JURIKOM (Jurnal Riset Komputer), Vol. 12 No. 4, Agustus 2025
e-ISSN 2715-7393 (Media Online), p-ISSN 2407-389X (Media Cetak)
DOI 10.30865/jurikom.v12i4.8854
Hal 648-658
https://ejurnal.stmik-budidarma.ac.id/index.php/jurikom

Determining Citizens Eligibility for Cash Assistance Using the BORDA Method

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Submitted **08-07-2025;** Accepted **22-08-2025;** Published **30-08-2025**

Abstract

The Bandar Lama Village Head Office has implemented a Direct Cash Assistance distribution system as an effort to help underprivileged people meet their daily needs. However, the selection process for aid recipients is still carried out manually and conventionally, which has the potential to cause inaccuracy in targeting, human error, and low time efficiency and accuracy of decision making. The absence of an integrated digital system and the use of selection methods that are not yet based on criteria weighting have caused inequality in the distribution of aid, leading to complaints from community members and ineffective program implementation. To overcome these problems, this study proposes the implementation of a web-based Decision Support System using the BORDA method. The BORDA method is a multi-criteria decision-making approach that allows for systematic evaluation of multiple criteria simultaneously, providing more objective and consistent results in the selection process. This system incorporates various socio-economic indicators such as income level, family size, housing conditions, and employment status to ensure comprehensive assessment of each applicant's eligibility. Based on the results of the BORDA method calculation on 30 tested resident data, it was obtained that a resident named Tomy had the highest score of 70, followed by Ranto Simanjuntak with a score of 70, and Marianik with a score of 67. With this BORDA method-based system, aid distribution in Bandar Lama Village can be carried out more accurately, fairly, and transparently, ultimately improving the effectiveness of social assistance programs and ensuring that aid reaches those who need it most.

Keywords: Decision Support System; Direct Cash Assistance; BORDA Method; Eligibility Determination

1. INTRODUCTION

Information technology is a general term that encompasses everything that helps humans create, store, communicate, and disseminate information[1]. By definition, information technology is a field of study that focuses on the design, implementation, development, maintenance, and management of computer-based information systems, both in terms of hardware and software that function to support and improve the quality of information so that it can be accessed by various layers of society quickly and accurately[2].

One form of information technology application that has an important role in various fields is in supporting decision-making processes[3]. Decision Support Systems are flexible and interactive computer-based systems designed to assist management in processing data and analyzing various alternative solutions[4]. These systems are very useful in handling semi-structured or unstructured problems, where decisions cannot be made based solely on standard or routine procedures. One of its applications is in the recipient selection process, where Decision Support Systems can be used to support the process to be more objective, transparent, and accurate in determining Direct Cash Assistance recipients[5].

Direct Cash Assistance is assistance provided by the government to underprivileged families or the poor with the aim of improving their social welfare standards[6]. This assistance aims to alleviate the economic burden that increasingly pressures people's lives, especially as a result of rising prices of daily necessities and fuel prices, which can significantly impact household economies. With the existence of Direct Cash Assistance, it is hoped that underprivileged communities can meet their basic needs, such as food, education, and health, so that their welfare can improve gradually[7]. In addition, this program is also expected to help maintain national economic stability by ensuring that people's purchasing power is maintained, especially for those who are on the poverty line. The government continues to strive to distribute Direct Cash Assistance accurately by using accurate data and transparent systems, so that the benefits of this assistance can be optimally felt by those who truly need it[8]. To obtain Direct Cash Assistance, the government provides several requirements for communities who are entitled to receive such assistance that exist in each village.

Related research supporting the use of the BORDA method in determining the eligibility of aid recipients is a study conducted by Amnur, H., Sisma Putri, N., & Satria, D. (2022) entitled "Group Decision Support System for Determining the Eligibility of Social Assistance Recipients Using the AHP (Analytical Hierarchy Process) and Borda Methods." This study discusses the development of a group decision support system that integrates the AHP and Borda methods to determine the eligibility of social assistance recipients. In this study, the Borda method is used as an aggregation technique to combine the preferences of multiple decision makers in the aid recipient selection process. This study shows that the combination of AHP and Borda can increase objectivity and transparency in the process of determining social assistance recipients, and is able to overcome the problem of subjectivity that often occurs in conventional decision-making. The results of the study demonstrate that the implementation of these two methods in a decision support system can produce a more accurate and fair ranking of aid recipients, so that social assistance can be targeted to people who really need it[9].

Bandar Lama Village is a village located in South Kualuh District, North Labuhan Batu Regency, North Sumatra Province. This village has a population of 18,089 people. Based on research conducted in this area, the poverty level is

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https://ejurnal.stmik-budidarma.ac.id/index.php/jurikom

still quite high, so Direct Cash Assistance is very helpful in daily life for the village community. To address this issue, the Bandar Lama Village Head Office has implemented a social assistance system for poor residents by considering several categories, such as age, number of dependents, income, employment status, housing conditions, chronic disease sufferers, and those who do not receive other social assistance[10]. However, the process of determining assistance recipients in Bandar Lama Village is still often not on target. Some residents who do not meet the criteria actually receive assistance, while those who should be entitled do not get it. In addition, the determination of assistance recipients is still done conventionally, which will consume a lot of time and require high accuracy in decision making[11].

To solve the problem of determining which residents are most entitled to receive Direct Cash Assistance in a more objective, transparent, and efficient manner, the BORDA method is applied. The BORDA method is one of the approaches in multi-criteria decision theory. This method is used to evaluate and establish priorities or rankings of the best alternatives based on preferences given by a number of voters or decision makers[12]. In the process, each alternative will be assessed and ranked by each voter, then calculations are performed to sum the weights of each ranking given. The final result is a list of resident rankings with the highest scores, which can be used as a reference in the decision-making process in a more fair, systematic, and structured manner[13]. Thus, the application of the BORDA method can reduce the level of subjectivity in the selection process and increase accuracy in determining assistance recipients who truly meet the established requirements.

This research produces an application that is useful for analyzing residents who are most eligible to receive assistance and helps staff at the Bandar Lama Village Head Office to accelerate performance in determining social assistance classification, so that errors can be avoided and accurate results can be achieved. The implementation of this web-based Decision Support System using the BORDA method represents a significant improvement over the traditional manual selection process, ensuring that social assistance distribution becomes more systematic, fair, and transparent for the benefit of the community[14].

2. RESEARCH METHODOLOGY

2.1 Research Stages

The research methodology used to determine eligibility for cash assistance recipients using the BORDA method at the Bandar Lama Village Office, as illustrated in Figure 1, encompasses a systematic process from problem identification to decision-making. Each stage of the research is designed to produce objective, transparent, and criteria-based decisions:

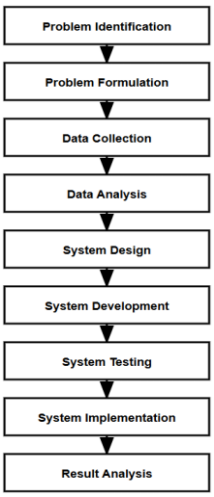

Figure 1. Research Stages

The stages of the research method as seen in the figure above are a series of research implementation steps which can be explained as follows:

a. Problem Identification
   The identified problem is the unavailability of a system that can assist the Bandar Lama Village Head Office in calculating and assessing the eligibility of residents who are entitled to receive Direct Cash Assistance.
b. Problem Formulation
   Problem formulation is a complete and solvable question about the scope of problems that can be researched in the form of identification of these problems.
c. Data Collection
   The researcher conducted observations at the Bandar Lama Village Head Office and interviewed the head of Bandar Lama Village regarding how the process of determining eligibility for direct cash assistance recipients is carried out.
d. Data Analysis

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Hal 648-658
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The data analysis used by the author includes data on residents receiving direct cash assistance in Bandar Lama Village.

e. System Design
System design is carried out using flowchart and Information System Flow tools, with supporting software such as Microsoft Visio. In addition, system design also uses Unified Modeling Language (UML) with the help of web-based Figma software to model the structure and flow of the system to be created[15].

f. System Development
The decision support system application is built using PHP V 8.2 programming language and MySQL database. This process aims to produce an application that can provide decisions effectively and efficiently[16].

g. System Testing
System testing is a process created to assess whether what is designed meets expectations, or an activity that is useful for evaluating the strengths and weaknesses of the system, and testing is conducted using black box testing.

h. System Implemetation
Implementing the system that has been completed and examining the results of the implementation that has been applied to the system.

i. Result Analysis
Result analysis is a review of the results obtained from the process through all stages and recommendations on the achieved results. The procedure carried out to draw conclusions from the implemented system whether the created system can be used.

2.2 BORDA Method

The BORDA method is a method that can be applied to decision support systems for selection from a group of choices based on the value that appears most frequently from several alternative choices[17]. This method uses a ranking aggregation approach, which sums the rankings given to an alternative by all voters or criteria. The higher the total score obtained by an alternative, the greater the likelihood that the alternative becomes the best choice[18]. The steps in solving using the BORDA method are as follows:

a. The first step in the BORDA method is to determine the alternatives to be selected. These alternatives are options or solutions that will be compared based on preferences from several voters or specific criteria. These alternatives are candidates that will be chosen based on rankings given by decision makers[19].

b. The next step is to establish who will provide assessments of these alternatives. Voters can be individuals who have expertise in specific fields or predetermined criteria. Each voter will provide rankings based on their preferences for each available alternative[20].

c. Each voter provides rankings for the existing alternatives based on a predetermined scale. The highest rank is given the largest score, while the lowest rank is given the smallest score. This scoring system helps determine the weight of each alternative based on how highly they are prioritized by voters. Each voter gives rankings from 1 (one) as the lowest, to n as the highest. The BORDA score for rank r_{ij} is given by:

$$S_{ij} = (n - r_{ij}) \quad (1)$$

Where:
1. S_{ij} = Score given by voter i to alternative j.
2. R_{ij} = Rank given by voter i to alternative j.

d. After all voters have provided their rankings, the next step is to sum up the scores from each alternative. The score is obtained by adding up the points given by each voter, so that the alternative with the highest total score indicates the highest level of preference in the selection. The formula for summing scores for each alternative is:

$$B_j = \sum_{i=1}^{m}(n - r_{ij}) \quad (2)$$

Where:
1. B_j = Total score for alternative j.
2. m = Number of voters.

e. The alternative with the highest total score is considered the best choice based on the BORDA method. Using this approach, decisions can be made objectively and systematically based on the collective preferences of all voters involved[21].

2.3 Direct Cash Assistance Recipient Criteria

The criteria used in determining priority recipients of Direct Cash Assistance at the Bandar Lama Village Head Office include three main aspects: not receiving other social assistance such as the Family Hope Program and Fuel Subsidy Assistance, being underprivileged people who do not have a steady income to meet daily needs, and suffering from chronic annual diseases such as stroke or kidney failure. The distribution of Direct Cash Assistance is carried out in accordance with applicable regulations to ensure assistance is given to those who truly need it. With these criteria, it is hoped that Direct Cash Assistance can be distributed precisely on target and provide significant impact in improving the welfare of people who are in difficult economic conditions and vulnerable health. This research focuses on evaluating the

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https://ejurnal.stmik-budidarma.ac.id/index.php/jurikom

priority recipients of Direct Cash Assistance at the Bandar Lama Village Head Office based on these criteria to ensure effectiveness in aid distribution.

3. RESULT AND DISCUSSION

3.1 Implementation of the BORDA Method

At this stage, the process involves systematic evaluation and ranking of potential beneficiaries based on predetermined criteria. The implementation begins with data collection of eligible candidates, followed by the application of the BORDA scoring system to ensure objective and transparent selection. Each criterion is weighted according to its importance in determining the recipient's eligibility, and the final ranking is established based on the cumulative scores obtained through the BORDA method calculation. The calculation process of the BORDA method in determining Direct Cash Assistance recipients at the Bandar Lama Village Head Office is as follows:

a. Determining Alternatives

Here are the alternatives that have been identified based on the collected data, as presented in Table 1. These alternatives will later be evaluated and ranked using the BORDA method to determine the most eligible recipients of cash assistance.

Table 1. Alternatives

Code	Names of Bandar Lama City Residents
A1	Karlena Wati
A2	Sriwiyani
A3	Nurmala Sari
A4	Ratiah
A5	Ria Susanti
A6	Siti Zulaiha Lubis
A7	Putri Mus Puspika
A8	Suginah
A9	Sarianti
A10	Tika Lestari
A11	Pariadi
A12	Jendi Syahputra
A13	Jumarin
A14	Sulastri
A15	Saminem
A16	Marianik
A17	Tomy
A18	Dedi Sagala
A19	Armansyah Tanjung
A20	Suparmin
A21	Farida Hanum
A22	Haratua Pangihutan Siagian
A23	Mahmud Tanjung
A24	Ranto Simanjuntak
A25	Abdul Aziz Tambunan
A26	Mahadir Siahaan
A27	Zainal Arifin Munthe
A28	Tulian Nababan
A29	Kalpin Simanjuntak
A30	Pangomoan Sibarani

b. Candidate Ranking Assessment

The candidate ranking assessment is based on preference, where Judge 1 (Village Head), Judge 2 (Hamlet Head), and Judge 3 (Sub-district Head) provide their respective evaluations as shown in Table 2. These assessments serve as the foundation for applying the BORDA method to generate a fair and transparent ranking of candidates.

Table 2. Judge Assessment

Winner	Judge 1	Judge 2	Judge 3
1	A24	A28	A21
2	A1	A27	A14
3	A3	A24	A8

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Hal 648-658
https://ejurnal.stmik-budidarma.ac.id/index.php/jurikom

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

c. Performing weighting
Performing weight values where there are (*n*) alternatives and (*i*) for the total number of each alternative, total alternatives are given points *n-i* and so on. This means 30 alternatives *n-i* equals 29 and so on.

Table 3. BORDA Rankings

Winner	*n-i*	Points
1	30-1	29
2	30-2	28
3	30-3	27
4	30-4	26
5	30-5	25
6	30-6	24
7	30-7	23
8	30-8	22
9	30-9	21
10	30-10	20
11	30-11	19
12	30-12	18
13	30-13	17
14	30-14	16
15	30-15	15
16	30-16	14
17	30-17	13
18	30-18	12
19	30-19	11
20	30-20	10
21	30-21	9
22	30-22	8
23	30-23	7
24	30-24	6
25	30-25	5
26	30-26	4
27	30-27	3

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Hal 648-658
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Winner	*n-i*	Points
28	30-28	2
29	30-29	1
30	30-30	0

d. Determining the BORDA values is done by multiplying the numbers in the ranking column with the corresponding weights listed below, then summing the multiplication results of the same type, and finally placing the total in the ranking column. This process ensures that each candidate's score reflects the overall preferences of all judges in a structured and measurable way.

A1 = (1x28) + (1x6) + (1x3) = 37
A2 = (1x18) + (1x16) + (1x5) = 39
A3 = (1x27) + (1x22) + (1x4) = 53
A4 = (1x26) + (1x21) + (1x3) = 50
A5 = (1x21) + (1x13) + (1x8) = 42
A6 = (1x20) + (1x7) + (1x8) = 35
A7 = (1x18) + (1x5) + (1x0) = 23
A8 = (1x27) + (1x19) + (1x6) = 52
A9 = (1x26) + (1x16) + (1x15) = 57
A10 = (1x17) + (1x2) + (1x2) = 21
A11 = (1x12) + (1x0) + (1x0) = 12
A12 = (1x23) + (1x1) + (1x1) = 25
A13 = (1x19) + (1x13) + (1x10) = 42
A14 = (1x28) + (1x25) + (1x14) = 67
A15= (1x25) + (1x22) + (1x11) = 58
A16= (1x25) + (1x22) + (1x20) = 67
A17= (1x24) + (1x23) + (1x23) = 70
A18= (1x18) + (1x9) + (1x4) = 31
A19= (1x17) + (1x17) + (1x16) = 50
A20= (1x24) + (1x19) + (1x15) = 58
A21= (1x29) + (1x13) + (1x6) = 48
A22= (1x21) + (1x15) + (1x7) = 43
A23= (1x20) + (1x12) + (1x5) = 37
A24= (1x29) + (1x27) + (1x14) = 70
A25= (1x14) + (1x12) + (1x1) = 27
A26= (1x11) + (1x4) + (1x3) = 18
A27= (1x28) + (1x10) + (1x9) = 47
A28= (1x29) + (1x10) + (1x9) = 48
A29= (1x24) + (1x11) + (1x7) = 42
A30= (1x26) + (1x8) + (1x2) = 36

The results of determining the BORDA value can be seen in Table 4 below.

Table 4. BORDA Points

Code	Alternative Name	BORDA Points
A1	Karlena Wati	37
A2	Sriwiyani	39
A3	Nurmala Sari	53
A4	Ratiah	50
A5	Ria Susanti	42
A6	Siti Zulaiha Lubis	35
A7	Putri Mus Puspika	23
A8	Suginah	52
A9	Sarianti	57
A10	Tika Lestari	21
A11	Pariadi	12
A12	Jendi Syahputra	25
A13	Jumarin	42
A14	Sulastri	67
A15	Saminem	58
A16	Marianik	67
A17	Tomy	70
A18	Dedi Sagala	31
A19	Armansyah Tanjung	50
A20	Suparmin	58
A21	Farida Hanum	48
A22	Haratua Pangihutan Siagian	43
A23	Mahmud Tanjung	37
A24	Ranto Simanjuntak	70
A25	Abdul Aziz Tambunan	27
A26	Mahadir Siahaan	18
A27	Zainal Arifin Munthe	47
A28	Tulian Nababan	48
A29	Kalpin Simanjuntak	42
A30	Pangomoan Sibarani	36
	Total	1305

JURIKOM (Jurnal Riset Komputer), Vol. 12 No. 4, Agustus 2025
e-ISSN 2715-7393 (Media Online), p-ISSN 2407-389X (Media Cetak)
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Hal 648-658
https://ejurnal.stmik-budidarma.ac.id/index.php/jurikom

e. The BORDA value is an alternative preference used for ranking, where each individual BORDA value is compared with the total number of BORDA values. The calculation is carried out systematically to determine the final ranking of candidates.

$A1 = \frac{37}{1305} = 0{,}02835249$
$A2 = \frac{39}{1305} = 0{,}029885057$
$A3 = \frac{53}{1305} = 0{,}040613027$
$A4 = \frac{50}{1305} = 0{,}038314176$
$A5 = \frac{42}{1305} = 0{,}032183908$
$A6 = \frac{35}{1305} = 0{,}026819923$
$A7 = \frac{23}{1305} = 0{,}017624521$
$A8 = \frac{52}{1305} = 0{,}039846743$
$A9 = \frac{57}{1305} = 0{,}043678161$
$A10 = \frac{21}{1305} = 0{,}016091954$
$A11 = \frac{12}{1305} = 0{,}009195402$
$A12 = \frac{25}{1305} = 0{,}019157088$
$A13 = \frac{42}{1305} = 0{,}032183908$
$A14 = \frac{67}{1305} = 0{,}051340996$
$A15 = \frac{58}{1305} = 0{,}044444444$
$A16 = \frac{67}{1305} = 0{,}051340996$
$A17 = \frac{70}{1305} = 0{,}053639847$
$A18 = \frac{31}{1395} = 0{,}023754789$
$A19 = \frac{50}{1305} = 0{,}038314176$
$A20 = \frac{58}{1305} = 0{,}044444444$
$A21 = \frac{48}{1305} = 0{,}036781609$
$A22 = \frac{43}{1305} = 0{,}032950192$
$A23 = \frac{37}{1305} = 0{,}02835249$
$A24 = \frac{70}{1305} = 0{,}053639847$
$A25 = \frac{27}{1305} = 0{,}020689655$
$A26 = \frac{18}{1305} = 0{,}013793103$
$A27 = \frac{47}{1305} = 0{,}036015326$
$A28 = \frac{48}{1305} = 0{,}036781609$
$A29 = \frac{42}{1305} = 0{,}032183908$
$A30 = \frac{36}{1305} = 0{,}027586207$

After calculating the BORDA value, the ranking of each alternative is obtained, which can be seen in table 5 below.

Table 5. Final Score and Rankings

Alternative Name	Final Score	Code	Rank
Tomy	0,053639847	A17	1
Ranto Simanjuntak	0,053639847	A24	1
Sulastri	0,051340996	A14	3
Marianik	0,051340996	A16	3
Saminem	0,044444444	A15	5
Suparmin	0,044444444	A20	5
Sarianti	0,043678161	A9	7
Nurmala Sari	0,040613027	A3	8
Suginah	0,039846743	A8	9
Ratiah	0,038314176	A4	10
Armansyah Tanjung	0,038314176	A19	10
Farida Hanum	0,036781609	A21	12
Tulian Nababan	0,036781609	A28	12
Zainal Arifin Munthe	0,036015326	A27	14
Haratua Pangihutan Siagian	0,032950192	A22	15
Ria Susanti	0,032183908	A5	16
Jumarin	0,032183908	A13	16
Kalpin Simanjuntak	0,032183908	A29	16
Sriwiyani	0,029885057	A2	19
Karlena Wati	0,02835249	A1	20
Mahmud Tanjung	0,02835249	A23	20
Pangomoan Sibarani	0,027586207	A30	22
Siti Zulaiha Lubis	0,026819923	A6	23

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Hal 648-658
https://ejurnal.stmik-budidarma.ac.id/index.php/jurikom

Alternative Name	Final Score	Code	Rank
Dedi Sagala	0,023754789	A18	24
Abdul Aziz Tambunan	0,020689655	A25	25
Jendi Syahputra	0,019157088	A12	26
Putri Mus Puspika	0,017624521	A7	27
Tika Lestari	0,016091954	A10	28
Mahadir Siahaan	0,013793103	A26	29
Pariadi	0,009195402	A11	30

3.2 System Implementation

System implementation is the stage of presenting and testing the application that has been developed to ensure that its features function properly and meet user needs. This stage displays the program interface, including menus, data input forms, selection of criteria, and calculation results of the BORDA method. The interface is designed to be simple, interactive, and easy to operate, so that users can carry out the selection process efficiently. Each page of the system is arranged in such a way as to support the flow of data from input to decision output. Through this display, users can better understand how the system works in practice and how the system contributes to a more accurate and transparent selection of aid recipients. The display is as follows:

a. Login Page View
Users must first log in to access the available features. This page includes input fields such as email and password. The login page appears below.

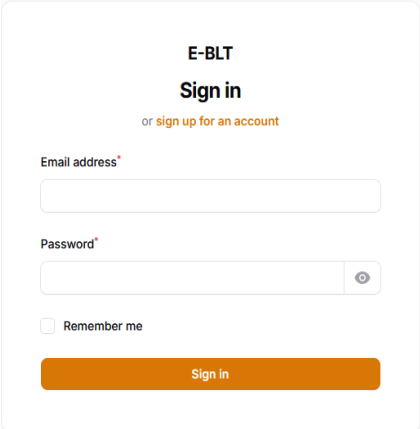

Figure 2. Login Page

b. Dashboard Page View
The Dashboard Page View is a page for displaying information pages on the system.

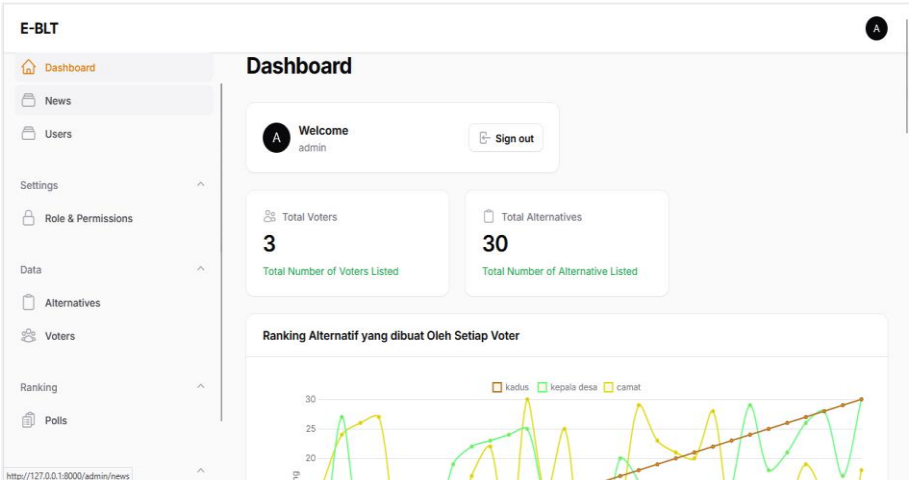

Figure 3. Dashboard Page

c. Alternatives Page View
The alternatives page display is a page that displays alternative data that will be processed to be used as a subject in the Borda method.

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e-ISSN 2715-7393 (Media Online), p-ISSN 2407-389X (Media Cetak)
DOI 10.30865/jurikom.v12i4.8854
Hal 648-658
https://ejurnal.stmik-budidarma.ac.id/index.php/jurikom

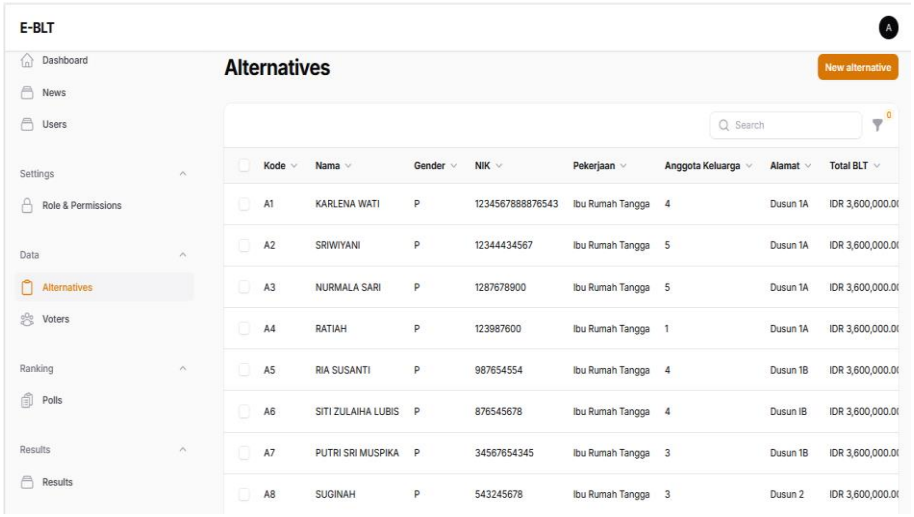

Figure 4. Alternatives Page

d. Add Alternative Page View
The add alternative page display is a page that displays a form for adding alternative data that will be processed.

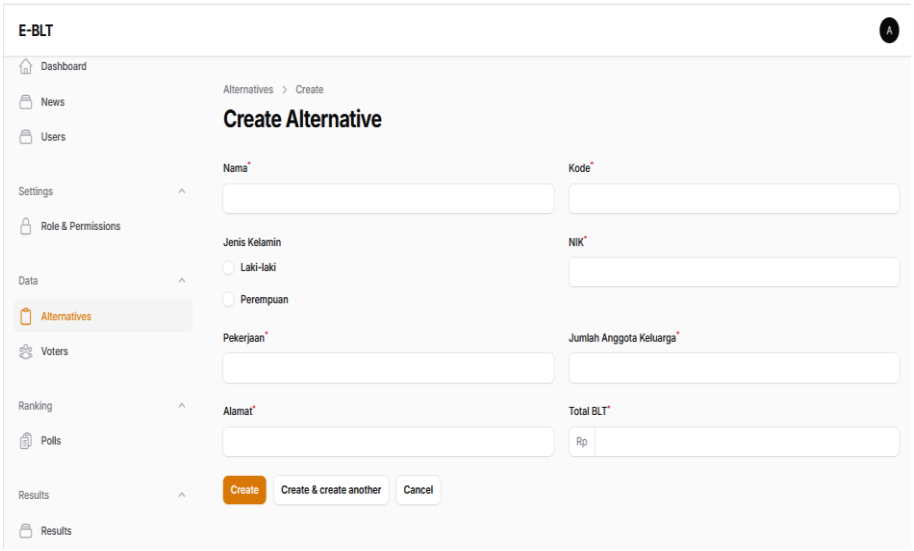

Figure 5. Add Alternative Page

e. Voters Page View
The voters page display is a page used to manage the jury, so that they can fill in poll or ranking data. On this page, it will be made clear who the jury members are who can provide rankings.

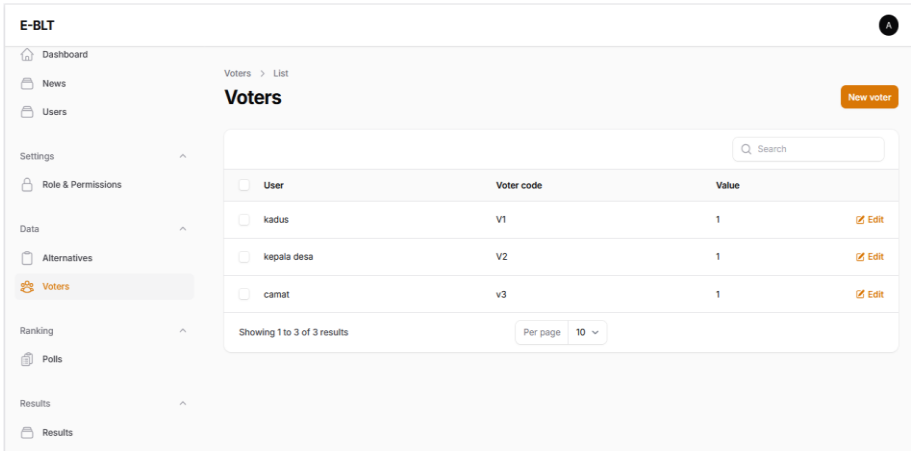

Figure 6. Voters Page View

f. Add Voters Page View

JURIKOM (Jurnal Riset Komputer), Vol. 12 No. 4, Agustus 2025
e-ISSN 2715-7393 (Media Online), p-ISSN 2407-389X (Media Cetak)
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The add voters page is a page used to add judges who can provide rankings.

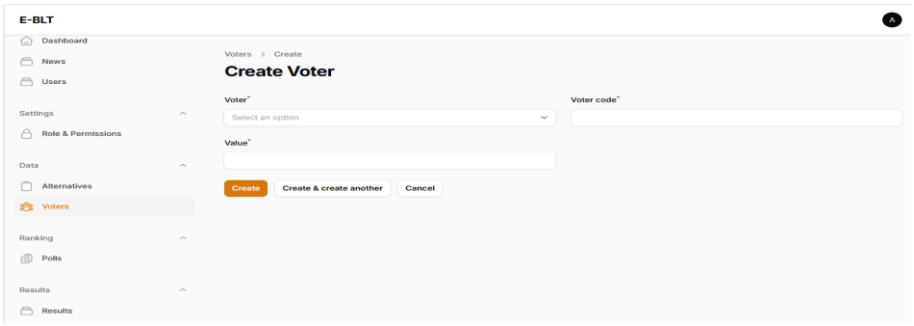

Figure 7. Add Voters Page

g. Final Result Page View
The results page display is a page that displays the final results of calculations using the Borda method, this page is related to calculations and printing reports.

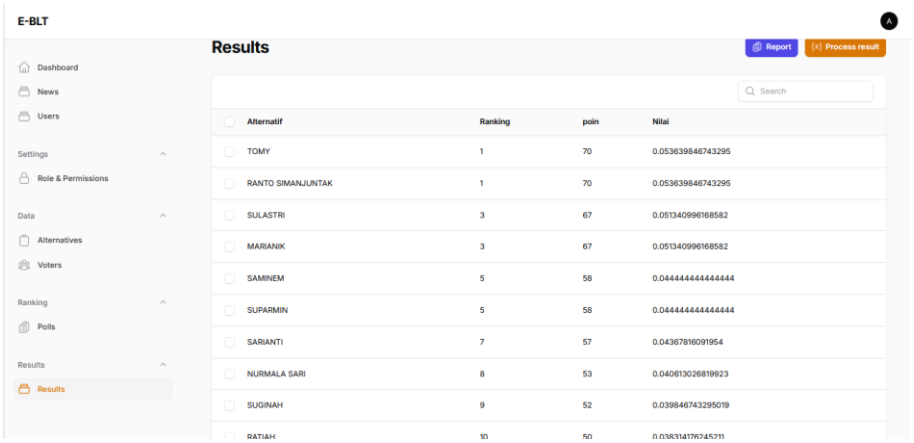

Figure 8. Final Result Page

The implementation of this web-based Decision Support System facilitates the selection process of Direct Cash Assistance recipients in terms of both data processing speed and calculation accuracy. By applying the BORDA method, the system helps minimize subjectivity in decision-making and enhances the efficiency of village officials in collecting and selecting eligible aid recipients. The final results of the system demonstrate that the determination of BLT beneficiaries can be carried out more fairly and accurately. In addition, the system also simplifies documentation and reporting of selection results, which can be accessed quickly and in an organized manner by relevant parties.

4. CONCLUSION

Based on the above research, the conclusions obtained from the analysis, design, implementation, and testing of the Decision Support System to determine the eligibility of Direct Cash Assistance recipients using the BORDA method, along with several recommendations for future software development. The results of the study indicate that the DSS significantly supports the Bandar Lama Village Office in selecting the most qualified residents in a more objective, transparent, and structured manner. By implementing the BORDA method, the system can rank all candidates based on the total preference score given by the panel of evaluators, minimizing subjectivity, and ensuring that decisions are based on measurable criteria. This system was developed using the PHP programming language and MySQL database, and is designed to be accessible online, allowing village officials to manage data and conduct evaluations more efficiently. The use of digital forms, automated scoring, and report generation not only improves data accuracy, but also simplifies the entire selection process, reducing manual workload and the risk of human error. In addition, this system increases transparency and accountability in the distribution of Direct Cash Assistance by providing clear documentation of the selection process that can be accessed and reviewed by relevant stakeholders. This contributes to increased public trust and better governance at the village level. Overall, the implementation of web-based DSS with the BORDA method has proven to be a practical and reliable solution to increase the effectiveness of social assistance programs.

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