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Selection Of The Best Employees Using The Complex Proportional Assessment Method

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Abstrak: Sistem Pendukung Keputusan Pemilihan Karyawan Terbaik dengan Metode Complex Proportional Assessment (Copras). Penghargaan yang diberikan perusahaan kepada karyawan terbaik dapat mendorong setiap karyawan untuk selalu memberikan kinerja terbaiknya bagi perusahaan dalam menjalankan tugas dan kewajibannya di perusahaan. Pengambilan keputusan untuk menentukan karyawan terbaik dapat dilakukan oleh perusahaan dengan menilai kinerja yang telah dilakukan oleh karyawannya dalam kurun waktu tertentu. Penilaian kinerja karyawan pada perusahaan dipengaruhi oleh beberapa kriteria yaitu kinerja, sikap kerja, kerjasama tim, hasil kerja, dan kedisiplinan. Sistem pendukung keputusan pemilihan karyawan terbaik menggunakan metode Complex Proportional Assessment (Copras), dimana proses pengambilan keputusan dilakukan dengan menilai alternatif pilihan berdasarkan kriteria yang telah ditentukan. Perhitungan dari metode Complex Proportional Assessment (Copras) memberikan hasil yaitu urutan kepentingan kriteria dan rekomendasi karyawan terbaik, dimana urutan kriteria terpenting dimulai dari kinerja, sikap kerja, kerjasama tim, hasil kerja, dan kedisiplinan. Adapun hasil penelitian pemilihan karyawan terbaik alternatif A7 dengan skor 100 adalah nama Deni.

Kata kunci: pengambilan keputusan multi atribut; Sistem Pendukung Keputusan; Pemilihan Karyawan; Metode COPRAS

Abstract: *Decision Support System for Selection of the Best Employees with the Complex Proportional Assessment (Copras) Method. Awards given by the company to the best employees can encourage every employee to always provide the best performance for the company in carrying out their duties and obligations in the company. Decision-making to determine the best employee can be done by the company by assessing the performance that has been carried out by its employees within a certain period. Evaluation of employee performance at the company is influenced by several criteria, namely performance, work attitude, teamwork, work results, and discipline. The decision support system for selecting the best employees uses the Complex Proportional Assessment (Copras) method, where the decision-making process is carried out by assessing choices based on predetermined criteria.*

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Calculations from the Complex Proportional Assessment (Copras) method yield results, namely the order of importance of the criteria and the best employee recommendations, where the order of the most important criteria starts from performance, work attitude, teamwork, work results, and discipline. As for the results of the research on selecting the best employee, the A7 alternative with a score of 100 is Deni's name

Keywords: *multi attribute decision making; Decision Support System; Elections Employees; COPRAS Method*

I. INTRODUCTION

Decision Support System is a system that has the ability to solve problems or communicate for structured and unstructured problem conditions that have a role in helping solve problems and no one knows how decisions should be made[1]. To make a decision, of course, requires careful analysis in calculations, depending on the number or number of criteria that affect the problem that requires a decision. Decision-making with many criteria requires a way for special handling, especially since the criteria and decision-making are interrelated. For that, we need a model of valuation decisions that will be taken in the company. The assessment factors consist of performance appraisal, work attitude, teamwork, work results, and discipline[2].

The human resources owned by the company must be qualified human resources. One of the ways to obtain quality human resources is through efforts to evaluate employee performance. In everyday life, humans are often faced with choices to make a decision. Taking quick and careful decisions will be the key to success in global competition[3]. Human resources in a company organization are very important to support the progress and quality of a company in achieving better goals. Employees who have high discipline will be evaluated in career planning in a company. In this case, the process of evaluating and assessing employee performance is relatively frequent, so the company requires a standard procedure in determining the requirements for an employee to occupy a certain position in the company. Companies that have a large number of employees will have problems in the field of human resource management[4]. Some of the obstacles faced by the company are a large number of employees, the cadre which is considered not optimal, and the existence of subjectivity in a promotion. Employees are one of the most important assets owned by a company in its efforts to maintain survival, development, and ability to compete and earn profits.

Employee evaluation is one of the factors to determine good human resources with multiple criteria and expertise required by the company. In its implementation, several problems that often occur in the process of evaluating and assessing employee performance include the subjectivity of decision-making. The subjectivity in question is if an employee immediately gets a promotion because of only one evaluation criterion regardless of the results of other evaluations, where this subjectivity is intertwined to reduce the complexity of the decision-making process due to the many alternatives[5]. In addition, the process of promotion and career planning in companies is only based on certain factors, namely the level of education and the length of time worked. However, there are still many other factors to judge someone in the promotion process, such as quality of work, work experience, employee expertise, work delays and absences in attendance or other skills possessed[6][7].

The multi-criteria problem in research requires a method that can process and compare individual competencies to job competencies so that differences in competence can be identified. Profile Matching is a very important process in HR management where competencies (capabilities) required by a position are determined first. These competencies must be fulfilled by the holder or candidate whose performance will be assessed by a Complex Proportional Assessment[1][3].

II. METODE DAN MATERI

The stages carried out in this study using the COPRAS (Complex Proportional Assessment) method must be followed include the following stages[5][3]:

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Stage 1:
Make matrix decisions. The decision matrix is the value matrix of alternatives and attributes

$$Xij= \begin{bmatrix} A^1 & A^{11} & A^{12} & A^{13} & A^{14} & A^1{}_n \\ A^2 & A^{21} & A^{22} & A^{23} & A^{24} & A^2{}_n \\ A^3 & A^{31} & A^{32} & A^{33} & A^{34} & A3_n \\ A^4 & A^{41} & A^{42} & A^{43} & A^{44} & A^4{}_n \\ A^5 & A^{51} & A^{52} & A^{53} & A^{54} & A^5{}_n \\ A^6 & A^{61} & A^{62} & A^{63} & A^{64} & A^6{}_n \\ A^7 & A^{71} & A^{72} & A^{73} & A^{74} & A^7{}_n \\ A^8 & A^{81} & A^{82} & A^{83} & A^{84} & A^8{}_n \\ A^9 & A^{91} & A^{92} & A^{93} & A^{94} & A^9{}_n \\ A^{10} & A^{101} & A^{102} & A^{103} & A^{104} & A^{10}{}_n \\ A^{11} & A^{111} & A^{112} & A^{113} & A^{114} & A^{11}{}_n \\ A_m & [A_m{}^1 & A_m{}^2 & A_m{}^3 & A_m{}^4 & A_{mn}] \end{bmatrix}$$

Stage 2:
Matrix normalization in decision making. To normalize the matrix using the following formula:
following:

$$R = \left[r_{ij}\right]_{mxn} = X_{ij} \,/\, \sum_{i=1}^{m} X_{ij} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Dividing each value from the column by the value of the sum of each column in question to get matrix normalization

Stage 3:
Determine the taking of the weighted normalization matrix, to determine the weighted normalization using the following formula:

$$D^1 = D_{ij} = X_{ij} \times W_j \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where Xij is the normalized value of the alternative, and Wj is the weight of the criteria. The sum of the weighted normalized values of each criterion is always the same as the weight for that criterion.

Stage 4:

Calculation of the highest and lowest values on the index for each alternative p. The following is the formula for calculating the highest and lowest values for each alternative:

$$S_{+i} = \sum_{j=1}^{n} y_{+ij} \;, S_{-i} = \sum_{j=1}^{n} y_{-ij} \quad \ldots\ldots\ldots\ldots (3)$$

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Where y+ij and y-ij are weighted normalized values for beneficial and unprofitable (cost) attributes. The lower the S-i value, the better the alternative. S+i and S-i values reveal the level of goals achieved by each alternative. However, the sum of the 'plus' S+1 and 'minus' S-1 of the alternatives always equals the sum of the weights for the benefit and cost attributes[3].

Stage 5:
Determine the significance of the alternative based on the determination of the positive alternative S+1 and the negative alternative S-1 by calculating the relative weight of each alternative.

Stage 6:
Relative significance value, determine the relative significance or relative priority (Qi) of each alternative.

$$Q_i = S_{+i} + \frac{\sum_{i=1}^{m} S_{-i}}{S_{-i} \cdot \sum_{i=1}^{m} (1 / S_{-i})}, \quad i = 1,2,.,,m \quad \ldots(4)$$

Where S-1 min is the minimum value of S-i . while the greater the Qi value, the higher the priority of the alternative. The relative significance value of an alternative shows the level of satisfaction achieved by the achieved alternative. The alternative with the highest significance value (Qmax) is the best choice among the follower alternatives[2].

Stage 7:
Calculate the quantitative utility (Ui) for each alternative.

$$U_i = \frac{Q_i}{Q_{max}} . 100\%$$

Where Qmax is the maximum relative significance value. This utility value ranges from 0% to 100%. The alternative with the highest utility value (Umax) is the best choice among follower alternatives.

Research methods
The following figure 1. of the Complex Proportional Assessment (COPRAS) method:

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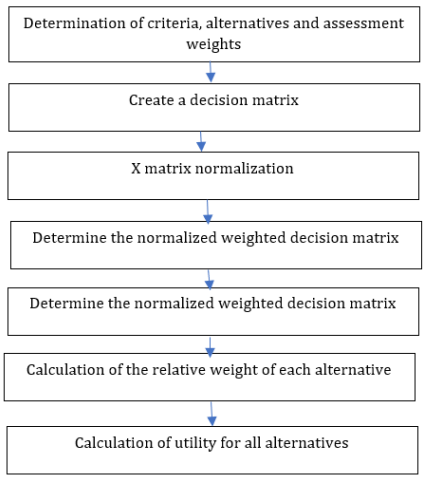

Figure 1. Complex Proportional Assessment Method Framework (COPRAS)

Data analysis

Data analysis was carried out using 12 employees as respondents at PT. Gading Sarana Putra Warehouse section. To obtain the required data, the authors requested employee assessment data from the HRD section.

III. RESULTS AND DISCUSSION

Determination of Criteria, Weight

In making decisions in selecting the best employees, data such as criteria data, weight data and alternatives are needed. For this selection, there are 5 (five) criteria used to carry out an assessment. The various criteria have a weight value where the results use the method, Complex Proportional Assessment (COPRAS).

Table 1. Criteria data

No	*Criteria Name*	*Criteria Code*
1	Performance	C1
2	Work attitude	C2
3	Teamwork	C3
4	Work result	C4
5	Discipline	C5

In table 1. You can see the criteria used as an assessment of the criteria in selecting the best employees. Once the criteria are known, a weight is created for each criterion. The weight of the criteria is the preference weight (weight of importance) given by the decision maker as a consideration of the level of importance of each existing criterion. The following is the weight of each criterion as shown in table 2

Table 2. Criteria data

No	*Criteria Name*	*Criteria Code*
1	Performance	40%
2	Work attitude	20%
3	Teamwork	20%
4	Work result	10%

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5	Discipline	10%

The following is a table of conversions for each criterion that will be used in data processing using the Complex Proportional Assessment (COPRAS) method, namely as follows:

Table 3. Work Results Criteria Data

No	*Work Results*	*Weight*
1	Very fast	5
2	Fast	4
3	Standard	3
4	Less fast	2
5	Very Less Fast	1

In table 4, it can be used for performance criteria, work attitudes, teamwork

Table 4. Disciplinary Criteria Data

No	*Discipline Criteria*	*Weight*
1	50%	1
2	60%	2
3	70%	3
4	80%	4
5	90%	5

The following is a table of criteria normalization of the alternatives that will be used in the problem solving process which can be seen in table 5.

Table 5. Disciplinary Criteria Data

No	*Employee Name*	*C1*	*C2*	*C3*	*C4*	*C5*
1	Deni	Very good	Very good	Well	Very Less Fast	90%
2	Iwan	Well	Well	Very good	Less fast	70%
3	Ismail	Well	Enough	Enough	Very fast	80%
4	Andri	Enough	Well	Not good	Standard	70%
5	Farlin	Not good	Very Less Good	Enough	Fast	60%
6	Rizki	Enough	Not good	Enough	Standard	50%
7	Susi	Very good	Very good	Very good	Standard	90%
8	Wahyu	Very Less Good	Very Less Good	Enough	Very fast	70%
9	Eriyanti	Very good	Enough	Enough	Less fast	80%
10	Afrizal	Very Less Good	Not good	Enough	Very fast	50%
11	Sumadi	Very good	Enough	Well	Less fast	90%
12	Irawan	Enough	Enough	Very good	Fast	60%

The following is the data from the assessment of each alternative to the criteria, namely in the table 6

Table 6. Alternative normalized data results

No	*Employee Name*	*C1*	*C2*	*C3*	*C4*	*C5*
1	Deni	5	5	4	1	5
2	Iwan	4	4	5	2	3
3	Ismail	4	3	3	5	4
4	Andri	3	4	2	3	3
5	Farlin	2	1	3	4	2
6	Rizki	3	2	3	3	1
7	Susi	5	5	5	3	5
8	Wahyu	1	1	3	5	3
9	Eriyanti	5	3	3	2	4

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10	Afrizal	1	2	3	5	1
11	Sumadi	5	3	4	2	5
12	Irawan	3	3	5	4	2

Application of the Corpars Method

The following are the steps in determining the selection of the best employees using the COPRAS method.
1. Create a Decision Matrix
Decision matrices based on alternative normalized data are:

$$Xij=\begin{bmatrix} A^1 & A^{11} & A^{12} & A^{13} & A^{14} & A^1{}_n \\ A^2 & A^{21} & A^{22} & A^{23} & A^{24} & A^2{}_n \\ A^3 & A^{31} & A^{32} & A^{33} & A^{34} & A3_n \\ A^4 & A^{41} & A^{42} & A^{43} & A^{44} & A^4{}_n \\ A^5 & A^{51} & A^{52} & A^{53} & A^{54} & A^5{}_n \\ A^6 & A^{61} & A^{62} & A^{63} & A^{64} & A^6{}_n \\ A^7 & A^{71} & A^{72} & A^{73} & A^{74} & A^7{}_n \\ A^8 & A^{81} & A^{82} & A^{83} & A^{84} & A^8{}_n \\ A^9 & A^{91} & A^{92} & A^{93} & A^{94} & A^9{}_n \\ A^{10} & A^{101} & A^{102} & A^{103} & A^{104} & A^{10}{}_n \\ A^{11} & A^{111} & A^{112} & A^{113} & A^{114} & A^{11}{}_n \\ A_m & [A_m{}^1 & A_m{}^2 & A_m{}^3 & A_m{}^4 & A_{mn}] \end{bmatrix} \quad Xij = \begin{bmatrix} 5 & 5 & 4 & 1 & 5 \\ 4 & 4 & 5 & 2 & 3 \\ 4 & 3 & 3 & 5 & 4 \\ 3 & 4 & 2 & 3 & 3 \\ 2 & 1 & 3 & 4 & 2 \\ 3 & 2 & 3 & 3 & 1 \\ 5 & 5 & 5 & 3 & 5 \\ 1 & 1 & 3 & 5 & 3 \\ 5 & 3 & 3 & 2 & 4 \\ 1 & 2 & 3 & 5 & 1 \\ 5 & 3 & 4 & 2 & 5 \\ 3 & 3 & 5 & 4 & 2 \end{bmatrix}$$

2. Normalization of the X Matrix
Matrix normalization is done by adding up each column. Then divide each alternative value from that column by the sum per column to get the Xij matri, as follows:

$$rij = \begin{bmatrix} 0.12195 & 0.13889 & 0.093023 & 0.02564 & 0.13158 \\ 0.09756 & 0.11111 & 0.116279 & 0.05128 & 0.07895 \\ 0.09756 & 0.08333 & 0.069767 & 0.12821 & 0.10526 \\ 0.07317 & 0.11111 & 0.046512 & 0.07692 & 0.07895 \\ 0.04878 & 0.02778 & 0.069767 & 0.10256 & 0.05263 \\ 0.07317 & 0.05556 & 0.069767 & 0.07692 & 0.02632 \\ 0.12195 & 0.13889 & 0.116279 & 0.07692 & 0.13158 \\ 0.02439 & 0.02778 & 0.069767 & 0.12821 & 0.07895 \\ 0.12195 & 0.08333 & 0.069767 & 0.05128 & 0.10526 \\ 0.02439 & 0.05556 & 0.069767 & 0.12821 & 0.02632 \\ 0.12195 & 0.08333 & 0.093023 & 0.05128 & 0.13158 \\ 0.07317 & 0.08333 & 0.116279 & 0.10256 & 0.05263 \end{bmatrix}$$

In Figure 3, the results of the matrix derived from calculations with the formula for the number of combinations of performance criteria, work attitudes, teamwork and discipline are obtained.

3. Determine the Normalized Weighted Decision Matrix
After obtaining the Xij matrix, the next step is to determine the normalized weighted decision matrix (Dij) by multiplying the value of each alternative with the weight of the criteria presented in Table 6 Criteria Data, using the equation D = yij = rij × Wij, from the calculation above then the Dij matrix is obtained:

$$\begin{bmatrix} 0.0488 & 0.0278 & 0.0186 & 0.0026 & 0.0132 \\ 0.0390 & 0.0222 & 0.0233 & 0.0051 & 0.0079 \end{bmatrix}$$

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$$Dij = \begin{bmatrix} 0.0390 & 0.0167 & 0.0140 & 0.0128 & 0.0105 \\ 0.0293 & 0.0222 & 0.0093 & 0.0077 & 0.0079 \\ 0.0195 & 0.0056 & 0.0140 & 0.0103 & 0.0053 \\ 0.0293 & 0.0111 & 0.0140 & 0.0077 & 0.0026 \\ 0.0488 & 0.0278 & 0.0233 & 0.0077 & 0.0132 \\ 0.0098 & 0.0056 & 0.0140 & 0.0128 & 0.0079 \\ 0.0488 & 0.0167 & 0.0140 & 0.0051 & 0.0105 \\ 0.0098 & 0.0111 & 0.0140 & 0.0128 & 0.0026 \\ 0.0488 & 0.0167 & 0.0186 & 0.0051 & 0.0132 \\ 0.0293 & 0.0167 & 0.0233 & 0.0103 & 0.0053 \end{bmatrix}$$

Figure 5. Matrix calculation results for each alternative.

4. Maximize and minimize the index for each alternative

From the acquisition of the Dij value then add the value of each criterion based on the type which has been described in Table 4.1 Data Criteria Type benefit means S+1 (max) while type cost means S-1 (min).

5. Ui utility calculation for each Alternative

The final step is to calculate the utility for each alternative, the utility value ranges from 0% to 100%.

$$U_i = \frac{Q_i}{Q_{max}} \times 100\%$$

Hasil:

$U_1 = (\frac{0,10165}{0,11143}) \times 100\% = 91,2\ \%$

$U_2 = (\frac{0,09617}{0,11143}) \times 100\% = 86,3\ \%$

$U_3 = (\frac{0.08737}{0,11143}) \times 100\% = 78,4\ \%$

$U_4 = (\frac{0.07502}{0,11143}) \times 100\% = 67,3\ \%$

$U_5 = (\frac{0.05907}{0,11143}) \times 100\% = 53,0\ \%$

$U_6 = (\frac{0.08156}{0,11143}) \times 100\% = 73,1\ \%$

$U_7 = (\frac{0.11143}{0,11143}) \times 100\% = 100\ \%$

$U_8 = (\frac{0.04867}{0,11143}) \times 100\% = 43.6\%$

$U_9 = (\frac{0,08943}{0,11143}) \times 100\% = 80,3\%$

$U_{10} = (\frac{0,06729}{0,11143}) \times 100\% = 60,4\%$

$U_{11} = (\frac{0,09310}{0,11143}) \times 100\% = 83,6\%$

$U_{12} = (\frac{0,08925}{0,11143}) \times 100\% = 80,1\%$

Based on the results of calculations using the Complex Proportional Assessment (COPRAS) method, the final

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ranking results are obtained which can be seen in the following table.

Table 10. Ranking Results on Alternatives

Code	*Name of Employee*	*Final Value Ranking*	*No. Ranking*
A7	Deni	100	1
A1	Iwan	91,2	2
A2	Ismail	86,3	3
A11	Andri	83,6	4
A9	Farlin	80,3	5
A12	Rizki	80,1	6
A3	Susi	78,4	7
A6	Wahyu	73,1	8
A4	Eriyanti	67,3	9
A10	Afrizal	60,4	10
A5	Sumadi	53	11
A8	Irawan	43,6	12

From the results of this ranking, a decision was taken according to the highest order of the final value of the calculation that was carried out. The one who deserved to be selected as the best employee at the company was deni with a final ranking value of 100.

IV. CONCLUSION

Based on the results of the implementation and testing of the Decision Support System for selecting the best employees by applying the Complex Proportional Assessment Method (COPRAS), it can be concluded that: The system can solve problems well in selecting the best employees by implementing the Complex Proportional Assessment Method (COPRAS) because the steps the solution is quite simple, by using this system the user can be more effective and efficient in determining the best employee and the results obtained from the calculation of this system are only a tool for the user to solve the problem of selecting the best employee.

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