E-ISSN : 2541-2019
P-ISSN : 2541-044X

SinkrOn

INFORMATICS ENGINEERING JOURNALS & RESEARCH

Volume 7 | Number 2 | April 2022

Dipublikasi oleh :
POLITEKNIK GANESHA Medan

TABLE OF CONTENT

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 7, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.v7i1.11228
e-ISSN : 2541-2019
p-ISSN : 2541-044X

AHP-SMART Method as Evaluation Decision Support for Employee Promotion

Akmaludin[1)*], **Adhi Dharma Suriyanto**[2)], **Nandang Iriadi**[4)], **Toni Sukendar**[4)], **Budi Santoso**[5)]
[1)]Universitas Nusa Mandiri, Jakarta, Indonesia
[2)3)4)5)]Universitas Bina Sarana Informatika, Jakarta, Indonesia
[1)]akmaludin.akm@nusamandiri.ac.id, [2)]adhi.ais @bsi.ac.id, [3)] nandang.ndi@bsi.ac.id
[4)]toni.tns@bsi.ac.id, [5)]budi.bis@bsi.ac.id

Submitted : Dec 9, 2022 | **Accepted** : Dec 28, 2022 | **Published** : Apr 1, 2022

Abstract: Evaluation of the quality of employees in an institution is very necessary, especially for promotions which are the rights of every employee in leading a company that is full of competition. The purpose of this paper is to contribute in terms of the evaluation process in selecting employees who are ready to be promoted in a particular institution. With the support of various parties, a consistent and optimal method is needed to carry out the evaluation process, which is a popular priority, it is recommended to use the AHP-SMART method, where this method will be collaborated to become a core unit of problem solving, especially in terms of promotion as evaluation and selection material. Selection of the best employees, The AHP method will be used to conduct an assessment of the criteria used with the concept of Multi-criteria Decision Making (MCDM) which utilizes the results obtained from the eigenvector through iteration to minimize differences in the assessments of a number of respondents, while the SMART method is used to determine the results of decisions in collaboration with the AHP method, especially in terms of benefit utility and cost utility. The criteria used as an assessment measure consist of Planning, Solution Capture, Knowledge of Job, Reaction Behavior, Quantity of Works, Failed of Jobs, and Dependability. The final result of the collaboration process of the two methods AHP and SMART gives a ranking of 26 employees with the highest score and being selected through an evaluation process for promotion won by K23 with a ranking weight (73.19) and the second is followed by K2 (76.17) and ranked the third was won by K3 (56.95). Thus the selection and evaluation process for promotion can be recommended and used as an optimal process from the selection stages of employee selection for promotion in every company agency.

Keywords: AHP, Benefit Utility, Consistency, Cost Utility, Eigenvector, SMART.

INTRODUCTION

To build the company's progress continuously, it is necessary to have a leader who has high abilities in handling future challenges, of course based on the evaluation process of each employee who has the same degree of opportunity to become a leader in an agency or company(Augustinus & Eric, 2013). The evaluation carried out certainly has several criteria that refer to the appropriateness value of each employee in an agency or company. Some of the criteria that can be used are Planning, Solution Capture, Knowledge of Job, Reaction Behavior, Quantity of Works, Failed Job, and Dependability. Of the seven criteria that will be used, they will be assessed and evaluated on a continuous basis by their leaders from each division or section they hold. Changes in leadership must be carried out in wise and consistent ways based on the same rules for each line of work for each employee. Each criterion will be compared from one criterion to another to find out how important the criteria are compared (Liang & Peng, 2017), by assessing through instrumentation in the form of a questionnaire using the Analytic Hierarchy Process (AHP) method. By following the AHP stage, the Multi-criteria Decision Making (MCDM) concept will be used (Aziz et al., 2016), (Krmac & Djordjevii, 2019). This concept will carry out a number of iterations whose function is to minimize the difference in the results decided to find a certain point that is able to eliminate the final difference between the eigenvector values and the previous eigenvector values (Saaty, 2010). This is done with the aim of finding the optimum point of the real eigenvector (The et al., 1936), this illustrates that a result will be much better than not finding the difference in eigenvector differences. Thus the results from the eigenvector can be continued into the second stage using the Simple Multi-Attribute Rating Technique (SMART) method which will be applied to the calculation of utility in the form of utility benefits and utility costs to determine the ranking of each selected employee in a particular agency or company (Yusnitha et al., 2019). The utility calculation process will be collaborated with the acquisition of the eigenvector value that has been calculated previously through a comparison of the assessments of all the criteria set. Several related studies that use the SMART method are the Implementation of the Smart Method in the Decision Support

*name of corresponding author

SinkrOn
JURNAL & PENELITIAN TEKNIK INFORMATIKA
Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 7, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.v7i1.11228
e-ISSN : 2541-2019
p-ISSN : 2541-044X

System for the Selection of Extracurricular Activities for High School Students (Magrisa et al., 2018), the Decision Support System for Selection of Exemplary Employees with the SMART Method (Safrizal, 2015), Application of the Method SMART in Decision Making for AMIK Tunas Bangsa Foundation Scholarship Recipients (Andani, 2019).

LITERATURE REVIEW

Decision Support System (DSS) dan Analytic Hierarchy Process (AHP)

A decision support system is a support for the results of a process that is carried out mathematic algebra matrices which is carried out repeatedly to eliminate the difference in the value of the difference in decisions resulting from a number of users in providing comparisons of a number of criteria based on their respective interests (Begicevic et al., 2009). The calculation process can be done using the comparison scale set by Saaty (Saaty, 2008b) through the scale conversion process from the geometric mean scale to the Analytic Hierarchy Process (AHP) scale (Ghaleb et al., 2020), see Figure 1. The resulting scale can be calculated using Mathematics Algebra Matrices or using a computerized application in the form of Expert Choice. Of course, the results obtained have the same identical results. This is one of the advantages of an Expert Choice application that displays the value of its inconsistency (Velasquez & Hester, 2013) and also the sophistication of Mathematics Algera Matrices which is able to prove the truth of the process in a very long way.

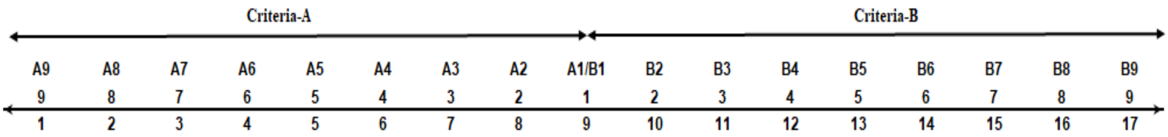

Fig 1. AHP conversion scale

The scale value of the processed geometric mean can be arranged according to the placement of the matrices according to the matrices layout elements in its rows and columns, pay attention to equation 1 which describes the layout of the matrices elements according to the order of the matrices. If the data elements of the matrices are completely placed, then perform the calculation of the matrices multiplication by AxA = B, then iterate over the results of the multiplication of matrices B in the same way, namely BxB = C, then find and determine the result of the difference from the CB eigenvectors and note whether there is a difference or not. no, if there is a difference, then do a second iteration by multiplying the C matrices by CxC=D and so on until you find the value of the difference eigenvector=0 (Saaty, 2008a). If you have succeeded in finding a zero value in the eigenvector difference, it can be concluded that the iegenvector is already at the optimal point. The matrices multiplication will be repeated until the eigenvector difference is zero (Vargas, 2010). This means that it will not find the difference value up to an infinite number of decimal digits. The applied matrices is a matrices that has the same order. For example order (5x5) or order (7x7) and so on. Consider the sample of the order matrices arrangement in equation 1.

$$M_{(r,s)} = \begin{bmatrix} a_{(1,1)} & a_{(1,2)} & a_{(1,3)} & \cdots & a_{(1,s)} \\ a_{(2,1)} & a_{(2,2)} & a_{(2,3)} & \cdots & a_{(2,s)} \\ a_{(3.1)} & a_{(3,2)} & a_{(2,4)} & \cdots & a_{(3,s)} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{(r,1)} & a_{(r,2)} & a_{(r,3)} & \cdots & a_{(r,s)} \end{bmatrix} \quad (1)$$

The method used to find out how many comparisons are produced from the seven criteria, can use equation 2. Thus, it can be seen the comparison (C) that must be provided for each number of criteria seen from the value of importance. After the optimal eigenvector value has been obtained, then do a test of the temporary decision of each data item , whether the decision can be accepted or rejected. The stages of testing the consistency value include Consistency vector, which is to find out the magnitude of the vector stack resulting from multiplying the initials of the matrices with the eigenvectors obtained, of course, the eigenvectors that are already optimal, whose multiplication results are divided by the initials of each row of the matrices. The next step is to find max by finding the average value of the consistency vector, its function is to find out the length of the resulting vector stack. Then proceed with looking for the Consistency vector using equation 3. Which is used to find out the magnitude of the value adjusted for the adjustment of the order of the matrices which is related to the Ramdom index table, pay attention to table 1, which will be used in determining the Consistency ratio (CR), pay attention to equation 4. the provision that becomes a measure of the provisional decision that greatly influences the amount of the CR value, namely if the CR value is less than 10 percent, the provisional decision can be accepted, otherwise if the CR value is more than 10 percent (Saaty, 2008b), the decision will be rejected and the data entry process needs to be reprocessed. sourced from a number of respondents having an error in the entry process through questionnaire instrumentation.

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 7, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.v7i1.11228
e-ISSN : 2541-2019
p-ISSN : 2541-044X

$$C = \frac{n*(n-1)}{2} \tag{2}$$

$$CI = \frac{(\lambda \max - n)}{(n-1)} \tag{3}$$

$$CR = \frac{CI}{RI} \tag{4}$$

To find the CR value, it is influenced by the Random index listed in Table 1. This random index has fixed rules which are shown by how many orders of materix are used, if the number of orders is seven in terms of how many criteria are processed (Liang & Peng, 2017), it is the order of a matrices. If the order used is seven, then the RI value used is 1.32. So the use of the RI value relationship is seen from the many orders that will be used.

Table 1
Random Index

Ordo	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.48

SMART

The SMART method (Simple Multi Attribute Rating Technique) is a method that can be used to examine the magnitude of the utility generated from each of the criteria used, the criteria that can be used with the SMART method can be qualitative or quantitative, this method has good ability in terms of ranking, so it is very well used for the selection and evaluation process (Andani, 2019). So that this SMART method can be collaborated with the AHP method to associate the utility results generated with the eigenvector values of the AHP calculation process (Magrisa et al., 2018). The utility obtained consists of utility benefits, pay attention to equation 5, whose function is to find out a number of criteria declared as benefit categories from each alternative and cost utility which is used to determine the amount that is considered as a cost incurred from each alternative, pay attention to equation 6, while collaboration What can be done between the SMART method and the AHP method in determining the utility value that can lead to ranking can be found by equation 7. With this process stage, the ranking of each alternative will be obtained through the sum of the multi-criteria used.

$$BU_i(x_i) = \frac{C_i - C_{min}}{C_{max} - C_{min}} x100\ percent \tag{5}$$

$$CU_i(x_i) = \frac{C_{max} - C_i}{C_{max} - C_{min}} x\ 100\ percent \tag{6}$$

$$U(a_i) = \sum_{i=1}^{n} U_i W_i \tag{7}$$

In this study there are seven criteria used, pay attention to the table as shown in Table 2 which is included with the acronym and category of each criterion.

Table 2. Criteria of Selection and Evaluation Employee Promotion

No.	Criterias	Acronime	Category
1.	Planning	PL	Benefit
2.	Solution Capture	SC	Benefit
3.	Knowledge of Job	KJ	Benefit
4.	Reaction Behavior	RB	Benefit
5.	Quantity of Work	QW	Benefit
6.	Failed Jobs	FJ	Cost
7.	Dependability	DB	Cost

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 7, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.v7i1.11228
e-ISSN : 2541-2019
p-ISSN : 2541-044X

METHOD

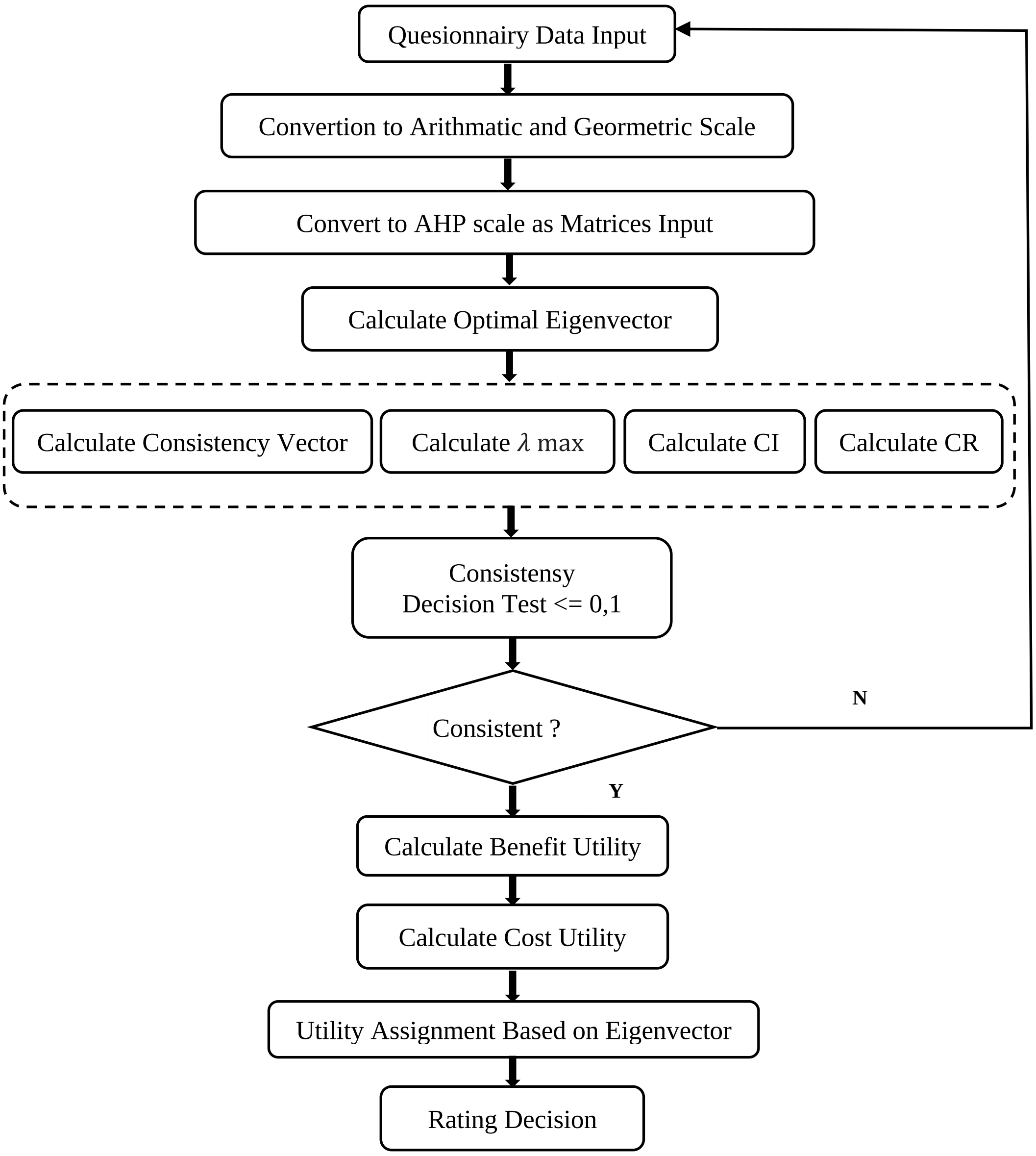

Fig. 1. AHP-SMART Algoritm

RESULT

To carry out the process of evaluating employee promotions, an appropriate method is needed to carry out the evaluation and selection process. This research is certainly supported by two collaborative methods, namely the Analytic Hierarchy Process (AHP) method and the Simple Multi Attribute Rating Technique (SMART) method. Both of these methods can be said to be popular because they are appropriate to use for processing data that tends to be a ranking system. The first time that is prepared is the criteria and rules that are very important to set in advance. How many criteria must be prepared, then determine the number of comparison criteria that must be compared to form a pairwise matrices as contained in equation 1. one comparison that must be compared to find the value of the importance of each criterion to be compared through input in the form of questionnaire instrumentation from forty respondents. The input data generated by the forty respondents was through questionnaire instrumentation and the method of distributing the questionnaire was using the random sampling method. The list of inputs from forty respondents can be seen in table 3.

Table 3

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 7, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.v7i1.11228

e-ISSN : 2541-2019
p-ISSN : 2541-044X

Data input from respondents.

No.	Pairwise Comparison Key Criteria		Respondent										Converted Scale		
			(1)	(2)	(3)	(4)	(5)	....	(37)	(38)	(39)	(40)			
1	Planning	Solution Capture	A2	B3	B2	A1	B2		A2	B1	A2	B3	Math	Geomean	AHP
			8	11	10	9	10		8	9	8	11	9.328	9.328	1.328
2	Planning	Knowledge of Job	B4	B2	A2	B3	B2		B3	B1	B3	A2			
			12	10	8	11	10		11	9	11	8	9.538	9.538	1.538
3	Planning	Reaction Behavior	B3	B1	B2	A2	A1		A1	A2	B2	B4			
			11	9	10	8	9		9	8	10	12	9.571	9.571	1.571
4	Planning	Quantity of Work	B4	A1	B1	B3	A1		B2	B1	A2	B2			
			12	9	9	11	9		10	9	8	10	9.405	9.405	1.405
5	Planning	Failed of Job	B2	B3	A2	B2	A1		B4	A2	A4	B2			
			10	11	8	10	9		12	8	6	10	9.101	9.101	1.101
6	Planning	Depandibility	B4	A1	A2	B3	A1		B2	B1	A2	A2			
			12	9	8	11	9		10	9	8	8	9.249	9.249	1.249
:	:	:	:	:	:	:	:		:	:	:	:	:	:	:
19	Quantity of Work	Failed of Job	A1	B1	B2	B2	B2		A1	B1	A2	A2			
			9	9	10	10	10		9	9	8	8	9.025	9.025	1.025
20	Quantity of Work	Depandibility	B1	B2	A1	B2	B1		A2	B2	B2	A2			
			9	10	9	10	9		8	10	10	8	9.044	9.044	1.044
21	Failed of Job	Depandibility	A1	B1	B2	B2	B2		B3	B1	A2	B1			
			9	9	10	10	10	....	11	9	8	9	9.148	9.148	1.148

Taking into account that table 3 is a list of comparisons of the criteria being compared with each other, the total number of criteria being compared consists of twenty-one items that can be compared according to the rules in equation 2. The data that has become input is processed using a mathematic algebra matrices with scale conversion system. The scale conversion is done firstly, the input data is converted to an arithmetic scale, the second is the arithmetic data is converted to a geometric scale and the third is the geometric scale is converted to the AHP scale. The data that has been successfully converted to the AHP scale means that it is ready to be used as a pairwise matrices as shown in equation 1. The real results can be seen in table 4.

Table 4
Pairwise matrices criteria

	(Benefit)	(Benefit)	(Benefit)	(Benefit)	(Benefit)	(Cost)	(Cost)
Kriteria Utama	Planning (PL)	Solution Capture (SC)	Knowledge of Job (KJ)	Reaction Behavior (RB)	Quantity of Works (QW)	Failed Jobs (FJ)	Depandibility (DB)
Planning	1.000	1.328	1.538	1.571	1.405	1.101	1.249
Solution Capture	0.753	1.000	1.157	1.025	1.145	1.397	1.146
Knowledge of Jobs	0.650	0.864	1.000	1.199	1.016	1.003	1.531
Reaction Behavior	0.636	0.975	0.834	1.000	1.462	1.003	1.306
Quantity of Works	0.712	0.874	0.984	0.684	1.000	1.025	1.044
Failed Jobs	0.908	0.716	0.997	0.997	0.976	1.000	1.148
Depandibiltiy	0.801	0.873	0.653	0.766	0.958	0.871	1.000

Pay attention to table 4 which explains the formation of a pairwise matrices from respondents' entries, this pairwise matrices will be used as the basis for determining the optimal eigenvector value and will be used later in the SMART method to determine the utility value and ranking. The steps to get the optimal eigenvector value are done by multiplying the matrices by itself. As a measure of the iteration of the matrices is the difference between the last eigenvector and the previous eigenvector. If the statement is true, there is no difference in the reduction in the eigenvector value, it can be concluded that the resulting eigenvector value is said to be optimal and ready to be used. The iteration results obtained through four stages of matrices multiplication iterations starting from the initial matrices to the last matrices iteration and used as optimal eigenvector values can be seen in table 5.

Table 5
The last pairwise matrices

5500178005919.780	6610416735480.160	7071863076501.430	7138371145452.570	7967797291357.100	7439385326549.200	8487073727620.950
4519666022885.710	5431983452955.260	5811168153278.420	5865819886215.560	6547384949401.340	6113172529210.920	6974090423831.600
4261582856754.020	5121804895332.870	5479337290482.910	5530868285693.060	6173514440149.510	5764096532564.450	6575854065579.200
4226823142214.400	5080028756730.460	5434644929337.890	5485755610607.510	6123160004518.700	5717081525046.010	6522217936033.700
3757921435241.340	4516476870276.270	4831753774818.470	4877194503765.610	5443888579719.070	5082858328143.140	5798677106299.730
4030255870058.080	4843783387196.740	5181908230177.480	5230642022976.210	5838404097169.720	5451210188048.260	6218903947025.990
3543492863817.770	4258764807943.400	4556051880231.570	4598899742148.230	5133258016719.210	4792828302546.790	5467802161339.480

The results obtained in table 5 are a pairwise matrices with the order of 7x7 where the criteria used are seven criteria. While the results of the pairwise matrices must be tested for consistency. Consistency testing is

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 7, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.v7i1.11228
e-ISSN : 2541-2019
p-ISSN : 2541-044X

carried out through several stages, starting from Consistency vector, max, Consistency Index, and Consistency Ratio. Of course, first make sure that there really is no difference from the eigenvectors, because this gives a perfect picture of the iteration process of the pairwise matrices which states that the optimal eigenvector has been found, see table 6.

Table 6
Optimal eigenvector without difference

Category	*Row Count*	*Normalization and eigenvector*	*eigenvector differences*
Planning	1921236961771810000000000000.000	0.184322812180068	0.000000000000000000000000000000
Solution Capture	1578739707821530000000000000.000	0.151463743638181	0.000000000000000000000000000000
Knowledge of Jobs	1488590094945430000000000000.000	0.142814820838496	0.000000000000000000000000000000
Reaction Behavior	1476448370026300000000000000.000	0.141649947932997	0.000000000000000000000000000000
Quantity of Works	1312658890866720000000000000.000	0.125936041733545	0.000000000000000000000000000000
Failed Jobs	1407786536112030000000000000.000	0.135062555243629	0.000000000000000000000000000000
Depandibiltiy	1237758024633760000000000000.000	0.118750078433083	0.000000000000000000000000000000
Total	10423218586177600000000000000.000	1.0000000000	0.000000000000000000000000000000

With the finding of the optimal eigenvector value, the consistency testing process can be carried out, see table 6 which describes the testing process for the seven criteria whether it is acceptable or rejected, as a measure it will be accepted, if the CR value is less than or equal to ten percent, pay attention to Fig. 2 following.

$$\begin{bmatrix} 1.000 & 1.328 & 1.538 & 1.571 & 1.405 & 1.101 & 1.249 \\ 0.753 & 1.000 & 1.157 & 1.025 & 1.145 & 1.397 & 1.146 \\ 0.650 & 0.864 & 1.000 & 1.199 & 1.016 & 1.037 & 1.531 \\ 0.636 & 0.975 & 0.834 & 1.000 & 1.462 & 1.003 & 1.306 \\ 0.712 & 0.874 & 0.984 & 0.684 & 1.000 & 1.025 & 1.044 \\ 0.908 & 0.716 & 0.965 & 0.997 & 0.976 & 1.000 & 1.148 \\ 0.801 & 0.873 & 0.653 & 0.766 & 0.958 & 0.871 & 1.000 \end{bmatrix} \times \begin{bmatrix} 0.18 \\ 0.15 \\ 0.14 \\ 0.14 \\ 0.13 \\ 0.14 \\ 0.12 \end{bmatrix} = \begin{bmatrix} 1.30 \\ 1.07 \\ 1.01 \\ 1.00 \\ 0.89 \\ 0.95 \\ 0.84 \end{bmatrix}$$

Consistency Vector	7.06
λ max	7.06
Consistency Index	0.01
Consistency Ratio	0.01

Fig. 2. Consistency process stages

By paying attention to Fig. 2, it can be seen that the testing phase of the consistency value gives the decision value against the seven criteria acceptable, this can be proven by the acquisition of the Consistency ratio (CR) value which has a value of less than ten percent, namely $0.01 < 0.1$ this means it is acceptable, so that the resulting decision on the criteria decision can be accepted and can be continued to be processed into the SMART method until the ranking. The eigenvector values that will be used are the results of calculations using Mathematic Algebra Matrices Method can be seen in table 7 which has optimal value.

Table 7. Optimal eigenvector using Mathematic Algebra Matrices

Keterangan	Akronim	Eigenvector	Sifat
Planning	PL	0.18	Benefit
Solution Capture	SC	0.15	Benefit
Knowledge of Job	KJ	0.14	Benefit
Reaction Behavior	RB	0.14	Benefit
Quantity of Works	QW	0.13	Benefit
Failed Jobs	FJ	0.14	Cost
Dependibility	DP	0.12	Cost
Total		100%	

The second proof of the acquisition of eigenvector values can be done using an expert choice application (Akmaludin et al., 2020). The data entry in the form of a pairwise matrices used is exactly the same as that shown in table 2. It's just that the data that is entered is only an upper triangular matrices, as shown in table 8.

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 7, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.v7i1.11228
e-ISSN : 2541-2019
p-ISSN : 2541-044X

Table 8
Pairwise matrices using expert choice apps

	Planning	Solution Capture	Knowledge	Reaction Behavior	Quantity Of Works	Failed Jobs	Depandibility
Planning		1.328	1.538	1.571	1.405	1.101	1.249
Solution Capture			1.157	1.025	1.145	1.397	1.146
Knowledge of Jobs				1.199	1.016	1.003	1.531
Reaction Behavior					1.462	1.003	1.306
Quantity Of Works						1.025	1.044
Failed Jobs							1.148
Depandibility	Incon: 0.01						

The results obtained through the expert choice input will give an inconsistency value of 0.01 with an error rate equal to zero, which can be seen in Fig. 3, where the results of the eigenvector values have exactly the same value as those calculated using mathematic algebra matrices.

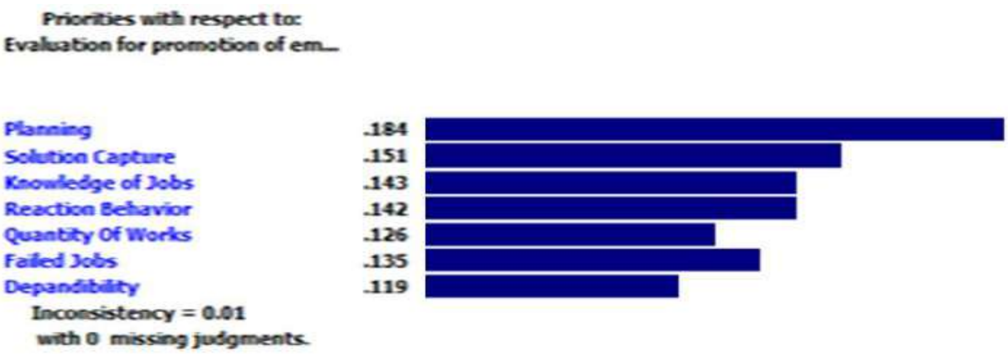

Fig. 3. Optimal eigenvector using Expert Choices Apps.

The dataset obtained is calculated for the evaluation process for the promotion of twenty-six employees and will be shown in table 9. The dataset will be normalized first so that the placement of data positions has a range of scales that can be calculated and has a positioned layout, so that each data element can be taken into account. with uniformity and have the same degree to be calculated into the SMART method.

Table 9
Dataset View

No.	Employee	(B) PL	(B) SC	(B) KJ	(B) RB	(B) QW	(C) FJ	(C) DP
1	K1	83.14	74.57	73.94	74.33	64.31	37.75	34.59
2	K2	95.12	84.13	84.23	73.25	63.74	56.41	15.04
3	K3	75.82	93.08	94.67	48.85	56.82	30.59	27.66
4	K4	88.59	70.65	75.22	64.84	65.22	22.43	59.52
5	K5	52.27	86.25	62.45	56.52	66.87	61.77	45.27
6	K6	72.31	75.48	63.20	65.34	75.96	22.54	60.33
7	K7	71.05	77.12	65.34	68.48	65.52	31.67	56.24
8	K8	73.81	71.75	72.82	67.93	66.63	25.53	50.32
9	K9	65.82	77.46	68.26	67.33	65.14	30.64	11.85
10	K10	81.25	84.23	82.88	56.00	64.13	24.63	52.73
11	K11	76.43	88.66	67.24	65.34	70.51	86.33	34.56
12	K12	66.91	90.55	68.33	77.32	75.29	76.94	56.69
13	K13	72.46	85.24	67.57	74.38	74.63	56.34	76.56
14	K14	75.32	90.54	90.34	52.86	65.92	63.29	54.33
15	K15	54.52	82.13	82.45	63.88	66.29	61.31	63.87
16	K16	65.31	73.83	85.92	72.93	75.02	75.38	75.32
17	K17	67.02	78.48	79.95	83.56	74.92	63.65	67.11
18	K18	76.50	77.67	75.66	52.23	66.68	23.66	12.76
19	K19	77.66	92.44	78.46	49.38	68.23	72.45	14.63
20	K20	91.44	98.36	76.48	48.92	76.51	20.46	27.34

*name of corresponding author

SinkrOn
JURNAL & PENELITIAN TEKNIK INFORMATIKA
Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 7, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.v7i1.11228
e-ISSN : 2541-2019
p-ISSN : 2541-044X

21	K21	88.74	80.24	66.12	52.54	68.92	19.34	53.81
22	K22	75.62	89.65	72.16	83.62	69.96	45.62	78.56
23	K23	61.35	91.47	78.91	75.61	73.40	77.14	54.00
24	K24	66.51	87.58	64.93	68.31	73.05	74.98	65.37
25	K25	76.06	73.98	78.83	72.37	73.05	74.91	56.52
26	K26	84.63	78.44	74.78	75.00	64.63	67.56	75.38
	MAX	**95.12**	**98.36**	**94.67**	**83.62**	**76.51**	**86.33**	**78.56**
	MIN	**52.27**	**70.65**	**62.45**	**48.85**	**56.82**	**19.34**	**11.85**

The normalization process is a form of uniformity so that the data is truly within the limited process range by determining the minimum data value and the maximum data value, so that the data range is in a consistent value point position. The normalization process can be carried out using equation 5 or equation 6. This of course must pay attention to each of the properties possessed by these criteria. The nature of the criteria is binding to the utility it has, some are normalizing utility benefits and some are normalizing cost benefits. The results obtained from the data normalization process are shown in table 10. The results of the next normalization will be related to the calculation by performing a multiplication process between the utility value of each criterion with the optimal eigenvector value to determine the ranking of a number of alternatives to the evaluation decision support of twenty-six prioritized employees. to promote. The determination of the utility can be done by using equation 7 which is the final result of an acceptable and consistent decision.

Tabel 10
Normalized dataset

No.	Employee	(B) PL	(B) SC	(B) KJ	(B) RB	(B) QW	(C) FJ	(C) DP
1	K1	72.04	14.15	35.66	73.28	38.04	72.52	65.91
2	K2	100.00	48.65	67.60	70.18	35.14	44.66	95.21
3	K3	54.96	80.95	100.00	0.00	0.00	83.21	76.30
4	K4	84.76	0.00	39.63	45.99	42.66	95.39	28.54
5	K5	0.00	56.30	0.00	22.06	51.04	36.66	49.91
6	K6	46.77	17.43	2.33	47.43	97.21	95.22	27.33
7	K7	43.83	23.35	8.97	56.46	44.18	81.59	33.46
8	K8	50.27	3.97	32.18	54.87	49.82	90.76	42.33
9	K9	31.62	24.58	18.03	53.15	42.25	83.13	100.00
10	K10	67.63	49.01	63.41	20.56	37.13	92.10	38.72
11	K11	56.38	64.99	14.87	47.43	69.53	0.00	65.96
12	K12	34.17	71.82	18.25	81.88	93.80	14.02	32.78
13	K13	47.12	52.65	15.89	73.43	90.45	44.77	3.00
14	K14	53.79	71.78	86.56	11.53	46.22	34.39	36.32
15	K15	5.25	41.43	62.07	43.23	48.10	37.35	22.02
16	K16	30.43	11.48	72.84	69.26	92.43	16.35	4.86
17	K17	34.42	28.26	54.31	99.83	91.92	33.86	17.16
18	K18	56.55	25.33	41.00	9.72	50.08	93.55	98.64
19	K19	59.25	78.64	49.69	1.52	57.95	20.72	95.83
20	K20	91.41	100.00	43.54	0.20	100.00	98.33	76.78
21	K21	85.11	34.61	11.39	10.61	61.45	100.00	37.10
22	K22	54.49	68.57	30.14	100.00	66.73	60.77	0.00
23	K23	21.19	75.14	51.09	76.96	84.21	13.72	36.82
24	K24	33.23	61.10	7.70	55.97	82.43	16.94	19.77
25	K25	55.52	12.02	50.84	67.64	82.43	17.05	33.04
26	K26	75.52	28.11	38.27	75.21	39.66	28.02	4.77

The results obtained from normalization will be processed into the sum of each alternative against all the criteria used as an assessment barometer to evaluate twenty-six employees who are ready to be promoted. The total result of the sum of all these criteria as a rating measure and becomes the final decision of the selection and evaluation process, see table 11.

Tabel 11
Employee Promotion Ranking Evaluation

No.	Employee	(B) PL	(B) SC	(B) KJ	(B) RB	(B) QW	(C) FJ	(C) DP	Total	Ranking

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 7, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.v7i1.11228
e-ISSN : 2541-2019
p-ISSN : 2541-044X

1	K20	16.82	15.10	6.23	0.03	12.60	13.27	9.14	73.19	1
2	K2	18.40	7.35	9.67	9.96	4.43	6.03	11.33	67.17	2
3	K3	10.11	12.22	14.30	0.00	0.00	11.23	9.08	56.95	3
4	K22	10.03	10.35	4.31	14.20	8.41	8.20	0.00	55.50	4
5	K10	12.44	7.40	9.07	2.92	4.68	12.43	4.61	53.55	5
6	K1	13.26	2.14	5.10	10.41	4.79	9.79	7.84	53.32	6
7	K18	10.40	3.83	5.86	1.38	6.31	12.63	11.74	52.15	7
8	K19	10.90	11.87	7.11	0.22	7.30	2.80	11.40	51.60	8
9	K17	6.33	4.27	7.77	14.18	11.58	4.57	2.04	50.74	9
10	K23	3.90	11.35	7.31	10.93	10.61	1.85	4.38	50.32	10
11	K21	15.66	5.23	1.63	1.51	7.74	13.50	4.42	49.68	11
12	K14	9.90	10.84	12.38	1.64	5.82	4.64	4.32	49.54	12
13	K4	15.60	0.00	5.67	6.53	5.38	12.88	3.40	49.44	13
14	K12	6.29	10.84	2.61	11.63	11.82	1.89	3.90	48.98	14
15	K9	5.82	3.71	2.58	7.55	5.32	11.22	11.90	48.10	15
16	K13	8.67	7.95	2.27	10.43	11.40	6.04	0.36	47.12	16
17	K6	8.61	2.63	0.33	6.73	12.25	12.86	3.25	46.66	17
18	K8	9.25	0.60	4.60	7.79	6.28	12.25	5.04	45.81	18
19	K11	10.37	9.81	2.13	6.73	8.76	0.00	7.85	45.66	19
20	K25	10.22	1.81	7.27	9.61	10.39	2.30	3.93	45.52	20
21	K26	13.90	4.25	5.47	10.68	5.00	3.78	0.57	43.64	21
22	K16	5.60	1.73	10.42	9.83	11.65	2.21	0.58	42.01	22
23	K7	8.06	3.53	1.28	8.02	5.57	11.02	3.98	41.45	23
24	K24	6.11	9.23	1.10	7.95	10.39	2.29	2.35	39.41	24
25	K15	0.97	6.26	8.88	6.14	6.06	5.04	2.62	35.96	25
26	K5	0.00	8.50	0.00	3.13	6.43	4.95	5.94	28.95	26

DISCUSSIONS

The results obtained from this study are in the form of ranking from the evaluation of employee promotions using the collaboration of two methods, namely AHM and SMART. AHP is applied to determine the value of the criteria in two ways, namely mathematic algebra matrices and expert choice applications, while the SMART method is used to measure the utility value of all the criteria to be collaborated with the results of obtaining the optimal eigenvector value with the utility value of each alternative. The results of obtaining the optimal eigenvector can be verified through a consistency process and can also be proven by using an expert choice application. In addition, all that is very important is the input process obtained from the questionnaire instrumentation from a number of respondents who must understand in detail the criteria assessment system being compared, so that the output results of data processing will provide consistent and acceptable values.

CONCLUSION

The final decision of supporting employee evaluation decisions for promotions provides tangible evidence that is consistent with the collaboration of the AHP-SMART method through the long stages of proving the employee selection and evaluation process. This method can be used as a reference for ranking problems. The results of this study provide support for employee evaluation decisions for promotions in an agency that can be applied according to the company's interests based on consistency. Based on the research results obtained with the collaboration of the SMART and AHP methods, the optimal decisions are as follows. The first rank of the selected employee promotions was K23 with a score of 73.19 and followed by K2 and K2 with respective scores of 67.17 and 56.95 respectively. Thus, the collaboration between the AHP-SMART method provides concrete evidence, that these two methods are very appropriate to be used for the rating system as a form of decision support. The researcher recommends that for future research, it is expected to determine the proportion of criteria obtained from research results in the form of questionnaire instrumentation, so that the results obtained are more objective and consistent and should not be determined individually which will ultimately be subjective and only for certain interests.

ACKNOWLEDGMENT

We as researchers would like to thank our fellow authors and colleagues who have helped in completing this article and we hope that this article can provide benefits to all of us and colleagues, and can be applied and implemented in every institution that wants to use it as a reference. We hope that the publisher can accept and publish it, thank you.

REFERENCES

Akmaludin, A., Hartati, T., Purwanto, H., & Sukendar, T. (2020). *The Best Selection of Programmers in Generation 4 . 0 Using AHP and ELECTRE Elimination Methods The Best Selection of Programmers in Generation 4 . 0 Using AHP and ELECTRE Elimination Methods*. 0–7. https://doi.org/10.1088/1742-6596/1477/3/032001

Andani, S. R. (2019). Penerapan Metode SMART dalam Pengambilan Keputusan Penerima Beasiswa Yayasan AMIK Tunas Bangsa. *Jurnal Sistem Dan Teknologi Informasi (JUSTIN)*, *7*(3), 166. https://doi.org/10.26418/justin.v7i3.30112

Augustinus & Eric. (2013). Pengelolaan SDM Pada PT. Aneka Sejahtera Engineering. *Pengelolaan SDM Pada PT. Aneka Sejahtera Engineering*, *1*(2). [Diposting pada 13 Mei 2020

Aziz, N. F., Sorooshian, S., & Mahmud, F. (2016). MCDM-AHP method in decision makings. *ARPN Journal of Engineering and Applied Sciences*, *11*(11), 7217–7220. https://doi.org/10.1109/TIE.2013.2297315

Begicevic, N., Divjak, B., & Hunjak, T. (2009). Comparison between AHP and ANP: Case Study of Strategic Planning of E-Learning Implementation. *International Journal of the Analytic Hierarchy Process*, *1*(1), 31–44. https://doi.org/10.13033/ijahp.v1i1.5

Ghaleb, A. M., Kaid, H., Alsamhan, A., Mian, S. H., & Hidri, L. (2020). Assessment and Comparison of Various MCDM Approaches in the Selection of Manufacturing Process. *Advances in Materials Science and Engineering*, *2020*. https://doi.org/10.1155/2020/4039253

Krmac, E., & Djordjevii, B. (2019). A Multi-Criteria Decision-Making Framework for the Evaluation of Train Control Information Systems, the Case of ERTMS. *International Journal of Information Technology and Decision Making*, *18*(1), 209–239. https://doi.org/10.1142/S0219622018500451

Liang, T. C., & Peng, S. H. (2017). Using analytic hierarchy process to examine the success factors of autonomous landscape development in rural communities. *Sustainability (Switzerland)*, *9*(5). https://doi.org/10.3390/su9050729

Magrisa, T., Wardhani, K. D. K., & Saf, M. R. A. (2018). Implementasi Metode SMART pada Sistem Pendukung Keputusan Pemilihan Kegiatan Ekstrakurikuler untuk Siswa SMA. *Informatika Mulawarman : Jurnal Ilmiah Ilmu Komputer*, *13*(1), 49. https://doi.org/10.30872/jim.v13i1.648

Saaty, T. L. (2008a). Decision making with the analytic hierarchy process. *International Journal of Services Sciences*, *1*(1), 83. https://doi.org/10.1504/IJSSCI.2008.017590

Saaty, T. L. (2008b). Relative measurement and its generalization in decision making why pairwise comparisons are central in mathematics for the measurement of intangible factors the analytic hierarchy/network process. *Revista de La Real Academia de Ciencias Exactas, Fisicas y Naturales - Serie A: Matematicas*, *102*(2), 251–318. https://doi.org/10.1007/BF03191825

Saaty, T. L. (2010). *The Eigenvector In Lay Language 2 . What we learn when we have measurement*. *2*(2), 163–169.

Safrizal, M. (2015). Sistem Pendukung Keputusan Pemilihan Karyawan Teladan dengan Metode SMART (Simple Multi Attribute Rating Technique). *Jurnal CoreIT*, *1*(2), 25–29.

The, F. O. R., Person, L. A. Y., & Lipovetsky, S. (1936). *An Interpretation Of The AHP Eigenvector Solution GfK Custom Research North America 8401 Golden Valley Rd ., Minneapolis , MN 55427 , USA 2 . The AHP solution and its interpretation for the maximum eigenvalue λ yields the principal eigenvector α which ser*. *2*(2), 158–162.

Vargas, R. V. (2010). Using The Analytic Hierarchy Process (AHP) To Select And Prioritize Projects In A Portofolio. *PMI Global Congress*, *32*(3), 1–22. http://www.ricardo-vargas.com/pt/articles/analytic-hierarchy-process/#english

Velasquez, M., & Hester, P. (2013). An analysis of multi-criteria decision making methods. *International Journal of Operations Research*, *10*(2), 56–66.

Yusnitha, K., Tursina, T., & Irwansyah, M. A. (2019). Sistem Pendukung Keputusan Pemilihan Wilayah Prioritas Intervensi Kegiatan Keluarga Berencana dengan Metode AHP-SMART. *Jurnal Edukasi Dan Penelitian Informatika (JEPIN)*, *5*(1), 99. https://doi.org/10.26418/jp.v5i1.31338

*name of corresponding author

AHP-SMART Method as Evaluation Decision Support for Employee Promotion

by akmaludin.akm@nusamandiri.ac.id 1

Submission date: 09-Dec-2021 06:05AM (UTC+0200)
Submission ID: 1725123533
File name: Artikel_AHP-SMART_Sent-09122021.docx (546.85K)
Word count: 4899
Character count: 25018

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 6, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.xxx.xxx
e-ISSN : 2541-2019
p-ISSN : 2541-044X

AHP-SMART Method as Evaluation Decision Support for Employee Promotion

Akmaludin[1)*], Adhi Dharma Suriyanto[2)], Nandang Iriadi[4)], Toni Sukendar[4))], Budi Santotoso[5)]
[1)]Universitas Nusa Mandiri, Jakarta, Indonesia
[2)3)4)5)]Universitas Bina Sarana Informatika, Jakarta, Indonesia
[1)]akmaludin.akm@nusamandiri.ac.id, [2)]adhi.ais @bsi.ac.id, [3)], nandang.ndi@bsi.ac.id
[4)]toni.tns@bsi.ac.id, [5)]budi.bis@bsi.ac.id

Submitted : xxxxx I **Accepted** : xxxx I **Published** : xxxxx

Abstract: Evaluation of the quality of employees in an institution is very necessary, especially for promotions which are the rights of every employee in leading a company that is full of competition. The purpose of this paper is to contribute in terms of the evaluation process in selecting employees who are ready to be promoted in a particular institution. With the support of various parties, a consistent and optimal method is needed to carry out the evaluation process, which is a popular priority, it is recommended to use the AHP-SMART method, where this method will be collaborated to become a core unit of problem solving, especially in terms of promotion as evaluation and selection material. Selection of the best employees, The AHP method will be used to conduct an assessment of the criteria used with the concept of Multi-criteria Decision Making (MCDM) which utilizes the results obtained from the eigenvector through iteration to minimize differences in the assessments of a number of respondents, while the SMART method is used to determine the results of decisions in collaboration with the AHP method, especially in terms of benefit utility and cost utility. The criteria used as an assessment measure consist of Planning, Solution Capture, Knowledge of Job, Reaction Behavior, Quantity of Works, Failed of Jobs, and Depandibility. The final result of the collaboration process of the two methods AHP and SMART gives a ranking of 26 employees with the highest score and being selected through an evaluation process for promotion won by K23 with a ranking weight (73.19) and the second is followed by K2 (76.17) and ranked the third was won by K3 (56.95). Thus the selection and evaluation process for promotion can be recommended and used as an optimal process from the selection stages of employee selection for promotion in every company agency.

Keywords: AHP, Benefit Utility, Consistency, Cost Utility, Eigenvector, SMART.

INTRODUCTION

To build the company's progress continuously, it is necessary to have a leader who has high abilities in handling future challenges, of course based on the evaluation process of each employee who has the same degree of opportunity to become a leader in an agency or company(Augustinus & Eric, 2013) . The evaluation carried out certainly has several criteria that refer to the appropriateness value of each employee in an agency or company. Some of the criteria that can be used are Planning, Solution Capture, Knowledge of Job, Reaction Behavior, Quantity of Works, Failed Job, and Depandibility. Of the seven criteria that will be used, they will be assessed and evaluated on a continuous basis by their leaders from each division or section they hold. Changes in leadership must be carried out in wise and consistent ways based on the same rules for each line of work for each employee. Each criterion will be compared from one criterion to another to find out how important the criteria are compared (Liang & Peng, 2017), by assessing through instrumentation in the form of a questionnaire using the Analytic Hierarchy Process (AHP) method. By following the AHP stage, the Multi-criteria Decision Making (MCDM) concept will be used (Aziz et al., 2016), (Krmac & Djordjevii, 2019). This concept will carry out a number of iterations whose function is to minimize the difference in the results decided to find a certain point that is able to eliminate the final difference between the eigenvector values and the previous eigenvector values (Saaty, 2010). This is done with the aim of finding the optimum point of the real eigenvector (The et al., 1936), this illustrates that a result will be much better than not finding the difference in eigenvector differences. Thus the results from the eigenvector can be continued into the second stage using the Simple Multi-Attribute Rating Technique (SMART) method which will be applied to the calculation of utility in the form of utility benefits and utility costs to determine the ranking of each selected employee in a particular agency or company (Yusnitha et al., 2019). The utility calculation process will be collaborated with the acquisition of the eigenvector value that

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 6, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.xxx.xxx
e-ISSN : 2541-2019
p-ISSN : 2541-044X

has been calculated previously through a comparison of the assessments of all the criteria set. Several related studies that use the SMART method are the Implementation of the Smart Method in the Decision Support System for the Selection of Extracurricular Activities for High School Students (Magrisa et al., 2018), the Decision Support System for Selection of Exemplary Employees with the SMART Method (Safrizal, 2015), Application of the Method SMART in Decision Making for AMIK Tunas Bangsa Foundation Scholarship Recipients (Andani, 2019).

LITERATURE REVIEW

Decision Support System (DSS) dan Analytic Hierarchy Process (AHP)

A decision support system is a support for the results of a process that is carried out mathematic algebra matrices which is carried out repeatedly to eliminate the difference in the value of the difference in decisions resulting from a number of users in providing comparisons of a number of criteria based on their respective interests (Begicevic et al., 2009). The calculation process can be done using the comparison scale set by Saaty (Saaty, 2008b) through the scale conversion process from the geometric mean scale to the Analytic Hierarchy Process (AHP) scale (Ghaleb et al., 2020), see Figure 1. The resulting scale can be calculated using Mathematics Algebra Matrices or using a computerized application in the form of Expert Choice. Of course, the results obtained have the same identical results. This is one of the advantages of an Expert Choice application that displays the value of its inconsistency (Velasquez & Hester, 2013) and also the sophistication of Mathematics Algera Matrices which is able to prove the truth of the process in a very long way.

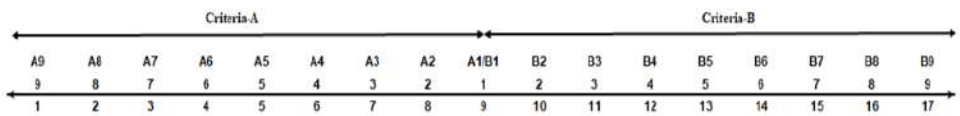

Fig 1. AHP conversion scale

The scale value of the processed geometric mean can be arranged according to the placement of the matrices according to the matrices layout elements in its rows and columns, pay attention to equation 1 which describes the layout of the matrices elements according to the order of the matrices. If the data elements of the matrices are completely placed, then perform the calculation of the matrices multiplication by AxA = B, then iterate over the results of the multiplication of matrices B in the same way, namely BxB = C, then find and determine the result of the difference from the CB eigenvectors and note whether there is a difference or not. no, if there is a difference, then do a second iteration by multiplying the C matrices by CxC=D and so on until you find the value of the difference eigenvector=0 (Saaty, 2008a). If you have succeeded in finding a zero value in the eigenvector difference, it can be concluded that the iegenvector is already at the optimal point. The matrices multiplication will be repeated until the eigenvector difference is zero (Vargas, 2010). This means that it will not find the difference value up to an infinite number of decimal digits. The applied matrices is a matrices that has the same order. For example order (5x5) or order (7x7) and so on. Consider the sample of the order matrices arrangement in equation 1.

$$M_{(r,s)} = \begin{bmatrix} a_{(1,1)} & a_{(1,2)} & a_{(1,3)} & \cdots & a_{(1,s)} \\ a_{(2,1)} & a_{(2,2)} & a_{(2,3)} & \cdots & a_{(2,s)} \\ a_{(3.1)} & a_{(3,2)} & a_{(2,4)} & \cdots & a_{(3,s)} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{(r,1)} & a_{(r,2)} & a_{(r,3)} & \cdots & a_{(r,s)} \end{bmatrix} \quad (1)$$

The method used to find out how many comparisons are produced from the seven criteria, can use equation 2. Thus, it can be seen the comparison (C) that must be provided for each number of criteria seen from the value of importance. After the optimal eigenvector value has been obtained, then do a test of the temporary decision of each data item , whether the decision can be accepted or rejected. The stages of testing the consistency value include Consistency vector, which is to find out the magnitude of the vector stack resulting from multiplying the initials of the matrices with the eigenvectors obtained, of course, the eigenvectors that are already optimal, whose multiplication results are divided by the initials of each row of the matrices. The next step is to find max by finding the average value of the consistency vector, its function is to find out the length of the resulting vector stack. Then proceed with looking for the Consistency vector using equation 3. Which is used to find out the magnitude of the value adjusted for the adjustment of the order of the matrices which is related to the Ramdom index table, pay attention to table 1, which will be used in determining the Consistency ratio (CR), pay attention to equation 4. the provision that becomes a measure of the provisional decision that greatly influences the amount of the CR value, namely if the CR value is less than 10 percent, the provisional decision can be accepted,

*name of corresponding author

SinkrOn
JURNAL & PENELITIAN TEKNIK INFORMATIKA
Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 6, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.xxx.xxx
e-ISSN : 2541-2019
p-ISSN : 2541-044X

otherwise if the CR value is more than 10 percent (Saaty, 2008b), the decision will be rejected and the data entry process needs to be reprocessed. sourced from a number of respondents having an error in the entry process through questionnaire instrumentation.

$$C = \frac{n*(n-1)}{2} \tag{2}$$

$$CI = \frac{(\lambda\max - n)}{(n-1)} \tag{3}$$

$$CR = \frac{CI}{RI} \tag{4}$$

To find the CR value, it is influenced by the Random index listed in Table 1. This random index has fixed rules which are shown by how many orders of materix are used, if the number of orders is seven in terms of how many criteria are processed (Liang & Peng, 2017), it is the order of a matrices. If the order used is seven, then the RI value used is 1.32. So the use of the RI value relationship is seen from the many orders that will be used.

Table 1
Random Index

Ordo	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.48

SMART

The SMART method (Simple Multi Attribute Rating Technique) is a method that can be used to examine the magnitude of the utility generated from each of the criteria used, the criteria that can be used with the SMART method can be qualitative or quantitative, this method has good ability in terms of ranking, so it is very well used for the selection and evaluation process (Andani, 2019). So that this SMART method can be collaborated with the AHP method to associate the utility results generated with the eigenvector values of the AHP calculation process (Magrisa et al., 2018). The utility obtained consists of utility benefits, pay attention to equation 5, whose function is to find out a number of criteria declared as benefit categories from each alternative and cost utility which is used to determine the amount that is considered as a cost incurred from each alternative, pay attention to equation 6, while collaboration What can be done between the SMART method and the AHP method in determining the utility value that can lead to ranking can be found by equation 7. With this process stage, the ranking of each alternative will be obtained through the sum of the multi-criteria used.

$$BU_i(x_i) = \frac{C_i - C_{min}}{C_{max} - C_{min}} x100\, percent \tag{5}$$

$$CU_i(x_i) = \frac{C_{max} - C_i}{C_{max} - C_{min}} x\ 100\, percent \tag{6}$$

$$U(a_i) = \sum_{i=1}^{n} U_i W_i \tag{7}$$

In this study there are seven criteria used, pay attention to the table as shown in Table 2 which is included with the acronym and category of each criterion.

Table 2.
Criteria of Selection and Evaluation Employee Promotion

No.	Criterias	Acronime	Category
1.	Planning	PL	Benefit
2.	Solution Capture	SC	Benefit
3.	Knowledge of Job	KJ	Benefit
4.	Reaction Behavior	RB	Benefit
5.	Quantity of Work	QW	Benefit
6.	Failed Jobs	FJ	Cost
7.	Dependibility	DB	Cost

*name of corresponding author

METHOD

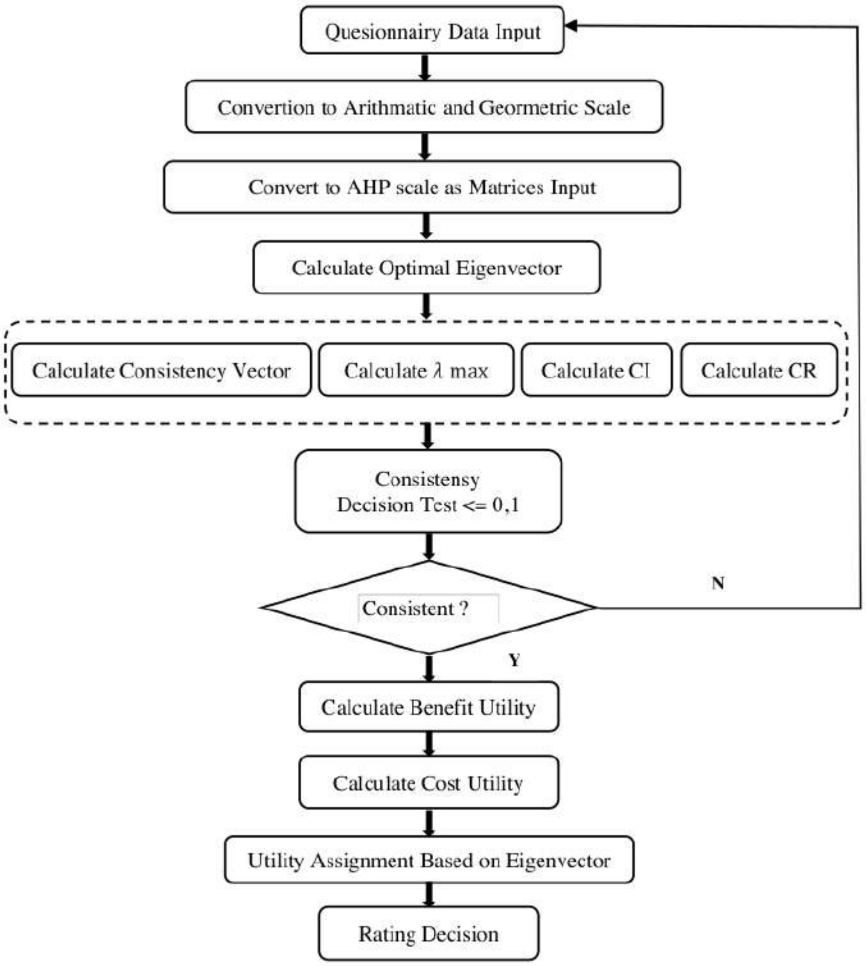

Fig. 1. AHP-SMART Algoritm

RESULT

To carry out the process of evaluating employee promotions, an appropriate method is needed to carry out the evaluation and selection process. This research is certainly supported by two collaborative methods, namely the Analytic Hierarchy Process (AHP) method and the Simple Multi Attribute Rating Technique (SMART) method. Both of these methods can be said to be popular because they are appropriate to use for processing data that tends to be a ranking system. The first time that is prepared is the criteria and rules that are very important to set in advance. How many criteria must be prepared, then determine the number of comparison criteria that must be compared to form a pairwise matrices as contained in equation 1. one comparison that must be compared to find the value of the importance of each criterion to be compared through input in the form of questionnaire instrumentation from forty respondents. The input data generated by the forty respondents was through

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 6, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.xxx.xxx

e-ISSN : 2541-2019
p-ISSN : 2541-044X

questionnaire instrumentation and the method of distributing the questionnaire was using the random sampling method. The list of inputs from forty respondents can be seen in table 3.

Table 3
Data input from respondents.

No.	Pairwise Comparison Key Criteria		Respondent										Converted Scale		
			(1)	(2)	(3)	(4)	(5)	....	(37)	(38)	(39)	(40)			
1	Planning	Solution Capture	A2	B3	B2	A1	B2		A2	B1	A2	B3	Math	Geomean	AHP
			8	11	10	9	10		8	9	8	11	9.328	9.328	1.328
2	Planning	Knowledge of Job	B4	B2	A2	B3	B2		B3	B1	B3	A2			
			12	10	8	11	10		11	9	11	8	9.538	9.538	1.538
3	Planning	Reaction Behavior	B3	B1	B2	A2	A1		A1	A2	B2	B4			
			11	9	10	8	9		9	8	10	12	9.571	9.571	1.571
4	Planning	Quantity of Work	B4	A1	B1	B3	A1		B2	B1	A2	B2			
			12	9	9	11	9		10	9	8	10	9.405	9.405	1.405
5	Planning	Failed of Job	B2	B3	A2	B2	A1		B4	A2	A4	B2			
			10	11	8	10	9		12	8	6	10	9.101	9.101	1.101
6	Planning	Depandibility	B4	A1	A2	B3	A1		B2	B1	A2	A2			
			12	9	8	11	9		10	9	8	8	9.249	9.249	1.249
:	:	:	:	:	:	:	:		:	:	:	:	:	:	:
19	Quantity of Work	Failed of Job	A1	B1	B2	B2	B2		A1	B1	A2	A2			
			9	9	10	10	10		9	9	8	8	9.025	9.025	1.025
20	Quantity of Work	Depandibility	B1	B2	A1	B2	B1		A2	B2	B2	A2			
			9	10	9	10	9		8	10	10	8	9.044	9.044	1.044
21	Failed of Job	Depandibility	A1	B1	B2	B2	B2		B3	B1	A2	B1			
			9	9	10	10	10	....	11	9	8	9	9.148	9.148	1.148

Taking into account that table 3 is a list of comparisons of the criteria being compared with each other, the total number of criteria being compared consists of twenty-one items that can be compared according to the rules in equation 2. The data that has become input is processed using a mathematic algebra matrices with scale conversion system. The scale conversion is done firstly, the input data is converted to an arithmetic scale, the second is the arithmetic data is converted to a geometric scale and the third is the geometric scale is converted to the AHP scale. The data that has been successfully converted to the AHP scale means that it is ready to be used as a pairwise matrices as shown in equation 1. The real results can be seen in table 4.

Table 4
Pairwise matrices criteria

	(Benefit)	(Benefit)	(Benefit)	(Benefit)	(Benefit)	(Cost)	(Cost)
Kriteria Utama	**Planning (PL)**	**Solution Capture (SC)**	**Knowledge of Job (KJ)**	**Reaction Behavior (RB)**	**Quantity of Works (QW)**	**Failed Jobs (FJ)**	**Depandibility (DB)**
Planning	1.000	1.328	1.538	1.571	1.405	1.101	1.249
Solution Capture	0.753	1.000	1.157	1.025	1.145	1.397	1.146
Knowledge of Jobs	0.650	0.864	1.000	1.199	1.016	1.003	1.531
Reaction Behavior	0.636	0.975	0.834	1.000	1.462	1.003	1.306
Quantity of Works	0.712	0.874	0.984	0.684	1.000	1.025	1.044
Failed Jobs	0.908	0.716	0.997	0.997	0.976	1.000	1.148
Depandibiltiy	0.801	0.873	0.653	0.766	0.958	0.871	1.000

Pay attention to table 4 which explains the formation of a pairwise matrices from respondents' entries, this pairwise matrices will be used as the basis for determining the optimal eigenvector value and will be used later in the SMART method to determine the utility value and ranking. The steps to get the optimal eigenvector value are done by multiplying the matrices by itself. As a measure of the iteration of the matrices is the difference between the last eigenvector and the previous eigenvector. If the statement is true, there is no difference in the reduction in the eigenvector value, it can be concluded that the resulting eigenvector value is said to be optimal and ready to be used. The iteration results obtained through four stages of matrices multiplication iterations starting from the initial matrices to the last matrices iteration and used as optimal eigenvector values can be seen in table 5.

*name of corresponding author

SinkrOn
JURNAL & PENELITIAN TEKNIK INFORMATIKA
Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 6, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.xxx.xxx
e-ISSN : 2541-2019
p-ISSN : 2541-044X

Table 5
The last pairwise matrices

5500178005919.780	6610416735480.160	7071863076501.430	7138371145452.570	7967797291357.100	7439385326549.200	8487073727620.950
4519666022885.710	5431983452955.260	5811168153278.420	5865819886215.560	6547384949401.340	6113172529210.920	6974090423831.600
4261582856754.020	5121804895332.870	5479337290482.910	5530868285693.060	6173514440149.510	5764096532564.450	6575854065579.200
4226823142214.400	5080028756730.460	5434644929337.890	5485755610607.510	6123160004518.700	5717081525046.010	6522217936033.700
3757921435241.340	4516476870276.270	4831753774818.470	4877194503765.610	5443888579719.070	5082858328143.140	5798677106299.730
4030255870058.080	4843783387196.740	5181908230177.480	5230642022976.210	5838404097169.720	5451210188048.260	6218903947025.990
3543492863817.770	4258764807943.400	4556051880231.570	4598899742148.230	5133258016719.210	4792828302546.790	5467802161339.480

The results obtained in table 5 are a pairwise matrices with the order of 7x7 where the criteria used are seven criteria. While the results of the pairwise matrices must be tested for consistency. Consistency testing is carried out through several stages, starting from Consistency vector, max, Consistency Index, and Consistency Ratio. Of course, first make sure that there really is no difference from the eigenvectors, because this gives a perfect picture of the iteration process of the pairwise matrices which states that the optimal eigenvector has been found, see table 6.

Table 6
Optimal eigenvector without difference

Category	*Row Count*	*Normalization and eigenvector*	*eigenvector differences*
Planning	1921236961771810000000000000.000	0.184322812180068	0.0000000000000000000000000000
Solution Capture	1578739707821530000000000000.000	0.151463743638181	0.0000000000000000000000000000
Knowledge of Jobs	1488590094945430000000000000.000	0.142814820838496	0.0000000000000000000000000000
Reaction Behavior	1476448370026300000000000000.000	0.141649947932997	0.0000000000000000000000000000
Quantity of Works	1312658890866720000000000000.000	0.125936041733545	0.0000000000000000000000000000
Failed Jobs	1407786536112030000000000000.000	0.135062555243629	0.0000000000000000000000000000
Depandibiltiy	1237758024633760000000000000.000	0.118750078433083	0.0000000000000000000000000000
Total	10423218586177600000000000000.000	1.0000000000	0.0000000000000000000000000000

With the finding of the optimal eigenvector value, the consistency testing process can be carried out, see table 6 which describes the testing process for the seven criteria whether it is acceptable or rejected, as a measure it will be accepted, if the CR value is less than or equal to ten percent, pay attention to Fig. 2 following.

$$\begin{bmatrix} 1.000 & 1.328 & 1.538 & 1.571 & 1.405 & 1.101 & 1.249 \\ 0.753 & 1.000 & 1.157 & 1.025 & 1.145 & 1.397 & 1.146 \\ 0.650 & 0.864 & 1.000 & 1.199 & 1.016 & 1.037 & 1.531 \\ 0.636 & 0.975 & 0.834 & 1.000 & 1.462 & 1.003 & 1.306 \\ 0.712 & 0.874 & 0.984 & 0.684 & 1.000 & 1.025 & 1.044 \\ 0.908 & 0.716 & 0.965 & 0.997 & 0.976 & 1.000 & 1.148 \\ 0.801 & 0.873 & 0.653 & 0.766 & 0.958 & 0.871 & 1.000 \end{bmatrix} \times \begin{bmatrix} 0.18 \\ 0.15 \\ 0.14 \\ 0.14 \\ 0.13 \\ 0.14 \\ 0.12 \end{bmatrix} = \begin{bmatrix} 1.30 \\ 1.07 \\ 1.01 \\ 1.00 \\ 0.89 \\ 0.95 \\ 0.84 \end{bmatrix}$$

Consistency Vector	7.06
λ max	7.06
Consistency Index	0.01
Consistency Ratio	0.01

Fig. 2. Consistency process stages

By paying attention to Fig. 2, it can be seen that the testing phase of the consistency value gives the decision value against the seven criteria acceptable, this can be proven by the acquisition of the Consistency ratio (CR) value which has a value of less than ten percent, namely $0.01 < 0.1$ this means it is acceptable, so that the resulting decision on the criteria decision can be accepted and can be continued to be processed into the SMART method until the ranking. The eigenvector values that will be used are the results of calculations using Mathematic Algebra Matrices Method can be seen in table 7 which has optimal value.

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 6, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.xxx.xxx
e-ISSN : 2541-2019
p-ISSN : 2541-044X

Table 7
Optimal eigenvector using Mathematic Algebra Matrices

Keterangan	Akronim	Eigenvector	Sifat
Planning	PL	0.18	Benefit
Solution Capture	SC	0.15	Benefit
Knowledge of Job	KJ	0.14	Benefit
Reaction Behavior	RB	0.14	Benefit
Quantity of Works	QW	0.13	Benefit
Failed Jobs	FJ	0.14	Cost
Depandibility	DP	0.12	Cost
Total		100%	

The second proof of the acquisition of eigenvector values can be done using an expert choice application (Akmaludin et al., 2020). The data entry in the form of a pairwise matrices used is exactly the same as that shown in table 2. It's just that the data that is entered is only an upper triangular matrices, as shown in table 8.

Table 8
Pairwise matrices using expert choice apps

	Planning	Solution Capture	Knowledge	Reaction Behavior	Quantity Of Works	Failed Jobs	Depandibility
Planning		1.328	1.538	1.571	1.405	1.101	1.249
Solution Capture			1.157	1.025	1.145	1.397	1.146
Knowledge of Jobs				1.199	1.016	1.003	1.531
Reaction Behavior					1.462	1.003	1.306
Quantity Of Works						1.025	1.044
Failed Jobs							1.148
Depandibility	Incon: 0.01						

The results obtained through the expert choice input will give an inconsistency value of 0.01 with an error rate equal to zero, which can be seen in Fig. 3, where the results of the eigenvector values have exactly the same value as those calculated using mathematic algebra matrices.

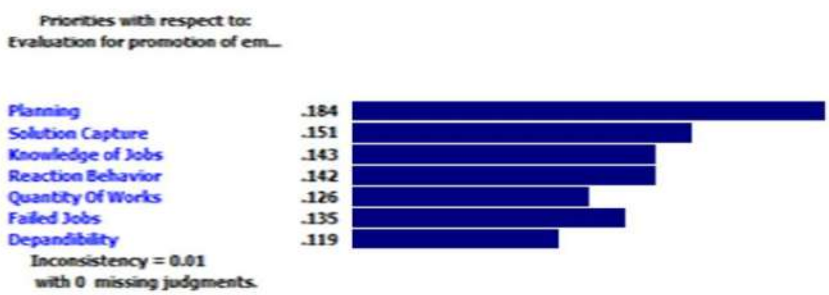

Fig. 3. Optimal eigenvector using Expert Choices Apps.

The dataset obtained is calculated for the evaluation process for the promotion of twenty-six employees and will be shown in table 9. The dataset will be normalized first so that the placement of data positions has a range of scales that can be calculated and has a positioned layout, so that each data element can be taken into account. with uniformity and have the same degree to be calculated into the SMART method.

Table 9
Dataset View

No.	Employee	(B) PL	(B) SC	(B) KJ	(B) RB	(B) QW	(C) FJ	(C) DP
1	K1	83.14	74.57	73.94	74.33	64.31	37.75	34.59
2	K2	95.12	84.13	84.23	73.25	63.74	56.41	15.04
3	K3	75.82	93.08	94.67	48.85	56.82	30.59	27.66

*name of corresponding author

SinkrOn
JURNAL & PENELITIAN TEKNIK INFORMATIKA
Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 6, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.xxx.xxx
e-ISSN : 2541-2019
p-ISSN : 2541-044X

4	K4	88.59	70.65	75.22	64.84	65.22	22.43	59.52
5	K5	52.27	86.25	62.45	56.52	66.87	61.77	45.27
6	K6	72.31	75.48	63.20	65.34	75.96	22.54	60.33
7	K7	71.05	77.12	65.34	68.48	65.52	31.67	56.24
8	K8	73.81	71.75	72.82	67.93	66.63	25.53	50.32
9	K9	65.82	77.46	68.26	67.33	65.14	30.64	11.85
10	K10	81.25	84.23	82.88	56.00	64.13	24.63	52.73
11	K11	76.43	88.66	67.24	65.34	70.51	86.33	34.56
12	K12	66.91	90.55	68.33	77.32	75.29	76.94	56.69
13	K13	72.46	85.24	67.57	74.38	74.63	56.34	76.56
14	K14	75.32	90.54	90.34	52.86	65.92	63.29	54.33
15	K15	54.52	82.13	82.45	63.88	66.29	61.31	63.87
16	K16	65.31	73.83	85.92	72.93	75.02	75.38	75.32
17	K17	67.02	78.48	79.95	83.56	74.92	63.65	67.11
18	K18	76.50	77.67	75.66	52.23	66.68	23.66	12.76
19	K19	77.66	92.44	78.46	49.38	68.23	72.45	14.63
20	K20	91.44	98.36	76.48	48.92	76.51	20.46	27.34
21	K21	88.74	80.24	66.12	52.54	68.92	19.34	53.81
22	K22	75.62	89.65	72.16	83.62	69.96	45.62	78.56
23	K23	61.35	91.47	78.91	75.61	73.40	77.14	54.00
24	K24	66.51	87.58	64.93	68.31	73.05	74.98	65.37
25	K25	76.06	73.98	78.83	72.37	73.05	74.91	56.52
26	K26	84.63	78.44	74.78	75.00	64.63	67.56	75.38
	MAX	**95.12**	**98.36**	**94.67**	**83.62**	**76.51**	**86.33**	**78.56**
	MIN	**52.27**	**70.65**	**62.45**	**48.85**	**56.82**	**19.34**	**11.85**

The normalization process is a form of uniformity so that the data is truly within the limited process range by determining the minimum data value and the maximum data value, so that the data range is in a consistent value point position. The normalization process can be carried out using equation 5 or equation 6. This of course must pay attention to each of the properties possessed by these criteria. The nature of the criteria is binding to the utility it has, some are normalizing utility benefits and some are normalizing cost benefits. The results obtained from the data normalization process are shown in table 10. The results of the next normalization will be related to the calculation by performing a multiplication process between the utility value of each criterion with the optimal eigenvector value to determine the ranking of a number of alternatives to the evaluation decision support of twenty-six prioritized employees. to promote. The determination of the utility can be done by using equation 7 which is the final result of an acceptable and consistent decision.

Tabel 10
Normalized dataset

No.	Employee	(B) PL	(B) SC	(B) KJ	(B) RB	(B) QW	(C) FJ	(C) DP
1	K1	72.04	14.15	35.66	73.28	38.04	72.52	65.91
2	K2	100.00	48.65	67.60	70.18	35.14	44.66	95.21
3	K3	54.96	80.95	100.00	0.00	0.00	83.21	76.30
4	K4	84.76	0.00	39.63	45.99	42.66	95.39	28.54
5	K5	0.00	56.30	0.00	22.06	51.04	36.66	49.91
6	K6	46.77	17.43	2.33	47.43	97.21	95.22	27.33
7	K7	43.83	23.35	8.97	56.46	44.18	81.59	33.46
8	K8	50.27	3.97	32.18	54.87	49.82	90.76	42.33
9	K9	31.62	24.58	18.03	53.15	42.25	83.13	100.00
10	K10	67.63	49.01	63.41	20.56	37.13	92.10	38.72
11	K11	56.38	64.99	14.87	47.43	69.53	0.00	65.96
12	K12	34.17	71.82	18.25	81.88	93.80	14.02	32.78
13	K13	47.12	52.65	15.89	73.43	90.45	44.77	3.00
14	K14	53.79	71.78	86.56	11.53	46.22	34.39	36.32
15	K15	5.25	41.43	62.07	43.23	48.10	37.35	22.02
16	K16	30.43	11.48	72.84	69.26	92.43	16.35	4.86
17	K17	34.42	28.26	54.31	99.83	91.92	33.86	17.16

*name of corresponding author

SinkrOn
JURNAL & PENELITIAN TEKNIK INFORMATIKA
Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 6, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.xxx.xxx
e-ISSN : 2541-2019
p-ISSN : 2541-044X

18	K18	56.55	25.33	41.00	9.72	50.08	93.55	98.64
19	K19	59.25	78.64	49.69	1.52	57.95	20.72	95.83
20	K20	91.41	100.00	43.54	0.20	100.00	98.33	76.78
21	K21	85.11	34.61	11.39	10.61	61.45	100.00	37.10
22	K22	54.49	68.57	30.14	100.00	66.73	60.77	0.00
23	K23	21.19	75.14	51.09	76.96	84.21	13.72	36.82
24	K24	33.23	61.10	7.70	55.97	82.43	16.94	19.77
25	K25	55.52	12.02	50.84	67.64	82.43	17.05	33.04
26	K26	75.52	28.11	38.27	75.21	39.66	28.02	4.77

The results obtained from normalization will be processed into the sum of each alternative against all the criteria used as an assessment barometer to evaluate twenty-six employees who are ready to be promoted. The total result of the sum of all these criteria as a rating measure and becomes the final decision of the selection and evaluation process, see table 11.

Tabel 11
Employee Promotion Ranking Evaluation

No.	Employee	(B) PL	(B) SC	(B) KJ	(B) RB	(B) QW	(C) FJ	(C) DP	Total	Ranking
1	K20	16.82	15.10	6.23	0.03	12.60	13.27	9.14	73.19	1
2	K2	18.40	7.35	9.67	9.96	4.43	6.03	11.33	67.17	2
3	K3	10.11	12.22	14.30	0.00	0.00	11.23	9.08	56.95	3
4	K22	10.03	10.35	4.31	14.20	8.41	8.20	0.00	55.50	4
5	K10	12.44	7.40	9.07	2.92	4.68	12.43	4.61	53.55	5
6	K1	13.26	2.14	5.10	10.41	4.79	9.79	7.84	53.32	6
7	K18	10.40	3.83	5.86	1.38	6.31	12.63	11.74	52.15	7
8	K19	10.90	11.87	7.11	0.22	7.30	2.80	11.40	51.60	8
9	K17	6.33	4.27	7.77	14.18	11.58	4.57	2.04	50.74	9
10	K23	3.90	11.35	7.31	10.93	10.61	1.85	4.38	50.32	10
11	K21	15.66	5.23	1.63	1.51	7.74	13.50	4.42	49.68	11
12	K14	9.90	10.84	12.38	1.64	5.82	4.64	4.32	49.54	12
13	K4	15.60	0.00	5.67	6.53	5.38	12.88	3.40	49.44	13
14	K12	6.29	10.84	2.61	11.63	11.82	1.89	3.90	48.98	14
15	K9	5.82	3.71	2.58	7.55	5.32	11.22	11.90	48.10	15
16	K13	8.67	7.95	2.27	10.43	11.40	6.04	0.36	47.12	16
17	K6	8.61	2.63	0.33	6.73	12.25	12.86	3.25	46.66	17
18	K8	9.25	0.60	4.60	7.79	6.28	12.25	5.04	45.81	18
19	K11	10.37	9.81	2.13	6.73	8.76	0.00	7.85	45.66	19
20	K25	10.22	1.81	7.27	9.61	10.39	2.30	3.93	45.52	20
21	K26	13.90	4.25	5.47	10.68	5.00	3.78	0.57	43.64	21
22	K16	5.60	1.73	10.42	9.83	11.65	2.21	0.58	42.01	22
23	K7	8.06	3.53	1.28	8.02	5.57	11.02	3.98	41.45	23
24	K24	6.11	9.23	1.10	7.95	10.39	2.29	2.35	39.41	24
25	K15	0.97	6.26	8.88	6.14	6.06	5.04	2.62	35.96	25
26	K5	0.00	8.50	0.00	3.13	6.43	4.95	5.94	28.95	26

DISCUSSIONS

The results obtained from this study are in the form of ranking from the evaluation of employee promotions using the collaboration of two methods, namely AHM and SMART. AHP is applied to determine the value of the criteria in two ways, namely mathematic algebra matrices and expert choice applications, while the SMART method is used to measure the utility value of all the criteria to be collaborated with the results of obtaining the optimal eigenvector value with the utility value of each alternative. The results of obtaining the optimal eigenvector can be verified through a consistency process and can also be proven by using an expert choice application. In addition, all that is very important is the input process obtained from the questionnaire instrumentation from a number of respondents who must understand in detail the criteria assessment system being compared, so that the output results of data processing will provide consistent and acceptable values..

CONCLUSION

The final decision of supporting employee evaluation decisions for promotions provides tangible evidence that is consistent with the collaboration of the AHP-SMART method through the long stages of proving the

*name of corresponding author

employee selection and evaluation process. This method can be used as a reference for ranking problems. The results of this study provide support for employee evaluation decisions for promotions in an agency that can be applied according to the company's interests based on consistency. The first rank of the selected employee promotions was K23 with a score of 73.19 and followed by K2 and K2 with respective scores of 67.17 and 56.95 respectively. Thus, the collaboration between the AHP-SMART method provides concrete evidence, that these two methods are very appropriate to be used for the rating system as a form of decision support. The researcher recommends that for future research, it is expected to determine the proportion of criteria obtained from research results in the form of questionnaire instrumentation, so that the results obtained are more objective and consistent and should not be determined individually which will ultimately be subjective and only for certain interests.

ACKNOWLEDGMENT

We as researchers would like to thank our fellow authors and colleagues who have helped in completing this article and we hope that this article can provide benefits to all of us and colleagues, and can be applied and implemented in every institution that wants to use it as a reference. We hope that the publisher can accept and publish it, thank you.

REFERENCES

Akmaludin, A., Hartati, T., Purwanto, H., & Sukendar, T. (2020). *The Best Selection of Programmers in Generation 4 . 0 Using AHP and ELECTRE Elimination Methods The Best Selection of Programmers in Generation 4 . 0 Using AHP and ELECTRE Elimination Methods*. 0–7. https://doi.org/10.1088/1742-6596/1477/3/032001

Andani, S. R. (2019). Penerapan Metode SMART dalam Pengambilan Keputusan Penerima Beasiswa Yayasan AMIK Tunas Bangsa. *Jurnal Sistem Dan Teknologi Informasi (JUSTIN)*, *7*(3), 166. https://doi.org/10.26418/justin.v7i3.30112

Augustinus & Eric. (2013). Pengelolaan SDM Pada PT. Aneka Sejahtera Engineering. *Pengelolaan SDM Pada PT. Aneka Sejahtera Engineering*, *1*(2). [Diposting pada 13 Mei 2020

Aziz, N. F., Sorooshian, S., & Mahmud, F. (2016). MCDM-AHP method in decision makings. *ARPN Journal of Engineering and Applied Sciences*, *11*(11), 7217–7220. https://doi.org/10.1109/TIE.2013.2297315

Begicevic, N., Divjak, B., & Hunjak, T. (2009). Comparison between AHP and ANP: Case Study of Strategic Planning of E-Learning Implementation. *International Journal of the Analytic Hierarchy Process*, *1*(1), 31–44. https://doi.org/10.13033/ijahp.v1i1.5

Ghaleb, A. M., Kaid, H., Alsamhan, A., Mian, S. H., & Hidri, L. (2020). Assessment and Comparison of Various MCDM Approaches in the Selection of Manufacturing Process. *Advances in Materials Science and Engineering*, *2020*. https://doi.org/10.1155/2020/4039253

Krmac, E., & Djordjevii, B. (2019). A Multi-Criteria Decision-Making Framework for the Evaluation of Train Control Information Systems, the Case of ERTMS. *International Journal of Information Technology and Decision Making*, *18*(1), 209–239. https://doi.org/10.1142/S0219622018500451

Liang, T. C., & Peng, S. H. (2017). Using analytic hierarchy process to examine the success factors of autonomous landscape development in rural communities. *Sustainability (Switzerland)*, *9*(5). https://doi.org/10.3390/su9050729

Magrisa, T., Wardhani, K. D. K., & Saf, M. R. A. (2018). Implementasi Metode SMART pada Sistem Pendukung Keputusan Pemilihan Kegiatan Ekstrakurikuler untuk Siswa SMA. *Informatika Mulawarman : Jurnal Ilmiah Ilmu Komputer*, *13*(1), 49. https://doi.org/10.30872/jim.v13i1.648

Saaty, T. L. (2008a). Decision making with the analytic hierarchy process. *International Journal of Services Sciences*, *1*(1), 83. https://doi.org/10.1504/IJSSCI.2008.017590

Saaty, T. L. (2008b). Relative measurement and its generalization in decision making why pairwise comparisons are central in mathematics for the measurement of intangible factors the analytic hierarchy/network process. *Revista de La Real Academia de Ciencias Exactas, Fisicas y Naturales - Serie A: Matematicas*, *102*(2), 251–318. https://doi.org/10.1007/BF03191825

Saaty, T. L. (2010). *The Eigenvector In Lay Language 2 . What we learn when we have measurement*. *2*(2), 163–169.

Safrizal, M. (2015). Sistem Pendukung Keputusan Pemilihan Karyawan Teladan dengan Metode SMART (Simple Multi Attribute Rating Technique). *Jurnal CoreIT*, *1*(2), 25–29.

The, F. O. R., Person, L. A. Y., & Lipovetsky, S. (1936). *An Interpretation Of The AHP Eigenvector Solution GfK Custom Research North America 8401 Golden Valley Rd ., Minneapolis , MN 55427 , USA 2 . The AHP solution and its interpretation for the maximum eigenvalue λ yields the principal eigenvector α which ser*. *2*(2), 158–162.

Vargas, R. V. (2010). Using The Analytic Hierarchy Process (AHP) To Select And Prioritize Projects In A Portofolio. *PMI Global Congress*, *32*(3), 1–22. http://www.ricardo-vargas.com/pt/articles/analytic-

*name of corresponding author

Sinkron : Jurnal dan Penelitian Teknik Informatika
Volume 6, Number 2, April 2022
DOI : https://doi.org/10.33395/sinkron.xxx.xxx
e-ISSN : 2541-2019
p-ISSN : 2541-044X

hierarchy-process/#english

Velasquez, M., & Hester, P. (2013). An analysis of multi-criteria decision making methods. *International Journal of Operations Research*, *10*(2), 56–66.

Yusnitha, K., Tursina, T., & Irwansyah, M. A. (2019). Sistem Pendukung Keputusan Pemilihan Wilayah Prioritas Intervensi Kegiatan Keluarga Berencana dengan Metode AHP-SMART. *Jurnal Edukasi Dan Penelitian Informatika (JEPIN)*, *5*(1), 99. https://doi.org/10.26418/jp.v5i1.31338

*name of corresponding author

AHP-SMART Method as Evaluation Decision Support for Employee Promotion

ORIGINALITY REPORT

14%	13%	12%	10%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Universitas Prima Indonesia Student Paper	8%
2	jurnal.polgan.ac.id Internet Source	3%
3	fr.scribd.com Internet Source	2%
4	test.journal.unipdu.ac.id Internet Source	<1%
5	Akmaludin Akmaludin, Mohammad Badrul. "Multi-criteria for Selection of SmartPhone Brands Product using AHP-TOPSIS Method", SinkrOn, 2019 Publication	<1%

Exclude quotes	On	Exclude matches	< 20 words
Exclude bibliography	On		

AHP-SMART Method as Evaluation Decision Support for Employee Promotion

SURAT TUGAS

036/B.01/LPPM-UNM/III/2022

Tentang

PENELITIAN YANG DIPUBLIKASIKAN DALAM JURNAL ILMIAH
Periode Maret - Agustus 2022

Menulis pada Sinkron : Jurnal dan Penelitian Teknik Informatika, Vol. 7, No. 2, April 2022
E-ISSN: 2541-2019, P-ISSN: 2541-044X

Judul :

AHP-SMART Method as Evaluation Decision Support for Employee Promotion

Menimbang :
1. Bahwa perlu diadakan pelaksanaan Tridharma Perguruan Tinggi dalam bentuk Penelitian.
2. untuk Keperluan pada butir 1 (satu) diatas, maka perlu dibentuk tugas yang berkaitan dengan penelitian yang dipublikasikan dalam Jurnal Ilmiah.

MEMUTUSKAN

Pertama : Menugaskan kepada saudara

Akmaludin S.Kom, MMSI

Sebagai Penulis yang mempublikasikan Penelitianya pada Jurnal Ilmiah.

Kedua : Mempunyai tugas sbb:
Melaksanakan Tugas yang diberikan dengan penuh rasa tanggung jawab.

Ketiga : Keputusan ini berlaku sejak tanggal ditetapkan, dengan ketentuan apabila dikemudian hari terdapat kekeliruan akan diubah dan diperbaiki sebagaimana mestinya

Jakarta,1 Maret 2022
Ketua LPPM
Universitas Nusa Mandiri

Andi Saryoko, M.Kom

Tembusan
- Rektor Universitas Nusa Mandiri
- Arsip
- Ybs

SERTIFIKAT

Kementerian Riset dan Teknologi/
Badan Riset dan Inovasi Nasional

RISTEK-BRIN

Petikan dari Keputusan Menteri Riset dan Teknologi/
Kepala Badan Riset dan Inovasi Nasional
Nomor 148/M/KPT/2020
Peringkat Akreditasi Jurnal Ilmiah Periode II Tahun 2020
Nama Jurnal Ilmiah

Sinkron : Jurnal dan Penelitian Teknik Informatika

E-ISSN: 25412019

Penerbit: Politeknik Ganesha Medan

Ditetapkan sebagai Jurnal Ilmiah

TERAKREDITASI PERINGKAT 3

Akreditasi Berlaku selama 5 (lima) Tahun, yaitu
Volume II Nomor 1 Tahun 2020 sampai Volume 15 Nomor 2 Tahun 2024

Jakarta, 03 Agustus 2020
Menteri Riset dan Teknologi/
Kepala Badan Riset dan Inovasi Nasional
Republik Indonesia,

Bambang P. S. Brodjonegoro