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Decision Support System Using Ahp and Topsis Methods in Determining Wedding Packages

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Abstract

Choosing a wedding package is always a problem for the prospective bride and groom. The decision support system helps the wedding organizer to make it easier for consumers to choose a wedding package. In this case, the researcher uses the AHP method to find the weight of the criteria and the TOPSIS method to rank alternative consumer choices. The criteria used in this study were 7 (seven), Makeup, Clothing, Catering, Documentation, Decoration, Number of Guests and Price. The results obtained from this study are that the system is able to produce a ranking order of wedding package options in a fast time and get the right choice.

I. INTRODUCTION

In this modern era, there are many technologies that make work faster, easier, efficient and organized. But there are still many jobs that still rely on manual labor which causes work to be less than optimal and less efficient. At this time, one of the main problems is creating a decision support system for choosing a wedding package to make it easier for brides-to-be who want to plan their wedding.

Wedding Organizer is a service that has the function of helping the bride and groom and their families personally who do the planning and supervision to make a series of wedding events with the theme of the event, schedule and costs that have been determined (Ss, Pratiwi, & Muhardi, 2017). In previous research, the Decision Support System for Choosing a Wedding Package using the SAW method can be used to choose a wedding package according to the customer's wishes. (Irvan, et al 2019).

The purpose of the study is to determine the selection of Wedding Packing based on the criteria that have been weighted by the Analytic Hierarchy Process (AHP) method after which they are ranked Decision Results with the Technique for Other Refresh by Similarity to Ideal Solution (TOPSIS).

II. RELATED WORKS/LITERATURE REVIEW (OPTIONAL)

Table 1. Research Overview

No.	Nama dan Tahun Penelitian	Judul dan Lokasi Penelitian	Metode	Hasil Penelitian
1	Irvan Sulistiya Putra dkk (2019)	Sistem Pendukung Keputusan Pemilihan Paket Pernikahan dengan Metode *Saw* Berbasis Web	SAW	Pada Penelitian menunjukkan hasil dari metode *Simple Additive Weighting* dapat dugunakan sebagai alternatif terbaik dalam perhitungan sistem pendukung keputusan dalam ha ini pemilihan paket pernikahan sesuai keinginan pelanggan.

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doi:

2	I Dewa Ayu dan Sandi Kosasi (2018)	Sistem Pendukung Keputusan Pemilihan *Wedding Organizer* (STMIK Pontianak)	SAW	Hasil penelitian ini membantu dan memberikan alternatif dalam melakukan penilaian setiap *Wedding Organizer* dan menunjukkan hasil yang baik dan sistem sudah sesuai dengan yang diharapkan.
3	Sheren Destari dan Bambang Kelana (2018)	Sistem Pendukung Keputusan untuk Menentukan *Wedding Organizer* Menggunakan Metode AHP (Universitas Bina Sarana Informatika)	AHP	Pada penelitian ini menunjukkan sistem pendukung keputusan dengan AHP bisa menyelesaikan permasalahan pemilihan WO yang tepat.
4	Intan Pramudita (2018)	Sistem Pendukung Keputusan Pemilihan Paket Pernikahan berbasis Web dengan Menggunakan Metode SAW *(Simple Additive Weighting)* studi Kasus di Joglomas Solo	SAW	Hasil Penelitian ini menunjukkan bahwa sistem pendukung keputuasn pemilihan paket pernikahan menggunakan metode *Simple Additive Weighting* (SAW) dapat berjalan dengan baik. Dari hasil pengujian user yang menunjukkan total persentase interpretasi sebesar 87,4% terhadap aplikasi tersebut.
5	Fachreza Ilham Dwi Cahyo dkk (2018)	Rencana Bangun Aplikasi Penentuan Vendor Pernikahan Pelanggan Untuk Usaha *Wedding Organizer* Menggunakan Metode SMARTER Berbasis Web (Institut Bisnis dan Infornatika STIKOM Surabaya)	SMARTER Dan Waterfall	Dari hasil implementasi uji coba dan evaluasi sistem pada aplikasi penentuan vendor berdasarkan budget calon pelanggan untuk usaha *Wedding Organizer* menggunakan metode SMARTER berbasis Web, aplikasi mampu memberikan rekomendasi paket pernikahan, sesuai dengan kriteria yang dibutuhkan oleh *customer* dari vendor terbaik.

III. METHODS

The research used is applied research (Applied Research). The criteria for the wedding package based on the data used are Makeup, Clothing, Catering, Documentation, Decoration, Quantity Guests and Prices. also data collection is done by observation, interviews and questionnaires for secondary data collection method is done by reading, observing and studying data from sources related to this research.

Model of Determining Wedding Package with the AHP method

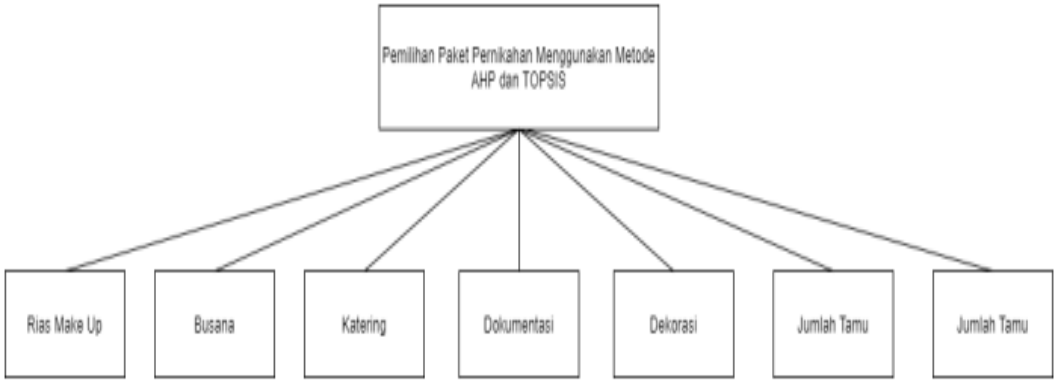

Figure1. Hierachy Model Wedding Package with AHP

Research Steps

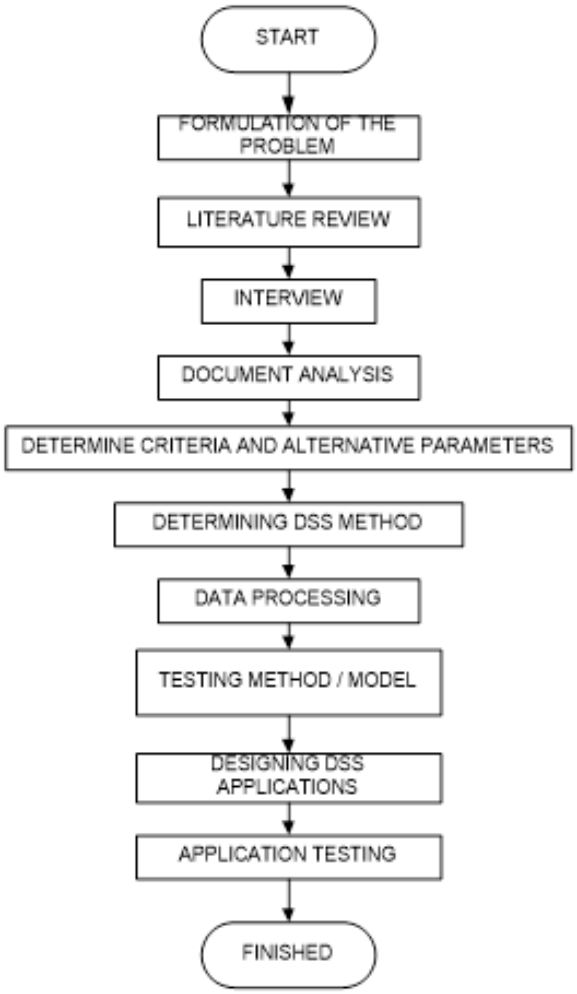

Figure2. Research Steps

IV. RESULTS

In this study discuss the results of AHP calculation as weighting criteria and TOPSIS method as a ranking:

Weighting Process with AHP

Table 2.
Interests Criteria According to Experts

Kode Kriteria	C01	C02	C03	C04	C05	C06	C07
C01	1.00	0.50	0.33	0.33	0.33	0.50	0.50
C02	2.00	1.00	0.33	0.25	0.33	0.50	0.33
C03	3.00	3.00	1.00	3.00	3.00	1.00	1.00
C04	3.00	4.00	0.33	1.00	1.00	0.25	0.33
C05	3.00	3.00	0.33	1.00	1.00	0.33	0.50
C06	2.00	2.00	1.00	4.00	3.00	1.00	2.00
C07	2.00	3.00	1.00	3.00	2.00	0.50	1.00
Total	**16.00**	**16.5**	**4.3333333**	**12.58**	**10.67**	**4.08**	**5.67**

Then matrix normalization is carried out where each result of pairwise comparison is divided by the SUM results from the criteria. After that the value is added to the right divided by the number of criteria to calculate the priority weight. The priority weight value will then be tested for its consequences before being used in ranking with the TOPSIS method.

$$Initial\ Element\ Value = \frac{the\ value\ of\ each\ initial\ matrix\ element}{number\ of\ initial\ columns}$$

The following is the calculation of the first column matrix normalization, namely Make Up:

1. Summation of the Make Up column:
   Makeup Makeup : 1.00 + 2.00 + 3.00 +3.00 + 3.00 + 2.00 + 2.00 = 16.00
2. Normalize Make Up:
   (C01/C01) / Total column C01 = 1.00 / 16.00 = 0.0625

Table 3.
Normalization

Kode Kriteria	C01	C02	C03	C04	C05	C06	C07
C01	0.0625	0.030303	0.076923	0.02649	0.03125	0.122449	0.088235
C02	0.125	0.060606	0.076923	0.019868	0.03125	0.122449	0.058824
C03	0.1875	0.181818	0.230769	0.238411	0.28125	0.244898	0.176471
C04	0.1875	0.242424	0.076923	0.07947	0.09375	0.061224	0.058824
C05	0.1875	0.181818	0.076923	0.07947	0.09375	0.081633	0.088235
C06	0.125	0.121212	0.230769	0.317881	0.28125	0.244898	0.352941
C07	0.125	0.181818	0.230769	0.238411	0.1875	0.122449	0.17471

1. If the value has been normalized the priority weight is searched by adding the first row and the next row.

$$Priority\ Weight = \frac{Number\ of\ Rows}{Number\ of\ Criteria}$$

Example of calculating Research Priority Weight
The following is the calculation of the priority weight of the Make Up line:

Makeup Line Priority Weight: (0.0625 + 0.030303 + 0.076923 +0.02649 + 0.03125 + 0.12249 + 0.088235) / 7 = 0.062592921

$$\lambda = \begin{bmatrix} \Sigma\ baris\ K1 \\ \vdots \\ \Sigma\ baris\ Kn \end{bmatrix} x \begin{bmatrix} BP1 \\ \vdots \\ BPn \end{bmatrix} = \begin{bmatrix} \lambda max\ K1 \\ \vdots \\ \lambda max\ Kn \end{bmatrix}$$

Makeup:
(1.00*0.062592921) + (2.00*0.7070272)+ (3.00*0.220159508)+(3.00*0.11430222) + (3.00*0.112761344)+ (2.00*0.239135897) +(2.00*0.180345368) = 0.456759282

Clothing:
(2.00*0.062592921) + (1.00*0.7070272)+ (0.33*0.220159508)+(0.25*0.11430222) + (0.33*0.112761344) +(0.50*0.239135897) +(0.33*0.180345368) = 0.515120828

Catering:
(3.00*0.159229307)+(3.00*0.134884924)+(1.00*0.293266552)+(3.00*0.05871403)+(3.00*0.052672646)+(1.00* 0.16123269)+(1.00*0.139999838) = 1.720718435

Documentation:
(3.00*0.159229307)+(4.00*0.134884924)+(0.33*0.293266552)+(1.00*0.05871403)+(1.00*0.052672646)+0.25* 0.161232697) +(0.33*0.139999838) = 0.890938895

Decor:
(3.00*0.159229307)+(3.00*0.134884924)+(0.33*0.293266552)+(1.00*0.058714035)+(1.00*0.052672646)+(0.33*0.161232697)+(0.50*0.139999838) = 0.870221706

The number of guests:
(2.00*0.159229307)+(2.00*0.134884924)+(1.00*0.293266552)+(4.00*0.05871403)+(3.00*0.052672646)+(1.00*0.16123269) +(3.00*0.139999838) = 1.882073077

Price:
(2.00*0.159229307)+(3.00*0.134884924)+(1.00*0.293266552)+(3.00*0.05871403)+(2.00*0.052672646)+(0.50*0.16123269)+(1.00*0.139999838) = 1.42579624

2. Looking for Lamda Max with a formula.

$$\lambda = \frac{Number\ of\ elements\ in\ the\ matrix}{m}$$

Information:
m = Number of criteria
Makeup:
0.062592921/ 0.456759282 = 7.297299352
Clothing:
0.7070272/ 0.515120828 = 7.285726282
Catering:
0.293266552/ 1.720718435 = 7.815780788
Documentation:
0.058714035/ 0.890938895 = 7.794589626
Decor:
0.052672646/ 0.870221706 = 7.717376173
The number of guests:
0.161232697/ 1.882073077 = 7.870296334
Price:
0.139999838/ 1.42579624 = 7.90592103

3. The final step is to calculate the consistency index value (CI) used to calculate the consistency ratio value that will determine whether the pairwise comparison matrix to be obtained from the results of the questionnaire has a consistent or not. The purpose of the consistency test is to determine the consistency of the answers that have been filled in by the respondents which will affect the stability of the results. By being declared consistent, the data can be used and processed to the next stage

Formula for calculating $CI = \frac{\lambda max - m}{m-1}$

Next looking for the ratio consistency value (CR), this CR value is obtained with the formula CR = CI / RI. The Random Index (RI) value, obtained from the L.Saaty table.
The random index value will be used to calculate ratio consistency (CR), this CR value will determine whether the paired comparison matrix obtained from the questionnaire results has a consistent or not. The index random value can be seen from the Random Index Table 3.
Consistency ratio (CR) will be valid or consistent if the value of CR <0.1 or worth <10%, and vice versa CR will be invalid or inconsistent if the value is greater ≥ 0.1, with the formulation of the consistency ratio value (CR) :

$$CR = \frac{CI}{CR}$$

In the two tables above the consistency ratio (CR) obtained a value of 0. This means that the ratio is considered consistent (CR <0.1) so that the assessment given by the respondents in the questionnaire is considered feasible

Ranking with TOPSIS method

Ranking by using the TOPSIS method, where the results of weighting with the AHP method will be included as part of the calculation in the steps of ranking with this topsis method, the steps of the topsis method:

1. Make a normalized decision matrix weighted (Y)

Table 4.
Alternative Weight Value

Kode Alternatif	C01	C02	C03	C04	C05	C06	C07
A01	3000000	3000000	17500	750000	7000000	500	2250000
A02	3000000	3000000	17500	750000	7000000	800	2775000
A03	3000000	3000000	19000	750000	7000000	1000	3275000
A04	3500000	4000000	19000	1250000	8000000	500	2625000
A05	3500000	4000000	19000	1250000	8000000	800	3355000
A06	3500000	4000000	21000	1250000	8000000	1000	3775000
A07	0	3000000	17500	750000	7000000	500	1950000
A08	0	3000000	17500	750000	7000000	800	2475000
A09	0	3000000	19500	750000	7000000	1000	2950000
A10	3000000	0	17500	750000	7000000	500	1950000
A11	3000000	0	17500	750000	7000000	800	2475000
A12	3000000	0	19500	750000	7000000	1000	2975000

2. Normalization Decision Matrix, the decision matrix is done by lifting each cell value from each column in the Alternative Weight Value. then add up each column, then add the square root to get the normalized decision table.

Table 5.
Alternative Data Squares Matrix

Kode Alternatif	C01	C02	C03	C04	C05	C06	C07
A01	9E+12	9E+12	3.06E+08	5.63E+11	4.9E+13	250000	5.06E+14
A02	9E+12	9E+12	3.06E+08	5.63E+11	4.9E+13	640000	7.7E+14
A03	9E+12	9E+12	3.06E+08	5.63E+11	4.9E+13	1000000	1.07E+15
A04	1.23E+13	1.6E+13	3.61E+08	1.56E+12	6.4E+13	250000	6.89E+14
A05	1.23E+13	1.6E+13	3.61E+08	1.56E+12	6.4E+13	640000	1.13E+15
A06	1.23E+13	1.6E+13	4.41E+08	1.56E+12	6.4E+13	1000000	1.43E+15
A07	0	9E+12	3.06E+08	5.63E+11	4.9E+13	250000	3.8E+14
A08	0	9E+12	3.06E+08	5.63E+11	4.9E+13	640000	6.13E+14
A09	0	9E+12	3.8E+08	5.63E+11	4.9E+13	1000000	8.7E+14
A10	9E+12	0	3.06E+08	5.63E+11	4.9E+13	250000	3.8E+14
A11	9E+12	0	3.06E+08	5.63E+11	4.9E+13	640000	6.13E+14
A12	9E+12	0	3.8E+08	5.63E+11	4.9E+13	1000000	8.85E+14

3. Making Normalization Data, Normalization data is done using the following formula:

$$N = \frac{Data}{Root\ results\ per\ criteria}$$

Table 6.
Normalization Data

Kode Alternatif	C01	C02	C03	C04	C05	C06	C07
A01	0.314918	0.297044	0.272574	0.240192	0.278225	0.181848	0.232944
A02	0.314918	0.297044	0.272574	0.240192	0.278225	0.290957	0.287298
A03	0.314918	0.297044	0.295937	0.240192	0.278225	0.363696	0.339064
A04	0.367405	0.396059	0.295937	0.240192	0.317971	0.181848	0.271769

A05	0.367405	0.396059	0.295937	0.40032	0.317971	0.290957	0.347346
A06	0.367405	0.396059	0.327089	0.40032	0.317971	0.363696	0.390829
A07	0	0.297044	0.272574	0.240192	0.278225	0.181848	0.201885
A08	0	0.297044	0.272574	0.240192	0.278225	0.290957	0.256239
A09	0	0.297044	0.303725	0.240192	0.278225	0.363696	0.305416
A10	0.314918	0	0.272574	0.240192	0.278225	0.181848	0.201885
A11	0.314918	0	0.272574	0.240192	0.278225	0.290957	0.256239
A12	0.314918	0	0.303725	0.240192	0.278225	0.363696	0.308004

4. Calculating Weighted Normalization, By multiplying normalization data by weighting criteria. Weighted Normalization Formula:

Weighted normalization = Normalization data x Weight of Criteria

Table 7.
Weighted normalization

Kode Alternatif	C01	C02	C03	C04	C05	C06	C07
Bobot	0.062593	0.070703	0.22016	0.114302	0.112761	0.239136	0.180345
A01	0.019712	0.021002	0.058154	0.027455	0.031373	0.043486	0.041936
A02	0.019712	0.021002	0.058154	0.027455	0.031373	0.069578	0.051722
A03	0.019712	0.021002	0.0648	0.027455	0.031373	0.086973	0.061973
A04	0.022997	0.028002	0.069785	0.045758	0.035855	0.043486	0.048926
A05	0.022997	0.028002	0.069785	0.045758	0.035855	0.069578	0.062532
A06	0.022997	0.028002	0.076431	0.045758	0.035855	0.086973	0.07036
A07	0	0.021002	0.058154	0.027455	0.031373	0.043486	0.036345
A08	0	0.021002	0.058154	0.027455	0.031373	0.069578	0.04613
A09	0	0.021002	0.0648	0.027455	0.031373	0.086973	0.054983
A10	0.019712	0	0.058154	0.027455	0.031373	0.043486	0.036345
A11	0.019712	0	0.058154	0.027455	0.031373	0.069578	0.04613
A12	0.019712	0	0.0648	0.027455	0.031373	0.086973	0.055449

5. Value Max and Min
Looking for the max and min values of weighted normalization can be done with the formulation:
Criteria are benefit (the greater the better) then: Y + = max and Y- = min
The criteria are cost (the smaller the better) then: Y + = min and Y- = max (4.10)

Table 8.
Tables of Max and Min of Weighted Normalization

Kode Alternatif	C01	C02	C03	C04	C05	C06	C07
Bobot	0.062593	0.070703	0.22016	0.114302	0.112761	0.239136	0.180345
A01	0.019712	0.021002	0.058154	0.027455	0.031373	0.043486	0.041936
A02	0.019712	0.021002	0.058154	0.027455	0.031373	0.069578	0.051722
A03	0.019712	0.021002	0.0648	0.027455	0.031373	0.086973	0.061973
A04	0.022997	0.028002	0.069785	0.045758	0.035855	0.043486	0.048926
A05	0.022997	0.028002	0.069785	0.045758	0.035855	0.069578	0.062532
A06	0.022997	0.028002	0.076431	0.045758	0.035855	0.086973	0.07036
A07	0	0.021002	0.058154	0.027455	0.031373	0.043486	0.036345
A08	0	0.021002	0.058154	0.027455	0.031373	0.069578	0.04613
A09	0	0.021002	0.0648	0.027455	0.031373	0.086973	0.054983
A10	0.019712	0	0.058154	0.027455	0.031373	0.043486	0.036345
A11	0.019712	0	0.058154	0.027455	0.031373	0.069578	0.04613
A12	0.019712	0	0.0648	0.027455	0.031373	0.086973	0.055449

Max	**0.022997**	**0.028002**	**0.076431**	**0.045758**	**0.035855**	**0.086973**	**0.07036**
Min	**0**	**0**	**0.058154**	**0.027455**	**0.031373**	**0.043486**	**0.036345**

6. Determine the ideal postifier's solution matrix (A +) and negative ideal solution (A-)
With the formulation are:

$$Dx+= \sqrt{(AxC1 - Y1+)^2 + (AxC1 - Y1+)^2} + \cdots + (AxCn - Yn+)^2 \quad (4.11)$$

$$Dx+= \sqrt{(AxC1 - Y1-)^2 + (AxC1 - Y1-)^2} + \cdots + (AxCn - Yn-)^2 \quad (4.12)$$

Table 9.
Ideal Solution Table

Atribut	Cost	Cost	Cost	Cost	Cost	Benefit	Cost
Positif	0	0	0.058154	0.027455	0.031373	0.086973	0.036345
Negatif	0.022997	0.028002	0.076431	0.045758	0.035855	0.043486	0.07036

7. Then determine the distance between the values of each alternative with the positive ideal solution matrix and the negative ideal solution matrix. Distance between alternatives with positive ideal solutions (Di +).

Table 10.
Table of Positive Ideal Solutions

Kode Alternatif	C01	C02	C03	C04	C05	C06	C07
A01	0.000389	0.000441	0	0	0	0.001891	3.13E-05
A02	0.000389	0.000441	0	0	0	0.000303	0.000236
A03	0.000389	0.000441	4.42E-05	0	0	0	0.000657
A04	0.000529	0.000784	0.000135	0.000335	2.01E-05	0.001891	0.000158
A05	0.000529	0.000784	0.000135	0.000335	2.01E-05	0.000303	0.000686
A06	0.000529	0.000784	0.000334	0.000335	2.01E-05	0	0.001157
A07	0	0.000441	0	0	0	0.001891	0
A08	0	0.000441	0	0	0	0.000303	9.57E-05
A09	0	0.000441	4.42E-05	0	0	0	0.00347
A10	0.000389	0	0	0	0	0.001891	0
A11	0.000389	0	0	0	0	0.000303	9.57E-05
A12	0.000389	0	4.42E-05	0	0	0	0.000365

Table 11.
Table of Negative Ideal Solution

Kode Alternatif	C01	C02	C03	C04	C05	C06	C07
A01	1.08E-05	4.9E-05	0.000334	0.000335	2.01E-05	0	0.000808
A02	1.08E-05	4.9E-05	0.000334	0.000335	2.01E-05	0.000681	0.000347
A03	1.08E-05	4.9E-05	0.000135	0.000335	2.01E-05	0.001891	7.03E-05
A04	0	0	4.42E-05	0	0	0	0.000459
A05	0	0	4.42E-05	0	0	0.000681	6.13E-05
A06	0	0	0	0	0	0.001891	0
A07	0.000529	4.9E-05	0.000334	0.000335	2.01E-05	0	0.001157
A08	0.000529	4.9E-05	0.000334	0.000335	2.01E-05	0.000681	0.000587
A09	0.000529	4.9E-05	0.000135	0.000335	2.01E-05	0.001891	0.000236
A10	1.08E-05	0.000784	0.000334	0.000335	2.01E-05	0	0.001157
A11	1.08E-05	0.000784	0.000334	0.000335	2.01E-05	0.000681	0.000587
A12	1.08E-05	0.000784	0.000135	0.000335	2.01E-05	0.001891	0.000222

8. Determine the preference value for each alternative. By using formulations:

$$Vx-= \frac{Dx -}{(Dx -) + (Dx+)}$$

Table 12.
Value of Alternative Preferences

Kode Alternatif	Positif	Negatif	Preferensi	Rank	Keterangan
A01	0.052459	0.039457	0.42927	10	
A02	0.036995	0.042156	0.5326	6	
A03	0.039123	0.050116	0.561594	5	
A04	0.06207	0.022441	0.265538	12	
A05	0.052836	0.02804	0.346701	11	
A06	0.056206	0.043486	0.436204	9	
A07	0.048292	0.049234	0.50483	8	
A08	0.028972	0.050348	0.63474	4	
A09	0.028855	0.056531	0.66206	2	
A10	0.047745	0.051392	0.51839	7	
A11	0.028051	0.052459	0.651582	3	
A12	0.028244	0.058298	0.673643	1	Terbaik

V. DISCUSSION

After analyzing, designing and testing it can be concluded as follows:

1) This application can be used as a way to make company decisions more accurate and useful.
2) By combining the two methods AHP and TOPSIS can provide a solution in determining the ranking and more weight. Meanwhile, the application of each method (AHP and TOPSIS) still has some limitations.

VI. CONCLUSIONS

After analyzing, designing and testing it can be concluded as follows:

1) Calculations using the existing AHP and TOPSIS methods have worked well. By using this system, it will help in making decisions. This system is made simple and easy to make it easier to operate and change the value of criteria and alternatives.
2) The system can be developed and is expected to provide user-friendly elements..

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