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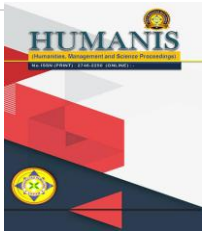

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Decision Support System of Web-Based Scholarship Admission Selection Using Analytical Hierarchy Process And Simple Additive Weighting Methods (Case: STIE Tribuana Bekasi)

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Abstract: STIE Tribuana Bekasi has a scholarship program for its students, but in making the selection it is difficult because of the large number of applicants and the absence of standard standards in the selection of scholarship recipients, because currently they are still using manual selection. To facilitate the selection of scholarship recipients, the authors developed a Decision Support System for scholarship recipients by comparison using the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW). AHP is a decision-making method according to predetermined criteria, where the decision-making criteria can be multi-criteria by setting priorities using a logical and structured procedure. Meanwhile, the SAW method is a method used to solve the problem of Fuzzy Multiple Attribute Decision Making (FMADM). The advantages of this research are doing comparisons and comparisons using 2 methods in finding and getting the best results from the selection of applicants for scholarship recipients, so that in the end the results of the selection are better and computerized, and through stages that are more selective and can be felt more fair and in accordance with the purpose of the scholarship, which is right on target for prospective scholarship recipients . Based on the results of the AHP and SAW methods, the AHP method is a more effective and optimal method to use. Because the AHP method has the closest value to zero with an average value of 0.246806737, while SAW has an average value of 1.60644. Thus, in the future for cases like this, the AHP method should be used.
Keywords : Scholarship Acceptance, Decision Support System, AHP, SAW

INTRODUCTION

STIE Bekasi Tribuana is one college tall private sector located in Bekasi City, precisely on Jl. HM Joyomartono No. 8-9 Campus Alley Mikar Ward Margahayu East Bekasi District 17113. College tall private bachelor degree (S1) has two Study Programs, namely the Study Program Management and Accounting. Two Major the has a scholarship program awarded to candidate enrolled students. However, there are often error in selection scholarship that is caused less method effective and efficient. So that resulted delays and insufficient data in accordance with provisions that have been set. Research using system supporters decision for help candidate student in selection scholarship with use method *Analytical Hierarchy*

Process and *Simple Additive Weighting* the will reduce error in set it and also avoid it from evaluation subjective. As for space environment and limitations in study this is the aim for avoid expansion problems , limitations knowledge and so more focus for reach destination is a) discuss selection scholarship for candidate student STIE Tribuana Bekasi, b) determination the value you get through method *Analytical Hierarchy Process* and *Simple Additive Weighting* and c) results obtained form recommendation in selection candidate eligible students _ get scholarship . Based on the above problems, the authors formulate a formula the problem is a) how to make the selection of scholarship recipients at STIE Tribuana Bekasi computerized ? b) how making the selection of scholarship recipients at STIE Tribuana Bekasi more objective and precise target? and c) how system selection election receiver Scholarship based computers at STIE Tribuana Bekasi with method *Analytical Hierarchy Process* and *Simple Additive Weighting* Becomes something system standard.

With see background back above, then destination from creation scientific this is for generate a support system decision accurate about candidate outstanding students with more results good, fast and accurate in selection scholarships that register at STIE Tribuana Bekasi and provide description comparison AHP and SAW methods for get optimal results. Whereas benefit from study this is as one alternative in help selection scholarship at a time for refer knowledge writer in learn method *Analytical Hierarchy Process* (AHP) and *Simple Additive Weighting* (SAW).

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Literature Study

Various literature and references are used researcher in writing creation scientific this. So that there is various the journal used related guidelines and references with similar topic. In this matter and for knowing methods, data and models performed review studies to previous studies which are those based on journals *review* [1-20]. Those are then taken conclusion that researcher chose method *Analytical Hierarchy Process* (AHP) and *Simple Additive Weighting* (SAW) for get something decision taken in a manner effective and systematic start from data collection to decide something score criteria and the final alternative get results something effective decisions and made. Some guidelines for taking decision through a calculation from something method that has been selected. Besides it, researcher created or developed method the to the previous research and this has not been taken yet there .

Base Theory

System Decision Support (SPK) or *Decision Support System* (DSS) is system information interactive that provides information, modeling and data manipulation. System this used for help taker decision in semi - structured and unstructured situations _ structured where no nobody know in a manner certain how decision should made (Kusrini , 2007) . *Analytical Hierarchy Process* (AHP) is a method of making decisions according to predetermined criteria, where the criteria for making decisions can be multi-criteria by setting priorities using logical and structured procedures, so that the existence of a hierarchy or indicators as a tool in solving a complex or difficult problem can produce quite good results through the processes that have been passed in solving or making decisions. Meanwhile, method *Simple Additive Weighting* is One _ method used _ for complete problem from *Fuzzy Multiple Attribute Decision Making* (FMADM). The Simple Additive Weighting (SAW) method ie something method used _ for look for optimal alternative of a number alternative with criteria certain. According to Palevy (2010). SAW is often also known term method sum weighted. Draft base SAW method is look for sum weighted of the performance rating on each alternative to all attribute. Method this requires a normalization process matrix decision X to something possible scale _ compared with all alternative ratings that exist.

As for some steps from method *Simple Additive Weighting* (SAW) is as following :

1. Determine the criteria to be made reference in taking decision, that is C.
2. Defines a match rating every alternative on each criteria.

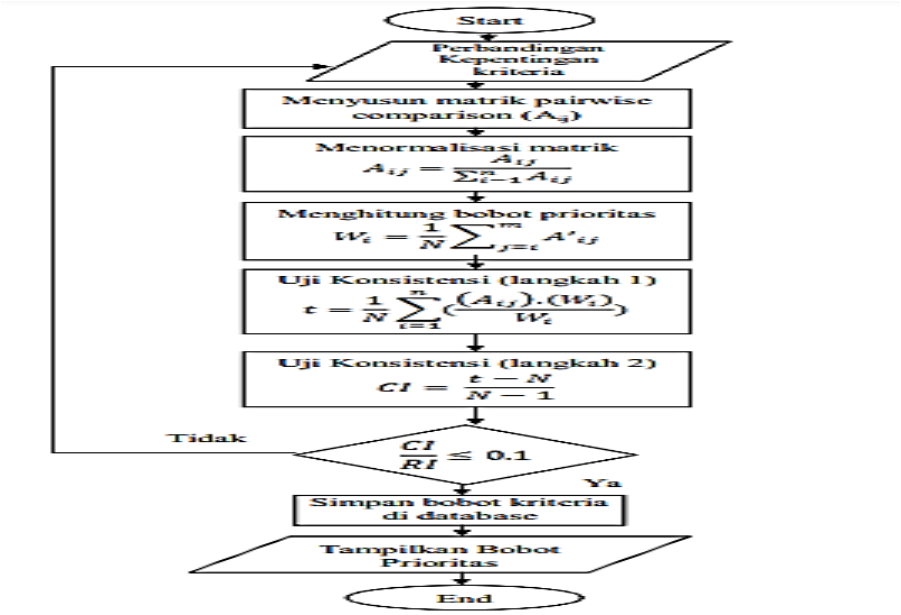
3. Make matrix decision based on criterion (C), then To do normalization matrix based on adjusted equation _ with type attribute (attribute profit or attribute cost) so obtained matrix normalized R.
4. Final result obtained from the ranking process that is sum from multiplication matrix normalized R with vector weight so that obtained score selected largest _ as alternative best (A) as solution (Hendri , 2009).

RESEARCH METHODS

Application method in complete problem creation scientific this is with use a number of a number of method followings:

1. **Method Literacy**
   At stage this conducted with learn journals, books or related sources with problem.
2. **Method Observation**
   In Thing this stage research and review direct to problem taken.
3. **Method Interview**
   Interview conducted more emphasize how standard procedure To do selection candidate receiver scholarships, in particular in weighting on priority criteria and alternative scholarship recipient selection, where the results of the interviews obtained, can be a reference and reference for writers.

Design Study *Analytical Hierarchy Process*



Source : Data search 2022

Figure 1 Analytical Flowchart Hierarchy Process

Process which there is in diagram flow method AHP is as following :

1. Start with Make matrix comparison in pairs criteria .
2. Make normalization matrix and priority criteria, formula calculation is like under this :
   a. Score line column new = score line column long / amount respectively - respectively row column.
   b. Priority = Amount column / n (Sum Criteria)
3. Count lambda max
   Row value column new = Number of columns long * Priority criteria. Results fromsum the called λn _ .
4. Count score CI (Consistency Index) formula calculation is
   CI = (λ −)/(− 1).
   Ket. n = Amount criteria a
5. Count CR (Consistency ratio) formula calculation is

$$C = \frac{C}{R}$$

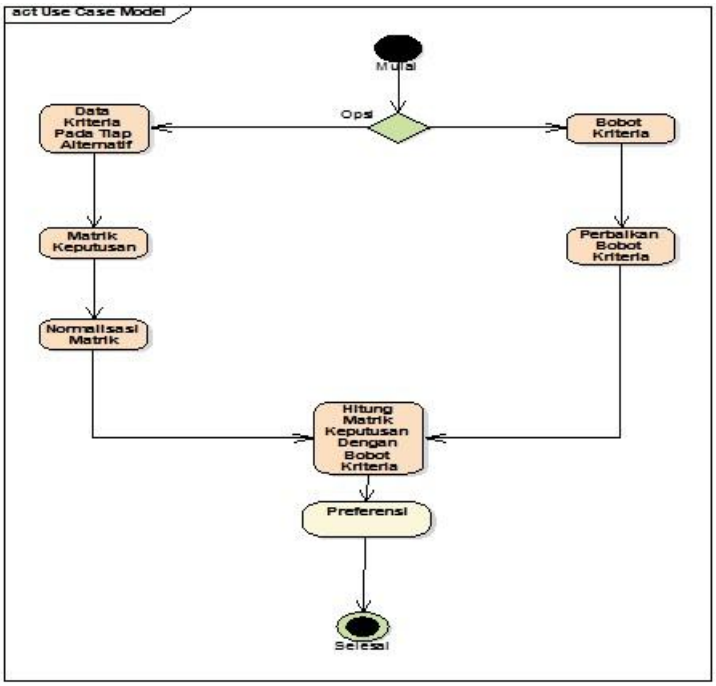
Ket. RI = Random Index.

6. Check score CR, if CR < 0.1 so calculation will done, however if no so must make matrix comparison again.
7. Make matrix comparison in pairs alternative.
8. Make matrix normalization and priority alternatives, calculation formulasis as follows :
   a. Score line column new = score line column long / amount respectively -respectively old column.
   b. Priority = Amount column / n (Sum alternative)
9. Count lambda max
   Row value column new = Number of columns long * Priority criteria. Results from sum the called λ m .
10. Count score CI (Consistency Index) formula calculation is
    $CI = (\lambda_m - n)/(n-1)$.
    Ket. n = Amount alternative
11. Count CR(Consistency ratio) formula calculation is

$$C = \frac{C}{R}$$

    Ket. RI = Random Index.
12. Results Analysis, used for count multiplication from priority criteria with priority alternative. Then done h result ranking and recommendation is results score end from calculation criteria and alternative.

Design Study Simple Additive Weighting



Source : Data search 2022

Figure 2 *Simple Additive Weighting Flowchart .*

Figure 2 shows the basic process of the method *Simple Additive Weighting* (SAW), where the processes passed in the above stages include the weighting of the criteria, improvement of the criteria weighting, criterion data for each alternative, decision matrix, normalization of the matrix, calculation of the decision matrix and

criteria weighting, and preference calculation results as the final stage of the problem solving process.

RESULTS AND DISCUSSION

Selection results scholarship for candidate STIE Tribuana Bekasi students will more objective. Amount Election scholarship based on majors taken in calculation this totaling 120, with all results could seen in Table following.

AHP Manual Calculations

In the process of manual calculations and system testing, several results have been obtained about making decisions on recipients of foundation scholarships using the AHP and SAW methods. In testing creation scientific this there are 110 sample candidates student , however with limitations sheet , then only the top 10 are taken , namely ranking 1-10 from calculation .

Table 1. AHP Normalization Results

0.428571	0.285714286	0.375	0.545454545	1.63474	0.408685	1.705357
0.214286	0.142857143	0.125	0.136363636	0.618506	0.154627	0.634334
0.142857	0.142857143	0.125	0.045454545	0.456169	0.114042	0.458672
0.214286	0.428571429	0.375	0.272727273	1.290584	0.322646	1.332995

Source : Data search 2022

Matrix in table 1 is really needed in calculation seen in the following Tables.

Table 2. Results of AHP GPA Criteria Matrix

Student Name	GPA matrix with AHP
Farchan Mungis Yudistira	0.258776
Mustafani Aqshal	0.255542
Aprilianti Muharani	0.2297
Elsa Setiawati	0.252387
M. Asep Gunawan	0.237713
Yayu Damayanti	0.252387
Muhammad Noor Ihsan	0.237713
Sopia Sasmita	0.246305
Anissa Deby	0.252387
Luthfiana Nur Fadila	0.232311
And so on	**And so on**

Source : Data search 2022

It is noted that Table 2 shows the matrix result from 110 students in which those are based GPA (Grade Prestige Average) of each student.

Table 3AHP of Graduate Year Matrix Results

NAME	Matrix Graduate Year
Farchan Mungis Yudistira	0.252328
Mustafani Aqshal	0.274973
Miko Izra Putra	0.268099
Aldi Sopian	0.246528
Acep Revelation	0.268099
Parhan Walidina	0.26156
Fikri Maulana Ramdani	0.240988

Hasannudin	0.264789
Aprilianti Muharani	0.255332
Elsa Setiawati	0.268099
M. Asep Gunawan	0.268099
Yayu Damayanti	0.268099
Muhammad Noor Ihsan	0.243726
Sopia Sasmita	0.246528
Anissa Deby	0.268099
Luthfiana Nur Fadila	0.255332
And so on	**And so on**

Source : Data search 2022

It is noted that Table 2 shows the matrix result from 110 students in which those are based on Graduated Year of each student.

Table 4. AHP Achievement Matrix Results

STUDENT NAME	Achievement Result Matrix
Farchan Mungis Yudistira	0.264357
Mustafani Aqshal	0.246126
Aprilianti Muharani	0.261134
Elsa Setiawati	0.248988
M. Asep Gunawan	0.261134
Yayu Damayanti	0.261134
Muhammad Noor Ihsan	0.267662
Sopia Sasmita	0.267662
Anissa Deby	0.254916
Luthfiana Nur Fadila	0.267662
And so on	**And so on**

Source : Data search 2022

It is noted that Table 2 shows the matrix result from 110 students in which those are based on Achievement of each student.

Table 5. Non-Scholarship Criteria Matrix Results

STUDENT NAME	**Non- scholarship Outcome Matrix**
Farchan Mungis Yudistira	0.242488533
Mustafani AQshal	0.242488533
Aprilianti Muharani	0.269768493
Elsa Setiawati	0.253899758
M. Asep Gunawan	0.253899758
Yayu Damayanti	0.250947435
Muhammad Noor Ihsan	0.266438017
Sopia Sasmita	0.256922374
Anissa Deby	0.248062982
Luthfiana Nur Fadila	0.263188773
And so on	

Source : Data search 2022

It is noted that Table 2 shows the matrix result from 110 students in which those are based on Non-Scholarship of each student. Having been identified using all important aspects as previously mentioned, the all 110 students were then ranked based on the final calculation and the rank of each student can bee seen in Table 6. The results of testing the AHP system are test results trial of the system that was built, where the results of the trial can be used as a reference in making decisions on scholarship recipients from the STIE Tribuana Bekasi Foundation scholarship.

Table 6. AHP Alternative Final Calculation Results

NO	NAME	FINAL SCORE	RANKING
1	Yayu Damayanti	0.258141684	1
2	Anissa Deby	0.255866204	2
3	Elsa Setiawati	0.255843328	3
4	M. Asep Gunawan	0.255211352	4
5	Mustafani AQshal	0.254782331	5
6	Luthfiana Nur Fadila	0.254623395	6
7	Farchan Mungis Yudistira	0.25448768	7
8	Sopia Sasmita	0.254354307	8
9	Aprilianti Muharani	0.253983682	9
10	Muhammad Noor Ihsan	0.253884845	10
And so on ….			

Source : Data search 2022

Results of Manual Calculations of the SAW Method

Manual calculations are the results of calculating each criterion used in the SAW method, where the calculation results for each criterion can be seen below.

Table 6. C1 Calculation Results (Benefit) SAW

Calculation C1	
R11	0.25
R21	0.2
R31	0.5
R41	1
R51	0.35
R61	0.5
R71	0.3
R81	0.2
R91	1
R10-1	0.45
And so on	

Source : Data search 2022

Table 7. C2 (Benefit) SAW Calculation Results

Calculation C2	
R12	0.3
R22	0.05
R32	0.15
R42	0.15
R52	1

R62	0.2
R72	0.25
R82	0.4
R92	0.2
R10-2	0.05
And so on	

Source : Data search 2022

Table 8. C3 Calculation Results (Cost) SAW

Calculation C3	
R13	8
R23	2
R33	1
R43	4
R53	6
R63	1
R73	3
R83	3
R93	1
R10-3	4
And so on ….	

Source : Data search 2022

Table 9. C4 Calculation Results (Cost) SAW

Calculation C4	
R14	10
R24	4
R34	9
R44	2
R54	2
R64	3
R74	6
R84	8
R94	2
R10-4	4
And so on ...	

Source : Data search 2022

Table 10. SAW Normalization Results

	C1	C2	C3	C4
1	0.25	0.3	8	10
2	0.2	0.05	2	4
3	0.5	0.15	1	9
4	1	0.15	4	2
5	0.35	1	6	2
6	0.5	0.2	1	3
7	0.3	0.25	3	6

8	0.2	0.4	3	8
9	1	0.2	1	2
10	0.45	0.05	4	4

Source : Data search 2022

Table 11. Value and Ranking of Each SAW Alternative

No	Name	Score	Ranking
1	Anissa Deby	12,274	1
2	Luthfiana Nur Fadila	4,492	2
3	Jagat Mahesa Putra	3,986	3
4	Muhammad Gilang Prasetya	3,782	4
5	Miko Izra Putra	3,646	5
6	Doni amarullah	3,274	6
7	Abu Hanifah	3,084	7
8	Perdo Mendoza	2,662	8
9	Beautiful Berliandi Putri	2,464	9
10	Umar Yusuf Arobi	2,428	10
And so on			

Source : Data search 2022

For discussion of the SAW Method, Tables 7 and 8 display the results of calculating C1 and C2 (Benefit) in the SAW method. While tables 9 and 10 show the results of calculating C3 and C4 (cost) in the SAW method. Finally, Tables 11 displays the results of the normalization factor in the SAW method and Table 12 displays the results of the preference and ranking of each alternative in the SAW method.

CONCLUSION

From the calculations, tests and discussions that have been carried out on the AHP and SAW methods, it can be concluded that with the existence of a foundation scholarship decision-making system that has been made in research using the AHP and SAW methods, scholarship recipients can be computerized and more efficient and It is hoped that the awarding of scholarships will be more targeted by using the procedures and values of each alternative and the criteria used in the AHP and SAW methods, so that in every decision made, prospective scholarship recipients no longer feel that the scholarship recipient's decision is ineffective and unfair. Based on results from the AHP and SAW methods, then AHP method is more effective and optimally used. Because the AHP method has the closest value score zero that is with an average of 0.246806737, while SAW has the average value is 1.60644. Indeed, for now and next case like this, the AHP method will be preferably applied.

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