



## DECISION SUPPORT SYSTEM FOR GRANTING PEOPLE'S BUSINESS CREDIT (KUR) USING WEIGHTED PRODUCT AND TOPSIS METHODS

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### Abstract

People's Business Credit (KUR) is a credit that gets subsidized facilities from the government, one of which is KUR BRI. The government itself recently extended the BRI KUR ceiling without collateral or collateral for loans of up to IDR 100 million with interest subsidies of up to 3 percent. In order for the credit given to be smooth, the bank must be selective in giving credit to creditors, where before credit is given to the debtor, the bank must analyze the provision of credit to determine the creditor's ability to repay the loan in accordance with the terms contained in the loan agreement. A decision support system is a system that helps decision makers in unstructured decision conditions and non-semi-structured situations. Metode Weighted Product (WP) dan Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) part of the Multi-Attribute Decision Making (MADM) is used to rank all alternatives from predetermined criteria and sub-criteria. The implementation of the two methods for the ten alternatives (BRI Kotabumi Branch) turned out to give very good results using these two methods. And the calculation results of these two methods are the same, so it can be concluded that the most feasible results from the WP and TOPSIS methods are Alternative 5 Initials A with WP values 0.134 and TOPSIS 0.774



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### I. INTRODUCTION

The People's Business Credit Program has a significant impact on the socio-economic life of the community, in which the People's Business Credit program makes a sizeable contribution. The community said that the existence of the People's Business Credit program could increase their business capital so that their income also increased according to their needs [1]. Therefore, the aim of banks to channel MSME financing is to increase access to finance for micro-enterprises engaged in productive business activities, business development, and to strengthen businesses related to poverty alleviation or alleviation. People's Business Credit (KUR) is a provision or financing of working capital provided by certain organizations to micro, small and medium enterprises, services for providing working capital are usually provided by banks as providers of funds for people who want to build their own business[2]. At Bank BRI Kotabumi branch, the

process of determining the eligibility of KUR recipients still uses income comparisons, causing bad credit by designing and building a decision system for selecting credit granting for prospective customers using a combination.

In the case of selecting the provision of credit to prospective customers, decisions are selected from various alternative results of information processing obtained using a decision-making model. This decision support system uses the Weighted Product (WP) method and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)[3][4], [5]. The basic concept of the WP method is to find the weighted sum of each alternative on all attributes, while the TOPSIS method has the ability to measure the relative performance of several decision alternatives and choose the alternative that is closest to the positive ideal solution. However, the weighting used in TOPSIS has high subjectivity because it is purely subjectively assessed by humans. Therefore,

the weighting of the WP method that has gone through a consistency test is used to cover weaknesses in the TOPSIS method of weighting. While the advantages of the TOPSIS method in choosing alternatives that are close to the positive ideal solution are chosen to complete the decision-making process. From this research a decision support system was produced that could process KUR application data from customers, then an assessment was carried out using the WP and TOPSIS methods and then a ranking was produced [6] eligible customers to receive KUR[7][8].

**II. LITERATURE REVIEW**

**2.1. Decision Support System**

A Decision-Making System can be said to be a further development of a computerized management information system that is designed in such a way that it is interactive with the user. The interactive nature is intended to facilitate integration between the various components in the decision-making process such as procedures, policies, analytical techniques, as well as experience and insight. managerial to form a flexible decision framework [9]. Decision support systems have several components that form a unit. According to Turban and Efrain (2005) several components, from DSS include[10], [11]:

1. Data management, a database that contains data that is relevant to a situation and is managed by software, namely the Database Management System (DBMS).
2. Model management, components that require a statistical modelling, knowledge management, or other quantitative models, which are able to provide an analytical capability into a system.

**2.2. Weight Product Method**

The WP method uses multiplication to connect attribute ratings, where the rating of each attribute must be raised to the power of the weight in question. Preference for alternative Ai [12] given by the equation[13], [14]

The steps are as follows:

1. Improved criterion weights, with the following equation:

$$W_j = \frac{W_j}{\sum W_j} \text{ Equality (1)}$$

2. Calculate the vector s, with the following equation:

$$S_i = [x_{ij} W_j, \dots] \text{ Equality (2)}$$

Calculate the vector v, or the relative reference of each alternative, for ranking with the following equation:

$$V = \frac{S_1}{S_1 + S_2 + S_3} \text{ Equality (3) [15], [16].}$$

Calculations used in the system decision support is to use Weighted Product (WP) method and

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)[17]. The object of this research is prospective KUR BRI customers at Kotabumi branch. The value and weight of each criterion is used to determine the feasibility of receiving people's business credit.

**2.3. Technique For Order Preference Similarity To Ideal Solution (TOPSIS)**

TOPSIS is a method that can help the optimal decision-making process to solve decision problems [18] practically. This is because the concept is simple and easy to understand, computationally efficient and has the ability to set the relative performance of decision alternatives in a simple mathematical form.[19][20]–[23]. In general, the TOPSIS procedure follows the steps:

1. Determine the normalized decision matrix
2. Calculate the weighted normalized decision matrix
3. Calculate the positive ideal solution matrix and negative ideal solution matrix
4. Calculate the distance between the values of each alternative with a positive ideal solution matrix and matrix negative ideal solution
5. Calculate the preference value for each alternative[24], [25].

**III. RESEARCH METHODS**

**3.1. Requirements Gathering**

At this stage the author will first analyze and identify all data requirements such as how the system worked before, what data was entered and the reports that were generated.

**Interview Method** Interview is a data collection method that requires direct communication between the researcher and the subject or respondent. In this case the researcher conducted interviews directly with the admin of the Kotabumi branch of the BRI credit officer to get an overview of the student majoring system so far.

**Documentation Method** The documentation method is a way of collecting data by recording existing data. So in this study, documents or records are used as a source to obtain data on creditworthiness recipients.

**Observation Method** is a data collection tool that is carried out by systematically observing and recording the system under investigation.

**Study of literature** This section will focus on finding relevant references related to the problems being studied by the author.

**3.2. Determining Weights and Criteria**

The weight value is determined using the Likert scale concept by adopting the numbers 1 to 5. For more details, see the following table:

Table 1. Criteria and Weight of Each Criterion	
Weight	Interest
1	Not important

2	Not too important
3	Quite important
4	Important
5	Very important

9	Initials K	A9
10	Initials O	A10

In order to make it easier to make calculations, based on the rules obtained, 5 criteria can be made for KUR recipient selection standards. Each criterion will be given a symbol C1 to C5. Can be seen in the following table:

Table 2. Prospective Customers

No	Alternative	Code
1	Initials S	A1
2	Initials R	A2
3	Initials N	A3
4	Initials B	A4
5	Initials A	A5
6	Initials I	A6
7	Initials J	A7
8	Initials G	A8

Table 3. Table of Criteria Weighted Values

No	Kode	Criteria	Categories	Values
1.	C1	File Completeness	Benefit	5
2.	C2	Type of Debtor's Business	Benefit	4
3.	C3	collateral	Benefit	3
4.	C4	Credit Package	Benefit	4
5.	C5	Length of Business	Cost	2

#### IV. RESULTS

##### 4.1. Assessment of KUR Beneficiaries Weighted Product and TOPSIS Methods

In determining the weights and variables in determining KUR using the WP and TOPSIS methods, it can be seen in the following table:

Table 4. KUR Beneficiary Assessment Table

Prospective Customer	KUR Recipient Criteria				
	C1 File Completeness	C2 Type of Debtor's Business	C3 Collateral	C4 Credit Package	C5 Length of Business
A1 Initials S	Quite complete	Fairly Smooth	Outside the Village	There Is Credit In Other Institutions	3-5 Year
A2 Initials R	Complete	Looks Unsmooth	In the village	No Credit at Other Institutions	>2 Year
A3 Initials N	Incomplete	Fluent	In the village	No Credit at Other Institutions	>2 Years
A4 Initials B	Complete	Fairly Smooth	Outside the Village	There Is Credit In Other Institutions	>5 Year
A5 Initials A	Complete	Fluent	Outside the Village	There Is Credit In Other Institutions	>2 Year
A6 Initials I	Incomplete	Looks Unsmooth	In the village	There Is Credit In Other Institutions	>2 Year
A7 Initials J	Quite complete	Visible Lancar	No In the village	No Credit at Other Institutions	3-5 Year
A8 Initials G	Incomplete	Looks Unsmooth	In the village	There Is Credit In Other Institutions	>2 Year
A9 Initials K	Quite complete	Fairly Smooth	Outside the Village	No Credit at Other Institutions	>5 Year
A10 Initials O	Complete	Fairly Smooth	Outside the Village	There Is Credit In Other Institutions	>2 Year

##### 4.2. Weighted Product and TOPSIS Method Values

In collecting data to fill in the alternative matrix, the author uses observation media filled in by survey officers (the survey form is attached). In order to obtain alternative matrix data as follows:

Table 5. Value Weight

Prospective Customer	KUR Recipient Criteria				
	C1 File Completeness	C2 Type of Debtor's Business	C3 Collateral	C4 Credit Package	C5 Length of Business
A1 Initials S	3	3	4	3	4
A2 Initials R	5	2	3	5	2
A3 Initials N	1	5	3	5	2
A4 Initials B	5	3	4	3	5
A5 Initials A	5	5	4	3	2
A6 Initials I	1	2	3	3	2
A7 Initials J	3	2	3	5	4
A8 Initials G	1	2	3	3	2

A9 Initials K	3	3	4	5	5
A10 Initials O	5	3	4	3	2

4.3. WP Method Matrix Normalization

Weight Improvement

Tabel 6. Weight Improvement

Recipient Criteria KUR	Weight	Weight Improvement
C1 File Completeness	5	0.278
C2 Type of Debtor's Business	4	0.222
C3 Collateral	3	0.167
C4 Credit Package	4	0.222
C5 Length of Business	2	0.111

Vektor S

The value of this vector (S). obtained by multiplying the values attributes that each criterion has with the results normalization of weights to a positive power for profit criteria (benefit) and which has a negative rank for the cost criterion. Normalization process (S) or Vector S. Determine the vector value s which can be calculated using the following equation formula:

Tabel 7. Vektor S

Prospective customer	Vektor S
A1 Initials S	$S1 = (3^{0.278})(3^{0.222})(4^{0.167})(3^{0.222})(4^{-0.111}) = 2.389$
A2 Initials R	$S2 = (5^{0.278})(2^{0.222})(3^{0.167})(5^{0.222})(2^{-0.111}) = 2.901$
A3 Initials N	$S3 = (1^{0.278})(5^{0.222})(3^{0.167})(5^{0.222})(2^{-0.111}) = 2.273$
A4 Initials B	$S4 = (5^{0.278})(3^{0.222})(4^{0.167})(3^{0.222})(5^{-0.111}) = 2.686$
A5 Initials A	$S5 = (5^{0.278})(5^{0.222})(4^{0.167})(3^{0.222})(2^{-0.111}) = 3.331$
A6 Initials I	$S6 = (1^{0.278})(2^{0.222})(3^{0.167})(3^{0.222})(2^{-0.111}) = 1.656$
A7 Initials J	$S7 = (3^{0.278})(2^{0.222})(3^{0.167})(5^{0.222})(4^{-0.111}) = 2.331$
A8 Initials G	$S8 = (1^{0.278})(2^{0.222})(3^{0.167})(3^{0.222})(2^{-0.111}) = 1.656$
A9 Initials K	$S9 = (3^{0.278})(3^{0.222})(4^{0.167})(5^{0.222})(5^{-0.111}) = 2.610$
A10 Initials O	$S10 = (5^{0.278})(3^{0.222})(4^{0.167})(3^{0.222})(2^{-0.111}) = 2.974$

Tabel 8. Vektor V

Prospective Customer	Vektor V
A1 Initials S	$V1 = \frac{2.389}{2.389+2.901+2.273+2.686+3.331+1.656+2.331+1.656+2.610+2.974} = \frac{2.389}{24.807} = 0.096$
A2 Initials R	$V2 = \frac{2.901}{2.389+2.901+2.273+2.686+3.331+1.656+2.331+1.656+2.610+2.974} = \frac{2.901}{24.807} = 0.117$
A3 Initials N	$V3 = \frac{2.273}{2.389+2.901+2.273+2.686+3.331+1.656+2.331+1.656+2.610+2.974} = \frac{2.273}{24.807} = 0.092$
A4 Initials B	$V4 = \frac{2.686}{2.389+2.901+2.273+2.686+3.331+1.656+2.331+1.656+2.610+2.974} = \frac{2.686}{24.807} = 0.108$
A5 Initials A	$V5 = \frac{3.331}{2.389+2.901+2.273+2.686+3.331+1.656+2.331+1.656+2.610+2.974} = \frac{3.331}{24.807} = 0.134$
A6 Initials I	$V6 = \frac{1.656}{2.389+2.901+2.273+2.686+3.331+1.656+2.331+1.656+2.610+2.974} = \frac{1.656}{24.807} = 0.067$
A7 Initials J	$V7 = \frac{2.331}{2.389+2.901+2.273+2.686+3.331+1.656+2.331+1.656+2.610+2.974} = \frac{2.331}{24.807} = 0.094$
A8 Initials G	$V8 = \frac{1.656}{2.389+2.901+2.273+2.686+3.331+1.656+2.331+1.656+2.610+2.974} = \frac{1.656}{24.807} = 0.067$
A9 Initials K	$V9 = \frac{2.610}{2.389+2.901+2.273+2.686+3.331+1.656+2.331+1.656+2.610+2.974} = \frac{2.610}{24.807} = 0.105$
A10 Initials O	$V10 = \frac{2.974}{2.389+2.901+2.273+2.686+3.331+1.656+2.331+1.656+2.610+2.974} = \frac{2.974}{24.807} = 0.120$

Table 9. Normalized Matrix

Prospective Custome	Criteria for KUR Recipients				
	C1 File Completeness	C2 Type of Debtor's Business	C3 Collateral	C4 Credit Package	C5 Length of Business
A1 Initials S	0.263117	0.297044	0.357770	0.241746	0.388514
A2 Initials R	0.438529	0.198029	0.268328	0.402911	0.194257
A3 Initials N	0.087705	0.495073	0.268328	0.402911	0.194257
A4 Initials B	0.438529	0.297044	0.357770	0.241746	0.485642
A5 Initials A	0.438529	0.495073	0.357770	0.241746	0.194257
A6 Initials I	0.087705	0.198029	0.268328	0.241746	0.194257
A7 Initials J	0.263117	0.198029	0.268328	0.402911	0.388514
A8 Initials G	0.087705	0.198029	0.268328	0.241746	0.194257
A9 Initials K	0.263117	0.297044	0.357770	0.402911	0.485642
A10 Initials O	0.438529	0.297044	0.357770	0.241746	0.194257

a. Positive Ideal Solution Matrix (A+) and Negative Ideal Solution Matrix (A-)

Table 10. Positive & Negative Ideal Solution Matrix

Prospective Customer	KUR Recipient Criteria				
	C1 File Completeness	C2 Type of Debtor's Business	C3 Collateral	C4 Credit Package	C5 Length of Business
A1 Inisial S	13.155.870	1.188.177	10.733.126	0.966.987	0.777.028
A2 Inisial R	21.926.450	0.792.118	0.804.984	16.116.459	0.388.514
A3 Inisial N	0.438.529	19.802.950	0.804.984	16.116.459	0.388.514
A4 Inisial B	21.926.450	1.188.177	10.733.126	0.966.987	0.971.285
A5 Inisial A	21.926.450	19.802.950	10.733.126	0.966.987	0.388.514
A6 Inisial I	0.438.529	0.792.118	0.804.984	0.966.987	0.388.514
A7 Inisial J	13.155.870	0.792.118	0.804.984	16.116.459	0.777.028
A8 Inisial G	0.438.529	0.792.118	0.804.984	0.966.987	0.388.514
A9 Inisial K	13.155.870	1.188.177	10.733.126	16.116.459	0.971.285
A10 Inisial O	21.926.450	1.188.177	10.733.126	0.966.987	0.388.514
A+	21.926.450	19.802.950	10.733.126	16.116.459	0.388.514
A-	0.438.529	0.792.118	0.804.984	0.966.987	0.971.285

b. Distance between Positive Ideal Solution (D+) and Negative Ideal Solution (D-)

Table 11. Distance of Positive & Negative Ideal Solutions

Prospective customer	D+	D-	Results
A1 Inisial S	14.011.458.030.604	10.177.570.257.116	0.4207515132918
A2 Inisial R	12.180.988.079.308	19.575.827.272.473	0.61642916821555
A3 Inisial N	1.774.520.520.288	14.720.637.768.032	0.4534192376037
A4 Inisial B	11.758.648.040.851	18.181.820.101.467	0.60726572527331
A5 Inisial A	0.6446583712203	22.136.644.787.128	0.7744627164019
A6 Inisial I	22.307.559.701.567	0.58277151741436	0.20713197933512
A7 Inisial J	155.046.408.257	11.056.902.974.485	0.41627486179505
A8 Inisial G	22.307.559.701.567	0.58277151741436	0.20713197933512
A9 Inisial K	13.176.890.343.068	11.889.818.879.669	0.47432707556539
A10 Inisial O	1.021.291.043.717	1.909.295.279.293	0.65150624102141

**WP Method**

From the test results using the WP method, you can see the ranking of each alternative in the following table:

Table 12. WP Method Ranking

No	Prospective customer	Vektor V
1	A5 Inisial A	0.134
2	A10 Inisial O	0.120
3	A2 Inisial R	0.117
4	A4 Inisial B	0.108
5	A9 Inisial K	0.105
6	A1 Inisial S	0.096
7	A7 Inisial J	0.094
8	A3 Inisial N	0.092
9	A6 Inisial I	0.067
10	A8 Inisial G	0.067

**TOPSIS Method**

From the test results using the TOPSIS method, you can see the ranking of each alternative in the following table:

Table 13. TOPSIS Ranking Method

No	Prospective Customer	Results
1	A5 Inisial A	0.7744627164019
2	A10 Inisial O	0.65150624102141
3	A2 Inisial R	0.61642916821555
4	A4 Inisial B	0.60726572527331
5	A9 Inisial K	0.47432707556539
6	A3 Inisial N	0.4534192376037
7	A1 Inisial S	0.4207515132918
8	A7 Inisial J	0.41627486179505
9	A6 Inisial I	0.20713197933512
10	A8 Inisial G	0.20713197933512

The implementation of the two methods for the ten alternatives (BRI Kotabumi Branch) turned out to give very good results using these two methods. And the calculation results of these two methods are the same, so it can be concluded that the most feasible results of the WP and TOPSIS methods are Alternative 5 Initials A with WP values: 0.134 and TOPSIS: 0.774

**V. CONCLUSION**

Based on the results of the analysis of the application of the Weighted Product (WP) method and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) for the selection of recipients of People's Business Credit (KUR), several

conclusions were drawn, including with this decision support system it makes it easier for PT Bank Rakyat Indonesia Kotabumi Branch to predict KUR recipients. The main factor that influences the results of the calculation is the weight of the criteria and the weight of the sub-criteria of each alternative (KUR candidate recipients) that are compared. The weight of the criteria, the weight of the sub-criteria of this system is dynamic, can be changed at any time according to needs. This system provides information in the form of ranking and value of each customer who applies for KUR to the bank. The value is taken from the requirements addressed to the customer by the bank. The value depends on whether the customer's requirements are complete or not.

#### REFERENCES

- [1] C. D. Sihombing, N. M. Benu, and R. Kaunang, "Dampak Program KUR Bank Rakyat Indonesia Terhadap Pendapatan UMKM Bidang Kuliner Di BRI Unit Bumi Beringin Kota Manado," *Agri-Sosioekonomi*, vol. 19, no. 1, pp. 85–90, 2023.
- [2] M. Ickhsan, D. Anggraini, R. Haryono, S. H. Sahir, and Rohminatin, "Sistem Pendukung Keputusan Pemberian Kredit Usaha Rakyat ( KUR ) Menggunakan Metode Weighted Product," *JURIKOM (Jurnal Ris. Komputer)*, vol. 5, no. 2, pp. 97–102, 2018.
- [3] D. W. Trise Putra, S. N. Santi, G. Y. Swara, and E. Yulianti, "Metode Topsis Dalam Sistem Pendukung Keputusan Pemilihan Objek Wisata," *J. Teknoif Tek. Inform. Inst. Teknol. Padang*, vol. 8, no. 1, pp. 1–6, 2020.
- [4] J. Y. Pak, V. V. Thai, and G. T. Yeo, "Fuzzy MCDM Approach for Evaluating Intangible Resources Affecting Port Service Quality," *Asian J. Shipp. Logist.*, vol. 31, no. 4, pp. 459–468, 2015.
- [5] Y. J. Lai, T. Y. Liu, and C. L. Hwang, "TOPSIS for MODM," *Eur. J. Oper. Res.*, vol. 76, no. 3, pp. 486–500, 1994.
- [6] D. M. Efendi and N. Novita, "Weight Product Dalam Implementasi Sistem Pendukung Keputusan Bantuan Bedah Rumah," *J. Inf. dan Komput.*, vol. 7, no. 1, pp. 35–42, 2019.
- [7] E. P. Widyaresti, "Analisis Peran Bri Unit Ketandan Dalam Pemberian Kredit Usaha Rakyat ( KUR ) Kepada Usaha Mikro Dan Kecil Di Kecamatan Ngawen Kabupaten Klaten," Universitas Diponegoro, 2012.
- [8] G. Muhammad Junaidi, Fiqih Satria, "Model Pengambilan Keputusan Calon Penerima Bantuan Usaha Mikro Bank Lampung Dengan Metode Weighted Product," *JTKSI*, vol. 03, no. 01, pp. 20–25, 2020.
- [9] W. Product, "Sistem Pendukung Keputusan Pemilihan Layanan Internet Service Provider Menggunakan Metode Weighted Product ( Studi kasus : STMIK AKBA ) Marwa Sulehu STMIK AKBA," vol. 4, no. 4, pp. 55–60, 2015.
- [10] B. E. Turban, J. E. Aronson, and T. Liang, *Decision Support System and Intelegent System*, 7th Ed. Ji. Yogyakarta: Penerbit Andi Yogyakarta, 2005.
- [11] E. Turban, J. E. Aronson, and T.-P. Liang, "Decision Support Systems and Intelligent Systems," *Decis. Support Syst. Intell. Syst.*, vol. 7, p. 867, 2007.
- [12] S. M. Sumarno and J. M. Harahap, "Sistem Pendukung Keputusan Dalam Menentukan Pemilihan Posisi Kepala Unit (Kanit) Ppa Dengan Metode Weight Product," *JUSTIT J. Sist. Informasi, Teknol. Inf. dan Komput.*, vol. 11, no. 1, p. 37, 2020.
- [13] D. Friedrich and A. Luible, "Assessment of standard compliance of Central European plastics-based wall cladding using multi-criteria decision making (MCDM)," *Case Stud. Struct. Eng.*, vol. 5, 2016.
- [14] S. Vinodh, M. Prasanna, and N. Hari Prakash, "Integrated Fuzzy AHP-TOPSIS for selecting the best plastic recycling method: A case study," *Appl. Math. Model.*, vol. 38, no. 19–20, 2014.
- [15] M. Muslihudin, R. Fitri Andriyanti, S. Mukodimah, P. Sistem Informasi, and S. Pringsewu Lampung, "Implementasi Metode Weighted Product Menentukan Beasiswa Bidik Misi Stmik Pringsewu," *Jatisi*, vol. 4, no. 2, 2018.
- [16] Basri, "Metode Weightd Product ( WP ) Dalam Sistem Pendukung Keputusan Penerimaan Beasiswa Prestasi," *Insypro*, vol. 2, no. 1, pp. 1–6, 2017.
- [17] A. Hafiz and M. Informatika, "Penerapan Sistem Pendukung Keputusan Pengangkatan Karyawan Tetap Dengan Menggunakan Metode Topsis," vol. 1, no. 2, pp. 1–11, 2020.
- [18] H. Mustafidah and R. P. Mayasari, "Sistem Pendukung Keputusan Menggunakan Metode TOPSIS untuk Pemilihan Lembaga Bimbingan Belajar," vol. 15, no. 1, pp. 39–53, 2018.
- [19] R. Agusli, M. I. Dzulhaq, and F. C. Irawan, "Sistem Pendukung Keputusan Penerimaan Karyawan Menggunakan Metode AHP - Topsis," vol. 2, no. 2, pp. 35–40, 2020.
- [20] S. Kusumadewi, S. Hartati, A. Harjoko, and Retanto Wardoyo, *Fuzzy Multi-Attribute Decision Making (Fuzzy MADM)*. Yogyakarta: Graha Ilmu, 2013.
- [21] M. M. Andino Maseleno, K. Shankar, Miftachul Huda, Marini Othman, Prayugo Khoir, "CEL : Citizen Economic Level using SAW," in *Expert Systems in Finance: Smart Financial Applications in Big Data Environments*, no. February, 2019, pp. 97–111.
- [22] L. Muhamad Muslihudin, "Implementasi Fuzzy Multiple Attribute Decision Making Menggunakan Metode Simple Additive Weighting Untuk Diagnosa Awal Gangguan

- Pada Masa Kehamilan,” in *KNSI 2016*, 2016, pp. 11–13.
- [23] A. D. Susanti, M. Muslihudin, and S. Hartati, “Sistem Pendukung Keputusan Perankingan Calon Siswa Baru Jalur Undangan Menggunakan Simple Additive Weighting ( Studi Kasus: SMK Bumi Nusantara Wonosobo ),” *SEMNASTEKNOMEDIA*, vol. 5, no. 1, pp. 37–42, 2017.
- [24] A. Vega, J. Aguarón, J. García-alcaraz, and J. M. Moreno-jiménez, “Notes on Dependent Attributes in TOPSIS,” *Procedia - Procedia Comput. Sci.*, vol. 31, no. Itqm, pp. 308–317, 2014.
- [25] I. Ertugrul and T. Oztas, “Business mobile-line selection in Turkey by using fuzzy TOPSIS , one of the multi-criteria decision methods,” *Procedia - Procedia Comput. Sci.*, vol. 31, pp. 40–47, 2014.