Jurnal Teknik Informatika Vol. 17 No. 2, Oktober 2024 (179-189)
ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v17i2.41097

JURNAL TEKNIK INFORMATIKA

Homepage : http://journal.uinjkt.ac.id/index.php/ti

Comparison of Criteria Weight Determination Using MEREC and CRITIC Methods in Choosing The Best Student Accommodation with the MOORA Method Case Study: Coventry University

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Article:
Accepted: July 30, 2024
Revised: March 27, 2024
Issued: October 29, 2024

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ABSTRACT

One of the challenges faced by IISMA Awardees and students in general in Coventry University is choosing a comfortable place to live. Although various student accommodations are provided, differences in facilities and considerations from other parties such as parents and friends make the selection process complicated. This study develops a decision support system to help students choose student accommodation objectively without any intervention from others and provides a comparison of the use of different combinations of methods as additional guidance in the decision-making process. Two methods, Method Based on the Removal Effects of Criteria (MEREC) and Criteria Importance Through Intercriteria Correlation (CRITIC), are used to weight the criteria. The Multi-Objective Optimization (MOORA) method is used to determine the best alternative after the weight calculation is known. The results using a combination of the MEREC-MOORA method and a combination of the CRITIC-MOORA method place Alternative 5 (A5) in first place, while the remaining alternatives show a similar ranking order. In this study, scenario testing was also carried out by deleting and adding criteria and alternatives which then provided ranking results with a positive correlation even though different combinations of methods were used in determining the ranking.

Keywords : *decision support system; student accommodation; MEREC; CRITIC; MOORA;*

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1. INTRODUCTION

Choosing a comfortable place to live during the study period is one of the problems often faced by students. In fact, this can still arise even though the university has provided accommodation for students, because often the accommodation offered has several different types. Students must consider the advantages and disadvantages of these types to determine the best choice that is objective. Not to mention having to consider the opinions of other parties such as parents or friends. The process of comparing each of these types can be confusing and tiring, including for students at Coventry University who want to live in accommodation provided by the campus. Student accommodation at Coventry University was chosen as the object of research because the available accommodation is officially managed by the university. In addition, at the time the research was taking place, the researcher was also participating in the Indonesian International Student Mobility Awards (IISMA) program at Coventry University and the problem of choosing accommodation came from the researcher's personal experience.

One thing that can be a solution is to create a calculation of a decision support system that is able to provide weight for each criterion from all alternatives as they are without any intervention from student preferences as one of the decision makers. In this study, a comparison will also be made of the use of two different methods to obtain the weighting that will be used in determining the best accommodation. With this, the determination and selection of accommodation will be easier because the advantages and disadvantages of each accommodation will be taken into account, not purely subjective judgments of the decision maker. The initial calculation will produce a weight for each criterion which will then be used in the next calculation in determining the best alternative as the final result. Then, the final result of this ranking can be a reference for students in deciding which accommodation will later become their residence.

The method used in this calculation is the Method Based on the Removal Effects of Criteria (MEREC) and Criteria Importance Through Intercriteria Correlation (CRITIC) in determining the weighting of the criteria. The reason for using these methods is because often the decision maker is not only the student himself, but also with parents or even prospective friends in their accommodation. This causes the weighting of the criteria to be complicated because it must unite various different opinions. Therefore, a method that provides weight for each criterion objectively is needed. Researches use MEREC as its method aimed to rank different indicators relevant to SEE (social, economic, and environmental) of sustainability [1] and a research to select the optimal spray-painting robot [2] and research to select pallet truck selection in the textile workshop [3]. Then, CRITIC method is used in research to select very light business jet [4], investment portfolio [5] and material [6]. In addition, these two methods are also specifically for giving weight to the criteria only. So, another method is required in determining the best alternative. In this study, the Multi-Objective Optimization (MOORA) method is used to determine the best alternative. As the name implies, this method is suitable for cases that have many objects that must be considered at the same time. In this method, the weighting can also come from calculations using other methods. Thus, this method is suitable for use in determining the best accommodation for students. Several research using this method are research to find aspects need to be focused on to improve learning quality [7], to select scholarship awardees [8] and to choose green supplier in steel door industry [9].

From the problems that have been described, the author made a study in the form of a decision support system that is expected to help students who will study at Coventry University in determining the accommodation they will live in. The research is intended to answer some questions including will the calculation be able to present the rank of student accommodations objectively, what is the purpose of implementing MEREC, CRITIC and MOORA method and the difference found by using two different methods. There are also a few limitations, such as the research object is focused solely on student accommodation at Coventry University, the problem trying to be solved is the hurdle to choose accommodation

objectively, the discussion is mainly focused on weighting criteria, ranking alternative, and analyzing the ranks, and lastly, the method used are MEREC, CRITIC and MOORA. By doing this specific research, hopefully this paper will be able to help students at Coventry University to compare the student accommodation's data and then choose it objectively.

2. METHODS

2.1. Data Collection

In this study, the data collection technique used is through the official website of Coventry University, namely www.coventry.ac.uk and Google Maps. The data collected is data related to the facilities provided by student accommodation, namely price, rental duration, mattress type, room size, room facilities, roommates, kitchen facilities, kitchen facility division, number of occupants, distance to campus, parking, gym, Google Maps review and rating.

The data will then be used as criteria for each student accommodation, which in this study will be an alternative. Using these criteria, objective criteria weighting will be carried out using the MEREC and CRITIC methods and then alternative rankings will be carried out using the MOORA method.

2.2. Method Based on the Removal Effects of Criteria (MEREC)

The MEREC method is an objective weighting method introduced by Mehdi Keshavarz-Ghorabaee et al. in 2021. To calculate the weight of the criteria, the effect of removing each criterion on the aggregate performance of the alternative is used in this method. The weight of a criterion will be greater when the removal of the criterion has a greater impact on aggregate performance [10]. It is something new to provide an assessment of an option based on the removal of attributes to determine the weight of the attribute attributes [1]. In this study, the MEREC method will be used to determine the weight of each existing criterion. One of the advantages of this method is its simplicity, because it does not require complicated calculations and can be run easily [11]. The calculation steps consist of creating a decision matrix, normalizing the decision matrix (N) using equation (1), calculating the overall alternative performance (Si) using equation (2), calculating the alternative performance by eliminating each criterion using equation (3), calculating the sum of absolute deviations using equation (4), and determining the final weight of the criteria using equation (5) [10]. The calculation equation or formula is as follows:

Normalization of decision matrix (N).

$$n_{ij}^{x} = \begin{cases} \frac{\min_k x_{kj}}{x_{ij}} & if \quad j \in B \\ \frac{x_{ij}}{\max_k x_{kj}} & if \quad j \in C \end{cases} \tag{1}$$

Calculation of overall performance of alternatives (Si).

$$Si = \ln\left(1 + \left(\frac{1}{m}\sum_j \left|ln\left(n_{ij}^{x}\right)\right|\right)\right) \tag{2}$$

Calculation of performance of alternatives by removing each attribute (Sij').

$$S'_{ij} = \ln\left(1 + \left(\frac{1}{m}\sum_{k,k\neq j} \left|ln(n_{ik}^{x})\right|\right)\right) \tag{3}$$

Calculation of removal effect (Ej).

$$E_j = \sum_i \left|S'_{ij} - S_i\right| \tag{4}$$

Estimate the final weights (Wj)

$$W_j = \frac{E_j}{\sum_k E_k} \tag{5}$$

2.3. Criteria Importance Through Inter-Criteria Correlation (CRITIC)

This method was proposed through a journal article in 1995 by D. Diakuolaki et al. Similar to the MEREC method, this method is also a weighting method. The determination of weights is based on two fundamental ideas of MCDM: namely the intensity of contrast and the character of conflicting evaluation criteria [12].This method allows for objective weighting of each criterion [13]. The correlation between criteria is used to determine the objective weight coefficient [14]. The CRITIC method briefly has three steps, namely creating a decision matrix, normalizing the decision matrix and determining the weight of the criteria where the standard deviation of the criteria and their correlation with other criteria are included [15]. To facilitate efficient decision-making in challenging situations, this method has been used intensively in various sectors such as engineering, business, and social sciences [16]. In this study, the CRITIC method will also be

used to determine the weight of the criteria objectively. After the decision matrix is obtained, the next calculation step follows the following equation or formula:

Normalization of decision matrix

$$r_{ij} = \frac{x_j^{max} - x_{ij}}{x_j^{max} - x_j^{min}} \quad if \quad j \in C$$

$$r_{ij} = \frac{x_{ij} - x_j^{min}}{x_j^{max} - x_j^{min}} \quad if \quad j \in B \qquad (6)$$

Calculation of Standard Deviation for Each Criteria.

$$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} \qquad (7)$$

Determine the Symmetric Matrix.

$$\rho_{ij} = \frac{m(\sum xy) - (\sum x)(\sum y)}{\sqrt{(m\sum x^2 - (\sum x)^2)(m\sum y^2 - (\sum y)^2)}} \qquad (8)$$

Measure of the Conflict Created by Criterion.

$$Con_j = \sum_{k=1}^{n}(1 - \rho_{jk}) \qquad (9)$$

Estimation of Criterion information (Cj).

$$Cj = Con \times s \qquad (10)$$

Determining the Objective Weights.

$$W_j = \frac{C_j}{\sum_{k=1}^{n} C_j} \qquad (11)$$

2.4. Method Based on the Ratio Analysis (MOORA)

In determining the ranking of alternatives, this study will use the MOORA method proposed by Brauers in 2004. The MOORA method provides the selection of the best alternative by creating a decision matrix from various alternatives based on various criteria [17]. The steps in this method are to create a decision matrix, then followed by normalizing the decision matrix using equation (12), constructing a weighted decision matrix using feelings (13) and finally sorting for ranking [18]. In the MOORA method, in determining the ranking and selecting the best alternative from several available options, both benefit criteria (bigger is better) and cost criteria (smaller is better) are considered [19].

Normalization of decision matrix

$$Nx_{ij} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^{m} x_{ij}^2}} \qquad (12)$$

Decision matrix weighting. In this study, the weights used are the weights that have previously been obtained using the MEREC and CRITIC method calculations.

$$W_j = \sum_{j=1}^{m} -1 \times x_{ij} \times w_j \quad if \quad j \in C$$

$$W_j = \sum_{j=1}^{m} x_{ij} \times w_j \quad if \quad j \in B \qquad (13)$$

3. RESULTS AND DISCUSSION

3.1 Alternative Determination

Following the initial limitations stated earlier, the alternatives used in this research are focused solely on student accommodations at Coventry University, United Kingdom. These alternative data were obtained from the official website of Coventry University, www.coventry.ac.uk. The list is presented in Table 1 below.

Table 1. *Alternative list*

Alternatives	Code
Bishop Gate (Undergraduate) Ensuite 1	A1
Bishop Gate (Undergraduate) Ensuite 2	A2
Bishop Gate (Undergraduate) Standard Studio	A3
Bishop Gate (Undergraduate) Twudio	A4
Bishop Gate (Postgraduate) Ensuite	A5
Bishop Gate (Postgraduate) Standard Studio	A6
Bishop Gate (Postgraduate) Premium Studio	A7
Bishop Gate (Postgraduate) Deluxe Studio	A8
Godiva Place (Undergraduate) Ensuite 1	A9
Godiva Place (Undergraduate) Ensuite 2	A10
Godiva Place (Undergraduate) Studio	A11
Godiva Place (Undergraduate) Twudio	A12
Godiva Place (Postgraduate) Ensuite	A13
Godiva Place (Postgraduate) Standard Studio	A14
Singer Hall (Undergraduate) Standard Bedroom	A15
Singer Hall (Undergraduate) Premium Room	A16
Singer Hall (Postgraduate) Standard bedroom	A17
The Cycle Works (Undergraduate) Ensuite 1	A18
The Cycle Works (Undergraduate) Ensuite 2	A19
The Cycle Works (Postgraduate) Standard Studio	A20
The Cycle Works (Postgraduate) Premium Studio	A21
Parish Rooms (Postgraduate) Standard Bedroom	A22
Parish Rooms (Postgraduate) Single Ensuite	A23

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3.2 Criteria Determination

In determining the criteria, only secondary data are used, and they were also obtained from the same website where the alternative data were sourced. Additionally, there are two criteria whose data were obtained from Google Maps, namely Google Maps Rating and Google Maps Review, which both are as well secondary data. Secondary data were used as they are sourced from official platforms, hence the certainty is more guaranteed. The list of criteria along with their cost or benefit status is presented in Table 2 below.

Table 2. *Criteria list*

Criteria	Code	Status
Weekly Price in £	C1	Cost
Contract Length	C2	Benefit
Bed Type	C3	Benefit
Bedroom Size	C4	Benefit
Bedrooms Facilities	C5	Benefit
Roomate	C6	Cost
Kitchen Facilities	C7	Benefit
Shared Kitchenette	C8	Cost
Number of Residence	C9	Cost
Distance to Uni	C10	Cost
Storage/Parking	C11	Benefit
On-Site Gym	C12	Benefit
Google Maps Review	C13	Benefit
Google Maps Rating	C14	Benefit

3.3 Determination of Criteria Weights

3.3.1 Application of the MEREC Method

The MEREC method is used in this research to objectively assign weights to each criterion. The calculation steps and equations follow the descriptions previously outlined. The first step is to create a decision matrix. The data for the decision matrix can be seen in Table 3 below.

Table 3. *Decision matrix*

A/C	C1	C2	C3	…	C13	C14
A1	167	39	3	…	164	4.4
A2	159	43	3	…	164	4.4
A3	185	43	3	…	164	4.4
A4	140	43	3	…	164	4.4
A5	159	50	3	…	164	4.4

Table 3 continued…

A/C	C1	C2	C3	…	C13	C14
…	…	…	…	…	…	…
A19	145	43	3	…	124	4.2
A20	165	50	3	…	124	4.2
A21	170	50	3	…	124	4.2
A22	115	50	2	…	6	3.8
A23	125	50	2	…	6	3.8

The next step is to normalize the matrix using Equation (1). The normalized matrix results are shown in Table 4.

Table 4. *MEREC step 2*

A/C	C1	C2	C3	⋯	C13	C14
A1	0.8	1	0.3	⋯	0	0.9
A2	0.8	0.9	0.3	⋯	0	0.9
A3	0.9	0.9	0.3	⋯	0	0.9
A4	0.7	0.9	0.3	⋯	0	0.9
A5	0.8	0.8	0.3	⋯	0	0.9
…	…	…	…	…	…	…
A19	0.7	0.9	0.3	⋯	0	0.9
A20	0.8	0.8	0.3	⋯	0	0.9
A21	0.9	0.8	0.3	⋯	0	0.9
A22	0.6	0.8	0.5	⋯	1	1
A23	0.6	0.8	0.5	⋯	1	1

The third step is to calculate the overall performance of the alternatives using Equation (2). The calculation results are presented in Table 5.

Table 5. *MEREC step 3*

A	Si
A1	0.450468
A2	0.457125
A3	0.374146
A4	0.45278
A5	0.463923
A6	0.382594
A7	0.358932
A8	0.369001
A9	0.41386
A10	0.420764
A11	0.366203
A12	0.44544

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Table 5 continued…

A	Si
A13	0.427812
A14	0.374719
A15	0.388019
A16	0.435026
A17	0.405072
A18	0.470724
A19	0.47507
A20	0.41254
A21	0.411127
A22	0.388261
A23	0.417374

Next, the performance of the alternatives is calculated by excluding each criterion using Equation (3). The results of these calculations are shown in Table 6.

Table 6. *MEREC step 4*

A/C	C1	C2	C3	…	C13	C14
A1	0.4	0.5	0.4	⋯	0.3	0.4
A2	0.4	0.5	0.4	⋯	0.3	0.5
A3	0.4	0.4	0.3	⋯	0.2	0.4
A4	0.4	0.4	0.4	⋯	0.3	0.4
A5	0.5	0.5	0.4	⋯	0.3	0.5
…	…	…	…	…	…	…
A19	0.5	0.5	0.4	⋯	0.3	0.5
A20	0.4	0.4	0.4	⋯	0.3	0.4
A21	0.4	0.4	0.4	⋯	0.3	0.4
A22	0.4	0.4	0.4	⋯	0.4	0.4
A23	0.4	0.4	0.4	⋯	0.4	0.4

The following step is to calculate the sum of absolute deviations using Equation (4). The calculation results are presented in Table 7.

Table 7. *MEREC step 5*

E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14
0.3	0.2	1	0.3	0.5	0.1	0.7	0.5	0.5	0.5	0.1	0.3	3.2	0.1

Finally, the last step is to determine the final weights of the criteria using Equation (5). The resulting weights are displayed in Table 8 below.

Table 8. *MEREC step 6*

Criteria	Code	Weight
Weekly Price in £	C1	0.037174
Contract Length	C2	0.02008
Bed Type	C3	0.12683
Bedroom Size	C4	0.038053
Bedrooms Facilities	C5	0.05868
Roomate	C6	0.007886
Kitchen Facilities	C7	0.084073
Shared Kitchenette	C8	0.055884
Number of Residence	C9	0.062065
Distance to Uni	C10	0.061151
Storage/Parking	C11	0.012319
On-Site Gym	C12	0.032736
Google Maps Review	C13	0.387925
Google Maps Rating	C14	0.015144

3.3.2 Application of the CRITIC Method

Similar to the MEREC method, this method is also used to assign weights to each criterion. The decision matrix for this method is the same as the decision matrix in the MOORA method, which is shown in Table 3. The first step in this method is to normalize the matrix using Equation (6). The results of the normalization are shown in Table 9.

Table 9. *CRITIC step 1*

A/C	C1	C2	C3	…	C13	C14
A1	0.3	0	1	⋯	1	1
A2	0.4	0.4	1	⋯	1	1
A3	0.1	0.4	1	⋯	1	1
A4	0.5	0.4	1	⋯	1	1
A5	0.4	1	1	⋯	1	1
…	…	…	…	…	…	…
A19	0.5	0.4	1	⋯	0.7	0.7
A20	0.3	1	1	⋯	0.7	0.7
A21	0.3	1	1	⋯	0.7	0.7
A22	0.8	1	0.5	⋯	0	0
A23	0.7	1	0.5	⋯	0	0

Next, the standard deviation for each criterion is calculated using Equation (7). The results of this calculation are presented in Table 10.

Table 10. *CRITIC step 2*

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.5	0.3	0.5	0.3	0.5	0.3	0.3

The following step is to determine the symmetric matrix using Equation (8). The results of this step are shown in Table 11.

Table 11. *CRITIC step 3*

C	C1	C2	C3	…	C12	C13	C14
C1	1	-0	-1	…	-0	-0	-1
C2	-0	1	-0	…	0.1	-0	-0
C3	-1	-0	1	…	0.1	0.2	0.6
…	…	…	…	…	…	…	…
C12	-0	0.1	0.1	…	1	0.8	0.5
C13	-0	-0	0.2	…	0.8	1	0.6
C14	-1	-0	0.6	…	0.5	0.6	1

Step 4 involves measuring the conflict created by each criterion using Equation (9). The results are displayed in Table 12.

Table 12. *CRITIC step 4*

Criteria	Code	SUM
Weekly Price in £	C1	13.87038
Contract Length	C2	14.3614
Bed Type	C3	12.45248
Bedroom Size	C4	12.97838
Bedrooms Facilities	C5	12.6332
Roommate	C6	12.76303
Kitchen Facilities	C7	13.0111
Shared Kitchenette	C8	12.39087
Number of Residence	C9	14.0371
Distance to Uni	C10	13.9979
Storage/Parking	C11	15.09109
On-Site Gym	C12	14.0021
Google Maps Review	C13	13.83962
Google Maps Rating	C14	13.17622

Next, the estimation of criterion information (cj) is calculated using Equation (10). The results are presented in Table 13.

Table 13. *CRITIC step 5*

Criteria	Code	Cj
Weekly Price in £	C1	3.718564
Contract Length	C2	5.950254
Bed Type	C3	3.941542
Bedroom Size	C4	3.962203
Bedrooms Facilities	C5	3.770051
Roommate	C6	3.596255
Kitchen Facilities	C7	4.428387
Shared Kitchenette	C8	6.04727
Number of Residence	C9	4.391473
Distance to Uni	C10	6.666928
Storage/Parking	C11	5.082394
On-Site Gym	C12	6.668925
Google Maps Review	C13	4.225967
Google Maps Rating	C14	4.379602

The final step is to determine the objective weights using Equation (11). This step provides the final weighting results, which are presented in Table 14 below.

Table 14. *CRITIC step 6*

Criteria	Code	W
Weekly Price in £	C1	0.055642
Contract Length	C2	0.089036
Bed Type	C3	0.058979
Bedroom Size	C4	0.059288
Bedrooms Facilities	C5	0.056413
Roommate	C6	0.053812
Kitchen Facilities	C7	0.066264
Shared Kitchenette	C8	0.090488
Number of Residence	C9	0.065711
Distance to Uni	C10	0.09976
Storage/Parking	C11	0.07605
On-Site Gym	C12	0.09979
Google Maps Review	C13	0.063235
Google Maps Rating	C14	0.065534

3.3.3 Ranking Calculation Using the MOORA Method

The MOORA method is used to rank the alternatives. The weights previously obtained using the MEREC and CRITIC methods will be applied in this method. The steps and equations in this method follow the explanations provided in the previous chapter. The first step is to create

a decision matrix. In this method, the decision matrix is the same as the one used in the MEREC method, as shown in Table 3. The next step is to normalize the decision matrix using Equation (12). The normalized matrix is presented in Table 15 below.

Table 15. *MOORA step 1*

A/C	C1	C2	C3	…	C13	C14
A1	0.2	0.2	0.2	⋯	0.3	0.2
A2	0.2	0.2	0.2	⋯	0.3	0.2
A3	0.2	0.2	0.2	⋯	0.3	0.2
A4	0.2	0.2	0.2	⋯	0.3	0.2
A5	0.2	0.2	0.2	⋯	0.3	0.2
…	…	…	…	…	…	…
A19	0.2	0.2	0.2	⋯	0.2	0.2
A20	0.2	0.2	0.2	⋯	0.2	0.2
A21	0.2	0.2	0.2	⋯	0.2	0.2
A22	0.2	0.2	0.2	⋯	0	0.2
A23	0.2	0.2	0.2	⋯	0	0.2

The following step is weighting. The weighting will be performed twice, using the weights obtained from the MEREC method and the CRITIC method. However, the same equation will be used, namely Equation (13). The calculation results using the MEREC method weights are shown in Table 16 below.

Table 16. *MEREC-MOORA result*

Alternatives	MEREC-MOORA Score	Ranks
A1	0.149872	3
A2	0.150635	2
A3	0.127434	8
A4	0.138414	4
A5	0.151276	1
A6	0.128273	7
A7	0.117882	10
A8	0.120221	9
A9	0.093953	16
A10	0.094715	15
A11	0.079788	21
A12	0.090768	18
A13	0.095356	14
A14	0.080627	20
A15	0.090718	19
A16	0.109571	13
A17	0.09222	17
A18	0.132779	6
A19	0.133145	5
A20	0.116288	11
A21	0.116041	12
A22	0.040485	23
A23	0.047894	22

The calculation results using the CRITIC method weights are shown in Table 17 below.

Table 17. *CRITIC-MOORA result*

Alternatives	MEREC-MOORA Score	Ranks
A1	0.065265	6
A2	0.067483	4
A3	0.041278	20
A4	0.06321	7
A5	0.070326	1
A6	0.044417	18
A7	0.03887	22
A8	0.041013	21
A9	0.055424	14
A10	0.057641	12
A11	0.038397	23
A12	0.060329	10
A13	0.060484	9
A14	0.041537	19
A15	0.057301	13
A16	0.065507	5
A17	0.062509	8
A18	0.06785	3
A19	0.069475	2
A20	0.051257	15
A21	0.050887	16
A22	0.045973	17
A23	0.05803	11

3.4 Result Analysis

The calculations using the MEREC-MOORA and CRITIC-MOORA methods yield different results, even though the weighting approaches in the MEREC and CRITIC methods are both objectives, meaning there is no influence from the researcher's opinion. Tables 14 and 15 in the previous chapter

Jurnal Teknik Informatika Vol. 17 No. 2, Oktober 2024 (179-189)
ISSN: p-ISSN 1979-9160 (Print)| e-ISSN 2549-7901 (Online)
DOI: https://doi.org/10.15408/jti.v17i2.41097

illustrate the differences in scores between the two methods and the ranking differences for each alternative when using these two different method combinations.

3.4.1. Pearson Correlation Coefficient Calculation

Next, using the data from the MEREC-MOORA Score column in Table 14 and the CRITIC-MOORA Score column in Table 15, the Pearson Correlation Coefficient (r) is calculated. The strength and direction of the relationship between two variables, which are measured on at least an interval scale, are expressed as the Pearson Correlation Coefficient (r) [20]. The correlation coefficient value can range between +1 and −1, including the endpoints +1 or −1 [21]. The result obtained is r = 0.37 (37%), indicating that a value between 0.3 and 0.7 suggests that the two variables have a moderate positive linear relationship. This means that when the values in the MEREC-MOORA Scores column increase, the values in the CRITIC-MOORA Scores column also increase, and vice versa.

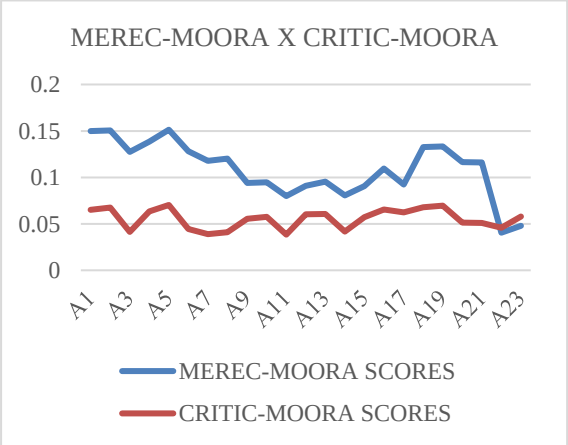

Figure 1. *Line diagram of ranks*

Additionally, the R-Squared (r^2) value was calculated from the same columns, resulting in $r^2 = 0.14$. The R^2 value has five categories: <1% (negligible), 1% - 15% (small), 16% - 48% (moderate), 49% - 80% (substantial), and ≥81% (very high) [22]. The r^2 value of 0.14 falls within the "small" category, indicating that the response variable (CRITIC-MOORA) can hardly be predicted by the predictor variable (MEREC-MOORA).

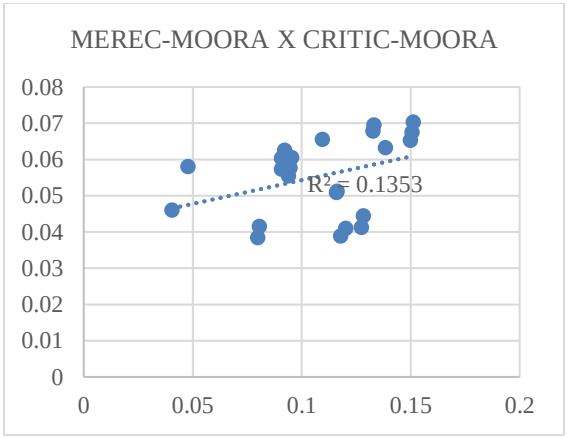

Figure 2. *Sccatter plot of ranks*

3.4.2. Outlier Removal Calculation

In this study, the differing rankings observed are influenced by outliers. It was found that values A22 and A23 from C9 and C13 are outliers, which are typically removed before data processing. Outliers are data points with extreme or unusual values compared to other data points, which can reduce and distort information within a dataset [23]. Removing outliers is expected to yield more similar and accurate results. Additionally, using what-if analysis, alternatives and criteria will be added to understand their impact on the final rankings. What-If Analysis is a simulation technique used to explore what might happen if certain changes are made in a given scenario or situation [24]. The scenarios to be used are as follows:

1. Removing outliers, namely A22 (Alternative 22) and A23 (Alternative 23).
2. Removing outliers, namely C9 (Criterion 9) and C13 (Criterion 13).
3. Adding a new alternative, A24.
4. Adding a new criterion, C15.

The results of these calculations are shown in Table 18 below:

Table 18. *Calculation comparison*

Scenario	r	Difference with r of scenario 0	r^2	Difference with r^2 scenario 0
0	0.37	-	0.14	-
1	0.77	0.4	0.6	0.46
2	0.81	0.44	0.66	0.52
3	0.38	0.01	0.15	0.01
4	0.33	-0.04	0.1	-0.04

Explanation:

– r = 0.7 - 1: Indicates a strong positive linear relationship.
– $r^2 = 0.1 – 0.15$: Indicates a small relationship, meaning the response variable is almost not predictable by the predictor variable.

– r^2 = 0.49 – 0.8: Indicates a substantial relationship, meaning the response variable can be predicted by the predictor variable.

CONCLUSION

Based on the discussion on the Comparison of Criterion Weight Determination Using MEREC and CRITIC Methods in Choosing the Best Student Accommodation with the MOORA Method, several conclusions can be drawn:

1. Calculation for decision support system are successful in giving student accommodation's rank.
2. The MEREC and CRITIC methods can be applied to decision support systems to provide weight for each criterion objectively
3. The MOORA method can be applied to decision support systems to help determine the accommodation that will be chosen by students at Coventry University.
4. The use of a combination of MEREC-MOORA and CRITIC-MOORA methods provides different accommodation ranking results. However, the correlation between the results of the two is a moderate positive linear relationship, which means that if the value of one combination of methods increases, the value of the other combination of methods also increases and vice versa. In addition, based on the r2 value, it can be indicated that the response variable (CRITIC-MOORA) can hardly be predicted by the predictor variable (MEREC-MOORA). In addition, the data used has outliers, and if removed, the correlation between the two becomes a strong positive linear relationship and the response variable (CRITIC-MOORA) can be predicted by the predictor variable (MEREC-MOORA).

In addition to that, some suggestions that can be given by the author for further research are:

1. Comparing methods that use subjective and objective weighting to determine the best student accommodation to find out whether the ranking of the system has similarities with students' subjective choices.
2. Expanding the range of alternatives, so that it is not limited to student accommodation under the management of Coventry University only.

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