Analytical Hierarchy Process Providing Loans to the North Sumatra Regional Police Cooperative Using the Analytical Hierarchy Process

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Abstract

Loans for civil servants and police employees must be given to employees who are entitled to receive them. Lending without any criteria makes other employees not accept them. Lending using criteria ensures that the employee given the loan is an employee who deserves to receive it. The ahp method is able to complete the selection of employees who are eligible for the loan. Because of the criteria that can determine the weight value for each attribute, and then proceed with a ranking process that will select the best alternative from a number of alternatives. In this case, the alternative in question is the one who is entitled to receive a loan based on attributes, or determining criteria in selecting employees who are eligible to receive loans. Based on the ranking, Juliana Situmorang's employee has the highest score of 0.977 compared to other employees. The ahp method is the right step in determining employees who are eligible to receive loans.

Keywords: Loans, Cooperatives, Analytical Hierarchy Process

INTRODUCTION

The North Sumatra Regional Police Cooperative Center (PUSKOPPOLDASU) is a business forum run by a collection of PNS/POLRI areas of North Sumatra which is one of the cooperatives engaged in savings and loans that serves loans to all ranks of PNS/POLRI in the North Sumatra region. Savings and loan cooperatives are one of the financial institutions whose business activities are to collect funds from their members, then distribute them back to members who need these funds. One of its activities is the provision of money loans to its members. The goal is to provide an opportunity for its members to get easy loans and low interest rates. Efforts that can be made to improve the welfare of cooperatives, namely in money lending activities, need to be developed so that Puskoppoldasu can carry out its function of providing money loans to its members.

Until finally, the community established credit cooperatives with the aim of helping their people who were in debt with moneylenders [1]. Various kinds of products are offered by cooperatives to their members, one of which is a savings account and loan services [2]. Any loans to cooperatives with low interest [3]. Cooperatives have an important role in Indonesia's economic progress [4]. Cooperatives should be able to stand alone in an effort to prosper and members should be able to [5]. Information is very important in supporting the course of a company to achieve its desired goals [6]. The history of the formation of cooperatives in the past [7]. A decision support system is an

information-generating system aimed at a particular problem that must be solved by the manager and can assist the manager in making decisions. Decision support systems are an integral part of the totality of the overall organizational system. An organizational system includes physical systems, decision systems, and information systems [8]. The decision support system is designed to support all stages of decision making, starting from identifying problems [9]. Decision support systems are not intended to replace the roles of decision makers [10]. The system is used to support decision making in an organization, company, or institution [11]. Select relevant data and determine the approach used in the decision-making process [12].

The Analytical Hierarchy Process method provides the best selection results from values that are considered unclear [13]. One method that is relevant and has a calculation of the value of consistency in determining the priority level of the criteria is the Analytical Hierarchy Process method [14]. One of the functions or services provided by cooperatives is lending [15]. AHP is a method of making decisions on the problem of determining the priority of choices from various alternatives or multiple criteria [16]. AHP can provide solutions for this SPK application to help complete credit decisions [17]. This decision support model will describe a complex multi-factor or multi-criteria problem in a hierarchy. The hierarchy is defined as a representation of a complex problem. Constraints faced by the Puskoppoldasu management in the process of providing loans, there are borrowers who cannot account for their obligations or cannot repay their loans in accordance with the agreement that has been agreed by both parties. This is because Puskoppoldasu in realizing the loan only provides a decision whether or not a borrower is given a capital loan, without taking into account the percentage of the feasibility value of the loan. This assessment was due to the difficulty of the management in calculating the percentage of loan eligibility whose parameters were income, employment, collateral value and credit status, which resulted in losses to Puskoppoldasu.

The problem faced by Puskoppoldasu, it is necessary to build a decision support system that will help determine who is entitled to get the loan. The model used in this decision support system is the Analytical Hierarchy Process (AHP). This method was chosen because it can determine the weight value for each attribute, then proceed with a ranking process that will select the best alternative from a number of alternatives. In this case, the alternative in question is the one entitled to receive a loan based on the specified criteria.

METHODS

Loan

Loans are a type of debt that can involve all types of tangible objects, although they are usually identified with monetary loans. Like any other debt instrument, a loan requires a redistribution of financial assets over time between the borrower (the debtor) and the debtor (the creditor).

Analytical Hierarchy Process

In solving problems with the Analytical Hierarchy Process (AHP), several principles must be understood, including :

1. Creating a Hierarchy
Complex systems can be understood by breaking them down into supporting elements, arranging elements in a hierarchy and combining them or synthesizing them.
2. Assessment criteria and alternatives
Kriteria Criteria and alternatives were carried out by pairwise comparisons. According to (Saaty, 1988), a scale of 1 to 9 is the best scale for expressing opinions..

3. Synthesis of priority
For each criterion and alternative, pair-wise comparisons are necessary. The relative comparison values of all alternative criteria can be adjusted according to predetermined judgments to produce weights and priorities. Weights and priorities are calculated by manipulating the matrix.
4. Logical Consistency
Consistency has two meanings. First, similar objects can be grouped according to uniformity and relevance. Second, it concerns the degree of relationship between objects based on certain criteria.

Procedure Method Process

Basically, the procedures or steps in the Analytical Hierarchy Process (AHP) method include:

1. Defining the problem and determining the desired solution, then compiling a hierarchy of the problems encountered. The goal of the hierarchy is to set goals that are the goals of the system as a whole at the top level.
2. Determining the priority of elements
 - a. The first step in determining the priority of elements is to make a pair comparison, which is to compare elements in pairs according to the given criteria.
 - b. The pairwise comparison matrix is filled in using numbers to represent the relative importance of an element to other elements.
3. Synthesizing
The considerations for pairwise comparisons were synthesized to obtain the overall priority. The things to do in this step are:
 - a. Sum the values of each column in the matrix..
 - b. Divide each value in the column by the total of the corresponding column.to obtain a normalized matrix..
 - c. Add up the values for each row and divide by the number of elements to get the average value..
4. Mesuring Consistency
In decision making, it is important to know how good the consistency is because we don't want judgmental decisions with low consistency. The things that are done in this step are: Multiply each value in the first column by the relative priority of the first element, the value in the second column by the relative priority of the second element and so on.
 - a. Sum each row
 - b. The result of the row sum is divided by the corresponding relative priority element.
 - c. Add the quotient above with the number of elements, the result is called

Calculate the Consistency Index (CI) with the formula: $CI = (\lambda_{maks} - n) / n$

Where n denotes the number of elements.

5. Calculate the Consistency Ratio (CR) with the following formula:

$$CR = CI / RC$$

Where $CR = \text{Consistency Ratio}$

$CI = \text{Consistency Index}$

$IR = \text{Indeks Random Consistency}$

RESULTS & DISCUSSION

Charging Criteria

Criteria serve to input the values of the criteria used in the system. In filling in the criteria, there are 3 data that can be entered, namely criteria, sequence numbers and information.

Menu : Data Kriteria [Tutup](#)

Kriteria:

Urutan:

Keterangan:

Kriteria	Urutan	Keterangan
Pendapatan	1	Kriteria ke 1
Pekerjaan	2	kriteria ke 2
Jaminan	3	kriteria ke 3
Status Kredit	4	Kriteria ke 4
*		

Baru Simpan Edit Hapus Batal

Figure 1 : Filling Criteria

Sub-criteria are determined after the criteria, therefore before filling in the sub-criteria then the user must fill in the criteria first. There are 4 data that must be filled in the sub-criteria, namely criteria, sub-criteria, sequence of sub-criteria and information.

Menu : Data Sub Kriteria [Tutup](#)

Kriteria:

Sub Kriteria:

Urutan:

Keterangan:

Kriteria	Sub Kriteria	Urutan	Keterangan
Pendapatan	BAIK	1	5.000.001 >
Pekerjaan	BAIK	1	POLRI
Jaminan	BAIK	1	Rumah/Ruko
Status Kredit	BAIK	1	Tidak Ada Kredit
Pendapatan	CUKUP	2	2.000.001 - 5.000.000
Pekerjaan	CUKUP	2	PNS
Jaminan	CUKUP	2	Tanah
Status Kredit	CUKUP	2	Ada Kredit di Bagian Jasa
Pendapatan	TIDAK	3	< 2.000.000
Pekerjaan	TIDAK	3	HONOR
Jaminan	TIDAK	3	BPKB Kendaraan
Status Kredit	TIDAK	3	Ada Kredit di Bank
*			

Baru Simpan Edit Hapus Batal

Figure 2 : Filling in Sub Criteria

The alternative is the data from the object's initiation that will be determined by the decision. In alternative filling, there are 10 data, namely borrower number, name, ID card number, address, telephone number, place of birth, date of birth, gender, marital status, and name of husband/wife.

Menu : Data Alternatif [Tutup](#)

No. Peminjam

Nama

No. KTP

Alamat

No. Telp

Tempat Lahir

Tanggal Lahir

Jenis Kelamin

Status Perkawinan

Nama Suami/Istri

No Peminjam	Nama	No KTP	Alamat	No Telp	Tempat Lahir	Tanggal Lahir	Jenis Kelamin
0001	W. HERLAMBA...	12072613086...	Jl. Budi Utomo	082160217000	Klambir V Deli...	13/8/1965	Laki-Laki
0002	KAROLINAKA...	127118420870...	Jl. Mesjid Taufi...	081263725550	Namutasi	2/8/1970	Perempuan
0003	JULIANA SITU...	02013165076...	Komp. Taman ...	-	Medan	31/12/1995	Perempuan
0004	BERTHABER...	12712068126...	Jl. Gg. Krakata...	081370306744	Medan	28/12/1964	Perempuan
*							

Figure 3 : Alternative Charging Diagram

Before carrying out the AHP process, data is first filled in the pairwise comparison of criteria and sub-criteria. In filling out the pairwise comparison criteria, the comparisons that need to be filled in are income-jobs, income-guarantees, income-credit status, employment-security, employment-credit status, and credit-status guarantees. The rest will be filled in automatically by the system.

Menu : Data Perbandingan Berpasangan Kriteria [Tutup](#)

Matriks Perbandingan Berpasangan

	Pendapatan	Pekerjaan	Jaminan	Status Kredit
Pendapatan	1	3	5	7
Pekerjaan	0.333	1	3	5
Jaminan	0.200	0.333	1	3
Status Kredit	0.143	0.200	0.333	1
Jumlah	1.676	4.533	9.333	16.000
*				

Priority Vector Matriks Normalisasi

	Jaminan	Status Kredit	Jumlah Baris	Priority Vector Normalisasi
Pendapatan	0.536	0.438	2.233	0.558
Pekerjaan	0.321	0.312	1.053	0.263
Jaminan	0.107	0.188	0.487	0.122
Status Kredit	0.036	0.062	0.227	0.057
Jumlah	1.000	1.000	4.000	
*				

Perhitungan Rasio Konsistensi

	Jumlah Baris	Priority Vector Normalisasi	Hasil
Pendapatan	2.233	0.558	2.791
Pekerjaan	1.053	0.263	1.316
Jaminan	0.487	0.122	0.609
Status Kredit	0.227	0.057	0.284
Jumlah			5.000
*			

λ Maks : 1.250

Indeks Konsistensi : -0.688

Rasio Konsistensi : -0.764

Konsistensi : Konsisten

Figure 4 : Comparison Filling in Paired Criteria

The process of filling in pairs of sub-criteria data is almost the same as filling in paired comparison data for criteria. The process of paired comparison of sub-criteria must be carried out after a paired comparison of criteria.

Menu : Data Perbandingan Berpasangan Sub Kriteria Tutup

Matriks Perbandingan Berpasangan

	Baik	Cukup	Tidak
Baik	1	3	5
Cukup	0.333	1	3
Tidak	0.200	0.333	1
Jumlah	1.533	4.333	9.000
*			

Priority Vector Matriks Normalisasi

	Baik	Cukup	Tidak	Jumlah Baris	Priority Vector Normalisasi	Perioritas Sub Kriteria
Baik	0.652	0.692	0.556	1.900	0.633	1.000
Cukup	0.217	0.231	0.333	0.781	0.260	0.411
Tidak	0.130	0.077	0.111	0.318	0.106	0.167
Jumlah	0.999	1.000	1.000	2.999	0.999	1.578
*						

Perhitungan Rasio Konsistensi

	Jumlah Baris	Priority Vector Normalisasi	Hasil
Baik	1.900	0.633	2.533
Cukup	0.781	0.260	1.041
Tidak	0.318	0.106	0.424
Jumlah			3.998
*			

Sub Kriteria Pendapatan ▼

Proses
Simpan

λ Maks : 1.333
Indeks Konsistensi : -0.556
Rasio Konsistensi : -0.958
Konsistensi : Konsisten

Figure 5 : Comparison of Filling in Paired Sub Criteria

The alternative filling process is to fill in the value of the criteria for each alternative. This filling serves to determine the value of the AHP calculation.

Menu : Penilaian Alternatif Tutup

	Kode Alternatif	Nama Alternatif	Pendapatan	Pekerjaan	Jaminan	Status Kredit
▶	0001	W. HERLABANG	BAIK	CUKUP	TIDAK	TIDAK
	0002	KAROLINA KABAN	CUKUP	BAIK	CUKUP	TIDAK
	0003	JULIANA SITUMORANG, SH	BAIK	BAIK	BAIK	CUKUP
	0004	BERTHA BERNIKE ARITONANG	CUKUP	CUKUP	BAIK	BAIK
*						

Simpan

Figure 6 : Filling in the Alternative Assessment

Results from Priority Score Results

The result of this priority value is to display the table values of the priority results of the criteria with the priority of the sub criteria.

Menu : Tabel Hasil Prioritas Kriteria Dengan Prioritas Sub Kriteria					Tutup
►	Pendapatan	Pekerjaan	Jaminan	Status Kredit	
	0.558	0.263	0.122	0.057	
	Baik	Baik	Baik	Baik	
	1.000	1.000	1.000	1.000	
	Cukup	Cukup	Cukup	Cukup	
	0.411	0.439	0.447	0.588	
	Tidak	Tidak	Tidak	Tidak	
	0.167	0.192	0.197	0.173	
*					

Figure 7 : Priority Value Results

AHP Process

The AHP process is the last process in a decision support system using the AHP method.

Menu : Proses Analytical Hierarchy Process (AHP)						Tutup
	Pendapatan	Pekerjaan	Jaminan	Status Kredit	Total	
► W. HERLAMBAANG	0.558	0.115	0.024	0.010	0.707	
KAROLINAKABAN	0.229	0.263	0.055	0.010	0.557	
JULIANA SITUMORANG, SH	0.558	0.263	0.122	0.034	0.977	
BERTHA BERNIKE ARITONANG	0.229	0.115	0.122	0.057	0.523	
*						

No Peminjam	Nama Peminjam	Rangking Alternatif
0003	0.977	JULIANA SIT
0001	0.707	W. HERLAMBAANG
0002	0.557	KAROLINAKABAN
0004	0.523	BERTHA BERNIKE ARITONANG
*		

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>
Hitung
Simpan

Figure 8 : Comparison Filling in Paired Sub Criteria

Creating Reports

Reports in the decision support system aim to store printed files from the decision support system process. There are 3 reports in the decision support system, namely alternative reports, criteria reports and AHP reports, all of which can be processed by clicking on the report menu. Alternative Reports The alternative reports can be seen in the following image:

Menu : Laporan Alternatif Tutup

**SISTEM PENDUKUNG KEPUTUSAN PEMBERIAN PINJAMAN
PADA PUSAT KOPERASI KEPOLISIAN DAERAH SUMATRA UTARA
DENGAN MENGGUNAKAN METODE ANALYTICAL HIERARCHY PROCESS(AHP)**

LAPORAN ALTERNATIF

No	No Peminjam	Nama	No KTP	Alamat	No Telp	Tempat Lahir	Tanggal Lahir	Jenis Kel	Status	Nama Suami/Istri
1	0001	W. HERLAMBAWANG	1207261301	Jl. Budi Utomo	08216021	Klabir V Deli s	08/13/1965	Laki-laki	Kawin	HARIANI
2	0002	KAROLINA KABAN	1271184201	Jl. Masjid Taufik No.177 Medan	08126372	Namutras	08/02/1970	Perempuan	Kawin	SIMON PASARIBU
3	0003	JULIANA SITUMORANG, SH	0201316501	Komp. Taman Tenera Indah	-	Medan	12/31/1995	Perempuan	Kawin	GUNUNG SEMBIRI
4	0004	BERTHA BERNIKE ARITONANG	127120681	Jl. Gg. Krakatau No.64 Medan	08137030	Medan	12/28/1964	Perempuan	Kawin	MARIHOT PASARIE

Figure 9 : Alternative Report

The Criteria Report

The appearance of the criteria report can be seen in the following image:

Menu : Laporan Kriteria Tutup

**SISTEM PENDUKUNG KEPUTUSAN PEMBERIAN PINJAMAN
PADA PUSAT KOPERASI KEPOLISIAN DAERAH SUMATRA UTARA
DENGAN MENGGUNAKAN METODE ANALYTICAL HIERARCHY PROCESS(AHP)**

LAPORAN KRITERIA

No	Kriteria	Keterangan
1	Pendapatan	Kriteria ke 1
2	Pekerjaan	Kriteria ke 2
3	Jaminan	Kriteria ke 3
4	Status Kredit	Kriteria ke 4

Figure 10 : Criteria Report

The AHP Report The display of the AHP report can be seen in Figure 5.13 below:

Menu : Laporan Keputusan AHP						
Main Report						
<p align="center">SISTEM PENDUKUNG KEPUTUSAN PEMBERIAN PINJAMAN PADA PUSAT KOPERASI KEPOLISIAN DAERAH SUMATRA UTARA DENGAN MENGGUNAKAN METODE ANALYTICAL HIERARCHY PROCESS(AHP)</p>						
LAPORAN HASIL						
No	No Peminjam	Nama	No KTP	Alamat	No Telp	AHP
1	0003	JULIANA SITUMORAN	0201316507610	Komp. Taman Tenera Ir	-	0.98
2	0001	W. HERLAMBAH	1207261308656	Jl. Budi Utomo	082160217000	0.71
3	0002	KAROLINA KABAN	1271184208700	Jl. Mesjid Taufik NO.17	081263725550	0.56
4	0004	BERTHA BERNIKE AI	1271206812640	Jl. Gg. Krakatau NO.64	081370306744	0.52

Figure 11 : AHP Report

The following table explains that the criteria or attributes in determining employees who are eligible to receive loans with criteria of income, employment, guarantees and credit status. It is an important point in determining a decent employee.

Table 1: Final Results

Alternative	Income	Work	Guarantee	Credit Status
W Herlambang	0.558×1.000	0.263×0.439	0.122×0.197	0.057×0.173
Karolina Kaban	0.558×0.411	0.263×1.000	0.122×0.447	0.057×0.173
Juliana Situmorang	0.558×1.000	0.263×1.000	0.122×1.000	0.057×0.588
Bertha Bernike	0.558×0.411	0.263×0.439	0.122×1.000	0.057×1.000

The value $1,000 \times 0.558$ in the income column of the row value w herlambang in the table multiplies each of the priority values of the sub-criteria values of the processing of alternative survey data on the table by the priority values of each criterion on the table, and to look for the values of the other rows, done in the same way. The final step is to calculate the alternate rankings. The results of each criteria column in the table are obtained from the results of multiplication. The results of the calculation can be seen in the table:

Table 2: Alternatives Ranking

Alternative	THE CRITERIA				
	income	Work	Certainty	Credit Situation	Total
W Herlambang	0.558	0.115	0.024	0.010	0.707
Karolina Kaban	0.229	0.263	0.055	0.010	0.557
Juliana Situmorang	0.558	0.263	0.122	0.034	0.977
Bertha Bernike	0.229	0.115	0.122	0.057	0.523

Based on the total column value in the table above, Juliana Situmorang has the highest value, which is 0.977. Based on the criteria, Juliana Situmorang was selected as a borrower in the regional Kepelosian cooperative.

CONCLUSION

Based on the results of the discussions that have been carried out previously, it can be concluded that the results of the tests carried out on reference data, the lending process is very dependent on the completeness of the inputted criteria data. Juliana Situmorang has the highest score of 0.977. Based on the criteria, Juliana Situmorang was selected as a borrower in the regional Kepelosian cooperative.

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