

# Designing a model of wise decision-making process in auditing with a fuzzy Delphi approach

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*(Communicated by Mohammad Bagher Ghaemi)*

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## Abstract

Since the attention and interest in the theory of wisdom is growing in various disciplines, but the integration of wisdom in professional methods such as auditing, especially their decision-making and professional opinions about financial statements, is still in an aura of ambiguity. Due to the lack of an understanding Empirical and explicit about the relationship between auditors' wisdom and decision-making, this gap doubles. Therefore, based on this argument, the current research aims to design a model of the wise decision-making process in auditing with a fuzzy Delphi approach. The methodology of this research is a combination (qualitative and quantitative) based on the participation of two expert communities as panel members in the qualitative section and 30 independent auditors as sociostatistical members in the quantitative section. In the qualitative part, the meta-analysis method was used to identify the factors related to wise decision-making, and then, through Delphi analysis, the basic factors were determined, based on the two criteria of the agreement coefficient and the average during the steps carried out back and forth to reach theoretical saturation. It investigated the results of this section and showed that 3 main components and 12 sub-components were approved. Based on the results, the professional thinking factor was chosen as the most influential factor and the social thinking factor as the second most influential factor on the auditors' wise decision-making.

Keywords: auditors' thoughts, wise decision-making, experts  
2020 MSC: 62C05, 62C86

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## 1 Introduction

The search for wisdom is almost as old as the life of humanity, which is the result of the efforts of thinkers and philosophers in various fields of science, such as humanities, psychology, management, and philosophy. Due to its importance in decision-making, wisdom has recently entered the auditing profession [33]. According to Sternberg [41], wisdom is considered a type of human quality in decision-making, which is very rare and difficult to conceptualize and operationalize because reaching this knowledge as a dimension of wisdom in a person's decisions because The internal complexities are challenging and time-consuming. Therefore, wisdom is one of the issues that managers understand, and at the same time, it is considered one of the most critical aspects of managerial performance [32]. The pursuit of wisdom is almost as ancient as mankind itself, and it has been the focus of thinkers and philosophers from many branches of study, including the humanities, psychology, management, and philosophy. Wisdom has recently appeared

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in the auditing industry due to its significance in decision-making areas [33]. Sternberg [41] claims that wisdom is a form of a human trait that is extremely rare and challenging to conceive and operationalize since it takes a lot of effort and time to acquire this knowledge as a dimension of wisdom in a person's actions owing to the internal complexity of the task. As a result, wisdom is one of the concepts that managers struggle to grasp, even though it is often regarded as one of the critical components of effective management [32].

According to several researchers, partners and managers who are wise in the auditing industry make good judgments [5, 24, 38, 42]. In the information economy age, standardization and complete exchange of corporate financial data and discipline will be made possible by constructing a comprehensive audit network system based on state-owned firms, independent audit institutions, and regulatory organizations. Regarding this, Sweeney et al. [46] thought about the requirement for sensible tact in decision-making to completely comprehend the nature of wisdom and knowledge to examine financial accounts by auditors in today's lack of openness [3]. Indeed, wisdom is a complex idea with dual subjectivity and dual objectivity that arises from human intellect, behavior, and emotions [47]. They contend that wisdom enables decision makers, such as auditors, to exercise sound judgment when making judgments based on studies conducted by researchers in the field of the function of wisdom in decisions in the audit field and the domains of the humanities [26, 36]. As a result, the current research in this field in the auditing space does not provide enough information to the theorists and financial analysts of this field to make appropriate decisions in the auditing profession due to the neglect of this important issue in decision-making. This is because the role of wisdom is stressed in the decision-making process of auditors; however, the theoretical knowledge of wisdom in the auditing industry might serve as a guide for auditors' areas of discretion. They contend that wisdom enables decision makers, such as auditors, to exercise sound judgment when making judgments based on studies conducted by researchers in the field of the function of wisdom in decisions in the audit field and in the domains of the humanities [26, 36]. As a result, the current research in this field in the auditing space does not provide enough information to the theorists and financial analysts of this field to make appropriate decisions in the auditing profession due to the neglect of this important issue in decision-making. This is because the role of wisdom is stressed in the decision-making process of auditors; however, the theoretical knowledge of wisdom in the auditing industry might serve as a guide for auditors' areas of discretion.

## 2 Theoretical foundations and conceptual development

Although the study of wisdom in auditing is expanding daily, it is a type of human attribute that is extremely rare and challenging to describe and operationalize. Because of the internal intricacies, according to Sternberg's [41] thesis, it is exceedingly challenging and time-consuming to understand a dimension of wisdom in a person's decision-making. Accordingly, Sweeney et al. [46] considered the requirement for sensible tact in decision-making to fully comprehend the nature of wisdom and knowledge to analyze financial accounts by auditors in the current climate of lack of openness. According to [47] thesis, wisdom is a complex idea that derives from human intellect, behavior, and emotions and blends subjectivity and objectivity.

Using the auditors' code of professional conduct as a foundation, auditing standards in the area of presenting auditors' reports attempt to moderate auditor behavior by inspiring ethical and qualified reasons [2]. But because it pays less attention to people's emotional and behavioral characteristics and overlooks their professional identity in greater dimensions, this work typically cannot be particularly productive in this sector [9]. Since decision-making is a behavior that occurs throughout the entire process of audit operations and because it is important to pay attention to qualities like professionalism, one of the accounting and auditing complexities that requires attention in the current situation is taking into account the decision-making criteria of auditors, which are not mentioned in the standard book. This raises expectations for the quality of the auditors' judgment because of the need to pay attention to features like professionalism. An auditor is a person with technical expertise in a particular area, time, and location and distinct from all his prior investigations, according to the behavioral theory in audit sectors. In this case, the auditor should adopt a wide perspective, concentrate on both behavioral and specialist areas, and strive to keep in touch with business owners. As a result, it is possible to say that decision-making refers to a group of mental processes that take place when a person decides to develop or select alternative solutions. The current research in the area of wisdom and intuition in the auditing environment does not provide the analysts and theorists of this field with enough information to make appropriate decisions in the auditing profession despite the recent emphasis on the crucial role of wisdom in decision-making. This is because this important issue in decision-making has been neglected. However, one point of reference in the auditors' decision-making domains might be deemed to be the theoretical understanding of the idea of wisdom. Judgment is crucial when auditing financial accounts since it guides all stages of the audit process, including planning, implementing operations, and commenting. Indeed, how a person thinks about and approaches problems is the first step in problem-solving. As a result, each auditor has a unique approach to problem-solving and decision-making that significantly effectiveness his professional judgment. To pick one of them and base a decision on

it, it should be stated that professional judgment in auditing is the application of knowledge and experience within the parameters defined in the accounting and auditing standards and the code of professional behavior.

### 3 Literature review

A conceptual framework for the wisdom-based decision-making process in the auditing profession was presented by Nguyen [31] in a study. This study aims to analyze the idea of wisdom in auditing, management decision-making, and audit performance based on the foundation's data theory. The findings point to the development of a conceptual framework for understanding the auditing industry's wisdom-based decision-making process. An integrated application of several variables, such as the absorption of wisdom, judging aptitude, and ethical orientation, is what a smart audit decision-making process means. This study also explains and examines the possible interactions between these elements in the audit decision-making process. He thinks that all independent auditors should have wisdom as a valuable implicit talent. The improvement of an auditor's capacity for making intelligent decisions should be seen as a crucial component of several virtues, including knowledge and features of judgment and ethics. Investigating the effect of audit knowledge sharing in the form of group thinking on audit quality was the title of a study done by Sun et al. in [44]. The findings demonstrated that the exchange of auditing information might increase the quality functions of auditing while also boosting group decision-making capacity and fostering better action and attitude unanimity based on the social obligations of auditors. Improving auditors' critical thinking abilities in complicated audit environments was the focus of a 2019 study by Bokaro. The findings of this study show that auditors who possess both an analytical and intuitive level of thought can recognize financial statements from businesses that have deceived and misled shareholders and investors.

Intezari and Pauleen [17, 18] used the grand theory technique to research prudent management decision-making. The results show that an iterative and integrated decision-making and learning process produces intelligent management decision-making. According to the results, the development of practical knowledge and intelligent decision-making requires a strategy beyond the agglomeration of information and simple knowledge from the sequence of actions of recognizing issues, creating, comparing, and selecting various solutions. Making intelligent judgments includes developing a collection of decision-making characteristics and criteria that change naturally over time. The main conclusions and ramifications of this research are discussed, along with a notion of intelligent management decision-making. [32] conducted a study on the determinant model of wisdom in the auditing industry. This paper explores the idea of wisdom and offers a theoretical framework to explain three crucial knowledge virtues in the auditing industry. The results of the literature review and empirical analysis of a case study demonstrate that the three virtues of epistemic (the application of general, technical, and specialized knowledge), feasible (the use of professional judgment), and ethical decision-making are combined to produce wise decision making in auditing (moral and occupational skepticism). The article introduces the 3-E framework, which describes how auditors should utilize their knowledge, judgment, and ethical principles to make audit judgments to conduct a high-quality audit. The model of the auditor's philosophical themes of prudent tact in professional judgment was created by Malekipour et al. [26], and the themes were proven in the quantitative section. To determine the most important factor related to the auditor's wise tact in professional judgment based on the comprehensive structural interpretive analysis method, they were first coded before being distributed among the target community members based on the creation of matrix questionnaires. According to the findings, the issue of adherence to professional ethics was selected as the fundamental theme of professional thought and the most important component of sensible tact.

Barzideh et al. [6] used a methodology based on the data theory of the foundation to explore the construction of the identification model in audit judgment. Using semi-structured interviews, the data was gathered. Two ways of examining the participants, as well as the reviews of experts who were not participants in the study, were employed to determine the reliability and validity of the data. The four dimensions of individual traits—wisdom, skill, and experience—as well as the traits of the audit institution—are used to analyze the central category of identity in audit judgment. Based on this analysis, strategies are developed according to the causal conditions, contextual conditions, and intervening conditions, and the final model is then presented. This research might serve as a useful place to start when thinking about auditor identification. In a study, Hajiha et al. [14] examined the connection between auditors' professional uncertainties and their judgment and decision-making. The analysis of the partial least squares statistical test of the characteristic of doubt (individual trust, suspension of judgment, source of control, and professional doubt) and the results of the questionnaire's four (PLS) showed that these factors have an impact on the judgment and decision-making of auditors. However, the control source has the most effectiveness. The better your judgment and decision-making will be, the more you pay attention to it.

## 4 Methodology

According to the nature of the study, both qualitative and quantitative participants are included. The target community for the qualitative portion includes 20 accounting professionals who engage in the analysis and identification of components and indicators as well as the needed investigations on the study issue. In other words, these volunteers took part in both the meta-analysis and the Delphi analysis with the researchers. These individuals were chosen by uniform qualitative sampling to make up the panel group. In this sampling technique, the researcher chooses his samples to gain in-depth, concentrated, and specific knowledge from persons who have encountered this occurrence and can provide the researcher with a wealth of information. The objective of this population's participation is to explain the findings of the qualitative section at the level of the auditing profession. The target population for the quantitative section was 30 independent auditors, which is acceptable given the need for a thorough structural-interpretive analysis. Indeed, since the comprehensive structural-interpretive technique is based on the study of complex systems at particular levels, it should be based on a particular criterion, such as experience or specialized knowledge by the participants. With the participation of 17 to 30 participants, a reciprocal matrix questionnaire is completed to avoid producing a large number of incoherent responses. The ideal number of samples, according to researchers like [5, 40], should be between 15 and 30, and the reason for choosing the sample population is the available sampling technique under the filters that best suit the nature of the research.

In the qualitative section, data analysis was carried out under the nature of the data using the coding technique, a form of qualitative content analysis, and the qualitative content analysis program MAXQDA.2020. The qualitative data coding technique, a type of qualitative content analysis, is used to analyze the data in the qualitative stage following the qualitative character of the information gleaned from the interview and the extraction of related ideas in them. Every phrase, word, sentence, paragraph, response, etc., is regarded as a key code or an event. Then we elevate the occurrences to the notion, which is a higher level. On coding sheets, relevant events and similar concepts are indicated. Four phases are required to complete the multi-criteria fuzzy Delphi procedure. Fuzzification is done at the initial stage following professional consultation. Inverse matrices are constructed in the next step. The third stage establishes the relative importance of each parameter, and the fourth step uses non-phased weights to establish the weight or priority of each parameter. The comments provided by experts and professionals are immediately taken into account while computing the fuzzy numbers in the first stage ( $\alpha_{ij}$ ). At this point, fuzzy numbers can be computed using a variety of membership functions, including the triangular approach or the trapezoidal mode. The computation of fuzzy numbers is displayed in the picture below due to the widespread use and simplicity of the triangle approach. The following relationships are used to define a fuzzy number in this instance:

$$\begin{aligned}\alpha_{ij} &= (\alpha_{ij}, d_{ij}, g_{ij}) \\ d_{ij} &= \left( \prod_{k=1}^n b_{ijk} \right), k = 1, \dots, n \\ g_{ij} &= \max(b_{ijk}), k = 1, \dots, n\end{aligned}\quad (4.1)$$

In the equation shown above,  $b_{ijk}$  represents the expert's judgment of the relative significance of parameter  $I$  over parameter  $j$ ,  $\alpha_{ij}$  and  $g_{ij}$  represent the lowest and upper bounds of respondents' opinions, respectively, and  $d_{ij}$  represents the geometric mean of respondents' opinions. The definition of the fuzzy number's components ensures that they always fluctuate in value within the range [9 and 1.9] and that the relation  $\alpha_{ij} > g_{ij} > d_{ij}$  always exists.

The fuzzy pair matrix is created between various parameters as specified in the following equation in the second stage, which is the production of the fuzzy inverse matrix using the fuzzy numbers acquired in the previous step:

$$A_{ij} = [\alpha_{ij}], \alpha_{ij} \times \alpha_{ji} \approx 1, V_{ij} = 1, 2, 3, \dots \quad (4.2)$$

The following relationships are used to determine the relative fuzzy weight of the parameters in the third stage, which is called relative fuzzy weight calculation.

$$\begin{aligned}\tilde{Z} &= [\tilde{\alpha}_{ij} \otimes \dots \otimes \tilde{\alpha}_{ij}]^{\frac{1}{n}} \\ \tilde{Z}_i &= \frac{1}{\tilde{Z}} \\ \tilde{W}_i &= \tilde{Z}_i \otimes (\tilde{Z}_i \oplus \dots \oplus \tilde{Z}_n)\end{aligned}\quad (4.3)$$

where  $(\alpha_1 \times \alpha_2, \sigma_1 \times \sigma_2, \gamma_1 \times \gamma_2) \otimes \alpha_1 \alpha = 2$ , and  $\otimes$  is the fuzzy number multiplication symbol, and  $\oplus$  is the sign of the sum of fuzzy numbers.  $W_i$  is a line vector that reflects the  $i$ -th parameter's fuzzily weighted value. The geometric mean of the fuzzy number components of the weight of the parameters is determined in the fourth phase, which fuzzifies the parameters, and the weight of the parameters is then given as a definite number:

$$W_i = \left( \prod_{k=1}^{3n} W_{ij} \right) \quad (4.4)$$

## 5 Findings

### 5.1 Meta-analysis and Delphi findings

The total number of valid and reliable studies in this field was ascertained to perform a meta-analysis, first through databases and research references like Jihad University in Iran, the country's publications database (Mogiran), the Islamic Computer Science Research Center of Iran, the international reference of current articles (Sciencedirect), the Emerald reference (Emeraldinsight), and the reference (onlineLibrary) under the specific procedure below. In other words, studies relevant to the research's goal were found by searching through similar publications and studies in the aforementioned research databases and references.

According to [43] methodology, the themes should be classified and segregated in the form of components and indicators relevant to the research issue once the study's 14 researchers had their material authorized. Based on this methodology, the first 14 research projects were approved using ten criteria for critical evaluation, including research objectives, the logic of the research method, the research plan, sampling, data collection, reflectivity, the accuracy of analysis, theoretical and clear expression of findings, and research value with the assistance of 20 research panel members. Now, the topics of the research are retrieved under authorized studies and based on [43] methodology. To appropriately merge these many and, at first glance, unconnected concepts, selected texts from the research sources should first be classified in the form of fundamental themes. Totaling 86 themes, some of which are briefly discussed in Table 1, the accepted investigations from the critical review stage yielded a total of 86 codes.

Table 1: Part of the basic themes of the research

| Extracted content  | Basic themes  |
|--|---|
| 1- Although the auditing profession has set standards and explicit criteria for decision-making, depending on the person, auditors' choices should be guided by social factors like accountability and responsibility [22].  | 1- Accountability<br>2- Responsibility  |
| 5- The auditor's ability to strike a balance between his mindset and appropriate audit procedures will result in a successful audit judgment [46].   | 15- Suitability between mentality and professional functions  |
| 8- The fact that an auditor is working on many tasks at once and longer than the allotted hours is not indicative of professional judgment or consideration of the interests of the majority of stakeholders [20].   | 24- Attention to the interests of the majority of beneficiaries   |
| 4- Acquiring information in the auditing field is said to be a significant determinant of the auditor's judgment. This knowledge progressively develops throughout a career by shattering mental frames of reference and increases a person's commitment to justice in this line of work [48]. | 10- breaking mental frames of reference<br>12- Compliance with justice in the auditing profession   |
| 43- A person needs intuition while making decisions to achieve a goal, and if it is disregarded, a crucial aspect of decision-making is upset [47].  | 35- Intuition in decision making  |
| 16- An auditor with intuitive thinking should have developed a relative awareness of the changes in the capital market and the characteristics of the owners based on his job experiences to make the optimal judgment [25].   | 24- Intuitive thinking<br>36- Knowing the capital market<br>27- Knowing the owners  |
| In light of the complexity of the auditing profession, people's abilities—while unique—play a significant part in learning and developing the degree of audit judgment [27].   | 64- Individual ability in professional complexities   |
| 22. A professional norm in auditing is the progression through the circuit of ethical principles, which, if adhered to appropriately, demonstrates the adequacy of perception with the professional qualities of auditing and attaining maturity [33].   | 33- Movement within the rules<br>74- Adherence to moral elements<br>70- The fit of perception with the professional characteristics of auditing |

|  |  |
|--|--|
| 79. Achieving recognition in auditing necessitates having a complicated thought process that goes outside the purview of the auditing profession. Recognition in auditing is a hazy subject dependent on a free perception for each person [46]. | 82- Knowledge of auditing<br>84- Transcendentalism<br>87- Intellectual depth |
|--|--|

An effort was made to portray some of the subjects in this section despite the magazine's page restrictions. The interesting fact, however, is that out of the 118 extracted contents, 88 fundamental themes were found, and eventually, 20 basic themes (basic) were distilled into three organizational themes (components) in the order shown in Table 2.

Table 2: The identified components of the auditor's intellectual characteristics

| Organizer components  | Basic indices   |
|-----------------------|---|
| Professional thinking | Learning along the professional path (career path)<br>Considering the interests of the majority of stakeholders<br>Analyzing individual ability<br>Evaluating professional values<br>Developing individual knowledge<br>Fitting between mentality and performance<br>Having inferential interpretations |
| Social thinking       | Focusing on social approaches to society<br>Persisting in professional ethics<br>Moving in the direction of regulations<br>Skepticism and impartiality in the auditing profession<br>Accountability of the auditor  |
| Cognitive thinking    | Knowledge of the capital market<br>Knowing the auditor's judgmental biases<br>Foresight when making decisions<br>Insight and intuition in professional decision making  |

The themes developed in Table 3 in the form of a scoring checklist are now collated and disseminated among the target audience in the qualitative part to control the quality of validity, reliability, and Delphi analysis (in the results analysis section).

Table 3: Sources used in identifying the components of entrepreneurship financing based on the collective participation approach

| Main theme            | Sub-theme   | Source               |
|-----------------------|---|----------------------|
| Professional thinking | Learning along the professional path (career path)        | [28, 29, 30, 31, 32] |
|                       | Considering the interests of the majority of stakeholders | [34, 35, 37]         |
|                       | Assessing individual ability                              | [15, 16, 21, 45]     |
|                       | Evaluating professional values                            | [17, 18, 19, 23]     |
|                       | Developing individual knowledge                           | [31, 35, 45]         |
|                       | Fitness between mentality and performance                 | [15, 21, 30, 37]     |
|                       | Having inferential interpretations                        | [11, 12, 13]         |
| Social thinking       | Focusing on social approaches to society                  | [1, 4, 7]            |
|                       | Persistence in professional ethics                        | [7, 8, 11, 13]       |
|                       | Moving in the direction of regulations                    | [11, 12, 13]         |
|                       | Skepticism and impartiality in the auditing profession    | [10, 15]             |
| Cognitive thinking    | Having inferential interpretations                        | [11, 12, 13]         |
|                       | Knowledge of the capital market                           | [10, 12, 13]         |
|                       | Knowing the auditor's judgmental biases                   | [12, 15, 21]         |
|                       | Foresight when making decisions                           | [31, 35, 45]         |
|                       | Insight and intuition in professional decision making     | [4, 15, 30, 37]      |

## 5.2 The resources used in the desired components and dimensions

The qualitative content analysis procedure (coding) was employed with MAXQDA.2020 qualitative content analysis software to evaluate the data in the qualitative phase of the research's initial stage. Excel software was used to calculate

each factor's effectiveness and efficacy. The fuzzy Delphi technique was used to assess the level of agreement regarding the dimensions and components that were taken from the literature, the analysis of the fuzzy network process was used to assess the significance and weight of the dimensions, and DEMATEL was used to assess the causal relationships (effectiveness and impressionability). As you are aware, Delphi analysis is a method of making decisions based on the advice of experts that iterates through some phases until it reaches the theoretical saturation point. The moment when it is established that the themes that have been found are reliable. Accordingly, two criteria—the mean and the agreement coefficient—are used to do the Delphi analysis at this point of the process.

### 5.3 The results of the second stage of Delphi

The Delphi analysis of the noted themes is displayed in Table 4. Given that the research checklists' Likert scale included seven possibilities, the analysis of the data in the Table below focused on themes with an average score of five or above. According to studies like [49], and many more, the results are considered valid if the agreement coefficient is 0.5 or above. This led to the conclusion that four fundamental themes were disregarded since they had an average of less than five and an agreement coefficient of less than 0.5. Again, the findings of the second round of Delphi analysis verified all 12 fundamental themes that were affirmed in the first round of Delphi after deleting the aforementioned basic themes and issuing amended checklists to experts. Accordingly, the theoretical saturation point was designed to confirm the ideas connected to the auditor's wisdom while still having the validity of the affirmed themes. The second stage of the Delphi process produced results that eventually approved three aspects of professional thinking, social thinking, and cognitive thinking with 12 indications each.

Table 4: Delphi analysis

| Components            | Mean | Coefficient of agreement | Indices   | Mean | Coefficient of agreement | Confirmed/deleted |
|-----------------------|------|--------------------------|---|------|--------------------------|-------------------|
| Professional thinking | 8.08 | 0.63                     | Learning along the professional path (career path)        | 5.10 | 0.75                     | Confirmed         |
|                       |      |                          | Considering the interests of the majority of stakeholders | 5.20 | 0.8                      | Confirmed         |
|                       |      |                          | Assessing individual ability                              | 5    | 0.7                      | Confirmed         |
|                       |      |                          | Evaluating professional values                            | 5    | 0.75                     | Confirmed         |
|                       |      |                          | Developing individual knowledge                           | 5.10 | 0.7                      | Confirmed         |
|                       |      |                          | Fitness between mentality and performance                 | 3.50 | 0.30                     | deleted           |
|                       |      |                          | Having inferential interpretations                        | 3    | 0.45                     | deleted           |
| Social thinking       | 5.2  | 0.70                     | Focusing on social approaches to society                  | 5.30 | 0.71                     | Confirmed         |
|                       |      |                          | Persistence in professional ethics                        | 5    | 0.9                      | Confirmed         |
|                       |      |                          | Moving in the direction of regulations                    | 4    | 0.43                     | deleted           |
|                       |      |                          | Skepticism and impartiality in the auditing profession    | 5.40 | 0.73                     | Confirmed         |
|                       |      |                          | Having inferential interpretations                        | 5.20 | 0.75                     | Confirmed         |
| Cognitive thinking    | 6.06 | 0.69                     | Knowledge of the capital market                           | 5.10 | 0.75                     | Confirmed         |
|                       |      |                          | Knowing the auditor's judgmental biases                   | 3    | 0.25                     | deleted           |
|                       |      |                          | Foresight when making decisions                           | 5.10 | 0.88                     | Confirmed         |
|                       |      |                          | Insight and intuition in professional decision making     | 5    | 0.9                      | Confirmed         |

## 5.4 Prioritization of indicators with fuzzy DIMATEL method

### 5.4.1 Determining the intensity matrix of internal relationships of indicators

The fuzzy Dimatel approach has been applied in this section of the investigation, as was previously described. Triangular fuzzy numbers, as presented by [39], have been employed in this approach. Table 5 lists the language phrases used in this study along with the matching triangular fuzzy numerical values.

Table 5: The linguistic terms and corresponding triangular fuzzy numerical values

| Linguistic terms for paired comparisons | Numerical value    |
|---|--------------------|
| very high impact (VH)                   | (0.75, 1, 1)       |
| high impact (H)                         | (0.5, 0.75, 1)     |
| low impact (L)                          | (0.25, 0.50, 0.75) |
| very low impact (VL)                    | (0.0, 0.25, 0.50)  |
| No effect (NO)                          | (0.0, 0.0, 0.25)   |

In the first section of the questionnaire, the experts were required to rate each indicator's effectiveness on the audit's prudent decision-making process on a scale of 0 (no impact), 1 (low impact), 2 (medium impact), 3 (high impact), and 4 (very high impact). These values were transformed into fuzzy expressions in the subsequent stage. The opinions of specialists were gathered in the third step.

Table 6: Aggregation of experts' opinions for Fuzzy DIMATEL

| AVC | C1   |      |      | C2   |     |      | C3   |      |      |
|-----|------|------|------|------|-----|------|------|------|------|
| C1  | 0.15 | 0    | 0.55 | 0.3  | 0.8 | 0.45 | 0.12 | 0.5  | 0.35 |
| C2  | 0.9  | 1    | 0.8  | 0.4  | 0.6 | 1    | 0    | 0.25 | 0.9  |
| C3  | 0.15 | 0.25 | 0.7  | 0.85 | 0.1 | 0.23 | 0.9  | 0    | 1    |

### 5.4.2 Determining the aggregated fuzzy normalized matrix

4 The following uses the relevant formulae to normalize this matrix using the fuzzy DIMATEL approach. The aggregated normalized matrix of expert opinions is displayed in Table 7.

Table 7: The aggregate normalized matrix of experts' opinions

| AVC | C1  |     |     | C2  |     |     | C3  |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| C1  | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 |
| C2  | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.2 |
| C3  | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 |

### 5.4.3 Determining the matrix of fuzzy aggregated relations

The matrix of fuzzy collective relations is generated after carrying out the necessary computations, as shown in the following Table:

Table 8: The final matrix of fuzzy aggregated relations

| AVC | C1   |      |      | C2   |      |      | C3   |      |      |
|-----|------|------|------|------|------|------|------|------|------|
| C1  | 0.44 | 0.19 | 0.1  | 0.47 | 0.22 | 0.13 | 0.29 | 0.07 | 0.17 |
| C2  | 0.18 | 0.13 | 0.15 | 0.19 | 0.14 | 0.17 | 0.19 | 0.2  | 0.16 |
| C3  | 0.13 | 0.13 | 0.14 | 0.19 | 0.15 | 0.15 | 0.2  | 0.17 | 0.16 |

## 5.5 How is the weight (importance) of the factors and elements that go into an auditors' sensible decision-making connected to the data analysis?

The results of the Delphi questionnaires (validated dimensions and components) were incorporated into the Network Paired Comparison Questionnaire (FANP) to respond to this inquiry, and experts were then able to assign numerical points to the dimensions and components that would help the auditors make wise decisions (between 1 and 9).



1. Determining the weight and significance of the components related to the dimension of professional thinking: Professional thinking includes the following elements: evaluation of professional values, personal knowledge growth, consideration of the interests of the majority of stakeholders, learning throughout the career, and evaluation of individual competency. The following pairwise comparison matrix might be shown in the light of the findings of the expert opinion-gathering process. Each of the acquired values for the normalized and fuzzy weight has a connection to the primary components. The following calculations were made to estimate the importance of the dimension of professional thinking:

Table 9: Defuzzification of the weights of the components of the dimension of professional thinking

| Component  | Obtained weight | Normalized weight | Rank |
|--|-----------------|-------------------|------|
| Evaluating professional values                             | 0.395           | 0.389             | 1    |
| Developing personal knowledge                              | 0.216           | 0.211             | 3    |
| Attention to the interests of the majority of stakeholders | 0.249           | 0.243             | 2    |
| Learning along the professional path                       | 0.184           | 0.179             | 4    |
| Assessing individual ability                               | 0.213           | 0.204             | 5    |

The evaluation of professional values, the development of individual knowledge, paying attention to the interests of the majority of stakeholders, learning along the professional path, and the evaluation of individual capabilities are, in that order, the components related to the dimension of professional thinking that is given the highest priority based on the results. Given that the produced special vector had an inconsistency rate of 0.018 and an agreement rate of more than 90%, the comparisons may be believed.

2. Determining the weight and importance of the components related to the dimension of social thinking: The focus on social approaches to society, adherence to professional ethics, the auditor's responsibilities, uncertainty, and objectivity in the auditing profession are the elements of social thinking. The following pairwise comparison matrix might be shown in the light of the findings of the expert opinion-gathering process. Each of the acquired normalized and fuzzy weight values has a connection to the primary components. The following calculations were performed to evaluate the importance of the social thinking dimension:

Table 10: Defuzzification of the weights of the components of the dimension of social thinking

| Component  | Obtained weight | Normalized weight | Rank |
|--|-----------------|-------------------|------|
| Skepticism and impartiality in the auditing profession | 0.241           | 0.238             | 4    |
| Persistence in professional ethics                     | 0.428           | 0.412             | 1    |
| Focusing on social approaches to society               | 0.324           | 0.311             | 2    |
| Accountability of the auditor                          | 0.289           | 0.284             | 3    |

Based on the results, the sustainability of professional ethics, the emphasis on social approaches toward society, the auditor's responsibility, uncertainty, and neutrality in the auditing profession are, in that order, the components related to the dimension of social thinking that should be given priority. Given that the produced special vector has an inconsistency rate of 0.002 and an agreement rate of more than 90%, comparisons may be trusted.

3. Determining the weight and significance of the cognitive thinking-related components: Cognitive thinking includes the ability to plan when making judgments, understand the financial markets, and use insight and intuition while making decisions for the sake of one's career. The following pairwise comparison matrix might be shown in the light of the findings of the expert opinion-gathering process. Each of the acquired normalized and fuzzy weight values has a connection to the primary components. The following calculations were made to evaluate the importance of the cognitive thinking dimension:

Table 11: Defuzzification of the weights of cognitive thinking dimension components

| Component   | Obtained weight | Normalized weight | Rank |
|---|-----------------|-------------------|------|
| Foresight when making decisions                       | 0.221           | 0.215             | 1    |
| Knowledge of the capital market                       | 0.147           | 0.143             | 3    |
| Insight and intuition in professional decision making | 0.190           | 0.186             | 2    |

According to the results, knowledge of the capital market, insight, and intuition in making professional decisions are the components associated with the dimension of cognitive thinking that is prioritized in that order. Given that the produced special vector had an inconsistency rate of 0.014 and an agreement rate of more than 90%, the comparisons may be believed.

**5.6 What is the relationship between the dimensions and components of auditors’ wise decision-making?**

The DIMATEL approach, whose stages are listed below, has been applied in this respect.

**Forming a diagram of the effectiveness of variables on each other**

At this point, the factors that go into an auditor’s intelligent judgment are placed in a graph’s vertices, and the interactions between the vertices are established, for instance, in the form of how elements impact one another. The variables are compared in pairs, and the opinions of experts are only called into question when there is a direct association between the variables.

**Determining the intensity of the impact of variables on each other**

One of the crucial and exact elements in the study process is figuring out how strongly different variables affect one another. To do this, a questionnaire was created, and the opinions of experts about the strength of each variable’s effect on the others were solicited. The degree of the components’ effectiveness is evaluated in this study using a scoring system that ranges from zero to one hundred (100). (4). According to the Table, the impact’s score and degree of intensity are calculated (11).

Table 12: How to score the intensity of variable impact on each other

| <b>Impact intensity</b> | <b>score</b> |
|-------------------------|--------------|
| Very high impact        | 4            |
| High impact             | 3            |
| Low impact              | 2            |
| Very low impact         | 1            |
| No impact               | 0            |

It is important to note that this severity of the effectiveness has been minimized by avoiding the judges’ general propensity to select the "average" scenario and hence the variance in the outcomes. The final analysis will be based on the "average" view of the experts, which is connected as follows: Due to the varied opinions supplied by the experts regarding the severity of the impacts of the factors on each other:

$$a_{ij} = \frac{1}{H} \sum_{j=1}^k x_{ij}^k \tag{5.1}$$

**Forming the matrix (group decision) of the intensity of direct relationships  $\widehat{M}$**

Each intersection’s item in the matrix of direct connections shows how strongly the variable from that row has an impact on the variable from that column. The resultant matrix, which is represented in the Table below, is created by averaging the expert judgments, and zero at each intersection denotes the lack of a link between the variables at that junction.

Table 13: The matrix of the mean opinions of experts on the intensity of direct relationships  $\widehat{M}$

|                                     | <b>Professional thinking</b> | <b>Social thinking</b> | <b>Cognitive thinking</b> | <b>Total column</b> |
|-------------------------------------|------------------------------|------------------------|---------------------------|---------------------|
| $\widehat{M} =$ Professional think- | 0.00                         | 2.40                   | 2.53                      | 4.93                |
| ing                                 |                              |                        |                           |                     |
| Social thinking                     | 2.14                         | 0.00                   | 1.20                      | 3.34                |
| Cognitive thinking                  | 1.50                         | 1.52                   | 0.00                      | 3.02                |
| Total row                           | 3.64                         | 3.92                   | 3.73                      | 0.20                |

$$S = \min \left\{ \frac{1}{\max\{4.93, 3.34, 3.02\}}, \frac{1}{\max\{3.64, 3.92, 3.73\}} \right\} = 0.20 \tag{5.2}$$

**Determining the sum of direct and indirect effects of elements on each other (formation of the matrix of general relationships T)**

At this point, a geometric progression based on the prevailing graphing principles is used to determine the total of an infinite series of direct and indirect variable effects on one another (along with any potential feedback). This total

has to be calculated using the  $(I - M)^{-1}$  matrix. The generic relationship matrix T, where I is the  $n \times n$  unit matrix, is the sum of this expansion.

**Calculating the inverse matrix  $(I - M)^{-1}$**  The outcomes are compiled in the matrix above after the unit matrix is subtracted from the M matrix and after the resultant matrix has been inverted:

Table 14: Inverse matrix  $(I - M)^{-1}$

|                  |                       | <b>Professional thinking</b> | <b>Social thinking</b> | <b>Cognitive thinking</b> |
|------------------|-----------------------|------------------------------|------------------------|---------------------------|
| $(I - M)^{-1} =$ | Professional thinking | 1.35                         | 0.60                   | 0.74                      |
|                  | Social thinking       | 0.41                         | 1.33                   | 0.66                      |
|                  | Cognitive thinking    | 0.41                         | 0.44                   | 1.39                      |

The intensity of all direct and indirect linkages (coming from the experts' responses) may be computed using the relationships mentioned above. This will provide us with general information about the matrix T:

**Determining the possible hierarchy or structure of the group of influential variables (calculating the sum of rows and columns of the general relationship matrix T)**

The hierarchy of those variables for problem-solving or improvement depends on the sequence in which variables impact one another and how they are effective by other factors.

The variables' occurrence in terms of the effect on other variables, as well as their order in terms of being affected, are examined in the matrix of Table 15 for this purpose to access the potential structure of direct and indirect linkages, and the relationships employed are as follows:

$$\begin{aligned}
 r &= [r_i]_{n \times 1} = \left[ \sum_{j=1}^n t_{ij} \right]_{n \times 1} \\
 d &= [d_j]_{n \times 1} = [d_j]_{1 \times n} = \left[ \sum_{i=1}^n t_{ij} \right]_{1 \times n}
 \end{aligned}
 \tag{5.3}$$

Table 15: The relative intensity of the direct and indirect relationships of the general relationship matrix (T)

|                  |                       | <b>Professional thinking</b> | <b>Social thinking</b> | <b>Cognitive thinking</b> | <b>Sum (R)</b> | <b>R+D</b> | <b>R-D</b> | <b>Effectiveness</b> | <b>Variable type</b> |
|------------------|-----------------------|------------------------------|------------------------|---------------------------|----------------|------------|------------|----------------------|----------------------|
| $(I - M)^{-1} =$ | Professional thinking | 0.35                         | 0.60                   | 0.74                      | 1.69           | 2.87       | 1.49       | 1                    | Cause                |
|                  | Social thinking       | 0.41                         | 0.33                   | 0.66                      | 1.40           | 2.74       | 0.52       | 2                    | Cause                |
|                  | Cognitive thinking    | 0.42                         | 0.41                   | 0.35                      | 1.18           | 2.93       | 0.75       | 5                    | effect               |
|                  |                       | 1.18                         | 1.34                   | 1.75                      |                |            |            |                      |                      |

**5.7 Analysis**

A data set (R+D, R-D), which in this picture is put on the X-axis  $R_i + D_j$  on the Y-axis  $R_i - D_j$ , may be used to determine the relationships of the effect of the major elements. The variable with the highest R-D value has the most effect, according to the results. As a result, as shown in the above Table and the study stages, the greater the penetration (cause) is, and the stronger the penetration is, the more positive the D-R value is (disabled). As a result, the element of professional thinking had the most influence, whereas the factor of cognitive thinking had the least.

**6 Discussion and conclusion**

This study aimed to identify the variables that influence auditors' sensible decision-making and to rank them in order of priority. Meta-analysis was employed in this study's initial stage to discover the variables associated with

auditors' prudent decision-making, as was discussed in the preceding sections. In this study, 14 research studies that are now under final assessment were chosen to extract the needed components for the research's goal due to the dearth of studies in the field of auditing. The chosen studies were then critically assessed based on the three aforementioned criteria to corroborate the study, once again, with the assistance of the panel members. As a consequence of this section's findings, a total of 12 investigations were ultimately allowed, while two research were eliminated. Then, by scrutinizing the substance and each paragraph of the authorized studies, the auditors' informed decision-making criteria were established. Based on the findings, three organizing themes (components) representing 20 fundamental themes (base) were identified, and Delphi analysis was performed to achieve a certain degree of dependability.

Four sub-themes were eliminated as a consequence of the Delphi study, and twelve more sub-themes were added to the phase of thorough structural interpretative analysis. Professional thinking was shown to be the most significant factor in the prudent decision-making of auditors at this point in the study. The second aspect that influences the substance of auditors' sensible decision-making was also discovered to be social thinking. The factors of learning along the professional path (career path), paying attention to the interests of the majority of stakeholders, evaluating an individual's ability, evaluating an organization's values, and developing an individual's knowledge are referred to as sub-factors of professional thinking in the current research. Social thinking also discovered and accepted the secondary aspects of emphasizing social approaches to society, perseverance in professional ethics, uncertainty, and impartiality in the auditing profession, and the auditor's duty. The sub-dimensions of capital market knowledge, foresight at the moment of decision-making, insight, and intuition in professional decision-making were also validated in the primary factor of cognitive thinking.

The definition of wisdom in decision-making by auditors is a mix of cognitive and reflective qualities; it is not seen as a universal quality shared by all individuals, nor is it always depends on a person's technical and specialized knowledge and abilities. A person's professional growth is based on logical thinking, which is the foundation of the existence of sensible tact to achieve decision-making maturity. In other words, a person selects a way of thinking for the difficulties of his or her career route through tactful decision-making. As previously noted, the content analysis technique yielded three categories of thinking. The findings of this investigation demonstrate that the auditor's mental inferences are significantly influenced by tact and intelligent thinking, leading to a more positive and fact-based conclusion. Accordingly, an auditor is a person with logical reasoning who consistently tries to select a level of thinking that is comprehensive and generalizable and, based on that, examines the problems and challenges of the auditing profession concerning multidimensional fields to achieve a comprehensive benefit. He should pick and make a judgment that is transcendental and goes beyond his mental and preconceived preconceptions, away from biases, by challenging the obvious things in the audit profession.

Although the components found in the data from the meta-analysis were provided, there is a very real need to pay attention to other unidentified criteria in this subject. This restriction calls for more study in this area, which can only be accomplished by analyzing and evaluating the reasons behind the interviewees' professional judgments. Since more recent research in this area is needed to develop its generalizability through quantitative methods, researchers interested in studying the prudent decision-making of auditors by learning more about its other dimensions, such as the external dimensions that are less focused in this research, should carry out more recent research in this field.

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