Identifying and Ranking the Factors Impacting Audit Quality from the Perspective of Audit Firms Using FANP and FTOPSIS

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ABSTRACT

Attest function is the attitude behind the presence of the independent auditors. The higher the quality of auditing process, the more qualified is the auditors' report. The present paper aims to analyze and rank the factors impacting the audit quality. The population is composed of the auditing institutions and the sample includes 60 of the top auditing firms. Initially, 24 factors affecting audit quality are identified based on the theoretical resources and the experts' opinions. These factors are classified into three main categories and are then measured in a form of a clear questionnaire. Finally, the exploited data is weighted and ranked based on FANP and FTOPSIS. The finding revealed that the factors related to the auditing firm are of the most importance among the other categories. In addition, further sub-factors are ranked and significant conclusions are discussed.
Keywords: Audit Report, Audit Quality, Certified Public Accountants, FANP, FTOPSIS.

INTRODUCTION

The more complicated population causes the decision makers to attain the unreliable information. There are various reasons for this case which include unavailable information, bias and the costly data along with the complicated transactions.

The competitiveness among the audit firms have been extensively increasing in the recent years and the audit profession has been impacted by some events. In this period, the American association of independent accountants modified its limitations for advertisement. In 1980s, the need to audit acquired through commercial combination caused the alliance of the companies reduce (Palmer, 1989).

Professional and experienced auditors have more perceived the mistakes occurred in financial statements which can enhance the auditing decisions (Libby and Fredrick, 1990,1).

There are common definitions of auditing stated by most of the audit researchers, among which De Angelo's can be pointed out. De Angelo defines audit quality based on two possibilities.

Initially, the auditor discovers the deficiency of the accounting system of the employer. Secondly, this deficiency is reported by the auditor.

Audit quality is a complicated concept so that it cannot be clearly identified, truly measured or consistently observed. Auditing is among the services by which the quality can be ensured. Therefore, audit quality is placed in the quality of the process so that more attempts to improve the audit process generally lead to higher audit quality (Knechel, 2009).

Improving quality ensures the continuity and development. This is not specifically ignored in the competitive and free market based systems. This is because the customer and the consumer are always desired to have the highest quality. The competitiveness leads to improving the qualitative level, but the factor which incentives the competitiveness is the supremacy, whether economical, social or cultural (Raai, 2005).

Therefore, identifying the factors impacting the audit quality and ranking these factors from the perspective of the audit firms can be a useful affair. Hence, the present study is designed and implemented with the predefined goal. Consequently, multi criteria decision making and fuzzy logic are used to come to more accurate conclusions.

LITERATURE REVIEW

Abbott and Parker (1999) investigated changing the independent accountant and found that when there are active and independent audit committees in the employers' institutions, then there will be a close relationship with increasing the audit quality.

In a roundtable set up about the audit efficiency, Pob (2001) declared that audit profession is not consistent with the increasingly changing environment. These concerns require surveys to be conducted in order to evaluate the factors influencing on audit quality. Aranada (2000) indicated that the law highly supports audit quality.

Krishnan and Shayor (2000) found that the big auditing firms are more qualified than the small ones. In other words, there is a positive relationship between audit firm size and its quality.

In addition, the more experienced audit firm is stimulated to provide high quality audit services (Dunn et al, 2000).

Reisch (2000) believes that there is a positive association between industry specialization and reporting quality. The expert auditors in an industry have more ability in recognizing and considering the problems of the given industry and this is the reason of their high quality audit.

Stean (2001) showed that the consulting fee has negatively impacted audit independence and audit quality (Mikko Zerni, 2009).

Graswell et al (2002) demonstrated that earnings independence level of the auditor has no influence on the attitude toward the nonqualified opinions of the auditor. Woutein (2003) found that big audit firms are more capable of declining legal claims and they receive high fees. They also found evidences that the big audit firms are more famous (Mikko Zeni, 2009).

In addition, Chung and Kallapur (2003) reported that the auditors make no distinction between their clients based on the received fees. Woutein also revealed that experiencing a job with a given employer increases the audit quality.

Francis (2004) conducted a study titled "What do we know about the audit quality". He found that audit quality is affected by some factor like firm size, industry characteristics, the specifications of the subsidiary audit firm and the international differences in the legal systems.

Geiger and Rama (2006) concluded that Big 4 audit firms render higher quality services than other institutions.

Chan et al (2006) found that local auditors with more economic dependency on the local clients are willing to have more satisfactory reports. Similarly, Hoitash et al (2007) indicated that the auditors confer exclusive privileges to their clients. Hunt et al (2007) perceived that the auditors contribute their clients in two ways. They do not allow their bigger clients to hold the responsibility of earnings management. There is also the least probability that they issue going concern opinion for those bigger distressed firms. Chen et al (2007) indicated that those firms, in which the family members are the shareholders, receive lower quality audit reports than the other firms without any family control.

It can be stated that competitiveness in the audit market is inversely related to audit quality. The more competitiveness in the audit firm reduces the audit quality and vice versa (Kallapur et al, 2008).

Salehi et al (2009) conducted a survey titled firm size, audit regulations and fraud detection. They showed that legal monitoring and market mechanisms lead the certified auditors to identify and report the significant deviations.

Mikkozein (2009) revealed that audit quality is defined based on various factors. Estimation and measurement of audit quality is not a simple task and the findings cannot be easily observable. The researchers measured audit quality in form of indicators and elements like firm size, fees, legal claims, annual income and other factors.

Multi Criteria Decision Making Techniques

Multi criteria decision making techniques are divided into two categories of multi objective decision making (MODM) and multi attribute decision making (MADM). MODM models are used to design, while MADAM models are used to select the optimum choice.

MADM and group decision making have extensive applications in literature review and provide the possibility of evaluating the choices in several aspects for the decision makers and managers (Sabeti, 2010).

The following section reviews fuzzy concept and investigates the methods to use this concept.

Analytic Network Process (ANP)

AHP has been developed by Saati in 1971 and it aims to create a structure in decisions which are impacted by several independent factors. After that, ANP technique was introduced by Saati which is actually an extended version of AHP. ANP considers the more complicated communications between the decision levels and ratios and is appropriate when the measures are highly interdependent. Fuzzy ANP is used for group decision making and determining the significance degree of any of the prioritization indicators.

TOPSIS

TOPSIS technique has been introduced by Hwang and Yoon in 1981. This technique is based on this concept and intends the selected alternative to have more distance from the negative ideal solution. This study aims to use TOPSIS technique to rank the indicators.

Fuzzy Logic

Fuzzy logic involves extensive spectrums of theories and techniques which are mainly based on four concepts: fuzzy sets, linguistic variables, possibility distribution (membership function) and if-then rules. The quantitative information is stated in the numerical form with a membership degree. However, the qualitative situation and the uncertain knowledge cause the information not to be described in accurate numbers. Most of the managers also cannot provide an accurate figure for their opinions and that's why they use linguistic evaluations instead of specific numerical values. Triangular and trapezium membership functions are suitable for interaction of

the uncertainties in these evaluations. In the present study, linguistic terms of decision making group are provided in form of triangular fuzzy numbers. Triangular fuzzy number of $\tilde{a}$ is revealed as a_1, a_2, a_3.

Methodology

The present study is an applied study because it seeks to find the factors affecting the audit quality and ranking these factors from the perspective of the audit firms. This is also classified as a descriptive survey paper.

Population and Sample

The audit firms compose the population. Based on the research objectives which include identifying and prioritizing the criteria, it is necessary to select a strong team of the experts who are familiar with auditing and are of the skills and interest in participating in the study. According to the investigations, the audit firms should have the following characteristics to improve the academic level of audit firms:

- Having A degree in quality control based on the ranking of Iran certified Public Accountants
- Having long working history (8 years and more)

Finally, 60 firms were selected as the sample.

Data Collection

As noted before, the main objective of this study is identifying and ranking the factors affecting the audit quality. The data is basically gathered from the questionnaires.

The effective factors were identified by using library method along with the expert texts and internal and external articles. These factors were finally classified into three factors including the factors related to the analyzed entity, audit firm factors and external effective factors.

According to the population, the required questionnaires were designed for the managers of the audit firms. Some of the university professors and experts were consulted to test the reliability and relevancy of the data and the final questionnaire was at last designed. The primary questionnaire was sent to a limited number of the commentators and the responses were partially modified and the final questionnaire was distributed among the statistical sample.

The questionnaire is composed of three main sections. The first section includes general information about the education degree, the major and the working background of the respondents.

The second section of the questionnaire was composed of six questions. The first three questions evaluated the effect of triple factors on the audit quality. The other three questions were aimed at any of the triple factors and the impact of the two other factors on the audit quality was evaluated. The data of this section had been finally analyzed by using FANP and the three factors were weighted.

The third questionnaire includes the criteria and the measures of each element. These criteria and measures were evaluated based on five points. These points involve very insignificant, insignificant, mediate significant, highly significant and very significant. The criteria were finally prioritized using FTOPSIS technique.

Two elements were measured to evaluate the appropriateness level of the questionnaire: validity and reliability. Validity determines how well the questionnaire can measure a specific concept (Hafeznia, 2005).

The questionnaires had been once distributed among the accounting experts to suggest some recommendations about the questions. These recommendations were collected and included in the final questionnaire. As a result, the measurement instrument of this study has sufficient validity.

There are different methods like parallel method, classification method and Cronbach's alpha to measure reliability. Cronbach's alpha is the most appropriate method in terms of cost and time saving. This value was computed as 0.84 (more than 0.675). Therefore, it can be concluded that the questionnaire is reliable enough.

Data Analysis

Data analysis is considered as one of the most important steps in empirical studies. Applying a proper statistical method makes the representation of the results possible. Based on the second section of the questionnaire, the triple factors were weighted by using FANP. Among the exploited weights and the data of the third section and TOPSS technique, the criteria have been prioritized.

The following steps are taken to implement Fuzzy analytic hierarchy process:

1. Analytic Network Process: fuzzy analytic network process is based on a hierarchy which shows what is going to be investigated. Modeling of this study aims to weight the three factors affecting audit quality. According to above, fuzzy analytic hierarchy tree is shown in the following chart.

Chart1. FANP Structure and the Interactions between the Criteria
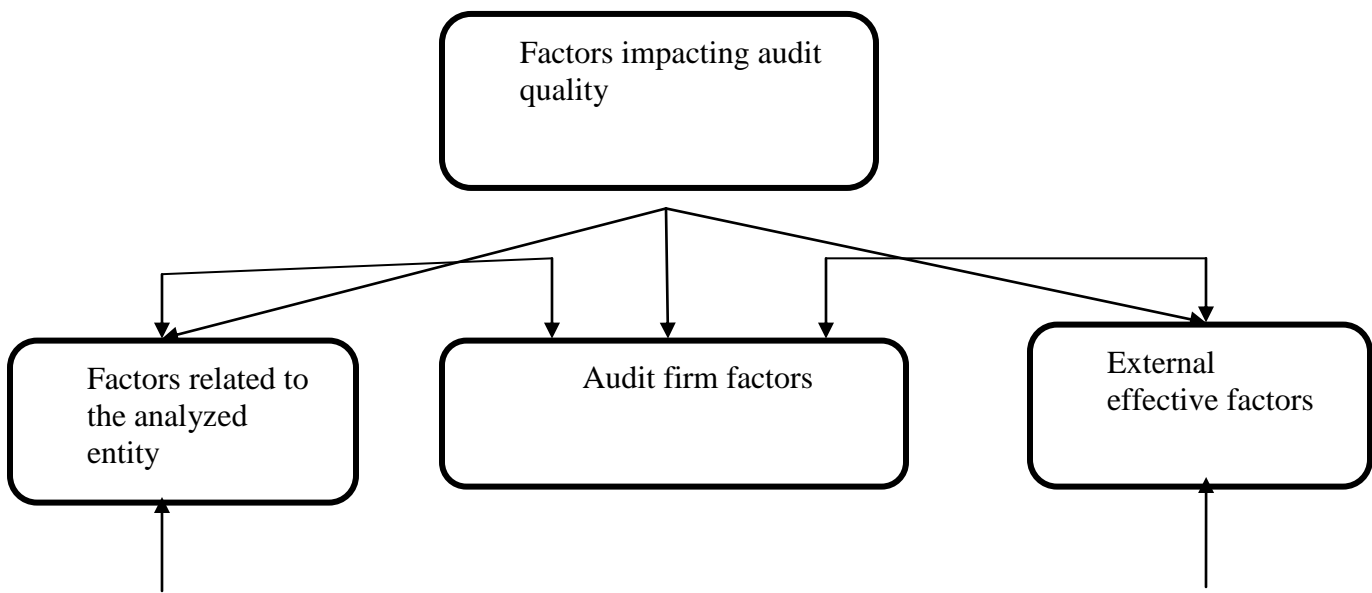
Based on table1, the pairwise comparison matrix is formed by using triangle fuzzy numbers of (l, m, u).

Table1. Fuzzy Numbers Consistent with the Linguistic Terms

Linguistic Terms	Fuzzy Numbers
Equally Preferred	(1, 1, 1)
Moderately Preferred	(2, 3, 4)
Strongly Preferred	(4, 5, 6)
Very Strongly Preferred	(6, 7, 8)
Extremely Preferred	(8, 9, 10)

2. Using the table of pairwise comparison matrix and the method introduced by Semmi et al (2009) in FANP, the weight of each factor is calculated.

Based on the super matrix of W, the weights of the three factors are determined to calculate W21 and W22 matrixes.

$$W = \begin{bmatrix} 0 & 0 \\ W_{21} & W_{22} \end{bmatrix}$$

To sum up the opinions of the experts, the pairwise comparison of the respondents is computed. The following table shows the geometric mean of the experts' opinions (audit firms) in relation to three factors dealing with the main objective of the study (W21).

Table2. Geometric Mean of the Pairwise Comparisons of Triple Factors Dealing with the Main Objective (W21 Matrix)

Effective External Factors	Audit Firm Factors	Entities' Factors	Audit Quality
(.16, .19, .24)	(.33, .41, .53)	(1.00, 1.00, 1.00)	**Entities' Factors**
(.12, .14, .16)	(1.00, 1.00, 1.00)	(1.87, 2.45, 2.89)	**Audit Firm Factors**
(1.00, 1.00, 1.00)	(6.22, 7.25, 8.27)	(4.21, 5.15, 5.74)	**Effective External Factors**

To form matrix W22, any of the three factors should be calculated. Compounding the geometric mean of pairwise comparisons of each factor, W22 matrix is formed and a logarithmic method of the least squares is used.

$$\tilde{W}_k = (W_k^l, W_k^m, W_k^u) \qquad K = 1, 2, 3, \dots, n$$

$$w_k^s = \frac{\left(\prod_{j=1}^{n} a_{kj}^s\right)^{1/n}}{\sum_{i-1}^{n}\left(\prod_{j=1}^{n} a_{kj}^m\right)^{1/n}}, \quad s \in \{l, m, u\}$$

Table3. Matrix W22 of the Triple Factors

Effective External Factors	Audit Firm Factors	Entities' Factors	Audit Quality
(.71, .80, .87)	(.18, .20, .22)	(0.00‹0.00‹0.00)	**Entities' Factors**
(.80, .87, .93)	(0.00‹0.00‹0.00)	(.12, .13, .14)	**Audit Firm Factors**
(0.00‹0.00‹0.00)	(.79, .86, .93)	(.13, .14, .15)	**Effective External Factors**

3. Matrix W_i is formed so that $W_i = W_{22} \times W_{21}$

Based on the matrixes calculated in the second step, Matrix W_i for three measures is as table 4.

Table4. Matrix W_i of the Triple Factors

Effective External Factors	Audit Firm Factors	Entities' Factors	Audit Quality
(.73, .83, .91)	(4.61,5.99, 7.46)	(3.33, 4.61, 5.68)	**Entities' Factors**
(.82, .89, .97)	(5.0, 6.35, 7.79)	(3.48, 4.60, 5.50)	**Audit Firm Factors**
(.11, .14, .18)	(.83, 93, 1.0)	(1.60, 2.25, 2.83)	**Effective External Factors**

4. Finally, the fuzzy weight of each factor is computed based on equation 1.

Table5. Fuzzy Weight of Each Factor

Factor's Weight	$w_k^s = \dfrac{\left(\prod\limits_{j=1}^{3} a_{kj}^s\right)^{1/3}}{\sum\limits_{i-1}^{3}\left(\prod\limits_{j=1}^{3} a_{kj}^m\right)^{1/3}}$			$\left(\prod\limits_{j=1}^{3} a_{kj}^s\right)^{1/3} \quad s \in \{l,m,u\}$			Audit Quality
	l	m	u	l	m	u	
(.35, .44, .52)	.35	.44	.52	2.24	2.84	3.38	**Entities' Factors**
(.37, .46, .52)	.37	.46	.52	2.42	2.97	3.46	**Audit Firm Factors**
(.08, .10, .12)	.08	.10	.12	.54	.67	.81	**Effective External Factors**

The final calculated weight has been used to prioritize the indicators influencing on audit quality by using FTOPSIS.

- **Identifying the Indicators Influencing on Audit Quality**

A schedule containing the factors impacting on the audit quality has been provided by applying the books and internal and external journals and articles. Finally, 24 factors were identified and selected as the basis to design the questionnaire. These factors were then divided in terms of three general categories as shown in table6.

Table6. Measures and Indicators of Audit Quality

Audit Quality Measures	Audit Quality Indicators
Entities' Factors	1- Firm Size 2- Internal control structure 3- Presence of internal auditors 4- Type of operations
Audit Firm Factors	1- Auditors' experience 2- Complete familiarity with audit standards 3- Relationship of audit members with the audit committee 4- Brand and reputation of the audit firm 5- Complete familiarity with accounting standards 6- Hiring talent staff in the entity 7- Setting up training periods for the staff 8- Performance evaluation of the personnel 9- Division of labor 10- Monitoring 11- Code of professional conduct 12- Mandatory rotation of the auditors 13- The expertise of the audit firm in the firms' industry 14- Audit firm size 15- Audit fee

Audit Quality Measures	Audit Quality Indicators
Effective External Factors	1- Political and legal environment 2- Technology developments 3- Competitive environment 4- General economic situations 5- Familiarity with common accounting method and software

- **Prioritizing the Indicators Affecting Audit Quality based on FTOPSIS**

1. After converting the linguistic terms of the third section of the questionnaire to the fuzzy numbers and using FTOPSIS technique, the indicators are weighted. The tables related to any of the factors are formed and the geometric mean is used to compound the data. K is the number of the participants.

$$X_{ij} = \frac{1}{k}\left[X_{ij}^{1}(+)X_{ij}^{2}(+)...(+)X_{ij}^{k}\right]$$

2. Converting Mean Matrix to the Normalized Matrix

All of the indicators used in this study have positive aspects; therefore, the maximum upper limit is calculated among the indicators of each factor and the figure is divided by its maximum. The result is the normalized matrix.

3. Converting normalized Matrix to the Weighted Matrix: normal matrix is the result of multiplying the normalized matrix by the fuzzy weights computed in the prior step.

Table7. Weighted Matrix of the Indicators of the Entity

	Triangular fuzzy number $(l, m, u$)		
The firm size	.15	.24	.34
Internal control structure	.26	.38	.52
Presence of internal auditors	.24	.36	.49
Type of operations	.12	.19	.28

Table8. Weighted Matrix of the Indicators of Audit Firms

	Triangular Fuzzy Numbers $(l, m, u$)		
Auditors' experience	.29	.41	.53
Brand and the reputation of the audit firm	.18	.27	.38
Complete familiarity with audit standards	.25	.36	.49
Relationship of audit members with the audit committee	.17	.27.	.38
Complete familiarity with accounting standards	.28	.39	.52
Hiring talent staff in the entity	.23	.34	.43
Setting up training periods for the staff	.20	.30	.42
Performance evaluation of the employees	.18	.27	.38
Division of labor	.20	.30	.42
monitoring	.22	.32.	.44
Code of professional conduct	.22	.32	.44
Mandatory rotation of the auditors	.12	.19	.27
The expertise of the audit firm in the firms' industry	.23.	.34	.46
Audit firm size	.13	.22	.32
Audit fee	.21	.31	.42

Table 9. Weighted Matrix of the Indicators of External Effective Factors

Triangular fuzzy numbers			
.04	.06	.09	Political and legal environment
.04	.07	.11	Familiarity with common accounting method and software
.06	.09	.12	Competitive environment
.05	.08	.12	Technology developments
.04	.07	.11	General economic situations

4. Determining the Fuzzy Positive Ideal Solution and the Fuzzy Negative Ideal Solution

After multiplying the normalized matrix by the weights, the distance of each criterion from the positive and negative ideal solution is calculated. In doing so, it is necessary to determine the positive and negative ideal solutions. In this study, fuzzy positive and negative ideal values introduced by Chen are used. These values are:

Positive Ideal Point $\tilde{v}_j^* = (1,1,1)$ 　　　　　　$\tilde{v}_j^- = (0,0,0)$ Negative Ideal Point

The distance from the positive and negative ideal solutions are calculated from the equations 4 to 6.

$$\tilde{A} = (a_1, b_1, c_1)$$

$$\tilde{B} = (a_2, b_2, c_2)$$

Eq. 4

$$D(A,B) = \sqrt{\frac{1}{3}\left[(a_2 - a_1)^2 + (b_2 - b_1)^2 + (c_2 - c_1)^2\right]}$$

Based on the above descriptions, the distance is computed as follows:

Eq. 5
$$D_i^* = \sum_{j=1}^{n} d(\tilde{v}_{ij} - \tilde{v}_j^*) \quad i = 1,2,...,m$$

Eq. 6
$$D_i^* = \sum_{j=1}^{n} d(\tilde{v}_{ij} - \tilde{v}_j^*) \quad i = 1,2,...,m$$

5. Final Prioritization of the criterion: Equation 7 is needed to prioritize the criterion. In doing so, the relative closeness of the ith element is obtained from the positive ideal solution.

Eq. 7 $\qquad CC_i = \dfrac{D_i^-}{D_i^* + D_i^-} \qquad i = 1,2,...,m$

The result is the final weight of each factor impacting audit quality. These weights are provided in the following table:

Table10. Final Weights of the Indicators of Entity

No.	Entities' Indicators	d_i^*	d_i^-	CC_i	Rank
1	the firm size	.76	.26	.25	.3
2	Internal control structure	.62.	.40	.39	1
3	The presence of internal auditors	.65	.38	.37	2
4	Type of operations	.80	.21	.21.	4

Table11. Final Weights of the Indicators of Audit Firm

No.	Audit Firms' Indicators	d_i^*	d_i^-	CC_i	Rank
1	Auditors' experience	.60	.42	.41	2
2	Brand and the reputation of the audit firm	.74	.29	.28	8
3	Complete familiarity with audit standards	.64	.38	.37	4
4	Relationship of audit members with the audit committee	.74	.28	.28	8
5	Complete familiarity with accounting standards	.61	.41	.40.	3
6	Hiring talent staff in the entity	.66	.36	.35	5
7	Setting up training periods for the staff	.70	.32	.32	7
8	Performance evaluation of the employees	.74	.62	.46	1

9	Division of labor	.70	.32	.32	7
10	monitoring	.68	.58	.46	1
11	Code of professional conduct	.68	.34	.34	6
12	Mandatory rotation of the auditors	.81	.20	.20	10
13	The expertise of the audit firm in the firms' industry	.66	.36.	.35	5
14	Audit firm size	.78	.24	.24	9
15	Audit fee	.69.	.32	.32	7

Table12. Final Weights of the Indicators of the Effective External Factors

| No.	Effective External Indicators	d_i^*	d_i^-	CC_i	Rank
1	Political and legal environment	.94	.07	.07	3
2	Familiarity with common accounting method and software	.92	.08	.08	2
3	Competitive environment	.91	.09	.09	1
4	Technology developments	.92	.09	.09	1
5	General economic situations	.93.	.09	.08	2

FINDINGS

The findings related to weighting the three factors affecting audit quality shows that the factors associated with the audit quality have the highest priority among the other factors.

Table13. The absolute weight of the factors affecting audit quality from the audit firms' directors

	Factors affecting audit quality	**Final fuzzy normalized weights**	**Absolute weights**	**preference**
Audit Quality	**Audit Firm's Factors**	**(.37, .46, .53)**	**.46**	**1**
	Entities' Factors	**(.35, .44, .52)**	**.44**	**2**
	Effective External Factors	**(.08, .10, .12)**	**.10**	**3**

Chart 2. The proportion of each factor in improving the audit quality
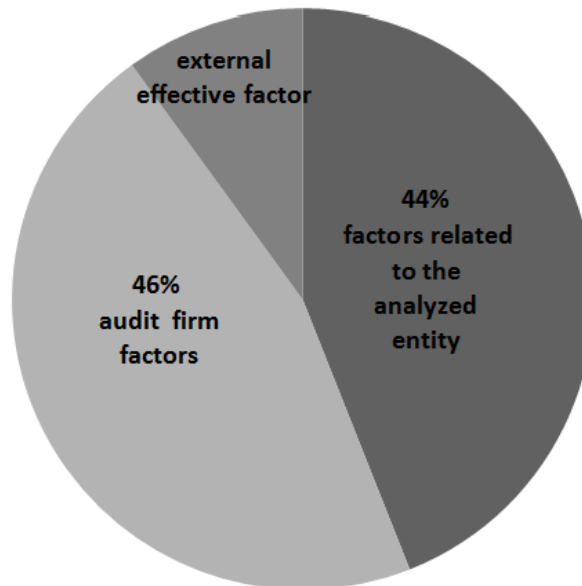
The results related to weighting the criteria of audit quality

Those weights calculated for the factors affecting audit quality are used as the inputs of fuzzy TOPSIS method. Based on the findings, internal control structure has the highest priority in terms of entities' factors. Additionally, monitoring is the factor with the highest weight among the other elements related to audit firm. The highest priority is for competitive environment element among the effective external factors. Five top factors among 24 factors are monitoring, performance evaluation of the personnel, auditors' experience, familiarity with accounting standards and internal control structure, respectively.

Research Based Suggestions

- Based on the highest priority assigned to the monitoring, it is suggested to enhance the quality by monitoring the operations in the pre-audit performance, during the audit and

after the audit. Alliance of these steps can make the result of monitoring more tangible and useful.

- The detailed factors affecting audit quality have been examined and ranked in this study. The auditors are offered to consider the significance of the factors and prioritize the more effective elements like internal controls and try to follow and improve them.

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