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Decision Support System For Keluarga Harapan Program (PKH) Recipients Using the PROMETHEE Method

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Abstract

Keluarga Harapan Program is a program of providing conditional social assistance for poor families who are designated as Beneficiary Families of the Keluarga Harapan Program. So many people in Geudong village with various socio-economic statuses, it will be difficult to determine which families are eligible to be candidates for assistance from the Program Keluarga Harapan. This requires a decision support system using the PROMETHEE Method to assist in the selection of potential beneficiaries. The PROMETHEE method is a method of determining the order (priority) in multi-criteria analysis. The decision maker must determine the criteria, sub-criteria and parameters. Then an assessment is carried out on each alternative, then the system will automatically perform calculations to get a ranking of each alternative. he results of this system test are able to assist in the process of selecting families who deserve assistance from the Keluarga Harapan Program in Geudong village based on existing criteria.

Keywords: Decision Support System, Program Keluarga Harapan, PROMETHEE

1. Introduction

Geudong Geudong Village is one of the villages located in Kota Juang District, Bireuen Regency, adjacent to Geulanggang Teungoh Village. Most of the residents work as farmers, traders, and mocok mocok. The number of families in Geudong Geudong Village is approximately 1200 families, and recipients of the Keluarga Harapan Program (PKH) in 2019 were 100 families. Based on the Regulation of the Minister of Social Affairs Number 1 of 2018. CHAPTER I. General Provisions. Article 1: The Keluarga Harapan Program (PKH) is a conditional social assistance program designed for poor families designated as Beneficiary Families (KPM) of the Keluarga Harapan Program (PKH). This type of program is internationally known as the Conditional Cash Transfer (CTT) program or conditional cash assistance. The purpose of the Keluarga Harapan Program is to accelerate poverty alleviation and improve the quality of life for family members categorized as poor families in Indonesia, which has been in operation since 2007. This assistance is given to poor families, especially those with pregnant/breastfeeding mothers, and children to be able to utilize health facilities (faskes) and education facilities (fasdik) around the family [1]. However, often this assistance program is not well targeted, and there are still families who should receive Keluarga Harapan Program assistance but do not receive it. This also happened in Geudong Geudong Village, with a large population it will be difficult to determine the right households to receive this assistance program. Inaccurate targeting has the potential to cause social jealousy among the community. Therefore, a system is needed that can assist in decision-making for the selection of prospective recipients of the Keluarga Harapan Program. The decision support system is an interactive computer-based system that provides information, modeling, and data manipulation [2]. This system is used to assist in decision-making so that it can produce the best decision from alternative decisions. The PROMETHEE method is used in this study because it provides many preference functions that can be used so it is quite good at calculating the characteristics of the data.

The preference Ranking Organization Method For Enrichment Evaluation (PROMETHEE) is a method of determining the order (priority) in multicriteria analysis. The main problem is the simplicity, clarity, and stability of the assumption and the dominance of the criteria used in PROMETHEE is the use of outranking relationship values.
Based on the background that has been described above, the author is interested in conducting research with the title "Decision Support System for Recipients of Keluarga Harapan Program Assistance (PKH) Using the PROMETHEE Method".

2. Methods

A. Data Collection Techniques

The data collection techniques used in this study consist of:

- Interviews
  Interviews are a technique for collecting data that has been carried out through face-to-face meetings and direct question-and-answer sessions with the Geudong Geudong Village Apparatus, the Bireuen Regency Central Statistics Agency, and the assistants and Administrators of the Bireuen Regency UUPKH Database.
- Literature Collection
  The literature collection is carried out by reading and studying books, papers, journals, and articles from the internet that are relevant to the topic of the decision support system for poor rice recipients using the PROMETHEE method.

B. System Creation Techniques

The system creation techniques that will be employed include data needs analysis, functional and non-functional requirements analysis, system design, and user interface design.

1. Data Needs Analysis
   a. Criteria Data
   b. Alternative Data or population data of Geudong Geudong Village

2. Non-Functional Needs Analysis

Non-functional needs are requirements that focus on the behavioral properties inherent in the system. Non-functional requirements consist of:

- Hardware
  To create a Decision Support System, hardware is needed so that the application program created can run properly. The hardware specifications used are as follows :Lenovo Ideapad 130-14IKB laptop with minimum 2. 4 GB RAM capacity.
- Software
  Software is used to support the creation of a Decision Support System; namely, it must be tailored to meet the specific needs. The software used is as follows: Windows 10 Operating System, Visual Studio Code, and Draw.io.

C. PROMETHEE (Preference Ranking Organization Method For Enrichment Evaluation)

PROMETHEE (Preference Ranking Organizational Method for Enrichment Evaluation) is a method of determining the order (priority) in MCDM. The primary challenges of this method are simplicity, clarity, and stability. The assumption of the dominance of the criteria used in PROMETHEE is the use of values in the outranking relationship. In this method, all stated parameters have a real influence [3]. The calculation steps with the PROMETHEE method are as follows [4]:

- Determining Alternatives
- Determining several and dominant criteria.
- Determining the type of assessment, where the type of assessment has two types: minimum and maximum.
- Determining the type of preference for each most suitable criterion based on data and considerations from the Decision Maker. There are six types of preferences (Usual, Quasi, Linear, Level, Linear Quasi, and Gaussian).
- Providing a Threshold value or tendency for each criterion based on the preferences that have been selected.
- Calculation of Leaving Flow, Entering Flow and Net Flow.
- Sorting the results of the ranking,

In the PROMETHEE method, there are six forms of preference function criteria, including ordinary criteria, quasi criteria, criteria with linear preferences (U-shape criterion), level criteria, criteria with linear preferences and areas that are not different (V-shape criterion), Gaussian criteria [3].
In this study, the preference functions used are:

1. Usual Criterion

$$H(d)=\begin{cases}0 \ if \ d \leq 0\\ 1 \ if \ d > 0\end{cases} \quad (1)$$

where d = the difference of citeria values {d = f(a) – f(b)}

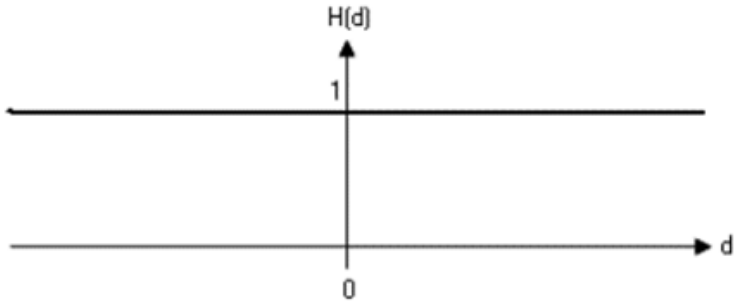

Figure 1. Usual Criterion Preference

In this case (Figure 1), there is no difference (equal importance) between a and b if only f(a) = f(b). If the criteria values for each alternative have different values, the decision maker makes an absolute preference for the alternative that has the better value [3].

D. Assessment Criteria

The Table 1 shown the criteria used in the research on the Decision Support System for Aid Recipients.

Table I
Assessment Criteria

Criteria	Weight
f1(.): Bangunan Rumah	20%
f2(.): Fasilitas Rumah Tangga	10%
f3(.): Kebutuhan Rumah Tangga	10%
f4(.): Kepala Rumah Tangga (Pendidikan Dan Penghasilan)	15%
f5(.): Tabungan / Aset yang dimiliki	5%
f6(.): Komponen Program Keluarga Harapan	40%

The criteria, sub-criteria, and parameter data used are taken based on the Verification and Validation criteria of the Integrated Social Welfare Data of the Ministry of Social Affairs of the Republic of Indonesia and the poverty variables of the Central Statistics Agency in the Population Socio-Economic Data Collection. The following are the Sub-criteria and Parameter data from each criteria.

In the criteria for house buildings, several factors are used as parameters, including the status of ownership of the residence, the largest floor area of the house building, the status of the land where the residence is located, and the type of the largest roof of the house building. Table II shown the house building criteria.

TABEL II
House Building Criteria

Subkriteria	Parameter	Nilai
Status penguasaan bangunan tempat tinggal	Bebas sewa / Menumpang	100
	Kontrak / Sewa	75
	Milik sendiri	50
Luas lantai	0 – 45 m^2	100
	45 – 54 m^2	75
	>55 m^2	50
Status lahan tempat tinggal yang di tempati	Tanah waqaf	100
	Milik orang lain	75
	Milik sendiri	50
Jenis lantai terluas	Tanah	100
	Kayu kualitas Rendah/Bambu	75
	Semen/Bata Merah	50
	Keramik/Kayu Kualitas tinggi	25
	Marmer/Granit	0
Jenis dinding terluas	Bambu/rumbia	100
	Kayu kualitas rendah	75
	Tembok tanpa plester	50
	Tembok Plester	25
	Keramik/ Kayu kualitas tinggi	0
Jenis atap terluas	Jerami/Ijuk/Daun-daunan/Rumbia	100
	Asbes	75
	Seng	50
	Genteng Tanah Liat	25
	Genteng Metal/ Genteng Keramik / Genteng Beton	0

In the household facilities criteria (shown in Table III), the parameters used are those commonly found in daily life, such as drinking water sources, primary lighting sources, and final disposal sites for feces. In the household needs criteria, the parameters used are consumption and clothing needs, whether household members are met in terms of the four healthy and five perfect conditions, and the number of new clothing purchases made in one month.

Table III
House Facility

Subkriteria	Parameter	Nilai
Sumber air minum	Mata Air/air sungai/air hujan	100
	Sumur Tak Terlindungi	75
	Sumur terlindungi	50
	Ledeng/Pompa	25
	Air kemasan Bermerek	0
Sumber penerangan utama	Bukan Listrik	100
	Listrik PLN 450 – 900 watt	75
	Listrik Non PLN	50
	Listrik PLN > 1300 watt	25
Bahan bakar /	Kayu bakar/ Arang	100

energi utama memasak	Minyak tanah	75
	Gas 3kg	50
	Gas > 3kg	25
	Listrik	0
Penggunaan fasilitas buang air besar	Tidak ada	100
	Umum	75
	Sendiri	50
Tempat pembuangan akhir tinja	Pantai/Tanah Lapang/Kebun	100
	Kolam/Sawah/Sungai/Danau/Laut	75
	Lubang Tanah	50
	SPAL	25
	Tangki	0

Table IV
Household Need Criteria

Subkriteria	**Parameter**	**Nilai**
Konsumsi daging / susu / ayam dalam seminggu	Tidak pernah	100
	Satu kali	75
	Dua kali / lebih	50
Membeli pakaian baru dalam setahun	Tidak pernah	100
	Satu stel	75
	Dua stel / lebih	50
Makan dalam sehari	Satu kali	100
	Dua kali	75
	Tiga kali / lebih	50

In the household needs criteria (shown in Table IV), the parameters used are consumption and clothing needs, whether household members are met in terms of the four healthy five and five perfect conditions, and the number of new clothing purchases made in one month.

Table V
Parameter Kriteria Kepala Rumah Tangga

Subkriteria	**Parameter**	**Nilai**
Pendidikan Terakhir Kepala Rumah Tangga	Tidak bersekolah	100
	Tidak tamat SD	75
	Tamat SD	50
	SMP / SMA	25
	Perguruan Tinggi	0
Penghasilan Kepala rumah tangga	Rp0 – Rp500.000	100
	Rp600.000 – Rp1.000.000	75
	Rp1.100.000 – Rp1.500.000	50
	Rp1.600.000 – Rp2.000.000	25
	> Rp2.100.000	0

In the criteria for head of household as shown in table V, the parameters used are the highest education of the head of household and the monthly income of the head of household to support household members.

TABLE VI
SAVINGS / ASSETS OWNED

Subkriteria	Parameter	Nilai
Memiliki tabungan / barang yang mudah di juak dengan nilai	Rp0 – Rp200.000	100
	Rp250.000 – Rp300.000	75
	Rp350.000 – Rp400.000	50
	Rp450.000 – Rp500.000	25
	> Rp550.000	0

The criteria for assets owned (as shown in Table VI) determine whether the household has assets that can be used to support its economy.

TABLE VII
CRITERIA KELUARGA HARAPAN PROGRAM

Subkriteria	Parameter	Nilai
Ibu hamil	Ada	100
	Tidak ada	0
Jumlah anak usia balita	>3	100
	3	75
	2	50
	1	25
	0	0
Jumlah anak yang bersekolah (SD / SMP / SMA)	>3	100
	3	75
	2	50
	1	25
	0	0
Memiliki anggota keluarga lansia mulai dari 70 tahun	Ya	100
	Tidak	0
Memiliki anggota keluarga penyandang disabilitas berat	Ya	100
	Tidak	0

The criteria for the Keluarga Harapan Program components are the requirements that households must meet to become beneficiary families of the Keluarga Harapan Program.

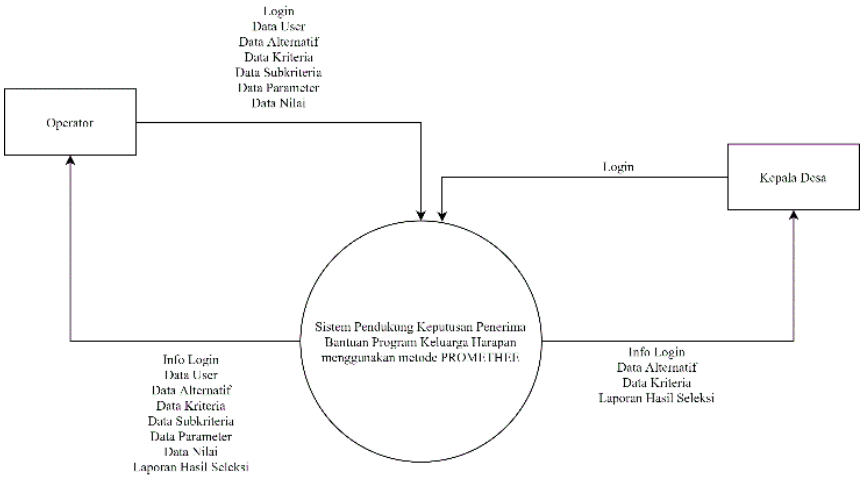

Figure 2. Context Diagram

E. Context Diagram Design

A context diagram is a diagram consisting of only one process; this process represents the entire system. This context diagram explains the general description of the Decision Support System for Recipients of the Keluarga

Harapan Program (PKH). Using the PROMETHEE Method, the context diagram display is as follows:

Based on the Context Diagram in Figure 2, it can be concluded:

1. The Decision Support System for Recipients of the Keluarga Harapan Program (PKH) Using the PROMETHEE Method consists of two entities, namely the Operator and the Village Head.

2. After successfully logging in, the Operator can:

   - Manage User data
   - Manage Alternative data
   - Manage Criteria, Subcriteria, and Parameter data
   - Manage value data

3. After successfully logging in, the Village Head can:

   - View alternative data
   - View Criteria, Subcriteria, and Parameter Data
   - View the selection result report.

F. Data Flow Diagram (DFD) Design

A Data Flow Diagram (DFD) is a data logic model or process created to describe where the data comes from or where the data that comes out of the system is going, where the data is stored, what process produces the data, and the interaction between the stored data and the process imposed on the data [5].

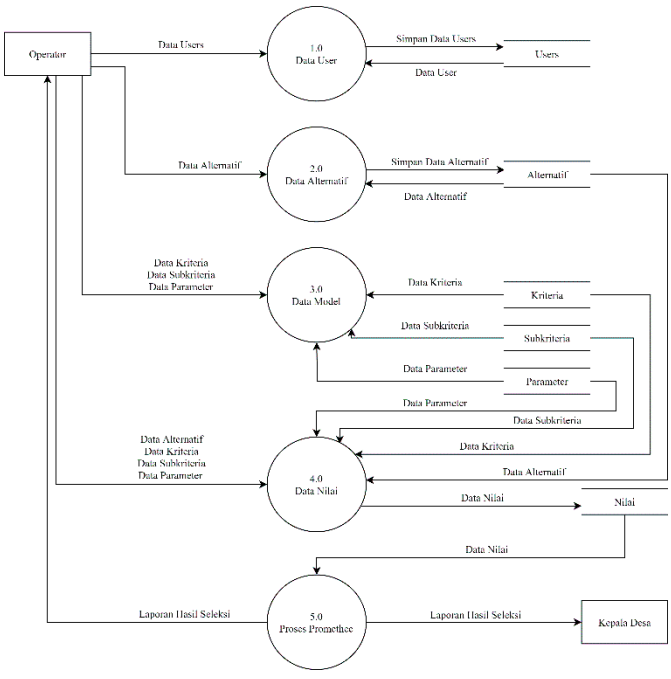

Figure 3. DFD Level 0 Decission Support System Aid Recipients Keluarga Harapan Program (PKH)

Based on Figure 3, DFD level 0 can be described as each process of system management includes its access rights, which enable it to manage all data, such as User data, Alternatives, criteria data, Subcriteria, and Parameters. Operators can also assess each alternative based on existing criteria and conduct the selection process by evaluating the value obtained for each alternative using these criteria.

G. Entity Relationship Diagram (ERD)

ERD (Entity-Relationship Diagram) is a technical approach model that describes the relationships within a model. In this relationship, the primary objective stated in the ERD is to depict data objects (Entities) and relationships (Relationships) that exist within the next Entity [6].

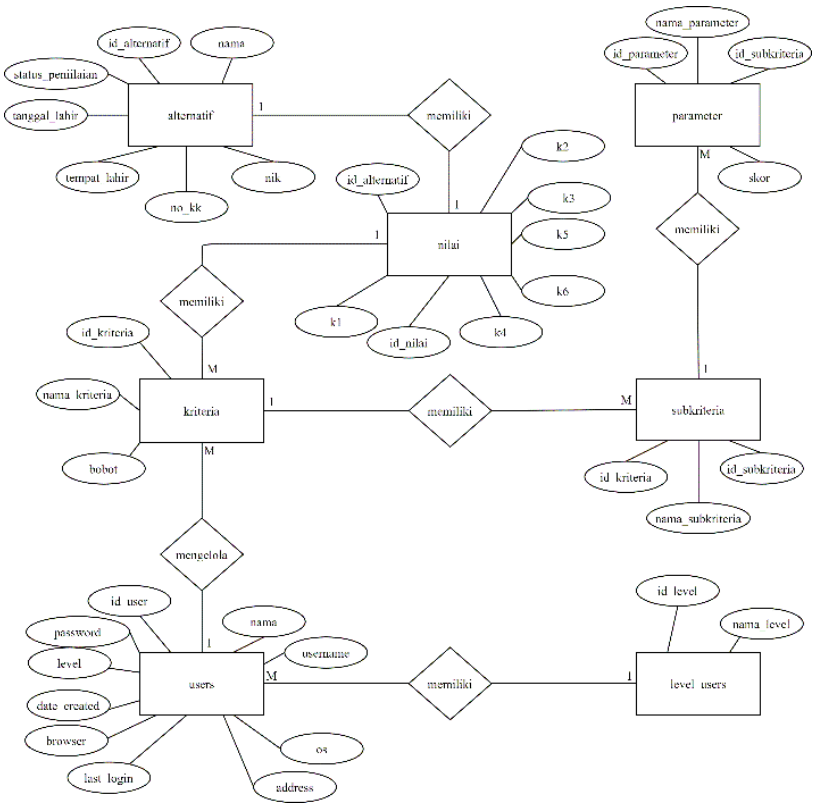

Figure 4. Entitiy Relationship Diagram (ERD)

Figure 4 is an ERD design of the Keluarga Harapan Program Recipient Decision Support System, where Users can manage multiple criteria, with one criterion potentially having many sub-criteria and parameters. At the same time, alternatives have assessment data from each criterion.

3. Result and Discussions

A. Login Page

The Login Page is a page that can be accessed by operators, village heads, or users who have access to the dashboard. To access the dashboard page, users must first log in. To log in, users are asked to enter two pieces of information in the form of a username and password correctly.

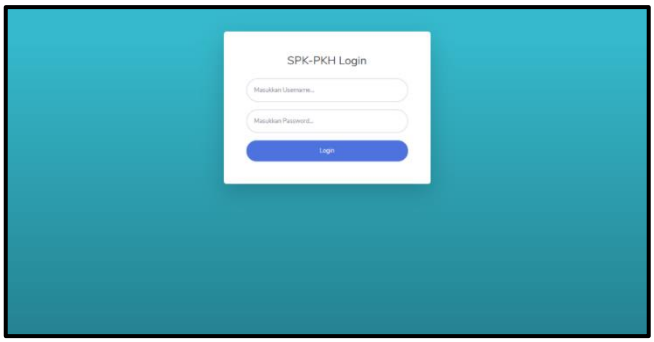

Figure 5. Login Page

B. Dashboard Page

The dashboard page is the main page that users access after logging in. On the dashboard page, you can also find information on the number of criteria and the number of alternatives. The menus that users can access also vary depending on the user's level of access. The dashboard page is shown in Figure 6.

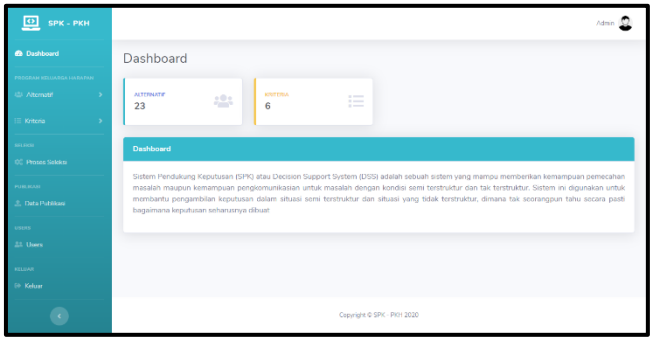

Figure 6. Dashboard Page

C. Alternative Data Page

The Alternative Page is a page designed to display all alternative data. On this page, users with Operator level can add data manually or import Excel data. Then, the Operator can also view the details of each alternative, edit the data, and delete it. The Operator can also know the assessment status and assess each alternative. The alternative data page is shown in Figure 7.

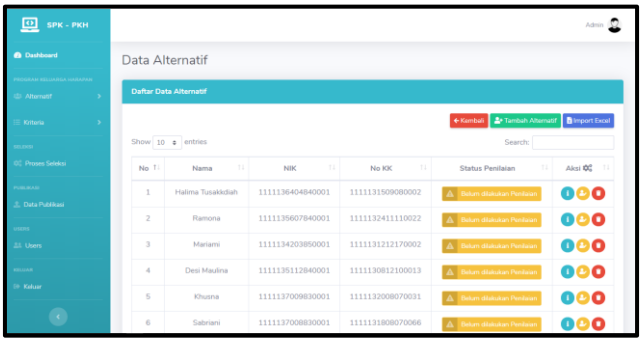

Figure 7. Alternative Data Page

D. Criteria Page

The Criteria Page is a useful page for displaying all existing criteria data, including weights, sub-criteria, parameters, and parameter scores. The Figure 8 shows the criteria page.

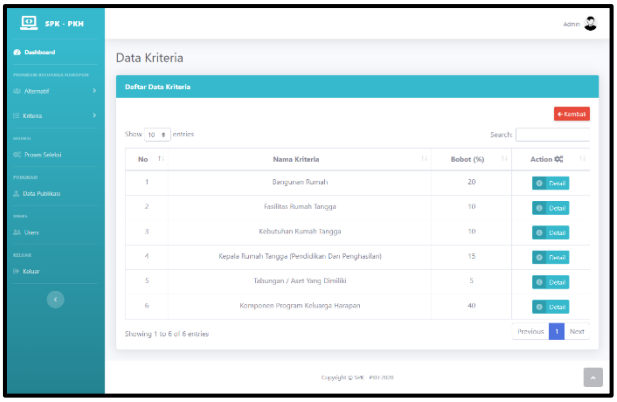

Figure 8. Criteria Page

Figure 8 displays the criteria data page in the system. In the action section, there is a feature to view detailed information for each Criterion. There is also a search feature that allows you to search for specific data criteria.

E. Criteria Detail Page

The criteria detail page is a page used to view the details of a criterion. On this criteria detail page, you will find the criteria name, weight, existing subcriteria, parameters, and the value of each parameter. The criteria detail page is shown in Figure 9.

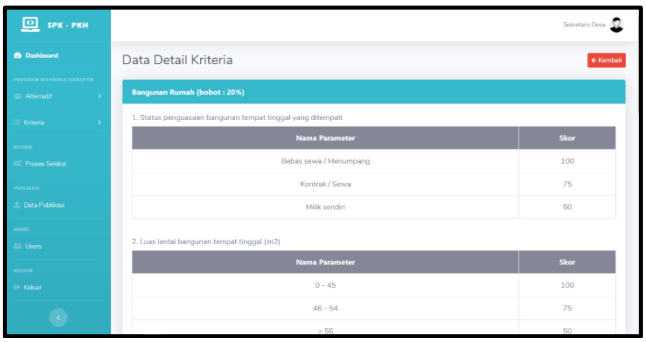

Figure 9. Criteria Detail Page

F. Alternative Value Page

The Alternative Value page displays the values of all previously assessed alternatives. The alternative value page is shown in Figure 10.

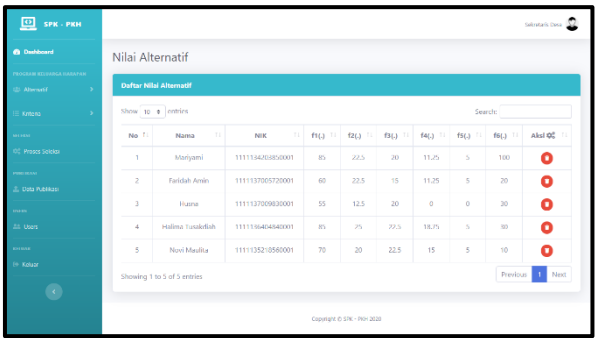

Figure 10. Alternative Value Page

Figure 10 is a display of value data from all Alternatives that have been assessed. On the Alternative Value page, there is also a feature to delete assessment results and a search feature to locate assessment data for a specific Alternative.

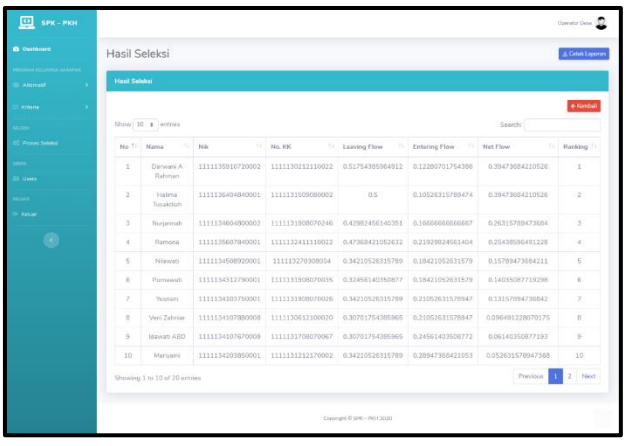

Figure 11. *PROMETHEE* Process Page

G. Promethee Process Page

The PROMETHEE Process Page displays the selection results for all alternatives that have been assessed. Figure 11 is the PROMETHEE process display page. On this page, we will find information in the form of Name, Population Identification Number of Alternative, Leaving Flow, Entering Flow, and Net Flow values, as well as the Ranking of each alternative.

H. Calculation Using the PROMETHEE Method

Before Performing Calculations using the PROMETHEE method, it is necessary to determine the alternatives first. The following is the alternative data that will be used.

Table VIII
Alternative Data

No	Name	Code
1	Mariyami	A1
2	Faridah Amin	A2
3	Husna	A3
4	Halima Tusakdiah	A4
5	Novi Maulita	A5

Table VIII presents alternative data, where each alternative is assigned a code to facilitate the calculation process using the PROMETHEE method. Alternative data was obtained by a questionnaire conducted in Geudong Geudong village.

After determining the alternative, an assessment was carried out on each alternative. The following are the values of each alternative

Description:

K1: House Building Criteria (20%)

K2: Household Facility Criteria (10%)

K3: Household Needs Criteria (10%)

K4: Head of Household Criteria (Education and Income) (15%)

TABLE IX
Alternative Value

Kriteria	Nilai Alternatif				
	A1	A2	A3	A4	A5
K1	85	60	55	85	70
K2	22,5	22,5	12,5	25	20
K3	20	15	20	22,5	22,5
K4	11,25	11,25	0	18,75	15
K5	5	5	0	5	5
K6	100	20	30	30	10

Table IX presents the results of the assessment process for each alternative, using the parameters and weights of the previously determined criteria. The alternative value is obtained by adding up all the alternative parameter values of each criterion and then multiplying them by the total weight of each criterion [7].

Next, calculate the preference value. At this stage, a comparison is made between two alternatives by subtracting the value of the first alternative from the second, and then calculating the preference value. The

preference function used for the selection of Prospective Recipients of the Keluarga Harapan Program is to use the usual preference criteria function using Equation (1)

Where:

H(d) = function of the difference in criteria between alternatives

d = difference in criteria values

TABLE X
Preference Value

	K1	K2	K3	K4	K5	K6
A1,A2	1	0	1	0	0	1
A1,A3	1	1	0	1	1	1
A1,A4	0	0	0	0	0	1
A1,A5	1	1	0	0	0	1
A2,A1	0	0	0	0	0	0
A2,A3	1	1	0	1	1	0
A2,A4	0	0	0	0	0	0
A2,A5	0	1	0	0	0	1
A3,A1	0	0	0	0	0	0
A3,A2	0	0	1	0	0	1
A3,A4	0	0	0	0	0	0
A3,A5	0	0	0	0	0	1
A4,A1	0	1	1	1	0	0
A4,A2	1	1	1	1	0	1
A4,A3	1	1	1	1	1	0
A4,A5	1	1	0	1	0	1
A5,A1	0	0	1	1	0	0
A5,A2	1	0	1	1	0	0
A5,A3	1	1	1	1	1	0
A5,A4	0	0	0	0	0	0

Table X is the difference value of the reduction between alternatives, where if the difference value of the reduction is more than 0 (zero), then it will be worth 1 (one). Furthermore, if the difference value is less than or equal to 0 (zero), then it will be worth 0 (zero) [8].

TABLE XII
Rangking Results

Kode	Nama	Leaving Flow	Entering Flow	Net Flow	Ranking
A1	Mariyami	0,5	0,208333333	0,291666667	2
A2	Faridah Amin	0,25	0,541666667	-0,291666667	4
A3	Husna	0,125	0,791666667	-0,666666667	5
A4	Halima Tusakdiah	0,708333333	0,041666667	0,666666667	1
A5	Novi Maulita	0,416666667	0,416666667	0	3

Table XII presents the results of calculating each Alternative using the PROMETHEE method. The calculation results show that Alternative with code A4 has the highest Net Flow value and Alternative with code A3 has the lowest value.

4. Conclusion

This Decision Support System can produce reports on the ranking of prospective recipients of the Keluarga

Harapan Program based on existing Criteria. The Decision Support System for Recipients of the Keluarga Harapan Program, utilizing the PROMETHEE method, is built on a website using the PHP programming language and the MySQL database. This website is responsive, adapting to the screen size of the device accessing it. The Promethee method was successfully implemented into the system. It can produce rankings, as evident from the results of calculations carried out manually and the system output, which yields the same values. According to the test results using 20 questionnaire data, the system indicates that the highest value and ranking in the calculation results are held by household members who receive benefits from the Keluarga Harapan Program. In contrast, the lowest value is held by household members who do not receive benefits from the Keluarga Harapan Program. From this test, it can be concluded that the system has shown quite good results.This Decision Support System can assist in decision-making to determine prospective recipients of the Keluarga Harapan Program in Geudong Geudong village.

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