

## ***Analytical Hierarchy Process Method in the Decision Support System for Non-Cash Food Assistance Recipients***

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### **Abstract**

Non-Cash Food Assistance is food assistance provided by the government to the poor. The assistance aims to reduce the burden of expenditure and provide better nutritional intake to the poor, the research site still makes decisions manually or checks the documents of the applicant for assistance and matches them with the criteria one by one without using an accurate system. This method is very time consuming and this results in errors so that assistance is less targeted and considered not optimal. In finding and determining decisions based on technology, many methods can be used, one of which is the Analytic Hierarchy Process (AHP) method. This research will be built using a decision support system using the *Analytical Hierarchy Process* (AHP) method. The AHP method is a method that is widely used in cases of criteria weighting and determining the priority of each criterion. The calculation results show that the CR value  $< 0.1$ , so the consistency ratio is considered acceptable. This study has succeeded in meeting the need for information related to the selection of Non-Cash Food Assistance recipients, and has helped in solving problems related to the process of selecting recipients of the assistance.

Keywords : Decision Support System, Analytic Hierarchy Process, Non-Cash Food Assistance

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### **1. Introduction**

The very rapid development of technological progress has made the use of personal computer technology increase greatly, where this use has made computers into branches that can still be developed, one of which is creating a decision-making system [ 1].

Technology is a need that must be met, both in the world of education, social media and in the world of business. Information technology is used not only as a support but also as a primary need that can be used to provide information quickly. Information technology has been widely used to support business processes that occur in family businesses, companies, agencies and others [ 2].

service is an element that implements government affairs in the social sector and empowerment of village/sub-district communities. The social service and community empowerment has the task of assisting the mayor in carrying out government affairs and assistance tasks, in carrying out its duties the Social Service carries out the functions of implementation, assistance efforts, coaching, in order to increase independence and improve the quality of human resources. Non-Cash Food Assistance is food assistance provided by the government to the poor in Indonesia. The assistance aims to reduce the burden of expenditure and provide better nutritional intake to the poor. Non-cash social assistance is provided in the context of poverty alleviation which consists of

protection, guarantees, empowerment, and social rehabilitation, as well as basic services[ 3].

Decision support system is a set of model -based system procedures to assist in making decisions on aid providers to potential recipients. The DSS process consists of several alternatives and several criteria that are processed to solve problems and can increase the accuracy of decisions taken, in finding and determining decisions based on methods [ 4].

Decision Support System (DSS) is one of the computer-based information systems used to support decision making in a company or organization. DSS is also often referred to as a system that helps companies or organizations process data into information that can solve problems and provide the right decisions [ 5 ] [ 6 ] [ 7 ] [ 8 ]. Employees are important resources in a company and are often referred to as the spearhead of achieving company goals [ 9 ] [ 10 ]. Employees who have a strong desire and good ability in carrying out their work are very supportive in the company's operational activities [ 11 ].

Analytic Hierarchy Process (AHP) is a decision support method developed by Thomas L, a mathematician in 1970. This method was developed with the main aim of breaking down a situation into several components and determining which variables have priority.[12][13]

The objectives of this study are as follows: Building a decision support system that can produce precise and accurate decisions. Applying the Analytical Hierarchy Process (AHP) method in creating a system using the PHP programming language and MySQL database that is able to assist decision making in determining recipients of non-cash food assistance.

In the implementation of this research, it is expected to provide benefits, including: From the system that is built, it can help the staff of the Lima Puluh Kota Regency Social Service in making decisions in determining aid recipients. With the existence of a decision support system for determining aid recipients, it can make it easier for staff to make the right decisions. Helps lighten the performance of staff to be more efficient and timely

**2. Research methodology**

The research framework in this research methodology is to obtain expected results that are easy to solve and understand. The steps taken in this research are arranged systematically. Therefore, it is important to have a research framework, where the research framework is carried out as in Figure 1.

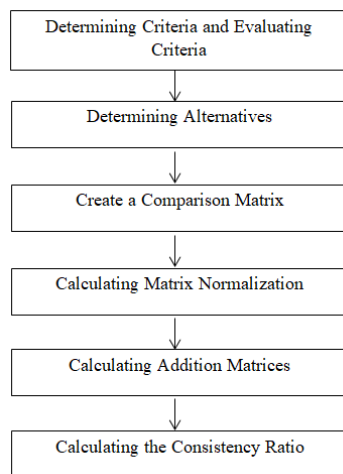


Figure 1. Research Framework

**1. Defining criteria, and evaluating alternatives**

Defining the criteria is then used as a parameter or standard to evaluate various alternative solutions that can be taken in order to achieve the goal, through a process of exploration, evaluation, and comparison of various alternative solutions.

**2. Creating a Hierarchy Diagram**

Create a hierarchy diagram with three levels, with the main objective at the top, criteria at the middle level, and alternatives at the bottom. Connect each criterion to the main objective and each alternative to the relevant criteria.

**3. Creating a pairwise comparison matrix . Criteria**

Each criterion is compared with other criteria to determine how much more important one criterion is than the other. This process helps in measuring the relative preference or priority between the criteria. A pairwise comparison matrix is used to generate relative weights for each criterion in the decision hierarchy, which are then used in the calculation to determine the final weights and make better decisions. The results of this comparison will reflect the level of importance of each criterion in achieving the goals or solving the problems that have been determined in the decision analysis.

**4. Determining the Pairwise Comparison Matrix Between Criteria**

The process of relative comparison between the criteria that have been determined in the decision hierarchy. The purpose of this step is to obtain information about how much more important one criterion is compared to another .

**5. Determining the Value of the Criteria Consistency Ratio**

$$\text{Determining the value } \lambda(\max) = \frac{\text{jumlah}}{n}$$

Information :  
 Sum = The sum of the results from the results table  
 n = Many Criteria

$$\text{Determining the value } CI = \frac{\lambda(\max) - n}{n - 1}$$

Information :  
 CI = Consistency Index  
 $\lambda(\max)$  = The result of dividing the sum by the number of criteria  
 n = Many Criteria

**3. Results and Discussion**

System analysis is defined as the decomposition of a complete information system into its component parts with the aim of identifying and evaluating problems, opportunities, obstacles that occur and expected needs so that improvements can be proposed. The analysis stage is carried out after the system planning stage and before the system design stage. By planning the design of the decision support system to be built, it is expected to minimize errors that occur in the system to be built. For this reason, it is necessary to conduct a system analysis on how the data information system flow procedures.

From the 5 criteria factors and 4 types of intensity in each of these criteria, the determination of prospective recipients of assistance is carried out using the AHP method so that the total value is obtained for each prospective recipient. The criteria and alternatives are presented in Table 1 and Table 2.

Table 3 List of Assessment Criteria

No	Criteria Code	Criteria
1	K1	Income
2	K2	Education
3	K3	Age
4	K4	Child dependency
5	K5	Work

Table 3 presents a list of criteria used in the assessment process. The criteria cover five main aspects coded as K1 to K5. The first criterion, K1, is income, which is an important factor in determining the level of need of an individual or family. K2 is education, which reflects the level of education achieved by the beneficiary. Next, K3 refers to age, which can affect the priority of assistance. The fourth criterion, K4, is the number of dependent children owned, which indicates the burden of family dependents. Finally, K5 is employment, which describes the employment status of the prospective beneficiary. All of these criteria are used to ensure that the assessment process is carried out objectively and fairly.

Table 3 List of Alternatives

No	Code	Alternative
1	A 1	Dani Yuhendri
2	A 2	Fatma Yuni
3	A 3	Elijah Roza Wati
4	A 4	Nurlaili

Table 3 lists the alternatives that are candidates for the assessment process. There are four alternatives, each coded from A1 to A4. These four alternatives will be assessed based on previously established criteria to determine the most deserving recipient.

AHP Stages

1. Matrix comparison in pairs

Matrix comparison in pairs originate from input mark scale comparison in pairs, where each criterion will be compared individually in pairs based on level interest, Can seen in Table 3 as following:

Table 3 Matrix Comparison

	K1	K2	K3	K4	K5
K1	1	5	7	5	1
K2	0.2	1	2	2	0.2
K3	0.14	0.5	1	3	0.14
K4	0.2	0.5	0.33	1	0.2
K5	1	2	7.01	5	1
Amount	2.54	12	17.33	16	2.54

Table 3 presents a comparison matrix between criteria used to determine the relative weight of each criterion in the assessment process. This matrix ends with a

total for each column. This total is used in the next step to calculate the relative weight of each criterion using the normalization method, which then becomes the basis for determining the assessment priorities.

2. Normalization

Perform normalization. The method is to divide each element with amount each column, can on Table 4 as follows:

Table 4 . Results Normalization Matrix Work

K1	K2	K3	K4	K5	Amount	P
0.39	0.41	0.40	0.31	0.39	1.91	0.38
0.07	0.08	0.11	0.12	0.07	0.48	0.09
0.05	0.08	0.05	0.18	0.05	0.39	0.07
0.07	0.04	0.01	0.06	0.07	0.28	0.05
0.03	0.41	0.40	0.31	0.39	1.91	0.38

3. Matrix summation line

Make matrix summation every line. Every element on table This counted with multiply matrix comparison pair with mark priority or average, can seen on Table 5 as following:

Table 5 . Results Matrix Row Addition

K1	K2	K3	K4	K5	Amount
0.38	0.45	0.49	0.25	0.38	2.33
0.076	0.09	0.14	0.1	0.076	0.48
0.053	0.045	0.07	0.15	0.053	0.371
0.076	0.045	0.023	0.05	0.076	0.27
0.38	0.18	0.4907	0.250	0.38	2.06

4. Calculation Results for Each Priority Criteria and SubCriteria

Recalculation for pairwise comparisons was performed and the results can be seen in Table 6. This table presents the data updates needed to ensure accuracy in the analysis. This process aims to adjust the relative weights between criteria so that the assessment results are more valid and in accordance with the research objectives.

Table 6 . Matrix Ratio

Criteria	∑Row	Priority	Results
K1	2,33	0,38	2,71
K2	0,48	0,09	0,57
K3	0,371	0,07	0,44
K4	0,27	0,05	0,32
K5	2,06	0,38	2,44
Amount			6,48

Priority column is obtained from priority column table matrix mark criteria And column amount per row is obtained from the total column in the table summation every line. Based on mark on table can counted mark following :

$$\lambda_{maks} = \frac{jumlah}{n} = \frac{6,48}{5} = 1,296$$

$$CI = \frac{\lambda_{maks} - n}{n} = \frac{1,296 - 5}{5} = -0,7408$$

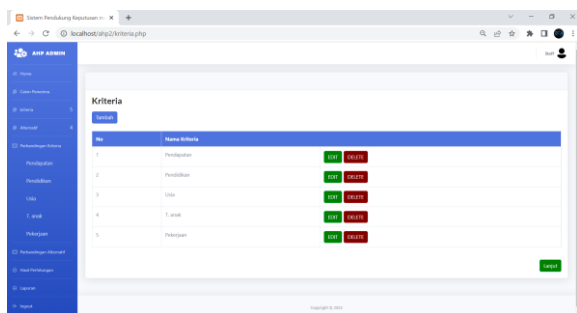
$$CR = \frac{CI}{IR} = \frac{-0,7408}{1,12} = -0,661$$

Since  $CR < 0.1$ , the consistency ratio of the calculation is acceptable. For the calculation of other subcriteria, calculations such as types can be performed.

### System Implementation

#### 1. Page data criteria

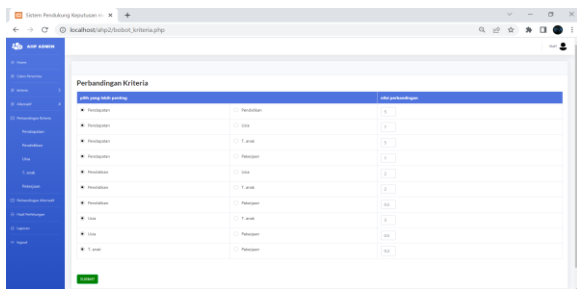
Page This contains data criteria, user Can add data criteria Which new, edit data criteria, And wipe data criteria, can seen on Picture 2 .



Picture 2 Data Criteria

#### 2. Comparison page criteria

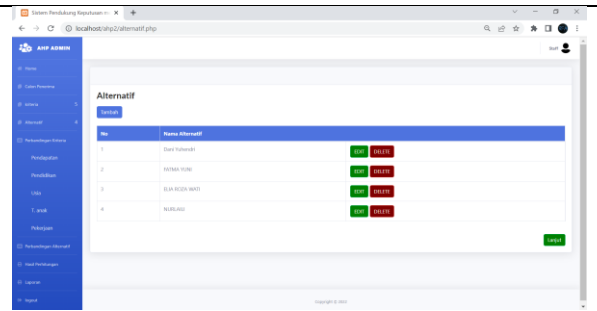
Page This clean up number comparison between every criteria, numbers the based on number levels interest ymag Already setby method AHP Page This contains data criteria, user Can add data criteria Whichnew, edit data criteria, And wipe data criteria, canseen in the picture 3 .



Picture 3 Comparison Criteria

#### 3. Alternative Data Page

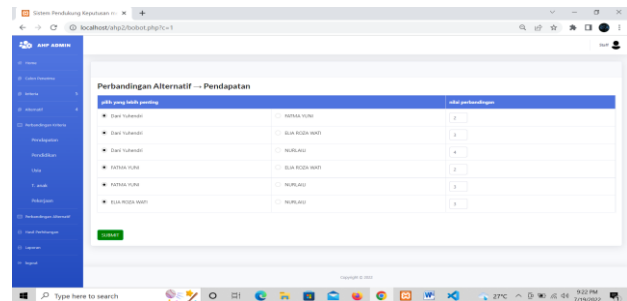
Page This contains data alternative, user Can add data criteria Which new, edit data is seen in Figure 4.



Picture 4 Data Alternative

#### 4. Comparison page alternative

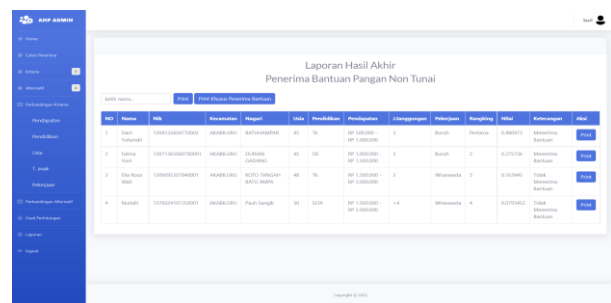
Page This clean up number comparison between every alternative , numbers the based on number levels interest ymag Already set by method AHP Page This contains data criteria, user Can add data criteria Whichnew, edit data criteria, And wipe data criteria, canseen in the picture 5 .



Picture 5 Alternative Comparison

#### 5. Final Calculation Result Page

On page This clean up results end calculation AHP Which there is ranking from mark Which highest until Which lowest, can seen onPicture 6 .



Picture 6 Calculation Results

### 4. Conclusion

This AHP (Analytical Hierarchy Process) decision support system can and is able to provide recommendations for aid recipients to prospective recipients using criteria as initial input in the AHP method process, for the criteria value and consistency test against the pairwise comparison matrix, the CR value obtained is less than 10% so that the criteria value obtained is declared consistent, after that a comparison of alternative values is carried out, then

the process of ranking prospective aid recipients is carried out from the highest to the lowest reference value.

### Reference List

- [1] Arif, MD (2016). LKP: Building a Wireless Network Based on Mikrotik Routers Using Vlan at BPD. Gapensi, East Java Province (Doctoral dissertation, Institut Bisnis dan Informatika Stikom Surabaya)
- [2] Tanaamah, AR, Wijaya, AF, & Maylinda, SA (2021). Information Technology Governance in the Public Sector: Aligning Information Technology with Leadership Vision. *Journal of Information Technology and Computer Science (JTIK)*, 8(6), 1-12. <https://doi.org/10.25126/jtik.202185379>
- [3] Baturangka, T., Kaawoan, J., & Singkoh, F. (2019). The Role of the Manado City Social Service in Empowering People with Disabilities. *Executive Journal*, 3(3).
- [4] Pratiwi, EI, & Kifti, WM (2023). Implementation of the SMART Method in Determining Exemplary Employees at the Population and Civil Registration Office of Asahan Regency. *Journal of Informatics and Information Technology*, 2(1), 182-189. <https://doi.org/10.56854/jt.v2i1.175>
- [5] Ahmad, R. (2018). The Use of Decision Support Systems Using the Analytical Hierarchy Process (AHP) Method in Selecting Eligibility of Scholarship Recipients. *Metik Journal*, 2(1), 28-33.
- [6] Seran, F., Kelen, YP, & Nababan, D. (2023). Decision Support System for Determining Majors Using the Weighted Product Method. *Jurnal Tekno Kompak*, 17(1), 147-159. <https://doi.org/10.33365/jtk.v17i1.2154>
- [7] Pertiwi, IP, Fedinandus, F., & Limantara, AD (2019). Decision Support System for Family Hope Program (PKH) Recipients Using the Simple Additive Weighting Method. *CAHAYATECH*, 8(2), 182-195.
- [8] Muljadi, NAUN, Witekso, W., & Atmojo, WT (2022). Comparison of TOPSIS Decision Support System with VIKOR in Selecting Cooperation Relationships. *Techno. Com*, 21(2), 224-236. <https://doi.org/10.33633/tc.v21i2.5889>
- [9] Sanjaya, HT, & Mardika, BD (2022). Factors Affecting Leadership: Work Quality, Work Effectiveness, and Work Communication (Work Quality Literature Review). *Journal of Information Systems Management Economics*, 3(3), 300-311. <https://doi.org/10.31933/jemsi.v3i3.820>
- [10] Adhika, NR, Salain, PPP, Puspitawati, NMD, Rismawan, PAE, Rihayana, IG, & Arsha, IMRM (2022). The Influence of Creativity on the Relationship between Job Satisfaction and Employee Performance in Cooperatives in North Denpasar District. *Widya Management*, 4(2), 101-110. <https://doi.org/10.32795/widyamanajemen.v4i2>
- [11] Muis, MR, Jufrizen, J., & Fahmi, M. (2018). The influence of organizational culture and organizational commitment on employee performance. *Jesya (Journal of Economics and Islamic Economics)*, 1(1), 9-25. <https://doi.org/10.36778/jesya.v1i1.7>
- [12] Satria, F. (2017). Decision Support System for the Best Teacher Performance Assessment at Min Kedondong Using AHP (Analytic Hierarchy Process). *TAM Journal (Technology Acceptance Model)*, 3, 21-31. <https://doi.org/10.56327/jurnaltam.v3i0.23>
- [13] Hasugian, AH, & Cipta, H. (2018). Analysis and Design of Decision Support System for Choosing Life Partner According to Karo Culture Using Analytical Hierarchy Process (AHP) Method. *ALGORITMA: Journal of Computer Science and Informatics*, 2(1). <http://dx.doi.org/10.30829/algorithm.v2i1.1612>