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Objective-Subjective CRITIC-MARCOS Model for Selection Forklift in Internal Transport Technology Processes

Eldina Huskanović, Željko Stević*, Sanja Simić

Faculty of Transport and Traffic Engineering, University of East Sarajevo, 74000 Doboj, Bosnia and Herzegovina

* Correspondence: Željko Stević (zeljko.stevic@sf.ues.rs.ba)

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Abstract: In today transport technology processes, forklifts are one of the most important equipment for making handling operations in order to increase sustainability. They have a large influence in achieving the efficiency and sustainability of internal transport. According to the previous studies, and based on the current needs of the company, skills, and knowledge of managers, criteria, and alternatives for evaluating forklifts were created. The paper aims to create an integrated decision-making model to improve the company's technological processes. The objective CRITIC (Criteria Importance Through Intercriteria Correlation) approach was used to determine the criteria weights which are a combination of economic, technological, technical and environmental criteria. MARCOS (Measurement of Alternatives and Ranking according to Compromise Solution) approach was applied to select the most suitable forklift in transport technology processes. Results show that A4 forklift is the most suitable, and the A1 forklift is the worst variant. Apart from this, sensitivity and comparative analysis have been done in order to verify the initial results.

Keywords: Forklifts; Technology processes; Warehouse; MCDM; CRITIC; MARCOS; Transport

1. Introduction

Transport as a field is becoming increasingly important every day by optimization processes improving the whole efficiency and the overall effects of the technology processes. In addition to transport, which is the greatest cause of logistics costs, which is important issue of sustainability, as a key element or subsystem of logistics, there is a storage. Taking into account that the movement of goods is a dominant activity in a today storage, the technology processes become more complex, so it is necessary to define various models for decision-making, which is the aim of this paper, too. Based on complete research, and this study is a part of it, the indicators of queues on two transshipment fronts were calculated in the first stage, and it was determined that the company achieves satisfactory results with two existing transshipment fronts. This is very important because the company has good infrastructure, it has links with two modes of transport: road and railway and can make delivery using both modes. In such cases, transshipment fronts play a huge role and can influence overall sustainability in performing technological processes. Logistics and infrastructure are core elements supporting trade facilitation efforts at the local level [1] and economic social growth. The final phase of the work is a part of the research presented in this paper.

After determining which forklift is the most efficient in the storage, it was started the procurement of an additional forklift according to the needs and appropriate sustainable criteria in this warehousing system, which is also one of the aims of this study. To analyze the collected data, it was applied an integrated MCDM model: CRITIC-MARCOS, which show good performance for solving such type of problems. The CRITIC was applied to determine criteria weights. Observing a large number of forklifts with various characteristics, the study analyzes nine sustainable criteria that are of great importance for the selection when buying forklifts. By research in the storage, and taking into account the experience and knowledge of managers, the criteria and variants for forklift selection were defined. Analyzing four potential variants, it is necessary to define the best one which is suitable for performing operations in technological processes. MARCOS method was applied to select the most suitable forklift. The obtained results have been tested via sensitivity analysis, which includes changes in weight criteria as well as comparative analysis with other MCDM methods. Also, Improved Fuzzy Stepwise Weight Assessment Ratio Analysis (IMF SWARA) has been integrated with MARCOS to verify previously obtained results.

The rest of the paper is structured as follows. The second section presents a short literature review analysis related to the aims of the paper and applied methodology. The third section shows a diagram flow of research and steps of applied CRITIC and MARCOS methods. In the fourth section, we show a case study with clear explanations and calculation steps. The fifth section represents sensitivity and comparative analysis, while the last sixth section shows conclusion remarks.

2. Short Literature Review

The current storage of the company is decentralized [2, 3], where each production facility has its own storage. In such circumstances, there is an accumulation of requests for loading goods by means of transport and waiting in line, which in turn incurs certain costs. According to Stević [4], in order to assess the quality of the functioning of the storage and processes in it, it is helpful to create a set of key performance indicators in a internal transport subsystem. Storage has proven to be part of the company representing a potential place for improving efficiency. However, this paper is an upgrade to the paper by Mahmutagić et al. [5], in which it was developed the DEA-MCDM model, which refers to determining the efficiency of present forklifts in the Natron-Hayat company.

MCDM methods are used in all areas which can be seen in the next papers [6-8]. In this study, the aim is on forklift selection to serve in the storage, however, MCDM methods are often used to select the warehouse location according to Ulutaş et al. [9]. The paper proposes an integrated gray MCDM approach to select the most suitable location of warehouse, where 5 variants were accessed with 12 criteria. Mihajlović et al. [10] studied fruit warehouse location selection based on AHP and WASPAS. Ma et al. [11] handled the choices of warehouse location utilizing an Integrated MADM method based on the cumulative prospect theory. Tabak et al. [12] proposed an AHP - CRITIC -VIKOR (visekriterijumska optimizacija i kompromisno resenje) based tool. Kabak and Keskin [13] proposed geographical information systems (GIS) and AHP models for potential warehouse locations.

In study by Amin et al. [14], the AHP-TOPSIS model was used to set the best pallet placement in storage racks. Besides, a lot number of research have been performed in the field of transport, such as study by Yannis et al. [15] concluding that MCDM models are applied mainly to evaluate transport options rather than transport policies or projects, with conclusion that most commonly applied method in transport sector is the AHP [16, 17]. Based to study by Mardani et al. [18] where different papers were analyzed, it was concluded that, within transport, ranking the quality of service was the first area of using of MCDM. In the study by Đalić et al. [19] applying MCDM method, it was created tool for selecting the best strategy in a transport company.

3. Methods

In this part of the paper, Figure 1 shows diagram of research.

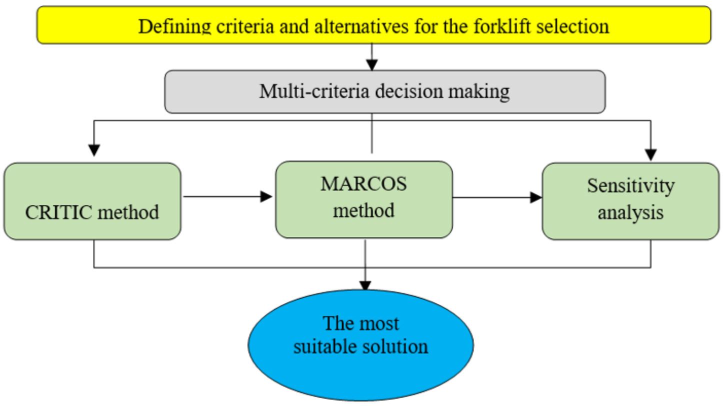

Figure 1. Applied methodology

3.1 CRITIC Method

Algorithm of the CRITIC method [20, 21] is:

Step 1. The initial matrix (X) is:

$$x_{ij}=\begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} i=1,2,\dots,m;\ j=1,2,\dots,n \tag{1}$$

where, (i=1,2,…,m, j=1,2,…,n).

Step 2. Normalization of the initial matrix:

a) For max criteria

$$r_{ij}=\frac{x_{ij}-\min_i x_{ij}}{\max_i x_{ij}-\min_i x_{ij}} \quad if\ \ j\in B\rightarrow \max \tag{2}$$

b) For min criteria

$$r_{ij}=\frac{x_{ij}-\max_i x_{ij}}{\min_i x_{ij}-\max_i x_{ij}} \quad if\ \ j\in C\rightarrow \min \tag{3}$$

Step 3. Forming of symmetric matrix with elements (m_{ij}) - coefficients of linear correlation of vectors.

Step 4. Calculation both the standard deviation of the criterion and its correlation with other criteria.

$$W_j=\frac{C_j}{\sum_{j=1}^{n}C_j} \tag{4}$$

where, C_j is the amount of information contained in the criterion:

$$C_j=\sigma\sum_{j'=1}^{n}1-r_{ij} \tag{5}$$

where, σ is the standard deviation of the j-th criterion and the correlation coefficient between the two criteria.

3.2 MARCOS Method

The MARCOS contain following steps [22, 23].

Step 1: Forming an initial decision matrix.

Step 2: Forming an extended initial matrix by defining the ideal (AI) and anti-ideal (AAI) solution.

$$X=\begin{array}{c} \\ AAI \\ A_1 \\ A_2 \\ \dots \\ A_m \\ AI \end{array}\begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \dots & C_n \end{array} \\ \begin{bmatrix} x_{aa1} & x_{aa2} & \dots & x_{aan} \\ x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{22} & \dots & x_{mn} \\ x_{ai1} & x_{ai2} & \dots & x_{ain} \end{bmatrix}\end{array} \tag{6}$$

(AAI) is the worst value, while (AI) is the alternative with the best value.

$$AAI=\min_i x_{ij} \quad if\ \ j\in B \quad and \quad \max_i x_{ij} \quad if\ \ j\in C \tag{7}$$

$$AI=\max_i x_{ij}\ \ if\ \ j\in B\ and\ \ \min_i x_{ij}\ \ if\ j\in C \tag{8}$$

where, B are benefit criteria, while C are non-benefit criteria.

Step 3: Process of normalization.

$$n_{ij} = \frac{x_{ai}}{x_{ij}} \quad if \;\; j \in C \tag{9}$$

$$n_{ij} = \frac{x_{ij}}{x_{ai}} \quad if \;\; j \in B \tag{10}$$

Step 4: Calculation the weighted matrix $V= [v_{ij}]_{mxn}$.

$$v_{ij} = n_{ij} \times w_j \tag{11}$$

Step 5: Calculation of the degree of utility of the alternative K_i.

$$K_i^- = \frac{S_i}{S_{aai}} \tag{12}$$

$$K_i^+ = \frac{S_i}{S_{ai}} \tag{13}$$

where, $S_i\,(i=1,2,\ldots,m)$ represents the sum of the elements of the weighted matrix:

$$S_i = \sum_{i=1}^{n} v_{ij} \tag{14}$$

Step 6: Determining the utility function of the alternative $f(K_i)$.

$$f\left(K_i\right) = \frac{K_i^+ + K_i^-}{1 + \frac{1 - f\left(K_i^+\right)}{f\left(K_i^+\right)} + \frac{1 - f\left(K_i^-\right)}{f\left(K_i^-\right)}} \tag{15}$$

The utility functions in relation to the AI and AAI solutions:

$$f\left(K_i^-\right) = \frac{K_i^+}{K_i^+ + K_i^-} \tag{16}$$

$$f\left(K_i^+\right) = \frac{K_i^-}{K_i^+ + K_i^-} \tag{17}$$

Step 7: Ranking the alternatives.

4. Application of Integrated CRITIC-MARCOS Model for Forklift Selection

According to the previous studies, and based on the current needs of the company, skills, and knowledge of managers, criteria, and alternatives for evaluating forklifts were created. Criteria in this MCDM model are shown as follows:

C1 - Purchase price,
C2 - Load capacity,
C3 - Lifting height,
C4 - Lifting speed,
C5 - Lowering speed,
C6 - Driving speed,
C7 - Battery capacity,

C8 - Noise level,
C9 - Spare parts supply.
Alternatives are represented in Figures 2-5.

Figure 2. HYSTER E45Z forklift

Figure 3. LINDE E16C-01 forklift

Figure 4. Still RX50-16 forklift

Figure 5. TOYOTA 8FBMT 25 forklift

4.1 Determining the Criteria Weights Using the CRITIC Method

The initial matrix (X) is shown in Table 1.

Table 1. Initial matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9
A1	11450	2041	4557	0.3	0.57	9.9	36	65	256
A2	15250	1600	4300	0.4	0.6	15.8	48	64	117
A3	10900	1600	3230	0.3	0.54	12	24	63.9	44
A4	14500	2500	3340	0.46	0.56	19	80	68.8	123
MAX	15250	2500	4557	0.46	0.6	19.0	80	68.8	256
MIN	10900	1600	3230	0.3	0.54	9.9	24	63.9	44

Normalization of the initial matrix is performed by applying Eqns. (2) and (3), shown in Table 2.
a) For benefit criteria

$$r_{ij} = \frac{x_{ij} - \min_i x_{ij}}{\max_i x_{ij} - \min_i x_{ij}}\ ; \quad r_{13} = \frac{4557-3230}{4557-3230} = 1$$

b) For cost criteria

$$r_{ij} = \frac{\max_i x_{ij} - x_{ij}}{\max_i x_{ij} - \min_i x_{ij}}\ ; \quad r_{11} = \frac{15250-11450}{15250-10900} = 0{,}8736$$

Table 2. Normalized matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9
A1	0.874	0.490	1.000	0.000	0.500	0.000	0.214	0.776	0.000
A2	0.000	0.000	0.806	0.625	1.000	0.648	0.429	0.980	0.656
A3	1.000	0.000	0.000	0.000	0.000	0.231	0.000	1.000	1.000
A4	0.172	1.000	0.083	1.000	0.333	1.000	1.000	0.000	0.627
STdev	0.499	0.478	0.505	0.493	0.417	0.444	0.430	0.470	0.417

Symmetric matrix with elements (m_{ij}) is shown in Table 3. An example of the calculation is:

$$r_{12} = r_{21} = \frac{4\cdot 0.600 - 2.046\cdot 1.490}{\sqrt{4\cdot 1.793-(2.046)^2}\cdot\sqrt{4\cdot 1.240-(1.490)^2}} = -0.226$$

Table 3. Symmetric matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9
C1	1.000	-0.226	-0.104	-0.892	-0.711	-0.840	-0.747	0.381	-0.096
C2	-0.226	1.000	-0.181	0.558	-0.175	0.472	0.800	-0.959	-0.374
C3	-0.104	-0.181	1.000	-0.242	0.742	-0.419	-0.204	0.371	-0.789
C4	-0.892	0.558	-0.242	1.000	0.346	0.977	0.943	-0.728	0.178
C5	-0.711	-0.175	0.742	0.346	1.000	0.217	0.216	0.178	-0.349
C6	-0.840	0.472	-0.419	0.977	0.217	1.000	0.884	-0.684	0.380
C7	-0.747	0.800	-0.204	0.943	0.216	0.884	1.000	-0.899	-0.055
C8	0.381	-0.959	0.371	-0.728	0.178	-0.684	-0.899	1.000	0.119
C9	-0.096	-0.374	-0.789	0.178	-0.349	0.380	-0.055	0.119	1.000

Further, (w_j) is obtained using Eq. (4):

$$W_j = \frac{c_j}{\sum_{j=1}^{n} c_j}\ ; \quad W_1 = \frac{5.604}{5.604+3.864+4.456+3.385+3.140+3.113+3.037+4.807+3.742} = 0.159$$

Cj is the amount of information contained in the criterion and is determined according to Eq. (5), and is presented in Table 4, and the weights of the criteria are presented in Table 5:

$$C_{ij} = \sigma\sum_{j=1}^{n} 1 - m_{ij}\ ; \quad C_{21} = 1-(-0{,}226) = 1.226$$

Table 4. Amount of information

C1	**0.000**	**1.226**	**1.104**	**1.892**	**1.711**	**1.840**	**1.747**	**0.619**	**1.096**
C2	1.226	0.000	1.181	0.442	1.175	0.528	0.200	1.959	1.374
C3	1.104	1.181	0.000	1.242	0.258	1.419	1.204	0.629	1.789
C4	1.892	0.442	1.242	0.000	0.654	0.023	0.057	1.728	0.822
C5	1.711	1.175	0.258	0.654	0.000	0.783	0.784	0.822	1.349
C6	1.840	0.528	1.419	0.023	0.783	0.000	0.116	1.684	0.620
C7	1.747	0.200	1.204	0.057	0.784	0.116	0.000	1.899	1.055
C8	0.619	1.959	0.629	1.728	0.822	1.684	1.899	0.000	0.881
C9	1.096	1.374	1.789	0.822	1.349	0.620	1.055	0.881	0.000
SUM	11.235	8.085	8.826	6.860	7.536	7.014	7.063	10.222	8.985
Cj	5.604	3.864	4.456	3.385	3.140	3.113	3.037	4.807	3.742

Table 5. Weights of criteria and their rank

C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
0.159	0.110	0.127	0.096	0.089	0.089	0.086	0.137	0.106
1	**4**	**3**	**6**	**7**	**8**	**9**	**2**	**5**

4.2 Selection of Forklifts Using the MARCOS Method

Forming an initial decision matrix, presented in Table 1.
In this step, the initial matrix is expanded by defining (AI) and (AAI) solutions, using Eqns. (6)-(8), Table 6.

Table 6. Extended initial matrix

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
AII	15250,000	1600	3230,0	0.3	0.54	9.9	24	69	256
A1	11450	2041	4557	0.3	0.57	9.9	36	65	256
A2	15250	1600	4300	0.4	0.6	15.8	48	64	117
A3	10900	1600	3230	0.3	0.54	12	24	63.9	44
A4	14500	2500	3340	0.46	0.56	19	80	68.8	123
AI	10900,000	2500	4557,00	0.46	0.60	19	80	64	44
Max/Min	Min	Max	Max	Max	Max	Max	Max	Min	Min

The elements of the normalized matrix are obtained by applying Eqns. (9) and (10), and shown in Table 7.

$$n_{11} = \frac{x_{ai}}{x_{ij}} = \frac{10900}{15250} = 0.715\,; \quad n_{12} = \frac{x_{ij}}{x_{ai}} = \frac{1600}{2500} = 0.640$$

Table 7. Normalized matrix

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
AAI	0.715	0.640	0.709	0.652	0.900	0.521	0.300	0.929	0.172
A1	0.952	0.816	1.000	0.652	0.950	0.521	0.450	0.983	0.172
A2	0.715	0.640	0.944	0.870	1.000	0.832	0.600	0.998	0.376
A3	1.000	0.640	0.709	0.652	0.900	0.632	0.300	1.000	1.000
A4	0.752	1.000	0.733	1.000	0.933	1.000	1.000	0.929	0.358
AI	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Calculation of weighted matrix using Eq. (11), shown in Table 8.

Table 8. Weighted normalized matrix

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**
AAI	0.114	0.070	0.090	0.063	0.080	0.046	0.026	0.127	0.018
A1	0.152	0.090	0.127	0.063	0.085	0.046	0.039	0.134	0.018
A2	0.114	0.070	0.120	0.084	0.089	0.074	0.052	0.137	0.040
A3	0.159	0.070	0.090	0.063	0.080	0.056	0.026	0.137	0.106
A4	0.120	0.110	0.093	0.096	0.083	0.089	0.086	0.127	0.038
AI	0.159	0.110	0.127	0.096	0.089	0.089	0.086	0.137	0.106

Calculation of the utility degree of the alternative using Eqns. (12) and (13):

$$K_i^- = \frac{S_i}{S_{aai}} = \frac{0.754}{0.635} = 1.187\,; \quad K_i^+ = \frac{S_i}{S_{ai}} = \frac{0.754}{1} = 0.754$$

$$S_{aai} = 0.114 + 0.070 + 0.090 + 0.063 + 0.080 + 0.046 + 0.026 + 0.127 + 0.018 = 0.635$$

Determining the utility function of the alternative $f(K_i)$.

$$f\left(K_1^-\right) = \frac{K_i^+}{K_i^+ + K_i^-} = \frac{0.754}{0.754 + 1.187} = 0.388\,; \quad f\left(K_1^+\right) = \frac{K_i^-}{K_i^+ + K_i^-} = \frac{1.187}{0.754 + 1.187} = 0.612$$

Step 7: Ranking the alternatives (Table 9).

Table 9. Final results calculated using MCDM model

	Si	Ki-	Ki+	fK-	fK+	Ki	Rank
A1	0.754	1.187	0.754	0.388	0.612	0.605	4
A2	0.779	1.227	0.779	0.388	0.612	0.625	3
A3	0.788	1.241	0.788	0.388	0.612	0.632	2
A4	0.842	1.327	0.842	0.388	0.612	0.676	1

5. Sensitivity and Comparative Analysis

5.1 Scenarios Changing Weights of the Criteria

Impact of the change of the three most important criteria, C_1, C_8 and C_3, was analyzed. By applying Eq. (18) [24], a total of 18 scenarios (Table 10) were formed.

$$W_{n\beta} = \left(1 - W_{n\alpha}\right) \frac{W_\beta}{\left(1 - W_n\right)} \tag{18}$$

Table 10. Scenarios with different criteria weights

	W1	W2	W3	W4	W5	W6	W7	W8	W9
S1	0.136	0.113	0.130	0.099	0.092	0.091	0.089	0.141	0.109
S2	0.112	0.116	0.134	0.102	0.094	0.094	0.091	0.145	0.113
S3	0.088	0.119	0.138	0.105	0.097	0.096	0.094	0.148	0.116
S4	0.064	0.122	0.141	0.107	0.100	0.099	0.096	0.152	0.119
S5	0.040	0.126	0.145	0.110	0.102	0.101	0.099	0.156	0.122
S6	0.016	0.129	0.148	0.113	0.105	0.104	0.101	0.160	0.125
S7	0.163	0.113	0.130	0.099	0.091	0.091	0.088	0.116	0.109
S8	0.167	0.115	0.133	0.101	0.094	0.093	0.091	0.096	0.112
S9	0.171	0.118	0.136	0.103	0.096	0.095	0.093	0.075	0.114
S10	0.175	0.120	0.139	0.105	0.098	0.097	0.095	0.055	0.117
S11	0.178	0.123	0.142	0.108	0.100	0.099	0.097	0.034	0.119
S12	0.182	0.126	0.145	0.110	0.102	0.101	0.099	0.014	0.122
S13	0.163	0.112	0.108	0.098	0.091	0.090	0.088	0.140	0.109
S14	0.166	0.115	0.089	0.101	0.093	0.092	0.090	0.143	0.111
S15	0.170	0.117	0.070	0.103	0.095	0.094	0.092	0.146	0.113
S16	0.173	0.119	0.051	0.105	0.097	0.096	0.094	0.149	0.116
S17	0.177	0.122	0.032	0.107	0.099	0.098	0.096	0.152	0.118
S18	0.180	0.124	0.013	0.109	0.101	0.100	0.098	0.155	0.120

In scenarios S_1-S_6, it was changed criterion C_1, criterion C_8 in scenarios S_7-S_{12}, and criterion C_3 in scenarios S_{13}-S_{18}.

According to 18 sets that represent the new criteria, we can conclude that there has been no significant change (Figure 6).

5.2 Reverse Rank Analysis

In this section of the paper, we have performed reverse rank analysis. We have formed three sets in which the worst alternative has been eliminated per each set and the calculation has been repeated. In the first set, the alternative A1 has been eliminated, and the model has been reproduced with three alternatives. In the second set, alternative A2 has been eliminated, and finally, in set three, alternative A3.

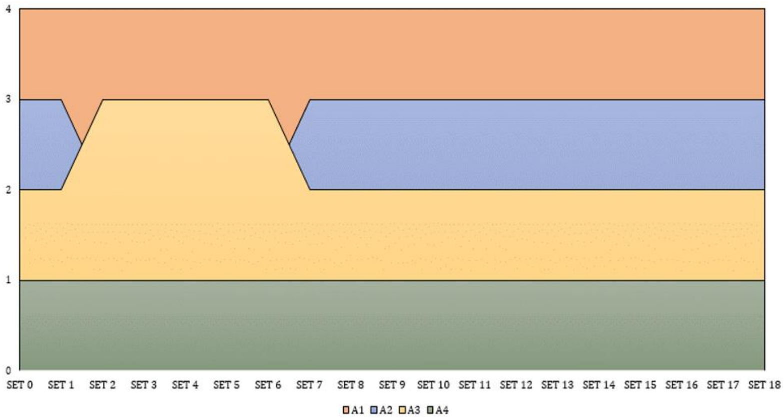

Figure 6. New ranking in sensitivity analysis (SA)

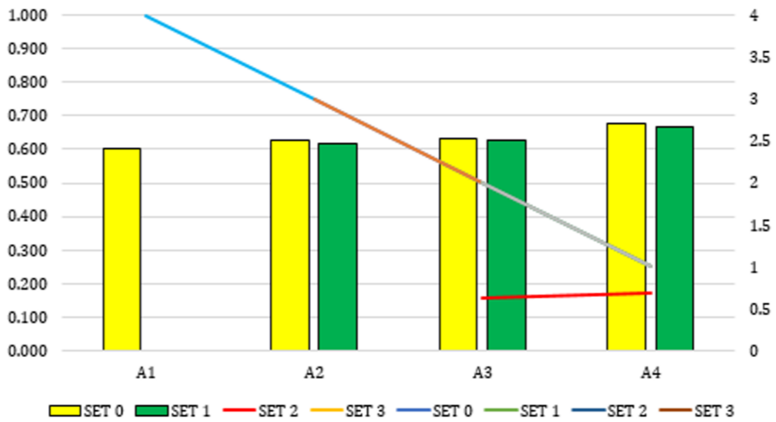

Figure 7. Matrix size changing results

Figure 7 has shown results of reverse rank analysis consisting of values of alternatives and their ranks. It can be concluded that the model is stable in this part of the analysis because there are no changes in ranks of alternatives.

5.3 Comparative Analysis

Comparative analysis contains the next methods: ARAS [25], MABAC [26], SAW [27], WASPAS [28] and EDAS method [29]. According to results from Figure 8, we can conclude that A4, i.e., the TOYOTA 8FBMT 25 forklift retains the first position and is the best solution in four of the five applied methods.

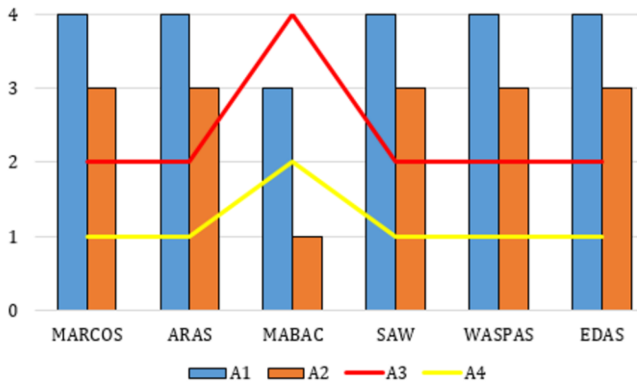

Figure 8. Ranking of alternatives for all applied methods

5.4 IMF SWARA -MARCOS Model

This subsection shows a validation test using Improved Fuzzy Stepwise Weight Assessment Ratio Analysis (IMF SWARA) for determining criteria weights and MARCOS for alternative ranking. IMF SWARA is a recently developed approach for determining criteria weights [30-32].

Table 11. Results obtained using IMF SWARA for determining criteria values

	Si	Ki-	Ki+	fK-	fK+	Ki	Rank
A1	0.644	1.197	0.769	0.391	0.609	0.615	4
A2	0.770	1.210	0.778	0.391	0.609	0.621	3
A3	0.779	1.260	0.810	0.391	0.609	0.647	2
A4	0.811	1.285	0.826	0.391	0.609	0.660	1

Results presented in Table 11 (IMF SWARA-MARCOS model) show no changes in ranks in comparison to the CRITIC-MARCOS model.

6. Conclusion

Based on extensive analysis of company's needs from technological aspect for an additional forklift, 4 potential variants were analyzed based on 9 sustainable criteria. After phase of collection data, it was developed CRITIC-MARCOS model. The CRITIC tool was used to determine values of criteria that were then applied in the MARCOS method for weighting normalized matrix. Performing steps of MARCOS method, it was obtained the ranking of forklifts, and based on the results forklift A4 is the most suitable alternative, while alternative A1 is the worst forklift. In the SA, comparative analysis uses 5 other MCDM methods for ranking forklifts and additionally one more for determining criteria weights. Additional analyses show that variants did not change significantly. By using the developed MCDM model, important results have been obtained in terms of forming sustainable strategies referring to storage technology processes. Implications of this study represent market uncertainty from the aspect of the significance of criteria because the model treats the current needs of the company.

Data Availability

The data [data type] supporting our research results are included within the article or supplementary material.

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Conflicts of Interest

The authors declare no conflict of interest.

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