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Research paperr

Implementation of Computer Based Systems for Effective Decisions in Acceptance of *Vikar*

Shinta Dharma Hardi[1], Hukendik Hutabarat[2], Benget Rumahorbo[3], W Willem[1], Mindo Judica Pangaribuan[1], Kusman Sudibyo[1], Andre Paulus Saleky[4], Henry Kristian Siburian[2], Fibry Jati Nugroho[5], Nuning Kurniasih[6], M Mesran[2*], Maringan Sianturi[2], Suardin Gaurifa[1], Abdul Karim[7],Janner Simarmata[8], Putri Ramadhani[2], Kurnia Ulfa[2], K Khasanah[9], Imam Saputra[2], Elvitrianim Purba[7]

[1]*STT Pelita Kebenaran, Medan, Indonesia*
[2]*STMIK Budi Darma, Medan, Indonesia*
[3]*Universitas Methodist Indonesia, Medan, Indonesia*
[4]*Sekolah Tinggi Keguruan dan Ilmu Pendidikan Biak, Papua, Indonesia*
[5]*Sekolah Tinggi Teologi Sangkakala, Semarang, Indonesia*
[6]*Universitas Padjadjaran, Bandung, Indonesia*
[7]*AMIK STIEKOM Sumatera Utara, Rantauprapat, Indonesia*
[8]*Universitas Negeri Medan, Medan, Indonesia*
[9]*STMIK Indonesia, Jakarta, Indonesia*
**Corresponding author E-mail: mesran.skom.mkom@gmail.com*

Abstract

The development of computer technology increasingly makes computers more popular in the community, so that it is easy to find computer usage in completing human work. The use of information technology is now increasingly developing with decision support-based information systems that can help decision makers in providing better decision decisions. Likewise in the process of receiving *Vikar* in the GKPI church. Vicar candidates must go through the selection stage and at the final stage a decision-based support system is used to provide the right decision, the prospective *Vikar* who can be accepted in the GKPI. In this study, ARAS method is used which is expected to solve problems related to multi-criteria-based decision processing.

Keywords: *Vikar Acceptance, ARAS Method, Computer Based System, DSS*

1. Introduction

The Indonesian Protestant Christian Church (GKPI) is a place of worship for Christians in Indonesia. In Indonesia, there are several churches including the Batak Protestant Christian (HKBP), Indonesian Christian Huria (HKI), Pentecostal Church in Indonesia (GPDI). The leader in the GKPI church is a pastor, not only in the GKPI, all churches have a pastor's leadership, but before becoming a pastor must get a Vicar title. The process of receiving *Vikar* is not easy, because *Vikar* actually has to go through a period of education for several years. Although a *Vikar* has finished his education and is declared to have graduated, every Church must certainly do the selection first in the *Vikar's* acceptance.

Some conditions are set for the acceptance of *Vikar* in the GKPI, including education, administrative completeness, GPA, interviews, election results. To facilitate the processing of acceptance of Vicar, a computer-based information system is used that can process the data of prospective *vikar*, so that the results can be objective and effective. This information system is known as a decision support system, which can provide effective decisions on alternative alternatives that have mutual interest in several criteria with each other [1][2]. The development of decision support systems is very rapid, it can be in the form of desktop-based or web-based applications [3][4].

Sometime before, a lot of research was conducted related to decision support systems. Research has been done such as determining the best computer lecturer at STMIK Budi Darma by using ELECTRE method [5], determining the provision of school assistance using the WSM method [6], the process of selecting a laptop using Fuzzy Tahani [7], the selection of the best mechanics applies EXPROM II [8]

Among the decision support system methods above, there are also many methods that can be used in resolving those related to multi-criteria, including the ARAS, VIKOR, COPRAS methods [9]–[12].

In this study, the method used in the process of receiving *Vikar* applies the Additive Ratio Assessment (ARAS) method which is expected to be able to provide effective results for decisions in receiving *Vikar*.

2. Methodology

Method of Additive Ratio Assessment (ARAS) was introduced by Zavadskas and Turksis. Method of Additive Ratio Assessment (ARAS) is able to solve complex problems using relatively simple

comparisons. The work process in the Additive Ratio Assessment (ARAS) method is found in quantitative measurements and utility theory. In the ARAS method, the value of the utility function determines the relative efficiency of the alternatives above other alternatives. This utility function is directly proportional to the relative effect of the criteria value and weight value. Alternative utility values are determined by variations in comparison with the best ideal alternatives[10].

The following are the steps of the Additive Ratio Assessment (ARAS) method as follows [10][11]:

Step 1: Formation of a decision matrix

$$Xij = \begin{bmatrix} X11 & X12 & \cdots & X1n \\ X21 & X22 & \cdots & X2n \\ \vdots & \vdots & \ddots & \vdots \\ Xm1 & Xm2 & \cdots & Xmn \end{bmatrix} \quad (1)$$

Information

m = Number of alternatives

n = Number of criteria

In the decision matrix the X_{0j} value is defined, if the X_{0j} value is unknown then it can be assumed that the value is obtained from the maximum value of the criterion (j) if the type of benefit, or the opposite of the minimum value if the type is cost.

Step 2: Normalize the decision matrix

If the Beneficial criteria:

$$Rij = \frac{Xij}{\sum_{i=0}^{m} Xij} \quad (2)$$

If the Non Beneficial criteria are normalized, follow the stages:

Stage-1: $Xij^* = \frac{1}{Xij}$ (3)

Stage-2: $Rij = \frac{Xij^*}{\sum_{i=0}^{m} Xij^*}$ (4)

R_{ij} is a normalized matrix.

Step 3: Determine the normalized weighted matrix

$$D = [dij]mxn = rij.wj \quad (5)$$

Information

W_j = the weight of criteria j

Step 4: Determine the optimal function (S_i)

$$Si = \sum_{j=1}^{n} dij; \quad (6)$$

Step 5: Determine the degree of the utility (U_i)

$$Ui = \frac{Si}{S0} \quad (7)$$

The U_i value is at the interval [0, 1], and the best value is the highest U_i value.

3. Results and Discussion

The application of information technology, in this case, the decision support system can provide objective results in data processing. The *Vikar* acceptance process was carried out in church congregation through several stages, including receiving files, checking the completeness of file administration, interviewing prospective *vikar* and the final determination stage whether the prospective *vikar* would be accepted as *vikar*. At the final stage, if the selection is still done without using a computer, the results of the decision will not be effective. This is because the process is still done manually without a computer. The existence of computer assistance in processing data can provide more effective results, far from subjective decisions. So that with the application of decision support methods can provide more effective results in *vikar* reception.

In determining the acceptance of *vikar*, alternative data is needed and the criteria used as a condition for receiving *vikar*. In table 1, it is a criterion that is determined as a condition for receiving *vikar*.

Table 1. Criteria and Weight

Criteria	Description	Weight	Type
C_1	Education	30%	Benefit
C_2	Administrative Completeness	10%	Benefit
C_3	GPA	15%	Benefit
C_4	Interview	15%	Benefit
C_5	Selection Test Value	30%	Benefit

The following list of candidates who become alternatives can be seen in table 1.

Table 2. Vikar List

Alternative	C_1	C_2	C_3	C_4	C_5
Theodorus, S.Th (A_1)	S1	Very Good	3,05	Good	85
David, S.Th (A_2)	S1	Very Good	3,10	Good	84
Marpaung,S.Th (A_3)	S1	Very Good	3,25	Good	86
Sihombing, S.Th (A_4)	S1	Good	3,05	Very Good	84
Edy, S.Th (A_5)	S1	Very Good	3,00	Good	83
Elia, M.Th (A_6)	S2	Very Good	3,25	Good	81
Hermalela, S.Th (A_7)	S1	Enough	3,30	Not Good	83
Dewi, S.Th (A_8)	S1	Very Good	2,98	Good	85
Zulkarnain, M.Th (A_9)	S2	Good	3,40	Enough	88
Larose, S.Th (A_{10})	S1	Good	3,15	Good	79
WagE, M.Th (A_{11})	S2	Good	3,20	Enough	85
Bayu Togar, M.Th (A_{12})	S2	Very Good	3,05	Very Good	90
Manalu, S.Th (A_{13})	S1	Good	3,20	Good	79
Ferry, S.Th (A_{14})	S1	Very Good	3,20	Very Good	82
Andy, S.Th (A_{15})	S1	Good	3,15	Very Good	81

From alternative candidates for *vikar*, there are linguistic data, namely education, administrative completeness, and interviews. In order to make the calculation easier, the data on these criteria are weighted as shown in table 3 and table 4.

Table 3. The Weighting Educational Values (C1)

Information	Weight
S1	1
S2	2
S3	3

Table 4. The weighting of Administrative Completeness (C2) and Interview (C4)

Information	Weight
Very Good	4
Good	3
Enough	2
Not Good	1

From the weighting used in the table in table 2 based on tables 3 and 4, the suitability rating is obtained as shown in table 5.

Table 5. Match Rating

Alternative	C_1	C_2	C_3	C_4	C_5
Theodorus, S.Th (A_1)	1	4	3,05	3	85
David, S.Th (A_2)	1	4	3,10	3	84
Marpaung,S.Th (A_3)	1	4	3,25	3	86
Sihombing, S.Th (A_4)	1	3	3,05	4	84
Edy, S.Th (A_5)	1	4	3,00	3	83
Elia, M.Th (A_6)	2	4	3,25	3	81

Hermalela, S.Th (A_7)	1	2	3,30	1	83
Dewi, S.Th (A_8)	1	4	2,98	3	85
Zulkarnain, M.Th (A_9)	2	3	3,40	2	88
Larose, S.Th (A_{10})	1	3	3,15	3	79
WagE, M.Th (A_{11})	2	3	3,20	2	85
Bayu Togar, M.Th (A_{12})	2	4	3,05	4	90
Manalu, S.Th (A_{13})	1	3	3,20	3	79
Ferry, S.Th (A_{14})	1	4	3,20	4	82
Andy, S.Th (A_{15})	1	3	3,15	4	81

The first step is to prepare a decision matrix based on table 5, can be seen in table 6.

Table 6. Decision Matrix (X_{ij})

Alternative	C_1	C_2	C_3	C_4
	Max	Max	Max	Max
A_0	2	4	3,4	1
A_1	1	4	3,05	3
A_2	1	4	3,1	3
A_3	1	4	3,25	3
A_4	1	3	3,05	4
A_5	1	4	3	3
A_6	2	4	3,25	3
A_7	1	2	3,3	1
A_8	1	4	2,98	3
A_9	2	3	3,4	2
A_{10}	1	3	3,15	3
A_{11}	2	3	3,2	2
A_{12}	2	4	3,05	4
A_{13}	1	3	3,2	3
A_{14}	1	4	3,2	4
A_{15}	1	3	3,15	4

For the value of X0j is obtained from the best value in the criterion column (j). The next step uses equations 2, 3, and 4 containing the normalized matrix.

Table 7. Normalized matrix (R_{ij})

Alternative	C_1	C_2	C_3	C_4
	Max	Max	Max	Max
A_0	0,0952	0,0714	0,0670	0,0889
A_1	0,0476	0,0714	0,0601	0,0667
A_2	0,0476	0,0714	0,0611	0,0667
A_3	0,0476	0,0714	0,0641	0,0667
A_4	0,0476	0,0536	0,0601	0,0889
A_5	0,0476	0,0714	0,0591	0,0667
A_6	0,0952	0,0714	0,0641	0,0667
A_7	0,0476	0,0357	0,0651	0,0222
A_8	0,0476	0,0714	0,0587	0,0667
A_9	0,0952	0,0536	0,0670	0,0444
A_{10}	0,0476	0,0536	0,0621	0,0667
A_{11}	0,0952	0,0536	0,0631	0,0444
A_{12}	0,0952	0,0714	0,0601	0,0889
A_{13}	0,0476	0,0536	0,0631	0,0667
A_{14}	0,0476	0,0714	0,0631	0,0889
A_{15}	0,0476	0,0536	0,0621	0,0889

Then calculating the normalized weighted matrix. At this stage the matrix has been normalized at times with weights on each criterion (equation 5), resulting in a weighted normalized matrix.

Table 8. The weighted of Normalization Matrix

Alternatives	C_1	C_2	C_3	C_4
	Max	Max	Max	Max
A_0	0,0286	0,0071	0,0101	0,0133
A_1	0,0143	0,0071	0,0090	0,0100
A_2	0,0143	0,0071	0,0092	0,0100
A_3	0,0143	0,0071	0,0096	0,0100
A_4	0,0143	0,0054	0,0090	0,0133
A_5	0,0143	0,0071	0,0089	0,0100
A_6	0,0286	0,0071	0,0096	0,0100
A_7	0,0143	0,0036	0,0098	0,0033
A_8	0,0143	0,0071	0,0088	0,0100
A_9	0,0286	0,0054	0,0101	0,0067
A_{10}	0,0143	0,0054	0,0093	0,0100
A_{11}	0,0286	0,0054	0,0095	0,0067
A_{12}	0,0286	0,0071	0,0090	0,0133
A_{13}	0,0143	0,0054	0,0095	0,0100
A_{14}	0,0143	0,0071	0,0095	0,0133
A_{15}	0,0143	0,0054	0,0093	0,0133

The next process calculates the optimal function (Si) using equation 6.

Table 9. Optimal Function Calculation Results (S_i)

Alternative	S_i
A_0	0,0793
A_1	0,0596
A_2	0,0595
A_3	0,0604
A_4	0,0609
A_5	0,0590
A_6	0,0735
A_7	0,0496
A_8	0,0594
A_9	0,0704
A_{10}	0,0567
A_{11}	0,0692
A_{12}	0,0783
A_{13}	0,0569
A_{14}	0,0627
A_{15}	0,0605

The final step is calculating the degree of the utility (Ui), using equation 7. In this final step, rank can be obtained from each candidate for *Vikar*.

Table 10. The Degree of the utility (Ui) and Rank

Alternative	Ui	Rank
A_1	0,7507	9
A_2	0,7497	10
A_3	0,7610	8
A_4	0,7674	6
A_5	0,7432	12
A_6	0,9269	2
A_7	0,6253	15
A_8	0,7481	11
A_9	0,8878	3
A_{10}	0,7149	14
A_{11}	0,8718	4
A_{12}	0,9870	1
A_{13}	0,7168	13
A_{14}	0,7898	5
A_{15}	0,7626	7

After performing the calculation phase using the ARAS method, the results are A12> A6> A9> A11> A14> A4> A15> A3> A1> A2> A8> A5> A13> A10> A7, and can get a list of prospective Vicar otherwise accepted taken from the 9 highest alternative values can be seen in table 11.

Table 11. List of Candidates who received / not received

Alternative	Ui	Description
Theodorus, S.Th (A_1)	0,987	Received
David, S.Th (A_2)	0,9269	Received
Marpaung,S.Th (A_3)	0,8878	Received
Sihombing, S.Th (A_4)	0,8718	Received
Edy, S.Th (A_5)	0,7898	Received
Elia, M.Th (A_6)	0,7674	Received
Hermalela, S.Th (A_7)	0,7626	Received
Dewi, S.Th (A_8)	0,761	Received
Zulkarnain, M.Th (A_9)	0,7507	Received
Larose, S.Th (A_{10})	0,7497	Not Received
WagE, M.Th (A_{11})	0,7481	Not Received
Bayu Togar, M.Th (A_{12})	0,7432	Not Received
Manalu, S.Th (A_{13})	0,7168	Not Received
Ferry, S.Th (A_{14})	0,7149	Not Received
Andy, S.Th (A_{15})	0,6253	Not Received

4. Conclusion

The results of the prospective vikar acceptance, obtained 7 alternatives that were propagated from 15 prospective *vikar*. The 7 alternatives can be accepted and appointed as *vikar* to the GKPI. The application of decision support systems to computer-based

information systems can provide decisions for decision makers to produce better and more effective decisions.

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