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NON-CASH FOOD ASSISTANCE PROGRAM BENEFICIARIES BASED ON COPRAS AND CODAS

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Abstract—*Determination of recipients of the Non-Cash Food Assistance Program (BPNT) is a matter that causes problems if it is not carried out in an objective, transparent, and targeted manner. Previous studies on BPNT were based on a specific method, which did not use a negative trend in the criteria. In this study, the Multi-Criteria Decision Making (MCDM) approach was used to recommend the recipients of the BPNT program in Tambelan Sampit Sub-district, Pontianak. MCDM is a technique of a Decision Support System that functions to support policymakers in making more objective decisions. Two MCDM models were used in this study, namely COPRAS and CODAS. This study aimed to determine the best model and measure the degree of similarity between the results obtained from different methods based on the Spearman rank correlation method Spearman's rank correlation method was used to determine the best model and measure the degree of similarity between the results obtained from different models. Spearman rank correlation shows that COPRAS and CODAS have a strong positive correlation of 0.89899. The combined COPRAS-CODAS ranking model produces a very strong positive correlation value of 0.9744 for both methods, so the model is used for recommendations for BPNT program recipients.*

Keywords: *BPNT, CODAS, COPRAS , MCDM, Spearman Rank Correlation*

Intisari— Penetapan penerima Program Bantuan Pangan Non Tunai (BPNT) merupakan hal yang menimbulkan permasalahan jika tidak dilaksanakan secara objektif, transparan, dan tepat sasaran. Studi sebelumnya tentang BPNT didasarkan pada metode tertentu, yang tidak menggunakan tren negatife pada kriteria. Pada penelitian ini, pendekatan *Multi-Criteria Decision Making* (MCDM) digunakan untuk rekomendasi penerima program BPNT pada Kelurahan Tambelan Sampit, Pontianak. MCDM merupakan bagian dari Sistem Pendukung Keputusan yang berfungsi untuk mendukung pemangku kebijakan dalam pengambilan keputusan yang lebih objektif. Dua model MCDM digunakan dalam penelitian ini, yaitu COPRAS dan CODAS. Tujuan penelitian ini adalah menentukan model terbaik dan mengukur tingkat kesamaan antara hasil yang diperoleh dari metode yang berbeda berdasarkan metode korelasi rank Spearman. Metode korelasi rank Spearman digunakan untuk menentukan model terbaik dan mengukur tingkat kesamaan antara hasil yang diperoleh dari model yang berbeda. Korelasi rank Spearman menunjukkan bahwa COPRAS dan CODAS memiliki korelasi positif kuat sebesar 0.89899. Model gabungan ranking COPRAS-CODAS menghasilkan nilai korelasi positif sangat kuat sebesar 0.9744 terhadap kedua metode, sehingga model tersebut digunakan untuk rekomendasi penerima program BPNT.

Kata Kunci*: BPNT, CODAS, COPRAS, MCDM, Spearman Rank Correlation.*

INTRODUCTION

The Non-Cash Food Assistance Program, also known as BPNT, is a government program to help poor people who lack food so that they can get food for household needs [1]. BPNT is a food-specific social program distributed non-cash from the government to beneficiary families every month through an electronic money mechanism that is used only to buy food at food vendors called E-warong, in collaboration with channeling banks [2]. Candidates for BPNT recipients are people who are proposed by the head of the Neighbourhood to the Urban village, and then the community data is managed by the Social Service [3]. The success of the BPNT program is based on the achievement of the 6T indicators, namely Right on target, Right quantity, Right price, Right time, Right quality, and Right administration[1].

To achieve targeted indicators for prospective BPNT recipients to be more objective, researchers [3] used the Composite Performance Index (CPI) to determine the priority of BPNT recipients in Sampit Pontianak Village. In this study, 14 assessment criteria were used to obtain the priority ranking of BPNT recipients. However, negative trends were not used in the criteria.

CPI is one method to solve ranking problems. Other methods that can overcome the ranking are COmplex proportional assessment (COPRAS) and COMBinative Distance-based Assessment (CODAS). According to Zavadskas, et al. in [4] the COPRAS method is a Multi-Criteria Decision Making (MCDM) method that is used to evaluate alternatives where the ratio based on two measures, the sum of the performance of the favorable criteria and the sum of the unfavorable criteria. The COPRAS method is used for the assessment of ICT development in G7 countries [5], vulnerability mapping of sub-watershed erosion [6], green logistics and green supply chain management [7], Decision Making for New Student Admissions at MTsN Bangkalan [8], motorcycle selection Electricity [9], multi-criteria decision making for hybrid wind power plants [10], Supplier Selection at ABC Mining Companies in Indonesia [11], and Determination of Potential Zones for the Pasir Batu Mine [12].

Ghorabaee et al. developed CODAS in 2016 to address the ranking issue. This method uses Euclidean distance as the primary measure and Taksicab distance as a secondary measure, and this distance is calculated based on the negative-ideal point. The CODAS method's alternatives that have a long distance are more desirable [13]. CODAS method was used in research on the weighting parameters of the CODAS method [14], Material Selection [15], Agricultural Supplier Selection [16], studies on heat transfer optimization [17], and Evaluation of the Usefulness of Multi-Criteria Health Applications in Type 2 Diabetes Mellitus [18].

In contrast to research [3] , this study will use the criteria of benefits and costs as part of the algorithm contained in COPRAS and CODAS.

This study aims to determine the best model and measure the similarity between the results obtained from different methods based on the Spearman rank correlation method on priority BPNT recipients in Tambelan Sampit Village, Pontianak. The method used in this research is COPRAS and CODAS. In addition, we propose a combined model of COPRAS and CODAS means and quantify the results of Spearman's correlation of the model against the COPRAS and CODAS methods.

MATERIALS AND METHODS

Materials

At this stage, the value of the sub-criteria data in the form of text is converted into numerical data so that it can be calculated using the COPAS and CODAS methods. There are 11 Benefits Criteria and 3 cost criteria in this research.

Table 1. Criteria and Value

Criteria	Benefit / Cost	Value (%)
Building ownership	Benefit	18
The widest type of floor	Benefit	8
The widest type of wall	Benefit	8
The widest type of roof	Benefit	5
Source of drinking water	Benefit	5
How to get drinking water	Benefit	5
Main source of light	Benefit	7
Main fuel/energy for cooking	Benefit	5
Toilet facility users	Benefit	6
Toilet type	Benefit	5
Final disposal of feces	Benefit	4
Surface area	Cost	11
Number of Bedrooms	Cost	8
Installed PLN power	Cost	5

This study uses the categories of benefits and costs, as in table 1, which are not included in the study [3]. Another difference is the criteria for Land Area, Number of Bedrooms, and If it is PLN electricity, then the installed power uses numerical data filled in by the BPNT recipient.

Methods

This study will use the COPRAS and CODAS methods for recommendations for BPNT Program beneficiaries. The data used in this study comes from research [3]. Calculations were performed using COPRAS based on the method in the study [9]

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and CODAS based on the method in the study [16]. The research stage of this research can see in Figure 1.

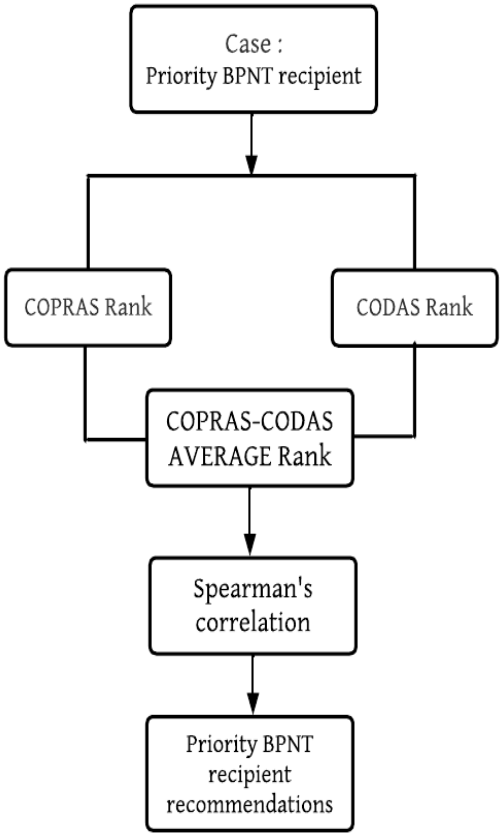

Figure 1. Research Stage

Based on figure 1, there are several stages of research conducted, including:

1. Anasila case. In this study, a case analysis was carried out related to the problems that occurred in the Tambelan Sampit Sub-district Pontianak to determine the priority of BPNT recipients so that they were right on target.
2. The calculation process uses the COPRAS method to obtain BPTN beneficiary rankings based on the quantitative utility value (Ui) from the order of the largest Ui to the smallest Ui value. Calculations also use the CODAS method to obtain the ranking of BPNT recipients based on the assessment score (Hi) value by sorting the highest value to the smallest Hi value.
3. Ranking using the average COPRAS-CODAS ranking. This ranking uses as a research [6], which carried out the final ranking based on the average ranking of the 4 MCDM methods.
4. Perform Spearman correlation calculations to measure the similarity between the ratings of the two MCDM models. If the average correlation value of COPRAS-CODAS to COPRAS or CODAS is better than the correlation between CODAS and COPRAS, then a recommendation for beneficiaries of the BPNT Program will be given based on the average rating of COPRAS-CODAS.
5. Provide priority recommendations for BPNT recipients based on the average COPRAS-CODAS ranking

RESULTS AND DISCUSSION

We used 30 data alternative from the study [3]. Data is processed using the steps of the COPRAS and CODAS methods.

Step 1-6 from COPRAS methods generate value S_{+i} , S_{-i} , and Q_i, as in Table 2. *S_(+i)* and *S_(-i)* are the sum of the maximum and a sum of minimum weighted values. Q_i is the relative significance of the alternatives.

Table 2. The results from steps 1 to 6 use the COPRAS method

Alternative	Si+	Si-	Qi
A1	0.024	0.008	0.031
A2	0.025	0.008	0.033
A3	0.021	0.009	0.028
A4	0.024	0.006	0.034
A5	0.022	0.008	0.03
A6	0.028	0.008	0.036
A7	0.03	0.006	0.04
A8	0.026	0.012	0.031
A9	0.024	0.008	0.032
A10	0.024	0.011	0.03
A11	0.024	0.011	0.029
A12	0.023	0.008	0.031
A13	0.019	0.006	0.028
A14	0.033	0.009	0.039
A15	0.024	0.005	0.037
A16	0.025	0.008	0.032
A17	0.031	0.005	0.044
A18	0.023	0.005	0.036
A19	0.022	0.008	0.03
A20	0.027	0.006	0.037
A21	0.023	0.007	0.032
A22	0.032	0.009	0.038
A23	0.024	0.009	0.031
A24	0.023	0.009	0.03
A25	0.031	0.009	0.038
A26	0.034	0.005	0.047
A27	0.022	0.008	0.03
A28	0.022	0.009	0.029
A29	0.028	0.011	0.034
A30	0.021	0.009	0.028

The final results of the COPRAS method can see in Table 3. Ui value is the quantitative utility for the alternative. Rank the solution from top value to bottom value of quantitative utility (Ui).

Table 3. Results of COPRAS method

Alternative	Ui Value	Rank
A1	65.56	17
A2	69.31	13
A3	58.30	30
A4	71.14	12
A5	63.83	21
A6	76.05	9
A7	84.22	3
A8	65.36	18
A9	67.28	15
A10	62.87	24
A11	61.91	26
A12	65.32	19
A13	59.06	29
A14	82.16	4
A15	78.28	7
A16	68.04	14
A17	93.11	2
A18	75.46	10
A19	63.13	22
A20	77.79	8
A21	66.81	16
A22	80.06	5
A23	64.88	20
A24	62.93	23
A25	80.00	6
A26	100.00	1
A27	62.51	25
A28	60.93	27
A29	71.46	11
A30	59.08	28

The ranking generated by COPRAS method is as follows:

A26>A17>A7>A14>A22>A25>A15>A20>A6>A18>
A29>A4>A2>A16>A9>A21>A1>A8>A12>A23>
A5>A19> A24>A10>A27>A11>A28>A30>A13>3.

Tabel 4 is final results of the CODAS method. Hi value is an assessment score for each possibility. Sort the possibilities by decreasing the assessment score value Hi. The option with the highest is the best.

Table 4. Results of CODAS method

Alternative	Hi Value	Rank
A1	-0.834	11
A2	-1.351	16
A3	-1.629	26
A4	-1.366	17
A5	-1.561	23
A6	2.320	7
A7	3.948	3
A8	-1.491	19
A9	-0.309	10
A10	-1.795	29
A11	-1.658	27
A12	-1.435	18
A13	-1.568	25
A14	2.761	6
A15	-1.063	14
A16	-0.917	12
A17	4.750	2
A18	-0.955	13
A19	-2.174	30
A20	0.507	9
A21	-1.549	22
A22	3.480	4
A23	-1.500	20
A24	-1.518	21
A25	3.302	5
A26	6.572	1
A27	-1.298	15
A28	-1.567	24
A29	1.641	8
A30	-1.742	28

The ranking generated by CODAS method is as follows:

A26>A17>A7>A22>A25>A14>A6>A9>A20>A9>A1
>A16>A18>A15>A27>A2>A4>A12>A8>A23>A24>
A21>A5>A28>A13>A3>A11>A30>A10>A19

With Spearman rank correlation, the correlation value between COPRAS and CODAS methods is 0.89899. It means that the ranking results using the COPRAS and CODAS methods have a strong positive correlation. Due to the strong correlation of methods, the ranking results of the two methods can average to obtain recommendations for prospective recipients of BPNT in Sampit Pontianak Village. The final results of the Average Rank can see in Table 5.

Table 5. Result of Average Rank

Alternative	COPRAS Rank	CODAS Rank	AVERAGE Rank
A1	17	11	14
A2	13	16	15
A3	30	26	28
A4	12	17	15
A5	21	23	22
A6	9	7	8
A7	3	3	3
A8	18	19	19
A9	15	10	13
A10	24	29	27
A11	26	27	27
A12	19	18	19
A13	29	25	27
A14	4	6	5
A15	7	14	11
A16	14	12	13
A17	2	2	2
A18	10	13	12
A19	22	30	26
A20	8	9	9
A21	16	22	19
A22	5	4	5
A23	20	20	20
A24	23	21	22
A25	6	5	6
A26	1	1	1
A27	25	15	20
A28	27	24	26
A29	11	8	10
A30	28	28	28

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The correlation between COPRAS, CODAS, and the average ranking using COPRAS and CODAS can see in Table 5.

Table 6. Spearman Rank Correlation obtained by different MCDM

	COPRAS	CODAS	COPRAS -CODAS AVERAGE
COPRAS	1	0.89899	0.9744
CODAS	0.89899	1	0.9744
	COPRAS	CODAS	COPRAS -CODAS AVERAGE
COPRAS - CODAS AVERAGE	0.9744	0.9744	1

From Table 6, it can see that the correlation value between COPRAS and the average rank of COPRAS and CODAS, with the correlation value between CODAS and the average rank of COPRAS and CODAS, is equal to 0.9744. This means that the nature of the correlation is very strong and positive, so it can be recommended for ranking.

Recommendations for recipients of BPNT funds from Sampit Pontianak Village based on the average ranking using the COPRAS and CODAS methods are as follows:

COPRAS-CODAS average rank:

A26>A17>A7>A22>A14>A25>A6>A20>A29>A15>A18>A9>A16>A1>A2>A4>A8>A12>A21>A23>A27>A5>A24>A28>A19>A10>A11>A13>A3>A30.

CONCLUSION

In this study, recommendations for prospective recipients of BPNT in Sampit Pontianak Village were obtained from ranking using the COPRAS, CODAS, and average rankings from COPRAS and CODAS, to overcome the achievement of the right target indicator, which is one indicator of the success of the BPNT program. The ranking generated by the COPRAS method differs from the CODAS method ranking. Still, it has a Spearman correlation value of 0.89899, which means it has a strong positive correlation. The average ranking of the COPRAS and CODAS methods has a very strong positive trait with a value of 0.9744 for both methods, so the rankings generated from the average COPRAS and CODAS rankings can use to determine the prospective BPNT recipients in Sampit Pontianak Village.

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