INNOVATIVE: Journal Of Social Science Research
Volume 4 Nomor 3 Tahun 2024 Page 5700-5713
E-ISSN 2807-4238 and P-ISSN 2807-4246
Website: https://j-innovative.org/index.php/Innovative

Fuzzy Simple Additive Weighting Method in Determining Single Tuition Fees for Prospective New Students at Manado State University

Navel Oktaviandy Mangelep[1✉], Ade Mahniar[2], Irfan Amu[3], Fricy O. Rumintjap[4]
(1) Universitas Negeri Manado, (2) Universitas Negeri Gorontalo, (3) Universitas Sam Ratulangi, (4) PT Insan Cerdas Indonesia
Email: navelmangelep@unima.ac.id[1✉]

Abstrak

Permasalahan untuk menentukan uang kuliah tunggal (UKT) bagi calon mahasiswa baru membutuhkan analisis yang mendalam dan membutuhkan waktu yang lama. Hal ini dikarenakan ada beberapa kriteria kualitatif dan kuantitatif yang menjadi dasar pengambilan keputusan. Permasalahan ini dapat diselesaikan dengan memanfaatkan logika Fuzzy terlebih khusus dengan metode Simple Additive Waighting (SAW). Oleh karena itu, studi ini berfokus pada pengembangan logika fuzzy menggunakan aplikasi SAW untuk menentukan UKT calon mahasiswa baru di Universitas Negeri Manado. Fokus dari studi ini adalah mencari bobot untuk beberapa atribut yang menjadi dasar untuk menentukan klasifikasi calon mahasiswa baru, sehingga dapat menentukan kelompok penerima UKT. Hasil studi ini dapat menjadi rujukan untuk diterapkan pada institusi lain dengan kriteria yang sama.

Kata Kunci: *Teori Fuzzy, Simple Additive Weighting, UKT, Mahasiswa Baru*

Abstract

The problem of determining single tuition fees (UKT) for prospective new students requires in-depth analysis and takes a long time. This is because several qualitative and quantitative criteria form the basis of decision-making. Fuzzy logic can solve this problem, especially with the Simple Additive Waighting (SAW) method. Therefore, this study focuses on developing fuzzy logic using the SAW application to determine the UKT for prospective new students at Manado State University. The focus of this study is to find weights for several attributes that are the basis for determining the classification of prospective new students so that they can determine the group of UKT recipients. The results of this study can be a reference for application to other institutions with the same criteria.

Keywords: *Fuzzy Theory, Simple Additive Weighting, UKT, New Students*

INTRODUCTION

Every university in Indonesia accepts new students through various admission channels. The results of these admissions determine the amount of tuition funding for students who pass the selection. Before 2013, there were several components of fees that prospective students had to pay before studying, including Education Implementation Contributions (SPP), practicum fees, practicum fees, campus coaching and introduction program fees (Probinas), Real Work Tuition fees (KKN), Field Experience Practice (PPL) fees, graduation fees, alma mater jackets, etc. (Muchsin & Sudarma, 2015; Yeremua & Gantini, 2020; Hasan & Nurlelah, 2023), where these components are paid separately. However, the fees paid need to be differentiated based on the economic level, type of work of parents, etc. (Jazuli, 2016; Alwi, 2017; Gusman, 2022). So that the tuition fees for all of them are the same.

In the 2013/2014 academic year, the government implemented new regulations in determining the amount of tuition funding at tertiary institutions through Minister of Education and Culture Regulation number 55 of 2013 concerning single tuition fees and single tuition fees at state universities within the Ministry of Education and Culture (Octaviana, 2021; Ardiansyah et al., 2022; Hasan & Nurlelah, 2023). Based on the Minister of Education and Culture's regulation, universities must determine the amount of tuition fees by adding up all the costs the student must incur divided by the number of regular semesters the student will complete (Mariani et al., 2016; Idfa 2018; Nurrahmaniah, 2019). So, students will pay tuition fees every semester or every six months.

In that year, Manado State University (Unima) immediately implemented this provision. The system for determining early tuition fees is created by considering the income of parents/guardians, number of siblings, size of house (m2), etc. The single tuition fee (UKT)

system applies to all new student admission routes, both the SNMPTN, SBMPTN and Baku Bekeng Pande (B2P) independent routes. Apart from that, there are 4 UKT groups determined, namely group I of IDR. 2,000,000,-, class II Rp. 2,500,000,-, group III Rp. 4,000,000,-, and group IV Rp. 5,000,000,-.

In practice, determining UKT groups for students has resulted in several complaints. For example, there is a mismatch between UKT groups and students' economic conditions. This occurs because the determination of UKT is left to the UKT determining officer by taking into account the parent's income, the size of the house, and the number of parents' dependents, where the officer sometimes has difficulty determining the appropriate group type due to the lack of a system accurate. Therefore, a system for determining appropriate decisions is needed in determining UKT.

Several decision-making methods exist, including Multiple-Attribute Decision Making (MADM) (Arifin, 2016; Priatni, 2017; Susmanto et al., 2018). MADM is good to use because it can make decisions without confusion even if there are many alternative decisions (Anam, 2019). After all, this MADM method can compare each alternative decision based on predetermined criteria (Surya, 2015; Muzakkir, 2017; Mulyani, 2019). There are several types of MADM, including Simple Additive Weighting (SAW), Weight Product (WP), ELECTRE, Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), and Analytic Hierarchy Process (AHP) (Tijaniyah, 2016; Sitompul et al., 2022; Nasution & Amin, 2023). However, the SAW type has a weakness: it can only solve problems if the attribute data is presented entirely and contains ambiguity/uncertainty (Siyamto, 2015).

Using a decision-making system using Fuzzy theory can be an alternative solution. Fuzzy theory can explain the value of vagueness/uncertainty in the range between [0.1] (Wahyuni, 2022). This Fuzzy Theory was first introduced by Lotfi Asker Zadeh in America in 1965 (Riyadli & Arliyana, 2017). Therefore, applying the Simple Additive Weighting (SAW) method with the Fuzzy theory is very useful for solving problems related to determining UKT groups for new students.

In this article, we explain the use of fuzzy additive weighting to determine the single tuition fee for new students at Manado State University.

RESEARCH METHOD

This study has several steps for drawing conclusions in determining single tuition fees using the Simple Additive Weighting method. The following are these steps, which are presented in Figure 1 below.

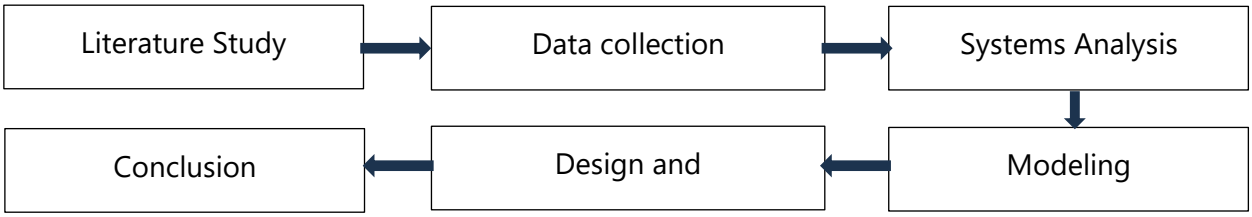


Figure 1. Research stages

RESULT AND DISCUSSION

a. Linguistic Variables and Their Definitions

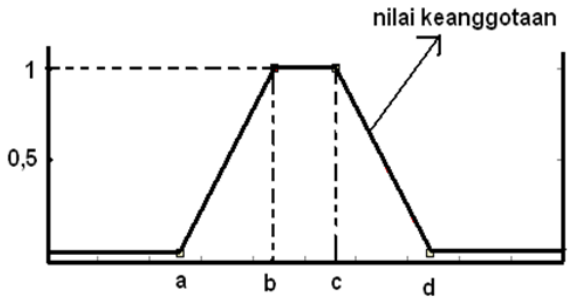
- Fuzzy system input and output variables

  The input variables in the system are the number of dependents, parent/guardian income, house size.
- The output variable in the system is the UKT category

  The fuzzy set in the system is as follows:
- Number of dependents: Few, Medium, Many
- Parental income: Low, Medium, High
- House Size: Small, Medium, Large
- Membership functions and membership degrees are determined based on the following categories and formulas

Table 1. Linguistic Variables

C1		*C2*		*C3*	
0-1	*FEW*	*500.000 – 2.000.000*	*LOW*	*0-45*	*SMALL*
2-4	*MEDIUM*	*2.000.000 – 3.000.000*	*MEDIUM*	*45-100*	*MEDIUM*
4-5	*MANY*	*>3.000.000*	*HIGH*	*>100*	*LARGE*



Gambar 1. Himpunan Keanggotaan Trapesium

$$S(u:a,b,c,d)=\begin{cases}0 & untuk\_\_u<a\\ (u-a)/(b-a) & untuk\_\_a\le u\le b\\ 1 & untuk\_\_b\le u\le c\\ (d-u)/(d-c) & untuk\_\_c\le u\le d\\ 0 & untuk\_\_u>d\end{cases}$$

Functions and degree of membership The number of dependents is defined as follows:

$$\mu Few\ (x)=\begin{cases}1\ ;x\le 1\\ \dfrac{4-x}{4-1};1\le x\le 4\\ 0;x\ge 4\end{cases}$$

$$\mu Medium\ (x)=\begin{cases}\dfrac{x-4}{4-2};\ 2\le x\le 4\\ \dfrac{5-x}{5-4};4\le x\le 5\\ 0;x\le 2\ or\ x\ge 4\end{cases}$$

$$\mu Many\ (x)=\begin{cases}1\ ;\ x\ge 5\\ \dfrac{x-4}{5-4};4\le x\le 5\\ 0;x\le 3\end{cases}$$

Function and degree of parental income membership

$$\mu Low(x)=\begin{cases}1\ ;x\ \le 2.000.000\\ \dfrac{3.000.000-x}{3.000.000-2.000.000};2.000.000\le x\le 3.000.000\\ 0;x\ge 3.000.000\end{cases}$$

$$\mu Medium\ (x)=\begin{cases}\dfrac{x-2.000.000}{3.000.000-2.000.000};\ 2.000.000\le x\le 3.000.000\\ 0;x\le 2.000.000\ or\ x\ge 3.000.000\end{cases}$$

$$\mu High\ (x)=\begin{cases}1\ ;\ x\ge 3.000.000\\ \dfrac{x-3.000.000}{3.000.000-2.000.000};2.000.000\le x\le 3.000.000\\ 0;x\le 2.000.000\end{cases}$$

Function and degree of membership of house size

$$\mu Small\ (x)=\begin{cases}1\ ;x\le 45\\ \dfrac{100-x}{100-45};45\le x\le 100\\ 0;x\ge 100\end{cases}$$

$$\mu Medium\ (x)=\begin{cases}\dfrac{x-45}{100-45};\ 45\le x\le 100\\ 0;x\le 45\ or\ x\ge 100\end{cases}$$

$$\mu Large\ (x)=\begin{cases}1\ ;\ x\ge 100\\ \dfrac{x-100}{100-45};100\le x\le 45\\ 0;x\le 45\end{cases}$$

b. Rule Base

In this study, there are 3 input variables: consisting of number of dependents, parents' income, and house size. All input variables have 3 fuzzy sets. Meanwhile, the output variable is determined based on the V value. Using Fuzzy MADM, the decision is determined based on the weight of the Vi obtained value.

c. Case Study

In fuzzy MADM the problem, criterion values and associated weights are in the form of fuzzy data in the form of linguistic variables. This method combines the Fuzzy Method and the Simple Additive Weighting Method. In the solution, there will be a conversion to fuzzy numbers, then to crisp numbers. Once converted, it is calculated using the Simple Additive Weighting Method. Below, we will outline the steps of the Fuzzy Simple Additive Weighting Method:

- Select the alternative (Xi, i = 1,2,...n) and the attributes to use.
- Give an alternative assessment (A) based on the attribute and determine the weight value (W) of the attribute according to the fuzzy number.
- Determine the profitable attributes and the cost attributes.
- Convert the fuzzy number in each assessment to a crisp number ranging from 0 to 1.
- Construction of the converted decision matrix (D).

$$D_{ij} = \begin{matrix} d_{11} & d_{12} & \dots & d_{1j} \\ \vdots & \vdots & \ddots & \vdots \\ d_{i1} & d_{i2} & \dots & d_{ij} \end{matrix}$$

  where D_{ij} is the assessment of alternative ai based on criteria cj, i = 1, 2, 3, ..., m and j=1, 2, 3, ..., n.

- Constructing a normalized decision matrix (R).

$$R_{ij} = \begin{matrix} r_{11} & r_{12} & \dots & r_{1j} \\ \vdots & \vdots & \ddots & \vdots \\ r_{i1} & r_{i2} & \dots & r_{ij} \end{matrix}$$

  Where,

$$r_{ij} \begin{cases} \dfrac{x_{ij}}{MAX\ (i)x_{ij}} & If\ j\ is\ the\ benefit\ attribute \\ \dfrac{MIN\ (i)x_{ij}}{x_{ij}} & If\ j\ is\ the\ cost\ attribute\ (cost) \end{cases}$$

  x_{ij} represents the normalized performance rating of alternative Xi on attribute Cj; i=1,2,3,..,m and j=1,2,3,...,n.

- Calculation of 1 score from each 1 alternative.

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

- Choose a larger value of Vi, which indicates that alternative Xi is more selected.

d. Select the alternatives and attributes used

In this discussion, data was taken from 30 prospective new students in 2021. For alternatives and attributes, each can be seen in Table 2.

Table 2. Alternative Data and Attributes of Prospective New Students in 2021

No.	No. Registration	Full Name	Data		
			Number of siblings	Parent's Income (Rp)	House Size (m^2)
1	4210030980	EKOSESONOCITRO	1	4,500,000.00	84
2	4210746404	WA ODE SITTI FATIMAH	4	3,000,000.00	104
3	4210009455	RIRI ANGGRAINI MAMONTO	1	3,500,000.00	70
4	4210014397	JORDI PASEBE	2	2,000,000.00	36
5	4210023223	PRISILIA PUTRI KONDULOW	1	1,500,000.00	42
6	4210836031	GLENNAIDY SELA	1	2,500,000.00	63
7	4210030775	GABY GOTE	4	1,000,000.00	96
8	4210037087	GILIANT MEIRALLDA RAUHE	2	4,500,000.00	115
9	4210042572	SELINA BIRA GRASIA MANDAS	3	3,000,000.00	63
10	4210090993	PUTRI FANGLAN MEYDA WAGIU	1	1,500,000.00	110
11	4210119573	PRAYCHI CHEREL WUNGKAR	1	1,500,000.00	56
12	4210133615	MICHAELA JANICE SILAP	2	3,500,000.00	36
13	4210152672	ELSYA SESILIA RAMPENGAN	2	4,500,000.00	48
14	4210157816	FINNY A. E. PONTOLULI	2	1,500,000.00	36
15	4210158418	EFRAIM MUHALING	2	1,500,000.00	70
16	4210161590	HIZKIA RIVALDI WATUSEKE	1	1,000,000.00	60
17	4210170964	GATINILA GEA	3	1,000,000.00	48
18	4210182624	ROSLIANA KALEPU	1	1,000,000.00	50
19	4210185595	TERESIA RANNIK	4	1,500,000.00	50
20	4210191220	RELITA PODOMI	2	1,000,000.00	52
21	4210192875	GEBY ANASTASYA MENDROFA	3	1,000,000.00	50
22	4210203307	ERIKA KAWULUR	2	1,000,000.00	50
23	4210831485	NI WAYAN MIRAWATI	2	1,000,000.00	42
24	4210225062	FAJAR FITRAH DATUNDUGON	1	1,000,000.00	42
25	4210204847	JENIFER ANJELY KORAH	1	1,000,000.00	60
26	4210236147	NICZEL DISON ERIKSON SAHALESSY	2	3,500,000.00	49

27	4210230522	DWI NANDA LAWE	1	4,500,000.00	70
28	4210248257	TATA PUTRI MOKOAGOW	1	1,000,000.00	60
29	4210849010	ANSYE ELSYE KARUNDENG	1	1,500,000.00	63
30	4210260528	MARIO ABAS	1	1,000,000.00	36

e. Alternative Assessment and Weighting (w)

There is no need to assess alternatives because the data is already available. The weighting (w) is done by giving each attribute a weight with the decision maker's standard feasibility value.

- (C1) The fewer dependent siblings, the greater the possibility of getting more nominal UKT. So (w) the number of siblings is set to 0.5.
- (C2) The more parents' income, the greater the possibility of getting more nominal UKT. So (w) parents' income is set at 1.
- (C3) The larger the residential building (parent's house), the greater the possibility of getting more UKT. So (w) the area of the house building is set at 0.89.

f. Determine Profit Attributes and Cost Attributes

Determining profit and cost attributes is seen from the type of attribute so that:

C1 -> profit

C2 -> costs

C3 -> profit

g. Fuzzy Number Conversion

Converting fuzzy numbers by grouping linguistic variables for each attribute in Table 1, then determining the number value using the trapezoidal rule membership function as in Figure 1.

Example:

The prospective student, on behalf of EKOSESONOCITRO, has 1 sibling, parents' income is IDR. 4,500,000, - per month, and the house area is 84 m2. In the fuzzy simple additive weighting method, the linguistic variables are explicitly determined from the values [1, 4500000, 84]. So, based on the grouping in Table 2, we get [LITTLE, HIGH, MEDIUM]. Based on the values of these linguistic variables, the membership function can be calculated as follows:

$$\mu_{\text{little}} = \frac{(1-0)}{(2-0)} = 0.5$$

$$\mu_{High} = \frac{(5000000-4500000)}{(5000000-3000000)} = 0.25$$

$$\mu_{Medium} = 1$$

h. Decision Matrix D

The decision matrix D is obtained from calculating the fuzzy membership value μf for each alternative based on linguistic variables for each decision attribute.

$$D = \begin{bmatrix} 0.5 & 0.25 & 1 \\ 0.5 & 1 & 0.8 \\ 0.5 & 1 & 1 \\ 1 & 1 & 0.4 \\ 0.5 & 0.666667 & 0.8 \\ 0.5 & 1 & 1 \\ 0.5 & 0.333333 & 1 \\ 1 & 0.25 & 0.25 \\ 1 & 1 & 1 \\ 0.5 & 0.666667 & 0.5 \\ 0.5 & 0.666667 & 1 \\ 1 & 1 & 0.4 \\ 1 & 0.25 & 1 \\ 1 & 0.666667 & 0.4 \\ 1 & 0.666667 & 1 \\ 0.5 & 0.333333 & 1 \\ 1 & 0.333333 & 1 \\ 0.5 & 0.333333 & 1 \\ 1 & 0.666667 & 1 \\ 1 & 0.333333 & 1 \\ 1 & 0.333333 & 1 \\ 1 & 0.333333 & 1 \\ 1 & 0.333333 & 0.8 \\ 0.5 & 0.333333 & 0.8 \\ 0.5 & 0.333333 & 1 \\ 1 & 1 & 1 \\ 0.5 & 0.25 & 1 \\ 0.5 & 0.333333 & 1 \\ 0.5 & 0.666667 & 1 \\ 0.5 & 0.333333 & 0.4 \end{bmatrix}$$

i. R Normalized Matrix

The normalized matrix calculation is carried out by calculating the profit attributes and cost attributes. For example, prospective EKOSESONOCITRO students.

C1: profit, with MAX value at d_{i1} = 1. So we get $r_{11} = \frac{0.5}{1} = 0.5$

C2: cost, with MIN value at d_{i2} = 0.25. So we get $r_{12} = \frac{0.25}{0.25} = 1$

C3: profit, with MAX value at d_{i3} = 1. So we get $r_{11} = \frac{1}{1} = 1$

The overall normalized matrix is obtained:

$$R = \begin{bmatrix} 0.5 & 1 & 1 \\ 0.5 & 0.25 & 0.8 \\ 0.5 & 0.25 & 1 \\ 1 & 0.25 & 0.4 \\ 0.5 & 0.375 & 0.8 \\ 0.5 & 0.25 & 1 \\ 0.5 & 0.75 & 1 \\ 1 & 1 & 0.25 \\ 1 & 0.25 & 1 \\ 0.5 & 0.375 & 0.5 \\ 0.5 & 0.375 & 1 \\ 1 & 0.25 & 0.4 \\ 1 & 1 & 1 \\ 1 & 0.375 & 0.4 \\ 1 & 0.375 & 1 \\ 0.5 & 0.75 & 1 \\ 1 & 0.75 & 1 \\ 0.5 & 0.75 & 1 \\ 1 & 0.375 & 1 \\ 1 & 0.75 & 1 \\ 1 & 0.75 & 1 \\ 1 & 0.75 & 1 \\ 1 & 0.75 & 0.8 \\ 0.5 & 0.75 & 0.8 \\ 0.5 & 0.75 & 1 \\ 1 & 0.25 & 1 \\ 0.5 & 1 & 1 \\ 0.5 & 0.75 & 1 \\ 0.5 & 0.375 & 1 \\ 0.5 & 0.75 & 0.4 \end{bmatrix}$$

j. Calculation of Score for Each Alternative (V)

Given weighted vector (w) = [0.5, 1, 0.89]

The calculation of the V value for prospective EKOSESONOCITRO students is as follows,

$$V_{11} = (0.5 * 0.5) + (1 * 1) + (0.89 * 1) = 2.142$$

The sum of the multiplication of the weighted vector and the xij matrix is obtained.

$$V = \begin{bmatrix} 2.142857 \\ 1.214286 \\ 1.392857 \\ 1.107143 \\ 1.339286 \\ 1.392857 \\ 1.892857 \\ 1.723214 \\ 1.642857 \\ 1.071429 \\ 1.517857 \\ 1.107143 \\ 2.392857 \\ 1.232143 \\ 1.767857 \\ 1.892857 \\ 2.142857 \\ 1.892857 \\ 1.767857 \\ 2.142857 \\ 2.142857 \\ 2.142857 \\ 1.964286 \\ 1.714286 \\ 1.892857 \\ 1.642857 \\ 2.142857 \\ 1.892857 \\ 1.517857 \\ 1.357143 \end{bmatrix}$$

k. The calculation results

FMADM will sort all alternatives based on the results (V). In this case, the final outcome decision variable is determined using the following value grouping rules:

If Vi < 1.00, then the UKT value = Rp. 2,000,000,-

If Vi ≥ 1.00 AND Vi <1.5, then the UKT value = RP. 2,500,000,-

If Vi ≥ 1.5 AND Vi < 2.00, then UKT value = Rp. 4,000,000,-

If Vi ≥ 2.00, then UKT value = Rp. 5,000,000,-

Based on the rules above, the UKT nominal amount borne by prospective new students in the name of EKOSESONOCITRO is IDR. 5,000,000, -.

CONCLUSION

Based on the results presented above, it was found that the decision-making process by the new student admissions team at Manado State University can use the SAW method based on certain criteria. The criteria obtained are converted into Fuzzy number form so that several values/weights are obtained and several calculations are obtained based on various specific cases. Using the SAW method can make determining the UKT amount at

Manado State University easier.

REFERENCES

Alwi, S. (2017). Unit Cost Satuan Pendidikan. *Idarah (Jurnal Pendidikan dan Kependidikan)*, *1*(1), 16-30.

Anam, M. (2019). *Sistem rekomendasi pondok pesantren mahasiswa kota Malang menggunakan metode Multi Criteria Decision Making (Analytic Hierarchy Process, Weighted Product, Dan Weighted Sum Model)* (Doctoral dissertation, Universitas Islam Negeri Maulana Malik Ibrahim).

Ardiansyah, M., Suharto, T., & Farid, A. S. (2022). Upaya Penanganan Uang Kuliah Tunggal (UKT) Bermasalah bagi Mahasiswa yang tidak Mampu pada Perguruan Tinggi. *JIIP-Jurnal Ilmiah Ilmu Pendidikan*, *5*(10), 4432-4441.

Arifin, A., & Fadillah, R. A. (2016). Implementasi Metode Attribute Decission Making (MADM) untuk Menentukan Kawasan Penanaman Bakau. *Jurnal Sains dan Teknologi Industri*, *14*(1), 86-92.

Gusman, F. (2022). *Analisis Bauran Promosi Penerimaan Mahasiswa Baru Universitas Islam Riau* (Doctoral dissertation, Universitas Islam Riau).

Hasan, F. N., & Nurlelah, E. (2023). Implementasi Metode Waterfall Pada Sistem Informasi Penerimaan Mahasiswa Baru di STKIP PGRI Jombang. *Jurnal Infortech*, *5*(1), 36-46.

Hasanuddin, H., Ibrahim, I., & Syamsul, S. (2019). *Persepsi Mahasiswa Terhadap Implementasi Uang Kuliah Tunggal di Fakultas Ilmu Sosial Universitas Negeri Makassar* (Doctoral dissertation, UNIVERSITAS NEGERI MAKASSAR).

Idfa, R. (2018). *Pengaruh kualitas informasi, religiusitas dan harga terhadap keputusan pembelian produk dalam jual beli online pada mahasiswa jurusan muamalah fakultas syariah iain ponorogo* (Doctoral dissertation, IAIN Ponorogo).

Jazuli, M. (2016). *Sistem pendukung keputusan penentuan kelompok uang kuliah tunggal menggunakan metode k-means clustering* (Doctoral dissertation, Universitas Islam Negeri Maulana Malik Ibrahim).

Mariani, E., Sutikno, B., & Chasanah, U. (2016). *Faktor-Faktor Yang Mempengaruhi Keputusan Mahasiswa Memilih Program Studi Kebidanan STIkes Muhammadiyah Ciamis Tahun 2016*(Doctoral dissertation, STIE Widya Wiwaha).

Muchsin, A. K., & Sudarma, M. (2015). Penerapan Fuzzy C-Means Untuk Penentuan Besar Uang Kuliah Tunggal Mahasiswa Baru. *Lontar Komput. J. Ilm. Teknol. Inf*, *6*(3), 175.

Mulyani, E. D. S. (2019). Analisis Perbandingan Sistem Pendukung Keputusan Menggunakan Metode SAW Dengan WP Dalam Pemberian Pinjaman. *Cogito Smart Journal*, *5*(2),

239-251.

Muzakkir, I. (2017). Penerapan metode topsis untuk sistem pendukung keputusan penentuan keluarga miskin pada desa panca karsa ii. *ILKOM Jurnal Ilmiah*, *9*(3), 274-281.

Nasution, R. P., & Amin, M. (2023). Rancang Bangun Aplikasi Sistem Pendukung Keputusan Kenaikan Jabatan Pegawai Dengan Menggunakan Metode Multi Criteria Decision Making (MCDM). *Bulletin of Information Technology (BIT)*, *4*(3), 391-399.

Nurrahmaniah, N. (2019). *Pengaruh Manajemen Waktu (Time Management) dan Minat Belajar terhadap Prestasi Akademik pada Mata Kuliah Bahasa Inggris Sekolah Tinggi Agama Islam Darunnajah Jakarta (Studi Empirik pada Mahasiswa Jurusan Manajemen Pendidikan Islam)* (Doctoral dissertation, Institut PTIQ Jakarta).

Octaviana, S. (2021). *Pengaruh Sistem Pembayaran UKT terhadap Prestasi Akademik Mahasiswa (Studi Kasus Mahasiswa Jurusan Pendidikan IPS UIN Syarif Hidayatullah Jakarta)* (Bachelor's thesis, Jakarta: FITK UIN Syarif Hidayatullah Jakarta).

Priatni, C. N. (2017). Sistem Untuk Menentukan Pilihan Pada Program Studi Menggunakan Fuzzy Multiple Attribute Decision Making (FMADM) Dengan Simple Additive Weighting (SAW)(Studi Kasus: POLTEKES Permata Indonesia Yogyakarta). *INFORMAL: Informatics Journal*, *2*(1), 54-63.

Riyadli, H., & Arliyana, A. (2017). Analisis Tingkat Akurasi Algoritma Novel Sebagai Metode Prediksi (Studi Kasus: Prediksi Harga Emas). *Jurnal Saintekom*, *7*(2), 162-173.

Sitompul, F. A., Helmiah, F., & Rohminatin, R. (2022). Implementation of the SAW Method in the Decision Support System for Giving Rewards for Honorary Employees. *Building of Informatics, Technology and Science (BITS)*, *4*(2), 649-662.

Siyamto, Y. (2015). Preferensi Kepuasan Nasabah Bank Umum Syariah dan Bank Umum Konvensional dalam Perspektif Fuzzy Carter dan Fuzzy Servqual di Surakarta Tahun 2015. *Skripsi Institut Agama Islam Negeri Surakarta*.

Surya, C. (2015). Sistem Pendukung Keputusan Rekomendasi Penerima Beasiswa Menggunakan Fuzzy Multi Attribut Decision Making (FMADM) dan Simple Additive Weighting (SAW). *Jurnal Rekayasa Elektrika*, *11*(4), 149-156.

Susmanto, S., Zainal, Z., & Munawir, M. (2018). Sistem Penerapan Fuzzy Multi Attribute Decision Making (MADM) Dalam Mendukung Keputusan Untuk Menentukan Lulusan Terbaik Pada Sekolah Tinggi Teknik Poliprofesi Medan. *Jurnal Nasional Komputasi dan Teknologi Informasi (JNKTI)*, *1*(1).

Tijaniyah, T. (2016). technique of multi attribute decision making in an election medicine by using simple additive weighting (SAW) and analytical hierarchy process (AHP)

method for skin diseases survivor. *Jurnal Arus Elektro Indonesia*, *2*(2).

Wahyuni, S. N. I. (2022). *Penerapan Inferensi Fuzzy Tsukamoto Dalam Pengambilan Keputusan Pengiriman Barang (Studi Kasus Jasa Ekspedisi Sicepat Cabang Mojoroto Kota Kediri)*(Doctoral dissertation, IAIN Kediri).

Yeremia, J., & Gantini, T. (2020). Pemodelan Sistem Informasi menggunakan Togaf ADM dari Preliminary Phase sampai dengan Phase D pada Sistem Penerimaan Mahasiswa Baru di Universitas X. *Jurnal STRATEGI-Jurnal Maranatha*, *2*(2), 248-262