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Decision Support System for Determining the Best Employee with Web-Based AHP Method at Pariwisata Polytechnic

Ilham Syahputra[1], Fahmi Ruziq[2], Aripin Rambe
[123] Universitas Battuta, Medan, Indonesia
[123] Fakultas Teknologi, Universitas Battuta, Medan, Indonesia
[1]ilhamsyahputra27jl@gmail.com, [2]fahmiruziq89@gmail.com, [3]arambe1903@gmail.com

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ABSTRACT

A Decision Support System (DSS) for Best Employee Determination Selection using the Analytical Hierarchy Process (AHP) method is an essential tool for enhancing employee performance and motivation. The awards given by companies to their best employees serve as a powerful incentive, driving each employee to consistently deliver their best work. To determine the best employee, companies assess performance over a specific period, considering various criteria. At Medan Tourism Polytechnic, these criteria include work behavior, work discipline, honesty, loyalty, and cooperation. The AHP method structures the decision-making process into a hierarchical model, allowing for systematic evaluation of alternative choices against the set criteria. By assigning weights to each criterion, AHP quantifies subjective assessments, providing an objective basis for comparing employees. This method ensures transparency and fairness in the selection process, promoting a culture of excellence and motivation among employees. Implementing a DSS with the AHP method not only simplifies the evaluation process but also ensures that decisions are based on measurable performance indicators. This fosters an environment where employees are encouraged to continuously improve their performance, contributing to the overall productivity and success of the organization. This system is integral in maintaining high standards and employee satisfaction within the organization.

Corresponding Author:

Ilham Syahputra
Battuta University
Email: ilhamsyahputra27jl@gmail.com

1. INTRODUCTION

A decision support system is an alternative process that provides the ability to solve problems by converting collected data into information and adding various factors that need to be considered in decision making [1], such as liver cancer prediction [2], selection of new members [3] or new employees [1]. AHP (Analytic Hierarchy Process) is a general theory of measurement used to find the ratio scale of both discrete and continuous pairwise comparisons [4]. Pairwise comparisons can be obtained by measuring the actual or relative level of preference, level of importance, feelings (intuition), own experience, and facts, which is a basic scale that describes relative strengths and preferences, it is hoped that the employee selection process will be right on target with the existing criteria. The development of information technology at this time was welcomed by the community with a positive response. In people's lives, information technology has succeeded in influencing their respective fields, for example, such as buying and selling services, food and drinks. The

widespread development of information technology also affects the world of education, especially universities. One of the services in higher education is to provide convenience in terms of employee assessment.

This research will apply the SDLC (System Development Life Cycle) with the waterfall method. SDLC is a very important approach 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 [5].

Based on Setiady's opinion, performance appraisal is an evaluation system and the performance of an employee and potential opportunities that can be improved. Assessment is an approximate process for determining the value, quality, and status of people [6]. Medan Tourism Polytechnic is one of the vocational state universities with Diploma 3, 4 and S2 master's degrees in applied tourism Poltekpar Medan has 2 majors, namely Hospitality and Tourism, currently Poltekpar Medan still uses manual methods to assess the best employees through attendance attendance lists and the process is not fast / accurate.

According to Suryadi Decision Support System (SPK) is a system widely used by all management in their decision making, which helps to make decisions with very precise and reliable results and avoid all possible choices that are unclear and ambiguous [7].

The decision support system for identifying the best employees is not used as a substitute for decisions, but as a decision support. The decision support system is expected to help the human resources department make the right decision to select the best employee. The selection is based on criteria such as employee attendance, position, length of service and responsibility. This is expected to bring change and encourage other employees to pay attention to work behavior and improve the performance of each employee, one of the decision support system methods used is the AHP (Analytical Hierarchy Process) method.

This research will be made web-based, so that it can be accessed easily and facilitate the process of assessing the best employees efficiently and accurately. Website is a collection of widely accessible document pages [8] that are interrelated [9] to meet the various needs of individuals, groups, businesses, or organizations can create and manage websites.

Therefore, researchers are interested in conducting research with the title "Decision Support System for Determining the Best Employee with Web-Based AHP Method at Pariwisata Polytechnic".

2. METHOD

2.1. Type of Data

In conducting this research, researchers obtained data from the results of searching for references from theses, final assignments, books and journals related to this research.

In making this research, researchers used two types of data, namely:

a. Primary data type, primary data is obtained by researchers directly from the object of research in the form of a brief history of the Medan Tourism Polytechnic along with other information needed to support this research.
b. Types of secondary data, secondary data is obtained by researchers from other sources in the form of reports or publications. Secondary data is taken directly from the staffing section of the Medan Tourism Polytechnic which is domiciled at Jl. Rumah Sakit Haji No.12 Medan such as employee assessment forms assessed by direct supervisors / work units.

2.2. Data Source

To collect data samples, certain methods are carried out in accordance with their objectives, the methods that will be used by the authors in the preparation of this study are as follows:

a. Field Research: In this study the authors collected data directly about the object of research or research location, namely the Medan Tourism Polytechnic, while the field research conducted was:
    1) Interview: One method of data collection is by conducting interviews, namely by asking directly to the source, in collecting through this interview stage the author directly asks the staffing staff related to employee performance appraisal.
    2) Physical Observation: Physical observation or observation is a method of collecting data by making direct observations about cases or obstacles that occur in the ongoing performance appraisal process at the Medan Tourism Polytechnic.
b. Lybray Research: The author conducts library research to obtain scientific materials that will be used as a basis for thinking in writing and analyzing existing problems.

2.3. Problem Topic Analysis

The Waterfall method is used in system development. In general, the steps of the Waterfall method are shown in the following figure:

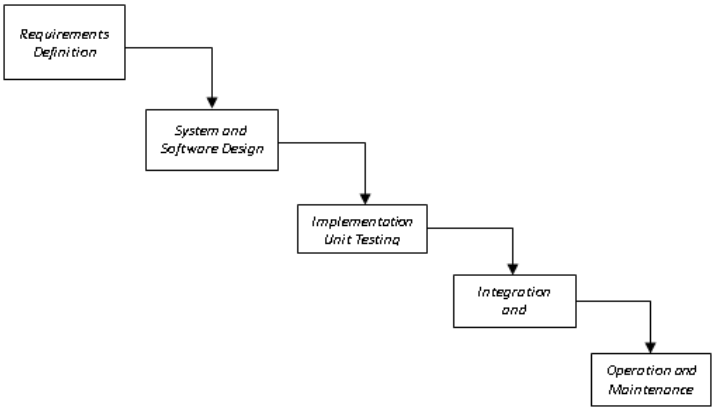

Figure 1. Waterfall Method

a. Requirements Definition: At this stage the system programmer requires communication aimed at understanding the software expected by the user and the limitations of the software. This data information is obtained through interviews, discussions or direct surveys at Poltekpar Medan. The data is analyzed to provide the necessary information to the user.
b. System and Software Design: The requirement specifications from the previous stage will be studied in this phase and the system design is prepared. The system design helps determine the hardware and system requirements and also helps determine the overall system architecture.
c. Unit Testing Implementation: In this stage, the system is first developed in small programs called units, which are integrated in later stages. Each unit is developed and tested for functionality called unit testing.
d. Operation and Maintenance: The final stage of the waterfall method. The finished software is run and maintained. Maintenance includes fixing errors that were not found in the previous step. Improving the implementation of system units and improving system services as new needs arise.

3. RESULTS AND DISCUSSION

Flowchart of the AHP method calculation process algorithm as follows:

a. Determining the qualitative scale of importance

Table I. Level of Importance

Intensity of Interest	Description
1	Equally Important
2	Close to slightly more important
3	Slightly more important
4	Close to more important
5	More important
6	Approaching very important
7	Extremely important
8	Approaching absolute very important
9	Absolutely very important

b. Determine alternatives, criteria and comparison between criteria

Table II. Alternative

Criteria Code	Criteria Name
AL1	Budi
AL2	Robi

AL3	Abdul

The following criteria have been determined for the acceptance of student final project titles. The following is a list of criteria determined:

Table III. Criteria

Criteria Code	Criteria Name
K01	Attendance
K02	Responsibility
K03	Communication
K04	Ethics and Behavior

The following table is a comparison matrix between criteria from the criteria that have been determined:

Table IV. Criteria Comparison Matrix

Criteria Code	K01	K02	K03	K04
K01	**1**	2	1	2
K02	0,5	**1**	2	1
K03	1	0,2	**1**	2
K04	0,5	1	0,5	**1**
Total	**3**	**4,5**	**4,5**	**6**

c. Determining comparisons between alternatives
The following is a comparison matrix table between alternatives from each criterion:

Table V. Alternative Comparison Criterion 1

Alternative Code	AL1	AL2	AL3
AL1	**1**	3	2
AL2	0,333	**1**	4
AL3	0,5	0,25	**1**
Total	**1,833**	**4,25**	**7**

Table VI. Alternative Comparison Criterion 2

Alternative Code	AL1	AL2	AL3
AL1	**1**	4	3
AL2	0,25	**1**	6
AL3	0,333	0,166	**1**
Total	**1,583**	**5,166**	**10**

Table VII. Alternative Comparison Criterion 3

Alternative Code	AL1	AL2	AL3
AL1	**1**	5	3
AL2	0,2	**1**	4
AL3	0,333	0,25	**1**

Total	**1,533**	**6,25**	**8**

Table VII. Alternative Comparison Criterion 4

Alternative Code	AL1	AL2	AL3
AL1	**1**	4	6
AL2	0,25	**1**	5
AL3	0,166	0,2	**1**
Total	**1,416**	**5,2**	**12**

d. Making Matrix Normalization and priority weights
The following is a matrix normalization table and priority weights:

Table VIII. Normalization Matrix and Criteria Priority Weight

#	K01	K02	K03	K04	Priority Weight
K01	0,333	0,444	0,222	0,333	0,333
K02	0,166	0,222	0,444	0,166	0,249
K03	0,333	0,111	0,222	0,333	0,250
K04	0,166	0,222	0,111	0,166	0,166

How to normalize the Matrix: Divide each matrix element by the total row of criteria.

Cell K01-K01 = 1 / 3 = 0,333
Cell K01-K02 = 2 / 4,5 = 0,444
Cell K01-K03 = 1 / 4,5 = 0,222
Cell K01-K04 = 2 / 6 = 0,333

Cell K02-K01 = 0,5 / 3 = 0,166
Cell K02-K02 = 1 / 3,5 = 0,222
Cell K02-K03 = 2 / 7 = 0,444
Cell K02-K04 = 1 / 6 = 0,166

Cell K03-K01 = 1 / 3 = 0,333
Cell K03-K02 = 0,5 / 4,5 = 0,1
Cell K03-K03 = 1 / 4,5 = 0,22
Cell K03-K04 = 2 / 6 = 0,333

Cell K04-K01 = 0,5 / 3 = 0,166
Cell K04-K02 = 1 / 4,5 = 0,222
Cell K04-K03 = 0,5 / 4,5 = 0,111
Cell K04-K04 = 1 / 6 = 0,166

How to Find Priority Weight: Averaging each row of the normalized matrix.

First Line = 0,333 + 0,444 + 0,222 + 0,333/ 4 = 0,333
Second Row = 0,166 + 0,222 + 0,444 + 0,166 / 4 = 0,249
Third Row = 0,333 + 0,111 + 0,222+ 0,333 / 4 = 0,250
Fourth Row = 0,166 + 0,222 + 0,111 + 0,166 / 4 = 0,166

e. Calculating Matrix Consistency

Table IX. Matrix Consistency

#	K01	K02	K03	K04	CM
K01	0,333	0,444	0,222	0,333	4,243
K02	0,166	0,222	0,444	0,166	4,341
K03	0,333	0,111	0,222	0,333	4,156
K04	0,166	0,222	0,111	0,166	4,253

How to Find Consistency Measure: Multiply the criteria comparison matrix with the priority weight of each row.

First Line = [(1*0,333) + (2*0,249) + (1*0,250) + (2*0,166)] / 0,333 = 4,243
Second Row = [(0,5*0,333) + (1*0,249) + (2*0,250) + (1*0,166)] / 0,249 = 4,341
Third Row = [(1*0,333) + (0,5*0,249) + (1*0,250) + (2*0,166)] / 0,250 = 4,156

Fourth Row = [(0,5*0,333) + (1*0,249) + (0,5*0,250) + (1*0,166)] / 0,166 = 4,253
λmax = (4,243 + 4,341 + 4,156 + 4,253) / 4 = **4,248**

f. Calculating the Consistency Index

$$CI = \frac{\lambda max - n}{n - 1} = \frac{4{,}248 - 4}{4 - 1} = 0{,}082$$

Based on Saaty's theory, the Ratio Index has been determined based on the order of the matrix (number of criteria), the following is shown in table IV.10

Table X. Ratio Index

Ordo Matriks	1	2	3	4	5	6	7	8	9	10
Ratio Index	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,46	1.49

Because the matrix consists of 4 criteria, RI = 0.9. From CI and RI, we can calculate the Consistency Ratio / CR by finding CI / RI = 0.082 / 0.9 = 0.091. For CR values of 0 - 0.1, it is considered consistent, if more than that, it is considered inconsistent. So that the comparison given for the criteria is consistent.

g. Finding the priority weight value of Alternatives

Table XI. Alternative Priority Weight

Criteria 1				
#	**AL1**	**AL2**	**AL3**	**Bobot Prioritas**
Criteria 1				
AL1	0,545	0,750	0,285	0,511
AL2	0,181	0,235	0,571	0,329
AL3	0,272	0,058	0,142	0,156
Criteria 2				
AL1	0,631	0,774	0,3	0,568
AL2	0,157	0,193	0,6	0,316
AL3	0,210	0,032	0,1	0,114
Criteria 3				
AL1	0,652	0,8	0,376	0,6
AL2	0,130	0,16	0,5	0,263
AL3	0,217	0,04	0,125	0,127
Criteria 4				
AL1	0,706	0,769	0,5	0,658
AL2	0,176	0,192	0,416	0,261
AL3	0,117	0,038	0,083	0,079

h. Finding the value and ranking of alternatives

Table XII. Alternative Value and Ranking

Alternative	**K01**	**K02**	**K03**	**K04**	**Nilai**	**Rank**
Bobot Prioritas	0,333	0,249	0,250	0,166		

AL1	0,511	0,568	0,6	0,658	0,574	**1**
AL2	0,329	0,316	0,263	0,261	0,295	**2**
AL3	0,156	0,114	0,127	0,079	0,123	**3**

Based on the table above, to find the value is to multiply the priority weight of the criteria by each row of the alternative priority weight matrix.

First Line = (0,333*0,511) + (0,249*0,568) + (0,250*0,6) + (0,166*0,685) = 0,574
Second Row = (0,333*0,329) + (0,249*0,316) + (0,250*0,263) + (0,166*0,261) = 0,295
Third Row = (0,333*0,156) + (0,249*0,114) + (0,250*0,127) + (0,166*0,079) = 0,123

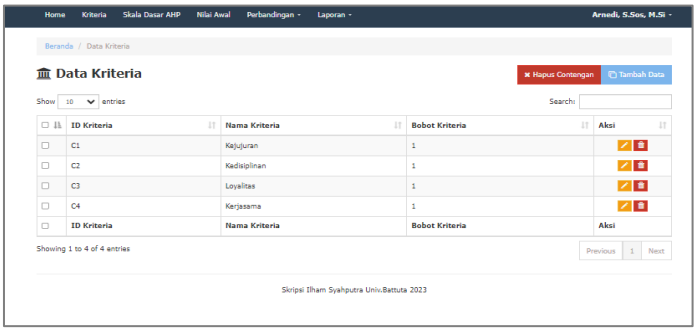

Figure 2. Criteria Page

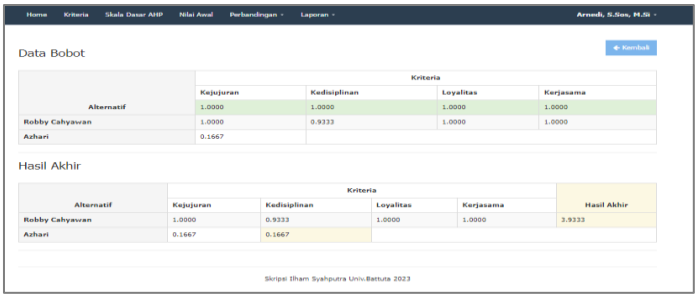

Figure 3. Result Page

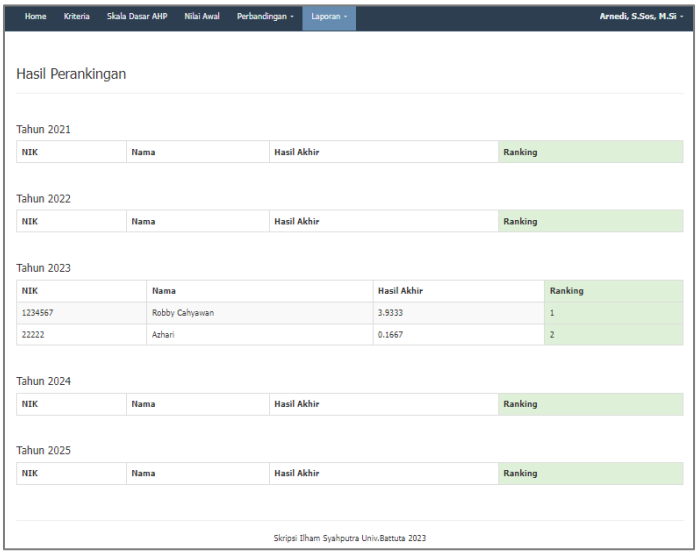

Figure 4. Ranking Page

4. CONCLUSION

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

1. The process of making a New Employee Selection System can be done with the Analytic Hierarchy Process (AHP) method with criteria and weights that have been determined by the Medan Tourism Polytechnic, then processed by the system to produce the best employee ranking output.
2. Based on the results of testing the AHP (Analytic Hierarchy Process) method calculation system with manual calculations, the final results are almost the same.

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