

## **CHAPTER III**

### **RESEARCH METHODOLOGY**

#### **3.1 Research Overview**

Determination of Research Granted Awardee and Community Service Using the AHP-SAW Method. This study employed the AHP (Analytical Hierarchy Process) and SAW (Simple Additive Weighting) methods. The AHP method was utilised to determine the alternative weighting by calculating the value of each criterion. There were several criteria in determining grant awardee recipients: reviewer rating, admin eligibility check, plenum, and cross-check. The SAW method could be solved the problem of an election with a model using a priority value or weight determined by each need.

The initial process is to calculate the weight value using the AHP method. The result value is the weighting value of the criteria on SAW. Subsequently, the process goes to the priority/ranking stage for data calculation by determining alternative values and criteria, furthermore normalising and ranking; thus, decision-making recommendations are produced according to the alternatives, criteria and weights of criteria needed. (Wahyu Istianto, 2020) .

#### **3.2 Data Collection**

In conducting this research, researchers collected primary and secondary data. Primary data was derived from interviews and interviews with related parties at LPPM to obtain information in determining research granted and community service related to the criteria and weights to be assessed. Secondary data was from report data on research grant recipients and community service at LPPM UMKT.

The research that has been carried out is the determination of research grants and community service using the AHP (Analytic Hierarchy Process) – SAW (Simple Additive Weighting) method. There are several stages in this research, are:

- 1) There are several criteria and alternatives for determining grants at LPPM that be used as a reference in making decisions, are:

Table 3.3.1 Alternative Table

| No | Alternative | Criteria name                               |
|----|-------------|---|
| 1  | A1          | Reni Suhelmi SKM.,M.Kes                     |
| 2  | A2          | Karina Putri Alamanda S.Psi., M.Psi.,       |
| 3  | A3          | Ikhawanul Muslimin SH, MH                   |
| 4  | A4          | Ni Wayan Wiwin Asthiningsih S.Kep.,<br>M.Pd |

**Alternative A1 =**

C1 -score 520

C2 - never submitted a proposal

- be the leader in 1 research
- does not have corn
- appropriate funds

C3- has no grant dependent

- the number of proposals has not met the quota
- members are not in various study programs
- have not received a grant in the previous year

C4 -has been a member four times

**Alternative A2 =**

C1 - score 0

C2 – never submitted a proposal

- be the leader in 1 research
- has corn
- appropriate funds

C3 - no grant dependent

- the number of proposals has not met the quota
- members are not in various study programs
- have not received a grant in the previous year

C4 - has been a member four times

**Alternative A3 =**

C1 - score 460

C2– never proposed a proposal

- be the leader in 1 research
- does not have corn
- appropriate funds

C3 - no grant dependent

- the number of proposals has not met the quota
- members are not in various study programs
- have not received a grant in the previous year

C4 - has been a member four times

**Alternative A4 =**

C1 - score 0

C2 – have proposed a proposal

- became the leader in 2 studies
- has corn
- appropriate funds

C3 - no grant dependent

- the number of proposals has not met the quota
- members are not in various study programs
- already received a grants in the previous year

C4 never participated in a grant

*Table 3.3.2 Criteria table*

| No | Criteria | Description                            |
|----|----------|--|
| 1  | C1       | Reviewer rating criteria               |
| 2  | C2       | Check the admin's eligibility criteria |
| 3  | C3       | Plenum criteria                        |
| 4  | C4       | Cross check criteria                   |

2) Determining the conversion value of each criterion is explained as follows:

Table 3.3. 3 Reviewer Rating

| No | Criteria C1  | weight |
|----|--|--------|
| 1  | Reviewer rating less than the 450 points                 | 1      |
| 2  | Reviewer rating more than 450 points                     | 2      |
| 3  | Reviewer rating more than 500 points or equal 500 points | 3      |
| 4  | Reviewer rating more than 550 points or equal 550 points | 4      |
| 5  | Reviewer rating more than 600 points or equal 600 points | 5      |

Table 3.3. 4 admin eligibility check criteria

| No | Criteria C2                                  | Weight |
|----|--|--------|
| 1  | Have applied for a grant                     | 1      |
|    | Be the group leader of more than 2 research  |        |
|    | Don't have a functional position             |        |
|    | Fund exceed ceiling which is determined      |        |
| 2  | Don't Have applied for a grant               | 2      |
|    | Be the group leader of more than 1 research  |        |
|    | Don't have a functional position             |        |
|    | Fund exceed ceiling which is determined      |        |
| 3  | Don't Have applied for a grant               | 3      |
|    | Be the group leader of more than 1 research  |        |
|    | have a functional position                   |        |
|    | Fund exceed ceiling which is determined      |        |
| 4  | Don't Have applied for a grant               | 4      |
|    | Be the group leader of more than 1 research  |        |
|    | have a functional position                   |        |
|    | Fund appropriate ceiling which is determined |        |

Table 3.3.5 Table plenum criteria

| NO | Criteria C3                                     | Weight |
|----|---|--------|
| 1  | have a dependents grants                        | 1      |
|    | the number of proposals has not met the quota   |        |
|    | does not have members in various study programs |        |
|    | have received a grant in the previous year      |        |
| 2  | does not have a dependent grant                 | 2      |
|    | the number of proposals has not met the quota   |        |
|    | does not have members in various study programs |        |
|    | have received a grant in the previous year      |        |
| 3  | does not have a dependent grant                 | 3      |
|    | the number of proposals has not met the quota   |        |
|    | does not have members in various study programs |        |
|    | have received a grant in the previous year      |        |
| 4  | does not have a dependent grant                 | 4      |
|    | the number of proposals has not met the quota   |        |
|    | have members in various study programs          |        |
|    | have received a grant in the previous year      |        |
|    | does not have a dependent grant                 |        |

|   |   |   |
|---|---|---|
| 5 | the number of proposals has not met the quota | 5 |
|   | have members in various study programs        |   |
|   | have received a grant in the previous year    |   |

*Table 3.3.6 Table cross check criteria*

| No | Criteria C4  | Weight |
|----|--|--------|
| 1  | if you have been a member 2x and have been chairman 2x | 5      |
| 2  | If you have been a member 4x                           | 4      |
| 3  | If you have been a member 2x                           | 3      |
| 4  | If you have been a chairman 1x                         | 2      |
| 5  | if you have never participated in a grant              | 1      |

### 3) Weighting the criteria values with the AHP method

This temporary preference weight is obtained from previous journals, then weighted using the AHP method. The AHP weighting is carried out in the following steps:

- a. Create a pairwise comparison matrix. The value of the comparison of the level of importance between each of the criteria used are:

5: Cx is more important than Cy

3: Cx is as important as Cy

1: Cx is not too important

The calculation process begins with the stage of comparing each criterion of interest with criteria x and criteria y which is as follows

*Table 3.3.7 Table of provisions for comparison of the importance of criteria*

| Cx | Cy | Information | Weight |
|----|----|-------------|--------|
|----|----|-------------|--------|

|                                  |                                  |                              |     |
|----------------------------------|----------------------------------|------------------------------|-----|
| Reviewer rating criteria         | Reviewer Rating Criteria         | Cx is not to important<br>Cy | 1   |
| Reviewer rating criteria         | admin eligibility check criteria | Cx is not to important<br>Cy | 1   |
| Reviewer rating criteria         | Plenum Criteria                  | Cx is more important than Cy | 5   |
| Reviewer rating criteria         | Cross Check Criteria             | Cx is not to important<br>Cy | 1   |
| admin eligibility check criteria | Reviewer Rating Criteria         | Cx is not to important<br>Cy | 1   |
| admin eligibility check criteria | admin eligibility check criteria | Cx is not to important<br>Cy | 1   |
| admin eligibility check criteria | Plenum Criteria                  | Cx is not to important<br>Cy | 1   |
| admin eligibility check criteria | Cross Check Criteria             | Cx is as important as Cy     | 3   |
| Plenum criteria                  | Reviewer Rating Criteria         | Cx is more important than Cy | 1/5 |
| Plenum criteria                  | admin eligibility check criteria | Cx is not to important<br>Cy | 1   |

|                      |                                  |                              |     |
|----------------------|----------------------------------|------------------------------|-----|
| Plenum criteria      | Plenum Criteria                  | Cx is not to important Cy    | 1   |
| Plenum criteria      | Cross Check Criteria             | Cx is more important than Cy | 5   |
| Cross check criteria | Reviewer Rating Criteria         | Cx is not to important Cy    | 1   |
| Cross check criteria | admin eligibility check criteria | Cx is as important as Cy     | 1/3 |
| Cross check criteria | Plenum Criteria                  | Cx is more important than Cy | 1/5 |
| Cross check criteria | Cross Check Criteria             | Cx is not to important Cy    | 1   |

b. Make a pairwise comparison table of each criterion which can be seen in the table 3.3.7

Table 3.3. 8 Pairwise comparison table for criteria

| Criteria | C1  | C2  | C3  | C4   |
|----------|-----|-----|-----|------|
| C1       | 1.0 | 1.0 | 5.0 | 1.0  |
| C2       | 1.0 | 1.0 | 1.0 | 3.0  |
| C3       | 1/5 | 1.0 | 1.0 | 5.0  |
| C4       | 1.0 | 1/3 | 1/5 | 1.0  |
| Amount   | 3.2 | 3.3 | 7.5 | 10.0 |

After the comparison process for C1 is completed, the next step is to make a value comparison assessment, where the value is broken down in decimal form, for example, the capacity value for characters with a value of 1/4 will change to a value of 0.25. The results of these values can be shown in the table below.

Table 3.3.9 Pairwise comparison results table for criteria

| Criteria | C1 | C2 | C3 | C4 |
|----------|----|----|----|----|
|----------|----|----|----|----|



|        |     |     |     |      |
|--------|-----|-----|-----|------|
| C1     | 1.0 | 1.0 | 5.0 | 1.0  |
| C2     | 1.0 | 1.0 | 1.0 | 3.0  |
| C3     | 0.2 | 1.0 | 1.0 | 5.0  |
| C4     | 1.0 | 0.3 | 0.5 | 1.0  |
| Amount | 3.2 | 3.3 | 7.5 | 10.0 |

c. Perform normalization from table 3.3.9 So that getting results like Table 3.3.10 can be described as follows:

$$C_1 = (C_x) \text{ Reviewer Rating Criteria} / \text{Sum of all Reviewer Rating Criteria } (C_y)$$

$$= 1.00 / 3.2$$

$$= 0.31$$

$$C_2 = (C_x) \text{ Check the admin's eligibility criteria} / \text{Sum of all Check the admin's eligibility criteria } (C_y)$$

$$= 1.00 / 3.3$$

$$= 0.3$$

$$C_3 = (C_x) \text{ Plenum Criteria} / \text{Sum of all Plenum Criteria } (C_y)$$

$$= 5.00 / 7.5$$

$$= 0.67$$

$$C_4 = (C_x) \text{ Cross Check Criteria} / \text{Sum of all Cross Check Criteria } (C_y)$$

$$= 1.00 / 10.00$$

$$= 0.1$$

The results of normalization of each criterion as a whole are shown in table 3.3.10

*Table 3.3.10 Normalization Table*

| Criteria | C1   | C2  | C3    | C4  |
|----------|------|-----|-------|-----|
| C1       | 0.31 | 0.3 | 0.67  | 0.1 |
| C2       | 0.31 | 0.3 | 0.13  | 0.3 |
| C3       | 0.06 | 0.3 | 0.13  | 0.5 |
| C4       | 0.31 | 0.1 | 0.067 | 0.1 |

d. Weighting is done by dividing each number of rows by the number of criteria.

An example of finding the average value as a weighted value is as follows:

- $W1 = \frac{1}{4} (0,31 + 0,3 + 0,67 + 0,1) = 0,35$
- $W2 = \frac{1}{4} (0,31 + 0,3 + 0,13 + 0,3) = 0,26$

- $W3 = \frac{1}{4} (0,06 + 0,3 + 0,13 + 0,5) = 0,25$
- $W4 = \frac{1}{4} (0,31 + 0,1 + 0,067 + 0,1) = 0,14$

The results of the search for the average value of the criteria to get the weight value of each criterion are shown in Table 3.3.11

*Table 3.3. 11 Table of the result of the weight value of each criterion*

| Criteria                               | Value Weight (W) |
|--|------------------|
| Reviewer Rating Criteria               | 0.35             |
| Check the admin's eligibility criteria | 0.26             |
| Plenum Criteria                        | 0.25             |
| Cross Check Criteria                   | 0.14             |

- e. Doing the consistency ratio, the way to get the consistent ratio value is by adding the number of rows per row plus the weight value. As Shown in table 3.3.12

*Table 3.3.12 consistency ratio calculation table*

|           | number of comparisons | Weight | Results     |
|-----------|-----------------------|--------|-------------|
| <b>C1</b> | 3.2                   | 0.35   | 1.13        |
| <b>C2</b> | 3.3                   | 0.26   | 0.87        |
| <b>C3</b> | 7.2                   | 0.25   | 1.81        |
| <b>C4</b> | 10                    | 0.14   | 1.33        |
|           | <b>amount</b>         |        | <b>5.13</b> |

The result column is all summed up to get a total of 5.13.

The value of NC comes from the criteria, namely 4.

$$\lambda \max = \frac{5,13}{4} = 1,28$$

$$Cl = \frac{1,28-4}{4-1} = \frac{-2,72}{3} = -0,91$$

$$CR = \frac{-0,91}{0,90} = -1,01$$

Then the value of CR is less than equal to 0.1 then the value is consistent

- 4) Doing the ranking using the SAW method.

a. The first step is to create a decision matrix. Shown in the table below

Table 3.3.13 Decision matrix table

| Alternative | Criteria |    |    |    |
|-------------|----------|----|----|----|
|             | C1       | C2 | C3 | C4 |
| A1          | 3        | 2  | 5  | 2  |
| A2          | 1        | 4  | 5  | 2  |
| A3          | 2        | 2  | 5  | 4  |
| A4          | 1        | 1  | 2  | 5  |

The following is the decision matrix (X):

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

b. Decision x matrix normalization process.

Column 1 benefits

$$r_{11} \frac{3}{\text{Max}(3.1.2.1)} = \frac{3}{3} = 1$$

$$r_{21} \frac{1}{\text{Max}(3.1.2.1)} = \frac{1}{3} = 0,33$$

$$r_{31} \frac{2}{\text{Max}(3.1.2.1)} = \frac{2}{3} = 0,67$$

$$r_{41} \frac{1}{\text{Max}(3.1.2.1)} = \frac{1}{3} = 0,33$$

Column 2 benefits

$$r_{12} \frac{2}{\text{Max}(2.4.2.1)} = \frac{2}{4} = 0,5$$

$$r_{22} \frac{4}{\text{Max}(2.4.2.1)} = \frac{4}{4} = 1$$

$$r_{32} \frac{2}{\text{Max}(2.4.2.1)} = \frac{2}{4} = 0,5$$

$$r_{42} \frac{1}{\text{Max}(2.4.2.1)} = \frac{1}{4} = 0,25$$

Column 3 benefits

$$r_{13} \frac{5}{\text{Max}(5.5.5.2)} = \frac{5}{5} = 1$$

$$r_{23} \frac{5}{\text{Max}(5.5.5.2)} = \frac{5}{5} = 1$$

$$r_{33} \frac{5}{\text{Max}(5.5.5.2)} = \frac{5}{5} = 1$$

$$r_{43} \frac{5}{\text{Max}(5.5.5.2)} = \frac{2}{5} = 0,4$$

Column 4 cost

$$r_{14} \frac{\text{Min}(2.2.4.5)}{2} = \frac{2}{2} = 1$$

$$r_{24} \frac{\text{Min}(2.2.4.5)}{2} = \frac{2}{2} = 1$$

$$r_{34} \frac{\text{Min}(2.2.4.5)}{4} = \frac{2}{4} = 0,5$$

$$r_{44} \frac{\text{Min}(2.2.4.5)}{5} = \frac{2}{5} = 0,4$$

normalization matrix R

$$R = \begin{pmatrix} 1 & 0,5 & 1 & 1 \\ 0,33 & 1 & 1 & 1 \\ 0,67 & 0,5 & 1 & 0,5 \\ 0,33 & 0,25 & 0,4 & 0,4 \end{pmatrix}$$

c. The ranking process using weights from AHP:

*Table 3.3.14 Weight Result Table*

| Criteria                               | Value of Weight (W) |
|--|---------------------|
| Reviewer Rating Criteria               | 0.35                |
| Check the admin's eligibility criteria | 0.26                |
| Plenum Criteria                        | 0.25                |
| Cross Check Criteria                   | 0.14                |
| <b>total</b>                           | <b>1</b>            |

$$W = (0.35 | 0.26 | 0.25 | 0.13) = 1$$

Multiply the normalized matrix with the weight matrix:

$$\begin{aligned} V1 &= (0.35 \times 1) + (0.26 \times 0.5) + (0.25 \times 1) + (0.13 \times 1) \\ &= (0.35) + (0.13) + (0.25) + (0.14) \\ &= 0.86 \end{aligned}$$

$$\begin{aligned} V2 &= (0.35 \times 0.33) + (0.26 \times 1) + (0.25 \times 1) + (0.13 \times 1) \\ &= (0.12) + (0.26) + (0.25) + (0.14) \\ &= 0.76 \end{aligned}$$

$$\begin{aligned}
 V3 &= (0.35 \times 0.67) + (0.26 \times 0.5) + (0.25 \times 1) + (0.13 \times 0.5) \\
 &= (0.23) + (0.13) + (0.25) + (0.07) \\
 &= 0.68
 \end{aligned}$$

$$\begin{aligned}
 V4 &= (0.35 \times 0.33) + (0.26 \times 0.25) + (0.25 \times 0.4) + (0.13 \times 0.4) \\
 &= (0.12) + (0.7) + (0.1) + (0.06) \\
 &= 0.33
 \end{aligned}$$

From the calculations carried out, the ranking results will be as follows:

*Table 3.3.15 Ranking results table*

| Name  | Mark | Rank |
|---|------|------|
| (A1) Reni Suhelmi<br>SKM.,M.Kes                           | 0,86 | 1    |
| (A2) Karina Putri<br>Alamanda S.Psi.,<br>M.Psi., Psikolog | 0,76 | 2    |
| (A3) Ikhwanul<br>Muslim S.H., M.H.                        | 0,68 | 3    |
| (A4) Ni Wayan<br>Wiwin Asthiningsih<br>S.Kep., M.Pd       | 0,33 | 4    |

The final result obtained from the ranking is that Reni Suhelmi SKM.,M .Kes has the highest ranking value, and the one with the lowest rank is Ni Wayan Wiwin Asthiningsih S.Kep., M.Pd.

*Table 3.3.16 Calculation results using matlab tools*

```

Pemilihan menggunakan metode SAW
W =

    0.35174    0.26285    0.25035    0.13507

Data Alternatif
3 2 5 2
1 4 5 2
2 2 5 4
1 1 2 5
Bobot
    0.35174    0.26285    0.25035    0.13507

```

```

atribut positif
3 4 5 5
atribut negatif
1 1 2 2
matrix ternormalisasi
0.35174 0.13142 0.25035 0.00000
0.11725 0.26285 0.25035 0.00000
0.23449 0.13142 0.25035 0.00000
0.11725 0.06571 0.10014 0.00000
Perangkingan
0.73351
0.63045
0.61627
0.28310

```

### 3.3 Testing

Tests in this study were conducted by comparing the results of the implementation of the AHP-SAW method with the results of decisions made by LPPM for determining the recipients of research grants and community service. Accuracy value is obtained by: 100% – the average error value. Finding the average value is by  $\frac{\text{Number of errors}}{\text{the amount of data}} \times 100$

### 3.4 Research Schedule

This research will be conducted from January 2022 to July 2022. The research schedule is described in the table below:

Table 3.5.1 Research schedule table

| No | Activity description | Execution time |   |   |   |          |   |   |   |       |   |   |   |       |   |   |   |     |   |   |   |      |   |
|----|----------------------|----------------|---|---|---|----------|---|---|---|-------|---|---|---|-------|---|---|---|-----|---|---|---|------|---|
|    |                      | January        |   |   |   | February |   |   |   | March |   |   |   | April |   |   |   | May |   |   |   | June |   |
|    |                      | 1              | 2 | 3 | 4 | 1        | 2 | 3 | 4 | 1     | 2 | 3 | 4 | 1     | 2 | 3 | 4 | 1   | 2 | 3 | 4 | 1    | 2 |
| 1  | Reference collection | ■              | ■ | ■ | ■ |          |   |   |   |       |   |   |   |       |   |   |   |     |   |   |   |      |   |
| 2  | Identification       |                |   |   |   | ■        | ■ | ■ | ■ |       |   |   |   |       |   |   |   |     |   |   |   |      |   |
| 3  | data collection      |                |   |   |   |          |   |   |   | ■     | ■ | ■ | ■ |       |   |   |   |     |   |   |   |      |   |
| 4  | Data Processing      |                |   |   |   |          |   |   |   |       |   |   |   | ■     | ■ | ■ | ■ |     |   |   |   |      |   |
| 5  | Implementation       |                |   |   |   |          |   |   |   |       |   |   |   |       |   |   |   | ■   | ■ | ■ | ■ |      |   |
| 6  | Evaluation           |                |   |   |   |          |   |   |   |       |   |   |   |       |   |   |   |     |   |   |   | ■    | ■ |
| 7  | Result report        |                |   |   |   |          |   |   |   |       |   |   |   |       |   |   |   |     |   |   |   |      |   |