A SYSTEM TO SUPPORT DECISION MAKINGS IN SELECTION OF AID RECEIVERS FOR CLASSROOM REHABILITATION FOR SENIOR HIGH SCHOOLS BY EDUCATION OFFICE OF PRINGSEWU DISTRICT BY USING SIMPLE ADDITIVE WEIGHING METHOD

*Corresponding author
*Email :
muslih.udin@ymail.com*

Muhamad Muslihudin, Miswan Gumanti
STMIK Pringsewu Lampung
Jl. Wismarini No. 09 Pringsewu – Lampung, Indonesia
Email : muslih.udin@ymail.com

Abstract
Pringsewu district as a new autonomous region has big potentials in education sector. Currently there are 12 public senior/vocational high schools and 27 private senior/vocational high schools under Education Office of Pringsewu district. There many schools still requiring attentions on school buildings, especially classrooms. To obtain classroom rehabilitation aids, a system to support decision making to determine which school has the right to receive aids from Education Office in Pringsewu district. In implementing system to support decision makings in selection of aid receivers for classroom rehabilitation in senior/vocational high schools by Education Office of Pringsewu district, there are five criteria to use; the physical condition of classroom, number of students, number of teachers and staffs, school income, and status of land ownership of the school. The problem in this research was to find best alternative based on predetermined criteria b using SAW (Simple Additive Weighing). The basic concept of SAW method is to find out weight rating of each alternative in an attribute, and then ranking process is conducted to determine best alternative.

Keywords: DSS, MADM, SAW, Pringsewu

1.0 INTRODUCTION

School building as an education infrastructure has an important role in efforts to develop life of nation and state. In this frame work, education infrastructure as a role to realize development distribution and its results. To realize objectives of education maximally, a conducive learning process by involving all learning components maximally is required. One of the important components to support proper learning process is classroom. Classrooms as sites for learners to conduct learning activities have very strategic roles in creating learning atmospheres for students. Classrooms bring wider effect such as secure feeling, sense of possession, comfort, and other positive things.

Pringsewu district as a new autonomous region has big potentials in education sector. Currently, there are 12 public senior/vocational high schools and 27 private senior/vocational high schools running under Education Office of Pringsewu district. Amongst these schools, there are many of them still need attentions about school building, especially classrooms. Varying aids have been issued by Educatio Office of Pringsewu district to improve educational structure qualities, but not all of schools in Pringsewu receive the aid funds. To obtain the aid fund, schools should meet varying

regulations. Determined criteria in this case study for obtaining aid fund are physical condition of classroom, number of students, number of teachers and staffs, school income and status of land ownership of the school.

Therefore, not all submitting schools for being candidates of aid fund receivers will be approved, but only those which meet the criteria. It needs a system to support decision making which is able to help in determining which schools will be proper to receive aid funds from Education Office of Pringsewu district.

A model to use in this system to support the decision making is *Fuzzy Multiple Attribute Decision Making* (FMADM). The SAW method is selected because this method determine weight rank for each attribute, and then followed by ranking process to select best alternative. Alternatives here means those schools which have rights to receive aid funds based on determined criteria. By this ranking method, assessment is expected to be more proper because it is based on predetermined values of criteria and weight to produce more accurate results to select proper schools to receive aid funds.

1.1. Problem statements
The problems statements of this research were:
a. How to make a system to support decision making in selection of aid receiver of classroom rehabilitation for senior/vocational high school by Education Office of Pringsewu district by using SAW method.
b. How to determine that schools are eligible to receive classroom rehabilitation aid for senior/vocational high school by Education Office of Pringsewu district

1.2. Objective
The objective of this research was to design a system to support decision making for selection of aid receiver of classroom rehabilitation for senior/vocational high school by Education Office of Pringsewu district.

2.0 THEORETICAL
Decision Making Support System (DMSS) is a part of computer based information system and it belongs to knowledge system to support decision making in an organization or company. DMSS is also a computer system which processes data into information to make decision from a specific semi-structured problem. DMSS can be an assisting device for decision makers to enhance decision capabilities which require assessments or decisions which cannot be supported by algorithm at all. Simon (Suryadi and Ramdhani, 2002: 15-16) describes model which illustrate decision making process. This process contains of three phase:

a. *Intelligence*
   This phase is a process of scrutinizing and detecting problem environment and problem identification. Input data are obtained, processed, and tested to identify problem.
b. *Design*
   This phase contains of processes to determine, develop, and analyze alternatives of actions to do. This phase includes processes to understand problem, solve problem, and test solution properness.
c. *Choice*
   Process of selecting alternatives of possible actions to do is conducted in this phase. The selection result is then implemented in the process of decision making.
   Even though implementation belongs to third phase, some experts argue that this phase needs to be considered as a separate phase to describe correlations between phases comprehensively.

Multi Attribute Decision Making (MADM) is conducted through 3 stages; composing components of situation, analysis, and information synthesis. In composing components of situation stage, estimation table containing of alternative identification and specifications of objective, criteria, and attribute will be formed. Analysis stage is conducted in 2 steps. First, provide estimation about the potential magnitude, possibility, and uncertainty related to effects that may rise for each alternative. Second, include selection from preferences of decision making doer each value and passiveness to each risk that may rise.

Simple Additive Weighting method is referred as additive weighting method. Basic concept of SAW method is looking for additive weighting from performance rating of each alternative on all attributes. SAW method requires normalization process of decision matrix (X) to a comparable scale with all existing alternative ratings.

$$r_{ij} = \begin{cases} \dfrac{\chi_{ij}}{\underset{i}{Max}\, x_{ij}} & \text{If j is benefit attribute...... (2.1)} \\[4ex] \dfrac{\underset{i}{Min}\, x_{ij}}{x_{ij}} & \text{If j is cost attribute...... (2.2)} \end{cases}$$

Where r_{ij} is normalized performance rating of alternative A_i at attribute $C_i; i = 1,2...$m and j=1,2,...,n. Preference value for each alternative (V_i) is:

$$V_i = \sum_{j=1}^{n} W_j r_{ij} \quad \text{.............. (2.3)}$$

Bigger V_i value identifies that alternative A_i is more preferable. Advantages of SAW method are:
1. Determining weight values of each attribute, and then proceed to ranking process to select best alternative.
2. Assessment will be more accurate because it is based on values of criteria from determined preference weights.
3. Matrix normalization estimation according to attribute value (i.e., cost and benefit values)

3.0 METHODOLOGY
The process of determining receiver of classroom rehabilitation aid fund by Education Office of Pringsewu currently is run manually. All of application sheets are examined one by one based on particular criteria to determine which school will be appropriate for the classroom rehabilitation aid fund. School principal proposes a proposal submitted to Head of Education Office of Pringsewu. The proposal is then submitted for eligibility selection. This process takes a long time and it takes more than one staff to process all proposals one by one.

A system to support decision making is a computer based system to support decision making which produces data to be used in decision making. It makes arrangements of aid fund receivers from highest alternative to lowest alternative. One of methods to use is SAW *(Simple Additive Weighting)* method. A system where a school can directly apply proposal online is proposed, so that when the school is eligible and meets the requirements, it can receive classroom rehabilitation aid funds. After data are entered into program of classroom rehabilitation aid, the related school submit complete requirements of data to Education Office in Pringsewu and administrator of

Education Office in Pringsewu does not need to input data of applicant school so that the administrator only processes data and determine which school is eligible to receive classroom rehabilitation aid. This work will only need one operator. It does not need many operators.

Table 1. a comparison of old system and new system to propose

No	Old System	New System to Propose
1	Administrator of Education Office inputs data of submitting schools.	School can directlt submit proposal data from school operator
2	It needs many operators	Only need one administrator to process data
3	Lack of information about classroom rehabilitation, so that many schools do not know that the submission for the aid program is already opened.	Information is issued faster because it uses computer media
4	Schools need a long time to find out result of its submission proposal for classroom rehabilitation	Schools can find out the result faster because the schools submit proposals and entering into decision making support system by using SAW method, so that their proposals will be processed faster.

3.1. System Designing

In making a system to support decision making for receiver of classroom rehabilitation aid from senior/vocational high school by Education Office in Pringsewu by using SAW method, criteria in aid receiver selection are first of all determined as follows: the physical condition of classroom, number of students, number of teachers and staffs, school income, and status of land ownership of school.

3.2. Weight

There are weight and criteria required to determine eligible school for receiving aid.

Table 2. Code and criteria provisions

Criteria codes	Criteria provisions
C1	physical condition of classroom
C2	number of students
C3	number of teachers and staffs
C4	school income
C5	status of land ownership of school

Weights for each criteria will be determined. Weights contain of five *fuzzy* numeric; Very Low (VR), Low (L), Middle (M), High (H), and Very High (VH)

A variable will be made from each of weight into *fuzzy* numeric with a formula of variable n/n-1

Table 3. Variable and Weight values

Variable	Weight (value)
Very Low (VL)	Variable 0/(5-1) = 0
Low (LR)	Variable 1st/(5-1) = 0.25
Middle (M)	Variable 2nd/(5-1) = 0.5
High (H)	Variable 3rd/(5-1) = 0.75
Very high (VH)	Variable 4th/(5-1) = 1

a. Criteria of Physical Condition of Classroom

Variable of physical condition of classroom is conversed with the following *fuzzy* number.

Table 4. Physical Condition of Classroom

Physical Condition of Classroom	Weight (Value)
Good (G)	0.25
Mild Damage (MD)	0.5
Moderate Damage (MD)	0.75
Severe Damage (SD)	1

b. Number of Students

Variable of number of students is conversed into following fuzzy number.

Table 5. Number of Students

Number of Students (A)	Weight (Value)
A = 1 <= 250	1
A = 250 <= 500	0.75
A = 500 <= 1000	0.5
A >= 1000	0.25

c. Number of Teachers and Staffs

Variable of number of teachers and staffs is conversed with the following *fuzzy* numbers.

Table 5. Number of Teachers and Staffs

Number of teachers and staffs (B)	Weight (Value)
B = 1 <= 50	1
B = 50 < = 100	0.75
B >= 100	0.5

d. School Income

Variable of school income is conversed with the following fuzzy numbers.

Table 6. School income

School income (C)	Value
C<= Rp. 10.0000	1
C = Rp.10.0000-Rp.20.0000	0.75
C = Rp.20.0000-Rp.50.0000	0.5
C >= Rp.50.0000	0.25

e. Status of land Ownership

Variable of status of land ownership is conversed with the following fuzzy numbers.

Table 7. Status of Land Ownership of School

Status of Land Ownership of School	Weight (value)
Foundation	1
Private	0.75
Non Private	0.25

4.0 RESULANTS AND DISCUSSION

An example of estimation to look for final values from four schools with the following final values:

Table 8. Data of Applicant School

Criteria	Names of Applicant Schools			
	SMK Taruna	SMK Nurul Huda	SMAN 1 Ambarawa	SMAN 2 Pringsewu
Physical condition of classroom	MD	SD	G	MD
Number of students	50	60	745	763
Number of teachers and staffs	23	25	38	32
School income	Rp. 7,5 Jt	Rp. 9 Jt	Rp.50 Jt	Rp.51 Jt
Status of land Ownership of School	Foundation	Foundation	Non Private	Non Private

Based on data of applicant schools above, a decision matrix of X which is conversed into fuzzy numbers can be formed as follows

Table 9. Fitness rating of each alternative of each criteria

Alternative	Criteria				
	C1	C2	C3	C4	C5
A1	0.5	1	1	1	1
A2	1	1	1	1	1
A3	0.25	0.5	1	0.5	0.25
A4	0.75	0.5	1	0.25	0.25

Decision making is made by giving weight, based on interest level of each criterion as follows:
Weight Vector: W = [1, 0.75, 0.5, 0.25, 0.5]
Matrix X for decision making is made from fitness rating table as follows:

$$
X = \begin{Bmatrix} 0.5 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 0.25 & 0.5 & 1 & 0.5 & 0.25 \\ 0.75 & 0.5 & 1 & 0.25 & 0.25 \end{Bmatrix}
$$

Max C1 = 1
Min   C2 = 0.5
Max   C3 = 1
Min   C4 = 0.25
Max   C5 = 1

Normalization of matrix X to estimate each criterion which is assumed as criteria of benefit and cost as follows:

Alternative A1

$$r_{11} = \frac{0.5}{1} = 0.5 \qquad\qquad r_{14} = \frac{0.25}{1} = 0.25$$

$$r_{12} = \frac{0.5}{1} = 0.5 \qquad\qquad r_{15} = \frac{1}{1} = 1$$

$$r_{13} = \frac{1}{1} = 1$$

Alternative A2

$$r_{21} = \frac{1}{1} = 1 \qquad\qquad r_{24} = \frac{0.25}{1} = 0.25$$

$$r_{22} = \frac{0.5}{1} = 0.5 \qquad\qquad r_{25} = \frac{1}{1} = 1$$

$$r_{23} = \frac{1}{1} = 1$$

Alternative 3

$$r_{31} = \frac{0.25}{1} = 0.25 \qquad\qquad r_{34} = \frac{0.25}{0.5} = 0.5$$

$$r_{32} = \frac{0.5}{0.5} = 1 \qquad\qquad r_{35} = \frac{0.25}{1} = 0.25$$

$$r_{33} = \frac{1}{1} = 1$$

Alternative 4

$$r_{41} = \frac{0.75}{1} = 0.75 \qquad\qquad r_{44} = \frac{0.25}{0.25} = 1$$

$$r_{42} = \frac{0.5}{0.5} = 1 \qquad\qquad r_{45} = \frac{0.25}{1} = 0.25$$

$$r_{43} = \frac{1}{1} = 1$$

Normalization of R matrix obtained from result of matrix X normalization is as follows:

$$R = \begin{Bmatrix} 0.5 & 0.5 & 1 & 0.25 & 1 \\ 1 & 0.5 & 1 & 0.25 & 1 \\ 0.25 & 1 & 1 & 0.5 & 0.25 \\ 0.75 & 1 & 1 & 1 & 0.25 \end{Bmatrix}$$

Multiplication matrix W*R and sum of result of multiplication to obtain best alternative by ranking highest score is as follows:

V1 = (1x0.5) + (0.75x0.5) + (0.5x1) + (0.25x0.25) + (0.5x1)
 = 0.5 + 0.375 + 0.5 + 0.0625 + 0.5 = 1.9375

V2 = (1x1) + (0.75x0.5) + (0.5x1) + (0.25x0.25) + (0.5x1)
 = 1 + 0.375 + 0.5 + 0.0625 + 0.5 = **2.4375**

V3 = (1x0.25) + (0.75x1) + (0.5x1) + (0.25x0.5) + (0.5x0.25)
 = 0.25 + 0.75 + 0.5 + 0.125 + 0.125 = 1.75

V4 = (1x0.75) + (0.75x1) + (0.5x1) + (0.25x1)+ (0.5x0.25)
 = 0.75 + 0.75 + 0.5 + 0.25 + 0.125 = 2.375

The ranking results are:

V1 = 1.9375   V3 = 1.75

V2 = **2.4375**   V4 = 2.375

The highest value is V2, so that alternative A2 = SMK Nurul Huda is selected alternative.

5.0 CONCLUSION

The conclusions of this research are as follows:

1. A system to support decision making of classroom rehabilitation aid receiver selection for senior/vocational high school by Education office of Pringsewu district by using SAW method use five criteria. They are physical condition of classroom, number of students, number of teachers and staffs, school income, and status of land ownership of school.
2. Estimation weight is on of important indicators in estimating aid receiver selection.
3. The system to support decision making is built with computer technology by using SAW method, so that decision is made based on criteria estimation and the decision can be made faster.

REFERENCES

[1] Muslihudin, Muhamad (2016). *Pembuatan Model Penilaian Proses Belajar Mengajar Perguruan Tinggi Menggunakan Fuzzy Simple Additive Weighting (SAW)(Sudi: Stmik Pringsewu)*. SEMNASTEKNOMEDIA. AMIKOM Yogyakarta.
[2] Li, D. F. 2005. An Approach to Fuzzy Multi-attribute Decision Making under Uncertainty. Information Sciences. 1(169): 97-112.
[3] Kusumadewi, Sri., Hartati., Harjoko, A., dan Wardoyo, R. (2006). *Fuzzy Multi-Attribute Decision Making (FUZZY FMADM)*. Yogyakarta: Penerbit Graha Ilmu

[4] Muhamad Muslihudin, Miswan Gumanti. 2016. *A System To Support Decision Makings In Selection Of Aid Receivers For Classroom Rehabilitation For Senior/Vocational High Schools By Education Office Of Pringsewu District By Using Simple Additive Weighing Method*. **4th International Scholar Conference**. 25 Oct 2016. Page 94. Klabat University. Makassar.

[5] Wiko Saputra, Rahmah Hida Nurrizka(2013) Jurnal : *Pengaruh Faktor demografi Terhadap Resiko gizi buruk Pada tiga komunitas di Sumatera barat.*

[6] Bellman, R. E. and Zadeh, L. A. (1970). Decision Making in a Fuzzy Environment. Management Science. 17(4): 141- 164.

[7] Ida Widianingrum, (2013). *Evaluasi Kinerja Dosen Menggunakan Metode Fuzzy Multi Attribute Decision Making (FMADM) Dengan Pengembangan (Studi Kasus: Universitas Muhammadiyah Ponorogo)*, Unversitas Muhammadiyah Diponegoro.

[8] Khoirunnisa Rahma Prasetyowati, (2013). *Sistem Pendukung Keputusan penilaian kinerja guru (PKG) menggunakan metode simple additive weighting (SAW) (studi kasus) SMA Negeri 9 Semarang,* Universitas Dian Nuswantoro.

[9] Muslihudin, Muhamad. (2015). *Sistem pendukung Keptusan Penilaian Air Minum Yang Sehat Bagi Tubuhmenggunakan Fuzzy Multiple Atribut Decission Making (Fmadm) Dengan Metode Simple Additive Wighting (SAW)*. SNATKOM 2015 Volome 1. YPTK PADANG. PADANG.

[10] Afifah, Nur. *Sistem Pendukung Keputusan Penerimaan Beasiswa Magang Menggunakan Metode SAW (Simple Additive Weighting)*. Madura: Universitas Trunojoyo.

[11] Eniyati, Sri. (2011). *Perancangan Sistem Pendukung Pengambilan Keputusan untuk Penerimaan Beasiswa dengan Metode SAW (Simple Additive Weighting)*.Universitas Stikubank.

[12] Indrawaty, Youllia., Andriana., dan Prasetya, Adi, Restu. (2011). *Implementasi Metode Simple Additive Weighting pada Sistem Pengambilan Keputusan Sertifikasi Guru*. Bandung : Institut Teknologi Nasional Bandung.

[13] Sari, Septiana, Yani, Sri., dkk. (2012). *Sistem pendukung Keputusan Pemberian Beasiswa Menggunakan Simple Additive Weighting di Universitas Bina Dharma Palembang.* Palembang: Universitas Bina Dharma.