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Research paper



The Implementation of VIKOR Method to Improve the Effectiveness of *Sidi* Learning Graduation

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Abstract

Sidi learning for the Christian community is one of the most important learning for Christians. *Sidi* teaches an understanding of the life given by God and understands the meaning of the death of Jesus Christ on the cross. Graduation for *sidi* participants is a responsibility for the assembly of church congregations. Graduation from learning *sidi* must go through several conditions such as attendance, test scores, leadership and attitudes which are also weighted on each criterion. In order for the results of the graduation to be more effective, a decision support system based on the method known as VIKOR was implemented.

Keywords: *Sidi Learning, Graduation, VIKOR Method*

1. Introduction

Sidi is a learning program for faith education and Christian teachings to prepare learning participants to become members of *SIDI* who understand and carry out the duties of calling in life as a whole. The implementation of *SIDI* learning is divided into several categories, namely General, Youth, Youth. Learning towards *sidi* is carried out by the Congregation Assembly and its implementation appoints pastors in learning. This learning activity can last 6 (six) to 9 (nine) months which is held once a week. *Sidi* held on the Indonesian Christian Church (GKI) in providing faith guidance to participants. In *Sidi* learning, the church must unfold before them the truth and beauty of the Christian faith, and convict them of God's call, so that they choose Christ as the only true purpose of life. Therefore *Sidi* is one of the learning points in the church.

Learning against *sidi* is one of the demands of the newly testified Christians who claim to be followers of Christ. Once the importance of learning to this faith, the expected graduation factor should be subjective. So that the graduation from *Sidi* is indeed one graduation expected from the Geraja Congregation Assembly. How important is the information about graduating learning participants, so the application of computers as a tool that can process the data of participants is very important [1]–[3]. Computer-based information systems that can provide effective information support are known as decision support systems (DSS) [4], [5]. DSS is able to process input data into effective and best results from several alternative categories provided. The use of DSS at this time is very appropriate and the use of DSS has many benefits for management/ leadership of an organization or company, as well as the scope of educational institutions. Many methods for decision support systems can be used to improve decision outcomes, such as VIKOR, ELECTRE, WSM, FUZZY Tahani [6]–[9].

From the explanation above it can be seen that the picture of learning is very important so that the expected results of the learning process can be useful. For this reason, the author conducted a study on the Indonesian Christian Church in terms of graduating *sidi* by applying the VIKOR method to make the results of graduation learning effectively.

2. Methodology

2.1 Graduation

Graduation is the success of passing all the exams so as to provide an experience, and when the same exam comes again it will be easy to achieve success even above the first level of success if you reach a graduation word so try to pass all the tests and challenges that will be given.

2.2 Sidi

The word "*sidi*" comes from the Sanskrit discussion, meaning full or perfect. When this term is used in the church, it is more about its membership status. If someone has received confirmation of *sidi*, that means that the church membership is full. Therefore, those who are still studying (not yet confirmed) cannot be appointed as elders, Church Teachers, Pastors, and others. Or in general, those who have not received confirmation can not obtain marriage blessings.

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2.3 VIKOR Method

VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) is a multi-criteria optimization and compromise solution (multi-criteria optimization and compromise solution), which is one of the many MCDM techniques. VIKOR was first introduced by Serafim Opricovic in 1998[10][11]. The development of the VI-KOR method is used as one of the Multi-Criteria Decision Making (MCDM) methods which aim to solve problems encountered in decision making. The VIKOR method works by ranking and choosing from a set of samples against conflicting criteria.
VIKOR is based on the best solution obtained based on the closest ideal solution. Next, do the ranking by comparing the distance to the ideal solution. The VIKOR method also uses linear normalization with the aim of getting the best solution [12].

Steps for calculating the VIKOR method [14], as follows:
a. Normalize the decision matrix, using equation 1.

$$r_{ij} = \left(\frac{Xj+ - Xij}{Xj+ - Xj-}\right) \quad (1)$$

Where r_{ij} and x_{ij} (i = 1,2,3, ..., m and j = 1,2,3, ..., n) are elements of the decision-making matrix (alternative i to criteria j) and x_j^+ is the best element of criterion j, x_j^- is the worst element of criterion j.

b. Calculating the Utility Measure (S_i) values and Regret Measure (R_i) using equations 2 and 3.
In obtaining the values of S_i and R_i, we need criteria weighting values. The criteria weight (w_j) aims to represent relative importance.

$$S_i = \sum_{j=1}^{n} Wj\left(\frac{Xj+ - Xij}{Xj+ - Xj-}\right) \quad (2)$$

and

$$R_i = \text{Max } j[w_j\left(\frac{Xj+ - Xij}{Xj+ - Xj-}\right)] \quad (3)$$

Where is the weight of each criterion j.

c. Determine the VIKOR index value using equation 4.

$$Q_i = \left[\frac{Si - S+}{S- - S+}\right]V + \left[\frac{Ri - R+}{R- - R+}\right](1-V) \quad (4)$$

Where S- = max S, S + = min S and R- = max R, R + = min R and v = 0.5.

d. Ranking of Utility Measure (S_i), Regret Measure (R_i) and VI-KOR index (Q_i) values.
The ranking of the three values, S_i, R_i, and Q_i is based on the largest value to the smallest value (ascending order), with the smallest value being the best candidate. So that there will be three lists/ranking versions.

Condition C1: "Acceptance of Profits"
The conditions for fulfilling C1 conditions or profit acceptance are by comparing the difference in the alternative value of the second rank with the alternative in the first rank against the DQ value. Equations (5) and (6) explain how mathematically C1 conditions are met.

$$Q(a'') - Q(a') \geq DQ \quad (5)$$

$$DQ = \frac{1}{m-1} \quad (6)$$

Condition C2: "Acceptance of Stability in Decision Support"
To fulfill C2 conditions, alternatives must also be ranked first in ranking Si and / or Ri values. If C2 conditions are met, then the stability of the compromise solution is accepted in the decision making process.

The type of stability achieved is in the form of:
a. Selected by the "majority rule", when v> 0.5
b. Chosen by "consensus", when v ≈ 0.5
c. Vetoed, when v <0.5

If one condition is not met, some compromise solutions will be submitted. A compromise solution can consist of:
Alternatives, if a'' and a' only if C2 conditions are not met.
Alternatives, a', a'', ..., a^m, if C1 conditions are not met

$$Q(a^m) - Q(a') < DQ \quad (7)$$

3. Results and Discussion

The process of determining the graduation of *sidi* catechism in GKI for each alternative learning participant in a certain period followed up by examining the learning outcome document, then re-examining the existing alternatives with the predetermined criteria of Examination Value, Attendance, Leadership, Attitude. The use of the VIKOR method, each specified criterion is given different values and weights in accordance with the priorities of decision making, thus the results will be obtained with an alternative effective graduation assessment of each participant in the *Sidi* catechism.
The output obtained from this study is a list of participants who graduated from the *Sidi* catechism learning process. The following is a list of alternatives and criteria obtained from the GKI Jamaat Assembly and the criteria used in determining graduation.

Table 1:. Graduation Criteria

Criteria	Information	Bobot
C_1	Test Scores	40%
C_2	Presence	10%
C_3	Leadership	25%
C_4	Attitude	25%

Table 2:. List of Alternatives (*Sidi* Students)

Sidi Students	C_1	C_2	C_3	C_4
Elni (A_1)	87	90 %	Very Good	Good
Ayusari (A_2)	65	90 %	Good	Good
Noni (A_3)	90	65 %	Very Good	Good
Erwin (A_4)	60	58 %	Very Good	Very Good
Reman (A_5)	98	100 %	Very Good	Good
Velman (A_6)	68	98 %	Very Good	Good
Anila (A_7)	75	86 %	Very Good	Good
Rianis (A_8)	50	100 %	Good	Enough
Sobadodo (A_9)	96	97 %	Good	Very Good
Aliomano (A_{10})	94	95 %	Enough	Good
Firman (A_{11})	100	96 %	Enough	Very Good
Andi (A_{12})	60	60 %	Very Good	Very Good
Eben (A_{13})	97	100 %	Very Good	Enough
Zebua (A_{14})	96	100 %	Enough	Very Good
Sokhi (A_{15})	0	50 %	Good	Enough
Yasoro (A_{16})	87	100 %	Good	Very Good
Fanotona (A_{17})	70	95 %	Very Good	Good

From the criteria C3 and C4 weighting using table 3.

Table 3:. Graduation Criteria

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

The results of table 3 weighting on table 2 obtained a match rating data can be seen in table 4.

Table 4:. Match rating

Alternatives	C_1	C_2	C_3	C_4
Elni (A_1)	87	90	4	3
Ayusari (A_2)	65	90	3	3
Noni (A_3)	90	65	4	3
Erwin (A_4)	60	58	4	4

Alternatives	C_1	C_2	C_3	C_4
Reman (A_5)	98	100	4	3
Velman (A_6)	68	98	4	3
Anila (A_7)	75	86	4	3
Rianis (A_8)	50	100	3	2
Sobadodo (A_9)	96	97	3	4
Aliomano (A_{10})	94	95	2	3
Firman (A_{11})	100	96	2	4
Andi (A_{12})	60	60	4	4
Eben (A_{13})	97	100	4	2
Zebua (A_{14})	96	100	2	4
Sokhi (A_{15})	0	50	3	2
Yasoro (A_{16})	87	100	3	4
Fanotona (A_{17})	70	95	4	2

After the suitability rating is obtained, the first step in completing the VIKOR method is normalizing the matrix using equations (1) and (2). Equation (1) aims to complete normalization and the normalization results are changed in the form of a matrix with equation (2). the following is the matrix resulting from normalization.

Table 5:. Normalized matrix (R_{ij})

Alternatives	C_1	C_2	C_3	C_4
A_1	0,13	0,20	0,00	0,50
A_2	0,35	0,20	0,50	0,50
A_3	0,10	0,70	0,00	0,50
A_4	0,40	0,84	0,00	0,00
A_5	0,02	0,00	0,00	0,50
A_6	0,32	0,04	0,00	0,50
A_7	0,25	0,28	0,00	0,50
A_8	0,50	0,00	0,50	1,00
A_9	0,04	0,06	0,50	0,00
A_{10}	0,06	0,10	1,00	0,50
A_{11}	0,00	0,08	1,00	0,00
A_{12}	0,40	0,80	0,00	0,00
A_{13}	0,03	0,00	0,00	1,00
A_{14}	0,04	0,00	1,00	0,00
A_{15}	1,00	1,00	0,50	1,00
A_{16}	0,13	0,00	0,50	0,00
A_{17}	0,30	0,10	0,00	1,00

Furthermore, it enters the completion stage of Utility Measure Value (S_i) and Regret Measure (R_i) using equations (2) and (3).

Table 6:. Value of Utility Measure (S_i) and Regret Measure (R_i)

Alternatives	Utility Measure (S_i)	Regret Measure (R_i)
A_1	0,197	0,125
A_2	0,410	0,140
A_3	0,235	0,125
A_4	0,244	0,160
A_5	0,133	0,125
A_6	0,257	0,128
A_7	0,253	0,125
A_8	0,575	0,250
A_9	0,147	0,125
A_{10}	0,409	0,250
A_{11}	0,258	0,250
A_{12}	0,240	0,160
A_{13}	0,262	0,250
A_{14}	0,266	0,250
A_{15}	0,875	0,400
A_{16}	0,177	0,125
A_{17}	0,380	0,250

The next step is to calculate the VIKOR (Q_i) index value using equation (4). At this stage we must determine the value of S^+ and S^- as well as R^+ and R^-. Based on table 4. Then you can determine the value of S^+ and S^-, S^+ and R^- as follows:

S^+ : 0,133
S^- : 0,875
R^+ : 0,125
R^- : 0,400
V : 0,5

From the determination above, the results obtained from the calculation of the VIKOR index value of each participant *sidi* along with the graduation status of the *Sidi* participants. For participants who have a value above 0.5 can be declared Not Passed while the value below or equal to 0.5 is declared Passed.

Table 7:. VIKOR Index values and ranking

Alternatives	Qi	Rank	Status
A_5	0,000	1	Pass
A_9	0,009	2	Pass
A_{16}	0,030	3	Pass
A_1	0,043	4	Pass
A_3	0,069	5	Pass
A_7	0,081	6	Pass
A_6	0,089	7	Pass
A_{12}	0,136	8	Pass
A_4	0,138	9	Pass
A_2	0,214	10	Pass
A_{11}	0,312	11	Pass
A_{13}	0,314	12	Pass
A_{14}	0,317	13	Pass
A_{17}	0,394	14	Pass
A_{10}	0,413	15	Pass
A_8	0,525	16	Not Pass
A_{15}	1,000	17	Not Pass

Based on the value of Vikor, it can be determined that the alternatives are not passed, namely Rianis (A_8) and Sokhi (A_{15}) while other than that the *SIDI* participants are declared to be graduated. Based on table 6, it can be seen the index of participants' graduation scores.

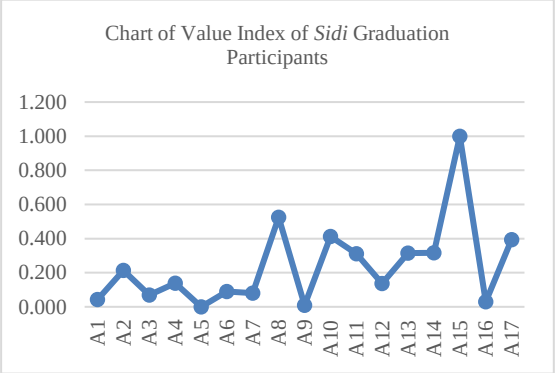


Fig 1:. *Sidi* graduation index value

4. Conclusion

The implementation of the VIKOR method in the decision support system is able to provide more effective results by considering all criteria that are taken into account for the graduation of participants. This can provide convenience to the congregation in determining graduation.

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