SYSTEM FOR DETERMINING HOUSE CREDIT RECIPIENTS BASED ON DATA OF COOPERATIVE MEMBERS USING SIMPLE ADDITIVE WEIGHTING (SAW)

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ABSTRACT

PMS Employee Cooperative is a savings and loan cooperative which aims to provide storage and loan services to employees who work at PT. Pro Manunggal Solusi and does not yet have a Decision Support System (SPK). A decision support system is needed in determining the eligibility of cooperative loans to employees. This study aims to help simplify and accelerate and minimize errors that occur in the cooperative borrower feasibility assessment process. The method used for this decision is to use the Simple Additive Weighting (SAW) method. Six criteria are used for the loan eligibility assessment process, namely criteria 1 (Loan size), criterion 2 (Loan Purpose), criterion 3 (Salary), criterion 4 (Position), criterion 5 (Age), criterion 6 (Period of service). Based on the results of the calculation, it can be concluded that each loan employee will be approved according to the ranking and is limited by the balance. If the balance is sufficient, the loan will be approved, but if the balance is less, the loan will be rejected. Of the total value of the ranking results, loans approved with a sufficient balance were Susanto (0.82) with a 12.13% chance, Sentot Sudiyantono (0.80) with a probability of 11.83%, and Siswandi (0.73) with big chance 10.80%..

Keywords: *Decision Support System, Simple Additive Weighting.*

1) INTRODUCTION

The development of information technology has enabled decision making to be carried out quickly and accurately. This also applies to every government and private agency that needs a system to collect, process and review a decision. One of the alternatives most likely to help complete work and handle the flow of large amounts of information, as well as help in making correct and accurate decisions is a computer. Therefore, in an organization the use / utilization of computers should be maximized, including in the cooperative organization.

PMS Employee Cooperative is a savings and loan cooperative which aims to provide storage and loan services to every employee who works at PT. Pro Manunggal Solusi and does not yet have a Decision Support System (SPK). A decision support system is needed in determining the creditworthiness of a cooperative to an employee. Therefore, we need a method that can process the calculation of the loan eligibility weight properly. The method used for making this decision is the Simple Additive Weighting (SAW) method. In connection with this, it is necessary to make a decision support system by analyzing employee data in the cooperative that existed in the previous year. So that a more effective and efficient way is found to assist the cooperative in taking the right assessment for each employee.

In this final project, the topic chosen is "Determination of Home Loan Recipients Based on Data from Cooperative Members Using the Simple Additive Weighting (SAW) Method". With the creation of a loan eligibility decision support system using the SAW method, it is expected to be able to help simplify and accelerate and minimize errors that occur in the process of assessing the feasibility of PMS Employee Cooperative borrowers.

2)　　**METHODOLOGY**

a) **Literature Review**

Designing a Decision Support System for Scholarship Admission with the SAW (Simple Additive Weighting) Method (Sri Eniyati, 2011), Implementation of the Simple Additive Method. Weighting in the Teacher Certification Decision Making System (Youllia Indrawaty, Andriana, Restu Adi Prasetya, 2011), Decision Support System.
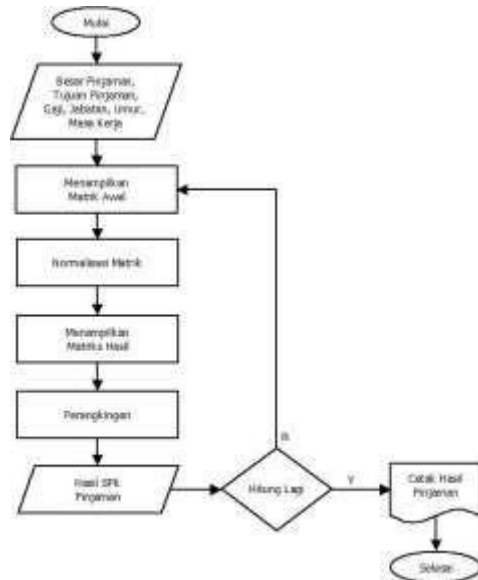
3)　**SYSTEM PLANNING**

3.1 Flowchart

Figure 3.1. *Flowchart System*

The flowchart above (Figure 3.1) illustrates the flow of the SAW Loan Feasibility DSS process
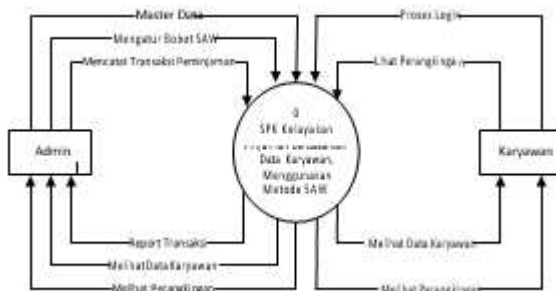
3.2 Context Diagram

Figure 3.2. *Context Diagram*

In Figure 3.2 the context diagram shows one user, namely an employee. Before entering the system, you must first login by entering the username and passsword that have been registered in the database. If you have entered the system, employees can see the ranking results. The admin manages the operation of the decision support system, both creating, changing and storing data needed by the system to process data such as master data, view rankings, adjust SAW weights, view employee data, record borrower transactions, report transactions, and others.
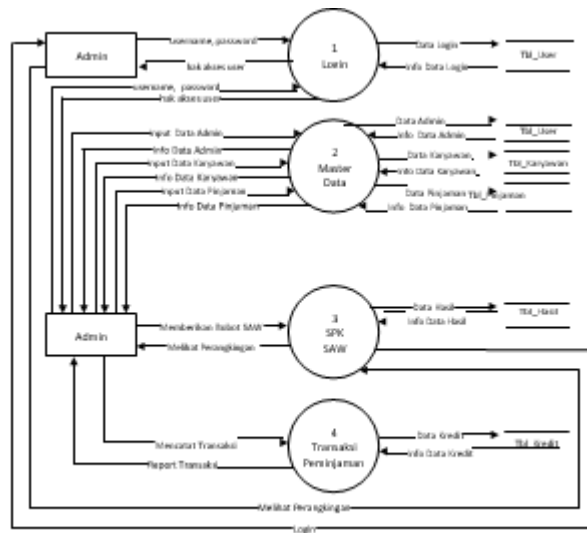
3.3 DFD Level 1

Figure 3.3. *DFD Level 1*

DFD Level 1 above (Figure 3.3) Calculating Normalized Matrices 3.4 is a comprehensive picture of Tbl_Results Result Ranking Calculates the Normalization of Each Element flow of the system to be made. For an explanation of DFD Level 1 in the loan eligibility system using the SAW method are as follows:

a. The flow of the employee and admin login process enters the username and password then the system processes it by checking the data in the database. If the data is correct or valid, the admin and employees will go to the next page, according to the access rights they have.
b. Employees can see the ranking results.
c. Admin can control the flow of application calculations by determining the SPK and managing the data needed by the system such as employee data, loan data, SAW weight data, yield data, transaction data, and credit data. The SAW calculation process starts when the admin enters the data for each employee who applies for a loan into the system.

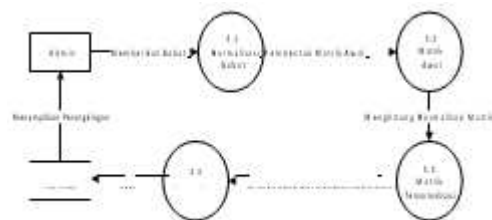### 3.4 DFD Level 2 Process 2 The SAW SPK Process

Figure 3.4. *DFD Level 2 Process 2 SPK SAW Process*

Figure 3.4. is DFD Level 2 which is the translation of DFD Level 1. The first stage is the admin gives weight to carry out the weight normalization process. After forming the initial matrix, then calculating the normalized matrix to produce a normalized matrix. The normalization results are then displayed in the ranking process after calculating the normalization of each element. Then display the ranking in the results table that will be displayed by the admin.

3.6 ERD (Entity Relationship Diagram)

ERD (Entity Relationship Diagram) contains a collection of tables, where each table has a unique name and structure. In each table, each data record organized in the same structure has a key field that will be a link between existing tables and those related to each other. This system has 9 entities / tables, namely user, credit, employees, installments, finance, submissions, SPK weights, matrices, and results.
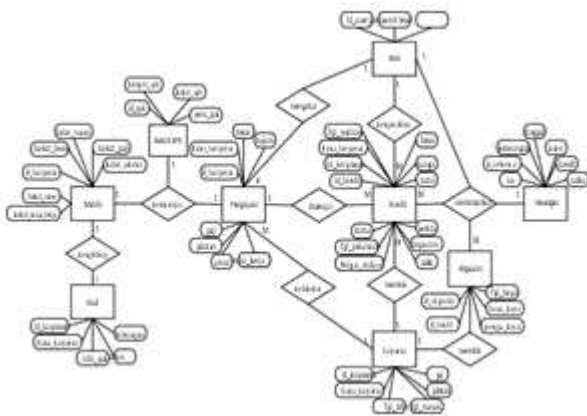
Figure 3.6. *ERD (Entity Relationship Diagram*

3.7 Calculation of Finding Weight

The criteria for evaluating employees who are eligible for a loan are as follows:
  a) Loan size = 0.2 (cost)
  b) Loan Objectives = 0.2 (benefit)
  c) Salary = 0.1 (benefit)
  d) Position = 0.2 (benefit)
  e) Age = 0.1 (benefit)
  f) Working period = 0.2 (benefit)

Table 3.1. Employee Evaluation / Assessment Data

Nama Karyawan	KRITERIA					
	Besar	Tujuan	Gaji	Jabatan	Umur	Masa Kerja
Jujuk Wikno Handoko (Karyawan 1)	5 juta	Keperluan Modal	10 juta	Plant Manager	59	34
Subandi (Karyawan 2)	3 juta	Kredit Barang	5 juta	Production Supervisor Area	61	34
Susanto (Karyawan 3)	2,5 juta	Keperluan Darurat Kesehatan	2,8 juta	Checker Bahan Packing dan Baku	46	26
Bambang Hermanto (Karyawan 4)	1,5 juta	Keperluan Konsumtif	2,7 juta	Helper	32	8
Wayan Suartana (Karyawan 5)	5 juta	Keperluan Modal	10 juta	Production Manager	51	32

From the assessment table, a rating table of the suitability of each alternative can be made for each criterion.

Table 3.2. Match Rating Table

Nama Karyawan	KRITERIA					
	Besar	Tujuan	Gaji	Jabatan	Umur	Masa Kerja
Karyawan 1	2	3	1	1	2	6
Karyawan 2	4	2	2	3	2	6
Karyawan 3	5	5	4	6	3	5
Karyawan 4	6	1	4	6	4	2
Karyawan 5	2	3	1	1	2	6

Completion steps:

  1) Weight vector: W = [(0,2), (0,2), (0,1),
  (0,2), (0,1), (0,2)]
  2) Decision Matrix X based on the weight criteria:

$$X = \begin{Bmatrix} 2 & 3 & 1 & 1 & 2 & 6 \\ 4 & 2 & 2 & 3 & 2 & 6 \\ 5 & 5 & 4 & 6 & 3 & 5 \\ 6 & 1 & 4 & 6 & 4 & 2 \\ 2 & 3 & 1 & 1 & 2 & 6 \end{Bmatrix}$$

3) Matrix Normalization X Using equation 1:

Alternative Employees 1

$r11 = \dfrac{\text{Min}(2;4;5;6;2)}{2} = 1$

$r12 = \dfrac{3}{\text{Max}(3;2;5;1;3)} = 0,6$

$r13 = \dfrac{1}{\text{Max}(1;2;4;4;1)} = 0,25$

$r14 = \dfrac{1}{\text{Max}(1;3;6;6;1)} = 0,17$

$r15 = \dfrac{2}{\text{Max}(2;2;3;4;2)} = 0,5$

$r16 = \dfrac{6}{\text{Max}(6;6;5;2;6)} = 1$

Alternative Employees 2

$r21 = \dfrac{\text{Min}(2;4;5;6;2)}{4} = 0,5$

$r22 = \dfrac{2}{\text{Max}(3;2;5;1;3)} = 0,4$

$r23 = \dfrac{2}{\text{Max}(1;2;4;4;1)} = 0,5$

$r24 = \dfrac{3}{\text{Max}(1;3;6;6;1)} = 0.5$

$r25 = \dfrac{2}{\text{Max}(2;2;3;4;2)} = 0,5$

$r26 = \dfrac{6}{\text{Max}(6;6;5;2;6)} = 1$

Alternative Employees 3

$r31 = \dfrac{\text{Min}(2;4;5;6;2)}{5} = 0,4$

$r32 = \dfrac{5}{\text{Max}(3;2;5;1;3)} = 1$

$r33 = \dfrac{4}{\text{Max}(1;2;4;4;1)} = 1$

$r34 = \dfrac{6}{\text{Max}(1;3;6;6;1)} = 1$

$r35 = \dfrac{3}{\text{Max}(2;2;3;4;2)} = 0,75$

$r36 = \dfrac{5}{\text{Max}(6;6;5;2;6)} = 0,83$

Alternative Employees 3

$$r31 = \frac{Min\,(2;4;5;6;2)}{3} = 0,4$$

$$r32 = \frac{5}{Max\,(3;2;5;1;3)} = 1$$

$$r33 = \frac{4}{Max\,(1;2;4;4;1)} = 1$$

$$r34 = \frac{6}{Max\,(1;3;6;6;1)} = 1$$

$$r35 = \frac{3}{Max\,(2;2;3;4;2)} = 0,75$$

$$r36 = \frac{5}{Max\,(6;6;5;2;6)} = 0,83$$

Alternative Employees 4

$$r41 = \frac{Min\,(2;4;5;6;2)}{6} = 0,33$$

$$r42 = \frac{1}{Max\,(3;2;5;1;3)} = 0,2$$

$$r43 = \frac{4}{Max\,(1;2;4;4;1)} = 1$$

$$r44 = \frac{6}{Max\,(1;3;6;6;1)} = 1$$

$$r45 = \frac{4}{Max\,(2;2;3;4;2)} = 1$$

$$r46 = \frac{2}{Max\,(6;6;5;2;6)} = 0,33$$

Alternative Employees 5

$$r51 = \frac{Min\,(2;4;5;6;2)}{2} = 1$$

$$r52 = \frac{3}{Max\,(3;2;5;1;3)} = 0,6$$

$$r53 = \frac{1}{Max\,(1;2;4;4;1)} = 0,25$$

$$r54 = \frac{1}{Max\,(1;3;6;6;1)} = 0,17$$

$$r55 = \frac{2}{Max\,(2;2;3;4;2)} = 0,5$$

$$r56 = \frac{6}{Max\,(6;6;5;2;6)} = 1$$

From the results of the above calculations, it is obtained the normalized matrix R, namely :

$$R = \begin{Bmatrix} 1 & 0,6 & 0,25 & 0,17 & 0,5 & 1 \\ 0,5 & 0,4 & 0,5 & 0,5 & 0,5 & 1 \\ 0,4 & 1 & 1 & 1 & 0,75 & 0,83 \\ 0,33 & 0,2 & 1 & 1 & 1 & 0,33 \\ 1 & 0,6 & 0,25 & 0,17 & 0,5 & 1 \end{Bmatrix}$$

4) Looking for the best alternative using equation 2

$$V1 = (1 \times 0,2) + (0,6 \times 0,2) + (0,25 \times 0,1) +$$
$$(0,17 \times 0,2) + (0,5 \times 0,1) + (1 \times 0,2) =$$
$$0.628333$$

$$V2 = (0,5 \times 0,2) + (0,4 \times 0,2) + (0,5 \times 0,1)$$
$$+ (0,5 \times 0,2) + (0,5 \times 0,1) + (1 \times 0,2)$$
$$= 0,58$$

$$V3 = (0,4 \times 0,2) + (1 \times 0,2) + (1 \times 0,1) +$$
$$(1 \times 0,2) + (0,75 \times 0,1) + (0,83 \times$$
$$0,2) = 0.821667$$

$$V4 = (0,33 \times 0,2) + (0,2 \times 0,2) + (1 \times 0,1)$$
$$+ (1 \times 0,2) + (1 \times 0,1) + (0,33 \times 0,2) =$$
$$0,573333$$

$$V5 = (1 \times 0,2) + (0,6 \times 0,2) + (0,25 \times 0,1)$$
$$+ (0,17 \times 0,2) + (0,5 \times 0,1) + (1 \times 0,2)$$
$$= 0.628333$$

So the result of the ranking value is :

Rank 1: V3 = Susanto (Employee 3)

Rank 2: V1 = Refer to Wikno Handoko (Employee 1)

Rank 3: V5 = Wayan Suartana (Employee 5)

Rank 4: V2 = Subandi (Employee 2) Rank 5: V4 = Bambang Hermanto (Employee 4)

5) Conclusions based on cooperative balances. The balance amount is 10,000,000.

| Rangking	Nama Karyawan	Hasil SPK	Besar Pinjaman	Saldo Koperasi	Keterangan
1	Susanto	0,82	2,5 juta	7,5 juta	pinjaman disetujui
2	Jujuk Wikno Handoko	0,62	5 juta	-2,5 juta	pinjaman disetujui
3	Wayan Suartana	0,62	5 juta	-2,5 juta	pinjaman ditolak/saldo koperasi kurang
4	Subandi	0,58	3 juta	-5,5 juta	pinjaman ditolak/saldo koperasi kurang
5	Bambang Hermanto	0,57	1,5 juta	-7 juta	pinjaman ditolak/saldo koperasi kurang

6) Loan Realization Plan

Nama Karyawan	Besar Pinjaman	Bunga	Total	Angsuran per bulan	Waktu (bulan)
Susanto	2,5 juta	300 ribu	2,8 juta	233.333	12
Jujuk Wikno Handoko	5 juta	900 ribu	5,9 juta	327.728	18

7) Estimated Balance

   a. Current balance = 2,500,000
   b. Next month = 3,061,111
   c. Balance in 2 months = 3,622,222
   d. Balance in 3 months = 4,183,333
   e. Balance in 4 months = 4,744,444
   f. Balance in 5 months = 5,305,555
   g. Balance in 6 months = 5,866,666
   h. Balance in 12 months = 9,233,333
   i. Balance in 18 months = 11,200,000

4. SYSTEM VIEW
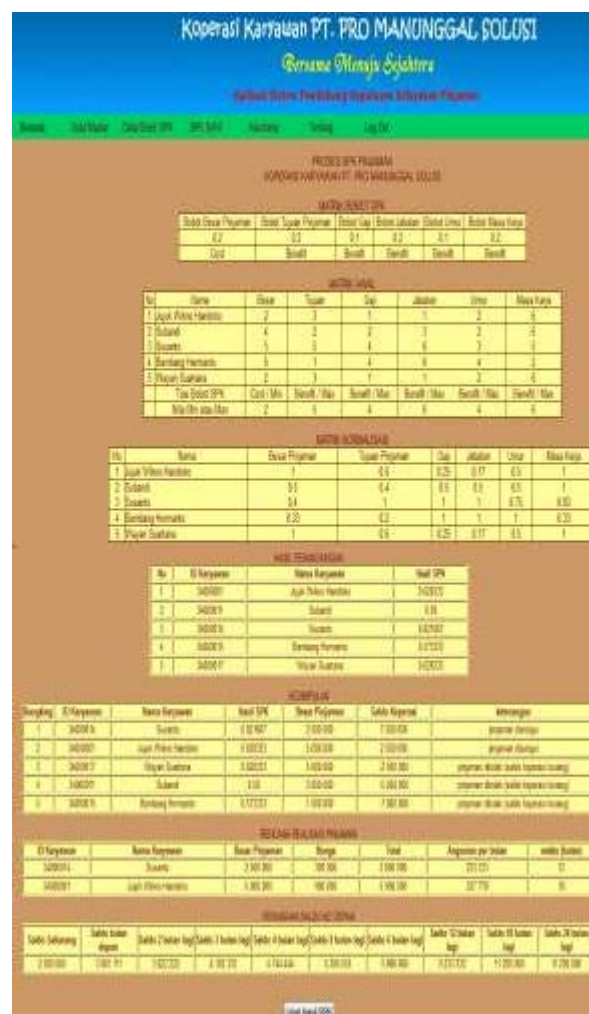
Figure 4.1. *SPK Process Menu Display*

Figure 4.2. *SPK Results Menu Display*

Figure 4.3 *Initial Cash Setting Menu Display*

5. RESULTS AND DISCUSSION

The experiment carried out was to carry out the SPK process on the data of employees who made loan applications. To facilitate understanding in testing, the test is modeled in a table form as follows:

a) Cooperative Data

Table 5.1. is cooperative data containing the name of the cooperative, address, motto and balance of the cooperative.

Table 5.1. Cooperative Data

Nama Koperasi	Alamat	Motto	Saldo Koperasi
Koperasi Karyawan PT. Pro Manunggal Solusi	Jl Camelia 1/10, Garden Dian Regency, Sedati - Juanda, Sidoarjo	Bersama Menuju Sejahtera	10000000

b) SPK Results without Cooperative Balance Limits

Table 5.2. is the result of SPK without limiting the balance of the cooperative, where the cooperative does not limit loans to every employee who applies for a loan. The SPK 1 results table contains the Employee ID, Employee Name, and the SPK Results.

ID Employee	Employee name	SPK Result
34000001	Jujuk Wikno Handoko	0,62
34000011	Subandi	0,58
34000014	Susanto	0,82
34000015	Bambang Hermanto	0,57
34000017	Wayan Suartana	0,62
34000019	Atim Subagyo	0,64
34000020	Budi Santoso	0,66
34000022	Sukahar	0,72
34000024	Sentot Sudiyantono	0,80
34000026	Siswandi	0,73

c) SPK Results with Cooperative Balance Limits

Table 5.3. is the result of SPK with a cooperative balance limit, where the cooperative limits loans to each employee who applies for a loan based on the ranking order and the cooperative balance. The SPK 1 results table contains Rank, Employee ID, Employee Name, SPK Results, Size, Cooperative Balance, and Information.

Table 5.3. *SPK Results 2*

Ranghing	ID Karyawan	Nama Karyawan	Hasil SPK	Besar	Saldo Koperasi	Keterangan
1	34000014	Susanto	0,82	2,5 juta	7,5 juta	pinjaman disetujui
2	34000024	Sentot Sudiyantono	0,80	3 juta	4,5 juta	pinjaman disetujui
3	34000026	Siswandi	0,73	1,5 juta	3 juta	pinjaman disetujui
4	34000022	Sukahar	0,72	4 juta	-1 juta	pinjaman ditolak (saldo koperasi kurang)
5	34000020	Budi Santoso	0,86	2 juta	-3 juta	pinjaman ditolak (saldo koperasi kurang)
6	34000019	Atim Subagyo	0,64	3,5 juta	-6,5 juta	pinjaman ditolak (saldo koperasi kurang)
7	34000017	Wayan Suartana	0,62	5 juta	-11,5 juta	pinjaman ditolak (saldo koperasi kurang)

d) Calculations on the Application
    1)   Loan Data

Figure 5.1. *Loan Data*

    2)   SPK Weight Matrix

Figure 5.2. *SPK Weight Matrix*

    3)   Initial Matrix

Figure 5.3. *Initial matrix*

    4)   Normalization Matrix

Figure 5.4. Normalization matrix

5) Ranking Results

Figure 5.5. *Ranking Results*

6) Conclusion

Figure 5.6. *Conclusion*

e) Manual Calculation

Completion steps:
1) Vector weight: W = [(0.2), (0.2), (0.1), (0.2), (0.1), (0.2)]
2) X Decision Matrix based on weight criteria:

$$
X = \begin{Bmatrix}
2 & 3 & 1 & 1 & 2 & 6 \\
4 & 2 & 2 & 3 & 2 & 6 \\
5 & 5 & 4 & 6 & 3 & 5 \\
6 & 1 & 4 & 6 & 4 & 2 \\
2 & 3 & 1 & 1 & 2 & 6 \\
4 & 1 & 4 & 6 & 4 & 3 \\
5 & 2 & 4 & 6 & 4 & 3 \\
3 & 3 & 4 & 6 & 4 & 2 \\
4 & 5 & 4 & 5 & 3 & 5 \\
6 & 4 & 4 & 5 & 3 & 5
\end{Bmatrix}
$$

3). Normalization of the X matrix using equation 1:

Alternative Employee 1

$$r11 = \frac{Min\ (2;4;5;6;2;4;5;3;4;6)}{2} = 1$$

$$r12 = \frac{3}{Max\ (3;2;5;1;3;1;2;3;5;4)} = 0{,}6$$

$$r13 = \frac{1}{Max\ (1;2;4;4;1;4;4;4;4;4)} = 0{,}25$$

$$r14 = \frac{1}{Max\ (1;3;6;6;1;6;6;6;5;5)} = 0{,}17$$

$$r15 = \frac{2}{Max\ (2;2;3;4;2;4;4;4;3;3)} = 0{,}5$$

$$r16 = \frac{6}{Max\ (6;6;5;2;6;3;3;2;5;5)} = 1$$

Alternatve Employee 2

$$r21 = \frac{Min\ (2;4;5;6;2;4;5;3;4;6)}{4} = 0{,}5$$

$$r22 = \frac{2}{Max\ (3;2;5;1;3;1;2;3;5;4)} = 0{,}4$$

$$r23 = \frac{2}{Max\ (1;2;4;4;1;4;4;4;4;4)} = 0{,}5$$

$$r24 = \frac{3}{Max\ (1;3;6;6;1;6;6;6;5;5)} = 0{,}5$$

$$r25 = \frac{2}{Max\ (2;2;3;4;2;4;4;4;3;3)} = 0{,}5$$

$$r26 = \frac{6}{Max\ (6;6;5;2;6;3;3;2;5;5)} = 1$$

Alternative Employee 3

$$r31 = \frac{Min\ (2;4;5;6;2;4;5;3;4;6)}{5} = 0{,}4$$

$$r32 = \frac{5}{Max\ (3;2;5;1;3;1;2;3;5;4)} = 1$$

$$r33 = \frac{4}{Max\ (1;2;4;4;1;4;4;4;4;4)} = 1$$

$$r34 = \frac{6}{Max\ (1;3;6;6;1;6;6;6;5;5)} = 1$$

$$r35 = \frac{3}{Max\ (2;2;3;4;2;4;4;4;3;3)} = 0{,}75$$

$$r36 = \frac{5}{Max\ (6;6;5;2;6;3;3;2;5;5)} = 0{,}83$$

Alternative Employee 4

$$r41 = \frac{Min\ (2;4;5;6;2;4;5;3;4;6)}{6} = 0,33$$

$$r42 = \frac{1}{Max\ (3;2;5;1;3;1;2;3;5;4)} = 0,2$$

$$r43 = \frac{4}{Max\ (1;2;4;4;1;4;4;4;4;4)} = 1$$

$$r44 = \frac{6}{Max\ (1;3;6;6;1;6;6;6;5;5)} = 1$$

$$r45 = \frac{4}{Max\ (2;2;3;4;2;4;4;4;3;3)} = 1$$

$$r46 = \frac{2}{Max\ (6;6;5;2;6;3;3;2;5;5)} = 0,33$$

Alternative Employee 5

$$r51 = \frac{Min\ (2;4;5;6;2;4;5;3;4;6)}{2} = 1$$

$$r52 = \frac{3}{Max\ (3;2;5;1;3;1;2;3;5;4)} = 0,6$$

$$r54 = \frac{1}{Max\ (1;3;6;6;1;6;6;6;5;5)} = 0,17$$

$$r55 = \frac{2}{Max\ (2;2;3;4;2;4;4;4;3;3)} = 0,5$$

$$r56 = \frac{6}{Max\ (6;6;5;2;6;3;3;2;5;5)} = 1$$

$$r61 = \frac{Min\ (2;4;5;6;2;4;5;3;4;6)}{4} = 0,5$$

$$r62 = \frac{1}{Max\ (3;2;5;1;3;1;2;3;5;4)} = 0,2$$

$$r63 = \frac{4}{Max\ (1;2;4;4;1;4;4;4;4;4)} = 1$$

$$r64 = \frac{6}{Max\ (1;3;6;6;1;6;6;6;5;5)} = 1$$

$$r65 = \frac{4}{Max\ (2;2;3;4;2;4;4;4;3;3)} = 1$$

$$r66 = \frac{3}{Max\ (6;6;5;2;6;3;3;2;5;5)} = 0,5$$

Alternative Employee 6

$$r61 = \frac{Min\ (2;4;5;6;2;4;5;3;4;6)}{4} = 0,5$$

$$r62 = \frac{1}{Max\ (3;2;5;1;3;1;2;3;5;4)} = 0,2$$

$$r63 = \frac{4}{Max\ (1;2;4;4;1;4;4;4;4;4)} = 1$$

$$r64 = \frac{6}{Max\ (1;3;6;6;1;6;6;6;5;5)} = 1$$

$$r65 = \frac{4}{Max\ (2;2;3;4;2;4;4;4;3;3)} = 1$$

$$r66 = \frac{3}{Max\ (6;6;5;2;6;3;3;2;5;5)} = 0,5$$

Alternative Employee 7

$$r71 = \frac{Min\ (2;4;5;6;2;4;5;3;4;6)}{5} = 0,4$$

$$r72 = \frac{2}{Max\ (3;2;5;1;3;1;2;3;5;4)} = 0,4$$

$$r73 = \frac{4}{Max\ (1;2;4;4;1;4;4;4;4;4)} = 1$$

$$r74 = \frac{6}{Max\ (1;3;6;6;1;6;6;6;5;5)} = 1$$

$$r75 = \frac{4}{Max\ (2;2;3;4;2;4;4;4;3;3)} = 1$$

$$r76 = \frac{3}{Max\ (6;6;5;2;6;3;3;2;5;5)} = 0,5$$

Alternative Employee8

$$r81 = \frac{Min\ (2;4;5;6;2;4;5;3;4;6)}{3} = 0,67$$

$$r82 = \frac{3}{Max\ (3;2;5;1;3;1;2;3;5;4)} = 0,6$$

$$r83 = \frac{4}{Max\ (1;2;4;4;1;4;4;4;4;4)} = 1$$

$$r84 = \frac{6}{Max\ (1;3;6;6;1;6;6;6;5;5)} = 1$$

$$r85 = \frac{4}{Max\ (2;2;3;4;2;4;4;4;3;3)} = 1$$

$$r86 = \frac{2}{Max\ (6;6;5;2;6;3;3;2;5;5)} = 0,33$$

Alternative Employee 9

$$r91 = \frac{Min\ (2;4;5;6;2;4;5;3;4;6)}{4} = 0,5$$

$$r92 = \frac{5}{Max\ (3;2;5;1;3;1;2;3;5;4)} = 1$$

$$r93 = \frac{4}{Max\ (1;2;4;4;1;4;4;4;4;4)} = 1$$

$$r94 = \frac{5}{Max\ (1;3;6;6;1;6;6;6;5;5)} = 0,83$$

$$r95 = \frac{3}{Max\ (2;2;3;4;2;4;4;4;3;3)} = 0,75$$

$$r96 = \frac{5}{Max\ (6;6;5;2;6;3;3;2;5;5)} = 0,83$$

Alternative Employee 10

$$r101 = \frac{Min\ (2;4;5;6;2;4;5;3;4;6)}{6} = 0,33$$

$$r102 = \frac{4}{Max\ (3;2;5;1;3;1;2;3;5;4)} = 0,8$$

$$r103 = \frac{4}{Max\ (1;2;4;4;1;4;4;4;4;4)} = 1$$

$$r104 = \frac{5}{Max\ (1;3;6;6;1;6;6;6;5;5)} = 0,83$$

$$r105 = \frac{3}{Max\ (2;2;3;4;2;4;4;4;3;3)} = 0,75$$

$$r106 = \frac{5}{Max\ (6;6;5;2;6;3;3;2;5;5)} = 0,83$$

From the results of the above calculations, the normalized matrix R is obtained, namely:

$$R = \begin{Bmatrix} 1 & 0,6 & 0,25 & 0,17 & 0,5 & 1 \\ 0,5 & 0,4 & 0,5 & 0,5 & 0,5 & 1 \\ 0,4 & 1 & 1 & 1 & 0,75 & 0,83 \\ 0,33 & 0,2 & 1 & 1 & 1 & 0,83 \\ 1 & 0,6 & 0,25 & 0,17 & 0,5 & 1 \\ 0,5 & 0,2 & 1 & 1 & 1 & 0,5 \\ 0,4 & 0,4 & 1 & 1 & 1 & 0,5 \\ 0,67 & 0,6 & 1 & 1 & 1 & 0,33 \\ 0,5 & 1 & 1 & 0,83 & 0,75 & 0,83 \\ 0,33 & 0,8 & 1 & 0.83 & 0,75 & 0,83 \end{Bmatrix}$$

4) Finding the best alternative using equation 2

$$V1 = (1 \times 0,2) + (0,6 \times 0,2) + (0,25 \times 0,1) +$$
$$(0,17 \times 0,2) + (0,5 \times 0,1) + (1 \times 0,2) = 0,62$$
$$V2 = (0,5 \times 0,2) + (0,4 \times 0,2) + (0,5 \times 0,1)$$
$$+ (0,5 \times 0,2) + (0,5 \times 0,1) + (1 \times 0,2) =$$
$$0,58$$

$$V3 = (0,4 \times 0,2) + (1 \times 0,2) + (1 \times 0,1) + (1 \times 0,2) + (0,75 \times 0,1) + (0,83 \times 0,2) = 0,82$$

$$V4 = (0,33 \times 0,2) + (0,2 \times 0,2) + (1 \times 0,1) + (1 \times 0,2) + (1 \times 0,1) + (0,83 \times 0,2) = 0,57$$

$$V5 = (1 \times 0,2) + (0,6 \times 0,2) + (0,25 \times 0,1) + (0,17 \times 0,2) + (0,5 \times 0,1) + (1 \times 0,2) = 0,62$$

$$V6 = (0,5 \times 0,2) + (0,2 \times 0,2) + (1 \times 0,1) + (1 \times 0,2) + (1 \times 0,1) + (0,5 \times 0,2) = 0,64$$

$$V7 = (0,4 \times 0,2) + (0,4 \times 0,2) + (1 \times 0,1) + (1 \times 0,2) + (1 \times 0,1) + (0,5 \times 0,2) = 0,66$$

$$V8 = (0,67 \times 0,2) + (0,6 \times 0,2) + (1 \times 0,1) + (1 \times 0,2) + (1 \times 0,1) + (0,33 \times 0,2) = 0,72$$

$$V9 = (0,5 \times 0,2) + (1 \times 0,2) + (1 \times 0,1) + (0,83 \times 0,2) + (0,75 \times 0,1) + (0,83 \times 0,2) = 0,80$$

$$V10 = (0,33 \times 0,2) + (0,8 \times 0,2) + (1 \times 0,1) + (0,83 \times 0,2) + (0,75 \times 0,1) + (0,83 \times 0,2) = 0,73$$

So the ranking results are: Rank 1: Susanto (Employee 3)

Rank 2: Sentot Sudiyantono (Employee 9)

Rank 3: Siswandi (Employee 10)

Rank 4: Sukahar (Employee 8) Rank 5: Budi Santoso (Employee 7) Rank 6: Atim Subagyo (Employee 6) Rank 7: Wayan Suartana (Employee 5)

Rank 8: Refer to Wikno Handoko (Employee 1)

Rank 9: Subandi (Employee 2) Rank 10: Bambang Hermanto (Employee 4)

5) Percentage of Opportunities The percentage of opportunities for each loan application, namely:

Table 5.4. *Percentage Table*

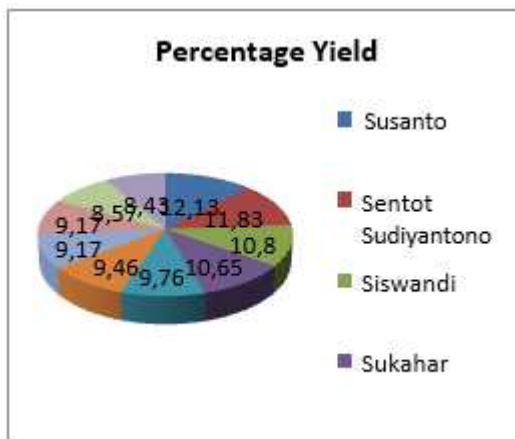| No.	Nama Karyawan	Hasil SPK	Prosentase
1.	Susanto	0,82	12,13 %
2.	Sentot Sudiyantono	0,80	11,83 %
3.	Siswandi	0,73	10,80 %
4.	Sukahar	0,72	10,65 %
5.	Budi Santoso	0,66	9,76 %
6.	Atim Subagyo	0,64	9,46 %
7.	Wayan Suartana	0,62	9,17 %
8.	Jujuk Wikno Handoko	0,62	9,17 %
9.	Subandi	0,58	8,57 %
10.	Bambang Hermanto	0,57	8,43 %

Figure 5.7. *Pie Chart*

f. Analysis of the SPK Results

The analysis carried out is to manually match the SAW calculation results using this application system whether it is appropriate or not. From the results of the above calculations, it can be seen that the results obtained from the application system are in accordance with the SAW calculation manually.

Whereas in Table 6.2. is the SPK result without the limit of the cooperative balance which only displays the ranking results. In Table 6.3. is the SPK result with a cooperative balance limit stated in the Cooperative Data (Table 6.1.). Each employee loan will be approved according to the rank and limited by the balance. So, after the ranking is done, then the loan size is added up according to the ranking order. From the order of ranking and addition, you can know the loan is approved or rejected. If the balance is sufficient, the loan will be approved, but if the balance is less, the loan will be rejected. Of the total value of the ranking results, loans approved with a sufficient balance were Susanto (0.82) with a 12.13% chance, Sentot Sudiyantono (0.80) with a probability of 11.83%, and Siswandi (0.73) with big chance 10.80% ..

6. CONCLUSIONS AND SUGGESTIONS

6.1 Conclusion

This final project entitled "Decision Support System for Cooperative Loan Feasibility Based on Employee Data, Using Simple Additive Weighting (SAW) Method. Case Study: PT. Pro Manunggal Solusi "aims to determine the creditworthiness of employees, so it can be concluded as follows :

[1]. Decision support system for loan eligibility for employees at PT. Pro Manunggal This solution can provide appropriate results in making the decision making process more efficient.
[2]. The Simple Additive Weighting (SAW) method can be used for decision support systems.
[3]. Application of the Simple Additive Weighting (SAW) method to perform calculations to produce a value in accordance with the needs of the cooperative.

6.2 Suggestion

After evaluating the system as a whole, it is hoped that this final project can be developed further with suggestions for development as follows:

[1]. For further determination, it is hoped that the system developed will perform other Decision Support System methods besides Simple Additive Weighting (SAW).
[2]. It is expected that the system developed further does not have a limit of only 6 criteria.

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