



Decision Support System for Determining Employee Leave Using the Moora Method Case Study of the Central Bureau of Statistics of Medan City

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ABSTRACT

Data is indispensable in the decision-making system process. Good and appropriate decisions require accurate, fast, and relevant data. The decision support system for determining employee leave at the Central Bureau of Statistics of Medan City still uses a simple method that is only considered by the general subdivision and its leadership without following the existing criteria standards, which is very inefficient for employees who have to wait for leave approval from their leaders. The method used in this decision support system for determining employee leave is the Multi-Objective Optimisation on the Basis of Ratio Analysis (MOORA) method and system development using the waterfall model. In implementing and designing the program using the Hypertext Preprocessor (PHP) programming language with the database used MySQL. The final results obtained from this research are A8 on behalf of Rabiah with the highest rank with a value of 0.2913 and A2 on behalf of Artha with the lowest rank with a value of 0.1338.

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1. INTRODUCTION

Good decisions require accurate, fast, and relevant data. With the right data, supervisors can understand specific situations and make more efficient and timely decisions. Information disclosure is key to promoting transparent and accountable governance. BPS Medan City, which reports directly to the President, provides important data for the government and the community. However, BPS still uses a manual, time-consuming, and ineffective approval mechanism for employee leave. This process is often considered unfair because it lacks transparency, with high operational costs and weak controls, resulting in frequent fraud and data loss.

To improve efficiency, transparency, and fairness, a Decision Support System (DSS) is needed. SPK is a system that is able to generate solutions or handle problems, helping someone make decisions more effectively and efficiently [1]. Decision-making technology can solve various other problems, such as knowing consumer purchasing patterns [2], predicting the eligibility level of prospective KPR (Home Ownership Credit) customers [3], detecting cancer [4], and determining the best employees [5] [6]. With the SPK, employees can receive leave fairly, and the accuracy of leave data can be guaranteed by following the predetermined standard criteria.

The MOORA method is suitable for a decision support system for determining employee leave at BPS Medan City because it is simple, easy to understand, flexible, and more stable than other methods [7]. The previous research using the MOORA method was conducted by [8] entitled Decision Support System for

Selection of the Best Oil Palm Harvester Employees Using the Moora Method. This research aims to select the best oil palm harvester employees and design a Decision Support System to evaluate the selection process.

Based on the above problems, an efficient, effective, and accurate decision support system is needed in determining employee leave. With this decision support system, employees can receive leave fairly, and the accuracy of their leave data can be guaranteed by following the standard criteria that have been determined. In designing this application, the system development life cycle (SDLC) will be carefully considered. This is very important in software (system) development because it helps to reduce the risk of errors and ensure that the software (system) produced is in accordance with the needs and expectations of users [9]. Therefore, researchers are interested in conducting research with the title "Decision Support System for Determining Employee Leave Using the Moora Method Case Study of the Central Bureau of Statistics of Medan City".

2. METHOD

2.1. Types and Sources of Data

The data used in this research consists of two types: Primary data is obtained directly from BPS Medan City through interviews and observations related to the process of determining employee leave. Meanwhile, secondary data is obtained from documentation, literature studies, and literature related to decision support systems using the Multi-Objective Optimisation on the Basis of Ratio Analysis (MOORA) Method.

2.2. Data Collection Methods

Researchers conducted observations, interviews, and literature studies to collect relevant data. Observations and interviews with employees of the General Administration Subdivision of BPS Medan City were conducted to understand the procedure for determining employee leave. Meanwhile, relevant literature was used to support the theoretical analysis of the Decision Support System with the MOORA method.

2.3. Data Analysis Method

The data analysis method used is descriptive, with an interview, observation, and literature study approach. The data obtained was then coded and classified to support research analysis.

2.4. Analysis

The method of developing a decision support system for determining employee leave uses a waterfall model.

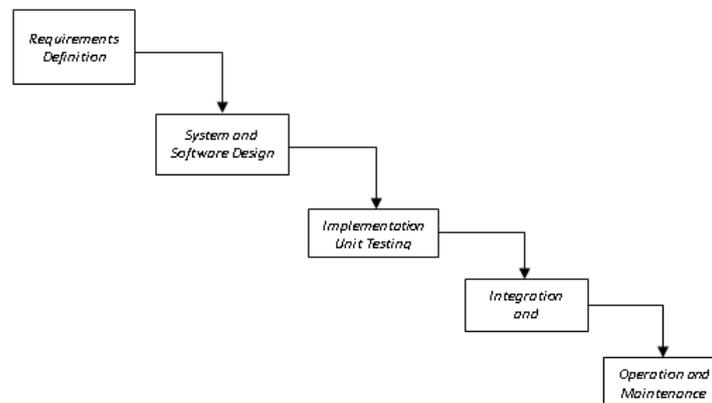


Figure 1. Waterfall Method

2.5. Analysis of the Weaknesses of the Current System

BPS Medan City still uses a manual process in determining employee leave, which risks causing errors and injustice due to the absence of a decision support system. The implementation of this system is expected to reduce errors and ensure that employees take leave according to established standards.

2.6. New System Requirements Analysis

The new system with the MOORA method must be able to manage employee data, leave criteria, and provide fair decisions. The design should be user-friendly and responsive. Required hardware: Intel Core i3 processor, 4 GB RAM, and 500 GB SSD. Required software: Windows 11, XAMPP 3.3.0, PHP 8, Sublime Text, and Chrome.

2.7. Use Case Diagram

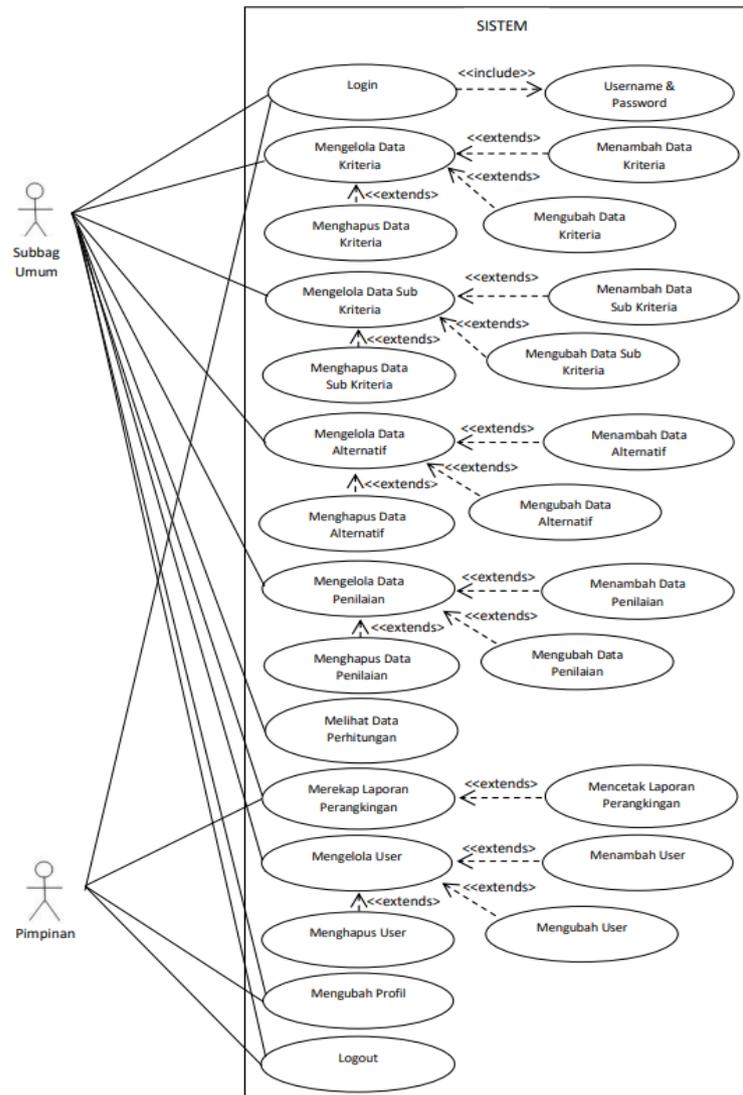


Figure 2. Use Case Diagram

3. RESULTS AND DISCUSSION

3.1. Discussion of MOORA Method Calculation

The following is a list of weights from the specified criteria:

Table I. Assessment Criteria

Criteria	Description	Weight	Type
C1	Types of Leave	0.15	Cost
C2	Leave Request Letter	0.15	Benefit
C3	Level of Importance of Leave	0.2	Benefit
C4	Length of Leave Request	0.25	Benefit
C5	Length of Service	0.25	Benefit

The following is a table of the weights of each of the assessment sub criteria that have been determined.

Table II. Assessment Sub Criteria

No	Name Sub Criteria	Description	Weight
1	Type of Leave	Sick Leave	1
		Leave for Important Reasons	2
		Annual Leave	3
		Maternity/Paternity/Leave	4
		Grand Leave	5

No	Name Sub Criteria	Description	Weight
		Leave of Absence	6
		Joint Leave	7
2	Leave Request Letter	None	1
		Available	2
3	Level of Importance of Leave	Quite Important	1
		Important	2
		Very Important	3
4	Length of Leave Request	> 2 monts	1
		1 month < C4 <= 2 months	2
		< 1 month	3
5	Employee's Length of Service	< 10 years	1
		11 years < C5 <= 20 years	2
		> 20 years	3

The following is the alternative data of employee leave of the Central Bureau of Statistics of Medan City.

Table III. Alternative Data

No	Name	Criteria				
		C1	C2	C3	C4	C5
1	Aan (A1)	Sick leave	Available	Very Important	2 days	18 years
2	Artha (A2)	Annual leave	Available	Moderately Important	3 days	4 years
3	Diah (A3)	Important reason leave	Available	Very Important	12 days	13 years
4	Erfin (A4)	Annual leave	Available	Important	5 days	6 years
5	Indra (A5)	Annual leave	Available	Important enough	4 days	16 years
6	Khairul (A6)	Important reason leave	Available	Important	15 days	11 years
7	Husni (A7)	Annual leave	Available	Important enough	6 days	24 years
8	Rabiah (A8)	Important reason leave	Available	Very Important	21 days	28 years
9	Ragdad (A9)	Important reason leave	Available	Important	18 days	9 years
10	Septi (A10)	Sick leave	Available	Very Important	1 day	3 years

The following table shows the rating of the suitability value of the employee leave of the Central Bureau of Statistics of Medan City.

Table IV. Suitability Value Rating

No	Name	Criteria				
		C1	C2	C3	C4	C5
1	A1	1	2	3	3	2
2	A2	3	2	1	3	1
3	A3	2	2	3	3	2
4	A4	3	2	2	3	1
5	A5	3	2	1	3	2

No	Name	Criteria				
		C1	C2	C3	C4	C5
6	A6	2	2	2	3	2
7	A7	3	2	1	3	3
8	A8	2	2	3	3	3
9	A9	2	2	2	3	1
10	A10	1	2	3	3	1

$$\text{Decision matrix: } X_{ij} = \begin{Bmatrix} 1 & 2 & 3 & 3 & 2 \\ 3 & 2 & 1 & 3 & 1 \\ 2 & 2 & 3 & 3 & 2 \\ 3 & 2 & 2 & 3 & 1 \\ 3 & 2 & 1 & 3 & 2 \\ 2 & 2 & 2 & 3 & 2 \\ 3 & 2 & 1 & 3 & 3 \\ 2 & 2 & 3 & 3 & 3 \\ 2 & 2 & 2 & 3 & 1 \\ 1 & 2 & 3 & 3 & 1 \end{Bmatrix}$$

$$W = \{0.15 \quad 0.15 \quad 0.2 \quad 0.25 \quad 0.25\}$$

Matrix normalization:

a. Criteria C1 (Type of Leave)

$$C1 = \sqrt{1^2 + 3^2 + 2^2 + 3^2 + 3^2 + 2^2 + 3^2 + 2^2 + 2^2 + 1^2} = 7.3484$$

$$X_{1,1} = 1 / 7.3484 = 0.1360 \quad X_{6,1} = 2 / 7.3484 = 0.2721$$

$$X_{2,1} = 3 / 7.3484 = 0.4082 \quad X_{7,1} = 3 / 7.3484 = 0.4082$$

$$X_{3,1} = 2 / 7.3484 = 0.2721 \quad X_{8,1} = 2 / 7.3484 = 0.2721$$

$$X_{4,1} = 3 / 7.3484 = 0.4082 \quad X_{9,1} = 2 / 7.3484 = 0.2721$$

$$X_{5,1} = 3 / 7.3484 = 0.4082 \quad X_{10,1} = 1 / 7.3484 = 0.1360$$

b. Criteria C2 (Leave Request Letter)

$$C2 = \sqrt{2^2 + 2^2 + 2^2 + 2^2 + 2^2 + 2^2 + 2^2 + 2^2 + 2^2 + 2^2} = 6.3245$$

$$X_{1,2} = 2 / 6.3245 = 0.3162 \quad X_{6,2} = 2 / 6.3245 = 0.3162$$

$$X_{2,2} = 2 / 6.3245 = 0.3162 \quad X_{7,2} = 2 / 6.3245 = 0.3162$$

$$X_{3,2} = 2 / 6.3245 = 0.3162 \quad X_{8,2} = 2 / 6.3245 = 0.3162$$

$$X_{4,2} = 2 / 6.3245 = 0.3162 \quad X_{9,2} = 2 / 6.3245 = 0.3162$$

$$X_{5,2} = 2 / 6.3245 = 0.3162 \quad X_{10,2} = 2 / 6.3245 = 0.3162$$

c. Criteria C3 (Leave Importance Level)

$$C3 = \sqrt{3^2 + 1^2 + 3^2 + 2^2 + 1^2 + 2^2 + 1^2 + 3^2 + 2^2 + 3^2} = 7.1414$$

$$X_{1,3} = 3 / 7.1414 = 0.4200 \quad X_{6,3} = 2 / 7.1414 = 0.2800$$

$$X_{2,3} = 1 / 7.1414 = 0.1400 \quad X_{7,3} = 1 / 7.1414 = 0.1400$$

$$X_{3,3} = 3 / 7.1414 = 0.4200 \quad X_{8,3} = 3 / 7.1414 = 0.4200$$

$$X_{4,3} = 2 / 7.1414 = 0.2800 \quad X_{9,3} = 2 / 7.1414 = 0.2800$$

$$X_{5,3} = 1 / 7.1414 = 0.1400 \quad X_{10,3} = 3 / 7.1414 = 0.4200$$

d. Criteria C4 (Length of Leave Request)

$$C4 = \sqrt{3^2 + 3^2 + 3^2 + 3^2 + 3^2 + 3^2 + 3^2 + 3^2 + 3^2 + 3^2} = 9.4868$$

$$X_{1,4} = 3 / 9.4868 = 0.3162 \quad X_{6,4} = 3 / 9.4868 = 0.3162$$

$$X_{2,4} = 3 / 9.4868 = 0.3162 \quad X_{7,4} = 3 / 9.4868 = 0.3162$$

$$X_{3,4} = 3 / 9.4868 = 0.3162 \quad X_{8,4} = 3 / 9.4868 = 0.3162$$

$$X_{4,4} = 3 / 9.4868 = 0.3162 \quad X_{9,4} = 3 / 9.4868 = 0.3162$$

$$X_{5,4} = 3 / 9.4868 = 0.3162 \quad X_{10,4} = 3 / 9.4868 = 0.3162$$

e. Criteria C5 (Length of Service)

$$C5 = \sqrt{2^2 + 1^2 + 2^2 + 1^2 + 2^2 + 2^2 + 3^2 + 3^2 + 1^2 + 1^2} = 6.1644$$

$$X_{1,5} = 2 / 6.1644 = 0.3244 \quad X_{6,5} = 2 / 6.1644 = 0.3244$$

$$X_{2,5} = 1 / 6.1644 = 0.1622 \quad X_{7,5} = 3 / 6.1644 = 0.4866$$

$$X_{3,5} = 2 / 6.1644 = 0.3244 \quad X_{8,5} = 3 / 6.1644 = 0.4866$$

$$X_{4,5} = 1 / 6.1644 = 0.1622 \quad X_{9,5} = 1 / 6.1644 = 0.1622$$

$$X_{5,5} = 2 / 6.1644 = 0.3244 \quad X_{10,5} = 1 / 6.1644 = 0.1622$$

$$x * ij = \begin{pmatrix} 0.1360 & 0.3162 & 0.4200 & 0.3162 & 0.3244 \\ 0.4082 & 0.3162 & 0.1400 & 0.3162 & 0.1622 \\ 0.2721 & 0.3162 & 0.4200 & 0.3162 & 0.3244 \\ 0.4082 & 0.3162 & 0.2800 & 0.3162 & 0.1622 \\ 0.4082 & 0.3162 & 0.1400 & 0.3162 & 0.3244 \\ 0.2721 & 0.3162 & 0.2800 & 0.3162 & 0.3244 \\ 0.4082 & 0.3162 & 0.1400 & 0.3162 & 0.4866 \\ 0.2721 & 0.3162 & 0.4200 & 0.3162 & 0.4866 \\ 0.2721 & 0.3162 & 0.2800 & 0.3162 & 0.1622 \\ 0.1360 & 0.3162 & 0.4200 & 0.3162 & 0.1622 \end{pmatrix}$$

Optimizing the value of Yi

a. Optimization calculation on alternative 1 (A1)

$$y^*1 = ((x_{1,2(\max)} * w_2) + (x_{1,3(\max)} * w_3) + (x_{1,4(\max)} * w_4) + (x_{1,5(\max)} * w_5)) - (x_{1,1(\min)} * w_1)$$

$$y^*1 = ((0.3162 * 0.15) + (0.4200 * 0.2) + (0.3162 * 0.25) + (0.3244 * 0.25)) - (0.1360 * 0.15) = 0.2711$$

b. Optimization calculation on alternative 2 (A2)

$$y^*1 = ((0.3162 * 0.15) + (0.1400 * 0.2) + (0.3162 * 0.25) + (0.1622 * 0.25)) - (0.4082 * 0.15) = 0.1338$$

c. Optimization calculation on alternative 3 (A3)

$$y^*1 = ((0.3162 * 0.15) + (0.4200 * 0.2) + (0.3162 * 0.25) + (0.3244 * 0.25)) - (0.2721 * 0.15) = 0.2507$$

d. Optimization calculation on alternative 4 (A4)

$$y^*1 = ((0.3162 * 0.15) + (0.2800 * 0.2) + (0.3162 * 0.25) + (0.1622 * 0.25)) - (0.4082 * 0.15) = 0.1618$$

e. Optimization calculation on alternative 5 (A5)

$$y^*1 = ((0.3162 * 0.15) + (0.1400 * 0.2) + (0.3162 * 0.25) + (0.3244 * 0.25)) - (0.4082 * 0.15) = 0.1743$$

f. Optimization calculation on alternative 6 (A6)

$$y^*1 = ((0.3162 * 0.15) + (0.2800 * 0.2) + (0.3162 * 0.25) + (0.3244 * 0.25)) - (0.2721 * 0.15) = 0.2227$$

g. Optimization calculation on alternative 7 (A7)

$$y^*1 = ((0.3162 * 0.15) + (0.1400 * 0.2) + (0.3162 * 0.25) + (0.4866 * 0.25)) - (0.4082 * 0.15) = 0.2149$$

h. Optimization calculation on alternative 8 (A8)

$$y^*1 = ((0.3162 * 0.15) + (0.4200 * 0.2) + (0.3162 * 0.25) + (0.4866 * 0.25)) - (0.2721 * 0.15) = 0.2913$$

i. Optimization calculation on alternative 9 (A9)

$$y^*1 = ((0.3162 * 0.15) + (0.2800 * 0.2) + (0.3162 * 0.25) + (0.1622 * 0.25)) - (0.2721 * 0.15) = 0.1822$$

j. Optimization calculation on alternative 10 (A10)

$$y^*1 = ((0.3162 * 0.15) + (0.4200 * 0.2) + (0.3162 * 0.25) + (0.1622 * 0.25)) - (0.1360 * 0.15) = 0.2306$$

Ranking Result

The largest value is the selected alternative. The following is a table of ranking results:

Table V. Ranking Results

Alternative	Value	Ranking
A8	0.2913	1
A1	0.2711	2
A3	0.2507	3
A10	0.2306	4
A6	0.2227	5
A7	0.2149	6
A9	0.1822	7
A5	0.1743	8
A4	0.1618	9
A2	0.1338	10

3.2. Discussion of the Program Interface

The following is the login page, which is the initial page before entering the main page.

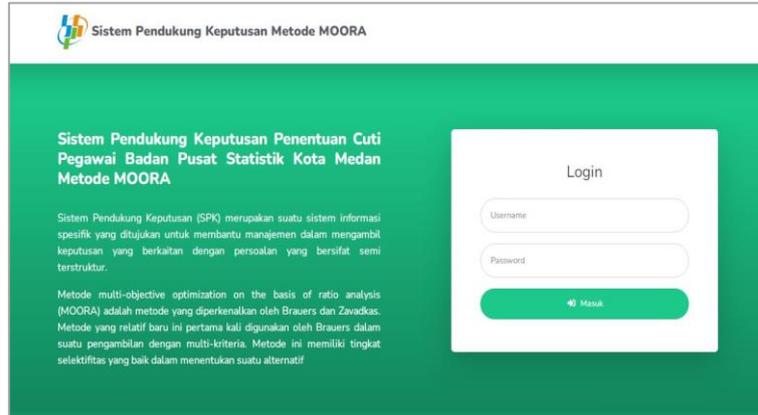


Figure 3. Login Page

The following is the admin/general subdivision dashboard page and user/leader, which contain options such as criteria data, sub-criteria data, alternative data, assessment data, calculation data, and ranking data.

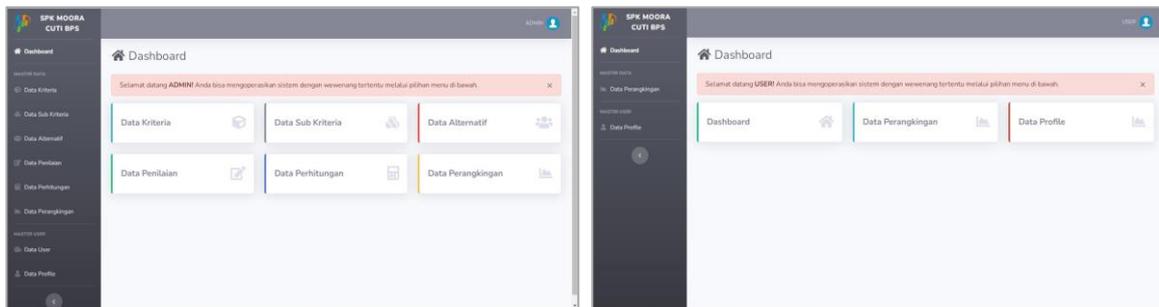


Figure 4. Dashboard Page Admin or General Subdivision and User or Leader

The following is the criteria data list page and the Leave Type Sub Criteria Page:

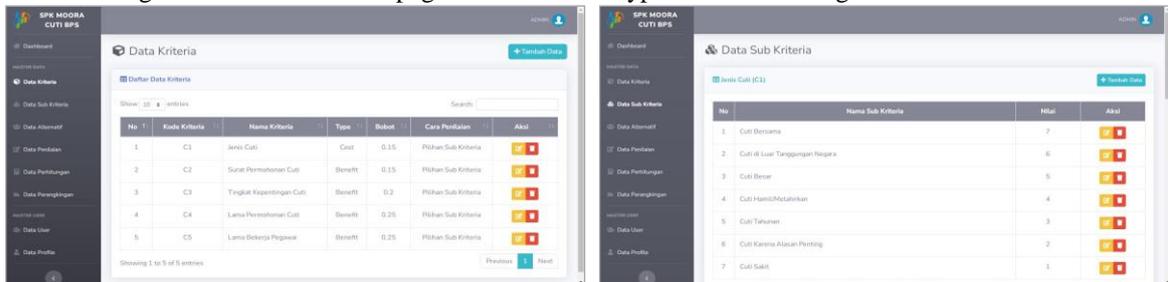


Figure 5. Criteria Data Page and Leave Type Sub Criteria Page

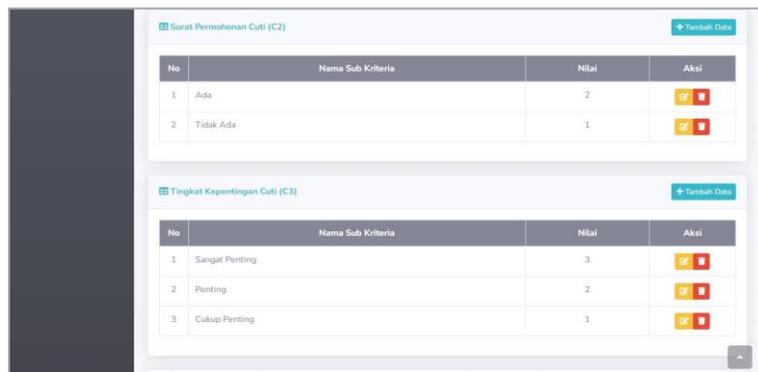


Figure 6. Leave Request Sub Criteria and Leave Importance Page

The image shows two sub-criteria pages. The first is titled 'Lama Permohonan Cuti (C4)' and the second is 'Lama Bekerja Pegawai (C5)'. Both pages have a table with columns for 'No', 'Nama Sub Kriteria', 'Nilai', and 'Aksi'.

No	Nama Sub Kriteria	Nilai	Aksi
1	< 1 bulan	3	[Edit] [Delete]
2	1 bulan < C4 <= 2 bulan	2	[Edit] [Delete]
3	> 2 bulan	1	[Edit] [Delete]

No	Nama Sub Kriteria	Nilai	Aksi
1	> 20 tahun	3	[Edit] [Delete]
2	11 tahun < C5 <= 20 tahun	2	[Edit] [Delete]
3	< 10 tahun	1	[Edit] [Delete]

Figure 7. Sub-criteria Page Length of Leave Request and Length of Service of Employees

Here is the alternative data page and assessment data:

Two screenshots showing data tables. The left one is 'Data Alternatif' and the right one is 'Matriks Data Penilaian'. Both show a list of 10 alternatives with columns for 'No', 'Name', and 'Aksi'.

Figure 8. Alternative Data and Assessment Data Page

The following decision matrix calculation data page (X) contains alternative names, C1, C2, C3, C4 and C5.

Two screenshots. The left one is 'Matriks Keputusan (X)' showing a matrix with columns C1-C5 and rows for 10 alternatives. The right one is 'Bobot Preferensi (W)' showing preference weights for C1-C5.

No	Nama Alternatif	C1	C2	C3	C4	C5
1	Aan	3	2	3	3	2
2	Artha	3	2	1	3	1
3	Diah	2	2	3	3	2
4	Erfin	3	2	2	3	1
5	Indra	3	2	1	3	2
6	Khanis	2	2	3	3	2
7	Huzni	3	2	1	3	3
8	Rabiah	2	2	3	3	3
9	Ragiblat	2	2	2	3	1
10	Septi	3	2	3	3	1

C1 (Cost)	C2 (Benefit)	C3 (Benefit)	C4 (Benefit)	C5 (Benefit)
0.15	0.15	0.2	0.25	0.25

Figure 9. Decision Matrix (X) and Preference Weight (W) Calculation Page

Two screenshots showing normalized matrices. The left one is 'Matriks Ternormalisasi (R)' and the right one is 'Matriks Normalisasi Terbobot'. Both show normalized values for 10 alternatives across criteria C1-C5.

Figure 10. Weighted Nominalized (R) and Nominalized Matrix Calculation Page

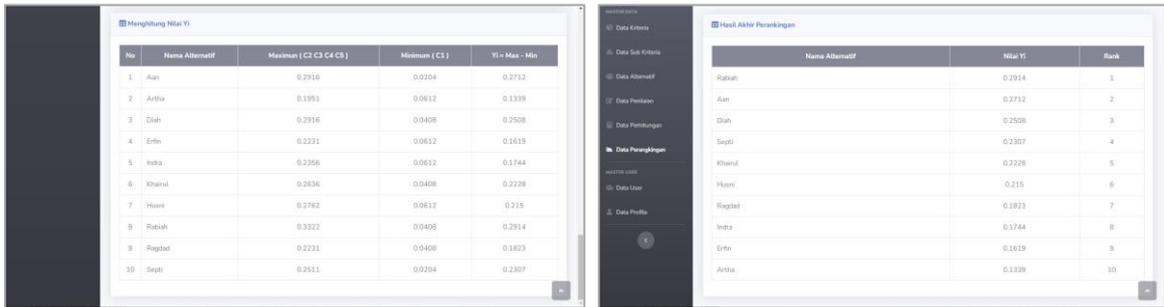


Figure 11. Calculating Yi Value Page and Ranking Data Page

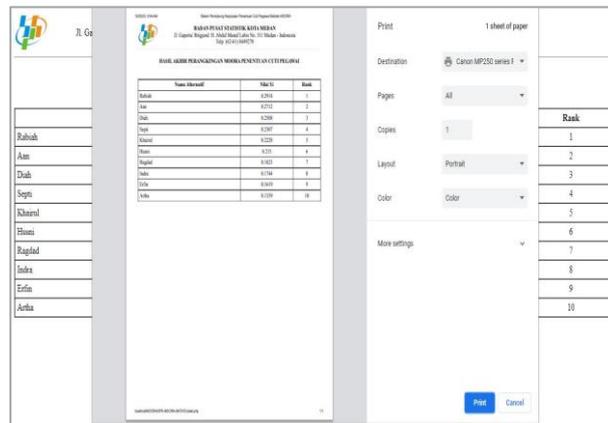


Figure 12. Data Print Output Page

4. CONCLUSION

Based on the results of research and discussion, the following conclusions can be drawn:

1. The application of a decision support system using the MOORA method makes it easier for the general subdivision to determine leave, and BPS Medan City employees can receive leave fairly and transparently based on predetermined criteria.
2. The calculation results of the decision support system application using the MOORA method at BPS Kota Medan are on behalf of Rabiah (A8) getting the first rank with the result of the Yi value of 0.2913 and on behalf of Artha (A2) getting the last rank with the result of the Yi value of 0.1338.

REFERENCES

[1] M. R. Wayahdi and F. Ruziq, "Implementasi Metode WASPAS pada Sistem Penerimaan Anggota Baru," *Jurnal Minfo Polgan*, vol. 13, no. 1, pp. 164–171, Feb. 2024, doi: 10.33395/JMP.V13I1.13504.

[2] R. Fadli, F. Ruziq, and C. Imam, "Implementation of Data Mining on Sales Data of Bambu Ungu Cafe to Find out Consumer Purchasing Patterns Using the Apriori Algorithm | Journal of Technology and Computer," *Journal of Technology and Computer*, vol. 1, no. 2, pp. 26–33, May 2024, Accessed: Aug. 10, 2024. [Online]. Available: <https://journal.technolabs.co.id/index.php/jotechcom/article/view/11>

[3] M. Anggraini, F. Ruziq, and R. N. Singarimbun, "Implementation of Data Mining to Predict the Eligibility Level for Prospective KPR (Home Ownership Credit) Subsidized Housing Customers Mitra Griya Indah Using the C4.5 Algorithm," *Journal of Technology and Computer*, vol. 1, no. 2, pp. 20–25, May 2024, doi: 10.33395/JMP.V12I1.12743.

[4] M. R. Wayahdi and F. Ruziq, "KNN and XGBoost Algorithms for Lung Cancer Prediction," *Journal of Science Technology (JoSTec)*, vol. 4, no. 1, pp. 179–186, Dec. 2022, doi: 10.55299/JOSTEC.V4I1.251.

[5] I. Syahputra, F. Ruziq, and A. Rambe, "Decision Support System for Determining the Best Employee with Web-Based AHP Method at Pariwisata Polytechnic | Journal of Technology and Computer," *Journal of Technology and Computer*, vol. 1, no. 2, pp. 12–19, May 2024, Accessed: Aug. 10, 2024. [Online]. Available: <https://journal.technolabs.co.id/index.php/jotechcom/article/view/9>

-
- [6] F. Ruziq, M. R. Wayahdi, “Sistem Pendukung Keputusan Seleksi Karyawan Baru dengan Simple Additive Weighting pada PT. Technology Laboratories Indonesia,” *Jurnal Minfo Polgan*, vol. 11, no. 2, pp. 153–159, Aug. 2022, doi: 10.33395/JMP.V11I2.13506.
- [7] S. Chaeruddin, I. Sukarsih, and R. Respitawulan, “Pemilihan Marketplace Di Masa Pandemi Covid-19 Menggunakan Metode MOORA,” *CESS (Journal of Computer Engineering, System and Science)*, vol. 6, no. 2, pp. 149–154, Jul. 2021, doi: 10.24114/CESS.V6I2.22511.
- [8] M. Mesran, S. D. A. Pardede, A. Harahap, and A. P. U. Siahaan, “Sistem Pendukung Keputusan Pemilihan Peserta Jaminan Kesehatan Masyarakat (Jamkesmas) Menerapkan Metode MOORA,” *JURNAL MEDIA INFORMATIKA BUDIDARMA*, vol. 2, no. 2, Apr. 2018, doi: 10.30865/MIB.V2I2.595.
- [9] M. R. Wayahdi and F. Ruziq, “Pemodelan Sistem Penerimaan Anggota Baru dengan Unified Modeling Language (UML) (Studi Kasus: Programmer Association of Battuta),” *Jurnal Minfo Polgan*, vol. 12, no. 1, pp. 1514–1521, Aug. 2023, doi: 10.33395/JMP.V12I1.12870.