

# Multi-Criteria Approach in Selecting Optimal Retail Store Locations Using Integration of LODECI and ERVD Methods

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**Abstract:** Selecting an optimal retail store location is a complex multi-criteria decision-making problem involving conflicting factors such as cost, accessibility, demographics, competition, and market potential. This study proposes an integrated approach combining the LODECI (Logarithmic Decomposition of Criteria Importance) method and the ERVD (Election based on Relative Value Distances) method to improve the objectivity, accuracy, and stability of decision results. LODECI is applied to determine criterion weights based on data distribution characteristics using logarithmic decomposition, reducing subjectivity in the weighting process. Subsequently, ERVD is utilized to evaluate and rank alternatives based on their relative distances to ideal and non-ideal solutions, enabling a more comprehensive assessment of each location. The research results show that the proposed integration effectively produces consistent and discriminative rankings, with Location F having a value of 0.9759 identified as the best alternative, followed by Location E with a value of 0.8461 and Location C with a value of 0.7882. Overall, the integration of LODECI and ERVD provides a robust decision-making framework that enhances reliability in selecting optimal retail store locations in complex and heterogeneous environments.

**Keywords:** Retail location selection; Multi-criteria decision making; LODECI method; ERVD method; Decision support system

## 1. INTRODUCING

Location selection is one of the most crucial factors in determining the success of a retail business because location directly affects visibility, accessibility, and the potential number of customers that can be reached. A strategic location, such as being in a crowded area, close to public facilities, or in a high-traffic area, tends to increase the chances of impulse purchases and repeat visits from consumers[1]. In addition, the suitability of the location with the target market is also an important aspect, because differences in demographic characteristics and purchasing power of people in a certain area can significantly impact sales performance. Choosing the right location can also provide a competitive advantage, especially in facing increasingly tough business competition, where proximity to consumers and ease of access become added values that are difficult for competitors to replicate. On the other hand, mistakes in determining the location can lead to low visitation rates, high operational costs that are not proportional to revenue, as well as difficulties in building brand awareness. Therefore, a comprehensive location analysis

that considers economic, social, and geographical factors becomes an important step that cannot be overlooked in retail business planning and development.

The complexity of multi-criteria decision-making in the retail business context arises from the many factors that must be considered simultaneously, such as operational costs, accessibility levels, demographic characteristics, and the intensity of competition from competitors[2], [3]. Each of these criteria has different levels of importance and influence, and they often conflict with each other; for example, a location with high accessibility tends to have higher rental costs. In addition, the data used can come in various scales and forms, both quantitative and qualitative, requiring proper normalization and weighting processes to be compared fairly[4], [5]. Uncertainty and the dynamics of the business environment, such as changes in consumer behavior or infrastructure developments, further increase the level of complexity in the decision-making process. Therefore, a systematic approach is required through a multi-criteria decision-making method that can integrate these various variables objectively and in a structured manner, thereby producing decisions that are more accurate, adaptive, and accountable.

The limitations of conventional approaches in handling conflicts between criteria lie in their tendency to be simple and less adaptive to the complexity of relationships between decision variables. Traditional methods generally use static weighting or linear assessments that assume each criterion is independent and can be directly combined, whereas in practice conflicts often arise, such as between low cost and high location quality or between accessibility and competition level[6], [7]. This approach is also less capable of accommodating uncertainty, ambiguity, and differences in data scale, so the decision results have the potential to be biased or not fully reflect the real conditions comprehensively. In addition, the involvement of subjectivity in determining weights without a strong validation mechanism can increase the risk of inconsistency in the final results. As a result, the decisions produced become less optimal, especially in situations that require a dynamic balance between conflicting criteria, thus necessitating a more sophisticated and flexible method to address these problems more accurately and representatively.

Decision Support Systems (DSS) play an important role in enhancing the objectivity of the decision-making process by providing a structured, systematic, and data-driven framework for evaluating various alternatives[8]–[10]. Through the integration of analytical methods, especially in multi-criteria approaches, DSS can reduce the dominance of individual subjectivity by replacing it with measurable and consistent calculations, such as weighting, normalization, and ranking of alternatives. In addition, DSS enables data processing in various forms and scales more accurately, allowing each criterion to be compared fairly without distortion. The capability of DSS to simulate different scenarios also adds value in testing the sensitivity of decisions to changes in weights or certain conditions, making the results obtained more robust and accountable.

The integration of Logarithmic Decomposition of Criteria Importance (LODECI) and Election based on Relative Value Distances (ERVD) methods represents a hybrid multi-criteria decision-making approach designed to enhance both the objectivity of weighting and the accuracy of alternative ranking. LODECI is utilized in the initial stage to derive criterion weights through a logarithmic decomposition mechanism that is sensitive to the distribution, variability, and informational content of the data, allowing for a more discriminative and data-driven weighting scheme[11]–[13]. These weights are then incorporated into the ERVD method, which evaluates alternatives based on their relative value distances to ideal and non-ideal solutions, enabling a more nuanced comparison that captures both proximity and divergence among alternatives[14], [15]. By combining these two approaches, the model effectively bridges the gap between objective weight determination and distance-based ranking, resulting in improved stability, reduced bias, and higher robustness against data fluctuations. This integration not only strengthens the

analytical foundation of the decision-making process but also provides a more comprehensive framework capable of handling complex, conflicting, and heterogeneous criteria in real-world applications.

Research gaps in the context of multi-criteria decision making indicate that there is still limited integration between objective weighting methods based on logarithms and ranking approaches that rely on the concept of relative distance between alternatives, so the potential combination of the advantages of both has not been optimally utilized to produce more accurate and adaptive evaluations. On one hand, logarithmic weighting methods are able to capture variations in information and data dispersion levels more sensitively, but they are often used separately without being directly linked to ranking mechanisms that consider the closeness of alternatives to the ideal solution. On the other hand, distance-based ranking models generally have not adequately accommodated sensitivity to the criterion data distribution, such as the presence of skewness or value imbalances, which can significantly affect the final results. As a result, there are still limitations in producing decision models that are truly representative of complex and dynamic data conditions, so the development of a hybrid approach is needed that can integrate objective-logarithmic weighting with distance-based evaluation mechanisms more comprehensively and responsively to the characteristics of the data distribution.

This research aims to develop a more accurate and adaptive multi-criteria decision-making model through the integration of the objective weighting method LODECI (logarithmic decomposition of criteria importance) with the ERVD ranking method (election based on relative value distances), thus capable of overcoming the limitations of conventional approaches in handling complexity and conflicts among criteria. The main contribution (novelty) of this research lies in the combination of a logarithmic decomposition-based approach that is sensitive to the distribution and variation of criteria data with an evaluation mechanism based on relative value distances that assesses the proximity of alternatives to the best solution more representatively. This integration is designed to improve the stability of decision outcomes through more objective weighting and to enhance the accuracy of ranking by comprehensively considering relative distances, so that the proposed model is not only capable of producing more consistent decisions, but also more responsive to data dynamics and changes in preferences in various decision-making contexts.

## 2. METHOD

The research stages in this study are arranged systematically to ensure that the decision-making process occurs in a structured, objective, and replicable manner. The initial stage begins with problem identification and determination of research objectives, followed by the establishment of criteria and the collection of alternative data relevant to the problem context. Next, the process of weighting the criteria is carried out using the LODECI method, which utilizes logarithmic decomposition to obtain weights that reflect the level of importance objectively based on data distribution. Once the weights are obtained, the next stage is the application of the ERVD method to evaluate and rank alternatives based on the concept of relative value distance to the ideal solution. The ranking results are then analyzed through a sensitivity test to examine the stability and consistency of the model against changes in weights or data. In the final stage, the entire research process is summarized in Figure 1, which illustrates the overall methodological flow, from data input to producing the final decision in the form of the best alternative, thereby providing a clear and comprehensive visualization of the proposed research framework.



Figure 1. Research Stage

The integration of the LODECI and ERVD methods is able to produce a multi-criteria decision-making model that is more objective, accurate, and stable. The weighting approach based on logarithmic decomposition allows for determining the importance level of criteria that is more sensitive to data distribution, thereby reducing subjective bias in the evaluation process. Meanwhile, the application of the relative value distances concept in the ERVD method provides more comprehensive analytical capabilities in comparing alternatives based on their proximity to the ideal solution. The combination of the two methods can improve the consistency of ranking results and provide decisions that are more representative of real conditions, making it suitable as a reliable approach in solving complex decision-making problems that involve many criteria.

### LODECI Method

The LODECI method is an objective weighting approach in multi-criteria decision-making designed to capture the level of importance of each criterion based on data distribution characteristics more sensitively. The main principle of this method lies in the use of logarithmic transformation to reduce the effect of extreme value dominance and extract variation information among the data, so that the resulting weights better reflect the actual contribution of each criterion. By utilizing logarithmic-based decomposition, LODECI is able to enhance discrimination among criteria and reduce the subjectivity that generally arises in manual weight determination.

The stages of the LODECI method begin with the preparation of a decision matrix containing the values of alternatives for each criterion, compiled using (1). Next, data normalization is carried out to equalize the scale between criteria so that they can be compared fairly, calculated using (2). After that, a logarithmic transformation is applied to the normalized data to identify the level of dispersion and the information contained in each criterion, calculated using (3). The next stage is the logarithmic decomposition process, which aims to calculate the relative contribution value of each criterion based on the variation of its data, calculated using (4). These contribution values are then accumulated and normalized again to produce the final weight of each criterion, calculated using (5). These weights are then used in the next stage of alternative evaluation in the decision-making method.

$$X = [x_{ij}]_{m \times n} \quad (1)$$

$$d_{ij} = \begin{cases} \frac{x_{ij}}{\max_j x_{ij}}; \text{benefit criteria} \\ 1 - \frac{x_{ij}}{\max_j x_{ij}}; \text{cost criteria} \end{cases} \quad (2)$$

$$SD_{ij} = \max\{|d_{ij} - d_r|\} r \neq i \quad (3)$$

$$LSD_j = \ln \left( 1 + \frac{\sum_{i=1}^m SD_{ij}}{m} \right) \quad (4)$$

$$w_j = \frac{LSD_j}{\sum_{j=1}^n LSD_j} \quad (5)$$

The LODECI method as an objective weighting approach is effective in improving the quality of multi-criteria decision-making processes. By utilizing logarithmic transformation and decomposition, this method is able to capture important information related to data variation and distribution more comprehensively, so that the resulting weights become more representative and minimally subject to bias. The advantage of LODECI lies in its ability to reduce the influence of extreme values while enhancing sensitivity to differences between criteria, which ultimately contributes to more stable and consistent evaluation results.

### ERVD Method

The ERVD method is a ranking approach in multi-criteria decision-making that evaluates alternatives based on their proximity to the ideal solution and distance from the non-ideal solution. The core of this method is the concept of relative value distance, where each alternative is assessed not only by the magnitude of its absolute value but also by its position compared to other alternatives in the decision space. Thus, ERVD is able to provide more representative ranking results because it considers the balance between closeness to the best condition and distance from the worst condition, making it suitable for situations with conflicting criteria and different scales.

The stages of the ERVD method begin with normalizing the decision matrix using equation (6), where each alternative value is divided by the total value of the same criterion to obtain the relative proportion value. Next, the reference value or the relative average of each criterion is calculated using equation (7) to obtain an evaluation reference point. The next stage is the transformation of the values into relative value functions using equations (8) and (9), which distinguishes the treatment between values above and below the reference point, taking into account the sensitivity parameter and penalty factor, thus obtaining partial utility values. After that, the distance of each alternative to the positive and negative ideal solutions is determined through equations (10) and (11), by calculating the weighted absolute difference between the best and worst values. In the final stage, the relative preference value is calculated using equation (12), which is the ratio of the distance to the negative solution to the total distance to both solutions, resulting in a final value used to rank the alternatives, where a higher value indicates a more optimal alternative.

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

$$\varphi_j = \frac{\mu_j}{\sum_{i=1}^m x_{ij}} \quad (7)$$

$$v_{ij} = \begin{cases} (r_{ij} - \varphi_j)^\alpha; & \text{if } r_{ij} > \varphi_j \\ -\lambda(\varphi_j - r_{ij})^\alpha; & \text{otherwise} \end{cases} \quad (8)$$

$$v_{ij} = \begin{cases} (\varphi_j - r_{ij})^\alpha; & \text{if } r_{ij} < \varphi_j \\ -\lambda(r_{ij} - \varphi_j)^\alpha; & \text{otherwise} \end{cases} \quad (9)$$

$$S_i^+ = \sum_{j=1}^n w_j * |v_{ij} - v_j^+| \quad (10)$$

$$S_i^- = \sum_{j=1}^n w_j * |v_{ij} - v_j^-| \quad (11)$$

$$\phi_i = \frac{S_i^-}{S_i^+ + S_i^-} \quad (12)$$

The ERVD method is a ranking approach that is effective in producing more accurate and representative decisions in a multi-criteria context. By relying on the concept of the relative value distance to ideal and non-ideal solutions, this method is able to capture the position of alternatives more comprehensively compared to conventional approaches that are only based on aggregate values. The advantage of ERVD lies in its ability to balance closeness to the best condition and distance from the worst condition, so that the ranking

results become more stable, rational, and sensitive to performance differences among alternatives.

### 3. RESULT AND DISCUSSIONS

The multi-criteria approach in selecting optimal retail store locations through the integration of LODECI and ERVD methods offers a robust and data-driven framework for addressing the complexity of location decisions. This approach leverages LODECI to generate objective and distribution-sensitive criterion weights, ensuring that the importance of each factor, such as cost, accessibility, demographics, and competition, is determined based on the inherent characteristics of the data rather than subjective judgment. These weights are then incorporated into the ERVD method, which evaluates and ranks potential locations by measuring their relative distances to ideal and non-ideal conditions, enabling a more nuanced and balanced assessment of each alternative. The integration of these methods enhances the accuracy, stability, and consistency of the decision-making process, particularly in scenarios involving conflicting criteria and heterogeneous data scales. As a result, the proposed approach provides a comprehensive solution that supports more rational and reliable retail location selection, ultimately contributing to improved business performance and strategic planning.

#### Problem Identification and Data Collection

Problem Identification is the initial stage that focuses on formulating the problem clearly and structurally in the context of multi-criteria decision making. At this stage, the main problem is identified, namely determining the most optimal retail location by considering various interrelated criteria such as cost, accessibility, demographics, and competition level. In addition, decision objectives are also established to ensure that the evaluation process carried out is aligned with the strategic business needs. This identification includes determining the alternative locations to be analyzed as well as setting up relevant criteria, so that it can represent the actual conditions and complexity of the problem faced.

Data Collection is the stage of gathering data aimed at obtaining accurate and relevant information regarding each alternative and criterion that has been determined. The data collected can be in the form of quantitative or qualitative data from various sources, such as field observations, statistical reports, or historical documentation. This process emphasizes the validity, consistency, and completeness of the data so that it can be used as a reliable basis for analysis in decision-making methods. The results of this stage are arranged in the form of a systematic decision matrix, where each value reflects the performance of the alternatives against each criterion, and overall is presented in Table 1 as a representation of the data collection results.

**Table 1.** Data Collection

<b>Alternative</b>	<b>C1 (Cost)</b>	<b>C2 (Access)</b>	<b>C3 (Demographics)</b>	<b>C4 (Competitors)</b>	<b>C5 (Potential)</b>
Location A	75	85	80	70	88
Location B	65	78	75	60	82
Location C	80	90	85	75	91
Location D	70	82	78	68	85
Location E	60	76	72	65	80
Location F	85	88	90	78	93
Location G	68	80	77	66	84
Location H	72	83	79	69	86

The data in Table 1 are the results of data collection used as a basis in the multi-criteria decision-making process for selecting a retail location. This dataset consists of eight location alternatives, namely Location A to Location H, which are evaluated based on five main criteria, including C1 (Cost), C2 (Access), C3 (Demographics), C4 (Competitors), and C5 (Potential). Each value in the table represents the performance level of each location against the specified criteria, where a higher value indicates a better condition for benefit criteria, while for cost criteria it indicates the level of cost that must be considered in the evaluation.

### Criteria Weighting Using LODECI Method

Criteria weighting using the LODECI method represents an objective approach to determining the relative importance of each criterion based on the intrinsic characteristics of the data. By incorporating logarithmic transformation, this method is able to capture variations in data distribution while reducing the dominance of extreme values, resulting in a more balanced and representative weighting scheme. The decomposition mechanism further enables the extraction of informational contributions from each criterion, allowing differences in variability to be translated into meaningful weight values. As a result, the weights produced by LODECI are more sensitive, consistent, and less influenced by subjective judgment, making them highly suitable for complex decision-making environments involving heterogeneous and conflicting criteria. These objective weights play a crucial role in ensuring that subsequent evaluation and ranking processes are grounded in reliable and data-driven importance measures.

The preparation of the decision matrix is the initial stage in the LODECI method, which aims to represent alternative data for each criterion in a structured matrix form, so that all the information required in the decision-making process can be systematically arranged and ready to be further analyzed using (1), the decision matrix results are as follows.

$$X = \begin{bmatrix} 75 & 85 & 80 & 70 & 88 \\ 65 & 78 & 75 & 60 & 82 \\ 80 & 90 & 85 & 75 & 91 \\ 70 & 82 & 78 & 68 & 85 \\ 60 & 76 & 73 & 65 & 80 \\ 85 & 88 & 90 & 78 & 93 \\ 68 & 80 & 77 & 66 & 84 \\ 72 & 83 & 79 & 69 & 86 \end{bmatrix}$$

Data normalization is carried out to equalize the value scale among different criteria, so that each criterion can be compared fairly without dominance due to differences in units or value ranges, with calculations using equation (2), the normalization results are shown in Table 2.

**Table 2.** Normalization Result

Alternative	C1	C2	C3	C4	C5
Location A	0.1176	0.0556	0.8889	0.8974	0.9462
Location B	0.2353	0.1333	0.8333	0.7692	0.8817
Location C	0.0588	0.0000	0.9444	0.9615	0.9785
Location D	0.1765	0.0889	0.8667	0.8718	0.9140
Location E	0.2941	0.1556	0.8000	0.8333	0.8602
Location F	0.0000	0.0222	1.0000	1.0000	1.0000
Location G	0.2000	0.1111	0.8556	0.8462	0.9032
Location H	0.1529	0.0778	0.8778	0.8846	0.9247

Logarithmic transformation is applied to normalized data to identify the level of dispersion and information content in each criterion, thereby being able to increase sensitivity to data variations while reducing the influence of extreme values, as calculated in equation (3), the results of the logarithmic transformation are shown in Table 3.

**Table 3.** Logarithmic Transformation Result

Alternative	C1	C2	C3	C4	C5
Location A	0.0368	0.0250	0.0056	0.0144	0.0202
Location B	0.0809	0.0528	0.0500	0.1138	0.0444
Location C	0.0956	0.0806	0.0611	0.0785	0.0524
Location D	0.0221	0.0083	0.0167	0.0112	0.0121
Location E	0.1397	0.0750	0.0833	0.0497	0.0659
Location F	0.1544	0.0583	0.1167	0.1170	0.0739
Location G	0.0456	0.0306	0.0278	0.0369	0.0228
Location H	0.0015	0.0028	0.0056	0.0016	0.0013

Logarithmic decomposition is a stage aimed at calculating the relative contribution of each criterion based on the level of variation in the data, so that an overview is obtained regarding how significant the role of each criterion is in the decision-making process. Using equation (4), the results of the logarithmic decomposition are presented in Table 4.

**Table 4.** Logarithmic Decomposition Result

C1	C2	C3	C4	C5
0.0696	0.0408	0.0448	0.0515	0.0360

The final accumulation and normalization are carried out to convert the contribution values into proportional criterion weights, so that the total weight becomes standardized and can be used as a basis in the next alternative evaluation stage, as calculated in equation (5). The criterion weight results are presented in Table 5.

**Table 5.** Criteria Weight Result

C1	C2	C3	C4	C5
0.2867	0.1682	0.1846	0.2123	0.1482

The results of the criteria weighting indicate that each factor has a different level of importance in the retail location decision-making process. Criterion C1 (Cost) obtained the highest weight of 0.2867, indicating that the cost aspect has the most dominant influence in determining the best alternative. Next, C4 (Competitors) with a weight of 0.2123 and C3 (Demographics) at 0.1846 indicate that the competitive conditions and population characteristics also play a fairly significant role in location evaluation. Meanwhile, C2 (Access) with a value of 0.1682 and C5 (Potential) at 0.1482 make a lower contribution compared to the other criteria, although they remain important in supporting the final decision. Overall, this weight distribution reflects the priority of the cost factor as the main consideration, followed by competition and demographics, and accessibility and market potential as supporting factors in determining the optimal retail location.

### Implementation of the ERVD Method

Implementation of the ERVD method is carried out by evaluating each alternative based on its relative position against reference conditions derived from the decision space. In this process, normalized decision values are first transformed into relative proportions to ensure comparability across criteria, followed by the determination of a reference value

that represents the central tendency of each criterion. These values are then converted into utility scores that reflect whether an alternative performs above or below the reference benchmark, allowing the method to capture both positive and negative deviations in a balanced manner. The concept of relative value distance is subsequently applied to measure how far each alternative is from the ideal and non-ideal solutions, producing a weighted distance-based evaluation. The final output of this implementation is a preference value for each alternative, which integrates all distance components into a single measure that can be used for ranking. This approach ensures that the decision-making process is not only based on absolute performance, but also on relative competitiveness among alternatives, resulting in a more robust and discriminative evaluation outcome.

Normalization of the decision matrix is carried out to convert the original values of each alternative into relative proportion values by dividing each value by the total value in the same criterion, so that all data are on a uniform scale and can be compared fairly using equation (6), the normalization results are shown in Table 6.

**Table 6.** Normalization Result

Alternative	C1	C2	C3	C4	C5
Location A	0.1304	0.1284	0.1258	0.1270	0.1277
Location B	0.1130	0.1178	0.1179	0.1089	0.1190
Location C	0.1391	0.1360	0.1336	0.1361	0.1321
Location D	0.1217	0.1239	0.1226	0.1234	0.1234
Location E	0.1043	0.1148	0.1132	0.1180	0.1161
Location F	0.1478	0.1329	0.1415	0.1416	0.1350
Location G	0.1183	0.1208	0.1211	0.1198	0.1219
Location H	0.1252	0.1254	0.1242	0.1252	0.1248

The calculation of reference values is carried out by determining the relative average of each criterion as a reference point for evaluation, which represents the standard condition or the center of data distribution in the assessment process, using equation (7), the reference value results are presented in Table 7.

**Table 7.** Reference Value Result

C1	C2	C3	C4	C5
0.1250	0.1250	0.1250	0.1250	0.1250

The transformation of relative values is carried out by converting the normalized values into a utility function that distinguishes between values above and below the reference point, taking into account sensitivity parameters and penalty factors to more adaptively reflect the level of preference, as calculated in equations (8) and (9). The results of the relative value transformation are presented in Table 8.

**Table 8.** Relative Value Result

Alternative	C1	C2	C3	C4	C5
Location A	0.0737	0.0583	0.0280	0.0452	0.0522
Location B	0.1093	0.0847	0.0841	0.1269	0.0774
Location C	0.1189	0.1047	0.0930	0.1054	0.0841
Location D	0.0571	0.0337	0.0486	0.0398	0.0404
Location E	0.1437	0.1010	0.1086	0.0839	0.0943
Location F	0.1511	0.0891	0.1285	0.1287	0.0999
Location G	0.0821	0.0645	0.0627	0.0722	0.0555
Location H	0.0147	0.0194	0.0280	0.0151	0.0135

The calculation of the distance to the ideal and non-ideal solutions is carried out to measure how far each alternative is from the best and worst conditions by using weighted absolute differences, thus providing an overview of the relative position of alternatives in the decision space, according to equations (10) and (11). The results of the distance to the ideal and non-ideal solutions are presented in Table 9.

**Table 9.** Ideal and Non-Ideal Value Result

<b>Alternative</b>	<b>Ideal</b>	<b>Non-Ideal</b>
Location A	0.0733	0.0356
Location B	0.0272	0.0817
Location C	0.0231	0.0858
Location D	0.0813	0.0276
Location E	0.0168	0.0921
Location F	0.0026	0.1063
Location G	0.0572	0.0516
Location H	0.1089	0.0000

The calculation of relative preference values is carried out by combining both distances into a single ratio that indicates the level of closeness of alternatives to the ideal condition, where a higher value indicates a superior alternative, as formulated in equation (12), the results of the distances to the ideal and non-ideal solutions are shown in Table 10.

**Table 10.** Distance Value Result

<b>Alternative</b>	<b>Distance Value</b>
Location A	0.3267
Location B	0.7500
Location C	0.7882
Location D	0.2533
Location E	0.8461
Location F	0.9759
Location G	0.4743
Location H	0.0000

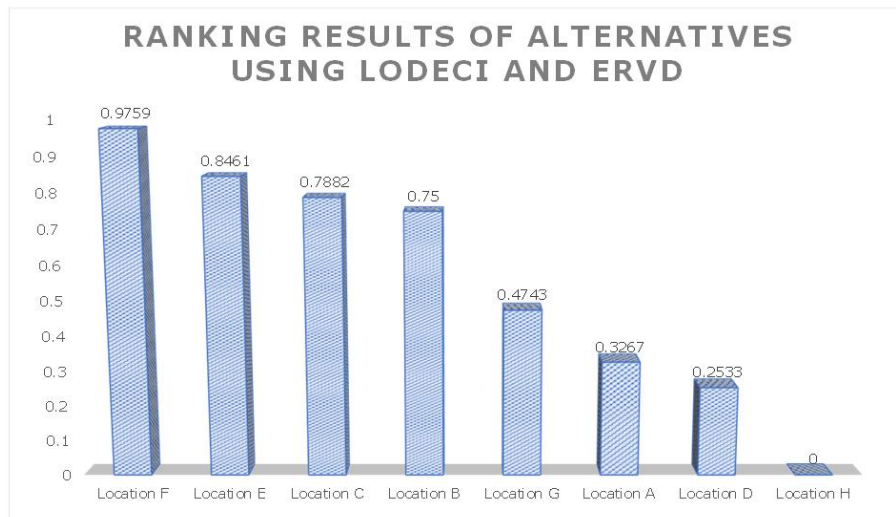
The ERVD method is a ranking approach that can provide more objective and representative evaluation results through the concept of the distance of values relative to ideal and non-ideal solutions. This method not only considers the absolute performance values of alternatives but also their relative positions within the overall decision space, thereby being able to produce clearer preference differences among alternatives. With its ability to capture variations and relationships between criterion values, ERVD makes an important contribution to improving the accuracy and consistency of decision-making results.

### Ranking Result

The ranking result is the final stage in the multi-criteria decision-making process, which aims to order all alternatives based on the preference values obtained from the previous calculations. At this stage, each alternative is quantitatively compared to determine its relative position, so it can be identified which alternative has the most optimal performance against all used criteria. This ranking result provides a clear overview of the feasibility level of each alternative, while also serving as the basis for making the final decision. Therefore,

the ranking result plays an important role in simplifying complex analysis results into information that is easier for decision-makers to understand and interpret.

The ranking results obtained from the combination of the LODECI and ERVD methods indicate that the integration of objective weighting based on logarithmic decomposition with ranking based on relative value distance is able to produce a sequence of alternatives that is more stable, accurate, and representative of multi-criteria data conditions. The criteria weights produced by LODECI provide a more objective basis for assessment, while ERVD plays a role in evaluating the closeness of each alternative to the ideal solution, resulting in clearer preference differences between locations. Overall, the final ranking results show that there is a best alternative with the highest preference value compared to other alternatives, reflecting an optimal balance across all criteria used in the study. The complete ranking results from the integration of these methods are presented in Figure 2 as the final representation of the decision-making process.



**Figure 2.** Alternative Ranking Results

The results of the alternative ranking using a combination of the LODECI and ERVD methods show that Location F received the highest score of 0.9759, making it the most optimal alternative compared to other locations, followed by Location E with a score of 0.8461 and Location C with 0.7882, which also show fairly good performance in meeting the evaluation criteria. Furthermore, Location B is in the middle position with a score of 0.75, while Location G and Location A obtained scores of 0.4743 and 0.3267 respectively, indicating lower feasibility levels. Meanwhile, Location D and Location H are at the bottom ranks with scores of 0.2533 and 0, respectively, indicating that these two locations are less compliant with the criteria established in the study. These results show that the LODECI and ERVD integration methods are able to produce a clear, structured ranking and can distinctly differentiate the feasibility level of each retail location alternative.

#### 4. CONCLUSION

This study successfully developed a multi-criteria decision-making approach for retail store location selection by integrating the LODECI and ERVD methods as a more objective, accurate, and stable solution in handling complex and conflicting criteria. The LODECI method plays an important role in generating criterion weights based on data distribution characteristics through a logarithmic decomposition approach, thereby reducing subjectivity in the weighting process and producing more representative criterion priorities.

Subsequently, the ERVD method contributes by evaluating and ranking alternatives based on the concept of relative distances to ideal and non-ideal solutions, resulting in a more discriminative assessment that reflects the relative position of each alternative within the decision space. The results show that Location F achieves the highest score as the best alternative, followed by Location E and Location C, indicating that the integration of both methods is capable of producing consistent and clearly differentiated rankings of location feasibility. Overall, the combination of LODECI and ERVD has proven effective in improving the quality of decision-making, particularly in retail location selection problems involving multiple heterogeneous criteria, making it a reliable approach for supporting data-driven strategic decisions.

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