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An Objective Sales Team Performance Assessment Model: Integrating Entropy Weighting and Multi-Attribute Utility Theory

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ABSTRACT

Evaluation of sales team performance is essential for measuring the effectiveness of marketing strategies and achieving corporate goals. The main problem in evaluating sales team performance lies in the high subjectivity of assessments, unclear performance indicators, and difficulties in determining objective and consistent criteria weights. This situation results in evaluation outcomes that are unstable and potentially lead to suboptimal managerial decisions. To address this, the study applies a hybrid approach combining Entropy weighting and Multi-Attribute Utility Theory (MAUT). Entropy objectively derives criterion weights from data variability, while MAUT systematically transforms performance scores into utility values, enabling more consistent comparisons than traditional assessment methods. The research results show that the proposed model produces stable and quantitatively consistent rankings, with a utility score range between 0 and 1.0048 reflecting measurable performance differentiation among teams. Team G achieved the highest score of 1.0048, while Team D scored 0, indicating a significant performance gap. Compared to conventional methods, which tend to yield more homogeneous values, this hybrid approach is more effective in minimizing bias, enhancing discriminative power, and strengthening the reliability of managerial decision-making. This research makes a significant contribution to the development of scientific knowledge by presenting an innovation in the form of integrating the Entropy and MAUT methods in the context of sales team performance evaluation that is more objective, systematic, and data-based.

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INTRODUCTION

Sales team performance evaluation plays a crucial role in improving business effectiveness, as sales teams are spearheaded in generating revenue and maintaining customer loyalty(Simanullang & Susilawati, 2023; Yudhistira & Wahyudi, 2024). By conducting a systematic evaluation, companies can identify the team's strengths and weaknesses, so that they can take strategic steps to improve performance. Data-driven evaluations also help companies in determining realistic targets, providing the right training, and designing more effective marketing strategies. Additionally, by objectively assessing performance, companies can provide fair incentives and motivate sales teams to work more productively(Aldisa et al., 2022; Palupiningsih & Setiawansyah, 2024). Accurate performance assessments not only enhance operational efficiency but also support sustainable business growth in the face of increasingly intense competition. The main problem in evaluating sales team performance lies in the high level of subjectivity in the assessment process, the lack of clarity and ambiguity of the performance indicators used, and the difficulty in determining the weight of

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criteria objectively and consistently for each aspect of evaluation. This condition causes the performance measurement process to be unable to comprehensively and standardized represent the team's performance, making the evaluation results prone to instability, susceptible to assessor bias, and potentially leading to managerial decisions that are less accurate and not optimal in supporting the achievement of company goals. Many companies still use traditional methods that only focus on sales target achievements, without considering other important factors. This has the potential to create bias in assessments, reduce work motivation, and hinder companies from identifying the strengths and weaknesses of each sales team member. Therefore, a more systematic and multi-criteria-based approach is needed to produce fair, accurate performance assessments that can support strategic decision-making.

Determining the weight of criteria objectively and consistently in evaluating the performance of the sales team is a complex challenge because it involves various factors that influence each other(Hariyanto et al., 2025). One of the main challenges is the difference in importance between the criteria, where some aspects such as the number of sales may be considered more important than customer satisfaction or the effectiveness of communication, depending on the company's strategy. However, without the right method, this weighting can be subjective and susceptible to managerial bias. In addition, the variability of performance data is an obstacle in determining accurate weights(Handoko, 2024). Sales data, customer satisfaction levels, or negotiation effectiveness can vary greatly between individuals and specific time periods, making it difficult to assign a weight that remains relevant under different conditions. Another obstacle is consistency in the weighting process, especially if it is done manually or based on intuition. Without a robust quantitative method, the weight given to an evaluation period can differ from another, leading to inconsistencies in the team's performance assessment. Therefore, a data-driven approach is required, such as the Entropy method, which objectively determines criterion weights based on the level of information variation within the data, along with the Multi-Attribute Utility Theory (MAUT) method to incorporate these weights into a more structured and precise decision-making process.

The implementation of the Entropy–MAUT hybrid approach in evaluating sales team performance is intended to enhance objectivity and accuracy in the assessment process. The Entropy method is applied to objectively calculate criterion weights based on the level of data variation, thereby minimizing subjectivity in determining the importance of each evaluation aspect(Aditia Yudhistira et al., 2024; Dua et al., 2024; Zeng et al., 2023). Meanwhile, the MAUT method enables the computation of each team member’s utility score based on the derived weights, leading to a more precise and equitable performance evaluation. The implementation process starts with identifying the assessment criteria, followed by collecting the team’s performance data, which is then analyzed using the Entropy method to determine the weight of each criterion according to the distribution of available information. These weights are subsequently incorporated into the MAUT method to calculate each team member’s utility value, considering the preferences and influence of every criterion on the final result.

The application of the Entropy–MAUT hybrid approach in assessing sales team performance is intended to enhance objectivity and precision in the evaluation process. The Entropy method is employed to objectively assign criterion weights according to the extent of data variation, thereby reducing subjectivity in defining the importance of each assessment component. Meanwhile, the MAUT method facilitates the calculation of each team member’s utility score based on the established weights, producing a more accurate and equitable performance appraisal. The process of applying this method begins with the identification of assessment criteria, after which, the team's performance data is collected and processed using the Entropy method to calculate the weight of each criterion based on the distribution of existing information. These weights are subsequently applied in the MAUT method to determine the utility value of each team member, taking into account the preferences and impact of each criterion on the final outcome(Campos & Moreira, 2022; Saputra et al., 2024; Setiawansyah et al., 2023). One of its key strengths lies in its capacity to objectively assign criterion weights through the Entropy method, which evaluates the degree of data variation to minimize subjectivity in the weighting process. As a result, the derived weights genuinely represent the importance of each criterion based on actual data. Furthermore, the MAUT method enables the computation of the utility value for each alternative using the established weights, producing a more precise ranking compared to conventional approaches that depend solely on simple aggregation. Another advantage is the flexibility in considering the preferences of decision-makers, where this method not only relies on objective weight but also adjusts to the specific needs of the organization. Additionally, this approach ensures consistency in the evaluation as weights and utility values are calculated systematically, avoiding subjective changes that could interfere with the accuracy of the results. This hybrid method also improves efficiency and scalability in decision-making, as it can be applied to a variety of evaluation scenarios without requiring excessive manual intervention. By combining the advantages of objective methods and a multi-criteria approach, the Entropy-MAUT hybrid is an effective solution in supporting more transparent and accurate data-driven decision-making.

Previous research related to this was conducted by Putra (2022) where the MAUT method was used for the appointment of daily employees to permanent employees and provided recommendations for decision-makers to determine which daily employees are eligible to be promoted to permanent employees (Putra et al., 2022). Previous research related to this was conducted by Sari (2025) using the MAUT method, which assists in the process of selecting the best employees based on criteria such as attendance, discipline, productivity, work ethic, and initiative. The results of the MAUT-based decision support system have proven to be well received and effective in supporting the decision-making process in the corporate environment(Loevita Yulian Sari et al., 2025). Previous research related to this was conducted by Rizki (2025), where the MAUT method algorithm was used for the calculation process, which can be effectively carried out to obtain competent employees through the process of hiring intern employees. The results obtained from the calculations using the MAUT method can be used as recommendations by the relevant parties to support the process of hiring intern employees. Previous research has only focused on the final evaluation results without paying attention to the systematic criteria weighting process. Most studies use a subjective approach determined by managers or experts, which could potentially create bias in the evaluation results. The lack of an objective weighting mechanism makes the assessment results less accurate and difficult to compare across studies or organizations. To address this challenge, this study proposes a new approach that combines Entropy as a data-driven weighting mechanism and MAUT as a utility aggregation method, aiming to reduce subjectivity and enhance the discriminative power among alternatives.

This study aims to develop and implement a hybrid model that integrates Entropy weighting and the MAUT method in evaluating sales team performance to enhance objectivity and accuracy in decision-making. The proposed approach seeks to address the limitations of subjective weighting by applying Entropy as an objective technique to determine the relative importance of each criterion, while MAUT is utilized to assess and rank alternatives based on utility preferences. Through this research, it is expected to provide a more transparent, equitable, and effective evaluation framework for identifying top-performing employees and supporting strategies to improve overall sales team productivity.

RESEARCH METHOD

1. Research Stages

   The research stage consists of a structured sequence of steps undertaken to identify, examine, and address a problem within a scientific investigation (Darmowiyono et al., 2021; MARUF & ÖZDEMİR, 2024; Tešić et al., 2022). This stage includes problem formulation, data collection, application of appropriate methods or models, and preparation of conclusions and recommendations. The phases of the study conducted are illustrated in Figure 1.

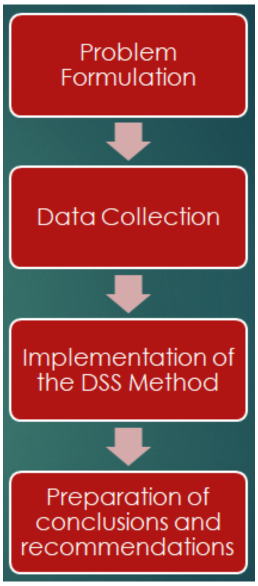

Figure 1. Research Stages

The research stage in Sales Team Performance Assessment in figure 1 begins with Problem Formulation, where the researcher identifies challenges in the sales team's performance evaluation system, such as subjectivity in weighting criteria and lack of methods capable of providing objective and accurate assessments. This problem was formulated to establish the research objective, which is to develop a more effective hybrid approach in assessing the performance of team members based on various relevant criteria, such as the number of sales, customer satisfaction, timeliness, and communication skills.

Once the problem is formulated, the next stage is Data Collection, where data related to the sales team's performance is obtained from various sources, including sales reports, customer feedback, and evaluations from managers. This data must reflect the key performance indicators that have been established in order to provide representative and accurate results. Subsequently, the study proceeds to the Appropriate Method or Model Implementation stage, in which the Entropy method is utilized to calculate the objective weight of each criterion according to the degree of data variation, while the MAUT method is employed to transform performance scores into utility scales and rank team members in a more transparent and equitable manner.

After the method is applied and the results are obtained, the research is concluded with the Preparation of Conclusions and Recommendations. At this stage, the results of the analysis are evaluated to assess the effectiveness of the approach used in providing a more accurate and objective assessment. The resulting conclusions will answer the problems that have been formulated beforehand, while recommendations are given to assist management in improving the performance appraisal system and designing a more optimal sales team development strategy.

2. Entropy Method

The Entropy method is an objective weighting technique in multi-criteria decision-making (MCDM) that determines the relative importance of each criterion by analyzing the degree of information variation within the data(Fan et al., 2023; Magableh, 2024; Yuan et al., 2024). The main principle of this method is that the greater the difference or variation in the value of a criterion among the alternatives evaluated, the higher the weight of importance. Conversely, if the value of a criterion is almost uniform for all alternatives, then it carries less weight because it contributes less to distinguishing alternatives(Gezen Ucar, 2024; Kizielewicz & Sałabun, 2024).

A decision matrix is a tabular representation that displays the performance values of each alternative according to predetermined criteria within a decision-making process. Each row corresponds to an evaluated alternative, while each column represents a specific criterion. This matrix serves as the foundation for weighting computations and performance analysis in MCDM methods.

$$X = \begin{bmatrix} x_{11} & \cdots & x_{1n} \\ \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{mn} \end{bmatrix} \quad (1)$$

Matrix X represents a decision matrix consisting of m alternatives and n criteria, where each element x_{ij} denotes the performance value of the i^th^ alternative with respect to the j^th^ criterion.

Matrix normalization is the procedure of transforming the values in a decision matrix into a consistent scale, typically within the range of 0 to 1. This step is intended to standardize different criteria so that none becomes disproportionately influential due to differences in measurement units. In the Entropy method, normalization is performed by dividing each matrix element by the total value of its corresponding criterion column.

$$k_{ij} = \frac{x_{ij}}{\sum_{j=1}^{n} x_{ij}} \quad (2)$$

The k_{ij} symbol represents the normalized value for the i^{th} alternative on the j^{th} criterion.

The entropy value represents the degree of uncertainty or variability within a criterion's data. The greater the variation among alternative values for a given criterion, the more information it provides, resulting in a lower entropy value. Conversely, if the alternative values are nearly identical, the entropy approaches its maximum level, indicating that the criterion offers limited information for differentiating among alternatives.

$$E_j = -\frac{1}{\ln m} \sum_{i=1}^{n} k_{ij} \ln(k_{ij}) \quad (3)$$

The symbol E_j represents the entropy value for the j^{th} criterion, ln is the natural logarithm.

Dispersion value is a measure used to calculate how significant a criterion is in influencing decision-making. This value is derived from the difference between the maximum entropy value (1) and the computed entropy value. The greater the dispersion measure of a criterion, the more significant its contribution to the decision-making process, as it shows that the criterion has a greater variation in value between alternatives.

$$D_j = 1 - E_j \quad (4)$$

The symbol D_j represents the criterion dispersion value in the entropy method.

The criterion weight represents a numerical value that reflects the relative importance of a criterion in the decision-making process. In the Entropy method, these weights are derived from the dispersion values, where each criterion's weight is calculated by dividing its dispersion value by the total dispersion of all criteria. A higher weight signifies that the criterion has a greater impact on the evaluation process.

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

The symbol w_j represents the criterion weight value in the entropy method.

The weights generated from the Entropy method are considered more transparent and fairs because they are determined mathematically based on the variation of actual data, rather than from the subjective preferences of decision-makers. This process ensures that each criterion receives a weight corresponding to the level of information contained within it, thereby reducing the potential for individual or organizational bias. Thus, the Entropy method is capable of providing an objective basis for determining criterion weights, making performance evaluation results more reliable, consistent, and supporting accurate decision-making.

3. MAUT Method

The MAUT method is a technique within MCDM used to assess and select the best alternatives based on multiple criteria. MAUT operates by transforming each criterion value into a utility scale, enabling direct comparison across criteria. This approach is well-suited for decision-making contexts because it incorporates the decision-maker's preferences for each criterion.

A decision matrix is a tabular representation that displays the value of each alternative according to predetermined criteria within a decision-making process. Each row represents an evaluated alternative, while each column corresponds to a specific criterion. This matrix serves as the foundation for weighting calculations and performance analysis in MCDM methods, as expressed in equation (1).

Matrix normalization refers to the process of transforming the values in a decision matrix into a standardized scale, typically within the range of 0 to 1. This process aims to equalize the scale of various criteria so that no one criterion is more dominant just because of the difference in units of measurement.

$$r_{ij}^{*} = 1 + \frac{\min x_{ij} - x_{ij}}{\max x_{ij} - \min x_{ij}} \quad (6)$$

$$r_{ij}^{*} = \frac{x_{ij} - \min x_{ij}}{\max x_{ij} - \min x_{ij}} \quad (7)$$

The symbol r_{ij}^{*} represents the normalized value for the i^{th} alternative on the j^{th} criterion; min x_{ij} is the minimum value of all alternatives on the j^{th} criterion; max x_{ij} is the maximum value of all alternatives on the j^{th} criterion;

The utility value in the MAUT method is a measure that shows the level of preference of an alternative based on all the criteria that have been normalized.

$$u_{ij} = \frac{e\left(\left(r_{ij}^{*}\right)^{2}\right) - 1}{1.71} \quad (8)$$

The symbol u_{ij} represents the utility value of the i^{th} alternative on the j^{th} criterion.

The utility end value is the end result obtained after all alternatives are calculated using the utility value formula with and weighted. This final score establishes the ranking of the alternatives, with the one obtaining the highest utility value regarded as the best choice.

$$u_{(x)} = \sum_{j=1}^{n} u_{ij} * w_j \quad (9)$$

The symbol $u_{(x)}$) represents the total utility value for the i^{th} alternative, w_j represents the weight of the j^{th} criterion.

In the MAUT method, utility values are calculated for each alternative based on the normalization of the value and weight of the criteria. The utility's final value is the highest value of all the alternatives that indicate the best option. The higher the utility value, the better the alternative will be at meeting the given criteria.

RESULTS AND DISCUSSION

The hybrid application of Entropy and MAUT weighting in evaluating sales team performance integrates the strengths of both methods to enhance objectivity and precision in decision-making. The Entropy method is employed to objectively assign criterion weights based on the level of data variation, thereby minimizing subjective bias in the weighting process. Subsequently, the MAUT method is utilized to compute the utility value of each alternative using normalized performance scores, which are then multiplied by the criterion weights derived from the Entropy method. This combined approach produces a more accurate ranking of sales team performance by considering all relevant factors. Overall, the Entropy–MAUT hybrid weighting model offers a more transparent, equitable, and dependable evaluation framework to support strategic decision-making within the organization.

1. Problem Formulation

   The performance assessment of the sales team is a crucial aspect in determining the effectiveness of the marketing strategy and the achievement of the company's targets. However, in practice, the evaluation process often faces various challenges, such as subjectivity in weighting criteria, imbalances in assessment, and difficulty integrating various performance indicators fairly and objectively. Some companies still use conventional methods that do not systematically consider the importance of each criterion, resulting in less accurate decisions. Therefore, a more structured approach is needed by combining objective methods such as Entropy in weighting criteria and MAUT in alternative rankings. With this combination, it is hoped that a more fair, transparent, and data-based performance appraisal system can be obtained, thereby helping companies identify the best performing sales team members and develop more effective performance improvement strategies.
2. Data Collection

   Data collection is an important stage in the performance assessment of a sales team, where information related to various aspects of performance is collected for further analysis. The data collected includes a variety of relevant criteria, such as sales count (A-1), customer satisfaction (B-2), report timeliness (C-3), individual productivity (D-4), and customer retention rates (E-5). Data sources come from internal company reports, customer satisfaction surveys, and direct evaluations from sales managers. Additionally, to ensure objectivity, data is collected from various time periods to avoid bias due to seasonal factors or specific market conditions. Table 1 is the assessment data on the performance of the sales team obtained.

Table 1. Assessment Data

Score	A-1	B-2	C-3	D-4	E-5
Tim A	250	8.5	95	8.2	90
Tim B	230	7.8	92	7.5	85
Tim C	270	9.2	98	8.7	92
Tim D	210	7.5	89	7.2	80
Tim E	260	8.8	96	8.5	91
Tim F	220	7.9	90	7.8	83
Tim G	280	9.5	99	9	94
Tim H	240	8.2	93	8	88

The data used in table 1 is data on the performance assessment of the sales team obtained directly from the company's internal sources that reflect the performance of each team objectively. Information regarding sales amounts is taken from monthly or annual sales reports recorded in the Sales Management System or the company's financial statements. Customer satisfaction is obtained through surveys collected from customers, both in the form of questionnaires, reviews on digital platforms, and feedback recorded in Customer Relationship Management (CRM). Data on the timeliness of reports is collected from the company's internal reporting system which records the team's discipline in completing administrative tasks on time. In addition, the productivity of individuals in the team is assessed based on the effectiveness of the sales strategy and the number of successful transactions, which are usually recorded in a supervisory report or a company's performance appraisal system. Meanwhile, customer retention rates are measured based on the number of customers who remain subscribed or make repeat transactions, with data obtained from customer databases within the CRM.

3. Implementation of the Hybrid Method
   The implementation of the hybrid method of entropy weighting and MAUT was applied to evaluate the performance of the sales team objectively and systematically(Campos & Moreira, 2022; Lubis et al., 2024; Song et al., 2024; Sulistiani et al., 2023). The process of implementing this method consists of several main stages. The first process is to weighting criteria using the entropy method, which aims to determine the objective weight based on the variation of data from each criterion. This step includes normalizing the decision matrix, calculating the entropy value, calculating the dispersion value, and determining the final weight of each criterion. With this approach, the weight of the criteria is determined based on the level of uncertainty of the information contained in the assessment data.

A decision matrix is a representation of a table that presents the value of each alternative based on predetermined criteria in a decision-making process made using equation (1) based on the assessment in table 1.

$$X = \begin{bmatrix} 250 & 8.5 & 95 & 8.2 & 90 \\ 230 & 7.8 & 92 & 7.5 & 85 \\ 270 & 9.2 & 98 & 8.7 & 92 \\ 210 & 7.5 & 89 & 7.2 & 80 \\ 260 & 8.8 & 96 & 8.5 & 91 \\ 220 & 7.9 & 90 & 7.8 & 83 \\ 280 & 9.5 & 99 & 9 & 94 \\ 240 & 8.2 & 93 & 8 & 88 \end{bmatrix}$$

Matrix normalization is the process of converting the values in a decision matrix into a scale that is uniformly calculated using equation (2).

$$k_{11} = \frac{x_{11}}{\sum_{j=1}^{n} x_{11,18}} = \frac{250}{1960} = 0.1276$$

The complete results of the matrix normalization calculations using the Entropy method are presented in Table 2.

Table 2. Results of Normalization of the Entropy Method

Team	A-1	B-2	C-3	D-4	E-5
Tim A	0.1276	0.1261	0.1263	0.1263	0.1280
Tim B	0.1173	0.1157	0.1223	0.1156	0.1209
Tim C	0.1378	0.1365	0.1303	0.1341	0.1309
Tim D	0.1071	0.1113	0.1184	0.1109	0.1138
Tim E	0.1327	0.1306	0.1277	0.1310	0.1294
Tim F	0.1122	0.1172	0.1197	0.1202	0.1181
Tim G	0.1429	0.1409	0.1316	0.1387	0.1337
Tim H	0.1224	0.1217	0.1237	0.1233	0.1252

The entropy value is a measure of the level of uncertainty or diversity of data in a criterion. The greater the difference in alternative values in a criterion, the higher the information provided by that criterion, so that the entropy becomes smaller calculated using equation (3).

$$E_1 = -\frac{1}{\ln 8} \sum_{i=1}^{n} k_{11,18} \ln(k_{11,18}) = (-0.4809) * (-2.0751) = 0.9979$$

$$E_2 = -\frac{1}{\ln 8} \sum_{i=1}^{n} k_{21,28} \ln(k_{21,28}) = (-0.4809) * (-2.0764) = 0.9985$$

$$E_3 = -\frac{1}{\ln 8} \sum_{i=1}^{n} k_{31,38} \ln(k_{31,38}) = (-0.4809) * (-2.0788) = 0.9997$$

$$E_4 = -\frac{1}{\ln 8} \sum_{i=1}^{n} k_{41,48} \ln(k_{41,48}) = (-0.4809) * (-2.0770) = 0.9988$$

$$E_5 = -\frac{1}{\ln 8} \sum_{i=1}^{n} k_{51,58} \ln(k_{51,58}) = (-0.4809) * (-2.0781) = 0.9994$$

The dispersion value is a measure used to calculate how significant a criterion is in influencing decision-making calculated using equation (4).

$$D_1 = 1 - E_1 = 1 - 0.9979 = 0.0021$$

$$D_2 = 1 - E_2 = 1 - 0.9985 = 0.0015$$

$$D_3 = 1 - E_3 = 1 - 0.9997 = 0.0003$$

$$D_4 = 1 - E_4 = 1 - 0.9988 = 0.0012$$

$$D_5 = 1 - E_5 = 1 - 0.9994 = 0.0006$$

The value of the criterion weight is a number that shows the level of relative importance of a criterion in the decision-making process calculated using equation (5).

$$w_1 = \frac{D_1}{\sum_{j=1}^{n} D_{1,5}} = \frac{0.0021}{0.0057} = 0.3687$$

$$w_2 = \frac{D_2}{\sum_{j=1}^{n} D_{1,5}} = \frac{0.0015}{0.0057} = 0.2561$$

$$w_3 = \frac{D_3}{\sum_{j=1}^{n} D_{1,5}} = \frac{0.0003}{0.0057} = 0.0547$$

$$w_4 = \frac{D_4}{\sum_{j=1}^{n} D_{1,5}} = \frac{0.0012}{0.0057} = 0.2088$$

$$w_5 = \frac{D_5}{\sum_{j=1}^{n} D_{1,5}} = \frac{0.0006}{0.0057} = 0.1117$$

The result of the weight of the criteria calculated using this entropy method will be used in the MAUT method to assess the performance of the sales team.

The next stage, the MAUT method calculates the utility value of each team by multiplying the weight of the criteria by the performance value of each team, which has been normalized according to the preference scale. After that, the utility's final value is calculated, which is used as the basis for ranking sales teams based on their overall performance.

Matrix normalization is the process of converting the values in the decision matrix into a uniform scale calculated using equation (7) because all criteria are beneficial.

$$r_{11}^{*} = \frac{x_{11} - \min x_{11,18}}{\max x_{11,18} - \min x_{11,18}} = \frac{250-210}{280-210} = 0.5714$$

The overall results of the matrix normalization calculations using the MAUT method are presented in Table 3.

Table 3. Results of Normalization of the MAUT Method

Team	A-1	B-2	C-3	D-4	E-5
Tim A	0.5714	0.5000	0.6000	0.5556	0.7143
Tim B	0.2857	0.1500	0.3000	0.1667	0.3571
Tim C	0.8571	0.8500	0.9000	0.8333	0.8571
Tim D	0.0000	0.0000	0.0000	0.0000	0.0000
Tim E	0.7143	0.6500	0.7000	0.7222	0.7857
Tim F	0.1429	0.2000	0.1000	0.3333	0.2143
Tim G	1.0000	1.0000	1.0000	1.0000	1.0000
Tim H	0.4286	0.3500	0.4000	0.4444	0.5714

The utility value in the MAUT method is a measure that shows the level of preference of an alternative based on all normalized criteria calculated using equation (8).

$$u_{11} = \frac{e((r_{11}^{*})^2) - 1}{1.71} = \frac{e((0.5714)^2) - 1}{1.71} = \frac{0.3862}{1.71} = 0.2258$$

The overall results of the calculation of utility values in the MAUT method are shown in table 4.

Table 4. Utility Value Results of MAUT Method

Team	A-1	B-2	C-3	D-4	E-5
Tim A	0.2258	0.1661	0.2534	0.2114	0.3893
Tim B	0.0497	0.0133	0.0551	0.0165	0.0796
Tim C	0.6344	0.6196	0.7298	0.5863	0.6344
Tim D	0.0000	0.0000	0.0000	0.0000	0.0000
Tim E	0.3893	0.3075	0.3698	0.4004	0.4994
Tim F	0.0121	0.0239	0.0059	0.0687	0.0275
Tim G	1.0048	1.0048	1.0048	1.0048	1.0048
Tim H	0.1179	0.0762	0.1015	0.1277	0.2258

The utility end value is the final result obtained after all alternatives are calculated using the utility value formula with and weighted calculated using equation (9).

$$u_{(1)} = \sum_{j=1}^{n} u_{11,51} * w_{1,6} = 0.0833 + 0.0425 + 0.0139 + 0.0442 + 0.0435 = 0.2273$$

The complete results of the final utility value calculations in the MAUT method are presented in Table 5.

Table 5. Final Value Results of MAUT Method Utility

Team	Final Value
Tim A	0.2273
Tim B	0.0371
Tim C	0.6258
Tim D	0.0000
Tim E	0.3819
Tim F	0.0283
Tim G	1.0048
Tim H	0.1204

The results of the application of hybrid weighting of Entropy and MAUT in the performance assessment of the sales team show that this method is able to provide an objective and accurate evaluation based on the contribution of each team member to the company's achievements. The Entropy method is applied to objectively assign criterion weights based on the degree of data variation, thereby minimizing subjectivity in determining the importance of each criterion. Meanwhile, MAUT is utilized to transform performance scores into utility scales, enabling more systematic comparisons among team members. The analysis results indicate that integrating these two methods produces a more consistent and equitable evaluation of sales team performance, while simultaneously considering both quantitative and qualitative aspects.

4. Conclusions and Recommendations

   The findings of this study indicate that implementing a hybrid Entropy–MAUT weighting approach in evaluating sales team performance yields more objective and precise assessment outcomes. The Entropy method effectively assigns criterion weights based on the extent of data variation, thereby minimizing subjective bias in the evaluation process. Meanwhile, the MAUT method transforms performance scores into a structured utility scale, facilitating clearer comparisons among team members. The overall results demonstrate that integrating these two methods produces a more consistent and equitable performance ranking, with the final ranking results presented in Figure 2.

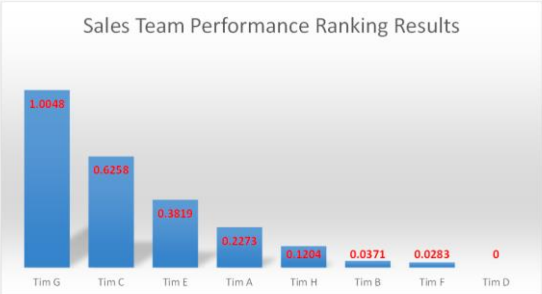

Figure 2. Sales Team Performance Ranking Results

Figure 2 illustrates the sales team performance rankings generated using the hybrid Entropy–MAUT method. Team G achieved the highest score of 1.0048, indicating superior performance compared to the other teams. Team C secured second place with a score of 0.6258, followed by Team E with 0.3819. Meanwhile, Team A and Team H occupied the middle positions, obtaining scores of 0.2273 and 0.1204, respectively. Team B and Team F recorded lower scores of 0.0371 and 0.0283. Team D received a score of 0, signifying the lowest performance level or failure to meet the established evaluation criteria. These findings reveal a considerable performance gap among the teams, suggesting that the company should consider implementing targeted performance improvement strategies for the lower-ranked teams.

Based on these results, it is advisable for companies to adopt the Entropy–MAUT hybrid approach within a periodic performance evaluation system to enhance transparency and accuracy in decision-making related to rewards and sales team development initiatives. Furthermore, organizations can integrate this method with technology-driven analytics systems to facilitate real-time performance monitoring and strengthen the overall effectiveness of human resource management.

CONCLUSION

The hybrid implementation of entropy weighting and MAUT in sales team performance assessment has proven to result in a more objective, structured, and accurate evaluation. The entropy method is used to determine the criterion weights based on the level of data variation, thereby reducing subjectivity in the assessment process. Meanwhile, the MAUT method converts performance values into a utility scale, allowing for clearer and fairer comparisons among teams. The sales team performance ranking results show a significant difference among teams, with Team G occupying the top position as the best-performing team, while Team D ranks the lowest. These findings indicate a clear performance gap based on the evaluation criteria applied. With the combination of these two methods, the company can make more accurate decisions in awarding, assigning training, or developing strategies to enhance the overall performance of the sales team. This research contributes by integrating the Entropy method and MAUT to produce a more objective and measurable evaluation of sales team performance. The Entropy method provides transparent and fair criterion weights, while MAUT transforms performance values into a utility scale that facilitates systematic comparison. This hybrid approach strengthens the MCDM literature while offering practical solutions for management in data-driven decision making. For future research, the proposed model can be extended by incorporating other objective weighting techniques or comparative MCDM methods, as well as testing its robustness across different organizational contexts and larger datasets to further validate its stability and generalizability.

REFERENCES

Aditia Yudhistira, Setiawansyah, Temi Ardiansah, Sufiatul Maryana, Yuli Yadin, & Risma Oktaviani. (2024). Development of Multi-Attribute Utility Theory Methods in Dynamic Decision Models Using Change-Data Driven. *Evergreen*, *11*(4), 3279–3289. https://doi.org/10.5109/7326962

Aldisa, R., Nugroho, F., Mesran, M., Sinaga, S. A., & Sussolaikah, K. (2022). Sistem Pendukung Keputusan Menentukan Sales Terbaik Menerapkan Metode Simple Additive Weighting (SAW). *Journal of Information System Research (JOSH)*, *3*(4 SE-Articles). https://doi.org/10.47065/josh.v3i4.1955

Campos, V. R., & Moreira, D. J. S. (2022). Risk assessment with multi-attribute utility theory for building projects. *Journal of Building Pathology and Rehabilitation*, *7*(1), 98. https://doi.org/10.1007/s41024-022-00241-7

Darmowiyono, M., Yuliyanto, W., Purnomo, K. I., Marlini, W., Pratiwi, H., Windarto, A. P., & Wijaya, H. O. L. (2021). Application of the Simple Multi Attribute Rating Technique (SMART) Method in the selection of thrush medicine products based on consumers. *Journal of Physics: Conference Series*, *1783*(1), 012015. https://doi.org/10.1088/1742-6596/1783/1/012015

Dua, T. Van, Duc, D. Van, Bao, N. C., & Trung, D. D. (2024). Integration of objective weighting methods for criteria and MCDM methods: application in material selection. *EUREKA: Physics and Engineering*, *2*, 131–148. https://doi.org/10.21303/2461-4262.2024.003171

Fan, L., Zhong, X., Chen, J., Tu, Y., & Jiang, J. (2023). Comprehensive Energy System Evaluation Method of Low-carbon Park Based on Improved Entropy Weight. *Journal of Physics: Conference Series*, *2418*(1), 012025. https://doi.org/10.1088/1742-6596/2418/1/012025

Gezen Ucar, M. (2024). Integrated entropy-based MCDM methods for investigating the effectiveness of Turkey's energy policies. *Energy Systems*, 1–30. https://doi.org/10.1007/s12667-024-00688-2

Handoko, D. (2024). Kombinasi Metode Pembobotan Entropy dan Grey Relational Analysis dalam Pemilihan Pelanggan Terbaik. *Jurnal Ilmiah Informatika Dan Ilmu Komputer (JIMA-ILKOM)*, *3*(2 SE-Articles), 70–79. https://doi.org/10.58602/jima-ilkom.v3i2.29

Hariyanto, H., Christian, A., Nurhayati, M. S., & Sudarsono, B. (2025). Modification of Multi-Attributive Border Approximation Area Comparison (MABAC) to Improve Multi-Criteria Assessment. *Jurnal Informatika Dan Rekayasa Perangkat Lunak*, *6*(1 SE-Articles), 50–60. https://doi.org/10.33365/jatika.v6i1.15

Kizielewicz, B., & Sałabun, W. (2024). SITW Method: A New Approach to Re-identifying Multi-criteria Weights in Complex Decision Analysis. *Spectrum of Mechanical Engineering and Operational Research*, *1*(1 SE-Articles), 215–226. https://doi.org/10.31181/smeor11202419

Loevita Yulian Sari, Dewi Sahara Nasution, Faiz Rafdhi, Nur Kumala Dewi, & Warno. (2025). Implementasi Sistem Pendukung Keputusan Dengan Metode Multi-Attribute Utility Theory Untuk Pemilihan Karyawan Terbaik Di PT Sharp Electronics Indonesia. *JUSIBI (Jurnal Sistem Informasi Dan E-Bisnis)*, *7*(2 SE-Articles), 46–51. https://doi.org/10.54650/jusibi.v7i2.602

Lubis, J. H., Mesran, M., & Siregar, C. A. (2024). The Decision Support System for Cashier Recruitment Implements the Multi-Attribute Utility Theory Method. *Building of Informatics, Technology and Science (BITS)*, *6*(1), 257–264. https://doi.org/10.47065/bits.v6i1.5352

Magableh, G. M. (2024). An integrated model for rice supplier selection strategies and a comparative analysis of fuzzy multicriteria decision-making approaches based on the fuzzy entropy weight method for evaluating rice suppliers. *PLOS ONE*, *19*(4), e0301930. https://doi.org/10.1371/journal.pone.0301930

MARUF, M., & ÖZDEMİR, K. (2024). Ranking of Tourism Web Sites According to Service Performance Criteria with CRITIC and MAIRCA Methods: The Case of Turkey. *Uluslararası Yönetim Akademisi Dergisi*, *6*(4), 1108–1117. https://doi.org/10.33712/mana.1352560

Palupiningsih, P., & Setiawansyah, S. (2024). Best Sales Selection Using a Combination of Reciprocal Rank Weighting Method and Multi-Attribute Utility Theory. *Journal of Computing and Informatics Research*, *3*(3), 242–250. https://doi.org/10.47065/comforch.v3i3.1496

Putra, D. W. T., Oktavia, I. S., Swara, G. Y., & Yulianti, E. (2022). Perancangan Sistem Pendukung Keputusan Menggunakan Metode Multi-Attribute Utility Theory (MAUT) Dalam Seleksi Pengangkatan Karyawan Tetap pada Dinas Pekerjaan Umum Kota Sawahlunto. *Jurnal Ilmiah ILKOMINFO - Ilmu Komputer & Informatika*, *5*(2), 53–59. https://doi.org/10.47324/ilkominfo.v5i2.147

Saputra, W., Wardana, S. A., Wahyuda, H., & Megawaty, D. A. (2024). Penerapan Kombinasi Metode Multi-Attribute Utility Theory (MAUT) dan Rank Sum Dalam Pemilihan Siswa Terbaik. *Journal of Information Technology, Software Engineering and Computer Science (ITSECS)*, *2*(1), 12–21. https://doi.org/10.58602/itsecs.v2i1.89

Setiawansyah, Sintaro, S., & Aldino, A. A. (2023). MCDM Using Multi-Attribute Utility Theory and PIPRECIA in Customer Loan Eligibility Recommendations. *Journal of Informatics, Electrical and Electronics Engineering*, *3*(2), 212–220. https://doi.org/10.47065/jieee.v3i2.1628

Simanullang, R. Y., & Susilawati, I. (2023). Seleksi Penerimaan Sales Marketing Dengan Menggunakan Pendekatan Metode Weighted Product Dalam Sistem Pendukung Keputusan. *JIKTEKS: Jurnal Ilmu Komputer Dan Teknologi Informasi*, *1*(3), 1–7. https://doi.org/10.46764/JITEKS.v1i3.12

Song, Y., Xiu, Y., Zhou, L., & Wang, J. (2024). Implementing multi-attribute utility theory in service recovery: An operational management perspective on online retailing. *Journal of Retailing and Consumer Services*, *81*, 103968. https://doi.org/https://doi.org/10.1016/j.jretconser.2024.103968

Sulistiani, H., Setiawansyah, Palupiningsih, P., Hamidy, F., Sari, P. L., & Khairunnisa, Y. (2023). Employee Performance Evaluation Using Multi-Attribute Utility Theory (MAUT) with PIPRECIA-S Weighting: A Case Study in Education Institution. *2023 International Conference on Informatics, Multimedia, Cyber and Informations System (ICIMCIS)*, 369–373. https://doi.org/10.1109/ICIMCIS60089.2023.10349017

Tešić, D., Radovanović, M., Božanić, D., Pamucar, D., Milić, A., & Puška, A. (2022). Modification of the DIBR and MABAC Methods by Applying Rough Numbers and Its Application in Making Decisions. *Information*, *13*(8), 353. https://doi.org/10.3390/info13080353

Yuan, H., Ma, X., Cheng, Z., & Kari, T. (2024). Dynamic Comprehensive Evaluation of a 660 MW Ultra-Supercritical Coal-Fired Unit Based on Improved Criteria Importance through Inter-Criteria Correlation and Entropy Weight Method. *Energies*, *17*(7), 1765. https://doi.org/10.3390/en17071765

Yudhistira, A., & Wahyudi, A. D. (2024). Penerapan Root Assessment Method dan Pembobotan ROC untuk Evaluasi Kinerja Tim Penjualan. *Jurnal Ilmiah Informatika Dan Ilmu Komputer (JIMA-ILKOM)*, *3*(2), 80–90. https://doi.org/10.58602/jima-ilkom.v3i2.30

Zeng, S., Chen, W., Gu, J., & Zhang, E. (2023). An Integrated EDAS Model for Fermatean Fuzzy Multi-Attribute Group Decision Making and Its Application in Green-Supplier Selection. In *Systems* (Vol. 11, Issue 3). https://doi.org/10.3390/systems11030162