Development Of Decision Support System For Selection of Yayasan Alumni Scholarship Using MOORA Method

by Endang Lestari

Submission date: 04-Nov-2019 01:32PM (UTC+0700)
Submission ID: 1206538424
File name: 191104_Paper_Arin-Endang_english_2_kumpul_edas.docx (81.43K)
Word count: 2672
Character count: 14212

Development Of Decision Support System For Selection of Yayasan Alumni Scholarship Using MOORA Method

Keywords: Decision Suport System, MOORA Method, Scholarship

Abstract. Yayasan Alumni Scholarship is a form of concrete contribution from the alumni to SMA N 1 to increase access and study opportunities in higher education for SMA N 1 students who are economically incapable and have academic potential. Yayasan Alumni routinely provides scholarships once a year. Several obstacles are starting from the registration process, the collection of prospective scholarship recipients, and the selection process which takes a long time due to many determining criteria. Also, the assessment tends not to be objective due to the subjectivity of each jury because there are no assessment standards. Therefore we need a decision support system that can provide the best solution to solve all existing problems. In this study using the Multi-Objective Optimization Method on the basis by Ratio Analysis (MOORA). The MOORA method has a degree of flexibility and is easy to understand in separating the subjective parts of an evaluation process into decision weight criteria with several attributes of decision making.

Introduction

Education is the process of learning science, learning individual and social skills, physical and spiritual, and developing one's potential to become a skilled, creative and better person. Although providing education is a government obligation, students also need money to meet their needs during the learning process, but not all students come from well-off families but some students come from underprivileged families. To support these costs, one of them with a scholarship.

Yayasan Alumni is an example of an institution that provides special scholarships to SMA N 1 students which are held once a year. This foundation was established to help to provide educational funding to the alumni of the students of SMA N 1 who will continue their tertiary education and introduce the simulation of scholarship registration for provision at universities.

The process of providing scholarships held by Yayasan Alumni was carried out using the foundation conducting socialization which was attended by all 12th-grade students of SMA N 1 and all students were allowed to register. After that, prospective scholarship recipients fill out forms and complete the files that have been determined by the foundation. Then prospective scholarship recipients will collect the files and conduct interviews. Several criteria have been set by the foundation, namely parents 'income, parents' dependents, academic value, achievement certificates, electricity bills, homes and interviews. And to get a scholarship prospective scholarship recipients must meet these criteria. Of the many scholarship registrants, Yayasan Alumni only provides scholarships for 2 to 3 applicants who are deemed eligible to receive the scholarship.

Several obstacles are starting from the registration process, the selection process which takes a long time due to many determining criteria. Also, the assessment tends not to be objective due to the subjectivity of each jury because there are no assessment standards. Therefore we need a decision support system that can provide the best solution to solve all the problems of the selection of prospective scholarship recipients at Yayasan Alumni. Decision support system (DSS) is a system that processes data into information that produces many alternative decisions to help support decision making with semi-structured and unstructured problems. Decision support systems (DSS) is the area of the information systems (IS) discipline that is focused on supporting and improving managerial decision-making[1]. This system was created so Yayasan Alumni can carry out all the screening processes in one system and shorten the selection time. Multi-Objective Optimization on the basis by

Ratio Analysis or as MOORA is a multi-objective system that optimizes conflicting attributes simultaneously Namely criteria that have value or benefit and which do not value or cost. This method refers to the toa matrix of responses of alternatives to objectives, to which ratios are applied[2]. The MOORA method has a degree of flexibility and is easy to understand in separating subjective parts of an evaluation process into decision weight criteria with several attributes of decision making.

Literature Review

Study Literature

It is observed that in comparison to other MODM methods, like grey-fuzzy logics, Taguchi method, grey–Taguchi method, grey relational analysis (GRA), the MOORA method is very simple and easy to implement. For this reason, the MOORA method is highly stable for varying decision-making problems. In general, for anyone alternative having all the attributes or factors are either beneficial or non-beneficial in nature. In that case, that alternative candidate is the first or best choice for the given application. i. e. no need to apply any other method. Also, for single performance characteristics, the designer can directly select the process parameters by considering beneficial (i.e. higher values) and non-beneficial (i.e. smaller values) attributes without the use of any methodology or tool. e. g. If SR is only the performance characteristic then the designer can select a lower value of SR and corresponding values give optimal values of process parameters[3].

In research about the decision support system for selecting new employee recruitment decision support system (DSS) at PT. Warta Media Nusantara using SAW and WP. In this paper use 4 criteria are an interview, field test, psychological test and medical check-up. The results of the study of the application of SAW and WP methods in the recruitment of new employees DSS there are some differences in the results of the candidate`s rank order and the differences in execution time of each method. The differences in rank order of these methods are due to the effects of alternative values, weighting criteria, and the calculation method. WP method can provide more rigorous results than SAW method, while the difference in execution time of SAW and WP methods explains that the execution time of SAW method relatively quick because SAW calculation method has a simpler process than the process of WP calculation methods[4].

Decision Support System

Decision support system is a computer program application that analyzes data and presents it so users can make decisions more easily[5]. Decision Support System (DSS) are computer-based tools that have been adapted to support and aid complex decision-making and problem-solving[6]. According to Simon, the process of making a decision is divided into 4 phases, such as[7]:

1. Intelligence phase.
   Herbert A. Simon called the first phase of the decision making the process an intelligence activity. According to him, executives spend most of their time surveying the economic, technical, political and social environment to identify problems and information that will be needed.
2. Design phase.
   The second phase also called the design phase deals with the analysis and formulates alternatives to solve the problem then identifies and evaluates these alternatives
3. Selection phase.
   This stage chooses the best solution or alternative among the alternatives.
4. Implementation phase
   Implement alternatives or solutions that have been chosen to solve the problem at hand.

Scholarships

Scholarships are aids to ease the burden of students while in education, especially the issue of cost[5]. The granting of this scholarship will be a passion for students to improve their learning achievement.

MOORA

Multi-Objective Optimization on the basis by Ratio Analysis or abbreviated as MOORA is a multi-objective system that optimizes conflicting attributes simultaneously. Namely, criteria that are of value or benefit and which are not of value or cost. The best alternative does not always have a higher cost than the benefit[8]. This method was first used by Brauers in 2004 in a multi-criteria decision making and introduced by Brauers and Zavadkas in 2006. The MOORA procedure steps are as follows [9][3][10].

1. Input criteria
   The first step is inputing the criteria value in an alternative where the value will be processed and produce a decision
2. Change the value of the criteria into a matrix value
   The next step is to represent all the information available for the attributes in the form of a decision matrix. The data given in eq. (1) are represented as matrix Xmxn. Where xij is the performance measure of i th alternative on j th attribute, m is the number of alternatives, and n is the number of attributes. Then a ratio system is developed in which each performance of an alternative on an attribute is compared to a denominator which is a representative for all the alternatives concerning that attribute.

$$X = \begin{bmatrix} x_{11} & x_{1i} & x_{1n} \\ x_{j1} & x_{ij} & x_{jn} \\ x_{m1} & x_{mi} & x_{mn} \end{bmatrix} \quad (1)$$

3. Normalization in the MOORA method
   At this stage, normalization aims to unite each matrix element so that all elements in the matrix have a uniform value. Where xij is a dimensionless number which belongs to the interval [0, 1] representing the normalized performance of i th alternative on j th attribute.

$$X^*_{ij} = X_{ij} / \sqrt{\left[\sum_{i=1}^{m} X_{ij}^2\right]} \quad (2)$$

4. Calculate the value of optimization
   For multi-objective optimization, these normalized performances are added in case of maximization (for beneficial attributes) and subtracted in case of minimization (for non beneficial attributes). Then the optimization problem becomes:

$$Y_i = \sum_{i=1}^{i=g} x^*_{ij} - \sum_{i=g+1}^{i=n} x^*_{ij} \quad (3)$$

   Where g is the number of attributes to be maximized, (n−g) is the number of attributes to be minimized, and yi is the normalized assessment value of i th alternative with respect to all the attributes. In some cases, it is often observed that some attributes are more important than the others. In order to give more importance to an attribute, it could be multiplied with its corresponding weight (significance coefficient). When these attribute weights are taken into consideration,becomes as follows:

$$Y_i = \sum_{j=1}^{g} w_j x^*_{ij} - \sum_{j=g+1}^{n} w_j w^*_{ij} \quad (4)$$

5. Determine the ranking of the results of MOORA calculation.
   From all the above stages an alternative ranking will be generated. The best alternative is the alternative which has the highest final value (yi) while the worst alternative is the alternative that has the lowest final value (yi).[3] The final value (yi) can be positive or negative depending on the maximum (benefit) and minimum (cost) [3][7][10].

Research Methods

According to Simon, the process of making a decision is divided into 4 phases, such as[7]:

1. Intelligence phase.

This stage is the process of negotiation carried out by the decision-maker for all problems that must be resolved. Data consists of primary data and secondary data. Primary data was collected through interviews with the chairman of the Yayasan Alumni the agency that organized the program. And secondary data were collected by concluding the literature with previous research. And then, the installation must analyze the problems or opportunities that might occur under the old decision-making system. Like the problem with the registration process which is done by sending files via school or by email, these published files can be lost and piling up. and also the long selection time due to the number of determinants and students who register. Each judge has a standard of judgment that makes the data subjective. After that, analyze the system feasibility. From technical and operational feasibility, this system will be created on a website using PHP program language and the admin of Yayasan Alumni is accustomed to using a computer. From economical feasibility, this system will be used once a year and make the selection process faster and more accurate. From law feasibility, the system will be under the rules by the government because the data, steps, judges, etc are based on interviews.

2. Design phase.
   This stage is the process of modeling the problem that has been previously defined by outlining the decision elements, alternative decision variables, and evaluation criteria were chosen. The model will be validated by the criteria set out to conduct an alternative evaluation of the selected decision. The process of determining a solution is a process for designing or developing alternatives, determining decisions and assigning values and weights given to each alternative that exists.
3. Selection phase.
   This stage chooses the best solution or alternative among the alternatives.
4. Implementation phase
   This stage is the implementation of a system that already designs in the design phase.

Result and Discussion

This research is needed to determine :

1. Criteria

Table 1. Criteria

Criteria	Description	Weight	Type
C1	Parents income	12%	Cost
C2	Parents dependents	20%	Benefit
C3	Academic value	20%	Benefit
C4	Achievement certificates	13%	Benefit
C5	Electricity bills	10%	Cost
C6	House status	5%	Cost
C7	House type	5%	Cost
C8	Interview	15%	Benefit

2. Subcriteria

   1) Subcriteria of Academic value

Table 2. Subcriteria of academic value

Description	Value
Participants certificates	1
Big 3 school certificates	2
Big 3 regency certificates	3
Big 3 provincial certificates	4
Big 3 National certificates	5

   2) Subcriteria of House Status

Table 3. Subcriteria of house status

Description	Value
Rent	1
Join with family	2
Own house	3

3) Subcriteria of House Type

Table 4. Subcriteria of house type

Description	Value
Not Permanent	1
Semi-Permanent	2
Permanent	3

4) Subcriteria of Interview

Table 5. Subcriteria of interview

Description	Value
Unable to communicate well	1
Less able to communicate well	2
Able to communicate well	3

3. Alternative Data

Based on the previous analysis, it can implement a simulation of MOORA in Excell with steps below. Steps in MOORA :

1) Input Criteria

Table 6. Subcriteria of house status

KA	C1	C2	C3	C4	C5	C6	C7	C8
A1	500.000	3	81,57	1	42.282	2	3	1
A2	750.000	1	79,3	2	107.033	3	2	2
A3	3.000.000	3	84,14	3	25.000	1	2	3
A4	300.000	1	81,68	3	24,615	3	2	2
A5	1.500.000	4	83,87	1	30.000	3	1	3

2) Change the value of the criteria into a matrix value

$$X = \begin{bmatrix} 500000 & 3 & 81{,}57 & 1 & 42282 & 2 & 3 & 1 \\ 750000 & 1 & 79{,}30 & 2 & 107033 & 3 & 2 & 2 \\ 3000000 & 3 & 84{,}14 & 3 & 25000 & 1 & 2 & 3 \\ 300000 & 1 & 81{,}68 & 3 & 24615 & 3 & 2 & 2 \\ 1500000 & 4 & 83{,}87 & 1 & 30000 & 3 & 1 & 3 \end{bmatrix}$$

3) Normalization in the MOORA method

$$X_{ij} = \begin{bmatrix} 0.143 & 0.5 & 0.444 & 0.204 & 0.341 & 0.353 & 0.640 & 0.192 \\ 0.215 & 0.167 & 0.432 & 0.408 & 0.863 & 0.530 & 0.426 & 0.385 \\ 0.861 & 0.5 & 0.458 & 0.612 & 0.202 & 0.176 & 0.426 & 0.577 \\ 0.086 & 0.167 & 0.445 & 0.612 & 0.199 & 0.530 & 0.426 & 0.385 \\ 0.430 & 0.667 & 0.457 & 0.204 & 0.242 & 0.530 & 0.213 & 0.577 \end{bmatrix}$$

4) Calculate the value of optimization

$$X_{wj} = \begin{bmatrix} 0.0172 & 0.1 & 0.0888 & 0.0265 & 0.0341 & 0.0177 & 0.0320 & 0.0289 \\ 0.0258 & 0.0334 & 0.0864 & 0.0530 & 0.0863 & 0.0265 & 0.0213 & 0.0577 \\ 0.1033 & 0.1 & 0.0916 & 0.0796 & 0.0202 & 0.0088 & 0.0213 & 0.0866 \\ 0.0103 & 0.0334 & 0.0890 & 0.0796 & 0.0199 & 0.0265 & 0.0213 & 0.0577 \\ 0.0516 & 0.1334 & 0.0914 & 0.0265 & 0.0242 & 0.0265 & 0.0107 & 0.0866 \end{bmatrix}$$

5) Determine the ranking of the results of MOORA calculation

Table 7. Subcriteria of house status

Alternatif	Max (C_2+ C_3 + C_4+ C_8)	Min (C_1+C_5+ C_6+ C_7)	Y_i = (Max-Min)
A1	0.2442	0.1049	0.1432
A2	0.2305	0.1599	0.0705
A3	0.3578	0.1536	0.2042
A4	0.2596	0.0780	0.1816
A5	0.3378	0.1130	0.2248

Table 8. Subcriteria of house status

Ranking	Alternatives	Y_i
1	A5	0.2248
2	A3	0.2042
3	A4	0.1816
4	A1	0.1432
5	A2	0.0705

Based on ranking results obtained that alternative 5 with a value of A5 = 0,2248 is the best alternatives with the largest Qi value that will get the scholarship.

Conclussion

The implementation of Multi-Objective Optimization on the basis by Ratio Analysis method in the decision support system can provide a recommendation system to assist decision-makers in determining the eligible participants to receive scholarships based on predetermined criteria.

References

[1] P. B. Keenan, "Changes in DSS disciplines in the Web of Science Changes in DSS disciplines in the Web of Science," *J. Decis. Syst.*, vol. 25, no. June 2016, pp. 542–549, 2019.

[2] W. Brauers and E. K. Zavadskas, "The MOORA method and its application to privatization in a transition economy," no. January 2006, 2016.

[3] G. S.V, "Application of MOORA method for parametric optimization of milling process," vol. 1, no. 4, pp. 743–758, 2011.

[4] A. Setyawan, F. Y. Arini, and I. Akhlis, "Comparative Analysis of Simple Additive Weighting Method and Weighted Product Method to New Employee Recruitment Decision Support System (DSS) at PT . Warta Media Nusantara," vol. 4, no. 1, pp. 34–42, 2017.

[5] M. Ibrohim, "Decision Support System for Determining the Scholarship Recipients using Simple Additive Weighting," vol. 151, no. 2, pp. 10–13, 2016.

[6] R. Accorsi, R. Manzini, and F. Maranesi, "Computers in Industry A decision-support system for the design and management of warehousing systems," *Comput. Ind.*, vol. 65, no. 1, pp. 175–186, 2014.

[7] T. Limbong and J. Simarmata, "The Implementation of Multi-Objective Optimization on the Basis of Ratio Analysis Method to Select the Lecturer Assistant Working at Computer Laboratorium," vol. 7, pp. 352–356, 2018.

[8] W. Fitriani and A. P. U. Siahaan, "Multi-Objective Optimization Method by Ratio Analysis in Determining Multi-Objective Optimization Method by Ratio Analysis in Determining Results in Decision Support Systems," no. November, pp. 2–7, 2018.

[9] A. Görener, H. Dinçer, and Ü. Hacıoğlu, "Application of Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) Method for Bank Branch Location Selection," vol. 2, no. 2, pp. 41–52, 2013.

[10] R. K. Hondro, M. Syahrizal, A. Putera, U. Siahaan, and R. Rahim, "Student Admission Assesment using Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA)," no. Irstc, 2017.

Development Of Decision Support System For Selection of Yayasan Alumni Scholarship Using MOORA Method

ORIGINALITY REPORT

31%	24%	26%	15%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.ipublishing.co.in Internet Source	11%
2	journal.unnes.ac.id Internet Source	5%
3	Submitted to Institute of Technology, Nirma University Student Paper	5%
4	D Hanifatulqolbi, I E Ismail, J Hammad, M H Al-Hooti. "Decision support system for considering the best teacher performance using MOORA method", Journal of Physics: Conference Series, 2019 Publication	3%
5	Tonni Limbong, Janner Simarmata, S Sriadhi, A R S Tambunan et al. "The Implementation of Multi-Objective Optimization on the Basis of Ratio Analysis Method to Select the Lecturer Assistant Working at Computer Laboratorium", International Journal of Engineering &	1%

Technology, 2018
Publication

6	www.cstp.umkc.edu Internet Source	1%
7	Chosy Yuda Sakti, Kelly Rossa Sungkono, Riyanarto Sarno. "Determination of Hospital Rank by Using Analytic Hierarchy Process (AHP) and Multi Objective Optimization on the Basis of Ratio Analysis (MOORA)", 2019 International Seminar on Application for Technology of Information and Communication (iSemantic), 2019 Publication	1%
8	ijsrst.com Internet Source	1%
9	espace.library.curtin.edu.au Internet Source	1%
10	Accorsi, Riccardo, Riccardo Manzini, and Fausto Maranesi. "A decision-support system for the design and management of warehousing systems", Computers in Industry, 2013. Publication	1%
11	www.wmich.edu Internet Source	1%

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		