MCDM Approach for Evaluating Salespeople in Traditional Markets: a Case Study in an Indonesian Grocery Store

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Abstract

In the current business activities characterized by technological integration, the role of salespeople remains crucial as the frontline in enhancing product sales. Due to their contribution, it is imperative for companies to evaluate their performance. This research proposes an evaluation model for salespersons using a multiple criteria decision-making (MCDM) approach. Two MCDM methods, namely fuzzy AHP and EDAS, are employed to determine the weight of evaluation criteria and rank 13 salespersons in a grocery store situated in an Indonesian traditional market. This study considers seven criteria: revenue (C_1), honesty (C_2), communication skills (C_3), empathy (C_4), extensive relationships (C_5), work motivation (C_6), and responsibility and discipline (C_7). Using fuzzy AHP, criteria C_2, C_6, and C_3 are identified as the main priority. Subsequently, the criteria weights are integrated into the EDAS calculation to rank the 13 salespersons. Salesman SP2, SP3, and SP6 emerge as the top performers. This research provides an applicable evaluation model for decision-makers in the store, enabling them to assess their salespeople not solely based on quantitative output but also considering other criteria that may have a lasting impact.

Keywords: *EDAS, evaluation performance, fuzzy AHP, salespeople*

Abstrak

Dalam aktivitas bisnis yang serba memanfaatkan teknologi saat ini, peran salesman tetap relevan sebagai garda terdepan untuk meningkatkan penjualan produk. Oleh karena pentingnya peran salesman, sangat penting sekali bagi perusahaan untuk mengevaluasi kinerja salesman. Penelitian ini mengusulkan suatu model evaluasi salesman dengan pendekatan *multiple criteria decision-making* (MCDM). Terdapat dua metode MCDM, yaitu fuzzy AHP dan EDAS untuk menentukan bobot kriteria penilaian dan merangking 13 salesman di toko grosir di suatu pasar tradisional di Indonesia. Di dalam studi ini, terdapat tujuh kriteria yang dipertimbangkan yaitu pendapatan (C_1), kejujuran (C_2), ketrampilan komunikasi (C_3), empati (C_4), relasi dan jejaring (C_5), motivasi (C_6), dan tanggungjawab – kedisiplinan (C_7). Dengan menggunakan fuzzy AHP, kriteria C_2, C_6, and C_3 merupakan kriteria dengan kelompok prioritas utama. Selanjutnya, bobot kriteria diintegrasikan ke perhitungan EDAS untuk merangking 13 salesman. Salesman SP2, SP3, and SP6 merupakan salesman dengan kinerja terbaik. Penelitian ini mampu memberikan model penilaian salesman yang aplikatif bagi pengambil keputusan di perusahaan sehingga mereka dapat menilai salesman tidak hanya dari aspek hasil kuantitatif, melainkan kriteria-kriteria lain yang mungkin memberikan efek jangka panjang.

Kata kunci: *EDAS, evaluasi kinerja, fuzzy AHP, salesman*

INTRODUCTION

In today's competitive business, salespeople are still considered relevant as the front line for promoting and increasing product sales. They directly contribute to boosting product sales since they can provide information and influencing consumers to purchase the offered products (Sekianti & Saepullah, 2023). However, the presence of salesmen in a company may not necessarily guarantee the expected results due to under-performed salesmen (Arjun Nainggolan et al., 2022). Consequently, the evaluation of salesmen's performance is crucial so that business owners can market their products more effectively and efficiently. This study aims to evaluate the performance of salespersons in a grocery store situated in an Indonesian traditional market. This case study was selected since the store has been relying

on a number of salespeople to sell its product to several community groups, especially during peak seasons. Meanwhile, in practice the business owner faces challenges due to non-performing salesmen.

To evaluate the performance of salespersons, the multiple criteria decision making (MCDM) is applicable to solve this issue. This method has been widely employed by previous researchers to assess performance in similar cases including new employee recruitment process, employee evaluation, as well as supplier ranking case. For instance, Kurniawan et al. (Kurniawan et al., n.d.), Sumarno et al. (Sumarno et al., 2021), and Haddad et al. (M. et al., n.d.) have applied MCDM to evaluate employee performance. Kurniawan et al. (Kurniawan et al., n.d.) developed the hybrid method BWM – Fuzzy TOPSIS to assess employees in a pipe fitting manufacturer in Yogyakarta. Sumarno et al. (Sumarno et al., 2021) and Haddad et al. (M. et al., n.d.) utilized the analytic hierarchy process (AHP) to evaluate the performance of personnel in the Ministry of Defense and the UST Coast Guard, respectively. Furthermore, several similar cases such as employee selection and new personnel recruitment have also been undertaken using various MCDM methods. The Fuzzy AHP method was employed by Zavadskas et al. (Zavadskas et al., 2020) to rank the best supplier for steel pipe. Another case proposed AHP to prioritize criteria in selection and recruitment decision-making in a manufacturing company (Fitriani, 2022). Meanwhile, POPOVIĆ (Popović, 2021) employed the combination between SWARA and CoCoSo to address personnel selection problem. Özgörmüş et al. (Özgörmüş et al., 2021) utilized a more complex hybrid MCDM method, namely Fuzzy Decision-Making Trial and Evaluation Laboratory (DEMATEL), Fuzzy Quality Function Deployment (QFD), and Fuzzy Grey Relationship Analysis (GRA) to develop a systematic approach for personnel selection issue in a textile company situated in Turkey. Somya and Wahyudi (Somya & Wahyudi, 2020) used the TOPSIS method to rank the alternatives in the employee recruitment case in an IT company.

With regard to salespersons evaluation problem, there were some papers which proposed different MCDM approaches. Setiawan and Yulistia (Setiawan, 2023) applied the TOPSIS method to determine the best employee who achieve the highest sales in a cement industry. Meanwhile, the simple additive weighting (SAW) has been utilized by Andiyani et al (Andiyani et al., 2022) to provide a recommendation for the best salesman demonstrated in a digital printing company. By using multiple criteria decision-making (MCDM) method, this study evaluates the performance of salespersons in a grocery store situated in a traditional market in Indonesia employing the fuzzy AHP and distance from average solution (EDAS). The fuzzy AHP method is utilized to identify the evaluation criteria and to determine the criteria weights, while the EDAS method is used to rank the salesmen's performance. The former method is selected as it simplifies the decision-making process into a structured decision-making framework (Kurniawan et al., n.d.). In contrast to previous papers, the fuzzy numbers applied in this study overcome ambiguity especially in assessing DMs preference score. Furthermore, the AHP method has been proven to have extensive application in most MCDM problems (Li et al., 2023; Kesuma et al., 2021). Meanwhile, the EDAS method provides more stable and consistent rank computation considering different criteria weights. Additionally, EDAS is characterized by its simplicity in computation and faster calculations without compromising accuracy (Suriady et al., n.d.-a).

METHOD

To construct a salespersons evaluation model, there are three main stages: identifying assessment criteria, determining the weights of criteria, and assessing the salesmen as presented in figure 1. The determination of criteria weights and the assessment of salesmen are carried out using the fuzzy Analytic Hierarchy Process (AHP) and the Evaluation based on Distance from Average Solution (EDAS) methods, respectively. This salesman evaluation model is demonstrated in

a grocery store located in an Indonesian traditional market, involving owners and sales managers as decision-makers.

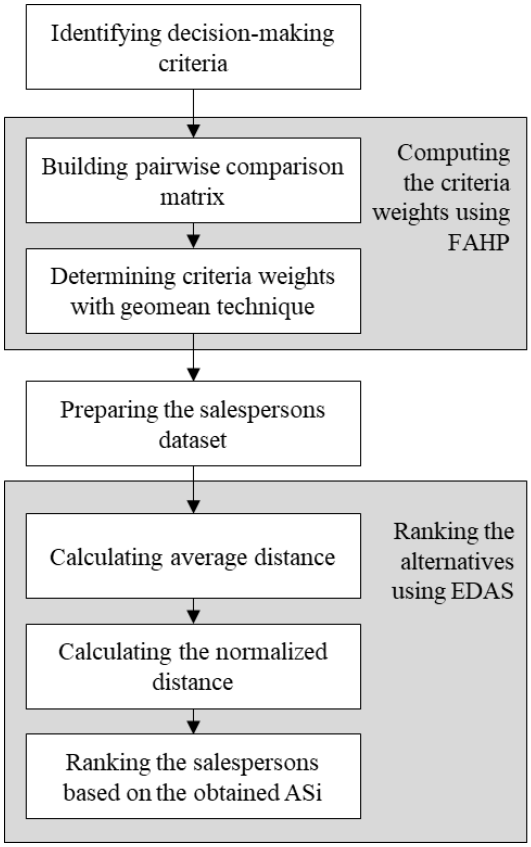

Figure 1. The research framework

Fuzzy AHP

In this study, the fuzzy AHP method was selected to overcome the limitation of traditional AHP through the utilization of triangular fuzzy numbers. The conversion of crisp sets to fuzzy sets in fuzzy AHP addresses the ambiguity inherent in pairwise comparison scales, which are sometimes challenging for the DMs to define. The computation process of fuzzy AHP commences by transforming crisp sets into fuzzy sets, followed by weight calculation using the geometrical mean as outlined in the subsequent steps (Kurniawan et al., 2021).

a. Defining the fuzzy traingular scales

Fuzzy numbers comprise three parameters: the lower bound (l), the mean (m), and the upper bound (u). Table 1 presents the corresponding fuzzy numbers for AHP, describing the conversion of Saaty's fuzzy scales based on linguistic definitions.

Table 1. Linguistic terms and the corresponding TFNs (Chou et al., 2019)

Saaty Scale	Definition	Fuzzy Triangular Scale
1	Equally important	(1,1,1)
3	Weakly important	(2,3,4)
5	Fairly important	(4,5,6)
7	Strongly important	(6,7,8)
9	Absolutely important	(9,9,9)
2	Intermittent values between two adjacent scales	(1,2,3)
4		(3,4,5)
6		(5,6,7)
8		(7,8,9)

b. Developing the fuzzy pairwise comparison matrices

The matrix (1) for pairwise comparisons illustrates the elements of $\widetilde{d_{ij}^k}$ in AHP fuzzy scales, denoting the k^{th}decision makers' preference for the i^{th}criterion over the j^{th}criterion.

$$\tilde{A}^k = \begin{bmatrix} \widetilde{d_{11}^k} & \widetilde{d_{12}^k} & \cdots & \widetilde{d_{1n}^k} \\ \widetilde{d_{21}^k} & \cdots & \cdots & \widetilde{d_{2n}^k} \\ \cdots & \cdots & \cdots & \cdots \\ \widetilde{d_{n1}^k} & \widetilde{d_{n2}^k} & \cdots & \widetilde{d_{nn}^k} \end{bmatrix} \quad (1)$$

c. Calculating the fuzzy weight of criteria

The calculation of fuzzy weights can be completed using equation (3) through the geometrical technique in equation (2).

$$\bar{r}_i = \left(\prod_{j=1}^{n} \bar{d}_{ij}\right)^{1/n}, i = 1,2,\ldots,n \quad (2)$$

$$\bar{w}_i = \bar{r}_i \otimes (\bar{r}_1 \oplus \bar{r}_2 \oplus \ldots \oplus \bar{r}_n)^{-1} \quad (3)$$

d. Calculating the average and the normalized weight criteria

The normalized weight is determined by calculating the criteria weight using equation (4).

$$M_i = \frac{\bar{w}_1 \oplus \bar{w}_2 \oplus \ldots \oplus \bar{w}_n}{n} \quad (4)$$

$$N_i = \frac{M_i}{M_1 \oplus M_2 \oplus \ldots \oplus M_n} \quad (5)$$

EDAS

The EDAS method is applied to rank salesmen. The EDAS method is a distance-based multiple criteria decision making (MCDM) method with steps that follow [17,18].

a. Computing the average value of alternatives based on criteria.

$$AV_j = \frac{\sum_{i=1}^{m} r_{ij}}{m}; j = 1, \dots, n \quad (6)$$

b. Calculating the average positive distance (PDA) and the negative distance (NDA)

To calculate PDA and NDA, the identified criteria are categorized into benefit and cost criteria. As in this study all criteria are considered as benefit criteria, therefore equation (7) and (8) is utilized.

$$PDA_{ij} = \frac{\max(0,(r_{ij} - AV_j))}{AV_j} \quad (7)$$

$$NDA_{ij} = \frac{\max\left(0,(AV_j - r_{ij})\right)}{AV_j} \quad (8)$$

$$i = 1, \dots, m; j = 1, \dots, n$$

c. Calculating the weighted sum of PDA and NDA

The weighted sum of PDA and NDA is denoted by SPi and SNi, respectively.

$$SP_i = \sum_{j=1}^{n} PDA_{ij}.w_j; i = 1, \dots, m \quad (9)$$

$$SN_i = \sum_{j=1}^{n} NDA_{ij}.w_j; i = 1, \dots, m \quad (10)$$

d. Calculating the normalized positive and negative distance

$$NSP_i = \frac{SP_i}{Max\ i\ (SP_i)} \quad (11)$$

$$NSN_i = \frac{SN_i}{Max\ i\ (SN_i)} \quad (12)$$

e. Calculating the salespeople score

The performance scores for salespersons Asi reflects their performance, enabling the ranking process to determine the best-performing salesman.

$$AS_i = \frac{1}{2}(NSP_i + NSN_i) \quad (13)$$

RESULTS AND DISCUSSION

Identifying criteria

Firstly, there are seven identified criteria for assessing the performance of company salespersons, namely generated revenue (C_1), honesty (C_2), communication skills (C_3), empathy (C_4), extensive relationships (C_5), work motivation (C_6), and responsibility and discipline (C_7). These seven criteria are considered as beneficial criteria. They were derived from relevant literature reviews such as criteria C_2, C_3, C_4, and C_6, as well as interviews with decision-makers, including criteria C_1, C_5, and C_7. The three criteria added through interviews with decision-makers make the assessment process highly unique and distinct from similar cases in the past.

Criterion C_1 represents the sales value achieved by a salesperson. Criterion C_2 is unique in nature as it is difficult to measure due to its intangible characteristics, yet it holds significant influence. Criterion C_3 encompasses communication skills and the ability to influence buyers. Similar to criteria C_2, criteria C_4, C_6, and C_7 are intangible criteria that add points to a salesperson's evaluation. For criterion C_4, empathy is considered as the ability to maintain relationships with customers, including understanding consumer needs. Meanwhile, criteria C_6 and C_7 appear almost similar, with C_6 emphasizing goal achievement and C_7 highlighting responsibility and commitment in executing planned targets.

Lastly, criterion C_5 indicates the relationships owned by salespersons to support their performance. In this context, relationships are often assessed as assets. These seven criteria are applied to evaluate the performance of 13 salespersons in the grocery store.

Determining criteria weights using fuzzy AHP

The next stage involves determining the criteria weights using fuzzy Analytic Hierarchy Process (AHP). Decision-makers are engaged to provide preference values for pairwise comparisons of criteria using the Saaty scale ranging from 1 to 9, where 1 signifies equal importance and 9 absolute importance. The paired comparison results between criteria, as displayed in the table below, are expressed in linguistic scales. Once the paired comparison matrix is constructed, the elements of the initial decision matrix are converted into triangular fuzzy numbers, as illustrated in Table 2. Table 3 presents the fuzzy weights and defuzzified weights, which are subsequently integrated to rank the performance of salespersons using the EDAS method.

Tabel 1. Initial decision matrix (source: DM's judgment)

	C_1	C_2	C_3	C_4	C_5	C_6	C_7
C_1	E	I	F	I	W	S	I
C_2		E	W	S	F	I	A
C_3			E	W	I	F	S
C_4				E	I	F	W
C_5					E	W	F
C_6						E	I
C_7							E

Based on the obtained weights, the order of criteria from the highest to the lowest weight is as follows: $C_2 > C_6 > C_3 > C_5 > C_4 > C_1 > C_7$.

According to the results, the decision-maker highly values the aspect of honesty possessed by salespersons, as this criterion is a key element in achieving long-term success and building trust with customers. Work motivation occupies the second-highest rank in the criteria evaluation. The high work motivation of a salesperson is believed to have a positive impact on performance, especially in achieving sales targets. The third-highest criterion is communication, indicating how a salesperson can influence customers and build solid relationships with them.

On the other hand, criteria C_1 (generated revenue) and C_7 (responsibility and discipline) are the two least prioritized criteria. This is intriguing because revenue is typically considered a primary performance indicator by various organizations, but in this case, the decision-maker does not prioritize it as the top criterion. Both criteria are seen as consequential outcomes achievable if the three criteria C_2, C_6, and C_3 are successfully met. Meanwhile, criteria C_5 and C_4 constitute the second-priority group, possibly having close connections with the top three criteria.

Ranking salespersons using EDAS

The final stage in this study is ranking the performance of salespersons using the EDAS method. To calculate EDAS, the weights of the seven criteria from fuzzy AHP are incorporated into the calculation process. Initially, performance scores for each criterion are identified on a scale of 1 – 10, where 10 represents the best score, as shown in Table 4.

Tabel 2. The fuzzy weight dan defuzzied weight (source: AHP calculation)

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	Fuzzy Weight	Weight
C_1	1.000;	6.000;	0.167;	0.333;	0.250;	0.125;	1.000;	0.038;	0.061
	1.000;	0.125;	0.200;	0.500;	0.333;	0.143;	2.000;	0.038;	
	1.000	7.000	0.250	1.000	0.500	0.167	3.000	0.106	
C_2	7.000;	1.000;	2.000;	6.000;	4.000;	1.000;	8.000;	0.226;	0.395
	8.000;	1.000;	3.000;	7.000;	5.000;	2.000;	9.000;	0.395;	
	9.000	1.000	4.000	8.000	6.000	3.000	10.000	0.564	
C_3	4.000;	0.250;	1.000;	2.000;	1.000;	0.333;	6.000;	0.089;	0.175
	5.000;	0.333;	1.000;	3.000;	2.000;	0.500;	7.000;	0.166;	
	6.000	0.500	1.000	4.000	3.000	1.000	8.000	0.268	
C_4	1.000;	0.125;	0.250;	1.000;	0.333;	1.000;	2.000;	0.042;	0.081
	2.000;	0.143;	0.333;	1.000;	0.500;	2.000;	3.000;	0.060;	
	3.000	0.167	0.500	1.000	1.000	3.000	4.000	0.140	
C_5	2.000;	0.167;	4.000;	1.000;	1.000;	0.250;	4.000;	0.076;	0.129
	3.000;	0.200;	0.500;	2.000;	1.000;	0.333;	5.000;	0.100;	
	4.000	0.250	6.000	3.000	1.000	0.500	6.000	0.211	
C_6	6.000;	0.111;	1.000;	4.000;	2.000;	1.000;	7.000;	0.123;	0.210
	7.000;	0.111;	2.000;	5.000;	3.000;	1.000;	8.000;	0.211;	
	8.000	0.111	3.000	6.000	4.000	1.000	9.000	0.296	
C_7	0.333;	0.250;	0.125;	0.250;	0.167;	0.111;	1.000;	0.018;	0.031
	0.500;	0.333;	0.143;	0.333;	0.200;	0.125;	1.000;	0.030;	
	1.000	0.500	0.167	0.500	0.250	0.143	1.000	0.047	

After documenting the performance scores for all thirteen salespersons, ranking is computed using the EDAS method. The core steps of the EDAS calculation involve determining positive and negative distance values and subsequently calculating the value of ASi and the ranking using equations (9) – (15), as illustrated in Table 5.

Based on the ranking results using the EDAS method, the top three salespersons are SP2, SP6, and SP11 with performance values (AS) of 1.000, 0.883, and 0.783, respectively. The aspects that make these three salespersons stand out are their performance, especially in criteria with the highest weights. When looking at the three priority criterion groups, Salesmen SP2, SP3, and SP6 have very high scores in criteria C_2 (honesty), C_3 (communication), and C_6 (work motivation), even though Salesman SP6 has a slightly lower score for C_2 compared to Salesman SP3. On the other hand, the salesperson with the lowest performance is SP9. Interestingly, there are two salespersons with the same performance score, namely Salesmen SP4 and SP8. Based on the performance scores per criterion, salesmen SP4 and SP8 are considered to have the same performance.

Table 4. Initial salesman performance (source: grocery's salesman performance score)

Sales (SP)	Revenue C_1	Honesty C_2	Comm. Skill C_3	Emphaty C_4	Relations C_5	Motivation C_6	Responsibility C_7
SP1	10	8	9	7	10	9	6
SP2	10	10	10	8	9	9	8
SP3	7	9	8	9	7	8	9
SP4	6	7	7	8	8	7	7
SP5	6	7	6	6	7	6	5
SP6	9	9	9	10	9	9	8
SP7	7	8	8	7	6	7	6
SP8	6	7	7	8	8	7	7
SP9	5	7	6	5	6	5	6
SP10	6	9	7	8	6	5	7
SP11	9	8	9	8	10	9	9
SP12	8	7	8	6	7	8	8
SP13	7	8	6	6	8	7	6

Tabel 3. The results of PDA, NDA, NSP, NSN, AS, and rank using EDAS (source: EDAS computation)

Sales	C_1		C_2		C_3....C_6	C_7		NSP	NSN	AS	Rank
(SP)	PDA	NDA	PDA	NDA	PDA/NDA	PDA	NDA				
S1	0.354	0.000	0.000	0.000	…	0.000	0.152	0.537	0.962	0.750	4
S2	0.354	0.000	0.250	0.000	…	0.130	0.000	1.000	1.000	1.000	1
S3	0.000	0.052	0.125	0.000	…	0.272	0.000	0.400	0.932	0.666	5
S4	0.000	0.188	0.000	0.125	…	0.000	0.011	0.042	0.627	0.335	10
S5	0.000	0.188	0.000	0.125	…	0.000	0.293	0.000	0.254	0.127	12
S6	0.219	0.000	0.125	0.000	…	0.130	0.000	0.766	1.000	0.883	2
S7	0.000	0.052	0.000	0.000	…	0.000	0.152	0.028	0.777	0.402	7
S8	0.000	0.188	0.000	0.125	…	0.000	0.011	0.042	0.627	0.335	10
S9	0.000	0.323	0.000	0.125	…	0.000	0.152	0.000	0.000	0.000	13
S10	0.000	0.188	0.125	0.000	…	0.000	0.011	0.224	0.471	0.347	9
S11	0.219	0.000	0.000	0.000	…	0.272	0.000	0.565	1.000	0.783	3
S12	0.083	0.000	0.000	0.125	…	0.130	0.000	0.135	0.672	0.403	6
S13	0.000	0.052	0.000	0.000	…	0.000	0.152	0.015	0.692	0.354	8

This study provides an applicable decision-making model, particularly for SMEs, in the assessment of salespersons. Despite the critical role of salespersons in this case, there has not been a rigid assessment model used to evaluate their performance. Existing evaluation processes may tend to be qualitative and subjective, with an emphasis on the output produced by salespersons. As a result, decision-makers may not have detailed insights into the abilities of salespersons and their strengths in specific criteria. This differs when an assessment model is constructed. The decision-maker's perspective becomes more objective in evaluating salesperson performance because the assessment calculation process can be completed accountably. Moreover, decision-makers can investigate the interrelationships between criteria – not prioritizing output criteria – and, of course, understand the strengths of each salesperson, which is beneficial for the sustainability and development of the company in the future.

CONCLUSION

This study presents an evaluation model for salespersons applied in a small to medium-sized grocery store. To assess salespersons, seven criteria were considered, and the weights of these criteria were calculated using fuzzy Analytic Hierarchy Process (AHP). The obtained weights were then integrated into the Evaluation based on Distance from Average Solution (EDAS) method to assess the 13 salespersons. The results indicate that the integration of fuzzy AHP and EDAS can effectively rank salespersons, including prioritizing criteria that influence the assessment outcomes.

By employing fuzzy AHP, it can be concluded that the seven criteria can be categorized into three priority groups, where the primary priority criteria group consists of C_2, C_6, and C_3. In the EDAS ranking, the top three salespersons are identified as SP2, SP6, and SP11. This study can be extrapolated to larger evaluation systems involving numerous alternatives, allowing the application of additional methods such as data science approaches.

REFERENCES

Afandhi, A. R., Rakhma Devi, P. A., & Rosyid, H. (2022). PENENTUAN SISWA BERPRESTASI KELAS BAHASA DI SMA “EFG” MENGGUNAKAN METODE EDAS. *Antivirus : Jurnal Ilmiah Teknik Informatika*, *16*(1), 39–51. https://doi.org/10.35457/antivirus.v16i1.2102

Andiyani, D., Winanti, & Nurasiah. (2022). SISTEM INFORMASI PENGAMBILAN KEPUTUSAN PEMILIHAN SALESMAN TERBAIK MENGGUNAKAN METODE SIMPLE ADDITIVE WEIGHTING (SAW) DI PT. CENTRAL SATRYA PERDANA. *Jurnal IPSIKOM*, *10*(2), 1–14.

Arjun Nainggolan, Annisa Siregar, & Mesran, M. (2022). Sistem Pendukung Keputusan Penilaian Indeks Kinerja Sales Marketing Menerapkan Metode MOORA. *Hello World Jurnal Ilmu Komputer*, *1*(3), 121–129. https://doi.org/10.56211/helloworld.v1i3.125

Chou, Y. C., Yen, H. Y., Dang, V. T., & Sun, C. C. (2019). Assessing the human resource in science and technology for Asian countries: Application of fuzzy AHP and fuzzy TOPSIS. *Symmetry*, *11*(2). https://doi.org/10.3390/sym11020251

Fitriani, R. (2022). Penentuan Prioritas Kriteria Proses Rekrutmen dan Seleksi Karyawan Menggunakan Metode Analytic Hierarchy Process di PT Citatah Tbk. *Serambi Engineering*, *VII*(2).

Kesuma, S. L., Khikmawati, E., & Anggraini, M. (2021). STRATEGI PEMASARAN ROTI DI KING’S BAKERY DENGAN METODE ANALYTICAL HIERARCHY PROCESS (AHP). *Industrika: Jurnal Ilmiah Teknik Industri*, *5*(2), 81–85.

Kurniawan, V. R. B., Yulianti, T., & Puspitasari, F. H. (n.d.). *Employee Performance Evaluation in an Indonesian Metal Casting Manufacturer using an Integrated MCDM Approach*.

Kurniawan, V. R. B., Yulianti, T., & Puspitasari, F. H. (2021). Fuzzy AHP – DEMATEL Methods To Investigate Passengers’ Decision Factors On Using Public City Bus In An Indonesian Region. *OPSI*, *14*(1), 10. https://doi.org/10.31315/opsi.v14i1.4478

Li, C., Solangi, Y. A., & Ali, S. (2023). Evaluating the Factors of Green Finance to Achieve Carbon Peak and Carbon Neutrality Targets in China: A Delphi and Fuzzy AHP

Approach. *Sustainability (Switzerland)*, *15*(3). https://doi.org/10.3390/su15032721

M., H., D., S., & N., B. (n.d.). *Selecting a Robust Decision Making Method to Evaluate Employee Performance*.

Özgörmüş, E., Şenocak, A. A., & Gören, H. G. (2021). An integrated fuzzy QFD-MCDM framework for personnel selection problem. *Scientia Iranica*, *28*(5 E), 2972–2986. https://doi.org/10.24200/sci.2019.52320.2657

Popović, M. (2021). AN MCDM APPROACH FOR PERSONNEL SELECTION USING THE COCOSO METHOD. *Journal of Process Management and New Technologies*, *9*(3–4), 78–88. www.japmnt.com

Sekianti, A., & Saepullah, A. (2023). ANALISIS PENGARUH TENAGA PENJUAL (SALES FORCE) TERHADAP VOLUME PENJUALAN POLIS ASURANSI PRUDENTIAL PADA PT. INFINITEAM INDONESIA DI JAKARTA. *Jurnal Manajemen Diversitas*, *3*(1), 53–76. https://ejournal-jayabaya.id/Manajemen-Diversitas

Setiawan, B. (2023). Sistem Pendukung Keputusan Penentuan Karyawan Terbaik Pada PT. Sukses Bangun Sriwijaya Dengan Metode TOPSIS Decision Support System for Determining the Best Employees with TOPSIS Method. In *JTSI* (Vol. 4, Issue 2).

Somya, R., & Wahyudi, A. (2020). Sistem Pendukung Keputusan Perekrutan Karyawan Menggunakan Metode TOPSIS di PT Visionet Data Internasional. *JURNAL INFORMATIKA*, *7*(2). http://ejournal.bsi.ac.id/ejurnal/index.php/ji

Sumarno, A. P., Setiawan, M., Aisjah, S., & Sunaryo. (2021). Employees Performance Evaluation in Defense Ministry of the Republic of Indonesia based on Multicriteria Decision Making (MCDM) and System Dynamic (SD). *International Journal of Operations and Quantitative Management*, *27*(3), 245–266. https://doi.org/10.46970/2021.27.3.4

Suriady, C. S., Dewi, L. P., & Setiawan, A. (n.d.-a). *Aplikasi Human Resource Information System dengan Fitur Sistem Pendukung Keputusan (Studi Kasus PT. Industri Kreatif Digital)*.

Suriady, C. S., Dewi, L. P., & Setiawan, A. (n.d.-b). *Aplikasi Human Resource Information System dengan Fitur Sistem Pendukung Keputusan (Studi Kasus PT. Industri Kreatif Digital)*.

Zavadskas, E. K., Turskis, Z., Stević, Ž., & Mardani, A. (2020). Modelling procedure for the selection of steel pipe supplier by applying the fuzzy AHP method. *Operational Research in Engineering Sciences: Theory and Applications*, *3*(2), 39–53. https://doi.org/10.31181/oresta2003034z