Dual-Factor Decision Making (DFDM) Method Inspired by Herzberg's Theory

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Abstract: Multi-Criteria Decision Making (MCDM) methods are effective in solving complex selection problems with numerous conflicting criteria. However, the traditional methods may not succeed in structurally modeling the decision-maker's psychological dynamics related to satisfaction and dissatisfaction. This study proposes a novel MCDM method inspired by Herzberg's Motivation-Hygiene Theory, which categorizes the employed criteria into two types: hygiene factors, whose absence causes dissatisfaction, and motivation factors, whose presence enhances satisfaction: the Dual-Factor Decision Making (DFDM) method. This method incorporates a strict threshold-based veto mechanism for hygiene factors and a dynamic contribution analysis for motivation factors. This approach distinguishes itself from the traditional compensatory methods (e.g. TOPSIS, AHP) by completely eliminating the alternatives that violate the threshold values, a feature which is reminiscent of the veto mechanism in the context of the ELECTRE methods. Furthermore, if a hygiene factor exceeds its threshold by a specified margin (δ), it will act as a motivation factor, enabling a dynamic evaluation. The applicability of the proposed method is demonstrated through a supplier selection case study. The obtained results indicate that the DFDM method can effectively identify and exclude the alternatives that violate critical constraints, such as budget limits, while providing a ranked list of feasible options. The DFDM method stands out as a human-centered decision support tool, making it particularly useful in domains with critical thresholds where psychological satisfaction is also important, such as public procurement, supply chain management, and human resources.

Keywords: Multi-Criteria Decision Making (MCDM), Herzberg's Motivation–Hygiene Theory, Dual-Factor Decision Making (DFDM), Veto Mechanism, Threshold Analysis, Decision Support Systems, Psychological Satisfaction.

1. Introduction

Decision-making is an indispensable element for individuals and institutions to sustain their lives. Especially in organizations, the decision-making process - considered one of the fundamental components of the management process - should be carried out by managers in a way that yields the most beneficial outcome for both the institution and its employees. A decision is often perceived as a singular event because it typically points to a result; however, in reality, it is the final outcome of a long and multidimensional process. Therefore, it is essential not only to focus on the moment of decision but also to analyze the process leading up to that point in a healthy and thorough manner (Kıral, 2015).

Decision-making can be defined as the selection of the most appropriate option among the available and applicable alternatives for achieving a specific goal. Individuals are constantly engaged in decision-making to meet both personal and societal needs. In its simplest form, the decision-making process involves choosing from various alternatives. More broadly, decision-making refers to the process of selecting one possible course of action from several in pursuit of the desired goals and objectives. This process enables individuals to find solutions to both simple and complex problems encountered throughout their lives. These problems may sometimes be influenced by numerous factors and can vary significantly in terms of scope and depth.

In daily life, the need arises to choose from numerous alternatives related to planned or ongoing activities. Such decision problems compel individuals to make choices. The selection process concludes with the evaluation of alternatives based on specific criteria, leading to the choice of one or several options. Decision-making is an integral part of human life. Often, individuals make decisions without even realizing it; however, not all decisions are simple or routine by nature. Some decisions may involve more complex, uncertain, and risky structures. At this point, decision-making has become a fundamental process in the field of management sciences, and various approaches have been developed to support this process (Güngör & Özcan, 2022).

Whether decisions are made consciously or subconsciously, regardless of their impact, they serve as fundamental tools that individuals use to solve problems and evaluate various opportunities (Orçanlı & Özdemir, 2013). Decision-making problems based on a single criterion can be resolved by selecting the alternative that performs

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best according to that criterion. However, when multiple criteria are involved, the decision-making process becomes significantly more complex. In such cases, factors such as the relative weights of criteria, their interrelations, and the potential conflicts between them must be considered (Tzeng & Huang, 2011).

Selecting the most appropriate option among the available alternatives in pursuit of a specific goal represents a decision problem. Multi-Criteria Decision-Making (MCDM) refers to the process of selecting, evaluating, ranking, classifying, and assigning weights to numerous alternatives and criteria when faced with complex decision scenarios (Bayram & Eren, 2023). The traditional evaluation methods typically rely on a single measurement criterion, such as minimizing cost or maximizing benefit. However, these approaches may fall short in increasingly complex and diverse decision-making environments. Therefore, to effectively address such situations, the use of a MCDM method becomes essential (Wang, 2012).

The MCDM approach, a crucial method used in situations requiring the evaluation of alternatives based on multiple criteria, helps decision-makers identify the most suitable option by optimizing a wide range of measures. In a MCDM problem, different methods may be employed to reach the optimal solution. One of the primary challenges faced at the outset is determining which method is the most appropriate for a specific decision context. To select the most suitable method, the decision-maker must consider the structure of the problem and the characteristics of the decision-making process (Dalbudak & Rençber, 2022).

MCDM, also referred to as a set of methods used for identifying, ranking, and classifying the most suitable alternative by incorporating both quantitative and qualitative criteria (Fidan, 2021), has emerged as a prominent approach in rational decision-making processes since the 1960s. MCDM methods involve mathematical models developed to prevent errors and support sound decision-making in situations where numerous alternatives and criteria are present (Ersoy, 2022).

The primary aim of using MCDM methods is to maintain control over the decision-making mechanism in situations involving multiple and generally conflicting criteria, and to reach a decision as easily and quickly as possible. In literature, numerous methods are available for ranking alternatives, including AHP, TOPSIS, EDAS, VIKOR, CODAS, MARCOS, MACBETH, and ARAS (Yenilmezel & Ertuğrul, 2022).

This MCDM approach is inspired by Herzberg's Motivation–Hygiene Theory and is designed to distinguish between criteria that primarily prevent dissatisfaction and those that contribute to satisfaction in the decision-making process. In Herzberg's framework, factors are categorized as hygiene factors, whose absence leads to dissatisfaction while their presence merely prevents dissatisfaction, and motivators, which enhance satisfaction when present. Building on this conceptual distinction, the DFDM method proposed in this study operationalizes this theory within a decision-analytic framework.

Specifically, the criteria designated as hygiene factors are subject to threshold requirements, and the primary objective is to prevent negative deviations from these minimum acceptable levels. At the same time, the criteria associated with motivation factors are evaluated in terms of their positive contribution and are maximized accordingly. In addition, this method allows a criterion initially treated as a hygiene factor to contribute positively to the overall evaluation if its performance exceeds the specified threshold by a predefined margin. This mechanism enables a dynamic contribution structure while preserving the original role of hygiene factors as safeguards against unacceptable alternatives.

The primary motivation behind this research and the key features that distinguish the DFDM method from other MCDM approaches can be summarized as follows. The traditional MCDM methods typically treat criteria in a one-dimensional manner and do not explicitly differentiate between satisfaction and dissatisfaction dynamics. In contrast, the DFDM method, drawing on the aforementioned hygiene and motivation factors, explicitly addresses this dual-dimensional structure. In conventional MCDM methods, a low performance with regard to certain criteria can often be compensated by deducting points from the overall score. However, in the DFDM method, the alternatives that fall below the threshold values for hygiene factors are automatically vetoed. Although this veto mechanism may initially appear to be a negative feature, it serves as a critical pre-evaluation tool by preventing the violation of threshold values deemed essential by experts. For instance, in public procurement processes, if a specified criterion in the purchasing specification fails to meet its required threshold, the elimination system will activate, creating an exclusion mechanism. As shown in the subsequent sections related to the methodology and implementation phases of the DFDM method, if these hygiene criteria are met, it will be possible to dynamically include them in the recalculation structure and provide a positive effect similar to that of a motivational criterion.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature on Multi-Criteria Decision Making (MCDM) methods and highlights the research gap this study addresses. Section 3 sets forth the proposed Dual-Factor Decision Making (DFDM) methodology in detail, including its procedural steps, the veto mechanism, and the dynamic contribution model. Further on, Section 4 demonstrates the applicability of the DFDM method through a real-world supplier selection case study. Finally, Section 5 discusses the obtained results, presents a comparative analysis involving the proposed method and traditional MCDM methods, outlines the study's contributions and limitations, and it provides concluding remarks and suggestions for future research.

2. Literature Review

Multi-Criteria Decision Making (MCDM) methods are recognized as powerful tools for structuring and solving complex selection problems. Numerous methods, including TOPSIS, AHP, VIKOR, PROMETHEE, ELECTRE, MARCOS, and their fuzzy extensions have been developed in the literature and successfully applied in various domains such as supplier selection, location selection, and resource allocation (Taherdoost & Madanchian, 2023; Sotoudeh-Anvari, 2022). For instance, Supçiller & Deligöz (2018) applied multiple MCDM methods to determine the most suitable supplier for a textile company, while Arıkan & Yağlı (2018) used an integrated application of TOPSIS and AHP for material procurement in the air force. However, comparing, classifying, and selecting the most appropriate method for a specific problem is itself a complex process (Ozernoy, 1992; Timor, 2011). Therefore, when developing new MCDM methods, understanding the limitations of the existing approaches and offering a unique contribution is of vital importance.

Most traditional MCDM methods focus on producing a final score or ranking by mathematically aggregating criterion weights and alternative performances. This approach is based on technical optimization and rational preference models. However, it has long been recognized that the decision-making process is not merely a technical matter but it is also profoundly influenced by the decision-maker's psychological state, risk perception, and the dynamics of satisfaction and dissatisfaction (Kahneman & Tversky, 1979). Despite these well-established findings in behavioral economics and decision theory, the structural and explicit integration of psychological dimensions into MCDM methodology has remained relatively limited. In the existing methods, poor performance in one criterion can often be compensated (offset) by high performance in others. This is problematic in scenarios involving "unacceptable violations", such as minimum legal compliance, maximum budget, or safety thresholds, as such violations create dissatisfaction or unacceptable risks that cannot be compensated by excellence in other areas.

Recent efforts to partially fill this gap are progressing in two directions. One of them is the direct incorporation of behavioral principles into MCDM models. For example, the Regret Theory, which examines how the feelings of regret and joy shape decisions, has recently been integrated with MCDM in an attempt to create more realistic preference modeling (Tsalatsanis et al., 2010). The other is the application of psychology and management theories to operational research problems. While the potential linkage between motivational theories like Herzberg's theory and structured decision making is conceptually evident, a review of the literature reveals that this integration has remained largely theoretical or anecdotal in the MCDM field. To the best of one`s knowledge, the existing MCDM methods

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do not inherently incorporate the fundamental dichotomy of factor types (hygiene vs. motivation) or asymmetric behavioral logic (veto for dissatisfaction, reward for satisfaction) proposed by Herzberg. This study aims to formalize this integration by operationalizing Herzberg's core principles into a concrete, algorithmic MCDM framework - the DFDM method.

It is precisely this methodological gap that this study targets. The proposed Dual-Factor Decision Making (DFDM) method aims to transform the essence of Herzberg's theory into an operational decision support algorithm. DFDM not only provides an analytical framework but it also offers: (1) an irreversible veto mechanism for hygiene factors; (2) traditional optimization for motivation factors, and (3) a dynamic contribution model triggered when hygiene factors exceed their thresholds. This approach, unlike the traditional compensatory methods (TOPSIS, AHP) and outranking methods based on technical superiority (ELECTRE), integrates the dynamics of psychological satisfaction and dissatisfaction structurally and mathematically into the decision process. Therefore, this study aims to contribute to the existing MCDM literature with an original method designed for complex decision environments with critical thresholds, placing the human factor at its center.

3. Methodology

The Dual-Factor Decision Making (DFDM) method is implemented by using the procedural steps outlined below, with clear definitions and justifications for all parameters.

3.1 Definitions and Criteria Classification

The following notations and definitions are used throughout the methodology:

$A = \{A_1, A_2, ..., A_m\}$: the set of alternatives;

$C = \{C_1, C_2, ..., C_n\}$: the complete set of criteria (factors);

$H \subset C$: the subset of **hygiene factors**. For every factor, a threshold value (**T_j**) is defined. This generates a constraint (e.g. if **T_j** is the cost, then the constraint is: maximum cost $\leq$**T_j**; if**T_j** is performance, then the constraint is **T_j** $\geq$ minimum performance). Failure to meet the constraint defined by **T_j** results in dissatisfaction and triggers a veto;

$M \subset C$: the subset of **motivation factors**. For these factors, the decision-maker's preference (either higher or lower values are desirable) is clearly defined, as they contribute to satisfaction;

X_{ij}: the performance value of alternative A_i for the criterion C_j;

T_j: the defined threshold value for the hygiene factor $C_j \in H$;

δ_j: the tolerance or excess margin for the hygiene factor C_j. It defines the minimum performance improvement beyond the threshold (T_j) required for that factor to start contributing positively to the motivation score. In this study, δ_j is initially set as 1% of T_j based on expert domain knowledge. However, this parameter can also be determined through data-driven methods (e.g. based on standard deviation) or sensitivity analysis to enhance objectivity;

w_j: the relative weight of criterion C_j, representing its importance. In the application of the DFDM method presented in Section 4 of this study, the weights were assigned directly through the consensus of an expert panel, with the condition that they sum to 1. This is a practical and rapid weighting method. However, the DFDM methodology is compatible with more systematic approaches; weights can also be determined using the Analytic Hierarchy Process (AHP), CRITIC, ENTROPY, or any other valid weighting technique.

If the performance X_{ij} of alternative A_i for a hygiene factor $C_j \in H$ exceeds its threshold value T_j by the margin δ_j (i.e. for a cost factor: $X_{ij} \leq T_j - \delta_j$; for a performance factor: $X_{ij} \geq T_j + \delta_j$), then this hygiene factor is considered satisfied and it also contributes to the motivation score.

3.2 Veto Mechanism for Hygiene Factors

An alternative is excluded from further evaluation (vetoed) if it fails to meet the threshold for any hygiene factor. Since the threshold represents the "minimum acceptable" limit, a performance equal to the threshold is considered acceptable. Therefore, the operators "≤" and "≥" are used in the equations.

For each alternative A_i and hygiene factor $C_j \in H$:

If C_j is a cost-like factor (lower values are preferable):

$$H_j(A_i) = \begin{cases} 1, & \text{if } X_{ij} \le T_j \\ 0, & \text{Otherwise (Veto)} \end{cases} \quad (1)$$

If C_j is a performance-like factor (higher values are preferable):

$$H_j(A_i) = \begin{cases} 1, & \text{if } X_{ij} \le T_j \\ 0, & \text{Otherwise (Veto)} \end{cases} \quad (2)$$

$$F(A_i) = \prod H_j(A_j) \quad (3)$$

If any of the hygiene factors associated with a given alternative fails to meet the required standards, the respective option is vetoed.

3.3 Motivational Contribution from Hygiene Factors Exceeding the Threshold

If the performance X_{ij} of alternative A_i for a hygiene factor C_j exceeds its threshold by at least δ_j, it provides a motivational contribution ($MS_j(A_i)$). To prevent these contributions from becoming overly dominant and overshadowing the core motivation factors, anempirical ruleis applied: no single hygiene factor's motivational contribution can exceed 20% of the total motivational effect. This rule ensures that the primary purpose of hygiene factors (preventing dissatisfaction) is preserved. If this limit is approached, it suggests that T_j or δ_j should be reviewed.

If Cj is a cost-like factor, MS_j, the motivational contribution ratio of the hygiene factor can be expressed as:

$$MS_j(A_i) = \begin{cases} \dfrac{T_j - X_{ij}}{\delta_j}, & \text{if } X_{ij} \le T_j - \delta_j \\ 0, & \text{Otherwise} \end{cases} \quad (4)$$

For example, if T_j = \$100.000 (maximum budget) and δ_j = \$1.000, a proposal of \$85.would yield a result of (100.000 − 85,000)/1.000=15 , indicating an additional contribution rate of 15%. Consequently, this supplementary rate would translate into a motivational contribution factor of 1,15.

If C_j is a performance-like factor:

$$MS_j(A_i) = \begin{cases} \dfrac{X_{ij} - T_j}{\delta_j}, & \text{if } X_{ij} \ge T_j - \delta_j \\ 0, & \text{Otherwise} \end{cases} \quad (5)$$

For example, if T_j = 85% (minimum acceptable performance) and δj = 0.5%, then a score of 95% yields a motivational contribution effect of (95 - 85) / 0.5 = 20 (units). This translates into a contribution factor of 1.20 when integrated into the motivation score calculation.

3.4 Calculation of the Motivation Score and Final Ranking

For the motivation factors $C_k \in M$, the performance values are normalized to the range of [0, 1]. The total motivation score is calculated by aggregating the weighted scores of motivation factors and the motivational contributions from hygiene factors exceeding their threshold.

The total motivation score can be expressed as:

$$M(A_i) = \sum_{C_k \in M} w_k \cdot X_{ik} + \sum_{C_j \in H} w_j \cdot MS_j(A_j) \quad (6)$$

Here, w_k and w_j represent the factor weights, and the calculation is performed by incorporating the motivational contribution ratios of the reclassified hygiene factors.

The final General Score (GS) for the ranking is:

$$GS(A_i) = F(A_i) \cdot M(A_i) \quad (7)$$

To determine the best alternative, the following procedure is used: first, the alternatives that pass the hygiene filter ($F(A_i)=1$) are identified. Then, among these, the alternative with the highest $M(A_i)$ score is ranked first, as its GS will be equal to $M(A_i)$ (since $F(A_i)=1$). The alternatives with $F(A_i)=0$ are eliminated and receive a GS of 0.

4. Application

Regarding this application of the DFDM method, a panel of experts was consulted to determine the values and weights of the technical criteria

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for a loading vehicle to be procured for use in the warehouse of a public industrial enterprise. Table 1 includes the threshold values and criteria weights identified through this process, and Tables 2, 3, and 4 present the detailed calculation steps and results for each of three alternatives.

Note on Motivation Factors: For motivation factors (Sustainability, OHS, Service Quality, Domestic Goods), performance is assessed on a scale from 0% to 100%, representing the degree of fulfillment (as shown in Table 1). To be used in the total motivation score calculation (equation 6),

Table 1. Criteria, Classes, Thresholds, Weights, and Performance Values for the Alternatives A_1, A_2, and A_3

Criteria	Criteria Class	Threshold Value	Criteria Weight	Criteria Values (A_1)	Criteria Values (A_2)	Criteria Values (A_3)
Cost	H	100.000	0.30	80.000	90.000	101.000
Performance	H	85	0.30	95	90	95
Energy Consumption	H	70	0.10	65	60	60
Sustainability	M		0.05	75%	100%	100%
OHS	M		0.10	50%	100%	100%
Service Quality	M		0.05	100%	100%	100%
Domestic Goods	M		0.10	100%	0%	100%

Table 2. DFDM Criteria Scores for the Alternative A_1

Criteria	Criteria Class	Threshold Value	Criteria Values (A_1)	Criteria Weight	Δj	H Criteria Ratio	Final Criteria Score
Cost	H	100.000	80.000	0.30	1.00	(100-80)/1.00= 20	0.36
Performance	H	85	95	0.30	0.85	(95-85)/0.85= 13	0.34
Energy Consumption	H	70	65	0.10	0.70	(70-65)/0.70= 7	0.11
Sustainability	M		75%	0.05			0.04
OHS	M		50%	0.10			0.05
Service Quality	M		100%	0.05			0.05
Domestic Goods	M		100%	0.10			0.10
							1.05

Table 3. DFDM Criteria Scores for the Alternative A_2

Criteria	Criteria Class	Threshold Value	Criteria Values (A_2)	Criteria Weight	Δj	Criteria Score	Final Criteria Score
Cost	H	100.000	90.000	0.30	1.00	(100-90)/1.00= 10	0.33
Performance	H	85	90	0.30	0.85	(90-85)/0.85= 6	0.32
Energy Consumption	H	70	60	0.10	0.70	(70-60)/0.70= 14	0.11
Sustainability	M		100%	0.05			0.05
OHS	M		100%	0.10			0.10
Service Quality	M		100%	0.05			0.05
Domestic Goods	M		0%	0.10			0
							0.96

Table 4. DFDM Criteria Scores for the Alternative A_3

Criteria	Criteria Class	Threshold Value	Criteria Values (A_3)	Criteria Weight	Δj	Criteria Score	Final Criteria Score
Cost	H	100.000	101.000	0.30	1.00	(100-101)/1= Red	
Performance	H	85	95	0.30	0.85	(95-85)/0.85= 13	
Energy Consumption	H	70	60	0.10	0.70	(70-60)/0.70= 14	
Sustainability	M		100%	0.05			
OHS	M		100%	0.10			
Service Quality	M		100%	0.05			
Domestic Goods	M		100%	0.10			
							0.00

these percentage values are linearly normalized to the interval [0, 1] by dividing them by 100. For instance, a performance value of 75% corresponds to a normalized input of 0.75. The shaded cells in Table 1 indicate the actual performance values selected for each alternative and criterion.

The motivational contribution (MS_j) from a hygiene factor is calculated as a raw contribution ratio using equation (4) or (5) (e.g. $(T_j-X_{ij})/\delta j$). This ratio represents the number of δ_j units by which the threshold is exceeded. To integrate this ratio into the motivation score in a balanced way, it is first converted into a contribution factor using the formula $1 + (MS_j / 100)$. This factor is then multiplied by the criterion's weight (w_j) in order to obtain its contribution to the total motivation score.

Example of calculation for Alternative **A_1:**

Motivation Factors (Normalized & Weighted):

Sustainability: 75% → 0.75 →0.05 x 0.75 = 0.04;

OHS: 50% → 0.50 →0.10 x 0.50 = 0.05;

Service Quality: 100% → 1.00 →0.05 x 1.00 = 0.05;

Domestic Goods: 100% → 1.00 →0.10 x 1.00 = 0.10;

Subtotal for Motivation Factors: 0.04 + 0.05+ 0.05 + 0.10 = **0.24**

Motivational Contribution from Hygiene Factors:

Cost:MS = (100.000 - 80.000) / 1,000 = 20→ Contribution Factor:1 + (20/100) = 1.20→ Weighted Contribution:0.30 x 1.20 = 0.36;

Performance:MS = (95 - 85) / 0.85 = 11.76→ Contribution Factor:1 + (11.76/100) = 1.1176→ Weighted Contribution:0.30 x 1.1176 = 0.34;

Energy Consumption:MS = (70 - 65) / 0.7 = 7.14→ Contribution Factor:1 + (7.14/100) = 1.0714→ Weighted Contribution:0.10 x 1.0714 = 0.11;

Subtotal for Contributions from Hygiene Factors: 0.36 + 0.34 + 0.11 = **0.81**

Total Motivation Score$M(A_1)$**:** 0.24 + 0.81 = **1.05**

As a result of the application, the alternative A_3 was excluded from the evaluation process due to exceeding the predefined threshold for the cost criterion, which is classified under hygiene criteria, in a negative direction. Upon examining the hygiene criteria associated with the remaining alternatives, it was observed that the established threshold values were met, and in certain cases, specific criteria evolved into motivation factors. The procedures defined during the methodological phase were duly executed, and the analysis revealed that the alternative A_1, with a total score of 1.05, emerged as the most favorable option.

The final ranking is carried out by calculating the General Score (GS) as specified in equation (7), namely $GS(A_i) = F(A_i) \times M(A_i)$. Here, $F(A_i)$ is a binary variable indicating whether the alternative A_i meets the threshold requirements for all hygiene factors: F=1 if all hygiene factors satisfy their threshold conditions (i.e. $X \leq T_j$ for cost-type factors or $X \geq T_j$ for benefit-type factors), and F=0 if any of them fails to meet the threshold (veto). $M(A_i)$ is the sum of the normalized weighted scores related to the motivational factors and the motivational contributions (MS_j) provided by the hygiene factors that exceed the threshold. Thus, first the alternatives that satisfy all hygiene criteria (F=1) are determined, and then these alternatives are ranked according to their $M(A_i)$ scores. The alternative with the highest GS score is the best option.

In this application:

- The Alternative A_3 was eliminated because it exceeded the threshold for the "Cost" hygiene criterion (101,000 > 100,000), so $F(A_3) = 0$ and $GS(A_3) = 0 \times M(A_3) = 0$;
- The alternatives A_1 and A_2 met all hygiene criteria, so $F(A_1) = F(A_2) = 1$;
- $M(A_1) = 1.05$ and $M(A_2) = 0.96$ were calculated;
- As a result, $GS(A_1) = 1 \times 1.05 = 1.05$ and $GS(A_2) = 1 \times 0.96 = 0.96$ were found, and the alternative A_1 ranked first.

5. Discussion and Conclusion

In this study, which introduces the DFDM method that integrates Herzberg's Motivation-Hygiene Theory into MCDM processes, the employed

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criteria are reclassified – unlike in traditional methods - into hygiene and motivation factors, and a threshold-based veto mechanism is proposed to enable a dynamic contribution analysis.

DFDM differs from the conventional MCDM approaches such as TOPSIS and AHP in several respects. While DFDM automatically vetoes threshold violations on hygiene factors, TOPSIS ranks the alternatives based on their closeness to an ideal solution. For example, rejecting an alternative when its cost exceeds a predetermined budget is a feature not available in TOPSIS. In AHP, criterion weights are established through pairwise comparisons and they do not incorporate a veto mechanism or dynamic motivational contributions as in DFDM. From this perspective, DFDM has the potential to yield more reliable outcomes in contexts characterized by critical thresholds (e.g. public procurement or supply chain management). Table 5 summarizes the key methodological differences between DFDM and the two aforementioned traditional MCDM methods.

Another distinctive contribution of DFDM is its integration of Herzberg's theory into decision making processes for modeling the dynamics of psychological satisfaction and dissatisfaction. The absence of hygiene factors leads to dissatisfaction, whereas the presence of motivational factors increases satisfaction. Furthermore, when the hygiene factors exceed their threshold values and thereby trigger motivational contributions, the criteria can be evaluated dynamically. This feature, absent from the conventional methods, is an advantage that provides decision makers with a more flexible form of analysis. The separation of hygiene and motivation factors, the veto mechanism, and the dynamic contribution analysis make DFDM particularly advantageous in scenarios that are human-centered and subject to risk management. In addition to providing technical optimization, DFDM enables a decision-making process that explicitly accounts for psychological satisfaction and contentment. This benefit, framed from a positive psychology perspective, can be considered an original contribution of this study. Modeling hygiene factors as dissatisfaction-preventing elements and motivational factors as satisfaction-enhancing elements allows decision processes to integrate both rational and affective dimensions. In this respect, DFDM differs from the existing MCDM methods in the literature by developing a human-centered, dynamic, and context-sensitive approach.

While the studies examined in the literature (Taherdoost & Madanchian, 2023; Sotoudeh–Anvari, 2022; Dolapoğlu, 2025; Ersoy, 2023) generally identify the strengths and limitations of various MCDM methods, they pay limited attention to psychologically-grounded criterion

Table 5. Methodological Comparison of the Proposed DFDM Method with Traditional MCDM Methods (TOPSIS and AHP)

Feature	DFDM (Proposed Method)	TOPSIS	AHP
Core Logic	Hygiene–Motivation dichotomy, Veto + Dynamic Contribution	Closeness to Ideal Solution	Pairwise Comparisons & Hierarchy
Criterion Types	Explicitly split intoHygiene (Veto) and Motivation (Contribution)	All criteria treated equally (usually benefit/cost)	All criteria treated equally (pairwise comparison)
Veto Mechanism	Yes; mandatory elimination if any hygiene threshold is violated	No; poor scores for one criterion can be compensated by scores for other criteria	No; low performance leads to low local priority, butit does not cause elimination
Psychological Model	Aligned with Herzberg's theory: Avoiding Dissatisfaction + Maximizing Satisfaction	Does not directly model psychological dimensions	Does not directly model psychological dimensions (subjectivity is implicit with regard to weights)
Dynamic Behavior	A hygiene factor significantly exceeding its threshold (beyond the δ_j tolerance) provides a motivational contribution	Static; the role of the criteria does not change	Static; the role of the criteria does not change
Weighting Flexibility	Flexible; any valid method can be used: expert consensus, AHP, ENTROPY, CRITIC, etc.	Weights are typically determined through a separate process (AHP, ENTROPY etc.) and are fixed	Weights are derived from pairwise comparisons - this is core to the AHP methodology

differentiation and the direct integration of that differentiation into decision-making processes. DFDM provides an original contribution at this juncture by incorporating both a strict veto mechanism and a dynamic motivational contribution model.

The application results show that the alternatives falling below the prescribed threshold values for hygiene factors are automatically eliminated, demonstrating the method's reliability in contexts where minimizing risk is critical, such as public procurement, regulatory–compliant supplier selection, and other similar high stakes domains. By contrast, the conventional methods (e.g., TOPSIS, AHP) only impose a score decrease in such cases and do not provide a definitive elimination mechanism. Moreover, the motivational contributions of DFDM when the hygiene criteria favorably exceed their thresholds (as defined in equations 4 and 5) represent an innovative feature rarely found in the literature, rewarding the transition from minimum acceptability to excellence in performance. The generalizability of DFDM can be increased by testing it across diverse sectoral decision problems, such as in the context of human resources, sustainable production, and project management.

In conclusion, the DFDM method can be considered a strong alternative for decision problems that require the simultaneous consideration of legal mandates, technical thresholds, and levels of psychological satisfaction. It should be noted, however, that this method remains open to improvements in flexibility, parametric optimization, and integration with various data types.

By addressing the hygiene–motivation dynamics that traditional MCDM methods do not explicitly capture, DFDM introduces a novel dimension to decision making. It is particularly effective in contexts characterized by critical thresholds and where psychological satisfaction is a significant factor. Nevertheless, addressing the method's limitations and testing it across diverse application domains constitute important steps for future research. This study is expected to make a significant contribution to the literature by articulating DFDM's theoretical foundations and practical applications.

However, the DFDM method has certain limitations. First, the T_j threshold values, δ_j tolerance parameter, and the criterion weights (w_j) are largely based on expert opinion, which carries a risk of subjectivity and arbitrariness. To mitigate this risk, future studies should focus on using objective data analysis techniques (e.g. standard deviation, data distribution) for determining the parameters and on integrating a consistency control mechanism, as in AHP, into the DFDM weighting process. Second, the application presented in this paper is relatively small in scale (3 alternatives, 7 criteria). To test the power and generalizability of this method, real-world case studies from different sectors (human resources, sustainable production, and project management) with more alternatives and criteria are needed. Third, the effect of the δ_j parameter and the 20% motivational contribution limit on performance should be examined through a systematic sensitivity analysis. Finally, evaluating the impact of DFDM on decision quality and user satisfaction through a comprehensive comparative analysis using methods such as TOPSIS, AHP, and ELECTRE would be beneficial for quantitatively demonstrating its methodological contribution.

REFERENCES

Arıkan, F. & Yağlı, U. (2018) Hava Kuvvetleri Komutanlığı Malzeme İhtiyaç Planlaması Tedarik Tavsiye Listesinin ÇKKV Yöntemleri ile Analizi. [Analyzing Turkish Air Force Material Requirement Planning Procurement List Results Via MCDM Techniques]. *Savunma Bilimleri Dergisi* [*The Journal of Defense Sciences*]. 17(1), 47-73. https://doi.org/10.17134/khosbd.427041.

Bayram, B. & Eren, T. (2023) Çok kriterli karar verme yöntemleriyle afet sonrası geçici depo yeri seçimi [Post-Disaster Temporary Warehouse Site Selection with Multi-Criteria DecisionMaking Methods] *Acil Yardım ve Afet Bilimi Dergisi* [*Emergency Aid and Disaster Science*]. 3(2), 22-30.

Dalbudak, E. & Rençber, Ö. F. (2022) Çok kriterli karar verme yöntemleri üzerine literatür incelemesi [A Lıterature Revıew on Multıcrıterıa Decısıon Makıng Methods]. *Gaziantep Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi* [*Gaziantep University Faculty of Economics and Administrative Sciences Journal*], 4(1), 1-17. https://doi.org/10.55769/gauniibf.1068692.

Dolapoğlu, N. (2025) Ürün Seçiminde Çok Kriterli Karar Verme Yöntemlerinden Topsis Kullanımı:

ICI Bucharest © Copyright 2012-2025. All rights reserved

Tablet Seçimi Örneği [The Use of Multi-Criteria Decision-Making Methods in Product Selection: An Example of Tablet Selection Using Topsis]. *Eurasian Business & Economics Journal.* 39, 19-27. https://doi.org/10.17740/eas.econ.2025-V39-02.

Ersoy, N. (2022) Asya Bölgesi Ülkelerinin Yaşam Kalitesinin ÇKKV Yöntemleri ile Analiz Edilmesi [Analysis of Life Quality in Asian Region Countries Using MCDM Methods]. In: *4. International CEO Communication, Economics, Organization & Social Sciences Congress, 20-22 May 2022, Udaipur, India*. pp. 658-670.

Ersoy, N. (2023) COPRAS-ARAS Hibrit ÇKKV Modeli İle AB Ülkelerinin Mevcut Yaşam Maliyetinin Bir Analizi [An Analysis of the Current Cost of Living of EU Countries with a COPRAS-ARAS Hybrid MCDM Model]. *Afyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi* [*Afyon Kocatepe University Journal of Social Sciences*]. *25*(1), 198-214. https://doi.org/10.32709/akusosbil.1058594.

Fidan, H. (2021) Crıtıc Ve Maırca çok kriterli karar verme yöntemi ile uluslararası hedef pazar seçimi [International Target Market Selection with Critic and Mairca Multi-Criteria Decision Making Method]. *Karamanoğlu Mehmet Bey Üniversitesi Sosyal ve Ekonomik Araştırmalar Dergisi* [*KMU Journal of Social and Economic Research*]. 23(41), 291-309.

Güngör, S. & Özcan, U. (2022) Karar kuramı ve karar verme [Decision Theory and Decision-Making]. *Avrupa Bilim ve Teknoloji Dergisi [European Journal of Science and Technology].* (33)*,* 119-125. https://doi.org/10.31590/ejosat.1035682.

Kahneman, D. & Tversky, A. (1979) Prospect theory: An analysis of decision under risk. *Econometrica.* 47(2), 263-292.

Kıral, E. (2015) Yönetimde karar ve etik karar verme sorunsalı [Decision in Management and Ethical Decision Making Problematique]. *Adnan Menderes Üniversitesi Eğitim Fakültesi Eğitim Bilimleri Dergisi* [*Journal of Educational Sciences*]. 6(2), 73-89.

Orçanlı, K. & Özdemir, A. (2013) Kredi Kartı Seçimine Yönelik Bir Karar Modeli ve Uygulama: Analitik Hiyerarşi Prosesi (AHP)-ELECTRE Yöntemi [A Decision Model for the Selection of Credit Cards and Application Analytic Hierarchy Process (AHP)–ELECTRE Method]. *Çankırı Karatekin Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* [*Journal of Institute of Social Sciences*]. 4(1), 77-106.

Ozernoy, V. M. (1992) Choosing The "Best" Multiple Criteria Decision-Making Method. *Information Systems and Operational Research.* 30(2), 159-171.

Sotoudeh-Anvari, A. (2022) The applications of MCDM methods in COVID-19 pandemic: A state of the art review. *Applied Soft Computing.* 126*,* Art. ID. 109238. https://doi.org/10.1016/j.asoc.2022.109238.

Supçiller, A. A. & Deligöz, K. (2018) Tedarikçi Seçimi Probleminin Çok Kriterli Karar Verme Yöntemleriyle Uzlaşık Çözümü [A Consensus Solution to the Supplier Selection Problem Using Multi-Criteria Decision-Making Methods]. *Uluslararası İktisadi ve İdari İncelemeler Dergisi* [*International Journal of Economic and Administrative Reviews*]. 18, 355-368. https://doi.org/10.18092/ulikidince.352742.

Taherdoost, H. & Madanchian, M. (2023) Multi-Criteria Decision Making (MCDM) Methods And Concepts. *Encyclopedia.* 3(1), 77-87. https://doi.org/10.3390/encyclopedia3010006.

Timor, M. (2011) *Analitik Hiyerarşi Prosesi.* Türkmen Kitabevi, İstanbul.

Tsalatsanis, A., Hozo, I., Vickers, A. et al. (2010) A regret theory approach to decision curve analysis: a novel method for eliciting decision makers' preferences and decision-making. *BMC Medical Informatics and Decision Making.* 10(1)*,* Art. ID 51. https://doi.org/10.1186/1472-6947-10-51.

Tzeng, G.-H. & Huang, J.-J. (2011) *Multiple Attribute Decision Making - Methods And Applications.* Boca Raton, USA, CRC Press Taylor & Francis Group.

Wang, T.-C. (2012) The Interactive Trade Decision-Making Research: An Application Case of Novel Hybrid MCDM Model. *Economic Modelling.* 29(3), 926-935. https://doi.org/10.1016/j.econmod.2012.02.001.

Yenilmezel, S, & Ertuğrul, İ. (2022) Çok kriterli karar verme yöntemleri ile bir mermer fabrikası için kesintisiz güç kaynağı seçimi [Uninterruptible Power Supply Selection for a Marble Factory with Multi Criteria Decision Making Methods]. *Aksaray Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi* [*Journal of Aksaray Unıversıty Faculty of Economıcs and Admınıstratıve Scıences*]. 14(3), 251-266. https://doi.org/10.52791/aksarayiibd.1009308.

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