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Modification Weight Criteria With Webbed Model For Selection Artist Music Festival Using Analytical Hierarchy Process (AHP)

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Abstrak

Proses pemilihan dari banyak alternatif dengan kriteria merupakan keputusan yang sering ditentukan dalam pengambilan keputusan. Kriteria yang kriterianya dapat terdiri dari banyak atribut digunakan oleh para pengambil keputusan dalam melakukan pemilihan atau disebut dengan multicriteria decision making (MADM). Dalam penelitian ini, penggunaan multi-atribut digunakan dalam memilih artis untuk tampil di festival musik, memilih artis menggunakan kriteria, yaitu Jumlah Followers (C1), Popularitas (C2), Rata-Rata Trek Populer (C3), Rata-rata Penonton Youtube (C4) , dan Harga Artis (C5). Data jumlah followers, popularitas, rata-rata lagu populer, dan rata-rata penonton YouTube diperoleh dengan menggunakan Spotify dan Youtube API. Metode penyelesaian yang diterapkan adalah Analytical Hierarchy Process (AHP), Webbed Model dan algoritma Rating Scale, dengan alternatif menggunakan lima sampel Artis Indonesia. Hasil penelitian ini diharapkan dapat memberikan rekomendasi artis sebagai pengisi acara dalam festival musik.

Kata kunci*— Multi-Attribute Decision Making, Rekomendasi artis, AHP, Rating Scale*

Abstract

The process of selecting from many alternatives to the criteria is a decision that is often determined in decision making. The criteria for which criteria can consist of many attributes are used by decision-makers in selecting or are called multi-criteria decision making (MADM). In this study, the use of multi-attributes used in selecting artists to perform at music festivals, selecting artists using criteria, namely Number of Followers (C1), stamp C2, Average Popular Tracks (C3), Average Youtube Viewers (C4), and the price of the artist (C5). Data on followers, popularity, average popular tracks and average YouTube viewers obtained using the Spotify and Youtube APIs. The settlement method applied is the Analytical Hierarchy Process (AHP), Webbed Model, and the Rating Scale algorithm, with an alternative using five samples of Indonesian artists. The research results are expected to provide recommendations for artists as performers in the music festival.

Keywords*—Multi-Attribute Decision Making, Recommendation artist, AHP, Rating Scale*

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1. INTRODUCTION

Hard Rock FM Bali is one of the most popular radios in Indonesia, with its segmentation of young executives with tastes in various genres is currently trending. However, in its development, radio does not merely provide information in broadcasts and songs. Radio often forms a contract with an outside party to manage an event or music festival that can benefit both parties. In a concert or music festival, the presence of guest stars or artists brought in and used as a line-up is an important factor in the event's success. In the process of determining the artist, the organizers of the festival or music concert event, in this case, are part of advertising and promotion or the public relations section of Hard Rock FM Bali, often find it difficult because several factors or criteria must be examined first, such as the artist's popularity, Listeners know whether the artist's song is widely known, the number of followers, whether the public's enthusiasm for the live artist is high or low, and the artist's cost. Based on these problems, this study determines the selection of artists for performers at music events using a decision support system[1] because the problems encountered are semi-structured and uses many assessment attributes[2], and based on a review of the objectives of the decision support system, namely to get the best alternative to be used as a recommendation[3]. Artist popularity data is obtained using the Spotify and Youtube API to get data on followers, popularity, average popular tracks, and average YouTube viewers[4].

The method proposed is Multi Attribute Decision Making (MADM) using the Analytical Hierarchy Process (AHP) algorithm to support the process of calculating criteria and alternatives[5][6], the use of this method is supported based on previous research regarding the recommendation system[7], as well as reviewing the advantages of the Analytical Hierarchy Process method, where The Analytical Hierarchy Process method has the advantage of handling qualitative and quantitative criteria in the form of pairwise comparisons[8][9]. However, the pairwise comparison score is still given subjectively by the decision-maker based on the Saaty scale value. In addition, the selection of using the Analytical Hierarchy Process method for this case study is based on the existence of several criteria (multi-criteria) used, so that by using the Analytical Hierarchy Process[10], the criteria can be broken down into smaller sub-criteria in the hierarchical structure and can be used. Provide weighting for each criterion and sub-criteria. The use of the Analytical Hierarchy Process method in this case study is also based on one of the main advantages of this method: it is relatively easy to handle decisions with several criteria because AHP involves the principles of decomposition, pairwise comparison, and priority vector generation and synthesis[11]. With this decision support system, it’s hoped that it will produce results in the form of an artist's recommendation that can attract festival music fans.

2. METHODS

The number of followers, popularity, average popular tracks, and average YouTube viewers obtained from streaming platforms Spotify and Youtube[12], and surveys from the admin. The average data for popular tracks is obtained from calculating the average number of the total number of top tracks artists (10 tracks), while for the average viewers, it is obtained from the average calculation of the number of views on the top five video (live) artists. To get data from Spotify and Youtube, use the Web Service using JS & Express Nodes as HTTP Server[13]. The flow of the system overview can be seen in Figure 1.

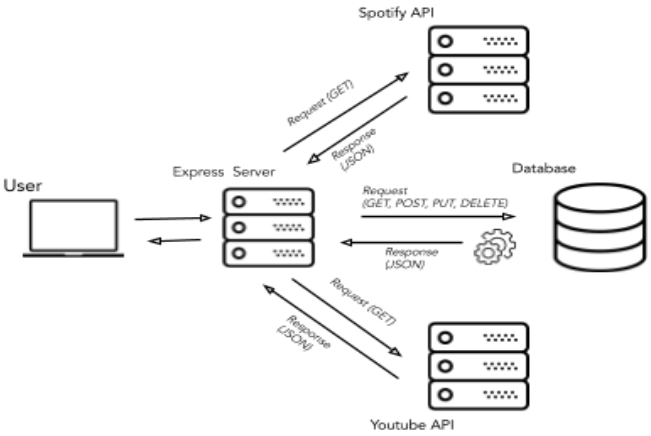

Figure 1. System Overview

In the flow of this decision support system, the database will be used to store data obtained from the Spotify API and Youtube, as well as cost artist data inputted by the advertisement and promotion section as the user in the artist recommendation decision support system, and the database provides data previously stored by admin. The role of the server is in addition to connecting the database with the system, and the server is designed to function to connect the approach to the API from Spotify and Youtube. Users here can manage artist data, criteria data, and calculation reports.

3. RESULTS AND DISCUSSION

This study uses a Decision Support System with the Analytical Hierarchy Process (AHP) method implemented in Hard Rock FM Bali. Data collection was carried out by interviewing the promotion section and the criteria used in the selection of artists for music festivals, namely Followers (C1), Popularity (C2), Average Popular Tracks (C3), Average Youtube Followers (C4), and Price (C5).

3.1 Alternative Analysis

The alternative data used were obtained in the alternative analysis by taking a sample of four Indonesian artists: Nostress, Pamungkas, Barasuara, and Hindia. Assessment of each criterion attribute using a rating scale from 1-5[14]. Can be seen in table 1, below:

Table 1 Artis Alternative

Alternative (A)	C1	C2	C3	C4	C5
	(Followers)	(Popularity)	(Avg. Popular Tracks)	(Avg. Youtube Viewers)	(Cost)
Nosstress (A1)	2	3	3	2	4
Pamungkas (A2)	4	4	4	5	3
Barasuara (A3)	2	3	3	3	1
Hindia (A4)	3	4	3	2	4

3.2 Attribute Analysis

The attribute analysis explains that each criterion has the attributes of the assessment using values 1 to 5 to categorize each attribute[15]. Can be seen in Table 2, as follows:

Table 2 Criteria Attribute

Criteria	Attribute	Rating Scale
Followers (C1)	< 100k	1
	> 100k - 300k	2
	> 300k - 500k	3
	> 500k - 700k	4
	> 700k	5
Popularity (C2)	0 - 20	1
	21 - 40	2
	41 - 60	3
	61 - 80	4
	81 - 100	5
Average Popular Tracks (C3)	0 - 20	1
	21 - 40	2
	41 - 60	3
	61 - 80	4
	81 - 100	5
Average Youtube Viewers (C4)	< 1jt	1
	> 1jt - 2jt	2
	>2jt - 3jt	3
	>3jt - 4jt	4
	>5jt	5
Cost (C5)	> 50jt	1
	41jt - 50jt	2
	31jt - 40jt	3
	21jt - 30jt	4
	10jt- 20jt	5

3.3 Step of Analytical Hierarchy Process (AHP)

The steps in completing the artist selection correspond to the finishing steps in the AHP method. The initial step is to create a hierarchy to identify the problem and determine the criteria used to produce the best alternative.

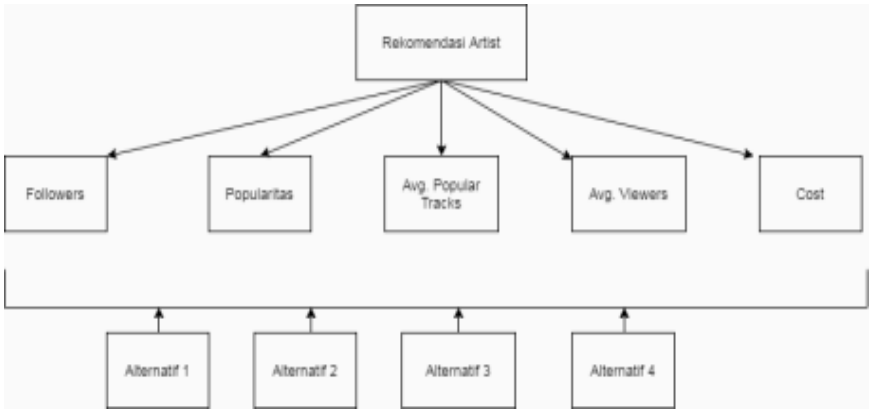

Figure 2. Hierarchy Of Analytical Hierarchy Process

3.3 Determining Priority Elements or Criteria

Decision-makers can compare the criteria one by one to get the desired comparison to determine priority criteria. Where in this study, the criteria used are followers (C1), popularity (C2), average popular tracks (C3), average viewers of youtube (C4), and cost (C5). The pairwise comparison matrix table can be seen in Table 3:

Table 3. Pairwise Comparison Matrix

Criteria	C1	C2	C3	C4	C5
C1	1	1/5	1/4	1/3	1/7
C2	5	1	3	3	1/5
C3	4	1/3	1	3	1/5
C4	3	1/3	1/3	1	1/5
C5	7	5	5	5	1

3.4 Calculating the Criteria Weight Value

In this stage, considerations for pairwise comparisons are synthesized to obtain the overall priority. The first stage in this process is to calculate the pairwise comparison matrix[8], which has not been normalized as in Table 4, as follow:

Table 4. Unnormalized Pairwise Comparison Matrix

Criteria	C1	C2	C3	C4	C5
C1	1	0,20	0,25	0,33	0,14
C2	5	1	3	3	0,20
C3	4	0,33	1	3.00	0,20
C4	3	0,33	0,33	1	0,20
C5	7	5	5	5	1
Total(Σ)	20	6,87	9,58	12,33	1,74

Then proceed with doing calculations to find the normalized value in the pairwise comparison matrix as in Table 5, below:

Table 5. Normalized Pairwise Comparison Matrix

Criteria	C1	C2	C3	C4	C5
C1	0,05	0,03	0,03	0,03	0,08
C2	0,25	0,15	0,31	0,24	0,11
C3	0,20	0,05	0,10	0,24	0,11
C4	0,15	0,05	0,03	0,08	0,11
C5	0,35	0,73	0,52	0,41	0,57

To get the result of criterion weight value, it is necessary to calculate the average value of the paired comparison matrix criteria.

C1 = (0.05 + 0.03 + 0.03 + 0.03+ 0.08) / 5 = 0.04
C2 = (0.25 + 0.15 + 0.31 + 0.24+ 0.11) / 5 = 0.21
C3 = (0.20 + 0.05 + 0.10 + 0.24+ 0.11) / 5 = 0.14
C4 = (0.15 + 0.05 + 0.03 + 0.08+ 0.11) / 5 = 0.09
C5 = (0.35 + 0.73 + 0.52 + 0.41+ 0.57) / 5 = 0.52

Then the results of calculating the weight value of the pairwise comparison matrix criteria between the criteria can be seen in Table 6.

Table 6. Weight Value of Criteria

Criteria	Weight Criteria (*Wj*)
C1	0.04
C2	0.21
C3	0.14
C4	0.09
C5	0.52

3.5 Measure Consistency

Consistency calculations are carried out by multiplying the pairwise comparison matrix to the synthesis results of *Wj*, it can produce λ_{max} with the following steps :

$$\begin{bmatrix} 1.00 & 0.20 & 0.25 & 0.33 & 0.14 \\ 5.00 & 1.00 & 3.00 & 3.00 & 0.20 \\ 4.00 & 0.33 & 1.00 & 3.00 & 0.20 \\ 3.00 & 0.33 & 0.33 & 1.00 & 0.20 \\ 7.00 & 5.00 & 5.00 & 5.00 & 1.00 \end{bmatrix} \begin{bmatrix} 0.04 \\ 0.21 \\ 0.14 \\ 0.09 \\ 0.52 \end{bmatrix} = \begin{bmatrix} 0.22 \\ 1.21 \\ 0.75 \\ 0.44 \\ 3.02 \end{bmatrix}$$

λ_{max} = (0.22/0.04 + 1.21/ 0.21 + 0.75/0.14 + 0.44/0.09 + 3.02/0.52) / 5
λ_{max} = (5.31 + 5.59 + 5.24 + 5.02 + 5.65) / 5
λ_{max} = 5.418

3.6 Calculating the Value of Consistency Index (CI)

The calculation of the consistency index value is carried out with the following formula[16]:

$$CI = \frac{(\lambda \max - n)}{n-1} \quad (1)$$

where n is the number of elements or the number of criteria, namely 5. The calculation of the consistency index can be seen as follows :

CI = (5.418 - 5) / 4
CI = 0.10

3.7 Calculating the Value of Consistency Ratio (CR)

The calculation of the consistency ratio value is carried out with the following formula[8]:

$$CR = \frac{CI}{IR} \quad (2)$$

IR value of 1.1086 is obtained from the number of elements or criteria used. The computation of the consistency ratio is as follows:

CR = 0.10 / 1.1086
CR = 0.09

Because the consistency ratio (CR) is less or equal to 0.1, the calculation results can be declared valid or stated as consistent[17].

3.8 Calculating Eigen Vector Value of Alternative

The calculation of the search for eigenvectors from each alternative on each criterion is carried out, and it can be seen in the table as follows:

Table 7 Eigen Vector Alternative of Criteria (C1)

Alternative	**Followers (C1)**						
	(Followers)	A1	A2	A3	A4	A5	Eigen
A1	1.00	0.08	0.08	0.08	0.08	0.08	0.08
A2	2.00	0.15	0.15	0.15	0.15	0.15	0.15
A3	5.00	0.38	0.38	0.38	0.38	0.38	0.38
A4	2.00	0.15	0.15	0.15	0.15	0.15	0.15
A5	3.00	0.23	0.23	0.23	0.23	0.23	0.23

Table 8 Eigen Vector Alternative of Criteria (C2)

Alternative	**Popularity (C2)**						
	(Popularity)	A1	A2	A3	A4	A5	Eigen
A1	3.00	0.18	0.18	0.18	0.18	0.18	0.18
A2	3.00	0.18	0.18	0.18	0.18	0.18	0.18
A3	4.00	0.24	0.24	0.24	0.24	0.24	0.24
A4	3.00	0.18	0.18	0.18	0.18	0.18	0.18
A5	4.00	0.24	0.24	0.24	0.24	0.24	0.24

Table 9 Eigen Vector Alternative of Criteria (C3)

Alternative	**Average Popular Tracks (C3)**						
	(Avg.Popular Tracks)	A1	A2	A3	A4	A5	Eigen
A1	2.00	0.13	0.13	0.13	0.13	0.13	0.13
A2	3.00	0.20	0.20	0.20	0.20	0.20	0.20
A3	4.00	0.27	0.27	0.27	0.27	0.27	0.27
A4	3.00	0.20	0.20	0.20	0.20	0.20	0.20
A5	3.00	0.20	0.20	0.20	0.20	0.20	0.20

Table 10 Eigen Vector Alternative of Criteria (C4)

Alternative	**Average Viewers (C4)**						
	(Avg.Popular Viewers)	A1	A2	A3	A4	A5	Eigen
A1	1.00	0.08	0.08	0.08	0.08	0.08	0.08
A2	2.00	0.17	0.17	0.17	0.17	0.17	0.17
A3	5.00	0.42	0.42	0.42	0.42	0.42	0.42
A4	2.00	0.17	0.17	0.17	0.17	0.17	0.17
A5	2.00	0.17	0.17	0.17	0.17	0.17	0.17

Table 11 Eigen Vector Alternative of Criteria (C5)

Alternative	**Cost (C5)**						
	(Cost)	A1	A2	A3	A4	A5	Eigen
A1	4.00	0.25	0.25	0.25	0.25	0.25	0.25
A2	4.00	0.25	0.25	0.25	0.25	0.25	0.25
A3	3.00	0.19	0.19	0.19	0.19	0.19	0.19
A4	2.00	0.13	0.13	0.13	0.13	0.13	0.13
A5	3.00	0.19	0.19	0.19	0.19	0.19	0.19

3.9 Calculate The Final Score Of Alternative

Perform the final calculation by multiplying the matrix between the eigenvectors of each alternative with the weight of the criteria in Table 6. Alternative eigenvectors can be seen in the following table:

Table 12 Eigen Vector Alternative of Each Criteria

Alternatives	C1	C2	C3	C4	C5
	(Followers)	(Popularitas)	(Avg. Popular Tracks)	(Avg. Youtube Viewers)	(Cost)
A1	0.08	0.18	0.13	0.08	0.25
A2	0.15	0.18	0.20	0.17	0.25
A3	0.38	0.24	0.27	0.42	0.19
A4	0.15	0.18	0.20	0.17	0.13
A5	0.23	0.24	0.20	0.17	0.19

Final Score (A1) = ((0.08 x 0.04) + (0.18 x 0.21) + (0.13 x 0.14) + (0.09 x 0.09) + (0.25 x 0.52)) = **0.197**

Final Score (A2) = ((0.15 x 0.04) + (0.18 x 0.21) + (0.20 x 0.14) + (0.09 x 0.09) + (0.25 x 0.52)) = **0.209**

Final Score (A3) = ((0.38 x 0.04) + (0.24 x 0.21) + (0.27 x 0.14) + (0.45 x 0.09) + (0.29 x 0.52)) = **0.240**

Final Score (A4) = ((0.15 x 0.04) + (0.18 x 0.21) + (0.20 x 0.14) + (0.18 x 0.09) + (0.13 x 0.52)) = **0.153**

Final Score (A5) = ((0.23 x 0.04) + (0.24 x 0.21) + (0.20 x 0.14) + (0.18 x 0.09) + (0.19 x 0.52)) = **0.201**

Table 13 Ranking Best Alternative

Alternative	**Result**	**Ranking**
A3	0,240	1
A2	0,209	2
A5	0,201	3
A1	0,197	4
A4	0,153	5

Based on the final calculation results, the artist alternative (A3) is obtained, namely Barasuara, which is the best alternative with a value of 0.240.

4. CONCLUSIONS

Based on these results, it can be concluded that the AHP and rating scale method can be applied in the selection of artists for music festivals by considering the comparison of criteria and criteria attribute values by producing the best alternative artist, Barasuara (A3), with a value of 0.240.

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