Optimization of Aid Recipient Selection during the COVID-19 Pandemic

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Abstract

The COVID-19 pandemic not only affects global health, but it also affects the global economy (including the Indonesian economy). This is indicated by the decline in Indonesia's gross domestic product in the first and second quarters. This prompted the Indonesian government to take strategic economic steps, including direct cash transfers to village funds. However, the implementation of direct cash assistance to village-level funds has caused many problems. For example, providing these funds to financially capable parties has led to direct cash assistance to village-level funds with unclear objectives. Therefore, we propose the ELECTRE method in building a decision information system that targets direct cash transfers to village funds. It is hoped that the ELECTRE method can help the Indonesian government to formulate a village-level fund recipient policy so that the assistance will be realized as scheduled.

Keywords: Decision Support Systems, Covid-19, Direct Cash Transfers, ELECTRE, Optimization.

1. Introduction

The Indonesian government's main means of maintaining the purchasing power of the people and solving social and economic problems during the current economic crisis is the social assistance program, but it seems to have encountered many difficulties in its distribution process. From upstream to downstream, almost all production lines have problems. In the upstream, there are problems related to the validity of social assistance recipient data, while in the downstream, problems usually arise due to improper distribution of social assistance in the community. This article aims to make some contributions to optimize the selection of recipients by countries, especially during the COVID-19 pandemic.

For almost all countries, the long-term economic turmoil seems to be a frightening specter. Since 2018, due to the increasing populist policies adopted by influential countries, including the trade war between the United States (U.S.) and China, and other external factors, such as the decline in commodity prices and trade volume, the world economy has been slowing down. Under such circumstance, some countries have exhausted all their ideas and cannot continue to promote economic growth in a positive direction. However, from the end of 2019 to the beginning of 2020, the spread of the COVID-19 outbreak and its devastating effects have burdened the world economy. Some institutions, including the International Monetary Fund (IMF) and the Economist Intelligence Unit (EIU), have revised their economic forecasts. None of the 2020 economic growth forecasts show a positive trend **(Suryahadi et al., 2020)**.

At a press conference in early April 2020, the Indonesian Ministry of Finance introduced two scenarios of the country's economic growth performance that are likely to occur in 2020 (-0.4% to 2.3%). These scenarios are the same as the predictions of **(Hirawan, 2020)**. In (Suryahadi et al., 2020), for the pessimistic and status quo scenario (0-3%) and the super pessimistic scenario, the range is -1.3%-4.7%. Unfortunately, the data from three different sources are far from Indonesia's projected economic growth in 2020, which is stated in the National Budget (APBN) at 5.3%.

The economic downturn due to the spread of COVID-19 is similar to a drama series; it is a continuation or addition to the series related to the economic slowdown in the previous series. Low- and middle-income families have already begun to feel the downturn in the Indonesian economy. It began to slow down since 2018 and was aggravated by the COVID-19 storm, but there is no conclusion yet. The uncertainty affects several components of economic growth, from household consumption to the trade sector. Apart from having an impact on the economy, COVID-19 has also had a major impact on the education sector **(Andar Gunawan Pasaribu & Frainskoy Rio Naibaho, 2021)**.

In Indonesia, the composition of household consumption is indeed a very serious problem. The 2008 economic and financial crisis reminded us that despite the impact of the economic turmoil, the household consumption sector prompted Indonesia's economy to still grow at a rate of about 4% in 2009. This happened because Indonesia's gross domestic product (GDP) structure by expenditure is mainly contributed by the household consumption sector (55-60%), which also forms 30% of total fixed capital formation or investment **(Suryahadi et al., 2020)**.

At the same time, the current spread of COVID-19 has had a very significant impact on household consumption in Indonesia. The implementation of PSBB (large-scale social restrictions) in many regions, especially in big cities in Indonesia's economic boom such as Jakarta and Surabaya, directly reduced Indonesia's overall economic performance **(Sparrow et al., 2020)**. Markets, offices and other economic activities have experienced a very significant decline. Although most of the implementation of PSBB started in April, the household consumption growth declined (from 4.97% (year-on-year) to 2.84% (year-on-year)) in the first quarter of 2020 (January to March) **(Yuda et al., 2020)**. Considering that the implementation of PSBBs was almost simultaneous in April 2020, the decline in household consumption may be even greater. In other words, by the second quarter of 2020, the decline in household consumption growth may be even more shocking **(Olivia et al., 2020)**.

It is worth noting that since the end of 2019, Indonesia's economic performance has been slowing down due to the global economic slowdown, both of which stem from external turbulence (e.g. trade wars and falling commodity prices) and internal turbulence (including slow structural and bureaucratic reforms, lack of fiscal and monetary performance, and stagnant sources of economic growth). So, the most relevant question is how can we mitigate the deeper weakening caused by the implementation of PSBB? The social assistance program seems to be the answer. However, compared with other financial means designed to maintain household consumption, such plans sometimes cause more problems **(Hirawan, 2020)**.

The Indonesian government released the contents of Presidential Regulation No. 54/2020 (Law No. 1/2020) to alleviate the economic downturn. It was approved as Law No. 1/2020 in May 2020. The government allocated a fiscal stimulus package of 405.1 trillion rupiah to encourage the development of multiple sectors, including health (75 trillion rupiah), industry support (70.1 trillion rupiah), social

safety net (10 trillion rupiah) and economic recovery plan (IDR 150 trillion).

During a pandemic, this social safety net is needed to maintain people's purchasing power. Forecast by the Fiscal Policy Agency (BKF) estimate that Indonesia's poverty population will increase. At the same time, the World Bank and SMERU Institute predict that the number of poor people will increase. Indonesia's poverty rate may return to double-digit levels **(Pradana, Rubiyanti, et al., 2020)**.

Therefore, the social assistance program seems to be the right tool to maintain or at least minimize deeper contraction of Indonesia's economic growth performance. Of the 110 trillion rupiah allocated to the social safety net, 65 trillion rupiah is dedicated to additional social safety nets (PKH, Plan Keluarga Harapan), food packaging (Sembako), pre-employment cards (Kartu Pra Kerja), electricity fee exemptions, discounts, and housing incentives for low-income communities; 25 trillion rupiah is meant to meet basic needs and market operations reserves; 19 trillion rupiah is meant to adjust the education budget for dealing with COVID-19 **(Pradana, Syahputra, et al., 2020)**. Specifically, for the social assistance program, the government also allocated 3.42 trillion rupiah for basic food assistance and 16.2 trillion rupiah for cash assistance (Banturang Langsung Tunai, BLT).

The implementation of direct cash assistance has caused many problems. For example, providing these funds to financially capable parties has led to direct cash assistance to village-level funds with unclear objectives. In implementing the direct cash assistance, there are difficulties caused by the large number of underprivileged village communities and the existence of several criteria used in determining who the recipients of the direct cash assistance are **(Suryahadi et al., 2020)**. For this reason, it is necessary to have an information system to assist in targeting direct cash assistance recipients, such as the decision support system. Decision support systems have often been used in previous research to help make decisions by sampling based on existing categories **(Dehraj & Sharma, 2020a)**.

The ELECTRE method is a multi-criteria decision-making method based on the outranking concept using pairwise comparisons of alternatives based on each appropriate criterion **(Dehraj & Sharma, 2020b)**. ELECTRE method is used in conditions where alternatives that do not meet the criteria are eliminated, and suitable options can be generated **(T. Singh et al., 2020)**. In other words, the ELECTRE method is used for cases with many alternatives, but only a few criteria are involved **(Rouyendegh, 2018)**. The ELECTRE method was chosen because it has a good performance in analyzing policies that involve qualitative and quantitative criteria. This method uses pairwise comparisons of alternatives based on each suitable criterion **(Choi et al., 2015)**. The author proposes the Elimination Et Choix Traduisant La Realite (ELECTRE) method in building an information system for targeting direct cash transfers.

2. Literature Review

2.1. Data Collection Process

In order to protect the poor, the Indonesian government is expanding the Social Safety Net (JPS), including those stipulated in the PDTT Village Ministerial Regulation Number 6 of 2020 concerning Amendments to the Regulation of the Village Minister for PDTT Number 11 of 2019 concerning Priority for the Use of Village Funds, which include the provision of direct cash assistance sourced from the Village Fund (BLT-Village Fund). In order to accelerate the implementation of the BLT-Village Fund, various other policies have been issued, including the

Minister of Home Affairs Instruction Number 3 of 2020 concerning Handling COVID-19 in Villages through the Village Revenue and Expenditure Budget and the Minister of Finance Regulation Number 40 of 2020 concerning Amendments to Minister of Finance Regulation Number 205 of 2019 concerning Village Fund Management. Due to economic pressure, BLT-Village Fund must be implemented quickly and on target, so it needs to be supported by valid and accurate data.

Therefore, the BLT-Village Fund data collection process was prepared by consolidating various regulations that form the legal basis for implementing BLT-Village Fund to help villages understand the technical steps for data collection of potential beneficiaries in accordance with applicable regulations. In its implementation, the data collection process must follow health protocols. The following is the process and mechanism of collecting BLT-Village fund data.

Prospective teachers are at risk for making poor dietary choices that can cause significant health problems. They are unaware of the nutritional requirements to maintain a healthy body weight, they make poor nutritional decision, which can cause poor weight management and health problems. Prospective teachers select food according to convenience, taste, time, and price rather than nutritional values. Poor nutrition due to unhealthy eating habits may lead to delayed puberty, nutrient deficiencies and dehydration, menstrual irregularities, poor bone health, increased risk of injuries, poor academic performance and increased risk of eating disorders. The student teachers who are nutrition under eaters may be affected by anorexia or bulimia. Prospective teachers who do not eat breakfast, or eat an insufficient breakfast, are more likely to have behavioral, emotional and academic problems at college. Prospective teachers who consume unhealthy foods can have trouble concentrating, become easily fatigued, listless or irritable and are likely to face difficulties in learning, which can lead to behavioral and social problems. Teaching prospective teachers about the importance of good nutrition lay the foundation for a healthier and more fulfilling life. Poor eating habits and nutritional knowledge deficits may affect health of the youngsters. Healthy eating habits may help to eliminate carbonated soft drinks and unhealthy junk foods from their routine diets. The high intake of sugar rich and white flour foods such as cookies and cakes will increase the risk of obesity among college students. The significance of this research is to enlighten the prospective teachers about the importance of healthy dietary habits.

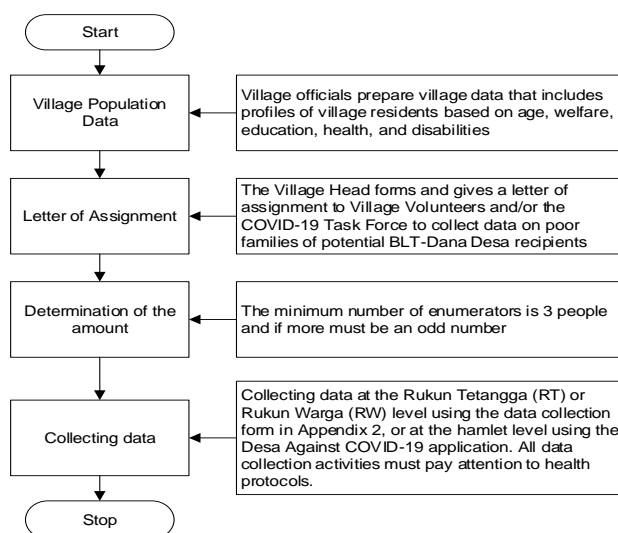**Figure.1** Showing the data collection process for the indonesian BLT-Village Fund.
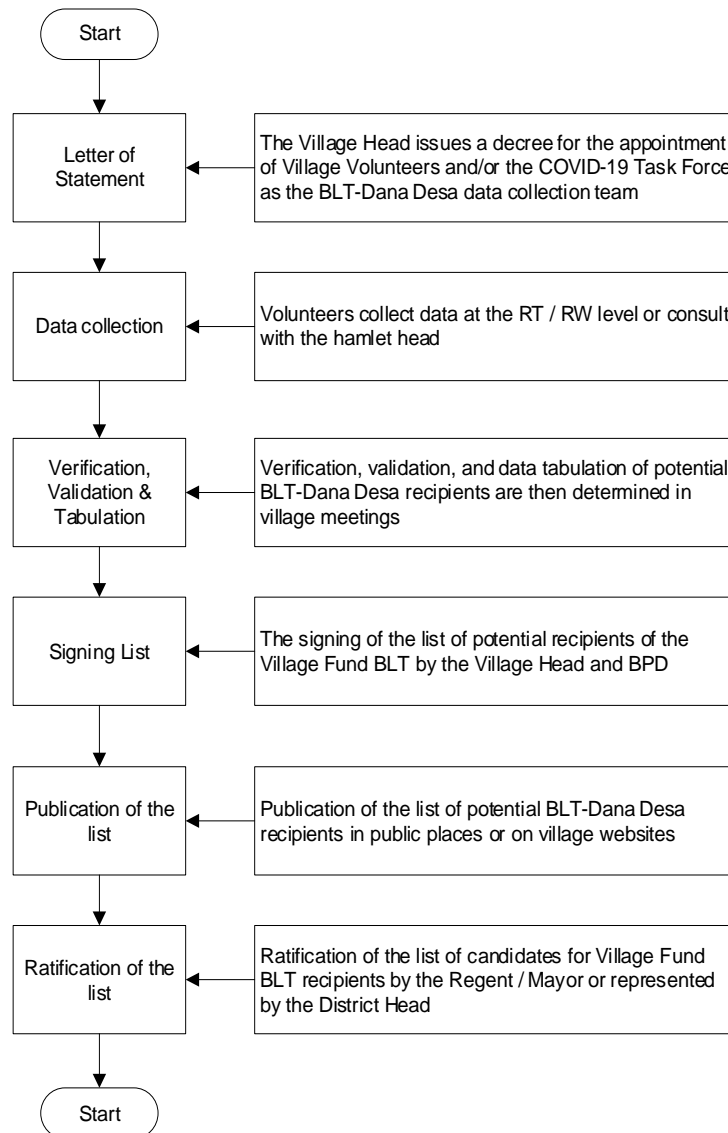
Figure.2 The mechanism for data collection and determination of BLT-Village Fund recipients.

2.2.Step of ELECTRE

The ELECTRE method is widely used in multi-criteria problem-solving. The ELECTRE method proposes an environment impact assessment methodology in the context of urban industrial planning **(Kaya & Kahraman, 2011)**. Hospital performance can be measured based on patient satisfaction and patient care. So, hospitals can be categorized into grades or classes. This can be done because ELECTRE is a multi-criteria decision support system **(A. Singh, 2019)**. Similarly, a research was conducted to determine the location of hospitals based on costs and population **(Kumar et al., 2016)**. Another study applied an ELCTRE approach in assessing the quality of user trust in autonomous computing software system products **(Dehraj & Sharma, 2020a)**. The ELECTRE method is proposed because it is the most effective method, since it has a fuzzy theory that can solve perceptual ambiguities **(Kilic et al., 2020)**. Also, other studies examined the concept of financial integration of several countries to rank international dependency relations in terms of finance. ELECTRE was

chosen because it is a decision based on multiple criteria **(Monaem & Ikram, 2018)**. From several previous studies, the authors concluded that the ELECTRE method is very effective in solving multi-criteria problems and has ambiguity values with the outranking concept. So, the authors used the ELECTRE method in optimizing the determination of direct cash assistance recipients.

- Matrix Normalization

Each attribute is converted into a comparable value. Any normalization of the Xij value can be done with the following formula:

$$r_{xi} = \frac{X_{11}}{\sqrt{\sum_{i=1}^{m} x^2_{i1}}} \qquad (1)$$

i=1,2,3,...,m

j=1,2,3,...,n

So the normalized R matrix is obtained

$$R = \begin{bmatrix} r_{11} & r_{12} & \cdots & r_{1n} \\ r_{21} & r_{22} & \cdots & r_{2n} \\ \cdots & & & \\ r_{m1} & r_{m2} & \cdots & r_{mn} \end{bmatrix}$$

- Weighting on the Normalized Matrix

The calculation is done by giving the weighted value to the matrix that has been normalized by the formula:

$$V = R.W \qquad (2)$$

$$V = \begin{bmatrix} v_{11} & v_{12} & \cdots & v_{1n} \\ v_{21} & v_{22} & \cdots & v_{2n} \\ \cdots & & & \\ v_{m1} & v_{m2} & \cdots & v_{mn} \end{bmatrix} = RW = \begin{bmatrix} w_1 r_{11} & w_2 r_{12} & \cdots & w_n r_{1n} \\ w_1 r_{21} & w_2 r_{22} & \cdots & w_n r_{2n} \\ \cdots & & & \\ w_1 r_{m1} & w_2 r_{m2} & \cdots & w_n r_{mn} \end{bmatrix}$$

Where: R = Decision Matrix Normalization

W = Alternative Weight

- Determine the set of Concordance and Discordance in the Index

The calculation is done by determining the set of concordance and discordance indexes for each alternative pair.

Concordance Index: Ckl = {j, Vkl ≥ Vlj}, untuk j= 1, 2, 3,....n

Discordance Index: Dkl = {j, Vkl < Vlj}, untuk j= 1, 2, 3,....n

- Calculating the Concordance and Discordance Matrices

The calculation of the concordance and discordance matrices is done by adding the weights included in the concordance set with the following formula:

$$Ckl = \sum_{j \in Ckl} wj \qquad (3)$$

The resulting concordance matrix is as follows:

$$C = \begin{bmatrix} - & c_{12} & c_{13} & \cdots & c_{1n} \\ c_{21} & - & c_{23} & \cdots & c_{2n} \\ \cdots & & & & \\ c_{m1} & c_{m2} & c_{m3} & \cdots & - \end{bmatrix}$$

The determination of the value of the elements in the discordance matrix is done by dividing the maximum difference between the criteria included in the discordance subset with the maximum difference between the values of all existing criteria mathematically as follows:

$$d_{kl} = \frac{\{\max(v_{mn} - v_{mm-ln})\}; m,n \; \varepsilon \; D_{kl}}{\{\max(v_{mn} - v_{mm-ln})\}; m,n = 1,2,3,\ldots} \qquad (4)$$

The resulting mismatch matrix is as follows:

$$D = \begin{bmatrix} - & d_{12} & d_{13} & \cdots & d_{1m} \\ d_{21} & - & d_{23} & \cdots & c_{2m} \\ \cdots & & & & \\ d_{m1} & d_{m2} & d_{m3} & \cdots & - \end{bmatrix}$$

- Calculating the Dominant Concordance and Discordance Matrix

This is done by calculating the threshold value of the concordance domain matrix with the following formula:

$$\underline{C} = \frac{\sum_{k=1}^{m} \sum_{l=1}^{m} ckl}{m(m-1)} \qquad (5)$$

- Determining the Aggregate Dominance Matrix

The determination of the aggregate dominance matrix is done with the following formula:

$$ekl = fkl \; x \; gkl \qquad (6)$$

- Elimination of Less Favorable Alternatives

The final result of the calculation is to form a matrix E. Matrix E gives the order of choice of each alternative. So, the row in matrix E which has the number of Ekl = 1 at least can be eliminated. Thus, the best alternative is the alternative that dominates the other alternatives.

2.3. Optimization

Optimization aims to solve a certain problem so that the most favorable conditions are obtained from a certain point of view. Optimization is a process related to input adjustment, characteristic selection, mathematical process, and testing (**Naibaho, 2020, 2021**).

Figure.1 Optimization classification
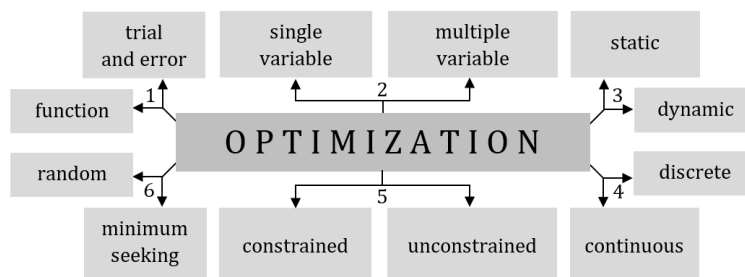
3.Research Methodology

3.1.Proposed method for determination of BLT-Village Fund recipients

Criteria required for the acceptance of BLT-Village Fund recipients are given:

C1: Education

C2: Number of Family Members

C3: Work

C4: Transportation

C5: Income

The suitability rating of each alternative for each criterion is rated 1-5, such that 1 = Very Bad, 2 = Bad, 3 = Fair, 4 = Good, 5 = Very Good. The level of importance used as a preference weight for each performance also has a value of 1-5 with the following conditions: 1 = Very Low, 2 = Low, 3 = Enough, 4 = High, 5 = Very High. The conversion table for the quality value to the numerical value to determine the criteria match rating with alternatives is shown in Table 1:

Table 1. Conversion table of criteria

No	Criteria				
	C1	C2	C3	C4	C5
1	Bachelor	0	Government Employees	Car	> 3 million
2	High School	1	General	Motorcycle	2 - 3 million
3	Junior High	2	Entrepreneur	Bicycle	1 – 2 million
4	Primary School	3	Traders	Public Transportation	600.000 - 1 million rupiah
5	Not attending	>3	Unemployment	Walking	<500.000

In fact, the amount of data used is very large, up to thousands of data. In this study, the author uses only a small amount of data, five pieces of data. As an example of an application based on the above criteria, suppose there are five potential targets for direct cash assistance to village fund in Table 2 as follows:

Table 2. Table of alternative list of assessment

No	Criteria				
	C1	C2	C3	C4	C5 (IDR)
A1	Primary School	2	General	Public	900.000
A2	High School	2	Entrepreneur	Motorcycle	800.000
A3	High School	1	Traders	Car	1.500.000
A4	Junior High School	3	General	Walking	950.000
A5	Primary School	1	General	Public	1.800.000

The suitability rating for each alternative on each criterion is shown in Table 3 as follows:

Table 3. Fitness Rating on Each Alternative

Alternative	Criteria				
	C1	C2	C3	C4	C5
A1	4	3	2	4	4
A2	2	3	3	2	4
A3	2	2	4	1	3
A4	3	4	2	5	4
A5	4	2	2	4	3

The weight values for each alternative are: W = (5, 5, 3, 4, 4). The decision matrix is taken from the suitability table.

$$X=\begin{bmatrix} 4 & 3 & 2 & 4 & 4 \\ 2 & 3 & 3 & 2 & 4 \\ 2 & 2 & 4 & 1 & 3 \\ 3 & 4 & 2 & 5 & 4 \\ 4 & 2 & 2 & 4 & 3 \end{bmatrix}$$

The counting process is carried out from the first to the seventh stage until a ranking is obtained for each participant who is a potential recipient of direct cash assistance.

Finding and Discussion

Results were obtained from the implementation and testing, based on the criteria and calculation process with the Elimination Et Choix Traduisant La Realite (ELECTRE) method, using sample data. After data collection on the criteria for likely villagers to receive village fund, the next stage is calculating each recorded criterion's value. This is followed by making decisions on prospective residents to receive funds, where the parameter is that a total value of more than 8.1 is a recipient of village fund.

The results of calculations obtained by the ELECTRE method, based on the case example, indicate that A4 has a value of 11.26 and A2 has a value of 8.46. From this calculation, it can be obtained that only two people are entitled to receive village funds, with a total value of 8.46 in A2 and 11.26 in A4. These results indicate the success of the built-in system in determining village fund recipients following the assumptions of the criteria for village fund recipients that have been mentioned earlier.

Conclusion and Further Research

Based on the analysis and discussion of this study, the authors draw general conclusions about the overall material of the study regarding the application of the Elimination Et Choix Traduisant La Realite (ELECTRE) method in the Village Fund Selection Decision Support System, which aims to improve government performance in the process of distributing village funds quickly and on target. The government can easily make calculations based on the data obtained from each village. Decisions that are multi-criteria and ambiguous in nature can be resolved by the ELECTRE method with a ranking scale.

Suggestions for improving this research include adding to the criteria for potential village fund recipients to make it more suitable to the conditions faced in each of the village fund recipient areas. It is also recommended that it is tried using other methods, such as VIKOR, MOORA and others. The variables used by the authors are still general in nature. It is recommended that other variables be added to be tested, as well as a wider scale.

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