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# A Fuzzy DEMATEL Application for Criteria Affecting Database Management System Selection in a Specific Problem Context



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## Abstract


Database management systems (DBMS) are one of the basic building blocks of many software projects developed in technology companies. However, each DBMS supports different features. It is practically impossible and costly to try out all DBMSs one by one. For this reason, the DBMS to use can be recommended using mathematical methods, considering the criteria desired by the software developers. In this study, a solution for DBMS selection was proposed using fuzzy DEMATEL, which can provide a better solution with fuzzy logic than the exact numerical values of the influence relationship between complex criteria. In the study conducted with the participation of a five-member software team in a technology company, the most effective criterion for DBMS selection was backup properties (0.184), followed by purchase cost (0.177). The least important criterion was user management and authorization properties (0.056). The findings of the relationships between the criteria were identified as the criteria influencing the backup properties, technical support solutions, performance, data storage format, and user management and authorization properties, and influenced by the purchase cost, training cost and common use.

## Keywords

Database Management System • Fuzzy DEMATEL • Multi Criteria Decision Making



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## Introduction

Fuzzy DEMATEL is a technique that develops a structural model to explore the influence relationship between complicated criteria (Chang et al., 2011). This technique is suitable for solving multi-criteria complex problems. To understand the fuzzy dematel, it is necessary to understand the basics of the dematel technique. The decision-making trial and evaluation laboratory (DEMATEL) technique was first developed in 1973 by the Battelle Memorial Institute via the Geneva Research Center (Chang et al., 2011, 1973). Wu and Lee (2007) explained that the DEMATEL technique is an effective method that for collecting group information to build a structural model and visualize the causal connection of sub-factors via a causal graph (Wu & Lee, 2007). This technique aims to solve problems that are difficult to understand or problems with complex intertwined structures. In this regard, DEMATEL contributes to the development of feasible solutions using a hierarchical structure. DEMATEL, which is based on graph theory, provides a solution by visualizing the problem. In this way, we can categorize the related factors into cause and effect clusters to better understand the causal connections between the factors (Li & Tzeng, 2009). In the DEMATEL technique, which assumes that all the criteria set for a decision problem interact, a threshold value for the degree of impact must be set by the decision maker to obtain an appropriate influence diagram map. Factors greater than this threshold value are called senders (influencers), whereas criteria whose exposure level is below the threshold value are called receivers (influenced) (Koca & Yıldırım, 2021; Tzeng et al., 2007). The DEMATEL problem can be applied even if it has a complex structure and can be easily understood in terms of visualizing the relationships between factors.

However, in the DEMATEL technique, the judgments of decision-makers are measured in terms of crisp values. Unfortunately, crisp values are insufficient to reflect the uncertainty of the real world. Because people's judgments about their preferences are uncertain and difficult to predict with precise numerical values, fuzzy logic is essential for handling problems characterized by uncertainty and ambiguity. Therefore, developing the DEMATEL technique with fuzzy logic is necessary to improve in decision making in unclear conditions. (Wu & Lee, 2007).

When the literature is reviewed, it is noticed that the fuzzy DEMATEL is applied in various fields. For instance, Wang et al. (2024) focused on encouraging women's participation in engineering education (WPEE) and used the fuzzy DEMATEL technique to define the key factors affecting WPEE that should be prioritized in policymaking. Kuzu (2023) implemented the fuzzy DEMATEL technique in maritime transportation. Fuzzy logic and the DEMATEL technique were combined to analyze and identify the cause-effect relationship between environmental factors in the anchorage area to reduce the risk of anchor loss. In 2023, the authors categorized the factors affecting the prevention of the COVID-19 pandemic in individual, social, environmental, and technological aspects and, then researched the cause and effect relationships between these factors using fuzzy DEMATEL. Yadegaridehkordi et al. (2023) categorized the factors influencing the prevention of the COVID-19 pandemic in Malaysia into individual, social, environmental, and technological aspects, and then used fuzzy DEMATEL to investigate the cause and effect relationships between these factors. Farooque et al. (2020) examined, how the barriers to decision-making in blockchain-based life cycle evaluation in China interacted with each other with fuzzy DEMATEL. Muhammad and Cavus (2017) applied the fuzzy DEMATEL technique to reveal the relationships and importance between the criteria for the selection of LMS that emerged with the reflection of technology and internet usage on the education sector. Seker and Zavadskas (2017) used the fuzzy DEMATEL technique to reveal the main causes of occupational accidents in the construction sector. The factors causing the hazard are evaluated with a cause-effect diagram, and it is also

shown that specific safety measures can be enhanced on construction sites. Furthermore, Mirmousa and Dehnavi (2016) applied it to the development of criteria considered by university managers in the selection of suppliers for outsourced activities. Moreover, Zhou et al. (2011) paid attention to emergency management due to the damages caused by natural disasters. Considering that different factors can affect emergency management, a solution is proposed with fuzzy DEMATEL by categorizing these complicated impact factors into groups.

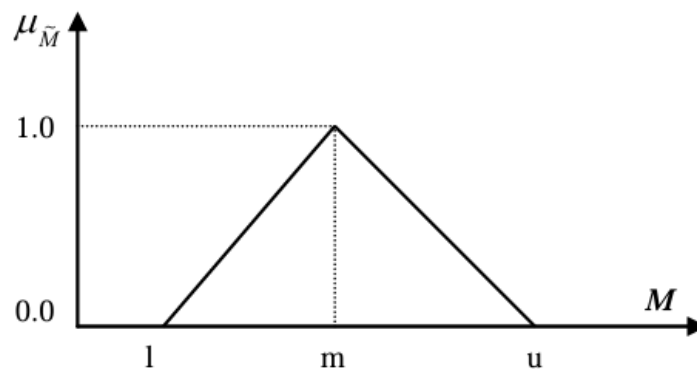
This study identified eight criteria affecting database management system selection. Then, the critical criteria affecting the database management system selection were examined using the fuzzy DEMATEL technique. Consequently, the most important criteria affecting the selection of the database management system were determined, and relationships between the criteria were understood. In addition, this study represents the first approach to addressing the criteria for database management system selection using the fuzzy DEMATEL method within a multi-criteria decision-making problem, as no such study has been encountered in the literature. This approach aims to determine the most appropriate database management system (DBMS) and to help database specialists, software developers, or business analysts in terms of data protection, avoiding unnecessary costs, performance efficiency, and sustainability in their projects.

## Methodology

### Fuzzy Logic

Fuzzy set theory has been successfully implemented in various fields since its introduction by Zadeh in 1965. Fuzzy sets, rather than exact numbers, can affectively define vague information or human subjective judgments in linguistic terms (Chen & Chiou, 1999). A fuzzy set is a class of objects with a contiguous membership degree. The set describes a membership function that appoints a degree of membership variance between zero and one to each object. If the symbol reflects a fuzzy set, it is overwritten with a tilde “~”. (Kahraman et al., 2004).

**Figure 1**  
A Triangular Fuzzy Number,  $\tilde{M}$



Source: Kahraman et al., 2004; Ertuğrul, 2007

A triangular number is illustrated in Figure 1. A triangular number is simply represented as  $(l|m, m|u)$  or  $(l, m, u)$ . The parameter  $l$  is the minimum probability value,  $m$  is the most promising value and  $u$  is the maximum probability value that characterizes a fuzzy case.

The membership function of a triangular fuzzy number is characterized as follows (Kahraman et al., 2004):

$$\mu(x | \tilde{M}) = \begin{cases} 0 & x < l \\ (x - l)/(m - l) & l \leq x \leq m \\ (u - x)/(u - m) & m \leq x \leq u \\ 0 & x > u \end{cases} \quad (1)$$

In fuzzy logic, decision-makers can specify the effects between the criteria of a problem with verbal expressions instead of exact numbers. To determine the level of impact, a 5-level scale of linguistic fuzzy statements such as “Very Low Impact (VL)”, “Low Impact (LI)”, “Normal Impact (NI)”, “High Impact (HI)”, and “Very High Impact (VH)” is used. For the following fuzzy operations, these linguistic scale level terms are converted into fuzzy numbers denoted as  $(l, m, u)$  (Chen & Chiou, 1999; Wu & Lee, 2007).

Table 1 presents the fuzzy triangular number transformations of fuzzy linguistic terms.

**Table 1**  
Fuzzy Linguistic Scale

Linguistic Terms	Triangular Fuzzy Numbers
Very Low Impact (VL)	(0.00,0.00,0.25)
Low Impact (LI)	(0.00,0.25,0.50)
Normal Impact (NI)	(0.25,0.50,0.75)
High Impact (HI)	(0.50,0.75,1.00)
Very High Impact (VH)	(0.75,1.00,1.00)

Source: Wu and Lee, 2007

### Step-by-step fuzzy DEMATEL

The Fuzzy Dematel procedure’s implementation stages are explained in the following (Akyuz & Celik, 2015; Muhammad & Cavus, 2017; Kuzu, 2023; Organ, 2013; Wu & Lee, 2007).

#### Step 1: Selection of a group of decision-makers, definition of criteria, and preparation of the fuzzy linguistic scale

After the research problem is identified, experts in this field are selected and their opinions are obtained. Decision makers are then involved in defining the criteria (affecting and affected) required for the analysis. Subsequently, the relationships between these criteria are detected using the fuzzy linguistic scale given in Table 1.

#### Step 2: Evaluation of decision-makers and obtaining a direct relationship matrix

Matrices are obtained in which each expert linguistically compares the criteria pairwise. These matrices are averaged and presented as triangular fuzzy numbers. In this way, the direct-relation matrix is formed.  $A = [a_{ij}]$ , where A is a  $n \times n$  non-negative matrix,  $a_{ij}$  indicates the direct effect of factor  $i$  on factor  $j$ ; and when  $i = j$ , the diagonal elements  $a_{ij} = 0$ .

#### Step 3: Creation of the normalized direct relationship matrix

The initial direct-relationship matrix is normalized in this step. The normalized direct relationship matrix,  $D = [d_{ij}]$  is computed using Eq. (2).

$$D = \frac{1}{\max_{1 \leq i \leq n} \sum_{j=1}^n a_{ij}} \quad (2)$$



### Step 4: Creation of the total relationship matrix

During this phase, Eq. (3) is applied to the normalized direct relationship matrix, and the total relationship matrix ( $T$ ) is obtained.  $I$  in the formula in Equation 3 refers to  $n \times n$  identity the matrix. The element  $t_{ij}$  denotes the indirect impact of criterion  $i$  on criterion  $j$ , accordingly,  $T$  represents the total relationship factor in the pairs.

$$T = D(I - D)^{-1} \tag{3}$$

### Step 5: Determination of criteria as influencer and influenced

In this step,  $r_i$  and  $c_j$  values are calculated by using Eqs. (4) and (5), respectively. The  $r_i$  value is the total of the rows of the T matrix and refers to all direct and indirect effects ensured by criterion  $i$  on all other factors. On the other side, the  $c_j$  value is the sum of the columns of the T matrix and refers to the degree of influenced impact.

$$r_i = \sum_{1 \leq j \leq n} t_{ij} \tag{4}$$

$$c_j = \sum_{1 \leq i \leq n} t_{ij} \tag{5}$$

If  $i = j$ ,  $\tilde{r}_i + \tilde{c}_j$  indicate whole influences given and taken by criterion  $i$ . That is,  $\tilde{r}_i + \tilde{c}_j$  shows both criterion  $i$ 's effect on the whole system and other system factors effect on factor  $i$ . Hence,  $\tilde{r}_i + \tilde{c}_j$  can denote the level of significance of criterion  $i$  in the system. By contrast with, the  $\tilde{c}_j - \tilde{r}_i$  value shows the net impact of criterion  $i$  on the system. If the  $\tilde{c}_j - \tilde{r}_i$  result is positive, then these criteria are understood to be influencers of other criteria. When the  $\tilde{c}_j - \tilde{r}_i$  result is negative, the criteria are identified as being in the influenced cluster.

### Step 6: Defuzzification

Subsequently, the  $\tilde{r}_i + \tilde{c}_j$  and  $\tilde{c}_j - \tilde{r}_i$  fuzzy number values are converted into exact numbers using Eq. (6). A defuzzification process is required to obtain a single crisp value instead of fuzzy numbers consisting of three values for the criteria weights. The defuzzification method employed in this study is based on Yao and Wu's (2000) signed distance approach. The concept of signed distance was introduced to define the ranking of fuzzy numbers (Baykasoğlu et al., 2013).

$$\begin{aligned} r_i^{def} + c_j^{def} &= \frac{1}{4}(l + 2m + u) \\ c_j^{def} - r_i^{def} &= \frac{1}{4}(l + 2m + u) \end{aligned} \tag{6}$$

### Step 7: Creation of cause-effect relationship graph

A cause and effect relationship graph is visualized by locating  $r_i + c_j$  totals on the horizontal axis and  $c_j - r_i$  differences in the vertical axis.

### Step 8: Finding weights

The weights of the criteria are computed using Eq. (7).



$$w_i = \left\{ r_i^{def} + c_j^{def} \right)^2 + \left( c_j^{def} - r_i^{def} \right)^2 \right\}^{\frac{1}{2}}$$

$$W_i = \frac{w_i}{\sum_{i=1}^n w_i}, \tag{7}$$

### Application of the Fuzzy Dematel

Nowadays, the success of software development processes is closely related to various DBMS features. The selection of an appropriate DBMS in software departments is a strategic decision that affects project cost, system integration, data security, and long-term sustainability. Moreover, businesses may need to identify different database systems that are suitable for the specific needs of various departments. Indeed, different departments may use database systems with varying characteristics. For example, while the finance department may require a highly structured relational database (e.g., PostgreSQL or Oracle) for transaction processes and regulatory compliance, the marketing team may need a NoSQL-based DBMS (e.g., MongoDB) to process large volumes of unstructured social media data. This study aims to identify the prominent criteria considered when selecting among different DBMS to be used in the software department of a technology company. The fuzzy DEMATEL method is employed to determine the causal relationships and the degree of influence among the criteria. The findings aim to contribute to both the academic literature and practitioners by systematically quantifying the experiential and intuitive judgments of decision-makers to identify the factors that should be prioritized in DBMS selection for software departments. Furthermore, it is aimed to prevent the occurrence of costs and underperformance that may arise from wrong decisions.

Table 2 presents the criteria for DBMS selection derived from the literature review (Ayçin, 2018) and five experts working in a technology company. Fundamental factors, such as database performance, cost, and data security, which are frequently emphasized in the literature, were primarily considered in determining the criteria. The experts evaluated the applicability of these criteria based on their practical requirements and experience in software development projects. The eight selected criteria include purchase cost (C1), training cost (C2), backup properties (C3), common use (C4), technical support solutions (C5), performance (C6), data storage format (C7) and user management and authorization properties (C8). Other criteria, such as supported partitioning types, supported operating systems, scalability, and supported programming languages, have been suggested in the literature (Catak et al., 2012; Ebrahimi and Taheri, 2015; Ur Rehman, 2023); however, this study focuses on the eight criteria commonly adopted in software projects. Therefore, the criteria were selected based on both academic foundations and sectoral experience, thus creating an applicable structure for the database management system selection process.

**Table 2**  
*Criteria Affecting Selection of Database Management System*

Code	Criteria	Definition
C1	Purchase Cost	The cost of the license, subscription, or ownership of the database.
C2	Training Cost	Time and cost for users to learn the database.
C3	Backup Properties	Automatic or manual backup solutions to prevent data loss.
C4	Common Use	The popularity of the database within the sector and community.
C5	Technical Support Solutions	Support, update, and error recovery services offered by the manufacturer or the community.
C6	Performance	Database efficiency in terms of speed, scalability, and query optimization.
C7	Data Storage Format	The use of structured (SQL) or unstructured (NoSQL) data models.



Code	Criteria	Definition
C8	User Management and Authorization Properties	Security mechanisms that enable user access levels to be determined.

**Step 1: Selection of a group of decision-makers, definition of criteria, and preparation of the fuzzy linguistic scale**

A team of five experts working in a technology company was determined as decision-makers within the scope of the research. The team consists of three software developers, two of whom are senior developers and one is a junior developer, one is a senior database specialist, and one is a junior business analyst. All team members are professionals who use database management systems in software development processes. Software developers actively use these systems in data storage and reporting tasks during application development processes. The database specialist is responsible for system architecture, data security, backup, and access control. The business analyst ensures the definition of user requirements, business process adaptation to the database infrastructure, and integration of database-based solutions into corporate workflows. Therefore, the decision-makers are qualified to contribute directly to the selection process of the database management system at both technical and functional levels. However, the focus on the software industry and the limited number of experts constitute the main limitation of the research.

Table 3 shows the fuzzy linguistic expressions in which decision makers mutually evaluate the criteria.

**Table 3**  
*Linguistic Evaluations by Decision Makers*

Criteria	C1	C2	C3	C4	C5	C6	C7	C8
C1	0	VL	HI	HI	NI	LI	VL	LI
C2	VL	0	VL	HI	NI	VL	VL	VL
C3	HI	VL	0	VL	LI	LI	LI	VL
C4	HI	HI	VL	0	VL	VL	VL	VL
C5	HI	VH	LI	NI	0	VL	VL	VL
C6	HI	VL	VL	HI	VL	0	VL	VL
C7	LI	VL	LI	NI	VL	NI	0	VL
C8	LI	VL	VL	LI	VL	VL	VL	0

**Step 2: Evaluation of decision-makers and obtaining at direct relationship matrix**

The triangular fuzzy equivalents of the linguistic expressions presented in Table 3 are derived using the values provided in Table 1 and are shown in Table 4.

**Table 4**  
*Initial Direct Relationship Matrix*

	C1	C2	...	C7	C8
C1	0,00	0,00	0,00	0,00	0,00
C2	0,00	0,00	0,25	0,00	0,00
·	·	·	·	·	·
·	·	·	·	·	·
C7	0,00	0,25	0,50	0,00	0,00

	C1			C2			...	C7			C8		
C8	0,00	0,25	0,50	0,00	0,00	.	0,25	0,00	0,00	0,25	0,00	0,00	0,00

### Step 3: Creation of the normalized direct relationship matrix

Eq. (2) is applied to the initial direct relationship matrix to create the normalized direct relationship matrix shown in Table 5.

**Table 5**  
Normalized Direct Relationship Matrix

	C1			C2			...	C7			C8		
C1	0,00	0,00	0,00	0,00	0,00	.	0,05	0,00	0,00	0,05	0,00	0,05	0,10
C2	0,00	0,00	0,05	0,00	0,00	.	0,00	0,00	0,00	0,05	0,00	0,00	0,05
.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.
C7	0,00	0,05	0,10	0,00	0,00	.	0,05	0,00	0,00	0,00	0,00	0,00	0,05
C8	0,00	0,05	0,10	0,00	0,00	.	0,05	0,00	0,00	0,05	0,00	0,00	0,00

### Step 4: Creation of the total relationship matrix

Eq. (3) is applied to the normalized direct relationship matrix, and the total relationship matrix ( $T$ ) is obtained as follow: The findings are presented in Table 6.

**Table 6**  
Total Relationship Matrix

	C1			C2			...	C7			C8		
C1	0,02	0,08	0,30	0,02	0,05	.	0,25	0,00	0,01	0,16	0,00	0,05	0,21
C2	0,01	0,04	0,26	0,02	0,04	.	0,16	0,00	0,00	0,13	0,00	0,00	0,13
.	.	.	.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.	.	.	.
C7	0,01	0,09	0,32	0,01	0,02	.	0,20	0,00	0,00	0,09	0,00	0,00	0,14
C8	0,00	0,06	0,25	0,00	0,01	.	0,16	0,00	0,00	0,11	0,00	0,00	0,07

### Step 5: Determination of criteria as influencer and influenced

To find the affecting and affected criteria, the row totals of the  $T$  matrix were first found with Eq. (4), and then the column sums were found with Eq. (5). Subsequently, the  $\tilde{r}_i + \tilde{c}_j$  and  $\tilde{c}_j - \tilde{r}_i$  were calculated. The obtained findings are presented in Table 7.

**Table 7**  
Fuzzy Scale of  $\tilde{r}_i$ ,  $\tilde{c}_j$ ,  $\tilde{r}_i + \tilde{c}_j$  and  $\tilde{c}_j - \tilde{r}_i$

	$\tilde{r}_i$			$\tilde{c}_j$			$\tilde{r}_i + \tilde{c}_j$			$\tilde{c}_j - \tilde{r}_i$		
C1	0,455	0,964	2,751	0,289	0,701	2,255	0,744	1,655	5,006	-0,166	-0,263	-0,496
C2	0,301	0,548	1,854	0,182	0,368	1,642	0,483	0,917	3,496	-0,119	-0,180	-0,212
C3	0,139	1,398	1,705	0,123	1,461	1,815	0,261	2,859	3,520	-0,016	0,063	0,110
C4	0,464	0,969	2,745	0,235	0,438	1,779	0,699	1,408	4,525	-0,228	-0,531	-0,966



	$\tilde{r}_i$		$\tilde{c}_j$		$\tilde{r}_i + \tilde{c}_j$			$\tilde{c}_j - \tilde{r}_i$				
C5	0,131	0,401	2,699	0,350	0,710	2,160	0,482	1,111	3,859	0,219	0,309	0,461
C6	0,048	0,262	1,460	0,240	0,448	1,768	0,288	0,710	3,258	0,193	0,187	0,339
C7	0,000	0,067	1,098	0,118	0,426	1,758	0,118	0,492	2,857	0,118	0,359	0,660
C8	0,000	0,094	1,146	0,000	0,149	1,250	0,000	0,243	2,396	0,000	0,056	0,104

Table 7 shows that the negative values under  $\tilde{c}_j - \tilde{r}_i$  indicate that the criteria are influenced and the positive ones are the influencer.

### Step 6: Defuzzification

$r_i + c_j$  and  $c_j - r_i$  were converted into exact numbers according to Eq. (6). Thus, the exact numbers were obtained and the influencer and influenced criteria were determined. The outcomes are showed in Table 8.

**Table 8**

Exact Number of  $r_i + c_j$  and  $c_j - r_i$

	$r_i + c_j$	$c_j - r_i$
C1	2,270	-0,297
C2	1,453	-0,173
C3	2,375	0,055
C4	2,010	-0,564
C5	1,641	0,325
C6	1,242	0,226
C7	0,990	0,374
C8	0,720	0,054

When the  $r_i + c_j$  column in Table 8, which represents the level of importance of the criterion on the total system, is analyzed, the three most important criteria are C3, C1 and C4. Conversely, when the  $c_j - r_i$  column showing the net influence on the system is examined, C3, C5, C6, C7 and C8 criteria are in the influencer cluster because they take positive values, whereas C1, C2, and C4 criteria are in the influenced cluster because they take negative values.

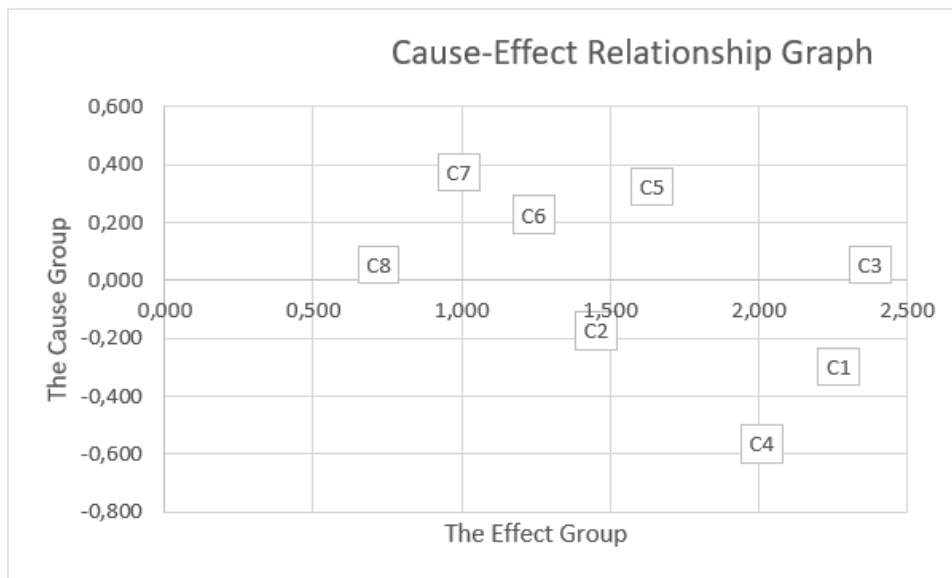
### Step 7: Creation of cause-effect relationship graph

Figure 2 Causes and effect graph of the criteria.

To evaluate the criteria that affect the selection of the database management system, it is important to concentrate on the cause criteria that have a positive value of  $c_j - r_i$ . When the cause and effect diagram of criteria C3, C5, C6, C7, and C8 is analyzed, they are in the cause cluster. Among these criteria, C7 (data storage format) has the highest  $c_j - r_i$  score of 0.374, indicating that C7 has an important effect on the other criteria. The second and third most important causa factors were C5 (technical support solutions) with a  $c_j - r_i$  score of 0.325 and C6 (performance) with a score of 0.226.



**Figure 2**  
Cause-Effect Relationship Graph



Since the  $c_j - r_i$  values of C1, C2, and C4 criteria are negative, they are included in the effect group. C4 (common use) is the criterion most influenced by database management system selection with a score of -0.564.

### Step 8: Finding weights

Using Equation (7), the criteria were weighted so that the ranking of importance in database management system selection was found. The importance ranking of the criteria is given in Table 9.

**Table 9**  
Criteria Weights

Rank	$W_i$	Criterion
1	0,184	C3- Backup Properties
2	0,177	C1- Purchase Cost
3	0,161	C4- Common Use
4	0,129	C5- Technical Support Solutions
5	0,113	C2- Training Cost
6	0,098	C6- Performance
7	0,082	C7- Data Storage Format
8	0,056	C8- User Management and Authorization Properties

Table 9 shows that the most important criterion in database management system selection was backup properties (0,182). It was followed by purchase cost (0,177) and common use (0,161). The least important criterion was user management and authorization properties (0,056).

## Discussion and Conclusion

Businesses must perform their processes in the best way to maintain their continuity. Increasing competition conditions have made it necessary to make the right decision, and as a result, the importance



of decision-making practices has increased (Organ, 2013). Systematic decision-making approaches are preferred because decisions based solely on decision makers' knowledge and intuition cause different losses. The fuzzy DEMATEL technique used in the field of MCDM allows the determination of the relationships among the criteria (Li & Tzeng, 2009).

In this study, the criteria affecting the selection of DBMS and the relationships among these criteria are investigated using the fuzzy DEMATEL technique. Although studies on the criteria affecting the selection of DBMS are available in the literature, no approach has been developed with fuzzy DEMATEL. The study is unique in this regard and will contribute to the academic field.

Within the scope of the study, nine criteria were discussed, including purchase cost, training cost, backup properties, common use, technical support solutions, performance, data storage format, user management and authorization properties were discussed and the study was conducted with the participation of a software team of five people in a technology company.

The most critical factor in DBMS selection was determined as backup properties (C3; 0.184). With the increasing dependence on data today, the fact that the systems have mechanisms to prevent data loss in case of any failure or attack is the first factor in the decision-making process. The second-ranked purchase cost (C1; 0.177) reflects the budgetary constraints of the organizations and the importance of cost-effectiveness analyses. Common use ranks third with (C4; 0.161), indicating that decision makers consider factors such as market share or user experience of the system. Widely used systems can facilitate user adaptation and accelerate the process of finding solutions to problems that may be encountered with the system. Following technical support solutions (C5; 0.129), these support mechanisms are critical for a sustainable system. The remaining criteria are training cost (C2; 0.113), performance (C6; 0.098), data storage format (C7; 0.082), and user management and authorization properties (C8; 0.056). These results indicate that these criteria play a relatively less determining role in the selection process.

In addition, when the cause and effect status of the criteria is evaluated, backup properties (C3), technical support solutions (C5), performance (C6), data storage format (C7), and user management and authorization properties (C8) are in the influencer cluster with positive values. Criteria C3, C5, C6, C7, and C8 are classified within the influencer group, as they collectively enhance the overall system efficiency, thereby exerting a significant impact on purchase cost, training cost, and user adoption level. This shows that these criteria play a determining role in other selection factors. On the other hand, purchase cost (C1), training cost (C2), and common use (C4) are in the influenced cluster with negative values. In other words, other factors influence them. C1, C2, and C4 are the outcomes of factors such as performance, technical support, backup, and data storage. Hence, they are as the results of other technical determinants within the influenced group.

Considering all these assessments, the selection of DBMS is a crucial decision for the effectiveness and long-term viability of information systems. An incompatible DBMS may cause difficulties in integration with other information systems of the organization, which may adversely affect operational efficiency and cause business process disruptions. Therefore, determining the most appropriate DBMS in terms of both technical and strategic requirements is also important for effective resource management.



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