Analysis of the Determination of the Result of Welfare Rice Aid in Indonesia (Case Study in Palang Karaya, Central Kalimantan) Using SAW and TOPSIS

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Abstract: The distribution of subsidized rice is expected to be slightly helped by the burden of daily life. But sometimes some things cause programs that were already well organized and planned to become off-target. So that, the selection process for receiving prosperous rice assistance in Indonesia, especially in the Palangkaraya region of Central Kalimantan can be on target and wise, a decision support system is needed by using the Simple Additive Weighting (SAW) method and TOPSIS. Research utilizing the SAW method can be used in determining decisions for scholarship recipients as did Eniyati. While the TOPSIS method in research conducted by Lestari is able to solve multi-dimensional problems in the case study of recruiting new employees. The results of the research conducted obtained the results of the decision of the two methods used. The results obtained from the data used are simulation data where the SAW method produces Ismadi in the first order of literary recipients who are entitled to the final value of the alternative, V9 = 0.95. While the TOPSIS method produces different literary recipients in the first order, namely Syarifah Hj. The relative closeness to the recipient of Syarif Hj is C3 = 0.7483. The results of both methods, if analyzed with the criteria/rating of importance used, the TOPSIS results are much closer to the decision that can be taken, because C3 is in first place with a value of 0.7483 and income criteria = 450,000, LR = 4, JT = 1, age = 81 and education = not elementary school. While the SAW results that produce V9 = 0,95 and income criteria = 5,500,000, LR = 14, JT = 4, age = 56 and education = Bachelor Degree.

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INTRODUCTION

In 2018, BPS recorded a decline in prices for a number of food commodities which pushed 0.08% deflation in February, 2019. For people who know about the decrease in food commodity prices, it is a positive thing to be caught as an effort to increase consumption in the family. But this has become the opposite as it turns

outwith these conditions does not necessarily improve consumption which is sustaining economic growth, meaning that consumer optimism is in a downward trend. This trend is also shown by the sluggish public demand for purchasing power. Seen in the consumer confidence index published by the Bank Indonesia survey, the figure is 125.5-125.1 in February. From these data, according to economic observers that there are causes of decreased public purchasing power that is due to inadequate employment and low levels of community income. With a low level of community income, it is feared that there will be an increase in poverty in Indonesia. Poverty conditions will cause a decrease in purchasing power for daily needs, such as rice, etc.[1].

The government has a Beras Sejahtera (Rastra) program and Non-Cash Food Aid. This program is one of the important government policy instruments in poverty reduction for low-income poor people. Implementation, the government, through BULOG, provides and distributes subsidized rice to low-income groups where BULOG prioritizes the procurement of grain/rice from domestic farmers. Distribution of subsidized rice to low-income groups to reduce the expenditure burden of the Keluarga Sasaran Penerima Manfaat (KPM) through meeting some of the food needs of rice[2]. With the distribution of subsidized rice, it is hoped that it can be helped a little by the burden of daily life. But sometimes there are things that cause programs that were already well organized and planned to become off-target. For example, what happened in the Central Kalimantan Palangkaraya region, where the region received subsidized Beras Sejahtera (Rastra) but there are still many poor people who have not received assistance, and while those who are able and sufficient to get the assistance.

Problems that occur when determining prospective recipients of subsidized rice assistance are due to difficulties and are limited in conducting detailed assessments and are still utilizing the ledgers in processing the data of prospective recipients of literature and then require a careful and long time in selecting prospective recipients because there are criteria factors taken into account. So, in this study, researchers make a decision solution[3] that can be produced quickly, easily and without having to spend a lot of paper. This research used two methods of SAW and TOPSIS. The research that was carried out wanted to obtain an analysis of the results of the use of 2 methods, so that, the best method in making the decision to determine the provision of literature in Indonesia (case study: Palangkaraya, Central Kalimantan).

MATERIALS AND METHODS

Determination of initial criteria: Research conducted by Rachman[4] that the results of the analysis of recipients of literary assistance in 5 cities surveyed there are variables that appear and vary such as literature recipients dominated by an average age of 45 years (although there are data up to 50 years), then the level of education it was concluded that it was still low (80%), 45% of the work was concentrated as non-agricultural laborers, income not proportional to the condition of the number of family members covered. This has become one of the researcher's references in determining criteria (Table 1).

Sampling data collection method: A sampling of data using quantitative descriptive[5], where data obtained from the sample of the study population were analyzed in accordance with the statistical methods used and then interpreted. This study uses a 50% sample of the population, i.e., 100 community members. The implementation of data collection is to use a questionnaire distributed to respondents in order to get the information needed in preparing the research material and the system to be built (Table 2).

The design calculation SAW: Analyze data by determining benefit criteria that will be used to select prospective recipients of Rastra in Palangkaraya, Central Kalimantan. The criteria for the benefits are determined by the number of dependents, age and criteria. The cost is income, home area and education. Giving weight value to prospective literary recipients, the maximum value is 100. The weighting of raw values on each predetermined criterion which will later be calculated by the Simple Additive Weighting (SAW) method. The weighting of raw values is converted into a matrix:

$$x = \begin{matrix} x_{11} & x_{12} & \cdots & x_{1n} \\ \vdots & \vdots & & \vdots \\ x_{m1} & & \cdots & x_{mn} \end{matrix}$$

Normalization of the value of the benefit criteria determined in the previous weighting. Next, do the normalization process with the maximum value of each

Table 1: Criteria
Criteria	Codes	Weight
Income	C1	0.40
House size	C2	0.30
No. of dependents	C3	0.15
Age	C4	0.10
Education	C5	0.05

Table 2: Preliminary trial data

Name	Income	LR	JT	Age	Education
Sujana	2500000	9	5	54	Elementary School
Sugianto	2100000	8	4	46	Elementary School
Syarifah Hj	450000	4	1	81	No School
Supriyadi	700000	6	5	42	Elementary School
Hawisin	700000	6	2	72	No School
MOH. Ilyas	850000	7	4	43	Elementary School
Satrawi	650000	8	2	58	Middle School
Ismadi	5500000	14	4	56	Bachelor Degree
Masadi	800000	7	3	61	Elementary School
Sudawi	950000	9	3	58	No School
Abdul Gani	500000	5	3	52	Elementary School
Sahri	1500000	10	3	58	Middle School
Sukardi	850000	8	4	57	No School
Juwanda	850000	7	3	57	Middle School
Daini	400000	4	1	70	Elementary School

row and column. Normalization value of the cost criteria that have been determined in the weighting of the previous value. Next, do the normalization process with the minimum value of each row and column.

After all, calculations are completed, the results of these values are entered into a normalized table. Calculating the results of the normalized value with the specified criteria weights:

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{\text{Max } xi_j} \text{ If } j \text{ is the profit it attribute (benfits)} \\ \dfrac{\text{Min } x_{ij}}{x_{ij}} \text{ If } j \text{ is the cost attribute (cost)} \end{cases} \quad (2)$$

The highest value results from the comparison of the final value which later the results will be chosen the greatest value of the ten literary recipient community values. Then the community is eligible to receive literary assistance in Palangkaraya, Central Kalimantan. Done.

The design of the TOPSIS calculation: The next method analysis uses the TOPSIS algorithm where TOPSIS assumes that each criterion will be maximized or minimized. Therefore the value of a positive ideal solution and a negative ideal solution from each criterion is determined and each alternative is considered from that information. The positive ideal solution is defined as the sum of all the best values that can be achieved for each attribute while the negative ideal solution consists of all the worst values achieved for each attribute. The TOPSIS process carried out in this study such as: Making A Normalized Decision Matrix:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad (3)$$

Making a normalized weighted decision matrix. Determine the positive ideal solution matrix and the negative ideal solution matrix:

$$y_{ij} = w_i \, r_{ij} \quad (4)$$

$$A^+ = \left(y_1^+, y_1^+, \dots, y_n^+\right) \quad (5)$$

$$A^- = \left(y_1^-, y_2^-, \dots, y\overline{n}\right) \quad (6)$$

Determine the distance between the values of each alternative with the positive ideal solution matrix and the negative ideal solution matrix. The distance between Ai alternatives and positive ideal solutions:

$$D_i^+ = \sqrt{\sum_{j=1}^{n} \left(y_{ij} - y_j^+\right)^2} \quad (7)$$

where i = 1, 2, 3, …, n. The distance between the alternative Ai with the negative ideal solution:

$$D_i^- = \sqrt{\sum_{j=1}^{n} \left(y_{ij} - y_j^-\right)^2} \quad (8)$$

where i = 1, 2, 3, …, n. Calculate the preference value for each alternative:

$$V_i = \frac{D_i^-}{D_i^- + D_i^+} \quad (9)$$

where, $0 < V_i < 1$ and i = 2, 3, ..., m.

RESULTS AND DISCUSSION

Preliminary data in matrix form at SAW (Table 3). Normalization of cost and benefit value calculation

Table 3: SAW data matrix

Names	PE	LR	JT	U	PD
Sujana	3	3	3	4	3
Sugianto	4	3	2	3	3
Syarifah hj	5	5	1	5	5
Supriyadi	4	4	3	3	5
Hawisin	4	4	1	5	5
Moh.ILYAS	4	4	2	3	5
Satrawi	4	3	1	4	5
Ismadi	2	1	2	5	1
Masadi	4	4	2	5	5
Sudawi	3	3	2	4	5

Table 4: Normalization of cost and benefits

Values

1	2	3	4	5
0.666667	0.333333333	1	0.8	0.333333333
0.5	0.333333333	0.666667	0.6	0.333333333
0.4	0.2	0.333333	1	0.2
0.5	0.25	1	0.6	0.2
0.5	0.25	0.333333	1	0.2
0.5	0.25	0.666667	0.6	0.2
0.5	0.333333333	0.333333	0.8	0.2
1	1	0.666667	1	1
0.5	0.25	0.666667	1	0.2
0.666667	0.333333333	0.666667	0.8	0.2

Table 5: Normalized results x criteria weights

Results	Names	No. not sort yet
0.6133333	Sujana	2
0.4766667	Sugianto	8
0.38	Syarifah hj	14
0.495	Supriyadi	5
0.435	Hawisin	12
0.445	Moh. Ilyas	10
0.44	Satrawi	11
0.95	Ismadi	1
0.485	Masadi	7
0.5566667	Sudawi	4
0.43	Abdul Gani	13
0.6091667	Sahri	3
0.49	Sukardi	6
0.465	Juwanda	9
0.36	Daini	15

The next process of entering values into the R matrix is the normalized factor shown in the following matrix (Table 4).

Normalized data calculation with criteria weights: After getting the normalized factor table then multiply each column in Table 5 by the weight of the criteria that have been declared previously using Eq. 5, the calculation of comparison with the weight of the criteria that we have declared, examples of calculations as below and so on for each alternative.

SAW results: Then the alternative that has the highest value and can be chosen to receive welfare rice (rastra) is shown in Table 6. Preliminary data in matrix form at TOPSIS (Table 7).

Table 6: Final results of the SAW

Names	Sorting
Ismadi	0.95
Sujana	0.6133333
Sahri	0.6091667
Sudawi	0.5566667
Supriyadi	0.495
Sukardi	0.49
Masadi	0.485
Sugianto	0.4766667
Juwanda	0.465
Moh. Ilyas	0.445
Satrawi	0.44
Hawisin	0.435
Abdul Gani	0.43
Syarifah HJ	0.38
Daini	0.36

Table 7: Preliminary data of the TOPSIS matrix

Names	PE	LR	JT	U	PD
Sujana	3	3	3	4	3
Sugianto	4	3	2	3	3
Syarifah HJ	5	5	1	5	5
Supriyadi	4	4	3	3	5
Hawisin	4	4	1	5	5
Moh.Ilyas	4	4	2	3	5
Satrawi	4	3	1	4	5
Ismadi	2	1	2	5	1
Masadi	4	4	2	5	5
Sudawi	3	3	2	4	5
Abdul Gani	4	5	2	3	5
Sahri	3	2	2	4	4
Sukardi	4	3	2	4	5
Juwanda	4	4	2	4	5
Daini	5	5	1	4	5

Normalization matrix: The next process of entering values into the R matrix is the normalized factor shown in the following matrix (Table 8).

Positive and negative ideal matrix: After getting the normalized alternative matrix, then next calculate the normalized weight rating as shown in the matrix results in Table 9.

Positive (A+) and Negative ideal (A-) calculations: Table 10 shows the results of the calculation of a positive ideal solution and a negative ideal solution.

The distance between the values of each alternative with the positive ideal solution matrix and the negative ideal solution matrix (Table 11). Results of calculation of preference values for each alternative (Table 12).

Comparison of SAW and TOPSIS results: The results of the comparison of SAW and TOPSIS calculations are shown in Table 13.

Table 8: Normalization of TOPSIS data

Values				
1	2	3	4	5
0.2	0.209529	0.393919	0.254000254	0.170389
0.266666667	0.209529	0.262613	0.190500191	0.170389
0.333333333	0.349215	0.131306	0.317500318	0.283981
0.266666667	0.279372	0.393919	0.190500191	0.283981
0.266666667	0.279372	0.131306	0.317500318	0.283981
0.266666667	0.279372	0.262613	0.190500191	0.283981
0.266666667	0.209529	0.131306	0.254000254	0.283981
0.133333333	0.069843	0.262613	0.317500318	0.056796
0.266666667	0.279372	0.262613	0.317500318	0.283981
0.2	0.209529	0.262613	0.254000254	0.283981
0.266666667	0.349215	0.262613	0.190500191	0.283981
0.2	0.139686	0.262613	0.254000254	0.227185
0.266666667	0.209529	0.262613	0.254000254	0.283981
0.266666667	0.279372	0.262613	0.254000254	0.283981
0.333333333	0.349215	0.131306	0.254000254	0.283981

Table 9: Positive and negative ideal matrix

Values				
1	2	3	4	5
0.08	0.062859	0.059088	0.0254	0.008519
0.106667	0.062859	0.039392	0.01905	0.008519
0.133333	0.104765	0.019696	0.03175	0.014199
0.106667	0.083812	0.059088	0.01905	0.014199
0.106667	0.083812	0.019696	0.03175	0.014199
0.106667	0.083812	0.039392	0.01905	0.014199
0.106667	0.062859	0.019696	0.0254	0.014199
0.053333	0.020953	0.039392	0.03175	0.00284
0.106667	0.083812	0.039392	0.03175	0.014199
0.08	0.062859	0.039392	0.0254	0.014199
0.106667	0.104765	0.039392	0.01905	0.014199
0.08	0.041906	0.039392	0.0254	0.011359
0.106667	0.062859	0.039392	0.0254	0.014199
0.106667	0.083812	0.039392	0.0254	0.014199
0.133333	0.104765	0.019696	0.0254	0.014199

Table 10: Calculation results for A+& A-

Ideal positif (A+)	0. 133333333	0. 104765	0. 059088	0. 031750032	0. 014199
Ideal negatif (A-)	0. 053333333	0. 020953	0. 019696	0. 019050019	0. 00284

Table 11: Calculation of the distance of values for each alternative

Results D^{+}_{i}	Results D^{-}_{i}
0.06836	0.063965
0.055215	0.070857
0.039392	0.11711
0.036214	0.092067
0.051979	0.084178
0.041223	0.085514
0.063712	0.069064
0.118074	0.023435
0.039218	0.086452
0.070914	0.054995
0.035501	0.101911
0.085041	0.040632
0.053809	0.071818
0.039729	0.085749
0.0399	0.116592

Table 12: Preference values

Criteria (C)	No.	Name not sort yet	Results	Not yet ordered	No. after sort	Sort name
C1	0.483392	3	Sujana	0.748297	1	Syarifah Hj
C2	0.562037	15	Sugianto	0.745033	2	Daini
C3	0.748297	11	Syarifah HJ	0.741644	3	Abdul Gani
C4	0.717701	4	Supriyadi	0.717701	4	Supriyadi
C5	0.618241	9	Hawisin	0.687927	5	Masadi
C6	0.674734	14	Moh. Ilyas	0.68338	6	Juwanda
C7	0.520155	6	Satrawi	0.674734	7	Moh. Ilyas
C8	0.165611	5	Ismadi	0. 618241	8	Hawisin
C9	0.687927	13	Masadi	0. 571674	9	Sukardi
C10	0.436786	2	Sudawi	0. 562037	10	Sugianto
C11	0.741644	7	Abdul Gani	0. 520155	11	Satrawi
C12	0.323316	1	Sahri	0. 483392	12	Sujana
C13	0.571674	10	Sukardi	0. 436786	13	Sudawi
C14	0.68338	12	Juwanda	0. 323316	14	Sahri
C15	0.745033	8	Daini	0.165611	15	Ismadi

Table 13: Comparison of SAW & TOPSIS results

SAW		TOPSIS		
Names	Rank values	No.	Names	Rank values
Ismadi	0.95	1	Syarifah HJ	0.748297212
Sujana	0.6133333	2	Daini	0.745033053
Sahri	0.6091667	3	Abdul Gani	0.741644193
Sudawi	0.5566667	4	Supriyadi	0.717701077
Supriyadi	0.495	5	Masadi	0.687927213
Sukardi	0.49	6	Juwanda	0.683379922
Masadi	0.485	7	Moh. Ilyas	0.674734252
Sugianto	0.4766667	8	Hawisin	0.618241136
Juwanda	0.465	9	Sukardi	0.571674261
Moh. Ilyas	0.445	10	Sugianto	0.562036716
Satrawi	0.44	11	Satrawi	0.520154714
Hawisin	0.435	12	Sujana	0.483392041
Abdul Gani	0.43	13	Sudawi	0.436785514
Syarifah HJ	0.38	14	Sahri	0.323315798
Daini	0.36	15	Ismadi	0.1656112

CONCLUSION

Based on the research conducted, the following are obtained: the results obtained from the data used are simulation data where the SAW method produces Ismadi in the first order of literary recipients who are entitled to the final value of the alternative, V9 = 0,95. While the TOPSIS method produces different literary recipients in the first order, namely Syarifah Hj. The relative closeness to the recipient of Syarif Hj is C3 = 0.7483. The results of both methods if analyzed with the criteria/rating of importance used the TOPSIS results are much closer to the decision that can be taken because C3 is in first place with a value of 0.7483 and income criteria = 450,000, LR = 4, JT = 1, age = 81 and education = not elementary school. While the SAW results that produce V9 = 0,95 and income criteria = 5,500,000, LR = 14, JT = 4, age = 56 and education = Bachelor Degree Analysis of SAW-based on results and criteria can be an alternative decision after TOPSIS.

Utilization of the TOPSIS method in making decisions determining the provision of RASTRA to the community in Palangkaraya, Central Kalimantan is an alternative decision for the government or those who implement it to accelerate decisions and facilitate literary distribution in the community.

REFERENCES

01. Eniyati, S., 2011. [Design of a decision support support system for scholarship acceptance by the SAW (Simple Additive Weighting) method (In Indonesian)]. J. Dyn. Inf. Technol., 16: 171-176.

02. TNP2K., 2017. Subsidized raskin-rice for low-income communities. National Team for the Acceleration of Poverty Reduction (TNP2K), Jakarta, Indonesia.

03. Manurung, P., 2010. Scholarship recipient selection support system using AHP and TOPSIS method (case study: FMIPA USU). BCS Thesis, University of North Sumatra, Medan, Indonesia.

04. Rachman, B., A. Agustian and N. Wahyudi, 2018. [Effectiveness and perspective of the implementation of the prosperous rice program (Rastra) and non-cash food aid (BPNT) (In Indonesian)]. Agric. Policy Anal., Vol. 16, No. 1. 10.21082/akp.v16n1.2018.1-18.

05. Sugiyono, 2003. Business research methods. Ministry of Education Language Center, Bandung, Indonesia.