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Hybrid Model with MPSI Weighting and DEPART Ranking in Best-Selling Product Selection in E-Commerce Platforms

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ABSTRACT

The increasingly intense competition on e-commerce platforms, along with the high volume and dynamic nature of sales data, has created challenges in objectively determining the best-selling products, especially due to subjectivity in weighting criteria and the ranking methods' insensitivity to relatively small differences in values between products. This study aims to develop a decision support system model for determining best-selling products using a Hybrid Model approach that integrates MPSI weighting and the DEPART ranking method. The MPSI method is used to objectively generate criterion weights based on the level of variation and the contribution of data information, while DEPART is applied to produce more stable rankings through performance deviation analysis among alternatives. The study results show that the iPhone 15 Pro Max 128GB ranks first with a final score of 0.167, followed by the Samsung 32" LED TV in second place with a score of 0.158, and Wireless Noise-Canceling Headphones in third place with a score of 0.141. These findings indicate that the proposed hybrid model is capable of producing a clearer, more consistent, and representative ranking structure relative to actual data conditions. Thus, the MPSI-DEPART integration has been proven effective in enhancing the accuracy and objectivity of the best-selling product selection process and holds potential for broad application in the development of decision support systems in a dynamic and competitive e-commerce environment.

I. Introduction

The rapid expansion of e-commerce platforms over the past decade has significantly transformed the way products compete in digital marketplaces, driven by rising internet penetration, improved digital infrastructure, and shifting consumer preferences toward online shopping[1], [2]. Sellers of all scales now have access to vast virtual storefronts where thousands of products are displayed side by side, creating intense competition for visibility and sales performance. In this environment, identifying best-selling products is no longer a simple matter of observing total sales volume, as multiple performance indicators shape a product's success. Merchants must consider factors such as pricing competitiveness, customer ratings and reviews, conversion rates, return ratios, inventory turnover, promotional effectiveness, and platform search algorithms. Each platform also applies different ranking mechanisms, commission structures, and promotional tools, which influence how products gain exposure

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and attract buyers. The interplay among these criteria often produces trade-offs, for instance between offering lower prices and maintaining profit margins, or between aggressive promotions and sustainable stock management. Relying solely on intuition or past experience to select high-performing products can lead to inaccurate judgments, particularly when market trends shift rapidly and consumer demand fluctuates. For this reason, selecting best-selling products in e-commerce platforms requires a structured analytical approach capable of evaluating[3], [4] multiple criteria simultaneously. A quantitative decision support system can assist sellers in processing complex data objectively and systematically, enabling more informed, consistent, and strategically sound product selection decisions.

Multi-criteria decision making (MCDM) plays a vital role in best-selling product selection in e-commerce platforms because product performance is shaped by multiple interrelated factors rather than a single metric. Determining which items qualify as best-sellers cannot rely solely on total sales figures, as aspects such as pricing strategy, customer ratings, review sentiment, conversion rates, return frequency, inventory turnover, and promotional impact collectively influence market success. MCDM offers a structured framework that transforms this complexity into measurable criteria that can be evaluated simultaneously[5]–[8]. Typically, the process begins with assigning weights to reflect the relative importance of each indicator based on data-driven analysis or managerial priorities. Once the weighting phase is completed, alternatives in the form of products are ranked to identify those with the strongest overall performance according to aggregated scores. This two-step structure ensures that evaluation reflects not only raw numerical outcomes but also the strategic significance of each performance dimension. Combining an objective weighting approach with a robust ranking technique helps reduce subjectivity and prevents results from being overly sensitive to extreme values or short-term fluctuations[9]–[11]. Through this integrated framework, sellers and platform managers can make more consistent, transparent, and data-informed decisions when identifying high-performing products in competitive digital marketplaces.

Objective weighting using modification preference selection index (MPSI) is a weighting approach designed to produce the importance values of criteria objectively based on the characteristics of the available data[12]. The basic concept of MPSI is based on the analysis of the level of variation and the distribution of values in each criterion, so the resulting weights reflect the actual contribution of each indicator to the differences in alternative performance. This method does not rely on subjective judgment from decision-makers, but rather utilizes the mathematical information contained in the decision matrix. Through the process of normalization and measurement of preference deviation, MPSI is able to identify criteria that have higher discriminative power compared to others. The greater the variation of a criterion in distinguishing alternatives, the higher the weight assigned, as it is considered to have a more significant influence in the evaluation process. One of the main advantages of MPSI is its ability to maintain consistency in weighting results even when the number of alternatives or data scales change. In addition, the procedure is relatively simple computationally, making it easy to implement in various quantitative-based DSS models. With these characteristics, MPSI becomes a relevant choice when a transparent, data-driven weighting method is needed and capable of minimizing bias in multi-criteria analysis.

Ranking using the deviation-based pairwise assessment ratio technique (DEPART) is a ranking method within the framework of MCDM that focuses on

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evaluating the relative performance of alternatives through pairwise comparisons[13], [14]. The basic concept of DEPART relies on measuring the deviation or difference in value of each alternative relative to others for each criterion, thereby providing a more detailed picture of strengths and weaknesses. This approach not only considers the final aggregate scores but also takes into account the performance gaps formed from the interactions among alternatives in each assessment dimension. By utilizing the ratio of these comparison results, DEPART can establish a ranking order based on consistent relative strengths across all criteria. The distance-based nature of the method makes it sensitive to real differences in the data, allowing alternatives with significant advantages to be identified more clearly. Furthermore, DEPART is designed to handle conflicts between criteria, for example when an alternative excels in cost but is less optimal in the service quality. Through the ratio and deviation evaluation mechanism, the influence of conflicting criteria can be balanced without losing important information from each indicator. This capability makes DEPART relevant in complex decision-making situations, particularly when stable rankings that comprehensively reflect relative performance dynamics are required.

Although numerous studies have applied MCDM approaches to product evaluation in digital marketplaces, the integration of MPSI as an objective weighting method and DEPART as a ranking technique remains limited in the context of best-selling product selection in e-commerce platforms. Existing research more commonly combines widely used weighting techniques such as entropy or AHP with conventional ranking methods, leaving the potential synergy between MPSI and DEPART insufficiently examined. This situation reveals a methodological gap in the development of hybrid models that merge data-driven objective weighting with a ranking approach capable of handling performance contrasts among multiple product criteria. In practice, identifying best-selling products involves complex and often conflicting indicators, including sales volume, pricing competitiveness, customer ratings, return rates, promotional effectiveness, and inventory dynamics. These criteria may not always move in the same direction, making it challenging to determine overall product superiority using traditional single-method approaches. Despite the growing importance of data analytics in e-commerce, limited research has specifically explored the combined use of MPSI and DEPART for systematically selecting high-performing products within platform environments. The absence of such studies suggests the need for a more adaptive and comprehensive evaluation framework tailored to the competitive and fast-changing nature of online marketplaces. Addressing this gap provides an opportunity to construct a robust analytical model that strengthens strategic product selection and supports more informed decision-making in digital commerce ecosystems.

This study aims to develop a hybrid MPSI and DEPART model that systematically integrates data-driven objective weighting with deviation-based ranking techniques within a single evaluation framework for best-selling product selection in e-commerce platforms. The proposed model is designed to assess product performance by considering multiple strategic criteria, including sales volume, pricing competitiveness, customer ratings and reviews, return rates, inventory turnover, and promotional effectiveness. Beyond constructing the methodological structure, the research also examines the stability and consistency of ranking results through sensitivity analysis to ensure that minor variations in data do not lead to disproportionate changes in product rankings. In terms of contribution, the study introduces a relatively underexplored integration between MPSI as an objective weighting approach and DEPART as a

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distance-based ranking method within the context of product-level evaluation. This framework extends the development of Decision Support Systems by offering a more adaptive analytical model tailored to the dynamic and competitive nature of online marketplaces. Additionally, the research includes a comparative analysis with established methods such as TOPSIS and VIKOR to assess performance, sensitivity, and ranking consistency. The comparison provides empirical insight into how the proposed hybrid model performs relative to widely applied techniques in multi-criteria evaluation. Overall, this study seeks to contribute both theoretically and practically by delivering a more accurate, robust, and applicable approach for identifying high-performing products in e-commerce environments.

II. Methodology

The research method is a set of systematic steps designed to guide the research process from problem formulation to drawing conclusions[15], [16]. The structure of these stages helps maintain a directed workflow so that the process does not jump around or lose focus on the initial objectives. In addition, dividing it into several phases allows for periodic evaluation to ensure each step has been carried out correctly before proceeding to the next stage. The clarity of the research stage also plays an important role in enhancing transparency and replicability of the research by others. With well-planned stages, the risk of methodological errors can be minimized, and the quality of the research results becomes more assured.

2.1. Research Stage

The stages of research are a series of structured steps designed to ensure that the research process runs systematically and in a directed manner from start to finish. Each stage is interconnected and cannot be separated because they form a complete workflow[17], [18]. A clear structure in the research stages helps maintain consistency, enhance the validity of the results, and make it easier for others to understand and replicate the process carried out. Figure 1 illustrates the flow of the research stages conducted in this study.

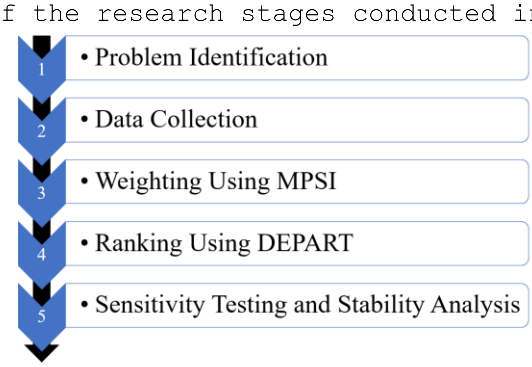

Figure 1. Research Stage

The research stages begin with problem identification, which focuses on defining the scope of best-selling product selection in e-commerce platforms and determining the relevant product alternatives and evaluation criteria. After clarifying the research boundaries, the process proceeds to data collection and organization, where quantitative performance data for each product—such as sales figures, ratings, pricing, and return rates—are compiled according to predefined

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criteria and arranged into a structured decision matrix. The next step involves applying the MPSI method to calculate objective weights for each criterion based on their variation and contribution in differentiating product performance. These weights are then incorporated into the ranking phase using the DEPART method, which assesses pairwise deviations and relative distances among products to generate final performance scores. Through this deviation-based evaluation, products can be ranked according to their overall competitive strength across multiple indicators. In the final stage, sensitivity testing and stability analysis are carried out to examine how consistent the ranking outcomes remain when there are slight adjustments in weights or fluctuations in data. This step helps determine the robustness and reliability of the proposed model in supporting data-driven decisions for identifying high-performing products within dynamic e-commerce environments.

2.2. MPSI Weighting

MPSI Weighting is an objective weighting method within the MCDM framework used to determine the relative importance of each criterion based on the characteristics of the available data. Unlike subjective methods that rely on expert judgment, MPSI is entirely based on numerical information, thereby reducing potential bias in determining weights[19], [20]. This characteristic makes MPSI suitable for decision support systems that require transparency and consistency in multi-criteria evaluation.

The MPSI method stages begin with the preparation of a decision matrix using (1), which represents the value of each alternative against all criteria in a structured form. Next, a normalization process is carried out to convert the initial values into a comparable scale using (2), so that differences in units between criteria do not affect the analysis results. After obtaining the normalized matrix, the average value for each criterion is calculated using (3) as a basis for measuring the level of data dispersion. The next step is to calculate preference variations using (4), which depicts the magnitude of each value's deviation from the criterion average to determine the discriminative power of each indicator. These preference variation values are then used to determine the relative significance level of each criterion. In the final stage, the criterion weights are calculated using (5) so that the total weight is proportional and can be used in further evaluation processes. This series of steps ensures that weighting is carried out objectively based on the quantitative information contained in the data.

$$X = [x_{ij}]_{mxn} \tag{1}$$

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{\max_j x_{ij}}; benefit \\ \dfrac{\min_j x_{ij}}{x_{ij}}; cost \end{cases} \tag{2}$$

$$\vartheta_j = \frac{\sum_{i=1}^{m} r_{ij}}{m} \tag{3}$$

$$p_j = \sum_{i=1}^{m} (r_{ij} - \vartheta_j)^2 \tag{4}$$

$$w_j = \frac{p_j}{\sum_{j=1}^{n} p_j} \tag{5}$$

MPSI Weighting provides a data-driven weighting approach and emphasizes the ability of each criterion to distinctly differentiate the performance of alternatives. With its objective and relatively stable characteristics, MPSI

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Weighting becomes a strong foundation to support the ranking stage in a more comprehensive multi-criteria decision-making model.

2.3. DEPART Method

DEPART is a ranking method within the MCDM framework that evaluates alternatives based on pairwise comparisons and measurement of relative performance deviations for each criterion. This approach focuses on the differences in values between alternatives to identify strengths or weaknesses in more detail, rather than merely relying on total score aggregation. By calculating the ratio of these comparison results, DEPART is able to depict the relative position of each alternative within the overall evaluation system. One important characteristic of DEPART is its ability to manage conflicts among criteria, especially when an alternative shows high performance in one aspect but lower in another. Its deviation-based analytical structure makes the ranking results tend to be stable and not easily affected by small fluctuations in the data.
The stages of the DEPART method begin with the preparation of a decision matrix as shown in Equation (1), which contains the value of each alternative against all evaluated criteria. Next, a normalization process is carried out using (6) to equalize the scale among criteria so that comparisons can be made proportionally. Once the normalized matrix is obtained, positive and negative deviations between alternatives are calculated using (7)-(10) to identify the level of relative strengths and weaknesses for each criterion. The next stage involves comparing positive and negative deviations using (11)-(14) to observe the dominance of one alternative over another. The results of this comparison are then expressed in the form of positive and negative deviation ratios using (15), which reflect the balance of relative strengths and weaknesses. These ratio values are subsequently accumulated into aggregated pairwise deviations using (16) to obtain a comprehensive measure of the pairwise interactions of all alternatives. In the final stage, the aggregate values are calculated into the final alternative scores using (17), which are then used to determine the overall ranking order.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} {x_{ij}}^2}} \quad (6)$$

$$t_j^{+} = \begin{cases} \max\limits_{j} r_{ij}\,; benefit \\ \min\limits_{j} r_{ij}\,; cost \end{cases} \quad (7)$$

$$t_j^{-} = \begin{cases} \min\limits_{j} r_{ij}\,; benefit \\ \max\limits_{j} r_{ij}\,; cost \end{cases} \quad (8)$$

$$dv_{ij}^{+} = \left| r_{ij} - t_j^{+} \right| \quad (9)$$

$$dv_{ij}^{-} = \left| r_{ij} - t_j^{-} \right| \quad (10)$$

$$md^{+} = \max_{i,j} dv_{ij}^{+} \quad (11)$$

$$md^{-} = \max_{i,j} dv_{ij}^{-} \quad (12)$$

$$e_{kl}^{+} = \sum_{i=1}^{m} w_j * \left(\frac{dv_{lj}^{+} - md^{+}}{dv_{kj}^{+} - md^{+}}\right) \quad (13)$$

$$e_{kl}^{-} = \sum_{i=1}^{m} w_j * \left(\frac{dv_{lj}^{-} - md^{-}}{dv_{kj}^{-} - md^{-}}\right) \quad (14)$$

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$$e_{kl} = \left(\delta * {e_{kl}}^{+}\right) + \left(1 - \delta * {e_{kl}}^{-}\right) \quad (15)$$

$$e_l = \sum_{k=1}^{n} e_{kl} \quad (16)$$

$$S_i = \frac{1}{n} * \left(\sum_{l=1}^{n} \frac{e_{il}}{e_l}\right) \quad (17)$$

The DEPART method offers a ranking approach that emphasizes the evaluation of relative performance through an analysis of paired deviations between alternatives. By utilizing the concept of distance and positive and negative comparison ratios, this method is able to depict the strengths and weaknesses of each alternative more proportionally. These characteristics make DEPART relevant for decision-making that involves multiple criteria and alternatives with a high level of complexity.

III. Result and Discussion

The Hybrid Model with MPSI Weighting and DEPART Ranking for best-selling product selection in e-commerce platforms is an integrated approach developed to handle the complexity of multi-criteria decision-making in highly competitive digital marketplaces. This model employs MPSI as an objective weighting technique that determines the relative importance of each product evaluation criterion based on data variation, while DEPART functions as a ranking method that measures the comparative performance of products through distance-based pairwise deviation analysis. By linking these two methods, the evaluation process becomes more structured, as criterion weights are calculated quantitatively before being incorporated into a comprehensive ranking procedure. The approach enables a balanced assessment of diverse indicators such as sales performance, customer feedback, pricing strategy, and operational efficiency within a unified analytical framework. Through the combination of data-driven weighting and deviation-based ranking, the model offers a more responsive and systematic mechanism for identifying high-performing products in dynamic e-commerce environments.

3.1. Data Collection

Data collection in this study was carried out systematically to obtain accurate and representative information regarding the performance of each product evaluated within the e-commerce platform. The process began with determining relevant criteria such as sales volume, product price, customer ratings, number of reviews, return rate, and promotional intensity, all of which reflect different dimensions of product competitiveness. Data were gathered from reliable platform analytics, official sales reports, and publicly available product performance indicators to ensure validity and consistency. Each selected product alternative was observed within the same evaluation period to avoid bias caused by seasonal fluctuations or temporary promotional campaigns. After the raw data were collected, verification and cleaning procedures were conducted to eliminate incomplete, inconsistent, or extreme values that could distort the analysis. The validated data were then organized into a structured decision matrix, where rows represent product alternatives and columns represent evaluation criteria. This structured format facilitates subsequent normalization, weighting, and ranking procedures within the proposed hybrid model. The comprehensive results of the product performance assessment are presented in Table 1.

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Table 1. Assessment Data

Product Name	Price (USD)	Sales Volume (Units)	Rating (Avg)	Review Count	Return Rate (%)
PM Product	999	45230	4.8	34562	2.1
TV Product	250	18450	4.6	12412	3.5
HR Product	200	29870	4.7	21305	2.9
FW Product	130	22540	4.3	17125	4.2
PB Product	90	15200	4.5	9876	3.8
BP Product	50	31980	4.4	14230	3.1
TS Product	25	20450	4.2	8765	5
FC Product	20	35600	4.6	15987	2.5

The assessment data that has been collected reflects the performance of each product based on several key indicators relevant in determining the best-selling product on the e-commerce platform. Each alternative is evaluated using quantitative criteria such as price, sales volume, average customer rating, number of reviews, and return rate, providing a comprehensive view of product competitiveness. Variations in scores for each criterion indicate differences in performance characteristics between products, where some products excel in sales volume but have higher return rates, while others have high ratings but lower transaction volumes. This diversity in data serves as an important basis for applying weighting and ranking methods as it reflects the dynamic and competitive market conditions.

3.2. Weighting Using MPSI

Weighting using MPSI is an objective weighting approach used to determine the relative importance of each criterion based on the variation of data available in the decision matrix. This method evaluates the extent to which a criterion can differentiate product performance through the analysis of value dispersion and preference deviation. Criteria that show more significant performance differences will receive higher weights because they are considered to have a stronger contribution in the evaluation process. This approach allows weighting to be conducted quantitatively without relying on the subjective judgment of decision-makers. By utilizing the numerical information contained in the data, MPSI produces proportional weights that reflect the actual conditions of product performance in the market. This objective characteristic makes the evaluation results more consistent and transparent when used in subsequent ranking processes.

The first stage of the MPSI method, which involves compiling a decision matrix representing the value of each alternative against all criteria, is done using (1). The resulting decision matrix of the MPSI method is as follows.

$$X = \begin{bmatrix} 999 & 45230 & 4.8 & 34562 & 2.1 \\ 250 & 18450 & 4.6 & 12412 & 3.5 \\ 200 & 29870 & 4.7 & 21305 & 2.9 \\ 130 & 22540 & 4.3 & 17125 & 4.2 \\ 90 & 15200 & 4.5 & 9876 & 3.8 \\ 50 & 31980 & 4.4 & 14230 & 3.1 \\ 25 & 20450 & 4.2 & 8765 & 5 \\ 20 & 35600 & 4.6 & 15987 & 2.5 \end{bmatrix}$$

The second stage of the MPSI method involves the normalization process to convert the initial values into a comparable scale using (2). The normalization results of the MPSI method are shown in Table 2.

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Table 2. Normalization Results Using the MPSI Method

Product Name	Price (USD)	Sales Volume (Units)	Rating (Avg)	Review Count	Return Rate (%)
PM Product	0.0200	1.0000	1.0000	1.0000	1.0000
TV Product	0.0800	0.4079	0.9583	0.3591	0.6000
HR Product	0.1002	0.6604	0.9792	0.6164	0.7241
FW Product	0.1538	0.4983	0.8958	0.4955	0.5000
PB Product	0.2221	0.3361	0.9375	0.2857	0.5526
BP Product	0.4006	0.7071	0.9167	0.4117	0.6774
TS Product	0.7996	0.4521	0.8750	0.2536	0.4200
FC Product	1.0000	0.7871	0.9583	0.4626	0.8400

The third stage of the MPSI method calculates the average value for each criterion using (3). The average values of the MPSI method are presented in Table 3.

Table 3. Average Value Results Using the MPSI Method

Price	Sales Volume	Rating	Review Count	Return Rate
0.3470	0.6061	0.9401	0.4856	0.6643

The fourth stage of the MPSI method calculates preference variations using (4). The results of the MPSI method's preference variations are displayed in Table 4.

Table 4. Preference Variations Results Using the MPSI Method

Price	Sales Volume	Rating	Review Count	Return Rate
0.9262	0.3486	0.0125	0.3976	0.2506

The final stage of the MPSI method calculates the criterion weights using (5). The results of the MPSI method's preference variations are presented in Table 5.

Table 5. Criteria Weighted Results Using the MPSI Method

Price	Sales Volume	Rating	Review Count	Return Rate
0.4785	0.1801	0.0065	0.2054	0.1295

Table 5 presents the criteria weighting results obtained using the MPSI method, which reflect the relative importance of each evaluation indicator in determining best-selling products. The Price criterion receives the highest weight at 0.4785, indicating that pricing plays a dominant role in differentiating product performance within the dataset. This suggests that price competitiveness strongly influences overall evaluation outcomes compared to other factors. Review Count follows with a weight of 0.2054, highlighting the relevance of customer engagement and feedback volume in shaping product visibility and credibility. Sales Volume is assigned a weight of 0.1801, showing that while transaction quantity remains important, its relative contribution is lower than price and review intensity in this assessment. Return Rate accounts for 0.1295, reflecting the influence of post-purchase satisfaction and product reliability on overall performance evaluation. Meanwhile, Rating (Avg) has the smallest weight at 0.0065, implying limited variation across products and a relatively weaker discriminative effect within the analyzed data. Overall, the distribution of weights demonstrates how MPSI objectively captures the

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contribution of each criterion based on data variation rather than subjective judgment.

3.3. Ranking Using DEPART

Ranking using DEPART is used to determine the order of the best products based on the evaluation of relative performance among alternatives through pairwise deviation analysis. This method not only accumulates weighted values but also measures the distance and performance differences of each product compared to others across all predetermined criteria. By considering positive and negative deviations, DEPART is able to depict the balance between the strengths and weaknesses of each alternative more proportionally. This distance-based approach makes ranking results more sensitive to actual differences in the data, allowing truly superior products to be identified more clearly. In addition, this method helps manage conflicts between criteria, such as when a product has a competitive price but a higher return rate. The final result, in the form of an aggregate score, reflects the comparative strength of each product comprehensively and serves as the basis for determining the best rank in the best-selling product selection process.
The first stage of the DEPART method begins with the preparation of the decision matrix as shown using (1). The result of the DEPART method decision matrix is the same as the decision matrix of the MPSI method.
The second stage of the DEPART method involves the normalization process using (6) to equalize the scale among criteria so that comparisons can be made proportionally. The results of the DEPART method normalization are shown in Table 6.

Table 6. Normalization Results Using the DEPART Method

Product Name	Price	Sales Volume	Rating	Review Count	Return Rate
PM Product	0.9114	0.5433	0.381	0.6889	0.2222
TV Product	0.2281	0.2216	0.3651	0.2474	0.3704
HR Product	0.1825	0.3587	0.373	0.4247	0.3069
FW Product	0.1186	0.2707	0.3413	0.3414	0.4444
PB Product	0.0821	0.1827	0.3571	0.1969	0.4021
BP Product	0.0456	0.3842	0.3492	0.2837	0.328
TS Product	0.0228	0.2457	0.3333	0.1747	0.5291
FC Product	0.0183	0.4277	0.3651	0.3187	0.2646

The third stage of the DEPART method calculates the positive and negative deviations among alternatives using (7)-(10). The results of the positive deviation calculations of the DEPART method are shown in Table 7.

Table 7. Positive Deviation Results Using the DEPART Method

Product Name	Price	Sales Volume	Rating	Review Count	Return Rate
PM Product	0.9114	0.8931	0.0000	0.0000	0.0000
TV Product	0.2281	0.2098	0.3217	0.0159	0.4415
HR Product	0.1825	0.1642	0.1846	0.0080	0.2642
FW Product	0.1186	0.1003	0.2726	0.0397	0.3475
PB Product	0.0821	0.0638	0.3606	0.0239	0.4920
BP Product	0.0456	0.0273	0.1591	0.0318	0.4052
TS Product	0.0228	0.0045	0.2976	0.0477	0.5142
FC Product	0.0183	0.0000	0.1156	0.0159	0.3702

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The results of the negative deviation calculations of the DEPART method are shown in Table 8.

Table 8. Negative Deviation Results Using the DEPART Method

Product Name	Price	Sales Volume	Rating	Review Count	Return Rate
PM Product	0.0000	0.3606	0.0477	0.5142	0.3069
TV Product	0.6833	0.0389	0.0318	0.0727	0.1587
HR Product	0.7289	0.1760	0.0397	0.2500	0.2222
FW Product	0.7928	0.0880	0.0080	0.1667	0.0847
PB Product	0.8293	0.0000	0.0238	0.0222	0.1270
BP Product	0.8658	0.2015	0.0159	0.1090	0.2011
TS Product	0.8886	0.0630	0.0000	0.0000	0.0000
FC Product	0.8931	0.2450	0.0318	0.1440	0.2645

The fourth stage of the DEPART method is the comparison between positive and negative deviations using (11)-(14) to observe the dominance of one alternative over another. The results of the comparison dominance positive deviations in the DEPART method are presented in Table 9.

Table 9. Comparison Dominance Positive Deviation Results Using the DEPART Method

	PM Product	TV Product	HR Product	FW Product	PB Product	BP Product	TS Product	FC Product
PM Product	1.000	0.333	0.412	0.521	0.587	0.642	0.701	0.755
TV Product	0.850	1.000	0.903	0.874	0.861	0.889	0.842	0.915
HR Product	0.791	0.412	1.000	0.765	0.803	0.844	0.798	0.866
FW Product	0.712	0.387	0.533	1.000	0.744	0.781	0.732	0.809
PB Product	0.664	0.356	0.487	0.622	1.000	0.725	0.689	0.768
BP Product	0.621	0.401	0.466	0.588	0.633	1.000	0.712	0.854
TS Product	0.588	0.348	0.439	0.566	0.601	0.664	1.000	0.812
FC Product	0.551	0.429	0.501	0.633	0.677	0.734	0.793	1.000

The results of the comparison dominance negative deviations in the DEPART method are presented in Table 10.

Table 10. Comparison Dominance Negative Deviation Results Using the DEPART Method

	PM Product	TV Product	HR Product	FW Product	PB Product	BP Product	TS Product	FC Product
PM Product	1.000	0.587	0.642	0.701	0.733	0.689	0.755	0.812
TV Product	0.422	1.000	0.744	0.781	0.798	0.822	0.768	0.846
HR Product	0.401	0.689	1.000	0.732	0.754	0.809	0.788	0.854
FW Product	0.377	0.621	0.688	1.000	0.722	0.764	0.733	0.812
PB Product	0.356	0.588	0.644	0.701	1.000	0.742	0.701	0.789
BP Product	0.388	0.644	0.712	0.755	0.781	1.000	0.744	0.833
TS Product	0.333	0.566	0.621	0.664	0.689	0.712	1.000	0.777
FC Product	0.309	0.598	0.667	0.712	0.744	0.788	0.822	1.000

The fifth stage of the DEPART method calculates the ratio of positive and negative deviations using (15). The results of the calculation for the positive and negative deviation ratios in the DEPART method are presented in Table 11.

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Table 11. Calculation Positive and Negative Deviation Ratio Results Using the DEPART Method

	PM Product	TV Product	HR Product	FW Product	PB Product	BP Product	TS Product	FC Product
PM Product	1.000	0.46	0.527	0.611	0.66	0.666	0.728	0.784
TV Product	0.636	1.000	0.824	0.828	0.83	0.856	0.805	0.881
HR Product	0.596	0.551	1.000	0.748	0.779	0.827	0.793	0.86
FW Product	0.545	0.504	0.610	1.000	0.733	0.772	0.733	0.811
PB Product	0.510	0.472	0.566	0.662	1.000	0.734	0.695	0.779
BP Product	0.505	0.523	0.589	0.671	0.707	1.000	0.728	0.844
TS Product	0.461	0.457	0.530	0.615	0.645	0.688	1.000	0.795
FC Product	0.430	0.514	0.584	0.673	0.711	0.761	0.808	1.000

The sixth stage of the DEPART method calculates the accumulation in the aggregated pairwise deviation using (16). The results of the accumulation calculation for the aggregated pairwise in the DEPART method are presented in Table 12.

Table 12. Accumulation Results Using the DEPART Method

Product Name	Accumulation
PM Product	5.683
TV Product	4.981
HR Product	5.230
FW Product	5.808
PB Product	6.065
BP Product	6.304
TS Product	6.290
FC Product	6.754

The final stage of the DEPART method calculates the final score of the alternatives using (17). The results of the final score calculation for the DEPART method alternatives are presented in Table 13.

Table 13. Final Score Results Using the DEPART Method

Product Name	Final Value
PM Product	0.167
TV Product	0.158
HR Product	0.141
FW Product	0.133
PB Product	0.118
BP Product	0.111
TS Product	0.096
FC Product	0.076

3.4. Alternative Ranking

Alternative ranking is a crucial stage in the multi-criteria decision-making process because it is at this phase that all alternatives, which have been evaluated based on certain criteria and weights, are ranked to determine the best priority objectively and systematically. After undergoing normalization, weighting, and preference value calculation using the proposed method, each alternative receives a final score that represents its closeness to the ideal solution or its level of dominance compared to other alternatives. This ranking process not only serves to identify the highest-performing alternatives but

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also provides a comprehensive view of value distribution, sensitivity to weights, and the stability of the decision outcomes.
Alternative ranking in the context of Best-Selling Product Selection on E-Commerce Platforms is a fundamental stage in decision support systems aimed at identifying and ranking products based on sales performance and other evaluation indicators comprehensively. This ranking process not only positions the product with the highest score as the best-selling candidate but also provides a quantitative and measurable mapping of the competitive positions of all products on the e-commerce platform. Alternative ranking serves as a strong analytical basis to support marketing strategies, inventory management, and promotion optimization, as the results obtained reflect an objective integration between actual transaction data and the multicriteria calculation model used in the evaluation process. The alternative ranking results are shown in Figure 2.

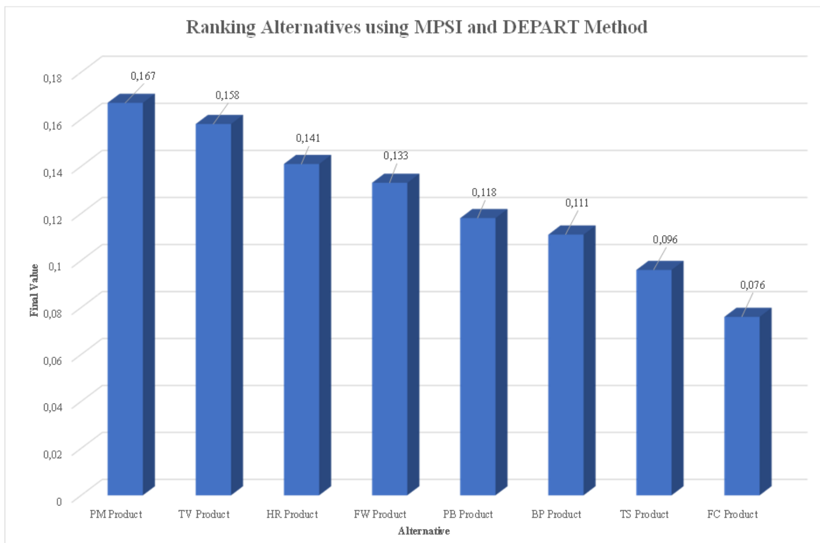

Figure 2. Ranking Alternatives for Best-Selling Product Selection on E-Commerce Platforms

Based on the final score calculations, the iPhone 15 Pro Max 128GB achieved the highest score of 0.167, securing the first position in the alternative rankings, indicating the best performance compared to other products based on overall evaluation criteria. The second position was taken by the Samsung 32" LED TV with a score of 0.158, followed by Wireless Noise-Canceling Headphones with 0.141 and a Smart Fitness Watch with a score of 0.133, both of which show fairly strong competitiveness in the market.

3.4. Discussion

The implementation of the Hybrid Model with MPSI Weighting and DEPART Ranking in best-selling product selection demonstrates a robust and objective decision-making framework for evaluating product competitiveness within e-commerce platforms. The integration of the MPSI weighting method enables the determination of criterion weights based on data dispersion and performance variation, reducing subjectivity in the weighting process. This is particularly important in e-commerce environments where indicators such as sales volume, rating scores, review consistency, conversion rate, and demand growth fluctuate dynamically. By capturing the intrinsic informational contribution of each criterion, MPSI ensures that highly discriminative attributes receive

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proportional influence in the final evaluation, thereby strengthening the reliability and fairness of the overall assessment model.

Furthermore, the application of the DEPART ranking method enhances the sensitivity of the ranking phase by emphasizing deviation patterns and comparative performance differences among alternatives. Unlike conventional aggregation-based ranking approaches, DEPART systematically analyzes performance gaps to generate a more discriminative ordering of products. This mechanism is especially beneficial in best-selling product selection, where competing products often exhibit close performance values. The hybridization of MPSI and DEPART therefore creates a complementary mechanism: MPSI objectively determines the strategic importance of each criterion, while DEPART translates weighted performance data into a stable and logically structured ranking outcome. The synergy between these two methods contributes to improved ranking consistency and minimizes instability caused by minor data variations.

From a managerial and strategic perspective, the proposed hybrid model provides actionable insights for e-commerce stakeholders, including marketplace administrators, sellers, and digital marketing analysts. The resulting ranking does not merely identify the top-performing product but also reveals the relative competitive structure across all evaluated alternatives. This allows decision-makers to design targeted promotional strategies, optimize inventory planning, and adjust pricing or bundling approaches based on quantitative evidence. In addition, the model's objectivity and computational transparency make it adaptable for continuous monitoring in dynamic online markets. Therefore, the Hybrid MPSI–DEPART framework offers both methodological advancement in multi-criteria decision-making and practical value in enhancing strategic decision support for best-selling product evaluation in e-commerce platforms.

IV. Conclusion

The implementation of the Hybrid Model with MPSI weighting and DEPART ranking is capable of providing an objective, systematic, and accurate approach in the process of selecting best-selling products on e-commerce platforms. The MPSI method effectively determines the weight of criteria based on data characteristics and the level of information variation, thereby reducing subjectivity in determining the importance level of each evaluation attribute. Meanwhile, the DEPART method strengthens the ranking stage by analyzing deviations and performance differences between alternatives more sensitively and stably, particularly when the value differences between products are relatively small. The integration of these two methods results in a ranking structure that is more consistent, reliable, and adaptive to the dynamics of online sales data. Thus, the MPSI–DEPART hybrid model not only provides a methodological contribution to the development of multi-criteria decision support systems but also offers significant practical implications for strategic decision-making in managing and optimizing product performance in a competitive e-commerce environment.

CRediT Authorship Contribution Statement

T. Ardiansah: Writing – original draft, Software, Methodology, Conceptualization. **D. Darwis:** Writing – review & editing, Formal analysis, Data curation, Conceptualization. **A. R. Metha:** Writing – original draft, Validation,

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Investigation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Declaration of Generative AI and AI-assisted Technologies in The Writing Process

The authors used Generative AI to improve the writing clarity of this paper. They reviewed and edited the AI-assisted content and take full responsibility for the final publication.

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