JITK (JURNAL ILMU PENGETAHUAN DAN TEKNOLOGI KOMPUTER)

VOL. 8. NO. 1 AUGUST 2022
P-ISSN: 2685-8223 | E-ISSN: 2527-4864
DOI: 10.33480/jitk.v8i1.2219

DECISION SUPPORT SYSTEM USING FUCOM-MARCOS FOR AIRLINE SELECTION IN INDONESIA

Gede Surya Mahendra

Program Studi Teknik Informatika
STMIK STIKOM Indonesia
www.stiki-indonesia.ac.id
gede.mahendra@stiki-indonesia.ac.id

Abstract— *Since deregulation in 1999, the development of the Indonesian aviation industry has continued to develop. However, many airlines still face various problems before and during flights. Problems in the plane, ranging from engine problems, technical problems, tire damage, cockpit problems to air pressure problems. Airlines customers have personal considerations and preferences when choosing an airline. The many choices and many considerations of airlines often confuse customers. To solve this problem, a decision support system (DSS) can be used to provide advice in selecting airlines based on customer preferences. This study uses the FUCOM-MARCOS method, using 8 criteria and 6 testing alternatives. When using FUCOM to calculate criterion weights, it appears that the factor price (C5) is the factor that counts most. Calculations using FUCOM-MARCOS show that Garuda Indonesia is the favorite airline in Indonesia with a preference value of 0.7390, followed by Citilink in second place, and Batik Air in third. Testing using consistency analysis shows that Garuda Indonesia remains stable and is the first choice by being ranked first 15 times out of 17 tests, with an average ranking distribution reaching 1.23466.*

Keywords: *FUCOM, MARCOS, DSS, Airlines, Indonesia*

Intisari— *Sejak deregulasi pada 1999, perkembangan industri penerbangan Indonesia semakin berkembang. Namun, banyak maskapai penerbangan yang masih menghadapi berbagai masalah sebelum dan selama penerbangan. Terdapat masalah di pesawat, mulai dari masalah mesin, masalah teknis, kerusakan ban, masalah kokpit hingga masalah tekanan udara. Pelanggan maskapai penerbangan memiliki pertimbangan dan preferensi pribadi saat memilih maskapai. Banyaknya pilihan dan banyaknya pertimbangan maskapai seringkali membingungkan pelanggan. Untuk mengatasi masalah tersebut, dapat digunakan sistem pendukung keputusan (SPK) untuk memberikan saran dalam memilih maskapai penerbangan berdasarkan preferensi pelanggan. Penelitian ini menggunakan metode FUCOM-MARCOS, menggunakan 8 kriteria dan 6 alternatif untuk dilakukan pengujian. Ketika menggunakan FUCOM untuk menghitung bobot kriteria, terlihat bahwa faktor harga (C5) adalah faktor yang paling diperhitungkan. Perhitungan menggunakan FUCOM-MARCOS menunjukkan bahwa Garuda Indonesia merupakan maskapai terfavorit di Indonesia dengan nilai preferensi 0,7390, disusul Citilink, sebagai peringkat kedua, dan Batik Air menduduki peringkat ketiga. Pengujian menggunakan analisis konsistensi menunjukkan bahwa Garuda Indonesia tetap stabil dan menjadi pilihan pertama, menduduki peringkat pertama sebanyak 15 kali dari 17 pengujian, dengan rata-rata sebaran peringkat mencapai 1.23466.*

Kata Kunci: *FUCOM, MARCOS, SPK, Maskapai, Indonesia*

INTRODUCTION

Since the issuance of a series of deregulation steps in 1999, the development of the Indonesian aviation service industry has continued to develop. The large number of airlines operating in Indonesia directly brings stiff competition. However, it turns out that there are still many airlines that experience various problems before and during the flight. In 2021 alone, various problems will occur in aircraft, ranging from engine problems, technical problems, tire damage, cockpit problems to air pressure problems[1]. The COVID-19 situation has also hampered the business conditions of airlines. Aircraft manufacturer Airbus announced that as a result of the pandemic, the losses amounted to 18.8 trillion IDR[2]. Not only affects companies, but as many as 25 million people are unemployed due to COVID-19, and this number continues to increase after the pandemic duration chart[3]. Airline service levels have continued to improve, especially during times of pandemics. One of them is by providing free rapid antigen testing services through Garuda

VOL. 8. NO. 1 AUGUST 2022
P-ISSN: 2685-8223 | E-ISSN: 2527-4864
DOI: 10.33480 /jitk.v8i1.2219

Indonesia, Lion Air, Batik Air, NAM Air and Sriwijaya Air[4].

The better the service quality standard of the selected airline, the greater the interest of potential passengers to use its services[5]. TripAdvisor is one of the websites that make online reservations and provides information about various accommodations in various parts of the world[6]. TripAdvisor customers have a tool that allows them to rate the accommodations used online. All parties can use this level to influence the improvement of service quality and provide information related to accommodation with characteristics. However, airlines customers have personal considerations and preferences when choosing their travel agency. The many choices and many considerations of airlines often confuse customers. To solve this problem, a decision support system (DSS) can be used to provide advice in selecting airlines based on customer preferences. A DSS is an effective system that uses decision rules, analysis models, comprehensive databases and decision maker knowledge to help make complex decisions[7]–[9]. In this research, the method used was the FUCOM-MARCOS combination. This method combination was chosen because FUCOM has the following advantages: the algorithm is simpler, the standard result weights are more reliable, the comparison between standards is less, and the predefined integer, decimal, or decimal values are allowed, so it is better than AHP More flexible or BWM[10]–[14]. When considering parameters in an uncertain environment, MARCOS will give good results, and considering the relationship between ideal and anti-ideal solutions can have a positive impact on effective decision making[15]–[21]. However, for consistency analysis, there has not been a comprehensive analysis of how several decision makers with different weights and method combinations that test how to use consistency analysis are compared. Therefore, this study aims to calculate the combination of the FUCOM-MARCOS method and analyze the consistency of the combination of these methods. The urgency of this research, if not realized, will hamper the development of the DSS method which can only reach the calculation and design stages manually so that it can hinder innovation in the DSS field.

MATERIALS AND METHODS

The research method used in this study follows the various stages of the Cross-Industry Data Mining Standard Process (CRISP-DM) model[22]–[26]. This framework is expected to analyze business problems and current conditions, provide appropriate data transformation, and provide a model that can assess effectiveness and record the results obtained[22]. The stages of the CRISP-DM process model are shown in Figure 1.

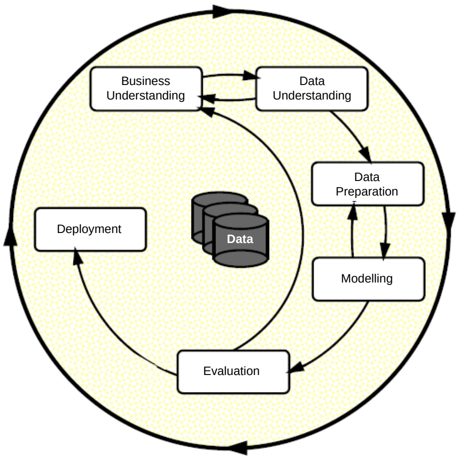


Figure 1. CRISP-DM Model

The first stage is the stage of understanding the business, which is used to determine business goals, analyze business conditions, and determine the objectives of the DSS. This stage analyzes the results of observations, interviews, and supporting documents to achieve the objectives and research results. Aviation business entity or air transportation is an air transportation business entity that is a state-owned company, regional business entity, or Indonesian legal entity in the form of a limited liability company whose main activity is to operate aircraft in accordance with the provisions of laws and regulations. Regulation of the Minister of Transportation (No. 77 PM, 2011) Article 1, paragraph 5[27], is used to transport passengers, cargo and / or post offices. Regular commercial air transportation is commercial air transportation that is carried out on fixed and scheduled routes and flight schedules with certain and published prices[28]. Indonesian scheduled airlines include Aviastar, Batik Air, Citilink, Garuda Indonesia, Indonesia AirAsia, Indonesia Metro Aviation, Kalstar Aviation, Lion Air, NAM Air, Sriwijaya Air, Susi Air, TransNusa, Wings Air, and Xpress Air.

TripAdvisor is a site that provides reviews of travel and travel accommodation, one of which is a review of Indonesia Airlines. On TripAdvisor, only exposure to value is provided, regardless of consumer preferences. Every customer has their own considerations, many airlines in Indonesia have similar policies and service quality standards, which often confuses consumers. This study will use data from TripAdvisor as substitute data and will use 3 sources to select airlines. An example of airline reviews on TripAdvisor can be seen in Figure 2.

VOL. 8. NO. 1 AUGUST 2022
P-ISSN: 2685-8223 | E-ISSN: 2527-4864
DOI: 10.33480/jitk.v8i1.2219

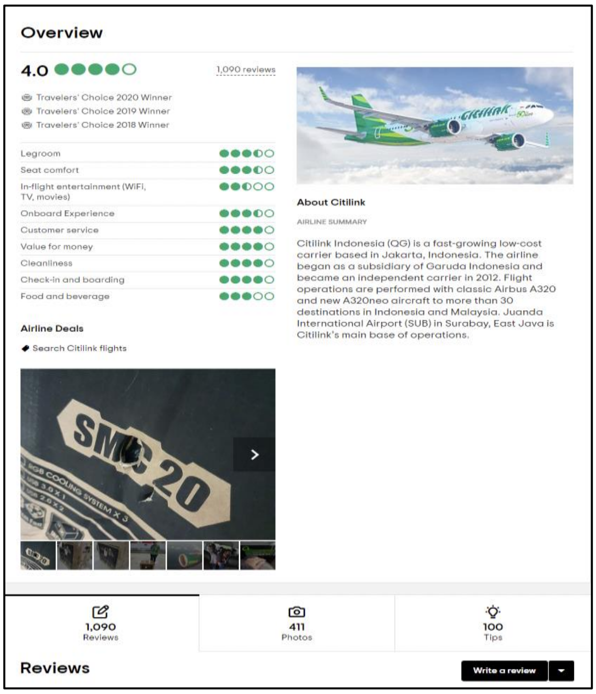


Figure 2. Airline Reviews On Tripadvisor

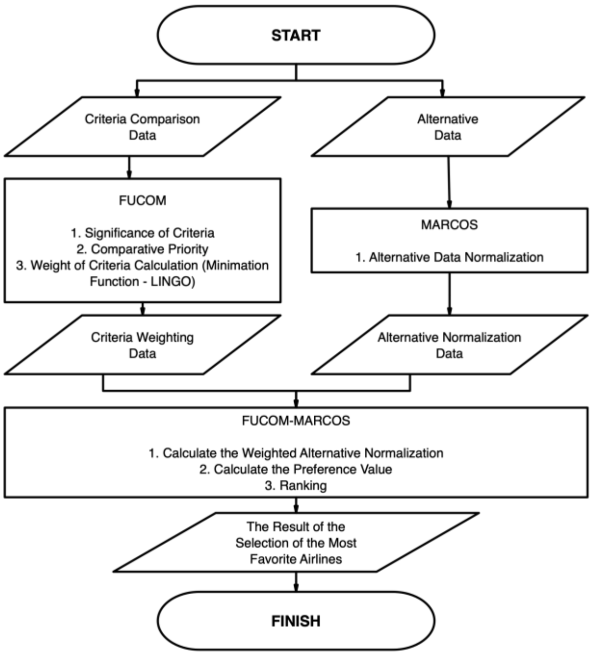


Figure 3. Flowchart Of Using The Fucom-Marcos Method

In addition, there are stages of understanding data for data collection, followed by data analysis and evaluation of the quality of the data used in the study. In order to provide recommendations to consumers, appropriate standards and alternative data must be obtained. The criteria used in this study include leg and chair comfort (C1), in-flight entertainment (C2), in-flight experience (C3), customer service (C4), price (C5), cleanliness (C6), check-in and boarding (C7) and food and beverage (C8). Criteria with cost condition is price (C5) while others are criteria with benefit condition. The alternative airlines used are Indonesian scheduled commercial `airlines, which consists of 6 airlines, namely Batik Airlines, Citilink, Garuda Indonesia, AirAsia Indonesia, Lion Air and NAM Air.

The next stage is the data preparation stage, this stage includes selecting the data to be used and the data to be published for inclusion in the DSS calculation. At this stage, data cleaning will also be carried out to repair, remove or ignore noise in the data. Three Decision makers will use FUCOM to weight the criteria. Instead, airline data will be evaluated based on predetermined criteria. At the business understanding stage, tools, techniques or methods have been selected to be used in this research, namely FUCOM-MARCOS to determine the most popular airlines in Indonesia. At this modeling stage, the process of using this method will be explained. Before proceeding, you can use provisional data to test your design to prove that this method works. The flowchart of the method is shown in Figure 3.

The first step is to prepare to compare the criteria provided by the decision maker as a resource with substitute data for airline data on TripAdvisor. By using the FUCOM method, standard weight data were determined starting from providing standardized significance levels, comparing priorities, and using LINGO to use minimization functions to calculate standard weight coefficients. In addition, the MARCOS method is used to normalize surrogate data to produce surrogate normalized data. Standard weighting data using the FUCOM method and alternative data normalized by the MARCOS method will be weighted and normalized to calculate and calculate the preference value, and a preference value will be generated which can be ranked to determine the favorite airlines in Indonesia. A higher priority value is a better airline recommendation. The evaluation phase will be tested based on the results of the DSS recommendations and the performance of the methods used. Consistency analysis was used to obtain the consistency of the FUCOM-MARCOS method and the lowest possible conditions. The final stage is implementation, where the implementation plan is carried out based on previous evaluations. If the test results show good results, further implementation can be planned. Apart from deployment planning, monitoring and maintenance plans can also be planned to produce final reports and scientific publications regarding research results.

RESULTS AND DISCUSSION

To be able to perform calculations using the FUCOM-MARCOS method, previously weighting the criteria for determining favorite airlines based on questionnaire data from decision makers who already understand well about active use of airlines, which is transformed in the FUCOM method as a comparison between criteria and airline data is used as alternative data. The number of decision makers (DM) used to compare between standards to produce standard weights is 3, which will be called the Decision Maker 1 (DM1), Decision Maker 2 (DM2), and Decision Maker 3 (DM3). The number of airlines used is 6 airlines company. Using the FUCOM method, these three decision makers providers provide a weighted standardized evaluation by providing a standardized level of importance, and calculation of mathematical coefficient and transitivity ratios. The decision maker chooses the most preferred standard and assigns a value of 1, which is the same as the previous value, or adds an ordinal or decimal value at the end before the next standard of choice, so the lower the weight, the better. Table 1 lists the weights of the three decision maker on each criterion.

Table 1. Weighted Criteria Based on the Three Decision Makers

Criteria	C1	C2	C3	C4	C5	C6	C7	C8
DM1 Weighting	1,5	1,1	1,9	2,4	1,0	1,7	1,3	2,1
DM2 Weighting	1,1	1,9	1,5	1,6	1,0	1,4	2,1	2,5
DM3 Weighting	1,0	2,0	1,8	1,4	1,2	1,6	2,2	2,5

In addition, calculations are focused on decision maker 1 (DM1), and calculations from other sources will follow computations of DM1. Carry out the DM1 weighting from the smallest to the largest weight. In addition, the value of comparison priority calculation is the calculation of the weight coefficient ratio, and mathematical transitive calculations are also carried out based on the ratio of the weight coefficient. Table 2 shows the standard weighted rating of DM1.

Table 2. Weighted Criteria Based on the Decision Makers 1

Criteria	C5	C2	C7	C1	C6	C3	C8	C4
DM1 Weighting	1	1,1	1,3	1,5	1,7	1,9	2,1	2,4

Comparative priority calculation and weight coefficient ratio on DM1, calculated using the following formula.

$$\frac{w_k}{w_{k+1}} = \varphi_{\frac{k}{k+1}}$$

Calculation of mathematical transivity from the calculation of the weight coefficient ratio on DM1, calculated using the following formula.

$$\frac{w_k}{w_{k+2}} = \varphi_{k/(k+1)} \times \varphi_{(k+1)/(k+2)}$$

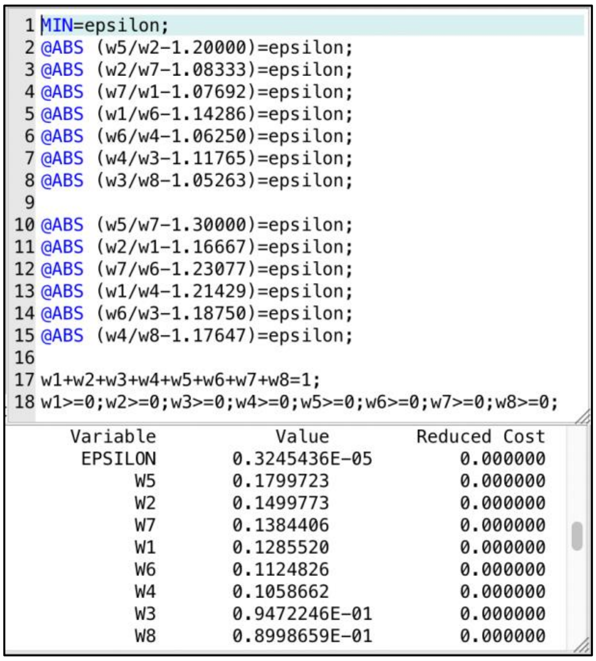
The final results of mathematical modeling to determine the evaluation criteria weight coefficient for informant 1 are as follows.

$$\begin{aligned}
&\min \chi \\
&s.t. \\
&\left|\frac{w_5}{w_2} - 1,10000\right| \le \chi, \left|\frac{w_2}{w_7} - 1,18182\right| \le \chi, \left|\frac{w_7}{w_1} - 1,15385\right| \le \chi, \left|\frac{w_1}{w_6} - 1,13333\right| \le \chi, \left|\frac{w_6}{w_3} - 1,11765\right| \le \chi, \left|\frac{w_3}{w_8} - 1,10526\right| \le \chi, \left|\frac{w_8}{w_4} - 1,14286\right| \le \chi, \\
&\left|\frac{w_5}{w_7} - 1,30000\right| \le \chi, \left|\frac{w_2}{w_1} - 1,36364\right| \le \chi, \left|\frac{w_7}{w_6} - 1,30769\right| \le \chi, \left|\frac{w_1}{w_3} - 1,26667\right| \le \chi, \left|\frac{w_6}{w_8} - 1,23529\right| \le \chi, \left|\frac{w_3}{w_4} - 1,26316\right| \le \chi, \\
&\sum_{j=1}^{8} w_j = 1 \\
&w_j \ge 0, \forall j
\end{aligned}$$

Then the mathematical modeling obtained is solved using the help of the LINGO application program to perform the minimization function. The notation and results of the minimization function to find the weight coefficient of the FUCOM evaluation criteria using LINGO can be seen in Figure 4.

To find the weighted average of all decision makers, the geometric mean (GeoMean) calculation is carried out based on the weighting of the criteria for all decision maker, are presented in table 3. The weighting to be used is the normalization result of GeoMean from all decision maker, are presented in table 4. Based on the weighting of the criteria from all Decision maker, it was determined that the price factor (C5) which reached 17% was a factor that became the main focus of airline selection followed by comfort (C1) which reached 16%, and the cleanliness factor (C6) and customer service (C4) became the next biggest factor which reached around 12%.

VOL. 8. NO. 1 AUGUST 2022
P-ISSN: 2685-8223 | E-ISSN: 2527-4864
DOI: 10.33480/jitk.v8i1.2219



```
MIN=epsilon;
@ABS (w5/w2-1.20000)=epsilon;
@ABS (w2/w7-1.08333)=epsilon;
@ABS (w7/w1-1.07692)=epsilon;
@ABS (w1/w6-1.14286)=epsilon;
@ABS (w6/w4-1.06250)=epsilon;
@ABS (w4/w3-1.11765)=epsilon;
@ABS (w3/w8-1.05263)=epsilon;

@ABS (w5/w7-1.30000)=epsilon;
@ABS (w2/w1-1.16667)=epsilon;
@ABS (w7/w6-1.23077)=epsilon;
@ABS (w1/w4-1.21429)=epsilon;
@ABS (w6/w3-1.18750)=epsilon;
@ABS (w4/w8-1.17647)=epsilon;

w1+w2+w3+w4+w5+w6+w7+w8=1;
w1>=0;w2>=0;w3>=0;w4>=0;w5>=0;w6>=0;w7>=0;w8>=0;
```

Variable	Value	Reduced Cost
EPSILON	0.3245436E-05	0.000000
W5	0.1799723	0.000000
W2	0.1499773	0.000000
W7	0.1384406	0.000000
W1	0.1285520	0.000000
W6	0.1124826	0.000000
W4	0.1058662	0.000000
W3	0.9472246E-01	0.000000
W8	0.8998659E-01	0.000000

Figure 4. Notation and Minimation Function Results to Find the Weight Coefficient of FUCOM Evaluation Criteria Using LINGO

Table 3. The Weight Coefficient of Evaluation Criteria for the Three Decision Makers

Weighted Criteria	DM1	DM2	DM3
W1	0,12855	0,17096	0,17997
W2	0,14998	0,09898	0,10587
W3	0,09472	0,12537	0,11248
W4	0,10587	0,11754	0,13844
W5	0,17997	0,18806	0,14998
W6	0,11248	0,13433	0,12855
W7	0,13844	0,08955	0,09472
W8	0,08999	0,07522	0,08999
SUM	1	1	1

Table 4. The Weight Coefficient of Evaluation Criteria for the Three Decision Makers in Geometric Mean

Weighted Criteria	GeoMean	GeoMean (Normalized)
W1	0,15815	0,15953
W2	0,11626	0,11728
W3	0,11013	0,1111
W4	0,11988	0,12093
W5	0,17186	0,17337
W6	0,12477	0,12586
W7	0,1055	0,10643
W8	0,08477	0,08551
SUM	0,99132	1

After getting the weighted criteria using FUCOM, then you can calculate the preference value using MARCOS. In general, in calculating the preference value starting from the alternative value normalization, the weighted alternative normalization calculation, calculating the preference value and ranking. The alternatives used are Batik Air (A1), Citilink (A2), Garuda Indonesia (A3), Indonesia AirAsia (A4), Lion Air (A5), and NAM Air (A6). Airlines alternative data used in this calculation is shown in Table 5.

Table 5. Airlines Alternative Data

Alter-native	C1	C2	C3	C4	C5	C6	C7	C8
A1	80	35	35	35	624.645	35	35	30
A2	70	25	35	40	512.152	40	40	30
A3	80	40	40	40	851.212	45	40	40
A4	65	20	30	35	421.969	40	40	30
A5	60	20	25	30	449.352	30	30	20
A6	60	15	25	35	430.914	35	40	35

Based on predetermined alternative data, the following calculation shows an example of calculating the normalized value for the Batik Air alternative using MARCOS. For the next alternative, use the same formula to produce the alternative normalized values shown in Table 6. Criteria with benefit condition using this formula.

$$n_{ij} = \frac{x_{ij}}{x_{ai}}$$

Criteria with cost condition using this formula

$$n_{ij} = \frac{x_{ij}}{x_{aai}}$$

$$n_{15} = \frac{624.645}{\min(624.645;512.152;851.212;421.969;449.352;430.914)} = \frac{624.645}{421.969} = 0{,}6755$$

Table 6. Airlines Normalized Alternative Data

Alter-native	A1	A2	A3	A4	A5	A6
C1	1,0000	0,8750	1,0000	0,8125	0,7500	0,7500
C2	0,8750	0,6250	1,0000	0,5000	0,5000	0,3750
C3	0,8750	0,8750	1,0000	0,7500	0,6250	0,6250
C4	0,8750	1,0000	1,0000	0,8750	0,7500	0,8750
C5	0,6755	0,8239	0,4957	1,0000	0,9391	0,9792
C6	0,7778	0,8889	1,0000	0,8889	0,6667	0,7778
C7	0,8750	1,0000	1,0000	1,0000	0,7500	1,0000
C8	0,7500	0,7500	1,0000	0,7500	0,5000	0,8750

After obtaining the alternative normalization value, the calculation of the preference value in MARCOS is continued with the calculation of the optimization value. The following calculation shows the preference value calculated using FUCOM-MARCOS on the Batik Air alternative. For the next alternative, use the same formula to generate preference values for determining favorite airlines using FUCOM-MARCOS. The airline weighted normalized alternative data as shown in Table 7. S_{ai} is the largest value in the list of alternatives in a criterion, and S_{aai} is the smallest value in the list of alternatives in a criterion. S_{ai} and S_{aai} will be used to calculate the value of the alternative utility rate. S_{ai} and S_{aai} value as shown in Table 8.

$$V_{ij} = n_{ij} \times w_j$$

Table 7. Airlines Weighted Normalized Alternative Data

Alter-native	A1	A2	A3	A4	A5	A6
C1	0,1595	0,1396	0,1595	0,1296	0,1196	0,1196
C2	0,1026	0,0733	0,1173	0,0586	0,0586	0,044
C3	0,0972	0,0972	0,1111	0,0833	0,0694	0,0694
C4	0,1058	0,1209	0,1209	0,1058	0,0907	0,1058
C5	0,1171	0,1428	0,1734	0,1628	0,1698	0,1698
C6	0,0979	0,1119	0,1259	0,1119	0,0839	0,0979
C7	0,0931	0,1064	0,1064	0,1064	0,0798	0,1064
C8	0,0641	0,0641	0,0855	0,0641	0,0428	0,0748
Si	0,8374	0,8563	0,9126	0,8332	0,7077	0,7878

Table 8. Airline S_{ai} and S_{aai} value

Alternative	Sai	Saai
C1	0,1595	0,1196
C2	0,1173	0,044
C3	0,1111	0,0694
C4	0,1209	0,0907
C5	0,1734	0,0859
C6	0,1259	0,0839
C7	0,1064	0,0798
C8	0,0855	0,0428
Si	1	0,6162

$$K_i^- = \frac{S_i}{S_{aai}}$$
$$K_1^- = \frac{S_1}{S_{aa1}} = \frac{0,8374}{0,6162} = 1,3591$$

$$K_i^+ = \frac{S_i}{S_{ai}}$$
$$K_1^+ = \frac{S_1}{S_{a1}} = \frac{0,8374}{1,0000} = 0,8734$$

$$f(K_i^-) = \frac{K_i^+}{K_i^+ + K_i^-}$$
$$f(K_1^-) = \frac{1,3591}{0,8734+,3591} = \frac{1,3591}{2,1965} = 0,618$$

$$f(K_i^+) = \frac{K_i^-}{K_i^+ + K_i^-}$$
$$f(K_1^+) = \frac{0,8734}{0,8734+,3591} = \frac{0,8734}{2,1965} = 0,3813$$

$$f(K_i) = \frac{K_i^+ + K_i^-}{1+\frac{1-f(K_i^+)}{f(K_i^+)}+\frac{1-f(K_i^-)}{f(K_i^-)}}$$
$$f(K_1) = \frac{0,8734+1,3591}{1+\frac{1-0,3813}{0,3813}+\frac{1-0,6187}{0,6187}} = 0,6781$$

The ranking for determining favorite airlines using FUCOM-MARCOS as shown in Table 9 and graph of preference value for determining favorite airline using FUCOM-MARCOS as shown in Figure 5.

Table 9. Favorite Airline Determination Preference Value

Criteria	Preference Value	Ranking
Garuda Indonesia (A3)	0,7390	Ranked 1st
Citilink (A2)	0,6934	Ranked 2nd
Batik Air (A1)	0,6781	Ranked 3rd
Indonesia AirAsia (A4)	0,6747	Ranked 4th
NAM Air (A6)	0,6379	Ranked 5th
Lion Air (A5)	0,5731	Ranked 6th

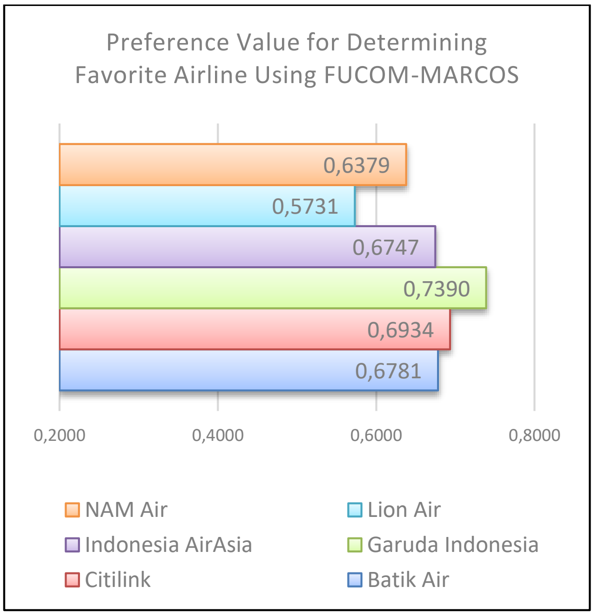


Figure 5. Graph of Preference Value for Determining Favorite Airline using FUCOM-MARCOS

From the ranking graph for the preference value for determining favorite airlines using FUCOM-MARCOS in Figure 5, the results of calculations using FUCOM-MARCOS show that Garuda Indonesia is the most favorite airline in Indonesia, followed by Citilink, Batik Air, Indonesia AirAsia, NAM Air and Lion Air to become the last position based on the data tested. Testing of the ranking on FUCOM-MARCOS is carried out using consistency analysis, with the aim of finding how consistent an alternative ranking is to changes in the weighted criteria conditions. There are 17 scenarios offered to calculate the consistency analysis, which are shown in Table 10.

Based on this scenario, the preference value is recalculated, the rating for FUCOM-MARCOS and the average ranking of all scenarios is sought. The results of the ranking distribution to calculate the consistency analysis and the average ranking distribution are shown in Table 11.

Table 10. Weighted Scenario Between Criteria for Normalized Consistency Analysis

Accredited Rank 3 (Sinta 3) based on the Decree of the Dirjen Penguatan RisBang Kemenristekdikti No.28/E/KPT/2019, September 26, 2019. Published by LPPM Universitas Nusa Mandiri

VOL. 8. NO. 1 AUGUST 2022
P-ISSN: 2685-8223 | E-ISSN: 2527-4864
DOI: 10.33480/jitk.v8i1.2219

Weighted Criteria	W1	W2	W3	W4	W5	W6	W7	W8
Basic Scenario	0,15953	0,11728	0,11110	0,12093	0,17337	0,12586	0,10643	0,08551
Scenario $w_1 + 0,5$	0,43969	0,07819	0,07406	0,08062	0,11558	0,08391	0,07095	0,05701
Scenario $w_2 + 0,5$	0,10635	0,41152	0,07406	0,08062	0,11558	0,08391	0,07095	0,05701
Scenario $w_3 + 0,5$	0,10635	0,07819	0,40740	0,08062	0,11558	0,08391	0,07095	0,05701
Scenario $w_4 + 0,5$	0,10635	0,07819	0,07406	0,41395	0,11558	0,08391	0,07095	0,05701
Scenario $w_5 + 0,5$	0,10635	0,07819	0,07406	0,08062	0,44891	0,08391	0,07095	0,05701
Scenario $w_6 + 0,5$	0,10635	0,07819	0,07406	0,08062	0,11558	0,41724	0,07095	0,05701
Scenario $w_7 + 0,5$	0,10635	0,07819	0,07406	0,08062	0,11558	0,08391	0,40428	0,05701
Scenario $w_8 + 0,5$	0,10635	0,07819	0,07406	0,08062	0,11558	0,08391	0,07095	0,39034
Scenario $w_1 + 1$	0,57977	0,05864	0,05555	0,06046	0,08668	0,06293	0,05321	0,04276
Scenario $w_2 + 1$	0,07977	0,55864	0,05555	0,06046	0,08668	0,06293	0,05321	0,04276
Scenario $w_3 + 1$	0,07977	0,05864	0,55555	0,06046	0,08668	0,06293	0,05321	0,04276
Scenario $w_4 + 1$	0,07977	0,05864	0,05555	0,56046	0,08668	0,06293	0,05321	0,04276
Scenario $w_5 + 1$	0,07977	0,05864	0,05555	0,06046	0,58668	0,06293	0,05321	0,04276
Scenario $w_6 + 1$	0,07977	0,05864	0,05555	0,06046	0,08668	0,56293	0,05321	0,04276
Scenario $w_7 + 1$	0,07977	0,05864	0,05555	0,06046	0,08668	0,06293	0,55321	0,04276
Scenario $w_8 + 1$	0,07977	0,05864	0,05555	0,06046	0,08668	0,06293	0,05321	0,54276

Table 11. Rank Distribution Consistency Analysis Calculation

Alternative	Number of Ranking						GeoMean of Rank Distribution
	1st	2rd	3rd	4th	5th	6th	
Batik Air	-	4 times	5 times	4 times	4 times	-	3,29068
Citilink	-	10 times	7 times	-	-	-	2,36341
Garuda Indonesia	15 times	-	-	-	-	2 times	1,23466
Indonesia AirAsia	2 times	-	4 times	9 times	2 times	-	3,26012
Lion Air	-	-	-	2 times	1 times	14 times	5,65948
NAM Air	-	3 times	1 times	2 times	10 times	1 times	4,06398

Based on the consistency analysis, it shows that from 17 different scenarios of the weighting criteria modification, it shows that Garuda Indonesia remains the customer favorite for selecting airlines in Indonesia. Of the 17 tests conducted by Garuda Indonesia, it reached 15 times the first rank and 2 times the sixth rank. This is due to the 2 times the test focuses on the price factor. The price set by Garuda Indonesia is indeed the most expensive among its competitors, but other factors such as comfort, cleanliness, customer service and others have a better value compared to competitors. This research shows that the selected sample of Decision maker shows that price is the main choice in selecting their favorite airline. Garuda Indonesia is the favorite airline based on the choice of sources as the sampling.

CONCLUSION

This research has successfully implemented FUCOM-MARCOS in determining the favorite airlines in Indonesia based on decision makers who were sampled, using 8 criteria and 6 tested alternatives. In calculating the weighting of the criteria using FUCOM, it shows that the price factor (C5) is the factor most taken into account by the Decision maker, followed by the factor of convenience (C1), cleanliness (C6) and customer service (C4). Calculations using FUCOM-MARCOS show that Garuda Indonesia is the favorite airline in Indonesia with a preference value of 0.7390, followed by Citilink as the second favorite airline, Batik Air in third place, and respectively Indonesia AirAsia, NAM Air and Lion. Water is in the last rank of tested alternatives. When the consistency analysis was carried out, Garuda Indonesia remained stable as the first choice by occupying the top 15 out of 17 tests with an average ranking distribution of 1.23466.

REFERENCE

[1] T. Santia, “Rentetan Kejadian Pesawat Maskapai Nasional di Awal 2021, Masalah Mesin hingga Pecah Ban,” *Liputan 6*, Mar. 12, 2021. https://www.liputan6.com/bisnis/read/4504854/rentetan-kejadian-pesawat-maskapai-nasional-di-awal-2021-masalah-mesin-hingga-pecah-ban.

[2] W. S. Widodo, “Airbus Umumkan Rugi Rp 18,8 Triliun Gegara Pandemi Corona,” *Detik.com*, Feb. 23, 2021. https://travel.detik.com/travel-news/d-5401132/airbus-umumkan-rugi-rp-188-triliun-gegara-pandemi-corona.

[3] J. Dalle, “Pandemi Corona dan Drama ‘Terra Incognita,’” *Detik.com*, Nov. 16, 2020. https://news.detik.com/kolom/d-5256888/pandemi-corona-dan-drama-terra-incognita.

[4] D. Kuswaraharja, “Cara Dapatkan Rapid Test Antigen Gratis di 5 Maskapai,” *Detik.com*, Mar. 08, 2021. https://travel.detik.com/travel-news/d-5485219/cara-dapatkan-rapid-test-antigen-gratis-di-5-maskapai.

[5] N. Indriyani, E. Ali, U. Rio, and R. Rahmaddeni, "Menentukan Kualitas Pelayanan Maskapai Penerbangan Domestik Dengan Menggunakan Metode Naïve Bayes:," *SATIN*, vol. 6, no. 1, pp. 37–44, Jun. 2020, doi: 10.33372/stn.v6i1.605.

[6] S. Seimahuira, "Implementasi Datamining dalam Menentukan Destinasi Unggulan Berdasarkan Online Reviews TripAdvisor Menggunakan Alogoritma K-Means," *Jurnal Technologia*, vol. 12, no. 1, pp. 53–58, 2021.

[7] N. K. A. P. Sari, "Implementation of the AHP-SAW Method in the Decision Support System for Selecting the Best Tourism Village," *Jurnal Teknik Informatika C.I.T Medicom*, vol. 13, no. 1, pp. 22–31, Mar. 2021.

[8] G. S. Mahendra and E. Hartono, "Implementation of AHP-MAUT and AHP-Profile Matching Methods in OJT Student Placement DSS," vol. 13, no. 1, p. 9, 2021.

[9] G. S. Mahendra and I. P. Y. Indrawan, "Metode AHP-TOPSIS Pada Sistem Pendukung Keputusan Penentuan Penempatan Atm," *JST (Jurnal Sains dan Teknologi)*, vol. 9, no. 2, pp. 130–142, 2020, doi: 10.23887/jst-undiksha.v9i2.24592.

[10] I. Badi and A. Abdulshahed, "Ranking the Libyan airlines by using Full Consistency Method (FUCOM) and Analytical Hierarchy Process (AHP)," *Operational Research in Engineering Sciences: Theory and Applications*, vol. 2, no. 1, pp. 1–14, 2019, doi: 10.31181/oresta1901001b.

[11] B. Matić *et al.*, "A New Hybrid MCDM Model : Sustainable Supplier Selection in a Construction Company," *Symmetry*, vol. 11, no. March, pp. 1–24, 2019, doi: 10.3390/sym11030353.

[12] M. Adnan, R. Adin, Z. Nunić, Ž. Stević, and S. Sremac, "Selection of transportation mean using integrated FUCOM-ARAS model," *st and*, p. 6, 2019.

[13] D. S. Pamucar, D. Božanic, and A. Randelovic, "Multi-criteria decision making: An example of sensitivity analysis," *Serbian Journal of Management*, vol. 12, no. 1, pp. 1–27, 2017, doi: 10.5937/sjm12-9464.

[14] Ž. Stević, B. Miĉić, D. Lukić, M. Tomašević, and S. Sremac, "Supplier Selection for Distribution of Finished Products: Combined FUCOM-MABAC Model," 2019, no. December, pp. 35–40.

[15] I. Badi and D. Pamucar, "Supplier selection for steelmaking company by using combined Grey-Marcos methods," *Decision Making: Applications in Management and Engineering*, vol. 3, no. 2, pp. 37–48, 2020, doi: 10.31181/dmame2003037b.

[16] M. Stanković, Ž. Stević, D. K. Das, M. Subotić, and D. Pamučar, "A New Fuzzy MARCOS Method for Road Traffic Risk Analysis," *Mathematics*, vol. 8, no. 3, p. 457, Mar. 2020, doi: 10.3390/math8030457.

[17] A. Puška, I. Stojanović, A. Maksimović, and N. Osmanović, "Project Management Software Evaluation by Using the Measurement of Alternatives and Ranking According to Compromise Solution (MARCOS) Method," *Operational Research in Engineering Sciences: Theory and Applications*, vol. 3, no. 1, pp. 89–101, 2020, doi: 10.31181/oresta2001089p.

[18] J. Mitrović Simić, Ž. Stević, E. K. Zavadskas, V. Bogdanović, M. Subotić, and A. Mardani, "A Novel CRITIC-Fuzzy FUCOM-DEA-Fuzzy MARCOS Model for Safety Evaluation of Road Sections Based on Geometric Parameters of Road," *Symmetry*, vol. 12, no. 12, p. 2006, Dec. 2020, doi: 10.3390/sym12122006.

[19] Ž. Stević and N. Brković, "A Novel Integrated FUCOM-MARCOS Model for Evaluation of Human Resources in a Transport Company," *Symmetry*, vol. 4, no. 1, pp. 4–4, 2020, doi: 10.3390/logistics4010004.

[20] R. Chattopadhyay, S. Chakraborty, Industrial Engineering and Management Department, Maulana Abul Kalam Azad University of Technology, West Bengal, India, and S. Chakraborty, "An integrated D-MARCOS method for supplier selection in an iron and steel industry," *Decis. Mak. Appl. Manag. Eng.*, vol. 3, no. 2, pp. 49–69, Oct. 2020, doi: 10.31181/dmame2003049c.

[21] I. Đalić, Ž. Stević, Ž. Erceg, P. Macura, and S. Terzić, "Selection of a distribution channel using the integrated FUCOM-MARCOS model," *International Review*, vol. 4, no. 3, pp. 80–96, 2020, doi: 10.5937/intrev2003080Q.

[22] R. Wirth and J. Hipp, "CRISP-DM : Towards a Standard Process Model for Data Mining," *Semantic Scholar*, vol. 1, no. 24959, pp. 1–11, 2000.

[23] E. Exenberger and J. Bucko, "Analysis of Online Consumer Behavior - Design of CRISP-DM Process Model," *AOL*, vol. 12, no. 3, pp. 13–22, Sep. 2020, doi: 10.7160/aol.2020.120302.

[24] C. Schröer, F. Kruse, and J. M. Gómez, "A Systematic Literature Review on Applying CRISP-DM Process Model," *Procedia Computer Science*, vol. 181, pp. 526–534, 2021, doi: 10.1016/j.procs.2021.01.199.

[25] M. A. Rivai, "Analysis of Corona Virus spread uses the CRISP-DM as a Framework : Predictive Modelling," *International Journal of Advanced Trends in Computer Science and Engineering*, vol. 9, no. 3, pp. 2987–2994,

VOL. 8. NO. 1 AUGUST 2022
P-ISSN: 2685-8223 | E-ISSN: 2527-4864
DOI: 10.33480/jitk.v8i1.2219

2020, doi: 10.30534/ijatcse/2020/76932020.

[26] G. S. Mahendra and P. G. S. C. Nugraha, "Komparasi Metode AHP-SAW dan AHP-WP pada SPK Penentuan E-Commerce Terbaik di Indonesia Comparison of AHP-SAW and AHP-WP Methods on DSS to Determine the Best E-Commerce in Indonesia," *Jurnal Sistem dan Teknologi Informasi (JUSTIN)*, vol. 08, no. 4, pp. 346–356, 2020, doi: 10.26418/justin.v8i4.42611.

[27] B. Setiani, "Tanggung Jawab Maskapai Penerbangan Sebagai Penyedia Jasa Penerbangan Kepada Penumpang Akibat Keterlambatan Penerbangan," *JHN*, vol. 7, no. 3, Feb. 2016, doi: 10.26555/novelty.v7i3.a3930.

[28] I. Setiawan, D. Nusraningrum, and Y. Pahala, "Deregulasi Penerbangan dan Kinerja Perusahaan Penerbangan Niaga Berjadwal di Indonesia," *Jurnal Manajemen Transportasi dan Logistik*, vol. 2, no. 1, p. 1, Jul. 2017, doi: 10.25292/j.mtl.v2i1.130.