**Journal of Computer Networks, Architecture and High Performance Computing**
Volume 6, Number 4, October 2024
https://doi.org/10.47709/cnahpc.v6i4.4716

**Submitted** : Sep 09, 2024
**Accepted** : Oct 03, 2024
**Published** : Oct 11, 2024

# ROC and COPRAS Algorithms in a Decision Support System for Employee Career Assessment

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**ABSTRACT**

PT. Union Confectionery, a company that had long operated in the sweet food production industry, faced significant challenges in managing employee career development, including transfers, demotions, and promotions. The primary difficulty encountered was in conducting objective employee performance assessments and determining the appropriate criteria for career development. These assessments involved various complex factors such as work experience, discipline, education level, age, performance, attendance, teamwork, and work ethics. To address these challenges, this study proposed the development of a web-based Decision Support System (DSS) that utilized the Rank Order Centroid (ROC) method for criteria weighting and the Complex Proportional Assessment (COPRAS) method for decision ranking. The implementation of this system was expected to assist the management of PT. Union Confectionery in making more accurate and transparent decisions, while also improving employee satisfaction and operational efficiency. This research also compared previous studies that employed similar methods for performance assessment, albeit with a narrower focus, particularly at the supervisory level. The comparison between the measured data and the applied models indicated that the established system was capable of providing more objective recommendations regarding transfers, demotions, and promotions based on the predetermined criteria. Furthermore, this system not only enhanced transparency in decision-making but also encouraged overall improvements in employee performance. The findings from this study were anticipated to provide a comprehensive and innovative solution for employee career management across all levels of PT. Union Confectionery, as well as contribute to the development of more effective human resource management practices.

**Keywords:** Career Management; COPRAS; DSS; Employee Performance Assessment; ROC

## INTRODUCTION

PT. Union Confectionery was a company engaged in the production of confectionery and had become one of the key players in the industry over the past few years. Along with the company's rapid growth, the management of PT. Union Confectionery faced challenges in managing employee career development, particularly in relation to transfers, demotions, and promotions. Effective career management had become crucial as it was directly linked to human resource development, which was a key asset in maintaining the company's competitive edge.

Through an interview with Mr. Surya Suhendra, the Head of Human Resources at PT. Union Confectionery, the author discovered that one of the main issues faced by the company was the difficulty in conducting objective employee performance assessments. These assessments were highly complex, as they involved multiple factors such as work experience, discipline, education level, age, and job performance. The difficulty in identifying relevant criteria for employee transfers, demotions, and promotions further complicated the decision-making process.

Employee transfers were necessary to ensure that staff were placed in positions that aligned with their skills and experience. However, the management often struggled to assess which employees should be transferred, particularly when considering factors such as discipline and work experience. Demotions, carried out when employees failed to meet performance standards, also presented challenges, as the evaluation of factors like teamwork, ethics, and attendance was often subjective. Similarly, promotions, which served as recognition of outstanding performance, faced comparable difficulties. Criteria such as tenure, performance achievements, violations, and absenteeism needed to be carefully evaluated.

To address these challenges, PT. Union Confectionery planned to implement a web-based Decision Support System (DSS) that combined the ROC (Rank Order Centroid) method for weighting criteria and the COPRAS (Complex Proportional Assessment) method for ranking decisions. The implementation of this DSS was expected to facilitate more accurate, objective, and transparent decision-making processes for transfers, demotions, and promotions within the company. Additionally, it was hoped that the system would enhance employee satisfaction and

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improve the overall operational efficiency of the company.

## LITERATURE REVIEW

The previous research by (Triayudi et al., 2022) focused on evaluating the performance of supervisors within a company using the COPRAS method to assess performance based on criteria such as tenure, leadership, communication, discipline, and absenteeism. The study aimed to identify the best supervisor through focused performance analysis.

In contrast, the research conducted by the author had a broader scope, encompassing aspects of employee transfers, demotions, and promotions at PT. Union Confectionery. In this study, a Decision Support System (DSS) was developed using a combination of the ROC method for weighting assessment criteria and the COPRAS method for ranking decisions. The criteria analyzed in this research included work experience, discipline, educational background, age, job performance, attendance, teamwork, ethics, achievements, and absenteeism.

The primary difference between this research and the previous study lay in its scope and complexity. The previous research solely assessed the performance of supervisors, while this study addressed various aspects of employee career management throughout the organization. Furthermore, this research developed a more sophisticated and holistic web-based DSS, which was expected to enhance operational efficiency and employee satisfaction at PT. Union Confectionery. Thus, this study not only broadened the understanding of employee career management but also provided a more comprehensive solution to the challenges faced by the company in managing human resources.

## METHOD

### Research Method

In this study, the method employed was Research and Development (R&D), aimed at developing new products or improving existing ones. R&D served as a bridge between basic research and applied research (Okpatrioka, 2023). The steps in the design of the R&D research were as follows (Syahranitazli & Samsudin, 2023).

1) Research and Data Collection
   The research commenced with a literature review and field study. The literature review included relevant concepts and theories supporting the development of the Decision Support System (DSS), covering prior research on the Rank Order Centroid and Complex Proportional Assessment methods. The field study gathered data from PT. Union Confectionery through interviews with Mr. Surya Suhendra, Head of HR, and direct observations of employee performance evaluations.
2) Planning
   Based on preliminary studies, the planning phase involved:
   Defining the DSS objectives for employee transfers, demotions, and promotions.
   Identifying DSS users, specifically the management of PT. Union Confectionery.
   Describing DSS components and their usage.
3) Initial Product Development
   In this phase, the initial design of the DSS was developed, ensuring completeness with input from experts in human resource management and information technology. Expert validation was conducted to align the product design with needs and standards.
4) Initial Product Testing
   Initial testing was conducted on a limited scale at PT. Union Confectionery, involving employees who would utilize the DSS for career determination. Intensive observations recorded critical issues for product improvement.
5) Refinement of the Initial Product
   Based on limited testing results, product refinement focused on enhancing the quality and functionality of the DSS according to feedback and findings.
6) Wider Field Testing
   The refined DSS was then tested on a broader scale at PT. Union Confectionery, involving more employees and departments to ensure functionality across various operational conditions.
7) Refinement Based on Broader Field Testing
   Further refinement occurred based on results from the broader field tests to strengthen the effectiveness of the DSS, with evaluations leading to quantitative and qualitative improvements.

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8) Final Product Testing
Final testing assessed the DSS's suitability and utility in employee career determination, utilizing control and experimental groups for objective evaluation.
9) Final Product Revision or Refinement
Following the final test, revisions and refinements were made to ensure the DSS was the most effective and accurate product, aimed at high generalizability and reliability.
10) Dissemination and Implementation
The final step involved the dissemination and implementation of the DSS at PT. Union Confectionery. The final product was introduced to all management and relevant employees to ensure effective understanding and use, with a phased implementation to facilitate smooth adaptation in daily operations.

**System Development Method**

The Waterfall system development method was applied due to its structured, sequential, and systematic stages (Batubara & Nasution, 2023). Each phase must be completed in order to avoid repeating steps (Syahputra et al., 2024). The Waterfall method includes several stages: requirement analysis, system design, implementation, verification, and maintenance (Razaq et al., 2024).

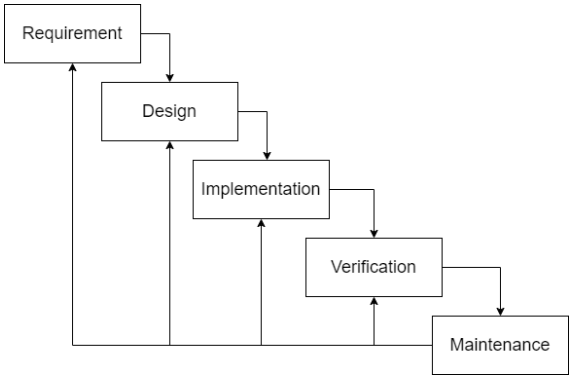


Fig. 1 Waterfall Diagram (Zufria et al., 2022)

Waterfall Stage Descriptions (Zainuri & Fakhriza, 2024):

1) Requirement: This stage involves gathering and analysing user or stakeholder needs to define system requirements, including functionality, technical specifications, and limitations. A detailed documentation of these requirements is created, focusing on essential employee information.
2) Design: This phase involves the comprehensive design of the system architecture, including the use of Unified Modelling Language (UML), such as use case diagrams.
3) Implementation: In this stage, the system design is converted into code using PHP 8.1.12 and MySQL 8.1.12, ensuring all system components function according to identified needs.
4) Verification: This phase involves testing the software to confirm it meets specified requirements, utilizing black box testing to evaluate functionality without requiring internal code knowledge.
5) Maintenance: This stage includes post-implementation software maintenance, such as bug fixes, functionality enhancements, and adjustments to meet changing business needs.

**Data Collection Methods**

In conducting the research, several methods were employed to gather the necessary data for this study. The techniques for data collection included:

1) Observation
One of the data collection methods utilized in the research involved observing and recording phenomena or events that occurred directly. In this observation, the researcher actively monitored and documented information regarding behaviors, interactions, events, or objects that were the focus of the study. The researcher conducted direct observations at PT. Union Confectionery.
2) Interview

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The data collection method used in the research aimed to obtain information directly from respondents or informants involved in the study. Interviews were conducted through direct interaction between the researcher and the informants, where the researcher posed relevant and in-depth questions to gain insights and a deeper understanding of the research topic. Data collection through this method involved interviewing Mr. Surya Suhendra, the Head of Human Resources at PT. Union Confectionery. The questions posed were as follows:

Question 1: What are the main challenges in human resource management at PT. Union Confectionery?

Answer: The primary challenge in human resource management at PT. Union Confectionery was determining employee transfers, demotions, and promotions. The main difficulty lay in objectively assessing employee performance and identifying relevant criteria for determining career movement.

Question 2: How does PT. Union Confectionery plan to address issues regarding employee transfers, demotions, and promotions?

Answer: PT. Union Confectionery planned to address these issues by implementing a web-based Decision Support System (DSS) that utilized the Rank Order Centroid (ROC) method for weighting criteria and the Complex Proportional Assessment (COPRAS) method for ranking decisions concerning employee transfers, demotions, and promotions.

Question 3: What benefits are expected from the implementation of the web-based Decision Support System (DSS) at PT. Union Confectionery?

Answer: The expected benefits from the implementation of the web-based DSS included increased efficiency in the decision-making processes related to employee transfers, demotions, and promotions. The DSS was anticipated to ensure proper placement of employees in positions that matched their competencies, enhance employee motivation, and support the sustainable growth of PT. Union Confectionery.

3) Literature Review

This data collection technique allowed the researcher to access and analyze existing information relevant to the research topic. This enabled the researcher to gain a deeper understanding of the research topic, support arguments or hypotheses, identify knowledge gaps, and acquire valuable new insights.

**ROC and COPRAS Algorithms**

The Rank Order Centroid (ROC) method was used to assign weights to each criterion based on predetermined priorities, resulting in a more structured and objective assessment (Santoso, 2024). Meanwhile, the Complex Proportional Assessment (COPRAS) method measured the performance of alternatives based on conflicting criteria, taking into account the criterion weights derived from ROC (Nurliadi & Karim, 2023). COPRAS selected the best decision by comparing ideal and worst-case solutions while categorizing positive and negative criteria. The combination of ROC and COPRAS provided a holistic and fair assessment, ensuring that the decisions made were the most optimal. The flowchart was explained as follows:

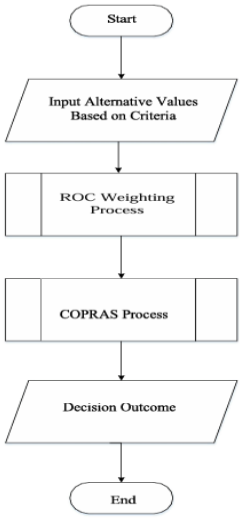


Fig. 2 Flowchart

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The flowchart illustrates the process of combining the ROC and COPRAS methods for criterion-based decision-making. It begins with the system's initiation, where users input alternative values according to predefined criteria. The ROC method is then employed to generate weights for each criterion, helping to prioritize them and assign relative importance. Following this, the COPRAS method analyzes and compares the alternatives based on the weighted criteria, calculating final scores for ranking. Ultimately, the system produces a decision outcome, ranking the alternatives, with the highest value deemed the best choice. The process concludes after obtaining the results.

## RESULT

### Analysis

Analysis of the Existing System was a process of evaluating and understanding the operation of a system, including hardware, software, processes, data, and user interactions. Its primary goal was to identify issues, analyze performance, security, and efficiency, and provide recommendations for improvement. The results of this analysis served as the foundation for system development to ensure greater effectiveness and efficiency in alignment with organizational goals.

In this study, the existing system was described as follows: The Head of Personnel (Kabag Personalia) printed employee performance evaluation forms and conducted the evaluation, which took place annually. Upon completing the evaluation, the Head of Personnel prepared an employee performance report, which was crucial for determining employee career progression. This report was then submitted to the leadership for review. If the report was deemed invalid, it was returned to the Head of Personnel for re-evaluation. If deemed valid, it was accepted as the official employee performance evaluation report.

Subsequently, a problem analysis was conducted to identify challenges encountered in the system. The purpose of this analysis was to uncover the root causes of issues and formulate solutions to mitigate any negative impacts. One of the main challenges faced by the management of PT. Union Confectionery was conducting an objective employee performance evaluation, where factors such as work experience, discipline, education, and age had to be assessed fairly to determine transfers, demotions, or promotions. Incorrect evaluations could lead to the improper placement of employees, causing misalignment with their skills and experience, and creating unfair career advancement decisions. Additionally, unclear and unmeasurable evaluation criteria added complexity to the decision-making process, potentially resulting in employee dissatisfaction and reduced motivation.

The Proposed System Analysis was an evaluation of the system intended to address the weaknesses of the existing system. In this analysis, three main parties were involved: Administrator, System, and Leadership. The administrator was responsible for entering, updating, and deleting data related to alternatives, criteria, sub-criteria, and scores necessary for the employee career process. The System managed the data through database management and utilized the ROC method to weight the criteria, as well as the COPRAS method to rank the alternatives. Leadership, as the end user, received employee career reports generated by the system based on the ROC and COPRAS analyses, which were used to inform decisions regarding employee career advancement.

### Testing of the ROC and COPRAS Methods

By applying the ROC and COPRAS methods, it was expected to improve efficiency, accuracy, and transparency in the employee career determination process. The steps were outlined as follows:

1) Alternatives

Alternatives were used to store employee data or sample data utilized in the process. The alternative data used included:

Table 1. Alternatives

| No | Alternative Name | Division |
|---|---|---|
| 1 | Ahmad Setiawan | Warehouse |
| 2 | Budi Santoso | Warehouse |
| 3 | Citra Dewi | Warehouse |
| … | … | … |
| 30 | Erlinda | Warehouse |
| 31 | Kurniawan Putra | Production |
| 32 | Lestari Anugrah | Production |
| 33 | Maya Sari | Production |

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| | | |
|---|---|---|
| 60 | Tri Bayu Siswanto | Production |
| … | … | … |
| 61 | Umi Kalsum | Packing |
| 62 | Vina Anindya | Packing |
| 63 | Wahyudi Prasetyo | Packing |
| | | |
| 90 | Sondang Maduma Sitorus | Packing |

**Criteria**

The criteria were used as requirements in determining employee career progression. The following data represent the criteria applied: the criteria were used to evaluate employees based on various aspects. The first criterion was Work Experience, with sub-criteria ranging from 1-2 years, given a score of 1, to 9-10 years, given a score of 5. The second criterion was Discipline, where employees with a discipline score of 0-59 received a score of 1, while those with a discipline score of 90-100 received a score of 5. Education became the third criterion, where high school graduates received a score of 1, while employees with a bachelor's degree received a score of 5. Age was also assessed, with employees aged 41-45 given a score of 1, and those aged 21-25 given a score of 5.

Job Performance was the fifth criterion, where a score of 0-59 received a score of 5, and a score of 90-100 received a score of 1. Attendance was evaluated based on the number of days present, with employees attending 0-20 days receiving a score of 5, and those attending 27-28 days receiving a score of 1. The seventh criterion was Teamwork, with the same scoring range as job performance and attendance. Ethics was also assessed, with a score of 0-59 receiving a score of 5, and 90-100 receiving a score of 1.

Next, Years of Service were scored from 1 to 5 years, with higher scores assigned for longer service. Job Achievements were evaluated, where a score of 0-59 received a score of 1, and 90-100 received a score of 5. Violations were another criterion, where fewer violations resulted in higher scores, with 0 violations receiving a score of 5. Lastly, Absenteeism was assessed similarly, where 4 absences received a score of 1, and 0 absences received a score of 5.

**Case Study on Employee Transfers**

The stages of the employee transfer process using the ROC and COPRAS methods were explained as follows:

1) Determination of Criteria, Weights, and Alternative Values

The first step in the assessment was to determine the criteria that would serve as a reference for decision-making. In this study, there were 4 criteria and 10 candidates or alternatives. The details are outlined in the following table.

Table 2. Mutation Criteria

| No | Criteria | Type |
|---|---|---|
| K01 | Work Experience | Benefit |
| K02 | Discipline | Benefit |
| K03 | Education | Cost |
| K04 | Age | Cost |

With these criteria, weighting was performed using the Rank Order Centroid method, with calculations as follows.

$$W1 \quad \frac{1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}}{4} = 0{,}5208$$

$$W2 \quad \frac{0+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}}{4} = 0{,}2708$$

$$W3 \quad \frac{0+0+\frac{1}{3}+\frac{1}{4}}{4} = 0{,}1458$$

$$W4 \quad \frac{0+0+0+\frac{1}{4}}{4} = 0{,}0625$$

This data, which had been assigned weighted values for evaluation, was subsequently found for each alternative in the following table.

Table 3. Alternative Mutation Values

| No | Alternative | K01 | K02 | K03 | K04 |
|---|---|---|---|---|---|
| 1 | Ahmad Setiawan | 3 | 4 | 4 | 5 |

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| | | | | | |
|---|---|---|---|---|---|
| 2 | Budi Santoso | 4 | 5 | 5 | 3 |
| 3 | Citra Dewi | 5 | 1 | 3 | 2 |
| … | … | … | … | … | … |
| 30 | Erlinda | 4 | 3 | 4 | 3 |

After the criteria, weights, and alternatives had been established, calculations using the COPRAS method were conducted according to the following steps.

2) A decision matrix was created using the alternative decision values, and the normalization of Matrix X was performed.

$A_{11}=\frac{3}{93}=0{,}032$ $A_{12}=\frac{4}{97}=0{,}041$ $A_{13}=\frac{4}{93}=0{,}043$ $A_{14}=\frac{5}{96}=0{,}052$

$A_{21}=\frac{4}{93}=0{,}043$ $A_{22}=\frac{5}{97}=0{,}052$ $A_{23}=\frac{5}{93}=0{,}054$ $A_{24}=\frac{3}{96}=0{,}031$

$A_{31}=\frac{5}{93}=0{,}054$ $A_{32}=\frac{1}{97}=0{,}010$ $A_{97}=\frac{3}{93}=0{,}032$ $A_{34}=\frac{2}{96}=0{,}021$

…. …. …. ….

After performing the normalization of the decision matrix, the matrix XijX_{ij}Xij was obtained, as shown in the table below:

Table 4. A Results of Normalization of the Matrix Xij for Mutation

| No | Alternative | K01 | K02 | K03 | K4 |
|---|---|---|---|---|---|
| 1 | Ahmad Setiawan | 0,032 | 0,041 | 0,043 | 0,052 |
| 2 | Budi Santoso | 0,043 | 0,052 | 0,054 | 0,031 |
| 3 | Citra Dewi | 0,054 | 0,010 | 0,032 | 0,021 |
| … | … | … | … | … | … |
| 30 | Erlinda | 0,043 | 0,031 | 0,043 | 0,031 |

3) Determining the normalized weighted decision matrix = Xij×Wj

$A_{11}$ = 0,032 x 0,5208 = 0,017 $A_{12}$ = 0,041 x 0,2708 = 0,011 A11 = 0,032 x 0,5208 = 0,017 A12 = 0,041 x 0,2708 = 0,011

$A_{21}$ = 0,043 x 0,5208 = 0,022 $A_{22}$ = 0,052 x 0,2708 = 0,014 A21 = 0,043 x 0,5208 = 0,022 A22 = 0,052 x 0,2708 = 0,014

$A_{31}$ = 0,054 x 0,5208 = 0,028 $A_{32}$ = 0,010 x 0,2708 = 0,003 A31 = 0,054 x 0,5208 = 0,028 A32 = 0,010 x 0,2708 = 0,003

….

$A_{301}$ = 0,043 x 0,5208 = 0,022 $A_{302}$ = 0,031 x 0,2708 = 0,008 A301 = 0,043 x 0,5208 = 0,022 A302 = 0,031 x 0,2708 = 0,008

After performing the calculations for the weighted decision matrix, the matrix \ (D_{ij} \) was obtained, as shown in the table below.

Table 5. Results of the Matrix Dij for Mutation

| No | Alternative | K01 | K02 | K03 | K04 |
|---|---|---|---|---|---|
| 1 | Ahmad Setiawan | 0,017 | 0,011 | 0,006 | 0,003 |
| 2 | Budi Santoso | 0,022 | 0,014 | 0,008 | 0,002 |
| 3 | Citra Dewi | 0,028 | 0,003 | 0,005 | 0,001 |
| … | … | … | … | … | … |
| 30 | Erlinda | 0,022 | 0,008 | 0,006 | 0,002 |

The calculation to maximize and minimize the index for each alternative was conducted as follows: by maximizing S + (Class 1 + Class 2). resulting in a total maximum attribute sum of S+ equal to 0.792. Subsequently, the calculation to minimize S- (Class 3 + Class 4) resulted in a total minimum S- of 0.208.

4) The relative weights for each alternative were calculated using the equations $1/s{-}1$ and $S{-}1$ * total $1/s{-}1$. resulting in the following.

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Table 6. Calculation of Relative Weights for Each Mutation Alternative

| Alternative | 1/S-i | S-*(1/S-i) |
|---|---|---|
| A1 | 1/0,010 = 104,958 | 0,010 x 5033,979 = 47,962 |
| A2 | 1/0,010 = 102,107 | 0,010 x 5033,979 = 49,301 |
| A3 | 1/0,006 = 166,490 | 0,006 x 5033,979 = 30,236 |
| …. | …. | …. |
| A30 | 1/0,008 = 121,573 | 0,008 x 5033,979 = 41,407 |
| Total | 5033,979 | |

5) Assigning each level to the priority of alternatives.

$Q_1$ = 0,028 + (0,208/47,962) = 16,032
$Q_2$ = 0,036 + (0,208/49,301) = 17,041
$Q_3$ = 0,031 + (0,208/30,236) = 11,038
…. …. …. …. ….
$Q_{30}$ = 0,031 + (0,208/41,407) = 14,036

Max $Q_i$ = 19,040

6) Calculating the Quantitative Utility (Ui) for each alternative can be done using the formula (Qi / Max Q) * 100.

$U_1$ = 16,032 / 19,040 x 100 = 84,203
$U_2$ = 17,041 / 19,040 x 100 = 89,498
$U_3$ = 11,038 / 19,040 x 100 = 57,971
$U_4$ = 11,027 / 19,040 x 100 = 57,914
$U_{30}$ = 14,036 19,040 x 100 = 73,717

The following table presents the final results derived from the calculation of priority order, performance index, and ranking, as shown in the table below.

Table 7. Ranking of Mutation Alternatives

| No | Alternative | Final Score (Ui) | Ranking |
|---|---|---|---|
| 1 | Ahmad Setiawan | 84,203 | 4 |
| 2 | Budi Santoso | 89,498 | 2 |
| 8 | Hendri Kurniawan | 79,012 | 5 |
| 14 | Sugiyanti | 84,291 | 3 |
| 18 | Rahmat Hidayat Nasution | 100,000 | 1 |

Based on the calculations above, it was indicated that alternative (A18 = Rahmat Hidayat Nasution) possessed the highest value of "100.000." Furthermore, from the results of the stages of calculation using the ROC and COPRAS methods outlined above, the alternative with the highest ranking is deemed eligible for mutation.

**Case Study on Demotion**

The following are several stages regarding the process of employee demotion using the ROC and COPRAS methods, and the explanations are as follows:

Determination of Criteria, Weights, and Alternative Values

The first step in the assessment was to determine the criteria that would serve as the basis for decision-making. In this study, there were 4 criteria and 10 candidates or alternatives. The details can be seen in the table below.

Table 8. Demotion Criteria

| No | Criteria | Type |
|---|---|---|
| K05 | Work Performance | Benefit |
| K06 | Attendance | Benefit |
| K07 | Teamwork | Cost |

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| | | |
|---|---|---|
| K08 | Ethics | Cost |

With the given criteria, the weighting was carried out using the Rank Order Centroid (ROC) method, resulting in the following values: W5 = 0.5208, W6 = 0.2708, W7 = 0.1458, and W8 = 0.0625.

This data has been weighted and used for evaluation. The alternatives can be found in the following table:

Table 9. Demotion Alternative Scores

| No | Alternative | K05 | K06 | K07 | K08 |
|---|---|---|---|---|---|
| 31 | Kurniawan Putra | 1 | 3 | 1 | 5 |
| 32 | Lestari Anugrah | 5 | 2 | 2 | 4 |
| 33 | Maya Sari | 4 | 4 | 3 | 1 |
| … | … | … | … | … | … |
| 60 | Tri Bayu Siswanto | 4 | 5 | 4 | 3 |

After the criteria, weights, and alternatives were determined, the calculation using the COPRAS method was conducted following the same steps as in the case studies of transfer but adjusted according to the data in the demotion case study.

The following table presents the final results derived from the calculation of priority order, performance index, and the resulting ranking, as shown in the table below:

Table 10. Ranking of Dismissal Alternatives

| No | Alternative | Final Score (Ui) | Ranking |
|---|---|---|---|
| 39 | Sari Susanti | 84,251 | 4 |
| 43 | Nurbaya | 100,000 | 1 |
| 48 | Suyanti | 89,468 | 3 |
| 59 | Syahrizal Notohasdinegoro | 89,517 | 2 |
| 60 | Tri Bayu Siswanto | 84,247 | 5 |

Based on the calculations above, it was shown that the alternative (A43 = Nurbaya) had the highest score of "100.000." Furthermore, from the stages of the ROC and COPRAS method calculations, the alternative with the highest ranking is deemed suitable for demotion.

**Case Study on Promotion**

The following are the stages of the employee promotion process using the application of the ROC and COPRAS methods, with the explanation as follows.

Determination of Criteria, Weights, and Alternative Values

The first step in the assessment is to determine the criteria that will serve as the basis for decision-making. In this study, there are 4 criteria and 10 candidates or alternatives. The details can be seen in the table below:

Table 11. Promotion Criteria

| No | Criteria | Type |
|---|---|---|
| K09 | Length of Service | Benefit |
| K10 | Work Performance | Benefit |
| K11 | Violations | Cost |
| K12 | Attendance | Cost |

With the given criteria, the weighting was carried out using the Rank Order Centroid (ROC) method, resulting in the following values: W9 = 0.5208, W10 = 0.2708, W11 = 0.1458, and W12 = 0.0625.

The data has been assigned weighted scores for the evaluation process. Subsequently, the alternatives can be found in the following table:

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**Journal of Computer Networks, Architecture and High Performance Computing**
Volume 6, Number 4, October 2024
https://doi.org/10.47709/cnahpc.v6i4.4716

**Submitted** : Sep 09, 2024
**Accepted** : Oct 03, 2024
**Published** : Oct 11, 2024

Table 12 Promotion Alternative Scores

| No | Alternative | K09 | K10 | K11 | K12 |
|---|---|---|---|---|---|
| 61 | Umi Kalsum | 4 | 5 | 2 | 2 |
| 62 | Vina Anindya | 5 | 3 | 2 | 1 |
| 63 | Wahyudi Prasetyo | 4 | 4 | 2 | 3 |
| … | … | … | … | … | … |
| 90 | Sondang Maduma Sitorus | 1 | 2 | 4 | 2 |

After the criteria, weights, and alternatives were determined, the calculation using the COPRAS method was conducted following the same steps as in the case studies of transfer and demotion, but adjusted according to the data in the promotion case study.

The following table presents the final results derived from the calculation of priority order, performance index, and the resulting ranking, as shown in the table below:

Table 13 Promotion Alternative Ranking

| No | Alternative | Final Score (Ui) | Ranking |
|---|---|---|---|
| 64 | Xenia Putri | 100,000 | 1 |
| 68 | Bella Kristanti | 93,764 | 3 |
| 83 | Asmanudi | 87,589 | 4 |
| 85 | Parluhutan Sihombing | 87,420 | 5 |
| 86 | Supiana | 93,786 | 2 |

Based on the above calculations, it is shown that the alternative (A64 = Xenia Putri) has the highest score of "100.000". Furthermore, from the stages of the ROC and COPRAS method calculations, the alternative with the highest ranking is deemed eligible for promotion.

**System Design**

System design refers to the process of planning and detailing how a system will be built or implemented (Haritsyah & Harahap, 2024). It involves organizing and specifying all system components, data structures, software architecture, and user interfaces (Akbar et al., 2024). This system design utilizes UML (Unified Modeling Language) modeling, which includes the Use Case Diagram.

In general terms, the business process of the system to be designed is illustrated with a use case diagram shown in the following image.

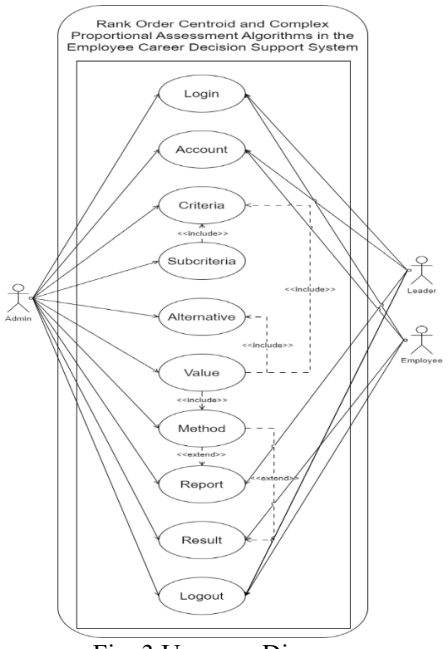


Fig. 3 Use case Diagram

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**Implementation**

The implementation of results refers to the method of presenting final information to users after data has been processed and analyzed by a system (Suendri et al., 2021). In the context of web development, result implementation often involves visually presenting data through user interface (UI) elements (Manurung et al., 2024). An effective display should be intuitive, informative, and easy to understand, ensuring that users can quickly interpret the presented data. The display of results is shown below.

1) Home Menu Display


Fig. 4 Home Menu Display

The description for the home menu is the first menu displayed when the system is launched. This menu can only be viewed by the administrator, management, and employees.

2) Display of Alternative Data and Criteria Data

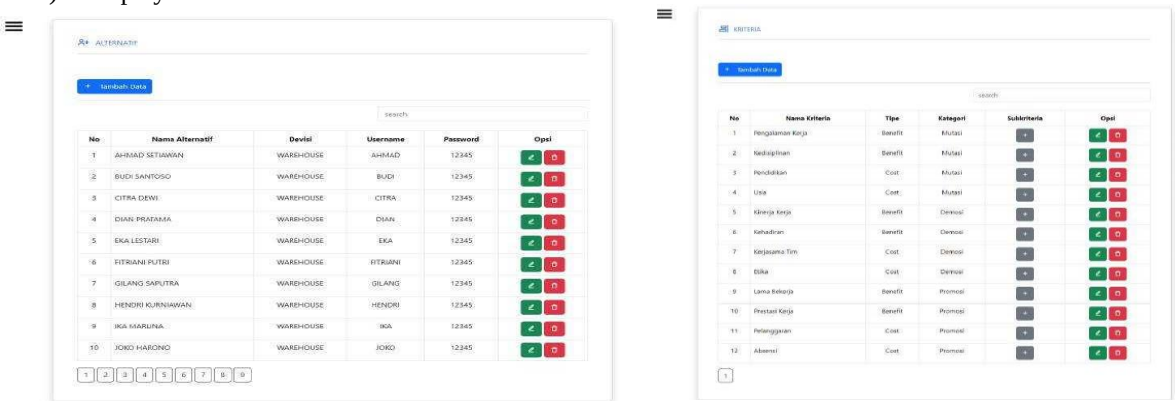


Fig. 5 Display of Alternative Data and Criteria Data

The alternative data menu functioned to store alternative data and featured three options: "Add Data" to insert alternative data, "Edit Data" to modify alternative data, and "Delete Data" to remove alternative data. This menu was accessible only to the administrator.

The criteria menu served to store criteria data and included three options: "Add Data" to insert data, "Edit Data" to modify data, and "Delete Data" to remove data. This menu was also accessible only to the administrator, who was responsible for managing the criteria data within this menu.

3) Method Process Display


Fig. 6 Method Process Display

The description for this method process menu was to execute the method in determining demotion, mutation, and promotion of employees using the ROC and COPRAS methods. Before executing the method process, the user had to

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select the year and category to be analyzed, then press the analyze process button. This menu was accessible only to the administrator.

4) Report and Result Display

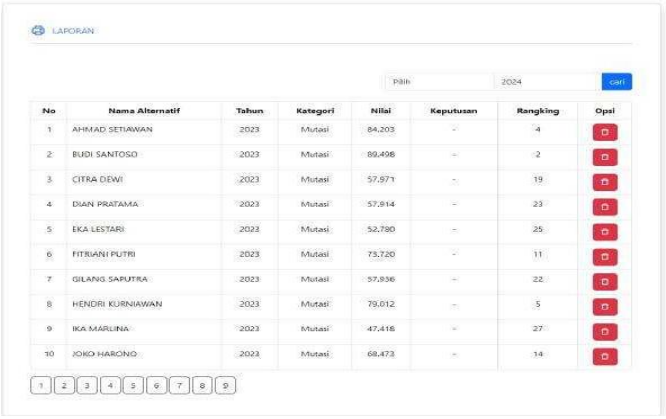


Fig. 7 Report Display


Fig. 8 Result Display

The report menu functioned to display the final results of the calculations in the employee career determination process, which could be printed as a report. The results menu displayed details of the employee demotion and transfer determination process.

The figure presented showed the final results of the system's calculations, including the determination of employee transfers. For example, the first data entry, Ahmad Setiawan, ranked 4th, where the system's calculations matched the manual calculations. Thus, the system that was developed operated as designed, facilitating management in making more accurate and transparent decisions, while also improving employee satisfaction and operational efficiency.

**Testing**

In software testing, the Black Box Testing method was an approach in which testing was conducted without considering the internal structure or logic of the program or system being tested (Usla & Ikhwan, 2023). Based on the testing that was performed, the system operated effectively; the user interface and buttons functioned as intended, and the calculations were accurate.

## DISCUSSIONS

In this study, the author noted that the implementation of a web-based Decision Support System (DSS) utilizing the Rank Order Centroid (ROC) and Complex Proportional Assessment (COPRAS) methods proved effective in addressing the challenges of employee career management at PT. Union Confectionery. The comparison between the measured data and the applied models indicated that the system was capable of providing more objective recommendations concerning transfers, demotions, and promotions based on the established criteria, such as work experience, discipline, education, and age. The author also compared the results of this research with previous studies, highlighting that this research offered a broader scope by integrating various complex assessment factors. Significant new findings from this study demonstrated that the system not only enhanced transparency in decision-making but also fostered overall improvements in employee performance. Therefore, the author recommended that the company periodically conduct evaluations and updates of the system to ensure that the proposed solutions remain relevant and effective in supporting the organization’s goals.

## CONCLUSION

Based on the findings, the research demonstrated that the implementation of the web-based Decision Support System (DSS) at PT. Union Confectionery, which integrated the Rank Order Centroid (ROC) method for criteria weighting and the Complex Proportional Assessment (COPRAS) method for decision ranking, successfully facilitated the decision-making process concerning employee transfers, demotions, and promotions. The results also indicated that the system provided more objective and accurate evaluations by considering various complex assessment factors such as work experience, discipline, education, age, job performance, attendance, teamwork, and work ethics. The application of this DSS offered greater transparency in decision-making, reduced subjectivity in employee evaluations, and enabled the company to manage employee career development more effectively.

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