. Surveying 117 decision-making leaders in the field, organizational mindfulness and its constitutive processes that include resistance to simplify interpretations, preoccupation with failure, sensitivity of operations and commitment to resiliency with deference to expertise, were empirically studied. A significant positive effect of these dimensions and OM as a whole on the rationality of the decision-making process was statistically shown. For this reason, it is important to assess the extent of the presence of organizational mindfulness in organizations. The use of this AHP-based OM evaluation framework is demonstrated for the case of the complex health sector in Colombia.

Keywords: organizational mindfulness; collective mindfulness; Colombian health sector; rational decision making; decision rationality; AHP evaluation

1. Introduction

It has been suggested that the presence of organizational mindfulness, also known as collective mindfulness, increases the likelihood of an organization to make decisions that take into account the state of the specific organization in relation to its context [1–3]. Currently, companies operate in environments that pose many different kinds of challenges; therefore, the decision-making process plays an important role in the survival of an organization. The rationality with which this process is achieved, and the contextual factors that affect it, are particularly relevant for highly complex organizations operating in vital dynamic environments. Colombia’s leading health institutions are highly complex; therefore, their ability to adapt to a changing environment is critical for their survival because a lack of ability to adapt to change has been associated with failure in the hospital industry [4]. Since organizational mindfulness allows the identification of information and weak signals in the environment that could be easily ignored, as well as information analysis within the context of the organization, it is hypothesized here that it is possible for OM to have a positive effect on the rationality of the decision. Therefore, it is important to assess the level of organizational mindfulness in organizations in the health sector; the present study proposes a framework to do so.

In conclusion, this study’s objectives are, first, to quantitatively explore the impact of organizational mindfulness on the rationality of the process of making strategic decisions and second, to assess the presence of organizational mindfulness in highly complex health institutions in Colombia, using the Analytic Hierarchy Process (AHP) for the development of...
an evaluation framework. Both objectives constitute important and novel contributions in the study of both organizational mindfulness and the rationality of strategic decision making.

2. Literature Review

Based on the established objectives, the extant literature related to the key elements in this research was reviewed. These key elements are the rationality of strategic decisions, organizational mindfulness and the use of the Analytic Hierarchy Process (AHP) as an evaluation framework.

2.1. Organizational Mindfulness and Rationality

Over the last few decades, research on decision making has been increasing steadily both theoretically [5] and empirically [6]. The research has focused on the study of variables that influence the strategic decision-making process, and rationality has been recognized as being particularly important [7–13]. For this reason, the dependent variable for the present study is rationality in the decision-making process, defined as the “the extent to which the decision process involves the collection of information relevant to the decision, and the reliance upon analysis of this information in making the choice to choice” [7].

However, this rationality in the strategic decision-making process cannot be properly understood if it is not analyzed within its context [14–16]. Because of this, the present study focused on a group of internal contextual factors in the organization that collectively make up organizational (or collective) mindfulness (OM), which can be defined as “a very high state of awareness of discriminatory details” [1].

Organizational research has recognized the importance of collective mindfulness in the operations of highly reliable organizations (HRO); that is, organizations whose performance level widely surpasses reasonable expectations, such as aircraft carriers, nuclear plants, and high level surgical units [1,17]. Within this theoretical framework, a set of collective procedures have been identified that, when acting jointly, create a collective state of full organizational awareness that has been described as organizational mindfulness [1,3].

These highly reliable organizations share five processes that lead to the development of an elevated state of collective awareness, organizational mindfulness (OM), which positively impacts the management of the unexpected within the organization [1]. These processes are preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations, commitment to resilience and deference to expertise [1,17–19]. Preoccupation with failure means continually considering the possibility that things may go wrong, treating any mistake, no matter how small, as an indicator of the emergence of potentially bigger mistakes. Reluctance to simplify interpretations means actively questioning precepts and operational assumptions and not assuming that they are automatically valid, motivating the generation of new ideas and recognizing that there are not simple answers to complex problems. Sensitivity to operations means developing and maintaining an integrated understanding of the operations at all times and by all the members of the organization. Commitment to resilience implies an increase in the collective ability to adapt, improvise and learn in order to better recuperate from unexpected events. Lastly, deference to expertise occurs when those who have the most knowledge and experience about a particular problem are highly respected, motivated and expected to act, even in the absence of managerial directives [17,20].

These processes, OM dimensions, allow organizations to develop a highly elevated state of alertness and self-understanding about their processes and the environment, continuously revise and challenge their sense of control, and keep a continuous watch on the environment in order to be ready to quickly respond to the unexpected. Because of this, organizational mindfulness has been found to be important in particularly difficult contexts that are characterized by complexity, dynamism and an intolerance of mistakes, such as the health sector.

Different studies have linked the presence of organizational mindfulness with higher commitment and labor performance [21], higher client satisfaction [22], more efficient
allocation of resources [23], greater innovation [24], and better quality, security and reliability [24]. Nevertheless, the expected link between organizational mindfulness and the rationality of the decision-making process has not yet been empirically tested despite its importance. The present study aims to fill this gap in the literature.

Additionally, it has been argued that in spite of the alluring theoretical support, there is little evidence of organizational mindfulness as a higher order construct comprised of the five proposed dimensions [25]. This study conceptualizes OM as a second-order construct and will measure it accordingly for the purposes of hypothesis testing.

2.2. Evaluation of Organizational Mindfulness Using the Analytic Hierarchy Process (AHP)

Given the importance of organizational mindfulness, it is necessary to assess the extent of its presence in organizations. The original work on this subject by Weick and Sutcliffe [1] proposed some questions for this purpose; however, these have not been statistically validated. Some instruments have been developed to measure OM as a construct by itself or in terms of the constituent processes in the health sector [18] and the information systems area [2]. There have been studies on the development of new instruments focused on the constituent cognitive processes of organizational mindfulness, such as those of Ray, Baker, Plowman [25] and Mu and Butler [3], among others. Nevertheless, the present study used the approach developed by Mu and Butler [3], which consists of a practical evaluation framework based on the Analytic Hierarchy Process (AHP). This AHP framework also allows the relative importance of the different dimensions of organizational mindfulness that are specific to the organization to be established. This AHP evaluation framework makes it extremely useful as a business dashboard for the assessment of collective mindfulness within an organization or sector. The AHP framework was chosen because it is the most common decision-making methodology worldwide due to its ease in incorporating the perspectives of multiple stakeholders and the use of simple comparison questions that do not require the participants to be familiar with the intricacies of the decision-making method.

The Analytic Hierarchy Process (AHP) was developed by Thomas L. Saaty [26] and is a method to select, prioritize and evaluate alternatives based on pairwise comparisons of the importance of the evaluation criteria. These pairwise comparisons constitute the decision maker’s judgments that are entered into a pairwise comparison matrix. The judgments are checked (and adjusted if necessary) to ensure that the level of inconsistency of the whole matrix of judgments is reasonable (this must not be more than 10% with respect to one random matrix). Inconsistency refers to the extent that the judgments may violate the law of transitivity (e.g., in the case of ideal consistency, if the first criterion is twice as important as the second, and the second is also twice as important as the third, then the first criterion should be four times as important as the third). The pairwise comparison matrix is used to calculate the relative importance of the criteria in order to evaluate the alternatives. The evaluation of the alternatives can be done in a similar way through pairwise comparisons of the alternatives with respect to each criterion using the rating scales and calculate the weighted sum to obtain the global ratings of the alternatives (synthesis). The steps 1 and 2 will be explained with a simple model here (Figure 1) and

2.3. Theoretical Foundations for the Analytic Hierarchy Process

Next, the basic concepts of the AHP are explained. Although the theoretical foundations were created by Saaty [27], Brunelli [28] and Ishizaka and Nemery [29] have written very accessible discussions about the topic. The AHP methodology, for the case of developing an absolute model, that is, one where the alternatives are evaluated using rating scales, requires the following steps: (1) develop a decision hierarchy (goal, criteria and alternatives); (2) evaluate the relative weights of the criteria; (3) develop rating scales for each of the criteria (4) evaluate the alternatives with respect to each of the criteria using the rating scales and calculate the weighted sum to obtain the global ratings of the alternatives (synthesis). The steps 1 and 2 will be explained with a simple model here (Figure 1) and
the steps 3 and 4 will become clear when developing the actual evaluation framework for this research in Section 5.2.

Figure 1. Example of a basic AHP ratings model.

Step 1—Development of the AHP hierarchy: In a basic AHP decision hierarchy, the following three levels exist: the goal, criteria and the alternatives (in more complex hierarchies, the criteria and alternatives can have sub-criteria and sub-alternatives). For the purpose of this explanation only the goal and criteria are needed.

Step 2—Evaluation of the relative importance of the criteria: In the AHP hierarchy shown in Figure 1, the criteria C1–C3 are utilized to evaluate the alternatives. However, not all criteria have the same importance in the decision-making process. C3 might be more important than C2 for one institution, and the opposite may be true for another. In AHP, the criteria must be compared pairwise with respect to the goal to derive the relative importance of the criteria, using an intensity scale developed for this purpose as shown in Table 1.

Table 1. Intensity scale for the pairwise comparison of criteria.

| Relative Intensity | Importance | Description                                               |
|--------------------|------------|-----------------------------------------------------------|
| 1                  | Same       | Both criteria are equally important                       |
| 3                  | Moderate   | One criterion is mildly more important than the other      |
| 5                  | Strong     | One criterion is strongly more important than the other   |
| 7                  | Very Strong| One criterion is very strongly more important than the other |
| 9                  | Extreme    | One criterion is extremely more important than the other   |
| 2,4,6,8            | Intermediate Values | A compromise needs to be reached                      |

The scale in Table 1 is used to ask questions such as, “With respect to the intended decision, is criterion ‘C2’ or ‘C3’ more important?” If we consider that C3 is mildly more important than C2, we are mathematically establishing that C3/C2 = 3 (using the scale in Figure 2). It must be taken into account that, in the AHP, this judgement automatically implies that the reciprocal comparison C2 with C3 will produce the ratio C2/C3 = 1/3. This is the reciprocity rule that can be mathematically expressed as Cij = 1/Cji, where Cij can be any element (i corresponds to the row and j to the column) in the pairwise comparison matrix (PWC).

```
|    | C1 | C2 | C3 | Weights |
|----|----|----|----|---------|
| C1 | 1  | 5  | 1  | 0.481   |
| C2 | 1  | 1/3| 1  | 0.114   |
| C3 | 1  | 1  | 0.405 |
```

Figure 2. Pairwise comparison matrix.
These comparison judgements are input into a PWC matrix as shown in Figure 2. Note that the pairwise comparison judgements of the importance of C1/C1, C2/C2 and C3/C3 will always be 1 in the diagonal of the PWC, given that the importance of one criterion compared with itself (Cij / Cij) will always be equal. Furthermore, notice that we only need the comparison judgments in the upper part of the matrix (shaded area). The judgements in the lower part of the matrix are the reciprocal values of the judgments in the upper part of the PWC matrix as shown in Figure 2.

Pairwise comparison matrix consistency verification: Another important element to consider for the PWC matrix is its extent of consistency, that is, to what extent is the principle of transitivity respected. Referring to Figure 2, if the importance of C1/C2 = 1/5, and the importance of C2/C3 = 1/3, then it should be expected, based on the principle of transitivity, that C1/C3 = (1/5) × (1/3) = 1/15. In mathematical terms, Cij = Cik × Ckj, where Cij is the comparison of criteria i and j. Nevertheless, this is not the case in Figure 2 where C1/C3 = 1, as stated by the decision maker in this example. This means that there is some degree of inconsistency in this PWC matrix, which will be explained next.

Any PWC matrix that follows the rules of reciprocity and transitivity is consistent. The reciprocity rule is easy to comply with; every time the judgement Cij is obtained (as a general rule) judgement Cji is registered as the comparative reciprocal value 1/Cij. On the other hand, it is more difficult to comply with the rule of transitivity because the decision maker answers each PWC without checking any previous one. This is harder, in particular, when only the verbal comparisons of Table 1 are used.

Deriving the criteria weights in the AHP only makes sense if the comparative matrix is consistent or almost consistent; Saaty [27] proposed the following consistency index (CI) to evaluate this:

\[
\text{CI} = \frac{\lambda_{\text{max}} - N}{N - 1}
\]

where \(\lambda_{\text{max}}\) is the principal eigenvalue of the matrix. This is used to calculate the consistency ratio defined as the following:

\[
\text{CR} = \frac{\text{CI}}{\text{RI}}
\]

where RI is the random index (the average CI of 500 randomly filled matrices). A consistency ratio (CR) of less than 10% means that the consistency is less than 10% of the 500 matrices. Therefore, CR can be interpreted as the % extent of consistency of the PWC matrix judgments by the decision maker with respect to the consistency obtained if the PWC matrix judgments were randomly generated. A value of 0.1 means that the consistency of the decision maker is about 10% of that obtained from a random PWC matrix. Simulations have shown that values for a CR of 0.1 or less constitute an acceptable consistency because the PWC priority results do not greatly differ from a PWC matrix with perfect consistency (CR = 0).

For the PWC matrix used in our example in Figure 2, the CR is 0.028, which constitutes an acceptable consistency and means that we can now calculate the priorities (weights) for our comparative matrix for criteria shown in Figure 2.

Derivation of criteria weights: The priority vector or weight (Figure 2), p, for the criteria in the PWC matrix, given that it has an acceptable consistency (CR < 0.1), is calculated by the following equation [29]:

\[
\text{Cp} = \lambda \text{p}
\]

where \(\lambda\) is the dimension of matrix C, the criteria matrix, and \(\text{p} = (p_1, p_2, \ldots, p_n)\).

Saaty [26] demonstrated that for a consistent matrix, the priority vector is obtained from the previous equation. However, for an inconsistent matrix, this equation is not valid. Therefore, the dimension “n” is replaced by the unknown dimension \(\lambda\) \(\lambda\) and \(\text{p}\) are calculated by the proper value problem \(\text{Cp} = \lambda \text{p}\). Any \(\lambda\) value which satisfies this equation is the principal eigenvalue of the PWC matrix and \(\text{p}\) is its associated eigenvector. According to Perron’s theory, a positive matrix has its own unique positive eigenvalue. The
non-trivial eigenvalue is called the maximum eigenvalue \( \lambda_{\text{max}} \). For perfectly consistent matrices, \( \lambda_{\text{max}} = n \); otherwise, the difference \( \lambda_{\text{max}} - n \), is a measure of inconsistency. Software packages [30] calculate the associated eigenvector by increasing the PWC matrix to successive powers until a matrix limit, where all the columns are equal, is reached reached (given the wide availability of commercial and free software such as Decision Lens, Expert Choice, Make It Rational and Super Decisions, for AHP computing, the mathematical calculations are not shown here). Any column constitutes the desired proper vector. The calculated priorities, using this method of proper value for the comparative matrix of tentative criteria, are shown in the right column (under the heading weights) in Figure 2.

The use of the Analytic Hierarchy Process (AHP) for the development evaluation frameworks has been a very popular application since its inception. There are many examples of its application, including the evaluation of professors [31], employees [32], new technology evaluation [33], and more recently in forensic applications [34,35]. Many of these types of applications are shown by Vaidya and Kumar [36] and Saaty and Vargas [37].

For these reasons, the present research will use preliminary evaluation tools and methods, based on the Analytic Hierarchy Process (AHP), that were developed by Mu and Butler [3] for measuring OM. This study proposes that the evaluation framework based on the AHP is also useful for measuring the extent of the presence of OM in health sector organizations. The present study focuses on high complexity organizations in the health sector in Colombia.

3. Objectives and Hypotheses

The objectives of the present study are as follows:

- Objective 1 (O1): To determine the impact of organizational mindfulness on the rationality of the decision-making process.
- Objective 2 (O2): To assess the extent of the presence of organizational mindfulness in highly complex health institutions in Colombia

The first objective O1 entails the following general hypothesis:

**Hypothesis 1 (H1).** Organizational mindfulness has a positive impact on the rationality of the decision-making process.

The conceptual model for the first objective is shown in Figure 3a. This hypothesis was tested using PLS-SEM and will be explained in the methods section.

(a) Organizational mindfulness impact on the rationality of decisions.  (b) Organizational mindfulness assessment using an AHP-based framework.

**Figure 3.** Conceptual models for research objectives

In the context of this first objective, the following are also hypothesized:

**H2** — OM mindfulness processes have an individual impact on the rationality of the decision-making process.
H2a — Reluctance to simplify interpretations has a positive impact on the rationality of the decision-making process.

H2b — Preoccupation for failures has a positive impact on the rationality of the decision-making process.

H2c — Sensitivity to operations has a positive impact on the rationality of the decision-making process.

H2d — Commitment to resilience with Deference to expertise has a positive impact on the rationality of the decision-making process.

The effect of each of the separate individual OM processes on the rationality of decisions was tested, using regression analysis.

The second objective O2 required the development of an evaluation framework to assess the extent of organizational mindfulness in Colombian health organizations, for which the AHP methodology was used as shown in Figure 3b. Furthermore, AHP sensitivity analysis and stakeholder congruence of perspectives using compatibility indices were employed to further extend understanding of the OM assessment in organizations and the Colombian health sector.

Finally, the original OM assessment, sensitivity analysis and congruence of perspective analysis will be informed and contextualized by qualitative interviews with key participants in this study as shown in Section 5.2.3. In the next section, the research design and methodology used in the present study are introduced.

4. Research Design and Methodology

This study used a mixed research design, including a quantitative stage followed by a qualitative one to fulfill the two intended objectives. The quantitative part required contacting the top executives of complex health institutions in Colombia and developing and testing the survey instruments, using first PLS-SEM methodology to assess the effect of OM as an overall second-order construct on the rationality of organizational decision-making (H1) and next, using simple regression analysis to assess the effect of each individual OM process (H2) as stated in the first research objective. The second research objective required using the survey responses to develop an AHP-based OM assessment framework and the use of qualitative semi-structured interviews to contextualize and interpret the OM assessment results as well as performing sensible sensitivity analyses.

4.1. Quantitative Research Design

For the quantitative part, it was important to survey a random, yet representative, sample of highly complex health institutions. Using this sample, a survey questionnaire was sent to the participants and the proper instruments were developed based on their responses and review of the prior literature as will be discussed next.

4.1.1. Survey Sample

For the sample selection, current regulations were reviewed, and the Colombian Health Ministry was asked to establish classification criteria to identify the Registry of Special Health Institutions, that is, highly complex health institutions in Bogota, Medellin and Cali (total of 49). Once these organizations were identified, we proceeded to contact executives (director, general manager, or president) in each institution to explain the project and invite them to take part in the research. Once they accepted, executive members were selected that routinely took part in the strategic decision-making process in their institutions. Finally, 143 executives from 20 health institutions were invited to participate in the study and were emailed a survey; 117 answered the questionnaire. An answer to all questions was required, and since there were no incomplete surveys, all of the received questionnaires were usable. Additionally, all the executive participants were personally contacted before the questionnaires were sent to ensure their participation in both the
quantitative (survey study) and qualitative (interviews) stages of the research. Because of this high level of commitment by the participants, the survey response rate was 82%, which is very high for this type of study. Table 2 shows the specific position at the strategic level of the health sector of each general manager who took part in the survey. It is important to reiterate that these participants were previously selected based on their level of participation in strategic decisions within their organizations.

Table 2. Participants’ managerial roles.

| Position | Number | Percentage |
|----------|--------|------------|
| General Manager—President | 20     | 17         |
| Chief Financial Officer    | 17     | 15         |
| Medical Director           | 14     | 12         |
| Scientific Director—Investigation | 11 | 9          |
| Quality and Planning Director | 9    | 8          |
| Human Resources            | 9      | 8          |
| Commercial Director        | 6      | 5          |
| Assistance and Services Director | 5   | 4          |
| Nursing Sub-director       | 4      | 3          |
| Systems and Communications  | 4      | 3          |
| Medical Services Coordination | 3   | 3          |
| Consumer Services          | 3      | 3          |
| Internal Control           | 2      | 2          |
| Operations Department      | 2      | 2          |
| Other Managerial Controls  | 8      | 7          |
| Total                     | 117    | 100        |

4.1.2. Measures and Instrument Development

To measure organizational mindfulness in institutions, the instrument developed by Mu and Butler [3] was used. They highlight three of the five organizational mindfulness dimensions proposed by Weick and Sutcliffe [1] and combine the last two into one dimension (Figure 3a). The processes to be evaluated, following Mu and Butler [3], are as follows: reluctance to simplify interpretations (RSI), preoccupation with failure (PF), sensitivity to operations (SO) and commitment to resilience with deference to expertise (CRRC). To measure rationality, the instrument developed by Dean and Sharfman [7] was used. See Appendix A for the questions in the survey.

4.2. Qualitative Design

The goal of this qualitative part is to contextualize and interpret the results of the quantitative part. In effect, for the purpose of the second research objective, it is not enough to assess the extent of the presence of OM and related processes in an organization or in a given sector, using the proposed AHP evaluation framework. It is also important to understand why this is so and in particular, identify “what if” situations (sensitivity analysis). For this purpose, twelve executives in health organizations were interviewed in relation to the study they had participated in. Their selection was based on their participation in the study and availability to be interviewed. In addition, the interviews were semi-structured to allow the participants to elaborate on the different topics without being in a “Yes” or “No” answer situation. These interviews provided understanding of the results of the OM assessment and allowed the proposal of alternative scenarios for the sensitivity analysis, as will be seen in the next section.

5. Model Analysis and Findings

To address the first objective and related hypotheses, two types of statistical analysis were carried out. First, an exploratory analysis using partial least square structural equation modeling (PLS-SEM) was conducted to test the hypothesis that organizational mindfulness as a whole has a positive effect on the rationality of the decision-making
process (H1). Second, a simple regression analysis was conducted to test the hypothesis that the individual OM processes have a positive significant effect on the rationality of decision making (H2) as described next.

5.1. Objective 1: Exploring the Effect of OM and Its Constituent Processes on Rational Decision Making

PLS-SEM explores structural relationships in small samples without considering normality about data and related variables. This type of analysis is convenient since there are not enough highly complex health organizations in Colombia to obtain a large enough sample for a traditional confirmatory covariance-based (CB-SEM) analysis. Additionally, it is not unusual to combine PLS-SEM with other traditional forms of statistical analysis as a way to address the small sample size, such as in the study of Balaban et al. [38]. A second reason to use PLS-SEM for the first hypothesis (H1) is that organizational mindfulness (OM) is theoretically conceptualized in the extant literature as a second-order construct constituted by five dimensions, and PLS-SEM is more suitable than traditional CB-SEM analysis for this purpose. On the other hand, to test the individual impact of each of the organizational mindfulness dimensions on the rationality of the decision-making process (H2), it was possible to use traditional regression analysis, given that the sample size, although small, was still within the minimum requirements. The first step in any statistical analysis is to inspect the collected data for outliers. Using standard outlier techniques, a box and whisker diagram for each variable was obtained to identify atypical values, using a 2.2IRQ range as recommended by Hoaglin and Iglewicz [39], who demonstrated that using the common 1.5 multiplier was ineffective in 50% of the cases. Since there were only seven atypical values, the corresponding cases were eliminated from the analysis and the sample size decreased to N = 110, which is the sample sized used in the present study.

5.1.1. PLS-SEM Analysis

PLS-SEM is used for exploratory research in causal models, usually when the sample size is small and the focus is on prediction. The analysis focuses on explaining the variance of the dependent variable(s). Additionally, it does not require data normality considerations, and has emerged as an alternative approach to CB-SEM to shape complex models; it is used particularly for the prediction and explanation of constructs [40]. Therefore, we used this analysis in our study.

This study proposes the conceptualization of organizational mindfulness as a second-order construct constituted by the dimensions of reluctance to simplify interpretations (RSI), preoccupation with failure (PF), sensitivity to operations (SO) and commitment to resilience/deference to expertise (CRRC). This claim is based on the extant literature and in particular on Weick and Sutcliffe (2001), who have indicated that collective mindfulness is constituted by the above process dimensions. Following this rationale and the previous discussion of the effect of organization mindfulness on the rationality of the decision-making process, a PLS model in which organizational mindfulness is a reflective-reflective second-order construct with an impact on the rationality of the decision is proposed.

Based on Hair et al. [40], the following three main stages can be established for the PLS-SEM analysis: structural model specification, measurement model evaluation and structural model evaluation. Established procedures for the analysis and reporting of the PLS-SEM model analysis were followed [41–44]. The second-order model was analyzed using a repeated indicator mode A approach and recommended practices (mode A means that the indicator loadings, bivariate correlations, were used for the convergent and discriminant analysis) [43,45,46]. First, a factor analysis using the PLS algorithm and the default 300 iterations of the reflective-reflective organizational mindfulness second-order higher order construct (HOC) was done (whenever a factor analysis was done, the 300-iteration setting and PLS algorithm was used). This analysis was used to locate and remove the lowest loading indicators in lower-order constructs (LOCs) with more than three indicator (for CRRC, the indicators CRRC1, CRRC3 & CCRRC4 were deleted. For SO, the indicators SO3 & SO5 were removed and for RSI, only the RSI3 indicator was removed). This way, all
lower-order constructs had the same number of indicators, which is recommended for the extended repeated indicators approach to avoid bias from lower-order constructs with a greater number of indicators [40]. In the repeated indicator approach mode A, all the indicators from the lower-order constructs (Figure 4) become indicators for the second-order organizational mindfulness construct, although, following custom, OM repeated indicators are not shown in Figure 4 (the indicators for the organizational mindfulness construct are not shown because they are the same lower order construct indicators).

![Figure 4. PLS-SEM model for the study.](image)

After the model was specified as indicated in Figure 4, the PLS-SEM model was evaluated in terms of convergent and discriminant validity (measurement model) followed by an analysis of the structural model following standard practices [40,42].

Construct reliability and convergent validity: Convergent validity refers to the indicator level at which it positively correlates with other indicators in the same construct; therefore, if the indicators are correlated and share a high percentage of variance, it is evident that it is measuring the same construct [40]. To test convergent validity, a PLS factor analysis was run, and an analysis of the loadings showed that the indicators RC4# (0.382) and PF2 (-0.061) were below the lowest threshold of 0.6. Only indicators with loadings greater than 0.6 were kept in accordance with advised practices for exploratory research. Following this approach, the lowest loading indicators RC4# and PF2 were removed. In addition, Hair et al. [40] stated that indicators between 0.4 and 0.7 must only be considered for removal if this leads to an increase in integrated reliability, which was not the case for any of the remaining indicators. The measurement model factor analysis was run again, including bootstrapping to assess the significance of the indicators with the results shown in Table 3 (also, following established practice, the second-order construct indicators are not considered for convergent validity analysis because they are made up of the same low order construct indicators).

Given that all loadings are above 0.6 and are significant for for \( p \leq 0.001 \), all indicators in Table 3 are relevant for the model. Furthermore, the reliability (CR) and convergent validity (AVE) measures for the LOCs are above the established thresholds of 0.7 and 0.5, respectively.

However, for the newly established HOC Organizational Mindfulness (OM), its measurement model is constituted by the LOCs: RSI, PF, SO and CRRC. Therefore, the path coefficients from each of these LOCs to OM must be treated as factor loadings for the OM measurement model. Using these loadings to calculate AVE and CR manually as indicated by Hair, Sarstedt et al. [47], it is found that AVE = 0.54 and CR = 0.82 for the OM construct. Both values are above the respective 0.5 and 0.7 thresholds.
Table 3. Indicator loadings and reliability measures.

| Construct/Indicators               | Outer Loadings | CR   | AVE  |
|------------------------------------|----------------|------|------|
| Rationality (RC)                   |                |      |      |
| RC1                                | 0.634          |      |      |
| RC2                                | 0.736          |      |      |
| RC5                                | 0.796          |      |      |
| Reluctance to Simplify Interpretations (RSI) |                | 0.781 | 0.548 |
| RSI1                               | 0.865          |      |      |
| RSI2                               | 0.710          |      |      |
| RSI4                               | 0.625          |      |      |
| Preoccupation with Failure (PF)    |                | 0.798 | 0.664 |
| PF1                                | 0.804          |      |      |
| PF3                                | 0.826          |      |      |
| Sensitivity to Operations (SO)     |                | 0.844 | 0.643 |
| SO1#                               | 0.827          |      |      |
| SO2                                | 0.833          |      |      |
| SO4                                | 0.743          |      |      |
| Commitment to Resilience & Deference to Expertise (CRRC) | | 0.862 | 0.676 |
| CRRC2                              | 0.772          |      |      |
| CRRC5                              | 0.845          |      |      |
| CRRC6                              | 0.848          |      |      |

N = 110.

Therefore, following the standard practices for the LOCs and HOC measurement model, the suitable construct reliability and convergent validity was established.

Discriminant validity: Discriminant validity exists when a construct is unique, and it is not confused with other constructs in the model. The first step to check for this is the use of the Forner–Lacker criterion as shown in Tables 4 and 5. This method is based on the idea that a construct should share more variance with its associated indicators than with any other construct in the structural model. In practical terms, the square root of the medium variance (AVE) shared between the construct and its indicators should be greater than the correlations with any other construct [40].

Table 4. Discriminatory validity of organizational mindfulness and rationality.

| Forner–Lacker | OM   | RC   |
|---------------|------|------|
| OM            | 0.593|      |
| RC            | 0.452| 0.725|

Table 5. Discriminatory validity of organizational mindfulness dimensions and rationality.

| Forner–Lacker | RC | RSI | PF | SO | CRRC |
|---------------|----|-----|----|----|------|
| RC            | 0.725|     |    |    |      |
| RSI           | 0.398| 0.740|    |    |      |
| PF            | 0.280| 0.192| 0.815|    |      |
| SO            | 0.384| 0.369| 0.457| 0.802|      |
| CRRC          | 0.295| 0.302| 0.343| 0.593| 0.822|

First, we will check the discriminant validity of the two main constructs in our model, organizational mindfulness (OM), the independent variable, and rationality (RC), the dependent variable as shown in Table 4.
In Table 4, the diagonal values constitute the square root of AVE. It can be seen that the correlation of RC with OM is 0.445, which is less than the diagonal AVE values.

Another point to consider is whether the lower order constructs are sufficiently discriminatory among themselves and from the dependent variable. For this purpose, the Forner–Lacker criterion will be applied again as shown in Table 5.

Applying the same principle as before, the square root of each construct’s AVE (diagonal) is greater than its highest correlation with any other construct. In other words, each construct shares more variance with its associated indicators than with any other construct [40]. Therefore, the proposed model (Figure 4) passes the Forner–Lacker discriminatory validity testing stage.

The second test used to establish the model’s discriminant validity is the examination of the cross loads between indicators of the two model’s constructs. Inspecting the cross loads requires that the analyzed indicator must be highly correlated with the construct with which it is associated, but has a low correlation with other indicators from different constructs (cross loads). An examination of the cross loadings showed that all indicators’ loadings were much higher on their own construct than any cross loading on a different construct.

The final test used to establish discriminant validity was the heterotrait–monotrait ratio (HTMT), which is based on the idea that the average of the correlations of indicators measuring the same construct (monotrait–heteromethod correlations) should be less than the correlations of indicators across constructs measuring different phenomena (heterotrait–heteromethod correlations) as proposed by Henseler, Ringle et al. [48]. This analysis is included in the SmartPLS 3.3 software [49] used for the PLS-SEM analysis and showed that the HTMT values were way below the conservative threshold of 0.85.

Therefore, following the standard tests proposed by Hair, Hult et al. [40], the proposed research model’s discriminant validity was fully established.

Structural model: Using the PLS algorithm for path model analysis, the model is analyzed as shown in Figure 5.

Running the PLS algorithm for path analysis (2000 iterations) shows that all the indicators as well as the path coefficient OM → RC were significant at *p < 0.001*. Additionally, the explained variance of the dependent variable, given by the coefficient of determination R2, is 0.205; this means that 20.5% of the rationality process is explained by organizational mindfulness. The effect size f2 is the same as the R2 because there is only one construct predictor in the model. To complete the recommended procedure by Hair, Hult et al. [40], a blindfolding procedure to obtain cross-validated redundancy measures for the only endogenous construct in this model, RC. Using a distance D = 7, to ensure that the sample size divided by the distance (110/7 = 15.7) is not an integer, the resulting Q2 was 0.088, which is above zero as required to assert a meaningful predictive relevance for the model. The results of the structural model evaluation support hypothesis H1 that organizational mindfulness has a positive impact on the rationality of the decision-making process.

This PLS-SEM analysis also suggests that the different process dimensions—namely RSI, PF, SO and CRRC—constitute low order construct (LOC) dimensions of the second-
order high-order construct (HOC), organizational mindfulness, as theorized by Weick and Sutcliffe [1]. More importantly, the results show that organizational mindfulness has a positive effect on the rationality of the decision process as hypothesized in H1. Therefore, it is important to assess the extent of its presence in an organization. This will be done next, using the proposed framework by Mu and Butler [3].

5.1.2. A Regression Approach to Assess the Effects of the Dimensions of Organizational Mindfulness on the Rationality of the Decision-Making Process

The modeling of organizational mindfulness as a second-order construct using the repeated indicators approach to test the first hypothesis that OM had a positive effect on the rationality of the decision-making process (RC) required discarding several indicators to ensure all low order constructs had the same number of indicators. Given that PF was the construct with the lowest number of indicators (3), it was necessary to get rid of several indicators to implement the procedure correctly. However, the task in this section is two-fold: to assess that every dimension has an impact on RC and also to measure the extent of the presence of OM in the health sector organizations. For this purpose, the original indicators (Appendix A) will be used again in a different analysis.

To test the separate effect of the different organizational mindfulness processes on the rationality of the decision-making process, we followed the same approach used by Papadakis, Lioukas et al. [16] for a similar analysis. Given the number of variables involved and the insufficient sample size to simultaneously test all variables, separate regression models were applied for each dimension (independent variable).

Exploratory factor analysis using principal component analysis with orthogonal rotation (varimax) was used. Next, standard psychometric techniques were applied to evaluate convergent and discriminant validity.

Elements that had unacceptable cross loadings (less than or equal to 0.4) were eliminated (the analysis for all indicators of the independent and dependent variables in a single EFA was discarded since the available sample was insufficient to obtain statistical reliable results). This step resulted in the elimination of two elements from the reluctance to simplify the interpretations scale. The exploratory factorial analysis (EFA) results (N=117) are shown in Tables 6–9.

Table 6. EFA for Reluctance to simplify interpretations (RSI).

|       | 1   | 2   | 3   | 4   |
|-------|-----|-----|-----|-----|
| RC1   | 0.899 |     |     |     |
| RC2   | 0.873 | 0.770 |     |     |
| RC3   | 0.430 | 0.604 | 0.616 |     |
| RC4   | 0.432 |     |     |     |
| RSI1  | 0.900 |     |     |     |
| RSI2  | 0.774 | 0.468 |     |     |
| RSI3  | 0.900 |     |     |     |
| RSI4  | 0.616 |     |     |     |

Table 7. EFA for Preoccupation with failure (PF).

|       | 1   | 2   | 3   |
|-------|-----|-----|-----|
| RC1   | 0.929 |     |     |
| RC2   | 0.866 | 0.767 |     |
| RC3   | 0.460 | 0.805 |     |
| PF1   | 0.810 |     |     |
| PF2   | 0.641 |     |     |
| PF3   | 0.688 |     |     |
Table 8. EFA for Sensitivity of operations (SO).

|   | 1   | 2   | 3   |
|---|-----|-----|-----|
| RC1 | 0.901 |   |     |
| RC2 | 0.842 |   |     |
| RC3 |       | 0.719 |     |
| RC5 |       | 0.496 |     |
| RC4 |       | 0.824 |     |
| SO1 | 0.738 |   |     |
| SO2 | 0.770 |   |     |
| SO3 | 0.746 |   |     |
| SO4 | 0.725 |   |     |
| SO5 | 0.760 |   |     |

Table 9. EFA for Commitment to resiliency and deference to expertise (CRRC).

|   | 1   | 2   | 3   |
|---|-----|-----|-----|
| RC1 | 0.922 |   |     |
| RC2 | 0.867 |   |     |
| RC3 |       | 0.772 |     |
| RC5 |       | 0.579 |     |
| RC4 |       | 0.756 |     |
| CRRC1 | 0.844 |   |     |
| CRRC2 | 0.753 |   |     |
| CRRC3 | 0.805 |   |     |
| CRRC4 | 0.746 |   |     |
| CRRC5 | 0.867 |   |     |
| CRRC6 | 0.898 |   |     |

These factorial loads, which constitute the correlation between each indicator and its factor, are used to calculate the relative weights of each indicator within its correspondent factor/dimension for the evaluation of organizational mindfulness processes in the AHP evaluation approach [3].

Later, to ensure that the chosen indicators to measure each construct could be used as an integrated scale, a reliability analysis was carried out. It is common in this phase to eliminate some additional indicators to improve the Cronbach’s Alpha, as in the PF case where the original Cronbach’s Alpha was 0.542. For this reason, the PF2 element was eliminated, and the Cronbach’s Alpha value increased to 0.616 once that was eliminated. Similarly, in the case of rationality, the analysis was continued only using RC1 and RC2, which provided a much better Cronbach’s Alpha value of 0.805 (Table 10).

Table 10. Scale reliability and descriptive statistics.

| Variable | Items | Alpha | Mean | S.D. | 1   | 2   | 3   | 4   | 5   |
|----------|-------|-------|------|------|-----|-----|-----|-----|-----|
| 1        | RC    | 2     | 0.805 | 3.991 | 0.669 | 1   |     |     |     |
| 2        | RSI   | 2     | 0.715 | 3.312 | 0.880 | 0.169 | 1   |     |     |
| 3        | PF    | 2     | 0.616 | 3.867 | 0.810 | 0.161 | 0.255** | 1   |     |
| 4        | SO    | 5     | 0.807 | 3.706 | 0.681 | 0.148 | 0.371** | 0.588** | 1   |
| 5        | CRRC  | 6     | 0.903 | 4.025 | 0.699 | 0.076 | 0.349** | 0.599** | 0.763** | 1   |

N = 117; ** The correlation (bilateral) is significant at p ≤ 0.01 level.

Linear regression was used for each of the organizational mindfulness dimensions (independent variables) with the rationality of the decision as the dependent variable. The dataset was examined for datapoint outliers, and this led to a sample size of N = 110 for the regression analyses. The results of the simple linear regressions for each of the OM dimensions are summarized in Table 11. In this table, the regression results are shown for
each of the dimensions of organizational mindfulness, with rationality having a significant statistical relationship in the four models.

Table 11. Regression analysis results.

| Variable | B   | Dev. Error | Beta | R square | Change in R Square |
|----------|-----|------------|------|----------|--------------------|
| Model 1  |     |            |      | 0.036    | 0.036              |
| RSI      | 0.154 | 0.076      | 0.190 |          |                    |
| Model 2  |     |            |      | 0.048    | 0.048              |
| PF       | 0.216 | 0.092      | 0.219 |          |                    |
| Model 3  |     |            |      | 0.044    | 0.044              |
| SO       | 0.241 | 0.109      | 0.209 |          |                    |
| Model 4  |     |            |      | 0.028    | 0.028              |
| CRRC     | 0.227 | 0.129      | 0.160 |          |                    |

N = 110. * Statistical significant for \( p \leq 0.1 \).

Table 10 shows that each of the organizational dimension processes, independently, has a positive effect \( (p \leq 0.1) \) on the rationality of the decision-making process. Therefore, H2, composed of hypotheses 2a–2d, is supported.

The PLS-SEM analysis in the previous section found that organizational mindfulness (OM) can be conceptualized as a reflective–reflective second order construct constituted by the presence of the following OM processes: reluctance to simplify interpretations, preoccupation with failure, sensitivity to operations and commitment to resilience/deference to expertise. Furthermore, it was found that organizational mindfulness has a positive impact on the rationality of the decision-making process. In this section, it was also found that each of the OM processes has a positive impact on the rationality of the decision-making process.

The fact that organizational mindfulness as well as its different dimensions has a positive impact on the rationality of the decision-making process validates the idea that the presence of organizational mindfulness and the related processes is very important to assess.

5.2. Objective 2: AHP Evaluation Framework for Organizational Mindfulness Assessment

To assess the extent of organizational mindfulness in the organizations in the study, an AHP ratings model was constructed (Figure 6). The goal is the evaluation of the OM processes, which, in turn, constitutes the second level of the hierarchy, including reluctance to simplify interpretations (RSI), preoccupation with failure (PF), sensitivity to operations (SO), commitment to resiliency, and deference to expertise (CRRC). These process components receive an initial equal weight of 0.250 in the model since there is no a priori information about the relative importance given by the participants to each of the dimensions. Also, to determine the relative weights of the criteria from the perspective of each participant, judgements of comparative preference are required for each pair of criteria in order to form a comparison table by pairs for each participant. From this, we can derive the relative weights. The aggregation of all perspectives can be done with the geometric mean to a level of judgements or priorities. The specific evaluation items in each process dimension constitute the elements to be rated and whose weighted aggregation constitutes the score or rating for each of the dimensions. Their local weightings are obtained from the factorial loadings acquired in the factorial analysis (Table 8). For example, reluctance to simplify interpretations (RS) is measured with two indicators: RS1 and RS2. The weights for these items in the model AHP are the normalized factorial loadings of each item of evaluation with respect to its specific component. In this way, for dimension RS, the relative weights are \((0.900 / (0.900 + 0.774)) \) and \((0.774 / (0.900 + 0.774)) \) for RS1 and RS2, respectively. Therefore, the relative weights 0.54 and 0.46 for RS1 and RS2 are shown in Figure 6. The weighted sum of the item values according to the participant’s answers measures the extent of the presence of the RS dimension of organizational mindfulness in an idealized scale (range of 1/5 to 5/5 = 1). For the dimension under discussion, RS, the total scored for this dimension would be 0.54*0.77 + 0.46*0.58 = 0.69 as shown in Figure 7. For the other dimensions, the
result for preoccupation with failure is 0.79; for sensibility to operations, the score is 0.77; and for commitment to resilience with deference to expertise, the result is 0.8.

Figure 6. AHP model for the assessment of organizational mindfulness.

Figure 7. Business dashboard visualization of organizational mindfulness.

The measures obtained for each of the dimensions (weighted sum), which is the result of multiplying the dimension score by its weight (25% in this case), provide the total level of organizational mindfulness present in the studied health sector. In the case studied, it would be 0.69*0.25 + 0.79*0.25 + 0.77*0.25 + 0.83*0.25 = 0.77 as shown next.

Figure 7 shows the results in a business dashboard format, and it is interesting to observe that, on average, the level of organizational mindfulness in highly complex health institutions in Colombia is at the middle level, which is a positive outcome for the sector.

A high level of presence is observed in the combined dimensions of commitment to resiliency and deference to expertise (respect for knowledge) as well as for preoccupation with failure with 0.83 and 0.79, respectively. The lowest result is found in reluctance to simplify interpretations with 0.69.

5.2.1. Organizational Mindfulness and Sensitivity Analysis in the Health Sector

Figure 7 shows the results of the original scenario (Figure 6), where it is assumed that the four dimensions of organizational mindfulness are equally important for the sector. Although, in principle, some possible combinations in terms of the weights or relative importance exist for this model, the best practice for the use of AHP models...
involves a sensitivity analysis within the context of the decision itself [50]. For this purpose, 12 executives in health organizations were interviewed about the sample in which they had participated. Their selection was based on their participation in the study and availability to be interviewed. Following the interview recommendations for qualitative investigation, direct questions, such as “What do you think is more important . . . ?” were avoided; instead, they were invited to elaborate on a topic with such questions as, “What is decision-making in health organizations? What are the processes? How are those decisions made?” Therefore, one could contextualize the results of the original scenario (Figure 6) from the information provided and establish two possible sensitivity scenarios. The different scenarios are shown in Table 12 and discussed next.

**Table 12.** Sensitivity analysis.

| Mindfulness Dimension                  | Original Scenario Mindfulness | Scenario 1 Mindfulness (Dimensions Are Equally Important (Each Weights 0.25)) | Scenario 2 Mindfulness (Both Weights 0.4 Are the Most Important) |
|----------------------------------------|------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Reluctance to Simplify Interpretations (RSI) | 0.17                         | 0.07                                                                            | 0.07                                                            |
| Preoccupation with Failure (PF)        | 0.20                         | 0.32                                                                            | 0.24                                                            |
| Sensitivity to Operations (SO)         | 0.19                         | 0.31                                                                            | 0.23                                                            |
| Commitment to Resilience/Deference to Expertise (CRRC) | 0.21                         | 0.08                                                                            | 0.25                                                            |
| Critical Questions (based on lowest value in their respective dimension) | RS2 = 0.58 | PF1 = 0.74 | SO2 = 0.67 | CRRC2 = 0.79  | PF1 = 0.74 | SO2 = 0.67 | CRRC2 = 0.79 |

**Original scenario:**

In this scenario, all the dimensions contribute equally to OM (Figure 7). The questions (measurement items) that received lower values from the participants in each one of the dimensions (Table 12) were RS2, PF1, SO2 and CRRC2. These questions are listed below for convenience (see Appendix A for all items in the questionnaire).

*Question RS2*—In this organization, the participants are willing to challenge the established order.

*Question PF1*—In this organization, even the smallest mistakes are taken seriously.

*Question SO2*—The employees in this organization are aware of the operations beyond their immediate function.

*Question CRRC2*—In case of any problem, the employees in this organization trust one another.

The low value answer to question RS2 (0.58 in Table 12) suggests that in the health sector under study, the participants are not very willing to challenge the established order. The reason for this is highlighted by some of the quotes given by the participants that emphasized the normative aspects of decision making in the health sector in the target country.

*Participant 34:* “The regulations, the legal framework, influence the decisions . . . ”

*Participant 9:* “I would think that health decisions are different . . . The current normativity for health establishes . . . ”

*Participant 76:* “The strategic decisions have a framework and the executives issue political ones to be able to make a decision.”

The majority of participants in the interviews (92%) emphasized that the health sector has particular characteristics and emphasized the normative aspect and regulation of the sector (83%).
In summary, the reason why health sector institutions do not defy the established order is because their processes are based on management guidelines and established rules. This makes defying the order a big and dangerous leap in terms of organizational conduct.

Sensitivity scenario 1: Our conversations with the participants in the qualitative part of the study suggested great concern for avoiding mistakes and focusing on the quality of the institutional operations. This suggested the first sensitivity scenario, where two dimensions, PF and SO, constituted the most important dimensions of organizational mindfulness for the institution (to reflect this, 0.4 was assigned to each), while the other two, RSI and CRRC, had much less importance (0.1 each) as shown in the column “Scenario 1” in Table 11. This scenario was suggested because of the constant comments from participants (50% of participants) about decision making in the health institutions being tense because of the lives at stake (which suggests that there is a great preoccupation with failure).

Participant 4: “They are environments that truly have a lot of tension. What makes them tense? The economic uncertainty, the problems surrounding that, including the direct attention of the patients and everything that entails, the difficulties, inconveniences, people’s pain . . .”

Participant 76: “… in the subject of health, there are moments when a decision must be made on the spot, right now, because we are working with a patient’s life . . . and that makes it different than other sectors.”

In addition, in the original scenario, the participants’ answers suggested little interest in challenging interpretations, but rather an adherence to operate according to the regulations, which also suggests the possibility of high sensitivity to operations (understood as regulated procedures).

In scenario 1, the critical measurement items are those that not only had a low value in the dimension, but are also part of the two dimensions (PF and SO) established as being the most important in this scenario. Therefore, the critical questions in this scenario are PF1 and SO2 as shown in the column “scenario 1” in Table 12.

In this scenario, the fact that the answer to item PF1, “in this organization even the smallest mistakes are taken seriously” is 0.74 may mean that, even though the institutions are very worried about avoiding failure in the patients’ health and lives (“big mistakes”), they are not greatly concerned with total quality, which also involves close calls. This is an area in which organizations could do better by introducing adequate training with courses offered by The Council for Six Sigma Certification (2020).

On the other hand, the low value (0.67) obtained for item SO2, “the employees in this organization are up to date about operations beyond their immediate function” suggests that this is also an important area that needs improvement. The low value obtained suggests that the employees are highly specialized in their respective functions but lack a complete mental model of the functions of other members of the organization. This knowledge of other members’ jobs is important for the ability to adapt to unexpected situations and constitutes an important element in modern management. For example, in the Toyota production system, the employees have the ability and knowledge to resolve problems and know the production process from beginning to end (Power, 2011).

Sensitivity scenario 2: Finally, we present a second scenario to consider with respect to the previous scenario. This scenario considers the dimension commitment to resilience combined with deference to expertise (CRRC) as equally important with preoccupation with failure (PF) and sensitivity to operations (SO). For this reason, each of these dimensions are given a priority (weight) of 0.3 in Table 12 (rightmost column). The dimension reluctance to simplify (RS) is the least important (with a weight of 0.1) as shown in the last column on the right side in Table 12. This scenario is consistent with the participants’ responses about the tendency to follow established protocols rather than challenge them. Therefore, it makes sense to discuss only the relevant results for this scenario. In this case, the important evaluation items are PF1, SO2 and CRRC2. Since PF1 and SO2 have already been discussed, we now analyze the meaning of a low value for CRRC2, “if there is any problem, the
employees in this organization can trust one another.” It should also be noted that CRRC2 has a low value (0.79) with respect to the other items in its dimension.

A low value for CRRC2 means that there is no professional confidence at the team level, but rather at an individual level. This is consistent with the fact that the low value for SO2 means that in general, the interviewed participants are not familiar with the functions of their team members. To improve this situation, one could combine the executive training suggested previously, such as Six Sigma, with high efficiency team development programs, such as those proposed by Interaction Science (2020) and similar organizations.

The analysis performed in this section shows how an analysis of the different OM dimensions can be performed to determine its level of importance to formulate organizational intervention measures that allow improvement of the weaker aspects.

5.2.2. Organizational Mindfulness Analysis at the Organizational Level with Respect to the Health Sector

The next step was to perform a comparative analysis of the organizations that participated in the study. For this purpose, an analysis was performed to choose the highest ranked executive (the organization’s general manager or president). Three organizations were eliminated from the list because no response was received from their top executive. Two of the organizations were eliminated due to lack of participation, and the third case was an outlier and therefore was eliminated during the process of data analysis. There were 17 institutions included in the final list. The results are shown in Table 13.

Table 13. Evaluation of organizational mindfulness at organizational level.

| Num | RSI | PF | SO  | CRRC | OM  |
|-----|-----|----|-----|------|-----|
| 1   | 0.71| 0.80| 0.72| 0.76 | 0.75|
| 2   | 1.00| 0.69| 0.80| 0.83 | 0.83|
| 3   | 0.62| 1.00| 0.52| 0.77 | 0.73|
| 4   | 0.60| 0.58| 0.64| 0.76 | 0.65|
| 5   | 0.62| 0.80| 0.92| 0.87 | 0.80|
| 6   | 0.71| 0.49| 0.76| 0.94 | 0.73|
| 7   | 0.71| 1.00| 0.80| 0.83 | 0.84|
| 8   | 0.51| 0.89| 0.76| 0.93 | 0.77|
| 9   | 1.00| 0.80| 0.84| 0.97 | 0.90|
| 10  | 0.60| 0.69| 0.84| 0.74 | 0.72|
| 11  | 0.71| 0.89| 0.80| 0.80 | 0.80|
| 12  | 0.82| 0.80| 0.81| 1.00 | 0.86|
| 13  | 0.71| 0.89| 0.92| 1.00 | 0.88|
| 14  | 0.80| 0.62| 0.56| 0.80 | 0.70|
| 15  | 0.80| 0.80| 0.68| 0.83 | 0.78|
| 16  | 0.80| 0.80| 0.76| 0.86 | 0.81|
| 17  | 0.71| 0.69| 0.80| 0.80 | 0.75|
| Sector | 0.69 | 0.79 | 0.77 | 0.83 | 0.77 |

To understand the situation in each institution with respect to organizational mindfulness, they must be compared to the original values from the health sector obtained in the previous section. For example, one could observe that at the process level, institutions 2 and 9 are the most reluctant to simplify interpretations, column RSI (1.00), which is very much above the value of 0.68 for the sector. These institutions should be studied in more detail to understand how they achieve this and learn from them. On the other hand, institution 3 has a value of 0.52 for sensitivity to operations, which is much lower than the value of 0.77 for the sector. In this institution, this anomaly should be investigated because it seriously decreases the level of organizational mindfulness.

Figure 8 displays a visual comparison of the different health institutions to one another and in relation to the health sector. An additional perspective using a bar graph is available in Appendix B.
Another possible comparison is the composition of the four dimensions of organizational mindfulness in a given organization: reluctance to simplify interpretations (RSI), preoccupation with failure (PF), sensitivity to operations (SO) and commitment to resilience/deference to expertise (CRRC), with respect to the presence and intensity of these processes in the health sector in general as shown in Appendix B.

An example of this type of analysis is a comparison of the distribution of processes in the participating organizations in cases 4 and 13 with respect to the average values in the health sector. This specific information taken from Table 13 is shown below (Table 14) for convenience.

Table 14. Comparison of OM processes in organizations with respect to the sector.

|       | RSI  | PF  | SO  | CRRC |
|-------|------|-----|-----|------|
| Case 4 | 0.60 | 0.58| 0.64| 0.76 |
| Case 13| 0.71 | 0.89| 0.92| 1.00 |
| Health Sector | 0.69 | 0.79| 0.77| 0.83 |

The comparison of the composition and intensity of the processes can be seen in Figure 9a,b. Since we are comparing the two perspectives in four dimensions, congruency (or discrepancy) in each case can be visualized as two overlapping polygons whose four vertices would coincide in the case of perfect congruency between the organization (case) and the health sector.

(a) – Case 4 organization  (b) – Case 13 organization

Figure 9. Congruency of two organizations with the health sector.

Greater or lesser congruency between the dimensions of organizational mindfulness is visible in these figures (for example, the perception of the dimension RSI is very congruent
The use of the AHP for this organizational analysis also includes the use of the compatibility index $G$ \cite{51,52} and are applied to assess the compatibility of perspectives in the organizational analysis \cite{53}. To obtain this index, the two perspectives are visualized (organization and health sector) as two vectors in a one multidimensional space (four dimensions: RSI, PF, SO, and CRRC, in this study). Perfect congruency is reached when the two vectors have the same coordinates in all dimensions. More specifically, to compare the perspectives of two decision makers, A and B are graphed as two vectors with normalized coordinates, and the congruency level can be calculated as follows:

$$G = \frac{1}{2} \sum (ai + bi) \times \frac{\text{Min}(ai, bi)}{\text{Max}(ai, bi)}$$

where the quotient $[\text{Min}(ai, bi)/\text{Max}(ai, bi)]$ provides the cosine value of $\alpha$ and $\alpha$ is the angle between the two vectors. Additionally, $i = 1$, and $N$ constitutes the number of dimensions or coordinates ($N = 4$ in the present study).

Using this formula, the congruency index between the four organizational mindfulness processes of the organization in case 13 with respect to the health sector is $G_{13} = 0.69$ and for case 4 is $G_4 = 0.94$. This means that the organization in case 13 has significantly less congruency in the processes of organizational mindfulness with respect to the average in the health sector than the organization in case 4. The next step is to investigate the differences between the organizations from case 4 and 13.

5.2.3. Relative Importance of OM Dimensions

Until now, each of the four dimensions in organizational mindfulness was assumed to have the same importance in all organizations (0.250 each in Figure 6). However, depending on the specific organization, this may not be the case. To investigate this, Mr. O.J.J (because of privacy considerations, only the initials are provided) Executive Director from participant firm 1 (Table 12) was contacted and asked to complete a questionnaire (see Appendix C) with comparative questions about the importance of the dimensions of organizational mindfulness for his organization. The questions were written in paired form to obtain the judgements for the comparison matrix of the dimensions and calculate the priorities, according to the established survey practices for the AHP \cite{32}. It should be noted that we used the “minimum spanning tree” technique, which only requires the comparative questions of the diagonal immediately superior to the principal diagonal of 1/s of the pairwise comparison matrix to be answered. The other judgements are derived from the participant answers, assuming perfect consistency. This technique is commonly used when the participants complete questionnaires and the possibility of meeting them later to discuss inconsistencies about the judgements is very remote \cite{53} p. 89. We were able to structure the organization’s perspective of the importance of the OM processes and to reassess the measurement of the OM processes in case 1, using the weights of the OM dimensions based on the calculated values from the questionnaire (RSI = 0.167, PF = 0.167, SO = 0.167 and CRRC = 0.500) as shown in Figure 10.

5.2.4. Congruence of OM Perspectives between CEOs and Their TMTs

Another use of the proposed AHP evaluation framework and compatibility analysis is with respect to the mental model perceptions of OM of the different leading people or teams in the organizations. This proposed analysis is demonstrated with two participant organizations in the study (cases 4 and 13). For each examined case (organization), the general manager and the various directors (2 or 3) at mid-level management provided their perceptions of the organizational mindful dimensions (Table 15). One problem that occurs in an organizational diagnosis is a lack of congruency between the perceptions of top executives (CEO) and those of their top management teams (TMT). This incongruity can reflect a communication problem if general managers do not perceive the OM status of the organization in the same way as the direction teams. To analyze this, the answers about the OM questions reported by the top executive (CEO) were compared to the aggregate
answers (arithmetic mean) of his/her TMT in order to determine if there were differences with respect to the dimensions of organizational mindfulness (RSI, PF, SO and CRRC).

Figure 10. AHP model for the organizational mindfulness process evaluation with different weights for a specific organization (case #1).

Table 15. Comparison of the perception of OM dimensions between directors and mid-level management for two specific organizations.

| RSI   | PF   | SO   | CRRC |
|-------|------|------|------|
| Case 4 |      |      |      |
| CEO   | 0.60 | 0.58 | 0.64 | 0.76 |
| TMT   | 0.67 | 0.76 | 0.69 | 0.76 |
| Case 13 |     |      |      |
| CEO   | 0.71 | 0.89 | 0.92 | 1.00 |
| TMT   | 0.68 | 0.79 | 0.84 | 0.91 |

Figure 11a,b illustrates the CEO and TMT perspectives for the case of two participant organizations (case 4 and case 13).

(a) Perspective congruence for case 4 organization
(b) Perspective congruence for case 13 organization

Figure 11. Perspective congruency with respect to OM dimensions for two organizations (G4 = 0.93) and (G13 = 0.98).
Figure 11 shows that the organization in case 13 presents a very low discrepancy in the perspective between the CEO and TMT, while the organization in case 4 shows a greater discrepancy in terms of the presence of preoccupation with failure (PF). Even more interesting is the fact that in case 13, the CEO has a more optimistic perspective of the four dimensions of organizational mindfulness than their employees, while in case 4, the opposite phenomenon occurs. Given that the congruencies/inconsistencies can be presented in any of the four dimensions and the differences between the CEO and TMT can be positive (case 13) or negative (case 4), it is convenient to have some way to measure this congruency/inconsistency.

By calculating the congruency index $G$, one can determine that the congruency index between the director and employees for case 13 is $G_{13} = 0.98$ and for case 4 is $G_{4} = 0.93$. This means that the organization in case 13 has greater congruency of perspective between the general manager and employees than the organization in case 4, at least with respect to the perception of full organizational awareness. This suggests that the organization in case 4 has a lack of communication between the CEO and TMT members.

6. Limitations and Future Research

The work presented here has limitations that must be considered when evaluating the results and conclusions. With respect to the first objective—the impact of the dimensions of organizational mindfulness on the rationality of the decision-making process—the sample size was rather small ($N = 110$), although not unusual in strategic decision-making research, for traditional first-generation statistical analysis. This is a common problem in strategic decision-making research. The number of highly complex health organizations in Colombia is small, and the number of top-level executives who are willing to participate in a study is even smaller. For this reason, PLS-SEM was used to explore $H1$—the positive effect of organizational mindfulness on the rationality of the decision-making process. PLS-SEM is a second-generation tool and does not have normal data distribution requirements but is useful for small samples. This makes it very popular in organizational analysis, where it is not easy or possible to obtain samples from hundreds of organizations. However, an important caveat must be made. A review of the extant literature strongly suggests that organizational mindfulness is constituted by specific process dimensions [1]. This suggests the need for a reflective–reflective second order model for which PLS-SEM is particularly suitable. In the end, the use of PLS-SEM due to a sample limitation was superseded by the opportunity to model a reflective–reflective second order variable for organizational mindfulness (OM).

With respect to the second objective—the use of an evaluation framework based on AHP—there are no limitations in the present study. Instead, there is interest in continuing to follow this line of investigation. One area of future research is the use of other available instruments from the extant literature to assess organizational mindfulness and its processes, even if the AHP continues to be used for their assessment. The goal would be to identify the most suitable instrument or to create a new instrument based on extant measures in the literature.

7. Conclusions

The present study contributes to the academic literature and organizational decision-making practice in several ways. According to the proposed first objective, this study has confirmed the empirical validity of conceptualizing organizational mindfulness as a second order construct constituted by its process dimensions ($H1$). Furthermore, it has empirically shown a significant relationship of the different individual dimensions of organizational mindfulness with the rationality of the decision-making process ($H2$). This relationship has been discussed as being theoretically possible but has never been statistically explored. Second, this study has proven the utility of the AHP-based OM assessment approach developed by Mu and Butler [3] for studying and measuring organizational mindfulness processes at the organizational level. Furthermore, this process was enriched with the use of qualitative
interviews to explore sensitivity scenarios and analysis of the congruence of perspectives between different organizational actors and/or between different organizations. Finally, the present study utilized an AHP framework for the assessment of organizational mindfulness in a real context, the highly complex health sector in Colombia, and shows how to use the method to diagnose organizational issues for improvement purposes.

In conclusion, the present study advances the research on organizational mindfulness and its relationship with the rational strategic decision-making process and establishes the methodological basis and discussion for OM assessment in highly complex organizations, such as leading health institutions in Colombia.

The potential impact of this research is magnified even more because the extant literature suggests, very strongly, that organizational mindfulness contributes to better decision making in highly dynamic and uncertain environments. Therefore, the efforts to understand and develop collective mindfulness within companies contribute not only to the management, but more fundamentally to the success and survival of organizations.

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Appendix A. Questionnaire

Appendix A.1. Organizational Mindfulness Dimensions (Mu and Butler, 2009)

Please honestly answer the following items. Read and select one number on the scale from 1 to 5 according to your degree of agreement, as follows: 1 Totally Disagree (TD); 2 Disagree (D); 3 Neither Agree nor Disagree (N); 4 Agree (A); and 5 Totally Agree (TA).

| Code | Organizational Mindfulness (OM) |
|------|--------------------------------|
| RSI1 | In this organization, collaborators are encouraged to question the way things are done. |
| RSI2 | In this organization, collaborators are ready to challenge the established order. |
| RSI3 | In this organization, doubt is preferred over the established truth. Collaborators have the freedom to take their time to understand problems. |
| RSI4 | |
| PF1  | In this organization, even the smallest mistakes are taken seriously. |
| PF2  | In this organization, possible failures are taken as mistakes. |
| PF3  | In this organization, it is recognized that a failure in one area could have grave consequences in the rest of the organization. |
| SO1  | Collaborators in this organization are willing to share all information related to the operations with everyone. |
| SO2  | Employees in this organization keep up with the operations beyond their immediate functions. |
In this organization, operational themes are frequently discussed. Management knows well what workers do daily.

Collaborators in this organization understand the purpose and goal of each of their jobs.

In this organization, the commitment to solve any problem that may happen is evident.

In case of any problem, employees in this organization can trust one another.

Collaborators in this organization do not give up when facing problems.

In this organization, there is an active concern for developing abilities and knowledge so that collaborators can better serve clients.

In this organization, any collaborator can easily ask for help from someone with more experience.

Collaborators respect the professionalism of all others.

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**Appendix A.2. Rationality (Dean and Sharfman, 1993a)**

Please answer the following questions and indicate your extent of agreement.

| Code | Organizational Mindfulness (OM) |
|------|----------------------------------|
| S03  | In this organization, operational themes are frequently discussed. |
| SO4  | Management knows well what workers do daily. |
| SO5  | Collaborators in this organization understand the purpose and goal of each of their jobs. |
| CRRC1| In this organization, the commitment to solve any problem that may happen is evident. |
| CRRC2| In case of any problem, employees in this organization can trust one another. |
| CRRC3| Collaborators in this organization do not give up when facing problems. |
| CPRC4| In this organization, there is an active concern for developing abilities and knowledge so that collaborators can better serve clients. |
| CRRC5| In this organization, any collaborator can easily ask for help from someone with more experience. |
| CRRC6| Collaborators respect the professionalism of all others. |

| Code | Rationality |
|------|-------------|
| RC1  | The search for information to make this strategic decision was |
|      | Very little | Little | Moderate | Very much | Intense |
|      | 1           | 2       | 3        | 4         | 5        |
| RC2  | The analysis of relevant information to make this decision was |
|      | Very little | Little | Moderate | Very much | Intense |
|      | 1           | 2       | 3        | 4         | 5        |
| RC3  | Grade the importance of the quantitative analytical techniques to make this decision |
|      | Not important | Not as important | Some important | Important | Very important |
|      | 1           | 2       | 3        | 4         | 5        |

Answer the following questions.

RC4—The process that had the greatest influence on making the decision was

Mainly analytic 1—2—3—4—5 Mainly intuitive

RC5—The team’s effectiveness at focusing their attention on the relevant information and ignoring irrelevant information was

Not effective 1—2—3—4—5 Very effective
Appendix B. Comparison of Organizational Mindfulness Processes for the Participating Organizations

(B1) Resistance to simplify interpretations

(B2) Preoccupation with failure

(B3) Sensitivity to operations

(B4) Commitment to resiliency and deference to expertise

Appendix C. AHP Questionnaire for Prioritization of the Organizational Mindfulness Process

It has been said that the presence of organizational mindfulness, also called collective mindfulness, increases the possibility for an organization to make decisions, taking into account the specific situation of the organization in relation to its context, which makes the organization highly reliable [1,3]. These organizations share the presence of processes that are developed within the organization, which allow them to handle the unexpected. These processes are preoccupation with failure, reluctance to simplify interpretations, sensitivity to operations and commitment to resilience/deference to expertise [1,17–19].

Preoccupation with failure is actively and continuously considering the possibility of failure, and treating any mistake, no matter how small, as a potential indicator for possible major mistakes.

Reluctance to simplify the interpretations means actively questioning significant precepts and operational assumptions and not assuming that they are valid, encouraging the generation of new ideas and recognizing that there are not simple answers for complex problems.

Sensitivity to operations means developing and maintaining an integrated understanding of the operations at all times and for all the members in the organization.

Commitment to resilience with deference to expertise implies an increase in the employee’s and organization’s capabilities to adapt, improve and learn in order to better recuperate from unexpected events, as well as respecting the opinions of employees, who
have more knowledge about the organization, rather than only considering hierarchy (Mu and Butler, 2009).

Next, we are going to ask some questions to evaluate the relative importance of these processes in the health area in general or in a specific organization. The investigator will explain for which of the two cases you are expected to answer the following questions.

Comparison of preoccupation with failure with reluctance to simplify interpretations

In your opinion, which of these two processes is more important for (the health area/organization)? (Choose one.)

Preoccupation with failure____
Reluctance to simplify interpretations____

How much more important is the selected process (with respect to the other)?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| Equally | Moderately | Strongly | Very Strongly | Extremely |

(You can select intermediate values if necessary)

Comparison of reluctance to simplify interpretations with sensitivity to operations

In your opinion, which of these two processes is more important for [the health area/organization]? [Choose one]

Reluctance to simplify interpretations_____Sensitivity to operations____

How much more important is the selected process (with respect to the other)?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| Equally | Moderately | Strongly | Very Strongly | Extremely |

(You can select intermediate values if necessary.)

Comparison of sensitivity to operations with commitment to resiliency and deference to expertise (respect for knowledge)

In your opinion, which of these two processes is more important for (the health area/organization)? (Choose one.)

Sensitivity to operations____
Commitment to resiliency and deference to expertise_____

How much more important is the selected process (with respect to the other)?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| Equally | Moderately | Strongly | Very Strongly | Extremely |

(You can select intermediate values, if necessary.)

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