



Extending and Ranking the Audit Judgment Factors in an Emerging Market With an Emphasis on Cognitive Neuroscience

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ABSTRACT

The current study investigated whether the cognitive neuroscience dimension affects auditors' judgment in an increasingly competitive emerging audit market. In addition, other influential dimensions, including "identity characteristics," "biological characteristics and moral values and spirituality," and "environment" were also considered. The research was a descriptive survey, and the statistical population consisted of independent auditors. The field survey and questionnaire were used for data collection. The results generally showed that the cognitive neuroscience dimension affects auditors' judgment positively. Among the examined factors, "the auditor's selectivity about which problems to solve," "the auditor's level of attention," and "the level of concentration" were the most important factors. In addition, other investigated dimensions, including "identity characteristics," "biological characteristics and moral values and spirituality," and "environment," were considered influential factors. The findings imply that different neuroscience factors that require more research in this area affect auditors' judgment and performance. Studying cognitive neuroscience factors as a novel stance to the audit literature can help auditors improve their professional judgments and opinions, resulting in reduced audit risk and increased audit quality. It can also help develop a new era in interdisciplinary studies via associating decision-making with cognitive theories and implementing neuroscience related technologies.

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1. Introduction

Today, increased attention to the information scope results from the speed of economic developments, the significance of efficient assignment of limited economic resources, and the environment. Different stakeholders need high-quality financial information to judge current events and conditions, so audit reports and professional audits are important (Salehi & Dastanpoor, 2021). Professional audit judgment plays a crucial role in the audit process and the performance of auditors, especially in providing audit opinion (IFAC, 2009) and considering the foundation of accounting and auditing (Trotman, 2006). Practically, auditors implement professional judgment in nearly all significant decisions in the audit process, such as materiality level and management estimates. Professional judgment is mentioned 244 times in international auditing standards, which shows the importance of judgment in the audit profession (Pillar, 2005). Economic realities, development in the scope of accounting and auditing application, and increased transparency of concepts result from improving the quality of audit judgment (Salehi & Dastanpoor, 2021). These show the importance and necessity of researching professional judgment, especially the factors that can affect it.

Different characteristics and factors, especially the ones related to cognitive neuroscience, can affect auditors' judgment to provide opinion resulting in decreased (increased) audit risk and increased (decreased) quality of financial reports (Gaynor et al., 2016). Iskandar et al. (2012) believe that auditors are affected by certain motivational factors in making a decision, which provides another justification for doing this research.

These factors are divided into two groups: "audit environment" and "audit characteristic." The audit environment is related to all circumstances and influences the surroundings of an individual when doing a specific task (e.g., time pressure, client financial ratios, etc.) (Salehi & Dastanpoor, 2021). Bhattacharjee et al. (2017) and Aida (2021) investigated the importance of environmental factors on professional judgment. Audit characteristics (such as knowledge, self-confidence, and emotional intelligence) contain an individual's attributes before doing duty and role (Salehi & Dastanpoor, 2021). Although two groups are investigated in audit research, their importance level is not investigated. The ranking of effective audit factors on professional judgment and improving them based their ranks can enhance the quality of audit professional judgment. Thus, in this paper, the rank of these factors is investigated.

The other reason to do more studies about audit characteristics is related to audit behavioral studies. Behavioral studies examine how biases and other behavioral traits affect judgment and decision-making (Ju et al., 2019). Experts believe that the variables related to the judge can explain differences in her/his behavior, i.e., judgments, which can be the same in the case of auditors as the judges of financial reports. Therefore, it is essential to pay attention to the audit processes in behavioral studies, which are almost full of judgments. One behavioral audit topic that has received little attention in prior research is cognitive neuroscience, which requires more research. Cognitive neuroscience concentrates on mental beliefs, thoughts, and related brain domains (Olsen & Gold, 2018), is used in other disciplines such as psychology (Boone & Piccinini, 2016) and economics (Plassmann et al., 2015), and can be applied more in auditing in which professional judgment plays a vital role. The judgment process occurs in the auditor's mind (Carvalho Júnior et al., 2017). Therefore, cognitive neuroscience can better predict the auditors' judgment process and its influential factors. This provides another justification for doing this research. Cognitive neuroscience has an extensive area that, though audit researchers (e.g., Bucaro, 2019; Salehi & Dastanpoor, 2021; Yang et al., 2018) investigate a small part of it. Olsen and Gold (2018) show the future of audit research is related to neuroscience. Some factors that can effect on decision making but did not consider at audit judgment researches, are attention (Mormann & Russo, 2021), creativity (Forgionne & Newman, 2007), critical thinking (Gorton & Hayes, 2014), memories (including the ability to retrieve information from memory, short-term memory range, and divergent/ convergent thinking) (Drost, 2013), disorder (including neurological and personality) (Noppe et al., 2016). Cognitive neuroscience provides instruments for measuring these factors. It can cover the audit research gap and provide a new area for doing research.

Thus, according to the literature gap (lack of audit judgment factor ranking and inattention to the most important cognitive neuroscience factors that affect audit judgment) and due to the importance of cognitive neuroscience factors, this research investigated them (cognitive neuroscience factors) as a separate group to determine the importance level and position of this dimension from the viewpoint of

experts. Other audit characteristic factors are grouped in “identity characteristics,” and “biological characteristics and moral values and spirituality” based on similarities among them.

The individual characteristics of auditors (i.e., critical thinking, creativity ,....) can also vary in different markets, resulting in different judgments and opinions (Previtali & Cerchiello, 2018). Unfortunately, prior research on audit has not paid much attention to the brain and its functions in terms of cognitive neuroscience and its relationship with the audit judgment. Applying cognitive neuroscience in auditing makes it possible to identify other factors affecting auditors’ judgment, which have not been considered in prior audit research.

There are differences between two kinds of markets, namely developed and emerging markets. For example, developed markets are more efficient and effective and provide more conservation to stakeholders and creditors than emerging markets (Bagherpour et al., 2014). The characteristics of emerging markets, such as culture, capital market, level of audit market competition, and political and economic relations, are different from developed markets (Sallal et al., 2021). Therefore, it is expected that the factors affecting the audit judgment and opinion can differ in these markets.

Audit market liberalization has led to several private audit firms in Iran, resulting in increased intense audit competition (Bagherpour et al., 2014), affecting the financial reporting process and related audit opinions. In this market, the clients can choose auditors to increase the competition (MohammadRezaei & Mohd-Saleh, 2017). Increased competition and related results such as a higher rate of auditor switching may affect auditors’ judgment and opinion in the Iranian context. According to the information provided in the Iranian Association of Certified Public Accountants’ website¹, the number of audit firms increased from 38 to 253 in the period 1978-2018, while in the world and in the large companies sector the number of suitable audit firms decreased from 8 to 6 in 1989 and to 4 after the fall of Arthur Anderson in 2002 (Francis, 2004). This situation and the lack of big international auditors results in a unique market in Iran, requiring a special environment for investigating auditing and auditors’ issues.

Inflation and economic sanctions in Iran influence auditors and their life. Therefore, they may reduce the quality of their judgment in order to attract the clients and earn more money. Auditors must be independent and objective in accordance with the professional code of conduct, so it is necessary to identify and rank the factors affecting their opinion, especially in the Iranian context. Iran has different cultural factors compared to other countries² (Hofstede Centre report, 2016). Culture can affect ethical values (Bodley, 2011) and so it can affect audit judgment. This situation creates a special environment for investigating the factors that affect audit judgment more.

In this context, effective audit judgment factors have not been considered so far, so our findings may extend the audit research. The social context of the auditor/client is a significant aspect that is largely neglected by research (Waller, 1989). Ranking audit judgment factors in this situation, such as Iran, can help audit regulatory body consider the most important factors in standard-setting and provide a method to improve the most important factors that can negatively affect audit judgment. As the Iranian market has faced intensive economic sanctions during the last years, a greater number of Iranian firms have financial problems. Iranian economic situation can create challenges in which of the groups (audit environment and audit characteristics) are most affected by audit judgment.

Based on the previously mentioned reasons, this paper aimed to extend and rank factors affecting auditors’ judgment in providing audit opinion, especially cognitive neuroscience factors in the increasingly competitive emerging audit market. The remaining parts of the paper are as follows. The next section develops the theoretical framework and prior research in related fields. The third section provides the research method. The fourth section presents the study’s findings, and the final section reports the conclusions, including implications and limitations.

2. Theoretical Framework and Prior Research

Preparing financial statements (clients’ board responsibility) and providing an opinion about them (auditors’ responsibility) (CPA Canada, 2019; IFAC, 2009) need judgment. Professional judgment is important for the auditor because the accounting standard is not a simple rule to apply in the different

1. <https://www.iacpa.ir>

2. Iran has a high rank at two cultural factors (“uncertainty avoidance” and “power distance”) and a low rank at “individuality.”

economic events and it sometimes could result in circumstances to circumvent standards (Shafer et al., 2004). There is no way to approve proper rules for all situations. Thus, standards cannot replace the audit professional judgment, and professional judgment increases the value of financial statements; therefore, professional judgment is the core of auditing (Balkir, 2000). Following audit standard No. 200 entitled “The General Objectives of the Independent Auditor and Performing Audits per Audit Standards,” the auditor should use professional judgment in the planning and auditing process (including reporting). In other words, auditing is a continuous process accompanied by professional judgment. Lehmann and Norman (2006.p.67) define judgment as “the process of solving problems using individual structure and strategy and mental perception.”

According to Libby and Luft (1993), decision making is an important part of the accounting and audit process. Some individuals are more successful at making decisions than others. Over the past twenty years, understanding this fact has attracted much attention to the factors that affect individuals’ decisions.

2.1 Factors Affecting Auditors’ Judgment

By reviewing the literature on auditing and psychology, we grouped these factors into 4 categories, including “cognitive neuroscience,” “identity characteristics,” “biological characteristics and moral values and spirituality,” and “environment,” which are explained in more detail in the following sections.

2.1.1 Cognitive Neuroscience

Cognitive neuroscience is an interdisciplinary area that incorporates the measurement of brain activity (mostly using neuroimaging) with human subjects’ synchronous performance of cognitive tasks and duties; it links the sciences of the brain (neurosciences) and the sciences of the mind (cognitive sciences) (Cooper & Shallice, 2010).

Cognitive neuroscience as an interdisciplinary science (and a newcomer in auditing) has 3 dimensions, including “abilities” (e.g., attention, vision, memory), “computation (e.g., computational analyses, computer simulations), and “neuroscience.” The vast use of this science in various fields is due to the modifications made to its methods and its theoretical integration with different theoretical models of psychology and economics, which allow the expansion of decision-making models (Ruff & Heutel, 2014). In addition, the application of cognitive neuroscience methods in each discipline has led to increased accuracy and solution of many problems and bottlenecks (Smelser & Baltes, 2001).

Literature review indicates that although two of the dimensions, including “abilities “and “computation,” have been mainly investigated by prior researchers (Yang et al., 2018), some of their essential factors, such as the level of auditor’s attention and concentration, correct decision making and communication skills, cognitive skills as an integral part of judgment and decision-making (Munyon et al., 2015), have not been considered so far. This gap in the literature is one of the justifications for doing this research.

Neuroscience is a branch of science that uses neuroscience methods to read and understand the brain (American Psychological Association, 2007). The judgment process occurs in the auditor’s brain (e.g., Carvalho Júnior et al., 2017). Griffith et al. (2021) show that the high-quality judgment in complex audit tasks requires enough mindware tasks. Therefore, we need to understand how auditors’ knowledge, insight, and experience are processed in their brains, indicating the importance of research on the application of neuroscience in auditing, which has not been considered adequately so far. It can be said that neuroscience will be more integrated with the auditing process, i.e., judgment, in the future (e.g., Olsen & Gold, 2018).

In this area, the factors investigated in audit research are emotional intelligence (Dewi et al., 2021; Salehi & Dastanpoor, 2018), self-efficacy (Salehi & Dastanpoor, 2021; Tandean, 2022), speed of information processing, ability to distinguish relevant and irrelevant information, the auditor’s selectivity about the problems to solve, concentration, correct decision-making skills, ability to distinguish relevant and irrelevant information, planning skills, communication, flexibility, being responsible, the ability to simplify the complexities, ability to organize, ability to make unstructured decisions (Shanteau, 1987), and auditor personality type (Tsunogaya et al., 2017). Although these

factors are investigated, the importance level (rank) of them is not investigated. In addition, most of the factors were investigated by Shanteau's (1987) questionnaire, but audit researchers can use our findings (in order to pay more attention to important factors) and cognitive neuroscience tools to examine and consider them more accurately, resulting in improvement in judgment quality.

Some of the more crucial cognitive neuroscience factors not considered in audit research are attention, creativity, critical thinking, memories, disorder, and feeling. Introducing them and determining their importance is the innovation of this paper. Future researchers can consider them to improve the quality of judgment. In the following, we describe them briefly.

Attention could be described as an overall level of alertness or ability to engage with the environment (Oken et al., 2006). Dekkers et al. (2022) show that attention deficit can affect risky decision making. Also, two methodological approaches have been adopted to investigate the role of attention during decision making. The first approach that the most empirical research consider is how participants freely and independently extend their attention during decision making (participant-controlled view). Another approach considers forced attention or at least partial control of the position and length of exposure to different alternatives or to their individual factors by the experimenter (experimenter-controlled view), which enables researchers to directly manipulate attention during judgment and decision making (Mormann & Russo, 2021).

Creativity is another factor that has an important role in decision making. There are different definitions of creativity. Analyzing 42 definitions of creativity by Kamylyis and Valtanen (2010) showed that a great number of these definitions emphasize four components: (1) creativity is an essential ability of the individual(s); (2) creativity assumes an intentional process; (3) the creative process happens in a special situation; and (4) the creative process involves generating tangible or intangible product(s). Because creative product(s) leads to new solutions for decision-makers, it (they) must be exquisite (genuine, unconventional) and proper (worthy, helpful) to some extent (Forgionne & Newman, 2007). Efraim et al. (2005) believed that creativity could be useful during most decision-making steps. Creativity can also help in solution design by identifying related alternatives during the designing step of the process (Pissarra & Jesuino, 2005). In addition, selecting a proper evaluation model (matching problem characteristics with available models or the construction of models) is one of the steps in a creative process. Thus, creativity can also improve the decision-making process (Rees & Koehler, 1999) by linking personal properties and motivation, which leads to improving the level of attention and the ability for problem solving (Swaminathan & Rathnasabapathy, 2021).

The studies by Forgionne and Newman (2007) and Pissarra and Jesuino (2005) suggested that creativity can improve individuals' performance when doing a variety of tasks and decision-making by the identification of relevant alternatives. Auditors face different situations that need creativity for finding the best solution, and it (creativity) can help auditors have high-quality judgment.

Critical thinking is a cognitive neuroscience factor shown by decision literature to be important in decision-making. There are different definitions in the literature, but there is general agreement that critical thinking is a purposeful thought, including reflective reasoning to make a decision (Thompson & Stapley, 2011). Critical thinking can help the individual process environment and evaluate problem better and so choose the better option and have a good decision (Hosseini & Hosseini, 2011). Many authors have tried to connect critical thinking skills to decision-making and use it to improve the decision-making process (Hicks et al., 2003), including clinical judgment (Gorton & Hayes, 2014). Bucaro (2019) believes that critical thinking can improve professional judgment. According to auditing standards, auditors should make decision independently, and critical thinking can facilitate this process (Rathbun & Ruth-Sahd, 2009)

Another cognitive neuroscience factor that affects decision-making regards memories (including the ability to retrieve information from memory, short-term memory range, and divergent/ convergent thinking). Memories play a significant role in an individual's decision making. These memories enable individuals to make informed decisions based on prior knowledge or experience and information (Marx et al., 2007) and integrate them into decision making (Drost, 2013; Hertwig & Pleskac, 2010). Vettorello et al. (2019) show that convergent thinking leads to a more conscientious decision-making outcome. They also demonstrate that divergent thinking also has an important role in representing different solutions and improving critical thinking, which can affect decision making.

As a component of personality traits, a disorder (either neurological and personality-driven) is a way of thought, sensation, and behavior that deviates from the expectations of the culture and causes distress or problems in performance (American Psychiatric Association and American Psychiatric Association, 2013). Psychologists believe that disorder is a common problem (its outbreak is estimated to be 10-15% in the general population) and includes the core of unreasonable decision-making, which can be the case in the audit profession. Anxiety and depression are important disorders that can affect decision making and judgment (Hartley & Phelps, 2012; Huys et al., 2015), but have not been considered in prior research. Studies such as Gur et al. (1992) and Demetriou et al. (2021) have shown that depressed individuals have a negative bias in realizing key social cues, affecting auditors' professional skepticism and judgment. Stress and fear are individual factors that may affect decision-making in some circumstances (Verhage et al., 2018). Stress is a normal reaction to feeling threatened or instable. Stress can retain lives in severe circumstances because the body creates further strength to defend itself. Beyond a certain point, however, stress is no longer beneficial and can negatively affect the quality of judgment (De Soir et al., 2007; Noppe et al., 2016). Stress can be deflected attention to specific things, so individuals cannot make a right direction (Verhage et al., 2018).

Behavioral researchers have concluded that feelings play an important role in judgment and decision-making. Different judgments by individuals are due to their different feeling responses to internal and external factors (Finucane et al., 2000; Gozé et al., 2019; Opara et al., 2022). The results of psychological research indicate that the decision-making process requires a balance of feelings and perceptions of individuals (Damasio, 1994)

2.1.2 Identity Characteristics

The auditor's ability to make high-quality decisions in a complex environment is affected by their identity characteristics (McKnight & Wright, 2011). Considering this fact can improve the efficiency and effectiveness of individuals as well as organizations.

Prior research on the relationship between personality and job performance shows that personality traits can affect audit job performance (Dewi and Dewi, 2018). Saadullah and Bailey (2014) and Saputra and Kawisana (2021) state that the personality of auditors can play an important role in their judgments.

In any audit work, auditors use their personal and identity characteristics (such as information and ability) to make judgments. Their identity characteristics limitations also lead to deviations in their judgments. Moreover, not paying attention to individual characteristics and ignoring its effects can undermine the auditor's independence. Identity characteristics refer to knowledge, expertise, gender, and decision tools that the decision-maker uses to do his/her task (Praditaningrum & Januarti, 2012). For example, research shows that women are usually more risk-averse than men and have the ability to process more comprehensive information. Given this, it is reasonable to assume that audit judgments can vary according to gender (Little, 2016).

2.1.3 Biological Characteristics and Moral Values, and Spirituality

Biological characteristics refer to Maslow's hierarchy of needs (used to study how humans naturally participate in behavioral motivation and how motivation is correlated with human behavior) (Maslow, 1943). Maslow explained the pattern for human motivations by using the terms "physiological," "safety," "belonging and love," "social needs" or "esteem," and "self-actualization" and explained that in order to change the next step (the steps of motivation), each step must be satisfied within the individual. Each individual level has a determined amount of internal perception that must be met for an individual to ascend to the top of the hierarchy (Deckers, 2018). The hierarchy goal is to achieve the fifth level or stage, "self-actualization" (Wills, 2014). Maslow's hierarchy of needs can affect judgment. Therefore, financial needs may affect the auditor's opinion as well. Kim et al. (2018) believed auditors who are financially dependent on their clients are more likely to undermine their independence.

Zavei and Jusan (2012) show that biological characteristics play an important role in personal characteristic, and because personal characteristic affect decision making (Dewi and Dewi, 2018), they can affect audit judgment. Muttanachai (2020) demonstrate that various biological characteristics can affect judgment.

Although there are many definitions of moral values, most researchers still refer to them as “a set of concepts or beliefs,” “desirable behaviors or goals,” “beyond special circumstances,” “helping to select or evaluate behaviors and events” (Añaña & Nique, 2007,p291). Recently, researchers have concentrated on studies related to ethical decision-making in accounting and auditing and have examined the relationship between personal values and ethical judgments (Nolder & Riley, 2014). Nolder and Riley (2014) and Arrami and QingXiang (2022) conclude that auditors react differently to audit evidence based on their beliefs and judgments.

One of the moral values mentioned in research is spiritual capital, which consists of morality, reliability, honesty, justice, truth, self-confidence, friendship, virtue, value, inspiration, self-respect, courage, strength, guarantee, cooperation, patience, ideals, love, and teamwork, which can affect individuals and the performance of a company (Vasconcelos, 2021) and have some effects on judgment (Cowperthwaite, 2010). Arrami and QingXiang (2021) also show that moral identity can affect audit judgment . According to social-cognitive theory, moral identity is a set of cognitive representations derived from moral values and goals (Aquino & Reed, 2002)

2.1.4 Environment

Environmental factors and their awareness can affect auditors’ behavior, i.e., judgment, as their actions are performed in the existing environment and conditions (Mahdavi & Daryaei, 2016). The environment includes “audit environment” and “client environment.” According to various studies, the audit environment refers to components such as professional standards, methods, culture and business models, accountability, and components in the client environment that, according to various studies, affect the audit professional judgment.

Hurt (2010) concluded that professional skepticism is a multidimensional personal characteristic and affects an audit judgment and decision. One of the important dimensions of professional skepticism is neutrality. Neutrality means that the auditor should not choose complete trust or complete distrust in his attitude towards management. The gathered evidence should not contain contradictory explanations and not include management claims and statements (Quadackers et al., 2014).

There is a significant relationship between the probability of issuing a modified audit report and the rules, policies, and business models of each audit firm and time, financial budget pressures (Soleymani et al., 2022; Wedemeyer, 2010), the culture of each country (Nolder & Riley, 2014), and the type of audit firm (Zureigat, 2015).

Other factors related to the professional judgment of the auditor are industry expertise, characteristics of work such as work complexity (Aida, 2021), work performance, evidence collection procedure, superior views (for example partner view) (Peytcheva & Gillett, 2011), and professional identity (Bauer, 2014).

These factors are related to the “client environment,” which is classified into 10 categories, including financial leverage, profitability, performance, liquidity, bankruptcy risk (Kirkos et al., 2008), capital structure (Min & Jeong, 2009), corporate governance (Feng et al., 2020), earning management (Commerford et al., 2018), company size, and the length of the period listed in the stock exchange (Bagherpour et al., 2013).

3. Method

This study adopted a descriptive survey research method as applied research concerning its goal. The statistical population included audit experts (managers and partners) of audit firms, which were ranked by the Iranian Association of Certified Public Accountants (IACPA) as the top qualified (grade A)¹ during the last 2 years and in the top quarter in terms of income. This choice was based on the assumption that these partners and managers are involved in large companies in different industries, and therefore their expertise and experience are more than others, which can improve the research validity. There are 24 audit firms in

1. The classification of an auditing firm by a quality control unit in the IACPA or the quality unit of the stock exchange can be divided into 4 categories according to the instructions of Article 10 of the Stock Exchange Organization of trusted stock exchange institutions.

this group. A sum of 100 questionnaires were distributed, 50 were received, and 49 were analyzed. The outbreak of Covid-19 and its consequences, especially in the audit firms, has had a significant effect on the cooperation of the experts. Because the individuals in the sample worked in various audit firms, it could be concluded that the sample represented the population.

The factors affecting the audit judgment in the reporting stage were identified by reviewing the related research and interviewing 5 experts. Accordingly, the researchers developed a questionnaire due to the lack of a standard questionnaire. General information was asked in the first part of it, and in the next part, experts were asked to identify and rank the factors affecting the audit judgment in the reporting stage using a 5-point Likert scale. The experts' opinion was used to examine the validity of the questionnaire.

In order to analyze the data, the Friedman test method was used. The Friedman test compares several dependent groups in terms of their average rank and determines the group of variables and their rank from the perspective of community members.

In this study, content validity was used. To estimate the validity of the questionnaire, it was distributed among the selected audit experts, and after making the necessary corrections, to the sample. The results showed that this questionnaire had good content validity. Cronbach's alpha was used to evaluate the reliability of the questionnaire and show that the questionnaire had high reliability.

Table 1. The Reliability of the Questionnaire

Variable	N of items	Cronbach's alpha
Cognitive neuroscience	41	0.940
Identity characteristics	11	0.744
Biological characteristics and moral values and spirituality	4	0.753
Environment	40	0.953

4. Findings

In Section 4, first the respondents' general demographic information is presented, followed by data analysis based on inferential statistics.

4.1 Descriptive Statistics

The demographic information is shown in Table 2. The majority of the respondents are over 50 years old (51%) and have more than 20 years of audit experience (49%). In addition, these individuals have mainly an MA degree (63%).

As shown in Table 3, the significance level is higher than 5%, so the normality is accepted.

Table 2. The Demographic Information

Frequency of the distribution of respondents by experience			Frequency of the distribution of respondents by education			Frequency of the distribution of respondents by age		
Experience	Frequency	Percentage	Experience	Frequency	Percentage	Experience	Frequency	Percentage
5 to 10 years	0	0	Associate Degree	2	5	Less than 40 years	4	10
11 to 15 years	5	12	B.Sc.	12	29	Between 40 and 50 years	16	39
16 to 20 years	16	39	MSc	26	63	Between 50 and 60 years	10	24
More than 20 years	20	49	PhD	1	2	Over 60 years	11	27

Table 3. The Normality of Variables

Variable	Significance level
Cognitive neuroscience	0.805
Identity characteristics	0.796
Biological characteristics and moral values and spirituality	0.761
Environment	0.785

4.2 Research Analyses

The findings presented in Tables 4 and 5 show that all the dimensions positively and significantly affect the audit judgment. The results imply that these dimensions totally improve the judgment quality.

The results of Table 6 show that the research model is significant (chi-square=100), and different groups have different significance for and effects on the audit judgment. The most influential group is “biological characteristics and moral values and spirituality” (rank 4.00), and the least is “environment” (1.49). The Cognitive neuroscience group is in the third rank.

Table 4. The One-Sample Test

	Test value = 0					
	t	df	Sig. (2-tailed)	Mean difference	95% Confidence interval of the difference	
					Lower	Upper
Identity characteristics	23.434	48	.000	3.365	3.076	3.65
Cognitive neuroscience	18.463	48	.000	3.041	2.7099	3.372
Biological characteristics and moral values, and spirituality	6.004	48	.000	1.738	1.156	2.320
Environment	14.454	48	.000	2.712	2.335	3.0901

Table 5. The One-Sample Effect Sizes

	Standardizer ^a	Point estimate	95% Confidence interval		
			Lower	Upper	
Identity characteristics	Cohen’s d	1.005	3.348	2.621	4.068
	Hedges’ correction	1.021	3.295	2.579	4.004
Cognitive neuroscience	Cohen’s d	1.1530	2.638	2.038	3.230
	Hedges’ correction	1.171	2.596	2.006	3.179
Biological characteristics and moral values and spirituality	Cohen’s d	2.0263	.858	.526	1.183
	Hedges’ correction	2.058	.844	.518	1.164
Environment	Cohen’s d	1.3137	2.065	1.563	2.559
	Hedges’ correction	1.334	2.032	1.539	2.519

Table 6. The Findings

Group	Rank
Biological characteristics and moral values and spirituality	4.00
Identity characteristics	2.37
Cognitive neuroscience	2.14
Environment	1.49
Chi square	100.420
DF	3
Sig	0.000

In the cognitive neuroscience group (dimension), the auditor’s selectivity about which problems to solve (28.77), the auditor’s level of attention (28.69), and the level of concentration (27.9) are the most critical factors (Table 7). Shanteau (1987) believes that these factors are features of expert decision-makers. These factors can help auditors better identify problems resulting in improved judgment.

Other cognitive neuroscience factors that affect audit judgment are as follows: correct decision-making skills (26.31); ability to distinguish relevant information from irrelevant (26.16); level of creativity (26.04); auditor responsibility (24.92); auditors’ critical thinking (24.3); the auditor’s knowledge level of the problems and issues ahead (24.24), speed of information processing (23.98); ability to justify decision-making processes regarding the auditor’s reporting (23.83); auditors’ intelligence (ability to learn and use knowledge, thinking, reasoning, and problem solving) (23.76); ability to predict based on available evidence (23.67); auditor cognitive flexibility (no bias and acceptance of new material on a subject) (23.42); having a strong memory in order to transfer

information and turn it into knowledge (22.9); ability to simplify the complexities (22.78); ability to organize (22.64); courage in action (audacity – risk-taking) (22.53); speech skills to persuade the client to solve the identified problems (22.51); ability to deter auditors (skill of resisting deviations and internal motivations) (22.29); listening carefully and attentively to the client’s explanation (22.23); communication skills (22.02); auditors’ planning skills (21.51); ability to retrieve information from memory (21.49); insight or foresight (21.31); visual and spatial processing skills (20.21); adaptability (19.85); auditor’s time management skills (19.63); ability to make unstructured decisions (19.04); auditor’s emotions (18.34); short-term memory range (18.02); having divergent thinking (17.42); auditors’ self-awareness (17.35); the amount (level) of stress tolerance (17.34); auditor’s personality type (extroverted-introverted-obsessive) (14.32); convergent thinking (14.1); negative feelings and emotional reactions (13.49); auditors’ mood (level of depression – level of happiness – level of aggression) (13.38); auditor’s personality disorders (13.34); auditor’s positive emotions and emotional reactions (12.96); auditor’s psychological neurological disorders (12.01).

Deliu (2020) shows that communication and teamwork skills, the ability to recognize the essential and relevant factors for doing the duties, and the responsibility impact professional judgment.

Table 7. Dimensions and Factors- Cognitive Neuroscience

Q	Question	Mean rank
X11	The auditor’s selectivity about which problems to solve	28.77
X4	The level of attention	28.69
X10	The level of concentration of the auditor	27.9
X9	Correct decision-making skills	26.31
X5	Ability to distinguish relevant and irrelevant information	26.16
X19	The level of creativity	26.04
X13	Being responsible	24.92
X88	Auditors’ critical thinking	24.3
X17	Speed of information processing	23.98
X20	Ability to justify decision-making processes regarding the auditor’s reporting	23.83
X71	Auditors’ memory and intelligence (ability to learn and use knowledge, thinking, reasoning, and problem solving)	23.76
X76	Ability to predict based on available evidence	23.67
X15	Auditor’s cognitive flexibility (no bias and acceptance of new material on a subject)	23.42
X21	Have a strong memory in order to transfer information and turn it into knowledge	22.9
X6	Ability to simplify the complexities	22.78
X75	Ability to organize	22.64
X47	Courage in action (audacity - risk-taking)	22.53
X8	Speech skills to persuade (justify) the client to do identified problems	22.51
X77	Ability to deter auditors (skill of resisting deviations and internal motivations)	22.29
X72	Listening carefully and attentively to the client’s explanation	22.23
X7	Communication skills	22.02
X74	Auditors’ planning skills	21.51
X22	Ability to retrieve information from memory	21.49
X70	Insight or foresight of auditors	21.31
X78	Visual and spatial processing skills	20.21
X14	Adaptability	19.85
X73	Auditor’s time management skills	19.63
X24	Ability to make unstructured decisions	19.04
X39	Auditor’s emotional intelligence	18.34
X23	Short-term memory range	18.02
X84	Having divergent thinking	17.42
X81	Auditor’s self-awareness	17.35
X18	The amount (level) of stress tolerance	17.34
X79	Auditor’s personality type (extroverted-introverted-obsessive)	14.32
X85	Convergent thinking	14.1
X32	Self-efficacy	13.49
X80	Auditor’s mood and feelings (level of depression - level of happiness - level of aggression)	13.38
X82	Auditor’s personality disorders	13.34
X83	Auditor’s neurological disorders	12.01
Chi-square		340.394
df		40
Asymp. sig.		0

In the “biological characteristics and moral values and spirituality” dimension, adherence to general ethical principles (3.39), spiritual intelligence (3.31), and auditor’s personal and family issues (2.3) are the most important factors. The ethical factors have a relationship with the auditor’s judgment in Arnold et al. (2009), Cowperthwaite (2010), and Salehi and Dastanpoor (2021) studies.

Table 8. Dimensions and Factors- Biological Characteristics and Moral Values and Spirituality

Q	Question	Mean rank
X35	Adherence to general ethical principles	3.39
X31	Spiritual intelligence	3.31
X92	Auditor’s personal and family issues	2.3
X30	Auditor’s excessive trust	2.22
X93	Non-observance of the auditor’s status by the client	2.09
X90	Auditor’s biological needs (financial, psychological, etc.)	1.6
Chi-Square		37.542
df		3
Asymp. Sig.		0

In the “identity characteristics” dimension, the “up-to-date level of professional knowledge” (7.93) is the most important factor. The adoption of international standards and the growing number of regulations and rules provided by different regulatory authorities (e.g., TSE) require auditors to be updated in order to make sound and professional judgments. Deliu (2020) shows that theoretical knowledge related to professional training and sufficient experience are factors that affect professional judgement.

Table 9. Dimensions and Factors- Identity Characteristics

Q	Question	Mean rank
X16	Up-to-date level of professional knowledge	7.93
X42	Auditor’s knowledge of the client’s activities	6.8
X27	Use of various checklists and audit programs	6.33
X1	Auditing a client frequently	6.21
X25	Passing the obligatory training courses	6.16
X12	Auditor’s confidence level	6.03
X67	Ability to properly analyze the gathered information and evidence	5.97
X2	Auditing similar clients (in an industry)	5.39
X94	Auditor’s decision-making methods	5.31
X3	Auditor’s level of knowledge about problems	5.08
X26	Taking voluntary training courses	5.05
X28	Using computer and statistical models	4.82
Chi-square		43.151
df		10
Asymp. sig.		0

In the “environment” dimension, professional skepticism - the neutral dimension (27.55), the effectiveness of the internal control system (27.3), the type, amount and nature of the evidence collected (27.07), and accountability/accountability pressure (26.28) are the most important factors. In similar investigations in the literature, Salehi and Dastanpoor (2021), DeZoort et al. (2006), and Tan et al. (2002) show that since accountability pressure afflicts stress to individuals, auditors’ judgment has a negative impact on the stress.

Table 10. Dimensions and Factors- Environment

Q	Question	Mean rank
X49	Professional skepticism - the neutral dimension	27.55
X60	Effectiveness of the internal control system	27.3
X37	The type, amount, and nature of the evidence collected	27.07
X41	Accountability / accountability pressure	26.28
X36	Methods used in auditing work	24.75
X86	Professional identity	24.72
X62	Stock exchange client	23.56
X89	Characteristics of an audit manager under which the current manager has grown as an auditor	23.02
X53	Ethical standards	22.47
X95	Professional skepticism - presumptive doubt dimension	22.35
X69	Application of existing and emerging digital technologies	22.24
X44	Independence of the client audit committee	21.3
X56	Audit firm size	21.27
X48	Type of audit firm (public or private)	21.26
X43	Audit committee expertise	20.85
X91	Fear of reporting consequences	20.81
X40	Complexity of the audit work	20.48
X63	Client's internal auditor expertise	20.44
X38	Client's business model	19.89
X57	Independence of the client board members	19.76
X34	The culture of the audit firm	19.57
X46	Attitudes and beliefs of the second signatory manager towards the type of comment	19.56
X87	Priority and delay in receiving evidence	19.51
X65	The size of the client firm	19.4
X45	Environmental pressures	19.28
X58	Client board members' expertise	19.17
X66	Stock life of client companies	19.15
X59	Independence of the client's internal auditor	19.04
X61	Type of client firm's ownership (public or private)	18.43
X68	Auditor's relationship with the client	18.22
X64	Client firm's earning management	17.67
X33	Social culture	16.91
X50	Financial leverage of client firm	16.71
X51	Client firm's profitability status and performance	16.61
X55	Probability of bankruptcy and financial incapacity of the client firm	15.5
X52	Client firm's capital structure	14.98
X54	Client firm's liquidity status	13.17
Chi-square		216.827
df		39
Asymp. sig.		0

5. Conclusions

The results generally show that all the dimensions positively affect audit judgment. Among them, “biological characteristics and moral values and spirituality” is the most important one and “cognitive neuroscience” is placed in the third position, while “environment” is placed in the last position. Similar investigations in the literature such as Cowperthwaite (2010) and Salehi and Dastanpoor (2021) suggest that moral values and spiritual intelligence affect audit judgment. Although there are severe economic sanctions in Iran, audit characteristic factors are more important than audit environment factors. These findings show that improving audit judgment is related to the personal characteristics, so auditors' efficiency can be improved by paying attention to their personal characteristics and improving their weak points by making more research about them. Our results may assist audit firms to consider these features when they want to employ applicants and can help promote the position of the audit profession in the eyes of the stakeholders.

Regarding the factors related to “biological characteristics and moral values and spirituality dimension,” “adherence to general ethical principles,” and “spiritual intelligence” were the most important and “auditor's biological needs” is the least important. The obtained results are mainly similar to Naslmosavi (2015) and Salehi and Dastanpoor (2021) findings that show ethical dimension affects audit judgment. “Up-to-date level of professional knowledge” and “auditor's knowledge of the client's activities” are the most important factors in the identity characteristics dimension. The obtained results

are mainly similar to the findings of Sila et al. (2015). Experts believe that professional knowledge is more important than the “use of computer and statistical models.” It shows their traditional perspectives may lead to a decrease in the audit profession’s development (fast growth).

Auditor’s selectivity, attention and concentration are the most critical factors in the cognitive neuroscience dimension. The obtained results are mainly similar to Shanteau’s (1987) findings. The high position of new cognitive neuroscience factors (the level of attention (second rank), the level of creativity (sixth rank), and auditors’ critical thinking (eighth rank)) show their importance, and future suggestions in this line of literature regard investigating the effect of these factors on audit quality and examining the moderating role of external pressure on the relationship between auditor professional ethics and audit quality.

“Professional skepticism - the neutral dimension” and “effectiveness of the internal control system” are the most important factors in the environment dimension. The obtained results are mainly similar to those of Popova (2013).

The findings imply that implementing cognitive neuroscience in the auditing field can improve audit judgment by understanding the auditor’s mental judgment processes. Using cognitive neuroscience technology in auditing (e.g., investigating auditors’ mental map and their level of brain waves) can also help solve related problems, leading to more job satisfaction and accurate judgment. Implementing cognitive neuroscience in recent research links decision-making to theories of cognitive processes (Fischhoff & Broomell, 2020; Gonzalez & Mehlhorn, 2016; May et al., 2020), which can be a new area for research on audit judgment.

This study has its limitations. This study is experimental, so making generalizations is one of the limitations. Moreover, the lack of a standard questionnaire about this subject and the use of a researcher-made questionnaire to receive respondents’ responses may result in biased estimated relationships (Spector, 1987). In addition, because we used the questionnaire, some respondents might have answered carelessly, a phenomenon which is out of the researchers’ control.

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