Evaluating the Corporate Governance Based Performance of Participation Banks in Turkey with the House of Quality Using an Integrated Hesitant Fuzzy MCDM

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Abstract

This study is prepared to evaluate corporate governance performance of participation banks in Turkey with the house of quality. For this purpose, an integrated model is constructed to evaluate the criteria and analyze the fuzzy pairwise and decision matrices. The method is proposed with the hesitant fuzzy DEMATEL for weighting criteria and hesitant fuzzy TOPSIS for ranking the alternatives. According to the expert opinions, it is concluded that foreign participation banks have better performance in comparison with state-owned participation banks with respect to corporate governance. For this reason, it can be said that state-owned participation banks should take actions to increase their performance regarding corporate governance by focusing on important criteria emphasized in the study.

Keywords: *Corporate Governance, DEMATEL, House of Quality, Performance, TOPSIS, Turkish Banking Sector*

JEL Classification: *C44, D81, G21, L25*

Özet - Türkiye'de Katılım Bankalarının Kurumsal Yönetiminin Çok Değişkenli Entegre Bulanık Karar Verme Yaklaşımı Kullanılarak Kalite Evi ile Değerlendirilmesi

Bu çalışma Türkiye'de faaliyet gösteren katılım bankalarının kurumsal yönetim temelli performanslarının değerlendirilmesine yönelik olarak hazırlanmıştır. Bu amaçla, kriterleri değerlendirmek ve bulanık ikili ile karar matrislerini analiz etmek için bütünleşik bir model oluşturulmuştur. Bu yöntem, kriterleri ağırlıklandırmak için bulanık DEMATEL ve alternatifleri sıralamak için bulanık TOPSIS yöntemlerini önermektedir. Çalışma sonucunda, yabancı katılım bankalarının kamu katılım bankalarına kıyasla kurumsal yönetim açısından daha iyi performans gösterdiği belirlenmiştir. Dolayısı ile kamu katılım bankaları kurumsal yönetim performanslarını artırmak için bu çalışmada vurgulanan önemli hususlara odaklanmak sureti ile aksiyon almalıdırlar.

Anahtar Kelimeler: *Kurumsal Yönetim, DEMATEL, Kalite Evi, Performans, TOPSIS, Türk Bankacılık Sektörü*

JEL Sınıflandırması: *C44, D81, G21, L25*

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1. Introduction

Stakeholders are strongly considered to make a strategic decision on the qualified investments multi-dimensionally (Harford et al., 2012). For this purpose, the corporate governance is a strong tool to understand the needs of customers, employees, and suppliers at the same time. So, it could be easy to measure the companies that are interested in the needs of customers and technical requirements (Griffin et al., 2017). Therefore, the policies based on the corporate governance have to be widely used to evaluate the companies more accurately. Accordingly, the business environment that reflects successful policies generally provides the motivation for all parts in the competitive market environment (Aguilera et al., 2018). Conditions of transparency and measurability for both customer needs and technical requirements might have a positive effect in increasing financial performance as well as the quality of the companies (Schmidt and Fahlenbrach, 2017; Laoworapong et al., 2018).

However, the concept of the house of quality (HoQ) provides a multi-dimensional quality evaluation of the companies by using customer requests and technical requirements to develop the policies related to new service and product development (Chen et al., 2017; Popoff and Millet, 2017). So, the critical issues of corporate governance when considering quality measurement could be structured using the determinants of corporate governance within the house of quality. Thus, it is possible to make the business projects more successful with the corporate governance-based quality policies (Liao et al., 2017).

As it stands, the banking sector plays a critical role in the economic performance of countries because it causes country investments to increase, resulting in funds for investors (Yüksel et al., 2017). Yet, as a result of globalization, competition in the banking sector has been steadily increasing. thereby forcing banks to excessively spend money to identify which actions are necessary to overcome this phenomenon. Quality function deployment methodology should be implemented by banks, making it possible for the banks to take corrective actions by considering the requirements of the customers.

In particular, the service industry deals with quality improvement-based policies to provide multi-dimensional success. Nowadays, even though stakeholders are an important issue for banking sector performance, the best policies in the banking sector could be provided by corporate governance-based quality factors (Dinçer et al., 2017; Yüksel et al., 2017). Especially since the popularity of participation banking (in general Islamic banking) has internationally grown during the last few years (Al-

Malkawi and Pillai, 2018), participation banks should take actions to improve within the sector (Yüksel and Canöz, 2017). In lieu of this growth, corporate governance has a prominent role in achieving this objective since corporate governance refers to the rules and best practices to manage a company, thereby increasing transparency with effective corporate governance. In other words, the banks would give greater importance to the benefits of different stakeholders using corporate governance and, as a result, customers and financial performance benefit (Tunay and Yüksel, 2017).

While considering the factors emphasized above, it is obvious that studies related to corporate governance of the banks have substantial importance. Similarly, the aim of this study is to evaluate the corporate governance performance of the banking sector with the HoQ. Within this scope, hesitant fuzzy decision-making trial and evaluation laboratory (DEMATEL) is considered for weighting criteria; additionally, hesitant fuzzy technique is considered for order preference by similarity to ideal solutions (TOPSIS) in order to rank the alternatives. As a result, it is possible to understand corporate governance performance of the banks in Turkey and give recommendations to increase performance.

The study consists of five sections and is organized as follows. After the introduction, section 2 reviews the related literature upon the HoQ and corporate governance. Section 3 gives details about methods used in the study. Section 4 reviews the research results of the study. Section 5 summarizes the results of the study and recommendations are made according to the analysis results.

2. Literature Review

2.1. House of Quality

The house of quality, which is a part of the quality function deployment approach, attracts the attention of many different researchers and most of the studies related to this methodology focus on multiple aspects of analysis. On the new service development process, for example, Adiano and Roth (1994) analyzed the requirements of new products generating in the United States of America (the USA) by using this approach and concluded that market needs should be taken into consideration in this process. Moreover, Scheurell (1994) also focused on this topic, defining the key role cost minimization plays in the development of new services. Furthermore, Olewnik and Lewis (2008), Li et al. (2011) and Wu (2011) underlined the house of quality method as being very helpful in the development of new services.

Additionally, it is also understood that the house of quality approach is used to analyze customer needs and demands. For instance, Kuijt-Evers et al. (2009) considered this methodology as an improvement on the requirements for process and product design in the Netherlands, concluding that customer needs should be considered for this purpose. Garver (2012) also underlined a similar aspect for the USA. Furthermore, Ko (2015), and Yang et al. (2015) used the house of quality approach for product development processes for companies in China, identifying that companies should focus on customer satisfaction in order to increase their financial performance.

In fact, another important point is that the house of quality approach is used to make analysis in multiple industries. As an example, Adinyira et al. (2017), Seow et al. (2016), and Akbaş and Bilgen (2017) focus on the requirement to increase efficiency in the energy sector by using this method. In addition, Illés et. al. (2017) and Yazdani et al. (2017) tried to determine the customer needs in the logistics sector by considering the house of quality. Also, Wu et al. (2018) and Lin et al. (2016) aimed to improve service quality in the health sector with the help of this methodology.

2.2. Corporate Governance

Most of the studies in the literature focus on corporate governance by analyzing the relationship to the performance of the companies. For example, Gupta et al. (2018) evaluated this relationship in 22 developed countries with the help of regression analysis, concluding that corporate governance has a significant influence on the financial performance of the companies. Yeh (2017), Kieschnick and Moussawi (2018), Paniagua et al. (2018), Sun and Liu (2018) reached a similar conclusion by using the same methodology, as did Zagorchev and Gao (2015), Pillai and Al-Malkawi (2018) stating that financial performance of companies increase with the deployment of effective corporate governance.

In addition to these studies, some studies consider the relationship between corporate governance and risk management. For instance, Ghosh (2018) prepared a study to understand the affecting factors of bank performance and stability in the Middle East and North Africa region. For this purpose, regression analysis was applied, whereby they identified that banks can be more successful in risk management in cases of effective corporate governance. Parallel to this study, Switzer, Tu and Wang (2018) also concluded that corporate governance is an important aspect to minimize the risks for the companies. Additionally, Safiullah and Shamsuddin (2018) also used the generalized method of moment approach to understand the effects of

corporate governance in 28 different countries, determining that the risks to banks can be managed effectively when they implement appropriate corporate governance.

Analyzing the relationship between corporate governance and economic growth was yet another aspect. For example, Kayalvizhi and Thenmozhi (2018) focused on this relationship in 22 emerging economies., concluding that corporate governance has a positive influence on the economic development of the countries. Similarly, Diallo (2017) also underlined this issue for 34 different countries. Likewise, the relationship between the size of the board of directors and corporate governance is also considered. For instance, Salim, Arjomandi and Seufert (2016) used data envelopment analysis to measure this relationship in Australia. They identified board size as having significant effect on the performance of corporate governance. Also, Anginer et al. (2016), Miyajima et al. (2018), and Schymik (2018) emphasized the same aspect by using different methodologies.

It is clear that there are a variety of studies related to the house of quality and corporate governance and different methodologies: regression, data envelopment analysis, probit and generalized method of moment. Nevertheless, there is a need for a new study which focuses on the subject of corporate governance using new methods like the house of quality. In other words, the dual usage of the house of quality and corporate governance in one study could make an important contribution to the literature.

3. Methodology

3.1. Hesitant Fuzzy Sets

Hesitant fuzzy sets developed by Torra (2010) have been accepted as the extension of fuzzy sets and can be used for the situation in which experts could not reach agreement. In this process, h refers to the hesitant fuzzy sets on the reference set X when applied to X returning a subset of [0, 1]. The hesitant fuzzy sets $h_M(x)$ are given on equation 1.

$$h_M(x) = \cup_{\mu \in M} \{\mu(x)\} \quad (1)$$

In this equation, $M = \{\mu_1, \ldots, \mu_N\}$ represents the set of N membership function. After that, lower bound ($h^-(x)$) and upper bound ($h^+(x)$) are defined as shown below.

$$h^-(x) = \min h(x) \ \ and \ h^+(x) = \max h(x) \quad (2)$$

In equation 2, h^- is the pair of functions and $1 - h^+$ defines the intuitionistic fuzzy set. The membership function h of the hesitant fuzzy set is explained by $h^c(x) = \cup_{\gamma \epsilon h(x)} \{1 - \gamma\}$. On the other side, the intersection of two hesitant fuzzy sets h_1 and h_2 is given as follows.

$$(h_1 \cup h_2)(x) = \left\{h \in \left(h_1(x) \cup h_2(x)\right) | h \geq \max(h_1^-, h_2^-)\right\}, \text{ or} \quad (3)$$

$$(h_1 \cup h_2)(x) = \left(h_1(x) \cup h_2(x)\right)_\alpha^+ for\ \alpha = \max(h_1^-, h_2^-) \quad (4)$$

$$(h_1 \cap h_2)(x) = \left\{h \in \left(h_1(x) \cup h_2(x)\right) | h \leq \max(h_1^+, h_2^+)\right\}, \text{ or} \quad (5)$$

$$(h_1 \cap h_2)(x) = \left(h_1(x) \cup h_2(x)\right)_\alpha^- for\ \alpha = \min(h_1^+, h_2^+) \quad (6)$$

3.2. Hesitant Fuzzy DEMATEL

The DEMATEL methodology is developed by Geneva Research Centre of the Battelle Memorial Institute. This approach is considered by decision making under the fuzzy environment (Bai et al., 2017; Dinçer et al., 2018). The hesitant fuzzy DEMATEL provides the flexibility by considering hesitant fuzzy sets when there is a lack of knowledge in case of uncertainty. The details of this method are given below (Asan et al., 2018).

In step 1, the relationship between the dimensions is rated. Within this framework, the priorities of decision makers are identified with a subset of [0, 1]. In step 2, the direct-relation fuzzy matrix is calculated by considering the evaluations of decision makers. This matrix is explained below.

$$\tilde{H} = \begin{bmatrix} 0 & \tilde{H}_{12} & \cdots & \cdots & \tilde{H}_{1n} \\ \tilde{H}_{21} & 0 & \cdots & \cdots & \tilde{H}_{2n} \\ \vdots & \vdots & \ddots & \ddots & \vdots \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \tilde{H}_{n1} & \tilde{H}_{n2} & \cdots & \cdots & 0 \end{bmatrix} \quad (7)$$

In this matrix, $\tilde{H}_{ij}$ presents the degree of the influence. On the other side, the average fuzzy scores of the experts' opinions are used in this matrix. The calculation process is shown in equation 8.

$$\tilde{H}^k = \frac{\tilde{H}^1 + \tilde{H}^2 + \tilde{H}^3 + \cdots \tilde{H}^l}{l}, \qquad k = (1,2,\ldots,l) \quad (8)$$

In this equation, l represents the number of experts. In step 3, the direct effect matrix is normalized. This process is detailed below.

$$\begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \cdots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \cdots & \cdots & \tilde{x}_{2n} \\ \vdots & \vdots & \ddots & \cdots & \cdots \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \tilde{x}_{n1} & \tilde{x}_{n2} & \cdots & \cdots & \tilde{x}_{nn} \end{bmatrix} \quad (9)$$

$$\tilde{x}_{ij} = \frac{H_{ij}}{r} \quad \text{and} \quad r = max_{1 \le i \le n} \left(\sum_{j=1}^{n} \tilde{H}_{ij} \right) \quad (10)$$

In step 4, the total influence matrix T is built. The details of the calculation process are explained below.

$$T = N + N^2 + N^2 + \cdots + N^h = N(I + N + N^2 + \cdots + N^{h-1})(I - N)(I - N)^{-1} \quad (11)$$

$$T = N(I - N^h)(I - N)^{-1} = N(I - N)^{-1}, \text{ when } \lim_{h \to \infty} N^h = [0]_{n \times n} \quad (12)$$

In the last step, the influential network relation map is created as below.

$$T = \left[t_{ij} \right]_{n \times n}, \quad i, j = 1,2, \ldots, n \quad (13)$$

$$r = \left[\sum_{j=1}^{n} t_{ij} \right]_{n \times 1} = (r_i)_{n \times 1} = (r_1, \ldots, r_i, \ldots, r_n) \quad (14)$$

$$y = \left[\sum_{i=1}^{n} t_{ij} \right]'_{1 \times n} = (y_j)'_{1 \times n} = (y_1, \ldots, y_i, \ldots, y_n) \quad (15)$$

In these equations, vector r explains the sum of all vector rows and vector y represents the sum of all vector columns. If $(r_i - y_i)$ is positive, it gives information that criterion i affects other criteria. Otherwise, it means that it is influenced by other criteria.

3.3. Hesitant Fuzzy TOPSIS

TOPSIS method is frequently used to rank the different alternatives. In this process, the maximized distance from the negative ideal solutions and the minimized distance from the positive ideal solutions is determined (Jain et al., 2018). This approach is also considered with hesitant fuzzy sets. The details of this process are explained below (Büyüközkan and Güler, 2017).

In the first step, a collective hesitant fuzzy decision matrix is created by considering the opinions of the experts. In the second step, the ideal (A^+) and negative (A^-) solutions are identified as follows.

$$A^+ = \{h_1^+, \ldots, h_n^+\} \quad (16)$$

$$\text{Where } h_j^+ = \cup_{i=1}^{m} h_{ij} = \cup_{\gamma 1j \in h_{ij}, \ldots, \gamma mj \in h_{mj}} max\{\gamma_{1j}, \ldots, \gamma_{mj}\} \; j = 1,2, \ldots, n \quad (17)$$

$$A^- = \{h_1^-, \dots, h_n^-\} \quad (18)$$

Where $h_j^- = \cup_{i=1}^m h_{ij} = \cup_{\gamma 1j \epsilon h_{ij}, \dots, \gamma_{mj} \epsilon h_{mj}} min\{\gamma_{1j}, \dots, \gamma_{mj}\}\ j = 1,2, \dots, n$ (19)

In the third step, the separation of each alternative from the ideal solution is weighted as below.

$$B_i^+ = w_i \times \|h_{ij} - h_j^+\| \quad (20)$$

$$B_i^- = w_i \times \|h_{ij} - h_j^-\| B_i^- = w_i \times \|h_{ij} - h_j^-\| \quad (21)$$

In the fourth step, the distances of the best (D_i^+) and the worst (D_i^-) alternatives are calculated with the help of following equations.

$$D_i^+ = \sum_{j=1}^n B_i^+ \quad (22)$$

$$D_i^- = \sum_{j=1}^n B_i^- \quad (23)$$

In the last step, the alternatives are ranked by computing the relative closeness to the ideal solution as following.

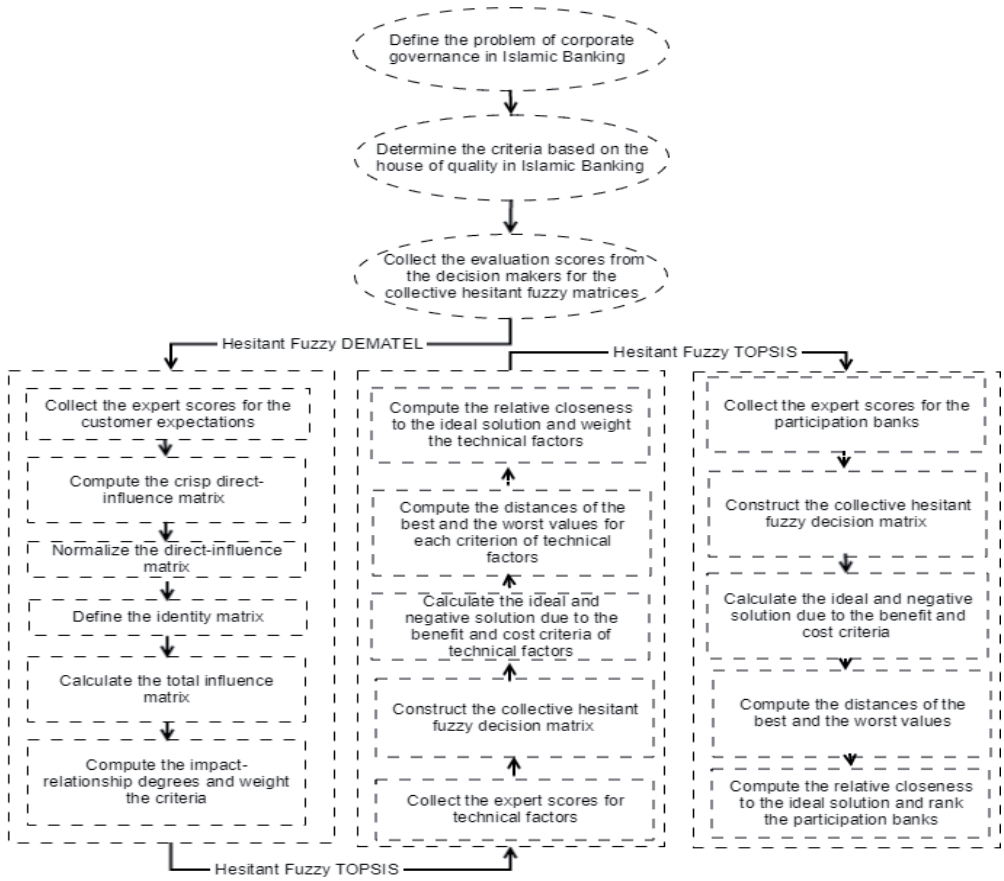
$RC_i = \frac{D_i^-}{D_i^+ + D_i^-}$ for i = 1, 2,..., m and $0 \leq RC_i \leq 1$ (24)

4. An Application On The Participation Banks

4.1. Model Construction

The model is constructed in three different phases. The flowchart of the proposed model is detailed in Figure 1.

Figure 1. The Flowchart of the Proposed Model



Initially, the problem of corporate governance in participation banking is defined in order to rank the banks. After that, a set of criteria defining the customer expectations and technical requirements of corporate governance is constructed to evaluate the alternatives based on the HoQ technique. Dey et al. (2012), Wang and Chen (2012) and Younesi and Roghanian (2015) used house of quality approach with fuzzy DEMATEL in the literature. Furthermore, fuzzy TOPSIS approach was also preferred using the house of quality methodology in many different studies (Wu, 2002; Bouchereau and Rowlands, 2000). Table 1 and 2 show the proposed customer and technical factors of corporate governance for the HoQ respectively.

Table 1. Proposed Customer-based Factors of Corporate Governance for House of Quality

Customer Expectations	Definition	Supported Literature
1.Extended hours	Offering the extended working hours to service the banking operations	Yemane (2015), Ndungu and Njeru (2014)
2.Physical facilities	Increasing the alternative distribution channels such as ATM and branch physically for the customer	Levy and Hino (2016), Ferreira et al. (2015), Pandey et al. (2017)
3.Operational ease	Developing the interfaces of the alternative distribution channels to be used more efficiently by the customers	Nippatlapalli (2013), Kumari (2004), Pandey et al. (2017)
4.Customer support	Constructing the information technologies that provides continuous customer support	Perez and Bosque (2015), Ray et al. (2016)
5.Data Security	Protecting all data of customers against improper use and illegal attacks.	Tebaa et al. (2015), Zkik et al. (2016)

Table 2. Proposed Technical Factors of Corporate Governance for House of Quality

Technical Factors	Definition	Supported Literature
1.ICT infrastructure	Planning the infrastructure of information and communication technologies to operate the service incrementally	Dhingra (2015), Ejeagbasi et al. (2015)
2.Operational convenience	Operating the services using the multidimensional facilities	Bapat (2017), Cambra-Fierro et al. (2016)
3.Security infrastructure	Constructing the infrastructure of security to protect the data	Tebaa et al. (2015), Zkik et al. (2016)
4.Ease of access	Increasing the omnichannel capacity to access the customer properly	Ferreira et al. (2015), Jolly (2016)
5.Competitive pricing	Defining the service costs by considering the competitive market environment	Zheng and Das (2018), Phang and Raweewan (2015)

In the following process, the collective hesitant fuzzy matrices are constructed, and the evaluations are obtained from the decision makers. After that, the HoQ is employed to evaluate the criteria of corporate governance as seen in Figure 2.

Figure 2. The House of Quality for Corporate Governance

			Technical Factors								
			ICT infrastructure	**Operational convenience**	**Security infrastructure**	**Ease of access**			**Competitive pricing**		
			C1 C2.....C(n-1) Cn								
Customer Expectations	Extended hours	C1	C1,C1		C1,C2	...	...	...	...	...	C1,Cn
			...		...	...	...	...	...	...	...	...
	Physical facilities	C2 . . C(n-1) Cn	.		.	.	.	.	.	.	.	.
	Operational ease		.		.	.	.	.	.	.	.	.
	Customer support		.		.	.	.	.	.	.	.	.
	Data Security		C(n-1),C1		...	...	...	...	...	...	...	C(n-1),Cn
			Cn,C1		....	...	...	...	...	...	...	Cn,Cn

Integrated hesitant fuzzy decision-making approach is used in three different phases. In the first phase, hesitant fuzzy DEMATEL is used to weight the criteria of customer needs and expectations. In this process, the main reason of selecting DEMATEL methodology is that the degree of influence and relationship between the criteria can be defined effectively with this approach. In the second phase, technical factors of corporate governance are evaluated with hesitant fuzzy TOPSIS by considering the weights of customer expectations that are calculated in the first stage. In this process, this approach is selected because there is a decision matrix consisting of criteria and alternatives. Due to this, fuzzy TOPSIS method is preferred instead of fuzzy DEMATEL. In the third stage, the participation banks are ranked by the technical factors of corporate governance. For this purpose, the banks are evaluated with hesitant fuzzy TOPSIS by using weights of the technical factors with the integrated approach of the HoQ. The biggest advantage of this methodology is that criteria weights are calculated by considering customer expectations and technical requirements in an integrated manner, in accordance with HoQ structure.

4.2. Analysis Results

Weighting the Criteria of Customer Expectations on the Corporate Governance with Hesitant Fuzzy DEMATEL:

In the first stage, the dimensions of customer requirements are weighted by using hesitant fuzzy DEMATEL. For this purpose, 4 decision makers, who are experts in the field, evaluated this process. In this process, expert opinions are equally weighted. Accordingly, hesitant fuzzy direct influence matrix and the crisp direct-influence matrix have been computed respectively. After that, the normalized direct influence matrix has been provided and the total relation matrix has been constructed. Finally, the impact relationship degrees and weights of the criteria were calculated. Analysis details are shown in Table 3, 4, 5, 6 and 7.

Table 3. The Collective Hesitant Fuzzy Direct-Influence Matrix for Customer Expectations of Corporate Governance

Criteria	C1	C2	C3	C4	C5
Extended hours (C1)	{0}	{0.6,0.7}	{0.5,0.6,0.7}	{0.4,0.5}	{0.4,0.5}
Physical facilities (C2)	{0.5,0.7}	{0}	{0.4,0.5,0.6}	{0.5,0.6,0.7}	{0.5,0.6}
Operational ease (C3)	{0.5,0.6}	{0.5,0.6}	{0}	{0.5,0.6,0.7}	{0.5,0.6}
Customer support (C4)	{0.6,0.7,0.8}	{0.5,0.6}	{0.5}	{0}	{0.5,0.6}
Data Security (C5)	{0.6,0.7,0.8}	{0.5,0.6}	{0.4,0.5,0.6}	{0.5,0.6}	{0}

The matrix values in Table 4 are obtained by taking the average of the values provided by the experts in Table 3. For example, regarding the crisp matrix values between the criteria of C2 and C1, the average of hesitant fuzzy values [(0.5+0.7)/2=0.6] in Table 3 are taken into the consideration.

Table 4. The Crisp Direct-Influence Matrix

Criteria	C1	C2	C3	C4	C5
C1	0.000	0.625	0.600	0.475	0.425
C2	0.600	0.000	0.500	0.600	0.525
C3	0.525	0.525	0.000	0.575	0.525
C4	0.700	0.550	0.500	0.000	0.575
C5	0.700	0.575	0.525	0.575	0.000

Table 5. The Normalized Direct-Influence Matrix

Criteria	C1	C2	C3	C4	C5
C1	0.000	0.263	0.253	0.200	0.179
C2	0.253	0.000	0.211	0.253	0.221
C3	0.221	0.221	0.000	0.242	0.221
C4	0.295	0.232	0.211	0.000	0.242
C5	0.295	0.242	0.221	0.242	0.000

Table 6. The Total-Relation Fuzzy Matrix

Criteria	C1	C2	C3	C4	C5
C1	3.237	3.197	3.030	3.087	2.882
C2	3.576	3.113	3.120	3.242	3.024
C3	3.464	3.210	2.866	3.153	2.947
C4	3.721	3.412	3.225	3.146	3.137
C5	3.781	3.474	3.284	3.395	2.993

Table 7. The Impact-Relationship Degrees and Weights of the Criteria

Criteria	$\tilde{D}_i^{def}$	$\tilde{R}_i^{def}$	$\tilde{D}_i^{def} + \tilde{R}_i^{def}$	$\tilde{D}_i^{def} - \tilde{R}_i^{def}$	Weights
C1	15.433	17.779	33.212	-2.345	0.206
C2	16.074	16.406	32.481	-0.332	0.201
C3	15.641	15.525	31.166	0.115	0.193
C4	16.641	16.023	32.665	0.618	0.202
C5	16.927	14.983	31.909	1.944	0.198

Table 7 shows that extended hours (C1) is the most important factor of the customer expectations on the corporate governance in the banking while operational ease (C3) has the weakest importance among the expectations. Additionally, data security (C5) is the most influencing factor as extended hours (C1) is the most influenced criteria of customer-based corporate governance in the participation banking.

Weighting the Technical Factors of the Corporate Governance based on the Customer Expectations with Hesitant fuzzy TOPSIS:

In the second phase, customer expectations were compared with technical factors of corporate governance in the banking with the HoQ. Initially, the collective hesitant fuzzy decision matrix was constructed for the technical requirements of corporate governance. The details are given in Table 8.

Table 8. The Collective Hesitant Fuzzy Decision Matrix for Technical Factors of Corporate Governance

Alternatives / Criteria	Extended hours (C1)	Physical facilities (C2)	Operational ease (C3)	Customer support (C4)	Data Security (C5)
ICT infrastructure (A1)	{0.5,0.6,0.7}	{0.6,0.7,0.8}	{0.6,0.7,0.8}	{0.4,0.5}	{0.6,0.7,0.8}
Operational convenience (A2)	{0.5,0.6}	{0.6,0.7}	{0.6,0.7}	{0.5,0.6,0.7}	{0.5,0.6,0.7,0.8}
Security infrastructure (A3)	{0.3,0.4,0.5}	{0.4,0.5,0.6,0.7}	{0.4,0.5,0.6}	{0.4,0.5}	{0.7,0.8}
Ease of access (A4)	{0.5,0.6,0.7,0.8}	{0.6,0.7,0.8}	{0.7,0.8}	{0.6,0.7,0.8}	{0.5,0.6,0.7}
Competitive pricing (A5)	{0.3,0.4,0.5}	{0.3,0.4,0.5}	{0.4,0.5}	{0.4,0.5}	{0.3,0.4}

Table 8 represents the expert choices for technical factors based on customer expectations of corporate governance in banking. The weight results are seen in Table 9. Table 9 values are calculated using the equations (16) and (24). In this process, the maximum values (equations 16-17) and minimum values (equations 18-19) in all alternatives for each criterion and the hesitant fuzzy average values of the collective hesitant fuzzy decision matrix values in Tables 8 and 10 are taken into the consideration. By using these values, B_i (equations 20 and 21) and D_i values (equations 22 and 23) can be calculated. Finally, the RC_i values (equation 24) are calculated to rank the alternatives. The details are demonstrated in Tables 9 and 11. For instance, the D+ value for the alternative A1 in Table 10 is calculated as the following.

The criteria weights obtained from hesitant fuzzy DEMATEL are respectively 0.206, 0.201, 0.193, 0.202, 0.198. The B + values according to equation 20 are as follows:

B11: absolute ((0.6 + 0.6 + 0.5 + 0.7) / 4) -0.8) 0.206 = 0.041,

B12: absolute (-0.8) * 0.201 = 0.02,

B13: absolute ((0.7 + 0.7 + 0.6 + 0.8) / 4) -0.8) 0.193 = 0.019,

B14: absolute (-0.8) * 0.202 = 0.066,

B15: absolute ((0.6 + 0.7 + 0.8 + 0.6) / 4) -0.8) 0.198 = 0.025.

According to the equation (22), the D1+ value for A1 is calculated as 0.041 + 0.02 + 0.019 + 0.066 + 0.025 = 0.171. Similarly, B- and D- values and RC_i values can be calculated with formulas.

Table 9. Values of RCi and Weights of Technical Factors of Corporate Governance

Technical Factors	D+	D-	RCi	Weights
ICT infrastructure (A1)	0.171	0.290	0.629	0.2425
Operational convenience (A2)	0.171	0.290	0.629	0.2426
Security infrastructure (A3)	0.261	0.199	0.433	0.1669
Ease of access (A4)	0.125	0.335	0.728	0.2807
Competitive pricing (A5)	0.380	0.080	0.174	0.0673

Table 9 demonstrates that the values of D+ and D- and then RCi values have been calculated to rank the technical factors of corporate governance. RCi values have been also considered to weight the factors. According to the results, ease of access (A4) is the most important factor in the technical requirements of corporate governance whereas competitive pricing (A5) has relatively the weakest importance in the technical factor evaluations based on customer expectations of corporate governance.

Ranking the participation banks with Hesitant Fuzzy TOPSIS by considering the integrated evaluation of the house of quality:

In the third phase, participation banks operating currently in Turkey were ranked using the evaluation results of the customer versus technical requirements of corporate governance in the banking. For this purpose, the evaluation results of the second phase were used to weight the criteria in the third phase and the final results of the banks have been illustrated in Table 10 and 11 respectively.

Table 10. The Collective Hesitant Fuzzy Decision Matrix for the Participation Banks Based on Integrated Requirements of Corporate Governance

Alternatives/ Criteria	ICT infrastructure (C1)	Operational convenience (C2)	Security infrastructure (C3)	Ease of access (C4)	Competitive pricing (C5)
Foreign participation bank 1 (FPB1)	{0.5,0.6}	{0.5,0.6}	{0.6,0.7,0.8}	{0.4,0.5,0.6}	{0.4,0.5,0.6}
Foreign participation bank 2 (FPB2)	{0.6,0.7}	{0.7,0.8}	{0.7,0.8}	{0.6,0.7}	{0.5,0.6,0.7}
Foreign participation bank 3 (FPB3)	{0.5,0.6}	{0.4,0.5,0.6}	{0.5,0.6}	{0.4,0.5}	{0.5,0.6}
State-owned participation bank 1 (SPB1)	{0.4,0.5,0.6}	{0.4,0.5,0.6}	{0.6,0.7}	{0.4,0.5}	{0.5,0.6}
State-owned participation bank 2 (SPB2)	{0.5,0.6}	{0.4,0.5,0.6}	{0.5,0.6,0.7}	{0.4,0.5}	{0.5,0.6}

Table 10 represents the expert choices for the Participation Banks by the technical factors of corporate governance. The fuzzy decision matrix has been applied to rank the participation banks based on integrated requirements of corporate governance. The ranking results are seen in Table 11.

Table 11. Values of RCi and Ranking Alternatives

Participation Banks	D+	D-	RCi	Ranking
Foreign participation bank 1 (FPB1)	0.189	0.135	0.416	2
Foreign participation bank 2 (FPB2)	0.064	0.261	0.804	1
Foreign participation bank 3 (FPB3)	0.218	0.106	0.327	3
State-owned participation bank 1 (SPB1)	0.227	0.098	0.301	5
State-owned participation bank 2 (SPB2)	0.220	0.104	0.321	4

Table 11 demonstrates that foreign participation bank 2 (FPB2) has the best performance in the integrated requirements of corporate governance with the HoQ while state-owned participation bank 1 (SPB1) has the worst performance of the participation banking in Turkey. Another important point in this study is that foreign participation banks have better performance in comparison with state-owned participation banks with respect to corporate governance.

Conclusion

The service industry has a positive influence, increasing liquidity in the market by attracting the parties who give importance to quality improvement. Hence, it can be said that it leads to increases in the investment amount of companies. Nevertheless, the participation banking in Turkey has a very small share- approximately 5% of the whole banking sector according to asset size- but this provides a strong growth potential at the same time. Therefore, participation banks should implement effective corporate governance in order to compete with deposit banks in Turkey.

This study aims to measure the corporate governance performance of the service industry with the house of quality. To reach this aim, an integrated model was developed by considering 3 different stages. In the first stage of the analysis, the dimensions of customer requirements were weighted using hesitant fuzzy DEMATEL. After that, customer expectations were compared with technical factors of corporate governance within the house of quality. In the third phase, the participation banks in Turkey were ranked using the evaluation results of hesitant fuzzy TOPSIS methodology.

As a result of hesitant fuzzy DEMATEL, extended hours (C1) were determined to be the most important factor of customer expectations within corporate governance in the banking sector. Moreover, by considering expert opinions, operational ease (C3) has the weakest importance among the expectations and data security (C5) is considered just as influential a factor as extended hours (C1) within customer-based corporate governance in the industry.

Likewise, ease of access (A4) is the most important factor for the technical requirements of corporate governance using hesitant fuzzy TOPSIS methodology. In addition ICT infrastructure (A1) and operational convenience (A2) are additional important technical factors. On the other hand, that competitive pricing (A5) has relatively the weakest importance in the technical factor evaluations based on customer expectations of corporate governance.

In the final stage of the analysis, it was determined that foreign participation banks have better performances in comparison to state-owned participation banks and foreign participation bank 2 (FPB2) had the best performance in the integrated requirements of corporate governance within the house of quality. In contrast, state-owned participation bank 1 (SPB1) had the lowest performance of the sector.

While considering all results, it can be said that state-owned participation banks

should take actions in order to increase their performance regarding corporate governance and it is strongly recommended that these banks focus on the more important criteria emphasized in the study. However, another study focusing on the cross-country analysis could be beneficial for further research.

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