Implementation of Analytic Network Process Algorithm in E-Lowker System

Herry Derajad Wijaya[1*], Wawan Gunawan[2]

[1,2]Faculty of Computer Science, Universitas Mercu Buana

*Email corresponding author: herry.derajad@mercubuana.ac.id

Abstract

Job vacancies information system at this time that there are still many companies that use the manual method to get the best employees and the number of job applicants who have not used the internet as a medium of information. In this case the research aims to facilitate companies in getting the best employees using the Analytical Network Process (ANP) Method in a web-based. Job information system will facilitate job applicants in utilizing internet media as a source of information that has been provided by the company. The ANP method is to find the weighted sum of the performance ratings for each alternative on all attributes, in this study the programming languages used are PHP, MySQL database, CSS and Java Script. The criteria used in this study are education, experience, age and expertise. In this study shows that the Implementation of the ANP Method in the Web-Based Job Vacancy Information System is able to produce the best prospective workers for the company in accordance with the criteria(4) with the ranking results starting from Endrajit Bayu with a score of 0.149, Erlan Suryanto 0.114 and Daffa Risky 0.109.

Keywords: Job Vacancies, ANP, Web, Research

1. Introduction

The increasing number of job seekers in Indonesia has resulted in a large number of job applications entering the company, so the company must really make the right selection to select prospective workers according to their expertise. The Central Bureau of Statistics (BPS) noted that in February 2018, 127.07 million people were working, while 6.87 million people were unemployed. When compared to the previous year, there was an increase in the number of working residents by 2.53 million, while unemployment decreased by 140 thousand people[1].

Employees are valuable assets of the company that can affect overall organizational performance [2], so we must be able to assess the extent to which employees can provide an active role in work to achieve organizational goals [3] through the recruitment process.

HRD in its activities must really select employee candidates in accordance with the required criteria [4], currently HRD must select one application file after entry to check applicants' personal data, education, and applicant experience in accordance with company requests. Applicants who meet the criteria will be invited by HRD to take part in the psychological testing and interview process until they are accepted as employees.[5]

Information needed by job seekers can now be found using internet access. Applicants no longer use the old-fashioned way to go to a company to view notice boards containing job openings, search print media such as newspapers, magazines, brochures or by word of mouth [6], but they can immediately register itself in accordance with the desired company through internet access. Vice versa, the companies no longer install information media through print media or other media.

The business process of the company providing job vacancies information is still not optimal in accepting job application files, because they must select one by one the incoming application files to check based on the applicant's personal data, education, and applicant's experience in accordance with company criteria so that it requires very much time long.

The application of the Android-based analytic network process (ANP) method as a decision support system has produced the output with the first highest value of 3.714% and the second highest value of 3.702%. [7]

Besides the decision making system for the selection of the best employees using ANP Shows that this system can solve problems in the selection of the best employees, so that it can help in selecting the best employees.[8]

The selection of the ANP method is due to the accuracy of the research that has been carried out by packaging companies with the priority results obtained for Oleofood Packaging A with a value of 0.2869 or 29%, B value of 0.2257 or 22%, a C value of 0.2557 or 26% , and a D value of 0.2318 or 23%.[9]

Referring to the background of the problems in this study, the problem that can be identified is the number of job applicants by going directly to the destination company because there are no tools available that allow applicants or job seekers to find vacancies or find workers who can be used / accessed easily.

Based on the identification of the problems that have been described and based on previous research, it is stated that organizational strategy in relation to changes in services, products, and product lines is a key growth factor organizations in a competitive market[10], solving these problems using the ANP algorithm model. This research will discuss how the recruitment process is in accordance with the needs of the HRD so as to minimize errors in the recruitment process.

2. Method

To solve this problem, the Analytic Network Process (ANP) method is used. The ANP method is able to improve the weakness of the AHP method in the form of the ability to recommend an association with the ANP method.

Figure 1. Research Method

3. Result and Discussion

This section explains the results of research conducted to implement the ANP method.

3.1. Design

Table 1. Table of criteria

Code	Criteria	Point
C1	Experience	30
C2	Education	25
C3	Age	25
C4	Skill	20

Furthermore, from the criteria that have been given, then do the comparison process between these criteria to get the eigenvector value using the following equation 1.

$$X = \sum\left(\frac{W_i}{\sum W_i}\right)$$

X = *eigenvector*
W_i = single row column cell value (i = 1....n) (1)
$\sum W_i$ = the total number of columns

Table 2. Comparasion Matrices

Criteria	C1	C2	C3	C4	Total
C1	1	1,2	1,2	1,5	4,9
C2	0,83	1,5	1	1,25	4,08
C3	0,83	1	1	1,25	4,08
C4	0,67	0,8	0,8	1	3,27
	3,33	4,00	4,00	5,00	16,33

So that the eigenvector calculation can be done using equation 1 with a data display like the following

Table 3. Criteria Eigenvalues

Code	Total	Eigen
C1	4,9	4,9/16,33 = 0,30
C2	4,08	4,08/16,33 = 0,25
C3	4,08	4,08/16,33 = 0,25
C4	3,27	3,27/16,33 = 0,20
	16,33	1,00

Furthermore, after getting the eigenvector value for the criteria, the next step is to check the consistency ratio. Consistency ratio is used to state whether the assessment given is consistent or not (if the value is <0.1, it is consistent). The steps to determine the Consistency Ration value are as follows:

a. Look for value λmaks, with equation 2

$$\lambda maks = (nilai\ eigenvector\ 1\ x\ jumlah\ kolom\ 1) + (nilai\ eigenvector\ 2\ x\ jumlah\ kolom\ 2)..n \quad (2)$$

Then the results are as follows

$$\lambda maks = (0,3 * 3,33) + (0,25 * 4,00) + (0,25 * 4,00) + (0,2 * 5,00) = 4$$

b. Calculate *Consistency Index* (CI), with equation 3.

$$CI = \frac{(\lambda maks - n)}{(n - 1)}$$

(3)

CI = *Consistency Index*
n = Number of comparison matrices
$\lambda maks$ = largest *eigenvector* value

Then the results are obtained as follows

$$CI = \frac{(4 - 4)}{(4 - 1)} = 0$$

c. Determine *Consistency Ratio* (CR)

$$CR = CI\ /\ RI \quad (4)$$

Table 4. Table *Random Index*

Orde Matrices	RI
1	0
2	0
3	0,58
4	0,9

5	1,12
6	1,24
7	1,32
8	1,41
9	1,45

So that the results obtained for the CR value are as follows

$$CR = 0 - 0,9 = 0$$

Because the CR result is 0.00 less than 0.10 (CR <0.1), the eigenvector value is considered consistent.

Next is to find the eigenvalues for each of the criteria, namely experience shown in the table 5, education shown in the table 6, age shown in the table 7 and expertise shown in the table 8.

Table 5. Eigenvalues of Experience (A)

No	Applicant	Point	Eigen Vector
1	Endrajit Bayu	24	0,1500
2	Erlan Suryanto	15	0,0938
3	Daffa Risky	16	0,1000
4	Rada Lia Hartanti	8	0,0500
5	Apip Priansyah	30	0,1875
6	Arfan Maulana	6	0,0375
7	Allan Saputra	10	0,0625
8	Litta Apriliyani	10	0,0625
9	M. Erwin	21	0,1313
10	Tri Wulandari	20	0,1250
	TOTAL	160	1

Table 6. Eigenvalues of Education (B)

No	Applicant	Point	Eigen Vector
1	Endrajit Bayu	2	0,0952
2	Erlan Suryanto	2	0,0952
3	Daffa Risky	1	0,0476
4	Rada Lia Hartanti	2	0,0952
5	Apip Priansyah	3	0,1428
6	Arfan Maulana	3	0,1428
7	Allan Saputra	2	0,0952
8	Litta Apriliyani	1	0,0476
9	M. Erwin	2	0,0952
10	Tri Wulandari	3	0,1428
	TOTAL	21	1

Table 7. Eigenvalues of Age(C)

No	Applicant	Point	Eigen Vector
1	Endrajit Bayu	20	0,0952
2	Erlan Suryanto	21	0,1000
3	Daffa Risky	22	0,1047
4	Rada Lia Hartanti	21	0,1000
5	Apip Priansyah	20	0,0952
6	Arfan Maulana	22	0,1047
7	Allan Saputra	24	0,1142
8	Litta Apriliyani	21	0,1000
9	M. Erwin	19	0,0904
10	Tri Wulandari	20	0,0952
	TOTAL	210	1

Table 8. Eigenvalues of Skills (D)

No	Applicant	Point	Eigen Vector
1	Endrajit Bayu	1	0,0833
2	Erlan Suryanto	1	0,0833
3	Daffa Risky	1	0,0833
4	Rada Lia Hartanti	1	0,0833
5	Apip Priansyah	2	0,1666
6	Arfan Maulana	1	0,0833
7	Allan Saputra	1	0,0833

8	Litta Apriliyani	2	0,1666
9	M. Erwin	1	0,0833
10	Tri Wulandari	1	0,0833
	TOTAL	12	1

After each of the priority criteria, the eigenvector value is obtained for each criterion, then the unweighted supermatrix is arranged. Unweighted supermatrix compilation of all eigenvector values obtained from previous calculations was pooled. The next step is the weighted supermatrix by means of the unweighted supermatrix value multiplied by the eigenvector from the results of the pairwise comparison matrix weight criteria.

The next step is limiting the supermatrix which is obtained from iterating the multiplication of the weighted supermatrix by itself so that the same value is obtained for each row.

Furthermore, the calculation of the alternative boarding cost data that has been made multiplied by the global eigenvector criteria will produce a global priority value. From the result, the alternative with the highest global priority is the best alternative. Obtained for Bayu Endrajit with the following calculations.

$$(0,15*0,30) + (0,0952*0,25) + (0,0952*0,25) + (0,0833*0,20) = 0,10926$$

So that the overall calculation results in the following values

Table 9. Alternative Values

No	Applicant	A	B	C	D	Alt.
1	Endrajit B	0,150	0,095	0,095	0,083	0,109
2	Erlan S	0,094	0,095	0,100	0,083	0,085
3	Daffa R	0,100	0,048	0,105	0,083	0,085
4	Rada Lia	0,050	0,095	0,100	0,083	0,081
5	Apip P	0,188	0,143	0,095	0,167	0,149
6	Arfan M	0,038	0,143	0,105	0,083	0,089
7	Allan S	0,063	0,095	0,114	0,083	0,088
8	Litta A	0,063	0,048	0,100	0,167	0,089
9	M. Erwin	0,131	0,095	0,090	0,083	0,103
10	Tri W	0,125	0,143	0,095	0,083	0,114

So that we get the final score for employee selection as in the table below

Table 10. Ranking

No	Applicant	Nilai
1	Endrajit Bayu	0,149
2	Erlan Suryanto	0,114
3	Daffa Risky	0,109
4	Rada Lia Hartanti	0,103
5	Apip Priansyah	0,094
6	Arfan Maulana	0,089
7	Allan Saputra	0,088
8	Litta Apriliyani	0,087
9	M. Erwin	0,085
10	Tri Wulandari	0,081

In the application design will be described with several diagrams to determine the flow in the application including use case diagrams, activity diagrams and class diagrams.
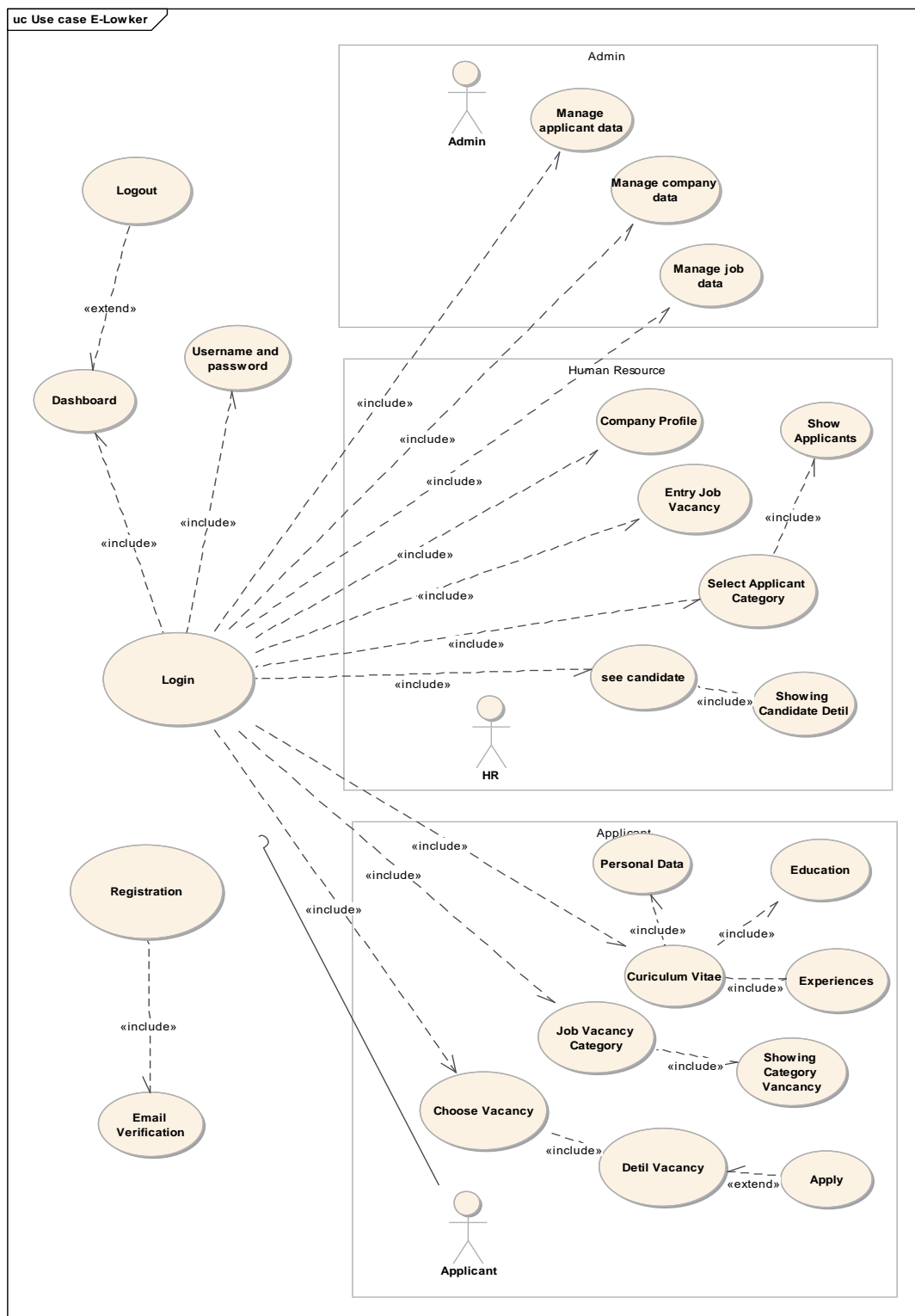
Use Case Diagram

Figure 2. Usecase Diagram E-Lowker System

In the Use case, this diagram illustrates the activities carried out by system users.

The application design has 3 actors starting from the login process as in table 1

Table 11. Activity actors on usecase diagram

Actor	Activity
Applicants	1. Applicants can register 2. The system sends registration details via email 3. The system checks whether the user is registered or not. If not, the system will send registration details via email. If already, the system will display index 4. Applicants can log in with an account that has been created 5. Applicants can edit personal data, educational data, education data, add work experience data, edit work experience data 6. Applicants can view job vacancies
HR	1. Companies can register 2. The system checks whether the user is registered or not. If not, the system will send registration details via email. If already, the system will display index 3. Companies can log in with an account that has been created 4. Companies can edit company data, add job vacancies, edit job vacancies, view applicants 5. Companies can see candidates who apply for job vacancies
Admin	1. Admin can add, edit and delete applicant data 2. Admin can see company data 3. Admin can see applicant data

Activity Diagram Register

In this Activity Diagram which illustrates the registration activities carried out by system users as shown in Figure 3.
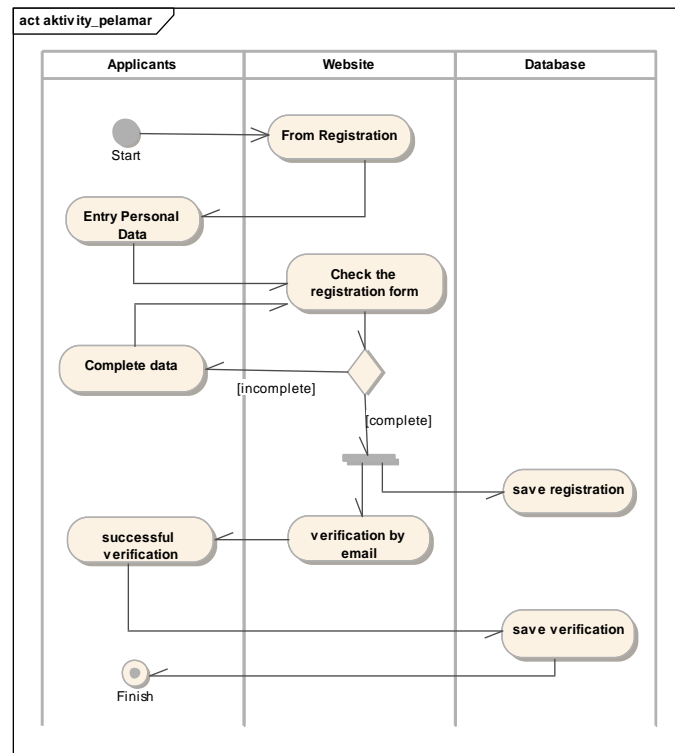

Figure 2. Activity Diagram Register

The Activity Diagram shown in Figure 3 explains how to register with the following explanation:
1. The user registers on the e-lowker application.
2. The user fills in personal data then the data is validated.
3. If the data is incomplete, the user is asked to complete the data, but if it is complete the application will save the registration and verify the data using an email sent to the user.
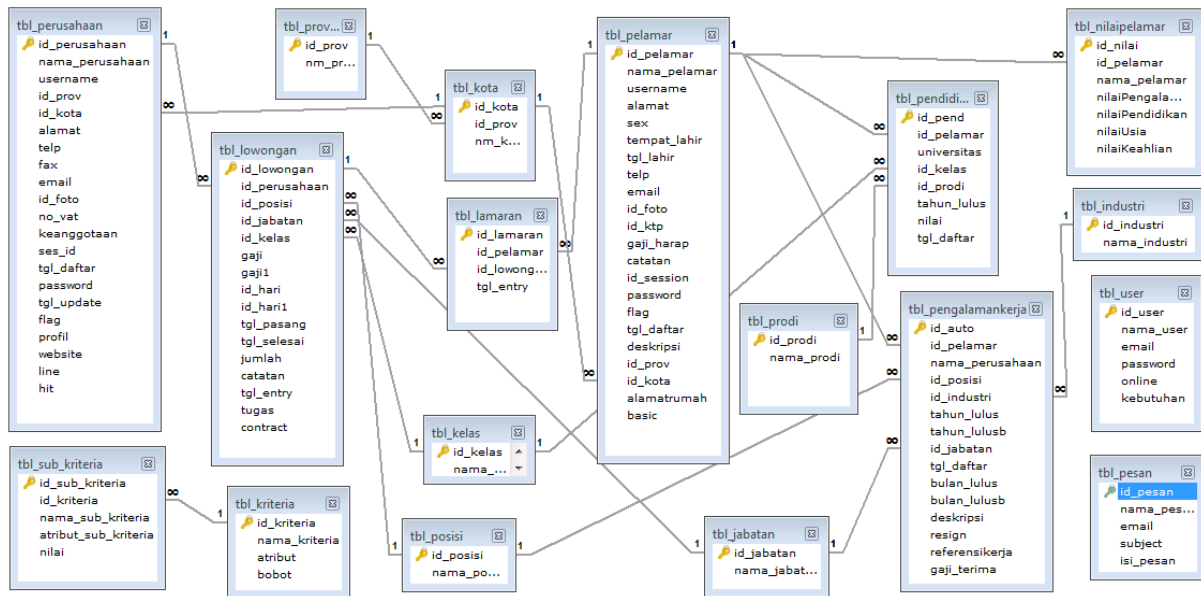
Figure 3. *Class Diagram*

Class Diagram

In this class diagram that illustrates the diagram used in the application system as shown in Figure 4.

Testing

Black box testing is a test that is only carried out observing the results of execution through test data and functional checking of the software. So analogous as we see a black box, we can only see the outer appearance, without knowing what's behind the black wrapper. Just like testing a black box, evaluating only from the outside appearance (its interface), its functionality without knowing what really happened in the detail process (only knowing the input and output).

Table 12. Job Vacancy Testing

Data Input	Observation	Result
The user has logged in as an applicant	The system will display the home page dashboard	Valid
Applicants choose the career info menu	The system will display job opening data	Valid
Applicants look for vacancy criteria only by filling the required position and vacating the minimum education, salary between, last position directly click the "Search Criteria" button	The system will display job data based on searches	Valid
Applicants look for vacancy criteria only by filling in the minimum education and vacating the positions needed, salary between, last positions directly click the "Search Criteria" button	The system will display job data based on searches	Valid

Table 12 shows how the system is tested for job vacancies, whether in line with expectations or not. even so with Tebel 13 testing the system when installing job vacancies

Table 13. Job Vacancy Testing

Data Input	Observation	Result
The user has logged in as a company	The system will display the home page dashboard	Valid
The company chooses the install menu	The system will display job opening data	Valid
company clicking on the "Add" button	The system will display a form added by job data	Valid

4. Conclusion

From the discussion previously described, it can be concluded that the system provides information about jobs that can help someone in finding a job and information systems can help companies in finding good and quality workforce. The decision support system for selecting the best employee candidates has been successfully created using the Analytical Network Process (ANP) method and the system provides recommendations for the best candidate employees to users (companies) according to the criteria and weights determined before the calculation. resulting in the best ranking starting from Endrajit Bayu with score 0.149, Erlan Suryanto 0.114 dan Daffa Risky 0.109. For the best future, we hope that the job vacancy information system website has menu options such as selecting language and other features and the job information system website can determine the criteria and weight for each company that is looking for prospective employees.

Acknowledgements

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