Original Article

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Defining Effective Performance Management Strategies for Hospital with a Novel Fuzzy Decision-Making Model

Yeni Bir Bulanık Karar Verme Modeli ile Hastane için Etkili Performans Yönetim Stratejilerinin Tanımlanması

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ABSTRACT

Objective: This study aimed to identify the most significant issues for the effective performance management of hospitals.

Methods: Accordingly, seven indicators were selected based on the literature review results. An analysis was carried out using the Spherical fuzzy TOP-DEMATEL method to determine the most important ones among these criteria.

Results: The main contribution of this study was that the prior indicators of effective performance management in the hospitals were identified. With the help of this issue, hospitals can take actions to improve performance without having too much costs. Moreover, the main methodological originality of this study is that a new decision-making model is proposed by the name of TOP-DEMATEL.

Conclusion: Effective supply chain is found as the best factor that affects the performance of the hospitals. Additionally, advanced technology also plays a key role in this framework. Nevertheless, qualified personnel criterion is on the last rank. Supply network refers to the process of providing medical supplies, medicines, equipment, and other resources for healthcare institutions. These resources are of great importance for the performance of hospitals as they are needed to deliver the service.

Keywords: Health management, performance management, hospitals, fuzzy logic

ÖZ

Amaç: Bu çalışma, hastanelerin etkin performans yönetimi için en önemli konuları belirlemeyi amaçlamaktadır.

Yöntemler: Buna göre, literatür taraması sonuçlarına dayalı olarak yedi kriter seçilmiştir. Bu kriterlerden en önemlilerini belirlemek için küresel bulanık TOP-DEMATEL yöntemi kullanılarak bir analiz yapılmıştır.

Bulgular: Bu çalışmanın temel katkısı, hastanelerde etkin performans yönetiminin ön göstergelerinin belirlenmesidir. Bu konu sayesinde hastaneler çok fazla maliyete katlanmadan performans artırıcı aksiyonlar alabilirler. Ayrıca bu çalışmanın ana metodolojik özgünlüğü, TOP-DEMATEL adıyla yeni bir karar verme modeli önerilmiş olmasıdır. Etkili tedarik zinciri, hastanelerin performansını etkileyen en iyi faktör olarak bulunmuştur. Ayrıca ileri teknoloji de bu çerçevede önemli bir rol oynamaktadır. Ancak nitelikli eleman kriteri son sırada yer almaktadır.

Sonuç: Tedarik ağı, sağlık kurumları için tıbbi malzeme, ilaç, ekipman ve diğer kaynakların sağlanması sürecini ifade eder. Bu kaynaklar, hizmeti sunmak için ihtiyaç duyulduğu için hastanelerin performansı için büyük önem taşımaktadır.

Anahtar Sözcükler: Sağlık yönetimi, performans yönetimi, hastaneler, bulanık mantık

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Introduction

Measuring performance is a process used to measure the degree to which a company has achieved its goals. In this context, it is aimed to determine both the operational and financial performance of the company. On the other hand, monitoring this measured performance in the future and determining the areas that need improvement are other stages involved in this process. Financial results are important in the performance management of businesses. In this framework, matters such as the company's profit, liquidity power and asset size play an important role. In addition, customer satisfaction is a key issue in terms of performance management (1). In this process, the opinions of customers about the business can be measured by conducting surveys. Performance management also includes the processes of evaluating the work performance of the personnel working in an enterprise. The main purpose here is to improve the performance of the personnel whose performance is evaluated. In this context, while highlighting the areas where the personnel are successful, improvement suggestions are offered for the issues they are deemed deficient in. There are several stages in the performance measurement system. First, measurable goals are set with both the employee and their manager. After that, the performance of the personnel in a period is compared with the target set. In this way, it is determined how far the personnel can reach these targets. In this process, feedback is given to the personnel regarding the issues that are thought to be missing (2). In this context, the superior aspects of the employee are also highlighted. As a result, development planning is carried out for the performance of the employee. In this way, it is aimed to improve the missing aspects of the employee until the next performance period.

Performance measurement is very important for businesses in many ways. First of all, effective performance management should be done in order to measure whether the enterprise can effectively reach its goals. In this way, it is possible to take corrective action when necessary. Performance measurement also enables businesses to produce the right strategies. In other words, businesses will be able to use business resources more effectively by considering performance management results (3). Moreover, measuring performance helps the company identify its strengths and weaknesses. Considering this information, it is more possible to create action plans to improve performance. In this context, together with the effective actions to be taken, businesses can take the necessary steps to improve their weak areas. Performance management is important for businesses in many ways. Thanks to successful performance management practices, it is possible to identify employees with good performance in businesses (4). In this way, a fairer incentive system can be applied to the personnel. Moreover, thanks to performance management processes, the communication of employees with their managers becomes stronger. In this process, employees often receive feedback from their managers regarding their performance. Thanks to this feedback, employees can both get suggestions for improving their shortcomings and understand their good points.

Measurement of performance is of great importance for hospitals. Measuring the performance of hospitals allows them to provide better quality service. Thanks to effective performance management, it is possible for hospitals to comply more with quality standards. On the other hand, patient safety can be ensured with successful performance management. Factors such as infection rates and medical errors are included in performance management processes. Moreover, performance management enables hospitals to use their resources more effectively (5). As a result of effective performance management, existing problems in hospitals may arise. In this way, hospitals can evaluate their resources more successfully by taking this information into account. Thus, efficiency in the operations of hospitals will be ensured, and this contributes significantly to effective cost management. Furthermore, the performance of health personnel will be clearly determined in this process. The performance of these personnel is very important in terms of providing quality and safe health services. Therefore, the performance management mechanism allows hospital staff to operate more successfully (5). Thus, it is much more possible to increase the quality of services provided by hospitals.

Performance management is a very important issue in hospitals. In this context, hospitals need to take actions to improve performance management. On the other hand, it is not financially possible for hospitals to improve on all these factors (6). In this context, the most important issues should be determined and given priority. The purpose of this study is to identify the most important issues for the effective performance management of hospitals. Accordingly, 7 criteria are determined based on the literature review results. An analysis has been carried out using the Spherical fuzzy TOP-DEMATEL method to determine the most important ones among these criteria.

The main contributions of this study are given as follows. (i) The prior indicators of effective performance management in the hospitals are identified. This situation helps to propose more prior strategies. With the help of this issue, hospitals can take actions to improve performance without having too much costs. (ii) A new decision-making model is proposed by the name of TOP-DEMATEL. There are lots of criticism to the classical DEMATEL technique. To overcome this issue, the final steps of TOPSIS are integrated into DEMATEL and a new approach is created.

Literature review is given in the second part. The methodology is shared in the next part. Analysis results are indicated in the fourth part. The final part gives information about the conclusions and discussions.

Literature Review

Hospitals are institutions responsible for providing health services. Health services should be provided 24/7 without interruption. Therefore, health institutions have a very dynamic structure. Accordingly, it becomes difficult to measure the performance of health institutions. One of the factors affecting the performance of health institutions is technology. Advanced technologies help increase the quality of service by contributing to the diagnosis and treatment processes. In addition, the processes carried out can be automated and resource efficiency can be achieved thanks to advanced technologies. Wanke et al. (7) conducted a study to

reveal how social welfare conditions affected performance. In the study, where the number of beds, the number of employees and the number of doctors had a significant effect on productivity, the importance of following the technology for the success of performance management was also emphasized. Jiang et al. (8) conducted a study with multi-criteria decision-making techniques to determine key performance indicators in hospital performance management. In the study, it was stated that one of the main performance indicators for hospitals was technology.

Another issue affecting the performance of health institutions is the quality of the service provided. It refers to meeting patient expectations. Apart from this, issues such as the accuracy of the treatments applied, ensuring patient safety, access to health services for those in need, and reducing medical errors are the factors that determine the quality of the service provided. Kennedy et al. (9) conducted a study on performance management and improvement of health service quality. It was identified that there was a direct relationship between the quality of service provided and the performance of the institution in the study conducted by qualitative interviews with 31 employees working in primary health care and surgical departments. Abdullah et al. (10) conducted a study on health performance management using the FUCOM-MARCOS approach. It was determined that service quality affects performance success.

The quality of the working personnel is another issue that affects the performance process. Employees play a key role in achieving the goals of the organization. Expertise and competencies of the employees, communication skills and sense of responsibility are the skills that are important in reaching the determined targets. Accordingly, it is important for a hospital that wants to achieve its goals to have qualified personnel. Kedikli et al. (11) made a study to improve hospital performance. According to the study conducted on 12 criteria, the quality of employees was one of the important issues affecting hospital performance. Another issue that affects the performance of health institutions is to have a strong supply network. The supply network of a healthcare business consists of drugs, equipment, and medical supplies. This equipment is needed to provide health services. Therefore, hospitals need to supply the materials and equipment needed at the right time and at the right cost. Accordingly, a strong supply network is needed for effective performance management. Cristofaro et al. (12) conducted an empirical study to measure health performance in the era of digitalization. In the study, which drew attention to the factors affecting the performance of health enterprises, it was stated that the supply network was an important criterion. In addition, health outcomes also affect the performance of hospitals. Health outcomes refer to the effectiveness of the services provided by hospitals. Issues such as the recovery time of patients, the scope of services and the range of services provided fall within the scope of health outcomes. Noto et al. (13) made a study to overcome the nasty problems in the performance management of public health. From the study, in which COVID-19 vaccination strategies were analyzed empirically, it was concluded that health outcomes affected performance.

The determined evaluation is another issue that affects the success of health institutions. In particular, whether the criteria to be determined are national or international is an important point of distinction in revealing the performance status of health institutions. Accordingly, clinical quality criteria such as mortality/morbidity rate and complication rate, efficiency measures such as waiting times and cost control, and patient experience criteria such as patient satisfaction will be decisive at this point. Peixoto et al. (14) conducted a study to measure the performance management of the Brazilian Federal University hospital. Data Envelopment and Principal Component analyzes were used in the study. In the study, the importance of the performance criteria determined for the success of performance management was emphasized. The performance of hospitals is also directly related to a well-defined organizational structure. Effective decision-making processes, communication channels and the distribution of responsibilities are factors within the scope of the organizational structure. These factors are also important criteria that affect the performance of the business. Yokota et al. (15) conducted a study examining the performance management systems of Japanese companies. Aiming to design a performance management system beyond the balanced scorecard, the authors contacted 1,700 companies traded on the Tokyo Stock Exchange through a survey. Accordingly, it was stated that the organizational structure of enterprises was an important factor in performance evaluations.

The research subject of optimization is to determine the most important criterion in line with a goal. One of the optimization issues is multi-criteria decision-making techniques. DEMATEL method is a multi-criteria decision-making technique used to determine the most important criteria. This method is used when numerical measurement is not possible. In other words, it is a method that rates criteria based on expert opinions. It involves ambiguity in the linguistic expressions used for expert opinions. Fuzzy numbers were preferred to include this uncertainty in the analysis.

As a result of the literature review, the following conclusions can be reached.

(i) The issue of performance management is important for health institutions.

(ii) In addition, ensuring the effectiveness of performance management also affects the quality of the services provided.

(iii) However, it may not be possible for the hospital management to intervene in all of these criteria at the same time. Therefore, with this study, it is necessary to weight the criteria for hospitals to provide effectiveness in performance management.

(iv) However, there is a limited number of studies in literature addressing this issue.

In this study, it is aimed to determine the most important strategies to be taken to carry out the performance management of hospitals effectively. In this context, an analysis has been carried out with fuzzy decision-making techniques.

Spherical Fuzzy TOP-DEMATEL Methodology

The classical DEMATEL method has been criticized in many ways. The first step in response to these criticisms was fuzzy numbers developed by Zadeh (16). The uncertainty in expert opinions in multi-criteria decision making was included in the analysis with the help of fuzzy numbers. However, this was also insufficient. A new method was developed in this study in order to eliminate the deficiencies mentioned in these criticisms (17). In this context, a new method has been created by including the last stages of the TOPSIS technique into the DEMATEL method (18). This new method is named TOP-DEMATEL because it is obtained as a result of the integration of both methods (19). The steps of this new technique are given below.

Quantitative Analysis

Step 1: The evaluations are provided from the experts by considering the questions related to the criteria. In this framework, the fuzzy numbers in Table 1 are taken into consideration. In this process, μ refers to the membership degree whereas η and υ give information about non-membership hesitancy degrees.

A matrix of expert opinions is created. Expert opinions are given in Table 1. In this context, Equation (1) is used.

$$D\,i = \lceil \lfloor 0 \cdots (\mu\,1n\,i, \eta\,1n\,i, v\,1n\,i) \vdots \ddots \vdots (\mu\,n1\,i, \eta\,n1\,i, v\,n1\,i) \cdots 0 \rceil \rfloor \quad (1)$$

Step 2: With the help of equation (2), the decision matrix (D) is formed by taking the average of the expert opinions. The decision matrix is shown by equation (3). The weights in equation (2) are considered as 1/k. k is number of experts. Weighted arithmetic mean (SFAM) in spherical fuzzy numbers is calculated by equation (3).

$$SFWAM_w(\tilde{D}_1, \tilde{D}_2, \ldots \tilde{D}_k) = \left\{ \begin{array}{c} \left[1 - \prod_{i=1}^{k}\left(1-\mu_{D_i}^2\right)^{\frac{1}{k}}\right]^{\frac{1}{2}}, \\ \prod_{i=1}^{k}\eta_{D_i}^{\frac{1}{k}}, \\ \left[\prod_{i=1}^{k}\left(1-\mu_{D_i}^2\right)^{\frac{1}{k}} - \prod_{i=1}^{k}\left(1-\mu_{D_i}^2-v_{D_i}^2\right)^{\frac{1}{k}}\right]^{\frac{1}{2}} \end{array} \right\} \quad (2)$$

Table 1. Linguistic expressions

	μ	η	υ
4	0.85	0.15	0.45
3	0.6	0.2	0.35
2	0.35	0.25	0.25
1	0	0.3	0.15
0	0	0	0

$$D = \begin{bmatrix} 0 & \cdots & \left(\mu_{1n}^d, \eta_{1n}^d, v_{1n}^d\right) \\ \vdots & \ddots & \vdots \\ \left(\mu_{n1}^d, \eta_{n1}^d, v_{n1}^d\right) & \cdots & 0 \end{bmatrix} \quad (3)$$

Step 3: For each component in the spherical fuzzy numbers, 3 separate submatrices are created. Then, each submatrix is normalized with equations (4) and (5). X is normalize matrix.

$$X = sD \quad (4)$$

$$s = \min\left[1 \_ \max i \sum j{=}1\ n\ |d\ ij|,\ 1 \_ \max j \sum i{=}1\ n\ |d\ ij|\right] \quad (5)$$

After normalization, the 3 submatrices are expressed by equation (6).

$$X^{\mu} = \begin{bmatrix} 0 & \cdots & \mu_{1n} \\ \vdots & \ddots & \vdots \\ \mu_{n1} & \cdots & 0 \end{bmatrix} \quad X^{\eta} = \begin{bmatrix} 0 & \cdots & \eta_{1n} \\ \vdots & \ddots & \vdots \\ \eta_{n1} & \cdots & 0 \end{bmatrix} \quad X^{v} = \begin{bmatrix} 0 & \cdots & v_{1n} \\ \vdots & \ddots & \vdots \\ v_{n1} & \cdots & 0 \end{bmatrix} \quad (6)$$

Step 4: Using equation (7), the total relationship matrices (T) are calculated over each sub-matrix.

$$T = X^*(1 - X) - 1 \quad (7)$$

Euclidean normalization is then applied to the 3 calculated sub-matrices.

Step 5: The 3 calculated subtotal relationship matrices are combined and the spherical fuzzy sum relationship matrix ($\tilde{T}$) is obtained. The details of this matrix are shown in equation (8).

$$\sim T = \lceil \lfloor 0 \cdots (\mu\,1n\,T, \eta\,1n\,T, v\,1n\,T) \vdots \ddots \vdots (\mu\,n1\,T, \eta\,n1\,T, v\,n1\,T) \cdots 0 \rceil \rfloor \quad (8)$$

Step 6: With equation (9), the score function is calculated. This score value is used for the clarification method.

$$Score = \mu\,2 - \eta\,2 - \nu\,2 \quad (9)$$

Step 7: After clarification of the spherical fuzzy T matrix, criteria importance degrees (W) are obtained using equation (10)-(16). C

matrices express the sum of the Euclidean distances of the columns to ideal values. R matrices express the sum of the Euclidean distances of the row to ideal values. While S^- indicates sum of the negative ideal distance, S* indicates the sum of the positive ideal distance.

$$C*j = \sqrt{\sum_{i=1}^{n} \left(t\,i - \max j\,t\,i\right)2} \quad j = 1,2,..n \qquad (10)$$

Table 2. Criteria list

Criteria	Literature
Advanced Technology (DVTG)	Wanke et al. (7)
Service Quality (SVQY)	Kennedy et al. (9)
Qualified Personnel (QDNN)	Kedikli et al. (11)
Effective Supply Chain (EPPC)	Peixoto et al. (14)
Defining Appropriate Performance Indicator (DAPI)	Yokota et al. (15)
Organizational Effectiveness (GZNS)	Jiang et al. (8)
Successful Health Outputs (SHTP)	Abdullah et al. (10)

$$C-j = \sqrt{\sum_{i=1}^{n} \left(t\,i - \min j\,t\,i\right)2} \quad j = 1,2,..n \qquad (11)$$

$$R*i = \sqrt{\sum_{j=1}^{n} \left(t\,j - \max i\,t\,j\right)2} \quad i = 1,2,..n \qquad (12)$$

$$R^-_i = \sqrt{\sum_{j=1}^{n} \left(t\,j - \max i\,t\,j\right)2} \quad i = 1,2,..n \qquad (13)$$

$$Si* = Ci* + Ri* \qquad (14)$$

$$Si- = Ci- + Ri- \qquad (15)$$

$$Wi = Si-\_Si- + Si* \qquad (16)$$

Table 3. Expert evaluations

Expert 1

	DVTG	SVQY	QDNN	EPPC	DAPI	GZNS	SHTP
DVTG	0	4	4	4	3	4	4
SVQY	3	0	4	3	3	4	3
QDNN	2	3	0	4	4	4	4
EPPC	3	4	4	0	4	4	3
DAPI	4	4	4	3	0	4	3
GZNS	3	4	4	4	3	0	3
SHTP	3	4	4	3	3	4	0

Expert 2

	DVTG	SVQY	QDNN	EPPC	DAPI	GZNS	SHTP
DVTG	0	4	4	3	4	4	4
SVQY	4	0	4	3	4	3	4
QDNN	4	4	0	4	4	4	4
EPPC	3	4	3	0	3	3	3
DAPI	4	4	4	3	0	4	4
GZNS	4	4	4	4	4	0	4
SHTP	4	4	4	3	4	4	0

Expert 3

	DVTG	SVQY	QDNN	EPPC	DAPI	GZNS	SHTP
DVTG	0	4	4	4	2	2	3
SVQY	4	0	4	4	4	4	4
QDNN	4	4	0	3	4	4	3
EPPC	4	4	3	0	3	4	3
DAPI	2	3	3	2	0	2	3
GZNS	2	4	4	4	2	0	3
SHTP	4	4	4	3	4	3	0

Analysis Results

In the analysis process, firstly, the criteria set is defined. In this context, literature review results are taken into consideration. As a result, seven criteria are defined as in Table 2.

An expert team was created with three experts who had the necessary experience in this area. The questio ns were created from the comparison of the criteria. The evaluations of the experts are provided as in Table 3. After that, decision matrix is created as in Table 4.

Normalized sub matrixes are generated in the following process as in Table 5.

In the following process, total relation matrix is generated as in Table 6.

The weights are calculated in the final stage. The details are indicated in Table 7.

Effective supply chain is found as the best factor that affects the performance of the hospitals. Additionally, advanced technology also plays a key role in this framework. Nevertheless, qualified personnel criterion is on the last rank.

Study Limitations

This study was carried out only in the health sector and experts were selected in the health sector. Separate studies could be done

Table 4. Decision matrix

	DVTG			SVQY			QDNN			EPPC			DAPI			GZNS			SHTP		
DVTG	0.00	0.00	0.00	0.85	0.15	0.45	0.85	0.15	0.45	0.80	0.17	0.48	0.68	0.20	0.38	0.77	0.18	0.50	0.80	0.17	0.48
SVQY	0.80	0.17	0.37	0.00	0.00	0.00	0.85	0.15	0.45	0.72	0.18	0.37	0.80	0.17	0.37	0.80	0.17	0.48	0.80	0.17	0.37
QDNN	0.77	0.18	0.27	0.80	0.17	0.37	0.00	0.00	0.00	0.80	0.17	0.48	0.85	0.15	0.45	0.85	0.15	0.45	0.80	0.17	0.48
EPPC	0.72	0.18	0.37	0.85	0.15	0.45	0.72	0.18	0.49	0.00	0.00	0.00	0.72	0.18	0.49	0.80	0.17	0.48	0.60	0.20	0.35
DAPI	0.77	0.18	0.50	0.80	0.17	0.48	0.80	0.17	0.48	0.54	0.22	0.35	0.00	0.00	0.00	0.77	0.18	0.50	0.72	0.18	0.37
GZNS	0.68	0.20	0.38	0.85	0.15	0.45	0.85	0.15	0.45	0.85	0.15	0.45	0.68	0.20	0.38	0.00	0.00	0.00	0.72	0.18	0.37
SHTP	0.80	0.17	0.37	0.85	0.15	0.45	0.85	0.15	0.45	0.60	0.20	0.35	0.80	0.17	0.37	0.80	0.17	0.48	0.00	0.00	0.00

Table 5. Normalized Sub matrixes

μ	DVTG	SVQY	QDNN	EPPC	DAPI	GZNS	SHTP
DVTG	0.0000	0.1703	0.1703	0.1594	0.1361	0.1542	0.1594
SVQY	0.1594	0.0000	0.1703	0.1438	0.1594	0.1594	0.1594
QDNN	0.1542	0.1594	0.0000	0.1594	0.1703	0.1703	0.1594
EPPC	0.1438	0.1703	0.1438	0.0000	0.1438	0.1594	0.1202
DAPI	0.1542	0.1594	0.1594	0.1077	0.0000	0.1542	0.1438
GZNS	0.1361	0.1703	0.1703	0.1703	0.1361	0.0000	0.1438
SHTP	0.1594	0.1703	0.1703	0.1202	0.1594	0.1594	0.0000
η	DVTG	SVQY	QDNN	EPPC	DAPI	GZNS	SHTP
DVTG	0.0000	0.1385	0.1385	0.1524	0.1807	0.1642	0.1524
SVQY	0.1524	0.0000	0.1385	0.1678	0.1524	0.1524	0.1524
QDNN	0.1642	0.1524	0.0000	0.1524	0.1385	0.1385	0.1524
EPPC	0.1678	0.1385	0.1678	0.0000	0.1678	0.1524	0.1847
DAPI	0.1642	0.1524	0.1524	0.1989	0.0000	0.1642	0.1678
GZNS	0.1807	0.1385	0.1385	0.1385	0.1807	0.0000	0.1678
SHTP	0.1524	0.1385	0.1385	0.1847	0.1524	0.1524	0.0000
μ	DVTG	SVQY	QDNN	EPPC	DAPI	GZNS	SHTP
DVTG	0.0000	0.1554	0.1554	0.1662	0.1317	0.1731	0.1662
SVQY	0.1268	0.0000	0.1554	0.1283	0.1268	0.1662	0.1268
QDNN	0.0927	0.1268	0.0000	0.1662	0.1554	0.1554	0.1662
EPPC	0.1283	0.1554	0.1696	0.0000	0.1696	0.1662	0.1208
DAPI	0.1731	0.1662	0.1662	0.1216	0.0000	0.1731	0.1283
GZNS	0.1317	0.1554	0.1554	0.1554	0.1317	0.0000	0.1283
SHTP	0.1268	0.1554	0.1554	0.1208	0.1268	0.1662	0.0000

Table 6. Total relation matrix

	DVTG		SVQY		QDNN		EPPC		DAPI		GZNS		SHTP							
DVTG	0.36	0.35	0.36	0.39	0.38	0.41	0.39	0.38	0.40	0.39	0.38	0.41	0.39	0.38	0.40	0.39	0.38	0.41	0.39	0.38	0.41
SVQY	0.39	0.37	0.36	0.36	0.35	0.32	0.39	0.37	0.36	0.39	0.37	0.36	0.39	0.37	0.36	0.39	0.37	0.37	0.39	0.37	0.36
QDNN	0.40	0.37	0.37	0.39	0.37	0.37	0.37	0.34	0.33	0.40	0.36	0.38	0.40	0.36	0.38	0.40	0.36	0.37	0.40	0.37	0.38
EPPC	0.36	0.39	0.39	0.37	0.39	0.39	0.36	0.40	0.40	0.34	0.37	0.35	0.36	0.39	0.40	0.37	0.39	0.39	0.36	0.40	0.39
DAPI	0.37	0.40	0.41	0.36	0.40	0.40	0.37	0.40	0.40	0.36	0.40	0.39	0.34	0.38	0.35	0.36	0.40	0.40	0.36	0.40	0.40
GZNS	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.37	0.39	0.38	0.38	0.38	0.38	0.37	0.35	0.36	0.33	0.38	0.38	0.37
SHTP	0.39	0.37	0.37	0.39	0.37	0.37	0.39	0.37	0.37	0.38	0.38	0.37	0.39	0.37	0.37	0.39	0.37	0.37	0.36	0.35	0.33

Table 7. Weights

Criteria	S*	S-	w
DVTG	0.1940	0.1980	0.1503
SVQY	0.2132	0.1780	0.1353
QDNN	0.2214	0.1808	0.1337
EPPC	0.1708	0.1797	0.1525
DAPI	0.1787	0.1702	0.1451
GZNS	0.1789	0.1778	0.1483
SHTP	0.1972	0.1635	0.1348

for other sectors. Apart from this, the criteria determined were generally based on the results of the literature review. These criteria could be generated based on a program or theory.

Discussions and Results

The aim of this study was to determine the most important issues for the performance management of hospitals to be effective. Accordingly, 7 criteria determined based on the literature were selected. An analysis was carried out using the global fuzzy TOP-DEMATEL method to determine the most important ones among these criteria. The results showed that both methods gave consistent results. As a result, the most important criteria to effectively manage the performance management process of hospitals were found to be supply network and technology.

Supply network refers to the process of providing medical supplies, medicines, equipment, and other resources for healthcare institutions. These resources are of great importance for the performance of hospitals as they are needed to deliver the service. If the necessary resources are not available, people's lives can be put at risk. Therefore, having a good supply network directly affects the health service provided. Cristofaro et al. (12) conducted a study investigating the challenges and prospects in the management of health services. In the study, which stated that the emphasis of performance management in health services evolved from an output or result-based approach to a system-based approach, the importance of having a good supply network for performance management was also mentioned. Çiftçi and Özkan (20) made a study examining the effects of the COVID-19 pandemic on the health sector in terms of global and Turkey. Stating that the pandemic affected many sectors such as education, military, and agriculture, especially the health sector, the article emphasized the importance of the supply network in terms of the continuity of health services.

Technological tools are needed to provide health services. In addition, innovative devices used in taste and treatment processes are important for resource efficiency. In addition, innovative technological devices are important in terms of providing more accurate diagnosis and treatment. Therefore, following technology directly affects the delivery of health services and the performance of hospitals. Korhonen et al. (21) conducted a study investigating the effect of new technology application on the financial aspect of health services. In a study to calculate the financial impact of introducing new digital technologies to elderly care in a Scandinavian city, it was stated that technological developments affected the performance of hospitals. Çınaroğlu (22) conducted a study using the PATH analysis developed by the World Health Organization for performance management in health institutions. According to the results of the study, it was stated that besides many factors, technological developments should be followed to improve the performance of health systems.

McDermott et al. (23) conducted a study in Ireland to improve the performance of hospitals. The results of the study indicated that an effective coordination system would improve performance. Ippolito et al. (24) examined the relationship between performance management and technology in the healthcare sector. It is stated that technological infrastructure has an important place in performance management. Lu et al. (25) investigated the place of data mining applications in the performance management of public hospitals. The results of the study conducted in China indicated that technological applications such as data mining positively affected performance. Kim et al. (26) examined the impact of managers' knowledge levels on hospital performance. The study was conducted by surveying 1,000 senior managers from American hospitals. The results of the study showed that the level of knowledge affected performance. Vaz et al. (27) conducted a study to improve the performance of healthcare providers in the Middle East. It was emphasized that the satisfaction and motivation of managers and employees should be ensured. Zheng et al. (28) and Kokko and Laihonen (29) pointed out that performance management was important for hospitals.

The factor that most affected the process was found to be the establishment of an effective supply network in the study. Accordingly, hospitals need to be careful in their supplier relationships to increase their performance. Apart from this, the supply network for hospitals also includes pharmaceutical and medical device processes. Therefore, it is important to avoid any problems in the supply network to ensure continuity of services. The second most important factor was that hospitals had advanced technology. Therefore, hospitals need to keep up with developing technology and use new technologies for their performance.

Conclusion

The most important contribution of this study to the literature was to determine the most important factors affecting the performance management process of health institutions. It is not financially possible for health institutions to improve all the factors affecting the process at the same time. By determining the factors that affect the performance of health institutions, priority strategies can be determined for improving performance management and it will be possible to keep costs at a reasonable level. The most important limitation of this study was that it dealed with the issue of performance management in health in general. In future studies, more specific strategies can be developed by considering technology or supply network specific issues.

Ethics

Ethics Committee Approval: Ethics committee approval was not required for this study.

Peer-review: Externally peer reviewed.

Authorship Contributions

Concept: S.Y., H.D., Design: S.Y., H.D., Data Collection or Processing: S.Y., S.E., Analysis or Interpretation: Y.D.U., S.Y., S.E., H.D., Literature Search: Y.G., Writing: Y.D.U., Y.G., S.Y., S.E., H.D.

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