**JURNAL TEKNOLOGI DAN OPEN SOURCE**
Vol. 5, No. 1, June 2023, pp. 41~54
e-ISSN: 2622-1659, accredited Four Grade by Kemenristekdikti, Decree No: 36/E/KPT/2019
DOI: 10.36378/jtos.v6i1.2698

# Decision Support System for Selecting Candidate of Indonesia Smart University Card Scholarship (Kip-K) recipients at Islamic University of Kuantan Singingi

**Helpi Nopriandi[1], Aprizal[2], Sri Chairani[3]**
[1,2,3]Teknik Informatika, Universitas Islam Kuantan Singingi, Teluk Kuantan

**Article Info**

***Article history:***

Received 12 05, 2022
Revised 01 20, 2023
Accepted 05 22, 2023

***Keywords:***

Scholarship
KIP-K
FMADM
SAW

**ABSTRACT**

Islamic University of Kuantan Singingi still selects students to receive Indonesia Smart University Card Scholarship (KIP -K) by looking at the registration documents of new students one by one. In such a system, it spends a lot of time on the selection and also the review of the registration documents of the new students is done by the selection team and the management of Islamic University of Kuantan Singingi, so there are many considerations in this selection. The results of the selection also did not produce a written report on the condition of the first-year students who received the Indonesia smart university Card (KIP -K) scholarship, so this type of system is no longer used effectively. The application of Fuzzy Multiple Attribute Decision Making (FMADM) method can help in determining the weights of the values in each criteria. Using the simple additive weighting method (SAW) makes it easier to add the weighting values for each criterion.



***Corresponding Author:***

Aprizal
Teknik Informatika
Universitas Islam Kuantan Singingi
Teluk Kuantan, Riau
Email: uprizal1992@gmail.com


## 1. Introduction

### 1.1 Background of the Research

Scholarships are grants in the form of financial assistance awarded to individuals to continue their education. Scholarships may be awarded by government agencies, companies or foundations. Scholarships may be awarded as unpaid or with work obligations (commonly referred to as official obligations) after completion of education [1].

The Indonesia Smart University Card (KIP-K) scholarship programme is a tuition assistance programme for prospective students who are economically disadvantaged and have good academic potential to study in higher education. Recipients of the Indonesia Smart University Card Scholarship (KIP-K) are determined based on certain criteria set by the Ministry of Research, Technology and Higher Education.

A decision support system (SPK) is part of a computerized information system, including a knowledge-based system or knowledge management system, used to support decision making in an

organization or business. It can also be said that it is a computer system that processes data into information to make decisions based on certain semi-structured problems [2].

Simple additive weighting (SAW) is a weighted summation method. The basic concept of simple additive weighting (SAW) is to find the weighted sum of performance scores for each alternative to a criterion. The simple additive weighting method (SAW) requires a process of normalising the decision matrix (X) to a scale that can be compared with all existing alternative branches [3].

Islamic University of Kuantan Singingi still selects the students who receive the Indonesia Smart University Card Scholarship (KIP-K) by looking at the new student registration files one by one, so with such a system, it spends a lot of time on the selection and also the review of the new student registration files is done by the selection team and the management of Islamic University of Kuantan Singingi, so there are many considerations on this selection. The results of the selection also did not result in a written report on the condition of the new students who received the Indonesia Smart University Card (KIP-K) scholarship, so this system is no longer used effectively.

Based on the above problem description, the author conducted an investigation of the decision support system used to conduct the selection process for the recipients of the Indonesia Smart University Card (KIP -K) scholarship at Kuantan Singingi Islamic University. The decision support system was developed based on a website with PHP programming and a MySql database.

### 1.2 Problem of the Research

Based on the background of the problem, it can be formulated: "How to design a decision support system for selecting the recipients of Indonesia Smart University Card Scholarship (KIP -K) at Kuantan Singingi Islamic University", which can help the management of Kuantan Singingi Islamic University (UNIKS) to select new students receiving KIP -K scholarships quickly and with more accurate results.

### 1.3 Objective of the Research

The objectives of the research in this study are as follows

→ Design a decision support system for scholarship selectionThe Smart Indonesian University Card (KIP-K) at Kuantan Singingi Islamic University to make it faster and more accurate.

→ Application of Fuzzy Multiple Attribute Decision Making (FMADM) method to make decisions for KIP-K) scholarship at Kuantan Singingi Islamic University.

### 1.4 Significance of the Research

The significance of the research proposed by the author in this research is as follows.

→ With the system to support this decision, it will facilitate the management in selecting scholarship recipients The Smart Indonesian Card (KIP-K) at Islamic University of Kuantan Singingi.

→ With the decision support system, more effective reports will be produced because it has clear criteria and effective data review.

## 2. Research Method

### 2.1 Basic Concepts of Multiple Attribute Decision Making (MADM)

The process of FMADM method is basically done in 3 phases, namely the preparation of the components, the analysis and the synthesis of the information. In the component compilation phase, a table of estimates is formed from the components of the situation, which includes the identification of alternatives and specifications, criteria and attributes. A way to specify the purpose of the situation | Ai, i=1,...,n In addition, it also consists of attributes that are used | ak, k=1,...,m|. Fuzzy Multiple Attribute Decision Making (FMADM) is a method to find alternatives from a number of alternatives with certain criteria. The FMADM method determines the value of the weights for the workforce and then performs a ranking process to select the given alternatives [5].

Most MADM approaches are carried out in 2 steps, namely: first, to aggregate choices that meet all the objectives of each alternative. Secondly, alternative decisions are made based on the results of the aggregation decisions.

Thus, we can say that the multi-attribute decision making (MADM) problem consists of evaluating m alternatives Ai (i =1,2, ... ,m) according to the corresponding attributes or criteriaCj (j = 1,2, ... ,n), where the individual attributes do not depend on each other. The matrix of choices of each alternative depends on each other. The matrix of separations of each alternative, X , is given as:

$$X = \begin{pmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ : & : & : & : \\ X_{m1} & X_{m2} & \dots & X_{mn} \end{pmatrix}$$

Where Xij is a performance rating alternative to-i toward atribut to-j, the value of the weight that indicates the level of relative importance of the deceased, is given as, W :

W = { w1,w2 , ... , wm }

Performance ratings (X), and weights (W) are the main values that represent the absolute preferences of the decision-makers.

### 2.2 Fuzzy Multiple Attribute Decision Making (FMADM) Algorithm)

Algorithm Fuzzy Multi Attribute Decision Making (FMADM) according to Aminudin N. et al. is:

1. Gives the value of each alternative (Ai) to each predetermined criterion (Cj), where the value is obtained based on the value of the crisp; i=1.2,... m and j=1,2,…n.
2. Gives a weight value (W) that is also obtained based on a crisp value.
3. Normalizing matriks by calculating the normalized performance rating value (rij) of the Ai alternative on the attribute Cj based on the adjusted equation with the type of attribute (benefit/benefit=MAXIMUM or cost=MINIMUM attribute). If attributes is probability, so the value crisp (Xij) of each column divided attributes with crisp value MAX (MAX Xij) of each column, while for attributes cost, the value of crisp MIN (MIN Xij) of the a-attribute is divided by the value of crisp (Xij) each column.
4. Perform the ranking process by multiplying the matrix ternormalization (R) by the value of weights (W).
5. Determine value preference for each alternative (Vi) by how to sum the multiplication between the normalization (R) and the weight value (W). A larger Vi value indicates that the alternative Ai is more elective [6].

### 2.3 Simple Additive Weighting (SAW)

Simple Additive Weighting (SAW) is more known as a method of summatianterweight. The basic concept of the SAW method is to find the summation of the weights of the performance ratings on each alternative on the same attribute. The SAW method requires a process of normalizationof the decision (X) of a scale that can be compared with all existing alternative ratings [3].

The method used to find the optimal alternative of some alternatives uses certain criteria by providing the value of weights for each attribute which is then done for the selection of alternatives owned is an explanation of the Simple Additive Weighting (SAW) method. Search weight from performance ratings on each alternative on all existing attributes constitutes concept basis of SAW. Decision-making in it involves a lot of atributakanmore when using SAW. In addition, the method requires normalizationmatriksdecisionscalethen the results obtainedare compared with all alternative ratings[7]. The formula fornormalizationis shown in the equationasfollowingThe method used to find the optimal alternative of some alternatives uses certain criteria by providing the value of weights for each attribute which is then done for the selection of alternatives owned is an explanation of the Simple Additive Weighting (SAW) method. Searchweightweightsfrom performance ratings on each alternative on all existing attributes constitutesconceptbasisof SAW. Decision-making in it involves a lot of atributakanmore when using SAW. In addition, the method requires normalization matrix decision scale then the results obtained are compared with all alternative ratings [7]. The formula for normalization is shown in the equation as following.

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{\max\limits_{i} x_{ij}} & \text{Jika j atribut keuntungan (}benefit\text{)} \\ \dfrac{\min\limits_{i} x_{ij}}{x_{ij}} & \text{Jika j atribut biaya (}cost\text{)} \end{cases}$$

Where :

Rij = Normalized performance rating
Maxij = Maximum value of each row and column

Minij = Minimum value of each row and column
Xij = Rows and columns from matriks With Rij is a normalized performance rating from the alternative Ai on attribute Cj; i =1.2,... m and j= 1.2,...,n.

$$V_i = \sum_{j=1}^{n} w_j \, r_{ij}$$

A larger Vi value indicates that the alternative Ai is more elective.
Where :
Vi = Final value from alternative
Wi = Weights determined
Rij = Normalization matrix

A larger value indicates that the alternative is more elected. The Simple Additive Weighting (SAW) method is recommended to solve the problem of selection the multi-process decision-making system. The Simple Additive Weight (SAW) method is a widely used method in decision making that has many attributes.

## 3. Result and Discussion

### 3.1 Criteria Data Types

In the process of making a Decision Support System that will be carried out for the selection of candidates for the KIP-K scholarship. Then there are some data that will be considered in the selection process. The data will be used as a criterion in the selection of candidates for the KIP-K Scholarship, as follows :

1. Ownership Card
   Ownership card is quite important in determining the recipient of KIP-K scholarship because this card is one of factor to become the recipients of KIP-K scholarship.
2. Parental Job
   The job of the parents can determine the level of ability in school fee payment. If the job of the parents of the students can be identified, it is low to get KIP-K scholarship.
3. Parental Income
   With the existence of the income of the parents, if it has low income then it will have opportunity to get KIP-K scholarship.
4. Sum of Dependents
   It is the factor to have the opportunity in getting KIP-K Scholarship and it relates to Parental job and parental income.
5. Home Ownership
   Home ownership is the factor if it was still rent a house then it will have opportunity to get KIP-K scholarship.
6. Prestasi
   If the candidate has an achievement in the field of education, then the possibility to study is higher and it will give a positive impact for the campus. So it will have big opportunity to get KIP-K scholarship.

### 3.2 Lots of Data

In order to be clearer about the completion of the method that the author will use in this research, the author needs the data to be processed in the discussion. A lot of data will be used as samples in this research, there are 15 samples, for more details, it can be seen in the table as follows:

**Table 3.1 Sample Selection Data for Candidate Recipients of KIP-K Scholarship**

| No | Name | Card Ownership | Parental Job | TuaParental Income | Sum of Dependents | Home Ownership | Achievement |
|---|---|---|---|---|---|---|---|
| 1 | SuyatnaArdiansah | KIP-K | Farmer | 1.5 Juta | 2 | Own | Never |
| 2 | Siti Nurholizah | Complete | Farmer | 850 | 4 | S/M | Often |
| 3 | RinoRiyatm | KIP-K | Farmer | 1.5 Juta | 3 | Own | Never |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | oko | | | | | | |
| 4 | Gita Nopisa A | KKS | Employee | 2 Juta | 2 | Inheritance | Never |
| 5 | Almanzah | PKH | Farmer | 900 | 3 | Inheritance | Never |
| 6 | Dini Septianur | KIP-K | Farmer | 1.5 Juta | 2 | Own | Seldom |
| 7 | PerdilaIndriani | KIP-K | Farmer | 1 Juta | 1 | S/M | Never |
| 8 | Muhammad Hafis | KIP-K | Farmer | 1.2 Juta | 3 | Own | Never |
| 9 | AptisyaMedilia | PKH | Employee | 2 Juta | 2 | Own | Seldom |
| 10 | Della Marlina | KIP-K | Farmer | 1.2 Juta | 3 | Own | Often |
| 11 | Lena Sepriani | None | Farmer | 1 Juta | 4 | Own | Seldom |
| 12 | Lucianti | KIP-K | Farmer | 1 Juta | 2 | S/M | Seldom |
| 13 | Ratna | KKS | Farmer | 1.3 Juta | 3 | Own | Never |
| 14 | ZahidaKasvia | None | Farmer | 1.5 Juta | 2 | Own | Often |
| 15 | Yona | KKS | Employee | 2.5 Juta | 3 | Own | Never |

From the data in table 4.1 then it is processed using the method that has been described in the previous chapters From the data in table 4.1 then it is processed using the method that has been described in the previous chapters.

### 3.3 Determination of Input

For the determination of input of the decision of kip-k scholarship recipients, the variables are used as follows:

1. Variabel C1 = Card Ownership
2. Variabel C2 = Parental Job
3. Variabel C3 = Parental Income
4. Variabel C4 = Sum of Dependents
5. Variabel C5 = Home Ownership
6. Variabel C6 = Achievement

From each variable will have a value of weight that has been determined by using Fuzzy Multiple Attribute Decision Making (FMADM).

### 3.4 Determination of Output

Determination of output from the Selection Decision Support System Recipients Scholarships Smart Indonesian Cards (KIP-K) At Islamic University of Kuantan Singingi are as following:

1. Through the process of input obtained, it will produce a value and ranking starting from the highest number to the lowest level by using the Simple Additive Weighting (SAW) method.
2. The results of the ranking are obtained stating that the candidates for the KIP-K scholarship are declared to be suitable or not to receive the KIP-K scholarship in accordance with the value and ranking obtained.

### 3.5 Criteria and Weighting

In the process of making the Decision Support System for the selection of the required KIP-K scholarship recipients criteria and weighting. The process of criteria and weighting that will be used in the selection of KIP-K scholarship recipients is as follows:

1. Determining the criteria used as a reference in decision-making

In the process of making a Decision Support System to establish Student is needed weighting on each of the previously specified criteria. There are 6 (Six) criteria that will be used in the selection of KIP-K scholarship recipients. The criteria and numbers used in the selection of KIP-K scholarship recipients are as following:

a. Criteria value ownership card converted with number of fuzzy as follows:

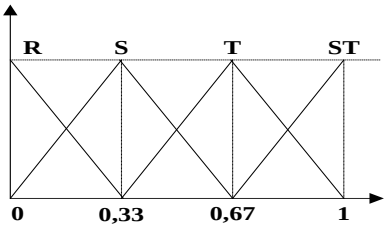


**Figure 3.1Fuzzy Ownership Value Card**

In figure3.1variable completeness is divided into 4 number of fuzzy, namely Low (R) with a value of 0, Medium (S) with a value of 0.33, High (T) with a value of 0.67 and Highest (ST) with a value of 1. Table 3.2 shows the number of fuzzy and the value of each education value.

**Table 3.2 Card Ownership Value**

| Card Ownership Value | *Fuzzy* | Mark |
|---|---|---|
| None | Low (R) | 0 |
| KKS/PKH | Medium (S) | 0,33 |
| KIP-K | High (T) | 0,67 |
| Complete | Highest (ST) | 1 |

b. Criteria value parental job converted with number of fuzzy as follows:

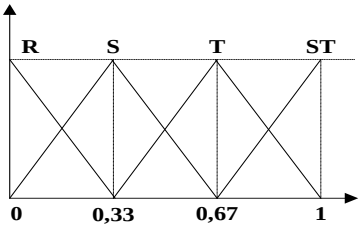


**Figure 3.2Fuzzy Parental Job Value**

In figure 3.2 variable the value of the parental job is divided into 4 number of fuzzy, namely Low (R) with a value of 0, Medium (S) with a value of 0.33, High (T) with a value of 0.67 and Highest (ST) with a value of 1. Table 3.3 shows the number of fuzzy and the value of the parental job.

**Table 3.3 Parental Job**

| Functional Position | *Fuzzy* | Mark |
|---|---|---|
| Civil Servant | Low (R) | 0 |
| Employee | Medium (S) | 0,33 |
| Farmer | High (T) | 0,67 |
| Jobless | Highest (ST) | 1 |

c. Parental income criteriaconverted by number of fuzzy as follows:

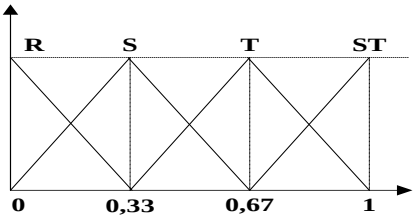


**Figure 3.3 FuzzyParental Income**

In figure3.3 variable values the parental income is divided into 4 numbers of fuzzy, namelyLow (R) with a value of 0, Medium (S) with a value of 0.33, High (T) with a value of 0.67 and Highest (ST) with a value of 1. Table3.4 shows number of fuzzy and value crisp for each parental income value.

**Table 3.4 Parental Income**

| Income/Salary | *Fuzzy* | Mark |
|---|---|---|
| >3 juta | Low (R) | 0 |
| 2-3 juta | Medium (S) | 0,33 |
| 1-2 juta | High (T) | 0,67 |
| <1 juta | Highest (ST) | 1 |

d. The criteria for the number of dependents are converted by number of fuzzy as follows:

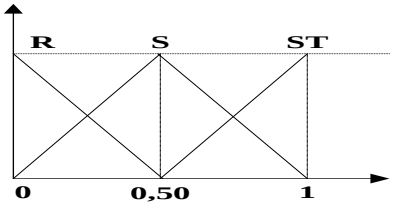


**Figure 3.4 Fuzzy Sum of Dependents**

In figure3.4 the variable value of the sum of the dependents is divided into 3 number of fuzzy, i.e. Low (R) with a value of 0, Medium (S) with a value of 0.50 and Highest (ST) with a value of 1. Table 3.5 shows the number fuzzy and crispfor each sum of dependents.

**Table 3.5 Sum of Dependents**

| Sum of Dependents | *Fuzzy* | Mark |
|---|---|---|
| 1 | Low (R) | 0 |
| 2-3 | Medium (S) | 0,5 |
| 4> | Highest (ST) | 1 |

e. Home ownership criteria are converted with fuzzy numbers as follows:

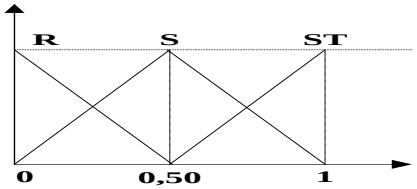


**Figure 3.5 Fuzzy Home Ownership**

In figure3.5the variable ownership of the house is divided into 3 numbers fuzzy, namelyLow (R) with a value of 0, Medium (S) with a value of 0.50 and Highest (ST) with a value of 1. Table 3.6 shows the number fuzzy and the value of each home ownership.

**Table 3.6 Home Ownership**

| Absence | Number of *Fuzzy* | Nilai |
|---|---|---|
| Own | Low (R) | 0 |
| Inheritance | Medium (S) | 0,5 |
| Rent | Highest (ST) | 1 |

f. The criteria that have been achieved are converted by number of fuzzy as follows:

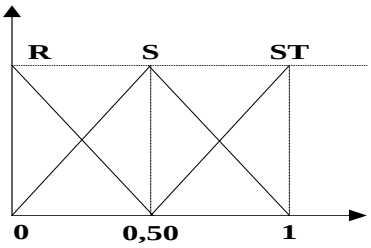


**Figure 3.6Fuzzy Achievement Value**

In figure3.6 the achievement variable is divided into 3 number of fuzzy, namely Low (R) with a value of 0, Medium (S) with a value of 0.50 and Higest (ST) with a value of 1. Table 3.7 shows the numbers of fuzzy and the value of each achievements .

**Tabel3.7 Achievement**

| Activity | Number of *Fuzzy* | Mark |
|---|---|---|
| Never | Low (R) | 0 |
| Seldom | Medium (S) | 0,5 |
| Often | Highest (ST) | 1 |

2. Determine the match rating for each alternative on each criterion

Based on the steps of solving the problem by using the Simple Additive Weighting (SAW) method that has been explained before, in the sub-chapter, it is discussed about the calculation process and the expected output in this research.

1. Determining the criteria to be used as a reference in the decision-making, namely C1 to Determining the criteria to be used as a reference in the decision-making, namely C1 to C6.
2. Specify a match rating for each alternative. It can be seen in table 4.2 to table 4.7
3. Create a matrix based on the criteria (Ci), then normalize the matrix based on the adjusted equation with the type of attribute so that it is obtained matrix ternormalization.

Analysis of the discussion and the results obtained based on the FMADM algorithm by manually determining the candidates for the KIP-K scholarship received using the SAW method. For example the case taken, that is, in table 4.8. As for the steps to resolve it:

1. Determining the criteria that will be used as a reference in decision-making, namely C*i*.
2. Determine the match rating for each alternative on each criterion.

For the 2 steps above will be described in the table as follows.

**Table 3.8 Alternatives and Criteria for Prospective StudentsScholarship Recipients**

| No | Alternative | Criteria | | | | | |
|---|---|---|---|---|---|---|---|
| | | C1 | C2 | C3 | C4 | C5 | C6 |
| 1 | SuyatnaArdiansah | KIP-K | Farmer | 1.5 M | 2 | Own | Never |
| 2 | Siti Nurholizah | Complete | Farmer | 850 K | 4 | S/M | Often |
| 3 | RinoRiyatmoko | KIP-K | Farmer | 1.5 M | 3 | Own | Never |
| 4 | Gita Nopisa A | KKS | Employee | 2 M | 2 | Inheritance | Never |
| 5 | Almanzah | PKH | Farmer | 900 K | 3 | Inheritance | Never |
| 6 | Dini Septianur | KIP-K | Farmer | 1.5 M | 2 | Own | Seldom |
| 7 | PerdilaIndriani | KIP-K | Farmer | 1 M | 1 | S/M | Never |
| 8 | Muhammad Hafis | KIP-K | Farmer | 1.2 M | 3 | Own | Never |
| Own | Seldom | Own | Seldom | Own | Seldom | Own | Seldom |
| 10 | Della Marlina | KIP-K | Farmer | 1.2 M | 3 | Own | Often |
| Own | Seldom | Own | Seldom | Own | Seldom | Own | Seldom |
| 12 | Lucianti | KIP-K | Farmer | 1 M | 2 | S/M | Seldom |
| 13 | Ratna | KKS | Farmer | 1.3 M | 3 | Own | Never |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 14 | ZahidaKasvia | incomplete | Farmer | 1.5 M | 2 | Own | Often |
| 15 | Yona | KKS | Employee | 2.5 M | 3 | Own | Never |

The table above explains that the candidates Students who have carried out various tests are ranked based on 6 criteria that have been determined, namely C1 (Card Ownership), C2 (Parental job), C3 (Parental Income), C4 (Sum of Dependents), C5 (Home Ownership), and C6 (Achievements) with the previous value has been made into a number of fuzzy.

The real data of the 15 prospective students who received the KIP-K scholarship above, will be converted into the fuzzy that has been determined in the previous discussion:

**Table3.9 Alternatives and Criteria candidates kip-K recipients with Numbers of Fuzzy**

| No | Alternative | Criteria | | | | | |
|---|---|---|---|---|---|---|---|
| | | C1 | C2 | C3 | C4 | C5 | C6 |
| 1 | SuyatnaArdiansah | 0,67 | 0,67 | 0,67 | 0,5 | 0 | 0 |
| 2 | Siti Nurholizah | 1 | 0,67 | 1 | 1 | 1 | 1 |
| 3 | RinoRiyatmoko | 0,67 | 0,67 | 0,67 | 0,5 | 0 | 0 |
| 4 | Gita Nopisa A | 0,33 | 0,33 | 0,67 | 0,5 | 0,5 | 0 |
| 5 | Almanzah | 0,33 | 0,67 | 1 | 0,5 | 0,5 | 0 |
| 6 | Dini Septianur | 0,67 | 0,67 | 0,67 | 0,5 | 0 | 0,5 |
| 7 | PerdilaIndriani | 0,67 | 0,67 | 1 | 0 | 1 | 0 |
| 8 | Muhammad Hafis | 0,67 | 0,67 | 0,67 | 0,5 | 0 | 0 |
| 9 | AptisyaMedilia | 0,33 | 0,33 | 0,67 | 0,5 | 0 | 0,5 |
| 10 | Della Marlina | 0,67 | 0,67 | 0,67 | 0,5 | 0 | 1 |
| 11 | Lena Sepriani | 0 | 0,67 | 1 | 1 | 0 | 0,5 |
| 12 | Lucianti | 0,67 | 0,67 | 1 | 0,5 | 1 | 0,5 |
| 13 | Ratna | 0,33 | 0,67 | 0,67 | 0,5 | 0 | 0 |
| 14 | ZahidaKasvia | 0 | 0,67 | 0,67 | 0,5 | 0 | 1 |
| 15 | Yona | 0,33 | 0,33 | 0,67 | 0,5 | 0 | 0 |

The above table represents all the values of the students who received KIP -K scholarships, which are later added by C1, C2, C3, C4, C5 and C6, so that they get a value with a number of fuzzy. Moreover, it is continued in the third phase, namely:

3. Create a matrix decision based on criteria and normalise the matrix

Create a matrix decision based on the criterion Ci, and then normalise the fitted equation with the type of attributes, so that you get the matrix normalisation R. Create a matrix decision based on the criterion Ci and then normalise the fitted equation with the type of attributes, so that you get the matrix normalisation R.

Based on the above table, it can be created data for the matrix decision X using the following formula (1):

$$X = \begin{pmatrix} 0,67 & 0,67 & 0,67 & 0,5 & 0 & 0 \\ 1 & 0,67 & 1 & 1 & 1 & 1 \\ 0,67 & 0,67 & 0,67 & 0,5 & 0 & 0 \\ 0,33 & 0,33 & 0,67 & 0,5 & 0,5 & 0 \\ 0,33 & 0,67 & 1 & 0,5 & 0,5 & 0 \\ 0,67 & 0,67 & 0,67 & 0,5 & 0 & 0,5 \\ 0,67 & 0,67 & 1 & 0 & 1 & 0 \\ 0,67 & 0,67 & 0,67 & 0,5 & 0 & 0 \\ 0,33 & 0,33 & 0,67 & 0,5 & 0 & 0,5 \\ 0,67 & 0,67 & 0,67 & 0,5 & 0 & 1 \\ 0 & 0,67 & 1 & 1 & 0 & 0,5 \\ 0,67 & 0,67 & 1 & 0,5 & 1 & 0,5 \\ 0,33 & 0,67 & 0,67 & 0,5 & 0 & 0 \\ 0 & 0,67 & 0,67 & 0,5 & 0 & 1 \\ 0,33 & 0,33 & 0,67 & 0,5 & 0 & 0 \end{pmatrix}$$

After the decision matrix is formed, then normalize the matrix decision by using the equations with the formula in chapter 2.

Based on the results of the calculation of normalization matrix X, it can be determined that the matrix of the normalization of R as follows:

$$R = \begin{pmatrix} 0,67 & 1 & 0,67 & 0,5 & 0 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 0,67 & 1 & 0,67 & 0,5 & 0 & 0 \\ 0,33 & 0,49 & 0,67 & 0,5 & 0,5 & 0 \\ 0,33 & 1 & 1 & 0,5 & 0,5 & 0 \\ 0,67 & 1 & 0,67 & 0,5 & 0 & 0,5 \\ 0,67 & 1 & 1 & 0 & 1 & 0 \\ 0,67 & 1 & 0,67 & 0,5 & 0 & 0 \\ 0,33 & 0,49 & 0,67 & 0,5 & 0 & 0,5 \\ 0,67 & 1 & 0,67 & 0,5 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 & 0,5 \\ 0,67 & 1 & 1 & 0,5 & 1 & 0,5 \\ 0,33 & 1 & 0,67 & 0,5 & 0 & 0 \\ 0 & 1 & 0,67 & 0,5 & 0 & 1 \\ 0,33 & 0,49 & 0,67 & 0,5 & 0 & 0 \end{pmatrix}$$

4. Normalized matrix multiplication R by vector

After the normalization process has been carried out or matrix ternormalization has been obtained, the next phase is to determine the level of importance of each criterion determined by the decision maker, symbolized by (W). From the criteria that have been determined, then a level of importance is based on the value of the weight that has been determined innumeral fuzzy with formula variable to-n/n-1. The appropriateness every alternative on each criteria as following:

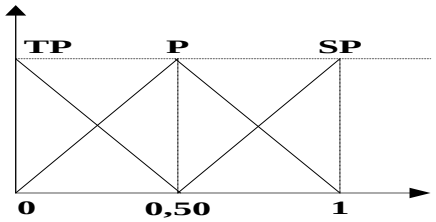


**Figure 3.7 Fuzzy Interests Every Criteria**

In figure 4.7 the variables are divided into 4 numbers, i.e. Unimportant (TP) with a weight value of 0, Important (P) with a weight value of 0.5 and Very Important (SP) with a value of weight 1. Table 4.11 shows the number of fuzzy and crisp for each of the kip-k scholarship selection values.

**Table 3.10 Tingkat KepentinganSetiapKriteria**

| Criteria | Fuzzy | Weight |
|---|---|---|
| (C1) Card Ownership | Important (P) | 0,5 |
| (C2) Parental Job | Very Important (SP) | 1 |
| (C3) Parental income | Very Important (SP) | 1 |
| (C4) Sum of Dependents | Important (P) | 0,5 |
| (C5) Home Ownership | Very Important (SP) | 1 |
| (C6) Achievement | Important (P) | 0,5 |

From table 4.11, the 6 existing criteria are weighted by changing them, namely (P) Important with value weight 0.5 and (SP) Very Important with the value of weight 1, so the range of weights taken is between 1. Weighting value number fuzzy is:

**W = [ 0,5 1 1 0,5 1 0,5 ]**

Then the last phase is calculated to get the ranking process, that is, by multiplying the weight (W) by the normalized matrix (R) as follows:

V1 = (0,67)(0,5) + (1)(1) + (0,67)(1) + (0,5)(0,5) + (0)(1) + (0)(0,5)
= 0,335 + 1 + 0,67 + 0,25 + 0 + 0
= 2,25

V2 = (1)(0,5) + (1)(1) + (1)(1) + (1)(0,5) + (1)(1) + (1)(0,5)
= 0,5 + 1 + 1 + 0,5 + 1 + 0,5
= 4,5

V3 = (0,67)(0,5) + (1)(1) + (0,67)(1) + (0,5)(0,5) + (0)(1) + (0)(0,5)
= 0,335 + 1 + 0,67 + 0,25 + 0 + 0
= 2,25

V4 = (0,33)(0,5) + (0,49)(1) + (0,67)(1) + (0,5)(0,5) + (0,5)(1) + (0)(0,5)
= 0,165 + 0,49 + 0,67 + 0,25 + 0,5 + 0
= 2,075

V5 = (0,33)(0,5) + (1)(1) + (1)(1) + (0,5)(0,5) + (0,5)(1) + (0)(0,5)
= 0,165 + 1 + 1 + 0,25 + 0,5 + 0
= 2,915

V6 = (0,67)(0,5) + (1)(1) + (0,67)(1) + (0,5)(0,5) + (0)(1) + (0,5)(0,5)
= 0,335 + 1 + 0,67 + 0,25 + 0 + 0,25
= 2,505

V7 = (0,67)(0,5) + (1)(1) + (1)(1) + (0)(0,5) + (1)(1) + (0)(0,5)
= 0,335 + 1 + 1 + 0 + 1 + 0
= 3,335

V8 = (0,67)(0,5) + (1)(1) + (0,67)(1) + (0,5)(0,5) + (0)(1) + (0)(0,5)
= 0,335 + 1 + 0,67 + 0,25 + 0 + 0
= 2,255

V9 = (0,33)(0,5) + (0,49)(1) + (0,67)(1) + (0,5)(0,5) + (0)(1) + (0,5)(0,5)
= 0,165 + 0,49 + 0,67 + 0,25 + 0 + 0,25
= 1,825

V10 = (0,67)(0,5) + (1)(1) + (0,67)(1) + (0,5)(0,5) + (0)(1) + (0,5)(0,5)
= 0,335 + 1+ 0,67 + 0,25 + 0 + 0,25
= 2,505

V11 = (0)(0,5) + (1)(1) + (1)(1) + (1)(0,5) + (0)(1) + (0,5)(0,5)
= 0 + 1 + 1 + 0,5 + 0 + 0,25
= 2,75

V12 = (0,67)(0,5) + (1)(1) + (1)(1) + (0,5)(0,5) + (1)(1) + (0,5)(0,5)
= 0,335 + 1 + 1 + 0,25 + 1 + 0,25
= 3,835

V13 = (0,33)(0,5) + (1)(1) + (0,67)(1) + (0,5)(0,5) + (0)(1) + (0)(0,5)

= 0,165 + 1 + 0,67 + 0,25 + 0 + 0
= 2,085
V14 = (0)(0,5) + (1)(1) + (0,67)(1) + (0,5)(0,5) + (0)(1) + (1)(0,5)
= 0 + 1 + 0,67 + 0,25 + 0 + 0,5
= 2,42
V15 = (0,33)(0,5) + (0,49)(1) + (0,67)(1) + (0,5)(0,5) + (0)(1) + (0)(0,5)
= 0,165 + 0,49 + 0,67 + 0,25 + 0 + 0
= 1,575

All values of scores V1-V15 of the results of multiplication by normalisation are summarised in Table 4.12, giving the results of the ranking in the following table:

**Table 3.11 Total Score of Prospective Students Scholarship Recipients**

| No | Alternative | Criteria | | | | | | Result |
|---|---|---|---|---|---|---|---|---|
| | | C1 | C2 | C3 | C4 | C5 | C6 | |
| 1. | SuyatnaArdiansah | 0,335 | 1 | 0,67 | 0,25 | 0 | 0 | 2,255 |
| 2. | Siti Nurholizah | 0,5 | 1 | 1 | 0,5 | 1 | 0,5 | 4,5 |
| 3. | RinoRiyatmoko | 0,335 | 1 | 0,67 | 0,25 | 0 | 0 | 2,255 |
| 4. | Gita Nopisa A | 0,165 | 0,49 | 0,67 | 0,25 | 0,5 | 0 | 2,075 |
| 5. | Almanzah | 0,165 | 1 | 1 | 0,25 | 0,5 | 0 | 2,915 |
| 6. | Dini Septianur | 0,335 | 1 | 0,67 | 0,25 | 0 | 0,25 | 2,505 |
| 7. | PerdilaIndriani | 0,335 | 1 | 1 | 0 | 1 | 0 | 3,335 |
| 8. | Muhammad Hafis | 0,335 | 1 | 0,67 | 0,25 | 0 | 0 | 2,255 |
| 9. | AptisyaMedilia | 0,165 | 0,49 | 0,67 | 0,25 | 0 | 0,25 | 1,825 |
| 10. | Della Marlina | 0,335 | 1 | 0,67 | 0,25 | 0 | 0,25 | 2,505 |
| 11. | Lena Sepriani | 0 | 1 | 1 | 0,5 | 0 | 0,25 | 2,75 |
| 12. | Lucianti | 0,335 | 1 | 1 | 0,25 | 1 | 0,25 | 3,835 |
| 13. | Ratna | 0,165 | 1 | 0,67 | 0,25 | 0 | 0 | 2,085 |
| 14. | ZahidaKasvia | 0 | 1 | 0,67 | 0,25 | 0 | 0,5 | 2,42 |
| 15. | Yona | 0,165 | 0,49 | 0,67 | 0,25 | 0 | 0 | 1,575 |

From the above table, the ranking of the scores of 15 prospective students is shown, with Siti Nurholizah's name in the first place. Then, from the results of the ranking and the evaluation measures, they become KIP -K Recipients.

In the determination of KIP -K students at the Islamic University of Kuantan Singingi, only eligible students, and what can be the same value that can make decisions is only the leadership of the Islamic University of Kuantan Singingi.

**Table 3.12 Decision Result**

| No | Alternative | Criteria | | | | | | Result | Rate | Inf |
|---|---|---|---|---|---|---|---|---|---|---|
| | | C1 | C2 | C3 | C4 | C5 | C6 | | | |
| 1. | Siti Nurholizah | 0,5 | 1 | 1 | 0,5 | 1 | 0,5 | 4,5 | 1 | L |
| 2. | Lucianti | 0,335 | 1 | 1 | 0,25 | 1 | 0,25 | 3,835 | 2 | L |
| 3. | PerdilaIndriani | 0,335 | 1 | 1 | 0 | 1 | 0 | 3,335 | 3 | L |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4. | Almanzah | 0,165 | 1 | 1 | 0,25 | 0,5 | 0 | 2,915 | 4 | L |
| 5. | Lena Sepriani | 0 | 1 | 1 | 0,5 | 0 | 0,25 | 2,75 | 5 | L |
| 6. | Dini Septianur | 0,335 | 1 | 0,67 | 0,25 | 0 | 0,25 | 2,505 | 6 | L |
| 7. | Della Marlina | 0,335 | 1 | 0,67 | 0,25 | 0 | 0,25 | 2,505 | 7 | L |
| 8. | ZahidaKasvia | 0 | 1 | 0,67 | 0,25 | 0 | 0,5 | 2,42 | 8 | TL |
| 9. | SuyatnaArdiansah | 0,335 | 1 | 0,67 | 0,25 | 0 | 0 | 2,255 | 9 | TL |
| 10. | RinoRiyatmoko | 0,335 | 1 | 0,67 | 0,25 | 0 | 0 | 2,255 | 10 | TL |
| 11. | Muhammad Hafis | 0,335 | 1 | 0,67 | 0,25 | 0 | 0 | 2,255 | 11 | TL |
| 12. | Ratna | 0,165 | 1 | 0,67 | 0,25 | 0 | 0 | 2,085 | 12 | TL |
| 13. | Gita Nopisa A | 0,165 | 0,49 | 0,67 | 0,25 | 0,5 | 0 | 2,075 | 13 | TL |
| 14. | AptisyaMedilia | 0,165 | 0,49 | 0,67 | 0,25 | 0 | 0,25 | 1,825 | 14 | TL |
| 15. | Yona | 0,165 | 0,49 | 0,67 | 0,25 | 0 | 0 | 1,575 | 15 | TL |

From the above table, it can be seen that 7 candidates of KIP -K scholars are declared eligible (L) because 7 candidates who receive the scholarship are the best of the 15 candidates selected by the method SAW. If the criteria meet the minimum requirements, the KIP -K scholarship recipients will be declared recipients of the KIP -K scholarship for the academic year 2022/2023, with a record of the decisions still held by the highest leadership of Islamic University of Kuantan Singingi.

## 4. Conclusion

After analysing the decision support system to determine the KIP -K recipient students in Islamic University of Kuantan Singingi using the Fuzzy Multiple Attribute Decision Making (FMADM) with the method of simple additive weighting (SAW), several conclusions can be drawn:

1. The application of Fuzzy Multiple Attribute Decision Making (FMADM) method can help in determining the weights of the values in each criterion.
2. The application of the simple additive weighting method (SAW) makes it easier to add the weighting values for each criterion.

## Acknowledgement

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