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Design of an Employee Recruitment System Based on the AHP-MOORA Algorithm Case Study of PT XYZ

Muhamad Ripin[1], Agung Triayudi[2], Sari Ningsih[3]
[1]Prodi Informatika, Universitas Nasional
[2,3] Prodi Informatika, Universitas Nasional
[1]muhamadripin99@gmail.com*, [2]agung.triayudi@gmail.com, [3]sari.ningsih@civitas.unas.ac.id

Abstract

The development of internet-based information technology has had a positive impact on human survival. One of the benefits of the Internet is support in building an employee recruitment system that is oriented towards good corporate governance. PT XYZ is a company that has been recruiting manually. Therefore, it is necessary to build an internet-based system for the employee recruitment process. This research uses the Analytical Hierarchy Process - Multi-Objective Optimization based on Ratio Analysis (AHP-MOORA) algorithm to determine the best applicants based on several criteria. The criteria used in this research are age, academic certificate, highest level of education, and work experience. The results of this study show that age and academic certification are priority criteria based on weight assessment using the AHP approach. Furthermore, five applicants became samples in application testing. The MOORA test results showed that three applicants had the highest scores. This research concludes that the application of the AHP-MOORA algorithm can provide objective results in determining applicants who meet the specified criteria.

Keywords: Information Technology, Good Corporate Governance, Employee Recruitment, Job Criteria, AHP-MOORA

1. Background

The development of internet-based information technology has had a positive impact on human survival, based on the survey. BPS Socio-Economics. in 2021, explains that the number of internet users in Indonesia has increased since 2018 [1]. This is also supported by the level of Internet penetration in Indonesia which is experiencing a positive increasing trend [2]. This trend has become momentum in the development of internet-based systems in Indonesia.

Human Resource Development cannot be separated from the presence of the internet. The presence of the internet encourages Human Resources to accelerate the achievement of industrial revolution 4.0. One of the functions of the Internet in implementing good corporate governance is how to build an appropriate employee recruitment system, by the principles of accountability and adhering to business ethics [3].

PT XYZ is one of the companies that has not maximized the role of the Internet in the employee recruitment process. So far, the recruitment process carried out by companies still uses conventional patterns with paper forms or hard copies so the archive process is still not well organized. Apart from that, the recruitment process becomes ineffective because each stage of recruitment must go through the first stage of the process, namely candidate screening the company does not have clear data and information so the screening process takes a long time and is difficult to find candidates who truly meet the company's criteria. Based on this, it is necessary to build an internet-based system to facilitate the recruitment process in the company.

A good recruitment system will produce quality human resources. The development of an internet-based employee recruitment system has been carried out by previous research. Some examples of the use of the internet in developing employee recruitment systems include the use of the K-nearest algorithm for recruitment of BPJS employees using a multiple criteria approach [4], the use of rapid application development (RAD) in building a database in one company [5] and the weight product approach (WP) to assist in determining employee recruitment [6]. However, this research uses another approach because it requires weighting of each criterion in a relatively short time and a high level of selectivity.

The employee recruitment design system built in this research uses the Analytical Hierarchy Process - Multi-Objective Optimization based on Ratio Analysis (AHP-MOORA) approach. This method is considered capable of answering the problem because of the choice of criteria [7] and has a high level of selectivity [8]. This method has been tested in many previous studies for identifying farmer groups that meet the criteria for assistance [9], selecting quality providers (vendors) [10], and selecting potential scholarship recipients [11]. Based on this information, the aim of this research is how to build an AHP-MOORA-based employee recruitment system at PT XYZ.

2. Research Methods

This research uses the AHP-MOORA algorithm to help companies design a Laravel-based security unit (security guard) recruitment information system that is capable of sorting a list of prospective employee candidates with objective and accurate assessment results. The stages of this research are as follows:

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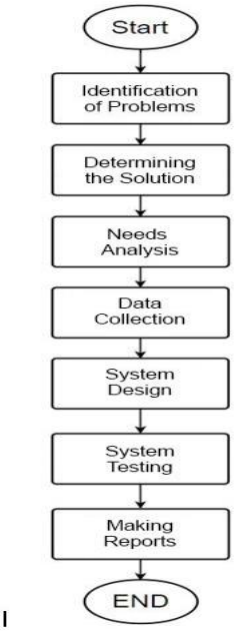

Figure 1. Flow chart of Research Stages

The initial stage of this research is problem identification. The problems found were based on the results of observations made by researchers in the Human Resources General Affairs (HRGA) division of PT XYZ, where the data collection method chosen was interviewed. This interview aims to obtain an in-depth understanding of the implementation of information systems with the ultimate aim of gaining insight into user needs and the extent to which the results that have been achieved are in line with expectations.

The next stage in this research is determining a solution to solve the problem. The author uses the waterfall system development method and the tools used to design the system are Unified Modeling Language (UML). The algorithm used is AHP-MOORA, and the program was created using PHP and MySQL with the Laravel framework. The mechanism for implementing the AHP-MOORA algorithm is as in figure 2:

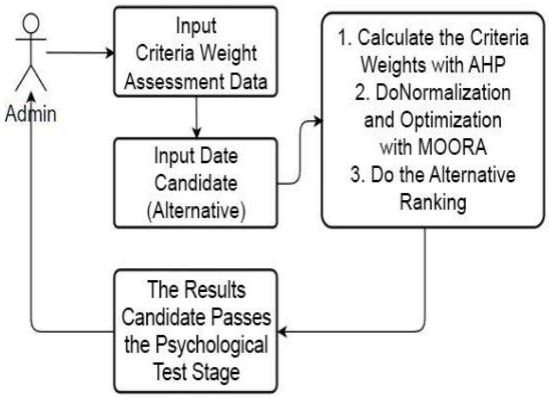

Figure 2. Application of the AHP-MOORA algorithm in research

3. Result and Discussion

3.1 System and User Interface Preparation

Based on the results of interviews with selected respondents, it is known that there are criteria determined in this research as in table 1:

Table 1. Representation of candidate criteria

Criterion Code	Criterion Name	Label
C1	Age	Benefit
C2	Academic Certificate	Cost
C3	Work Experience	Benefit
C4	Last Education	Benefit

The criteria for candidates who will be the focus of this research consist of age, academic certificates, work experience, and recent education. Each criterion has a scale that describes the quality of the candidate so that the company can determine the quality of prospective workers. The scale used includes very good, good, acceptable, and poor with the following ranges as in table 2:

Table 2. Assesment of each criterion

Criterion	Scale	Quality
Age	25-30 years old	Very Good
Age	18-24 years old	Good
Age	31-40 years old	Acceptable
Age	41-50 years old	Poor
Academic Certificate	Security Manager (Main Mace)	Very Good
Academic Certificate	Supervisor (Intermediate Mace)	Good
Academic Certificate	Basic (Primary Mace)	Acceptable
Academic Certificate	None	Poor

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Work Experience	> 5 Years	Very Good
Work Experience	4-5 Years	Good
Work Experience	1-3 Years	Acceptable
Work Experience	None	Poor
Last Education	Bachelor	Very Good
Last Education	Senior Highschool	Good
Last Education	Junior Highschool	Acceptable
Last Education	Elementary School	Poor

The criteria specified in Tables 1 and 2 will be implemented in the system which will later be managed by the admin. Admin will be given access to manage applicant data as a reference for inclusion in the database. This system supports integration with data from interviews and psychological tests for each candidate, making it easier for admins to determine which employees will enter the next stage. The architecture of this system is as in figure 3.

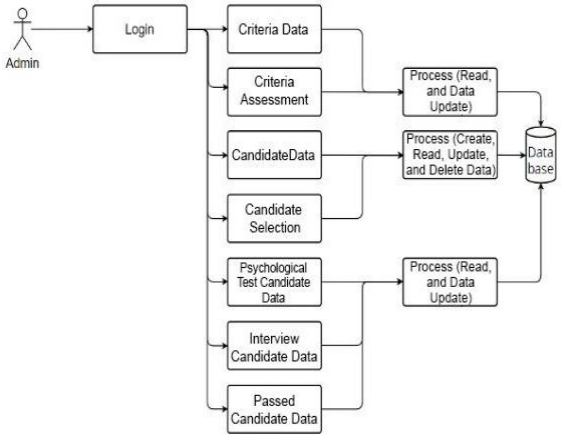

Figure 3. Research architecture (admin mode)

The next stage is to build an Entity Relationship Diagram (ERD), to determine the relationships between entities that produce certain conclusions based on predetermined value weightings. The entities built in this research will be transformed in tabular form to understand the coding given to each process that supports the program. The tables that support the program include criteria, assessment criteria, applicants, assessment results (based on weight), psychological test scores, job interview scores, and passing criteria. The ERD will be used as the basis for compiling the UML model for both admins and applicants. The UML model built for admins uses a use-case diagram approach. The admin use case diagram is as in figure 4.

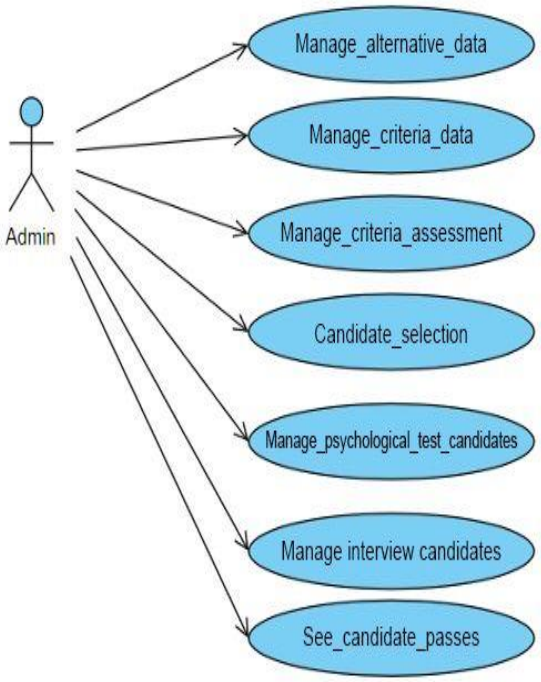

Figure 4. Use case diagram model admin

The use case scenario in Figure 4 for each function is as in table 3 to table 9:

Table 1. Manage Applicant Scenario

Actor	System
Main Flow	
1. Admin selects the Applicant Data menu	2. The system displays applicant data and an applicant data input form
Alternative Scenario	
3. Admin adds, edits, and. deletes	4. The data will be saved to the database and displayed on the applicant data page

Table 2. Manage Criteria Scenarios

Actor	System
Main Flow	
1. Admin selects the Criteria Data menu	2. The system displays criteria data and a criteria data input form

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Alternative Scenario	
3. Admin adds, edits, and. deletes	4. The data will be saved to the database and displayed on the applicant data page

Table 3. Scenarios manage performance appraisals

Actor	**System**
Main Flow	
1. Admin selects the Criteria Assessment Data menu	2. Sistem menampilkan data penilaian kriteria dan form input data penilaian kriteria
Alternative Scenario	
3. Admin updates criteria assessment data	4. The data will be saved to the database and displayed on the criteria assessment data page

Table 4. Candidate selection scenario

Actor	**System**
Main Flow	
1. Admin selects the Candidate Selection Data menu	2. The system displays candidate selection data, Calculates Criteria Weight Values using AHP, Ranks Alternatives using the MOORA Method
	3. The system ranks which candidates pass the psychological test stage

Table 5. Scenario Manage psychological test candidates

Actor	**System**
Main Flow	
1. Admin selects the Psychological Test Candidate Data menu	2. The system displays psychological test candidate data and a psychological test candidate data input form
Alternative Scenario	
3. Admin updates psychological test candidate data	4. The data will be saved to the database and displayed on the psychological test candidate data page

Table 6 Scenarios manage interview candidates

Actor	**System**
Main Flow	
1. Admin selects the Interview Candidate Data menu	2. The system displays interview candidate data and an interview candidate data input form
Alternative Scenario	
3. Admin updates interview candidate data	4. The data will be saved to the database and displayed on the interview candidate data page

Table 7. Scenarios manage successful candidates

Actor	**System**
Main Flow	
1. Admin selects the Passed Candidate Data menu	2. The system displays the passed candidate data page

The scenario that has been built above needs to be implemented into the system and the user interface configured. Primarily a system needs to be started from the login window. Admin login is used to enter the admin page. If the username and password are correct, the admin can enter the admin page, if they are incorrect the message "incorrect username or.

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password" will be displayed. The appearance and coding are presented as in figure 5 and figure 6:

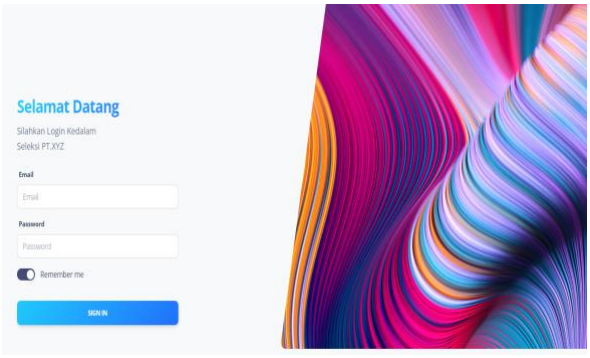

Figure 5. Display of the system login page

```
public function getLogin()
{
$username = $this->input->post('username',true);
$password = sha1($this->input->post('password',true));
if ($hasil = $this->login->cekLogin($username, $password) > 0) {
$data['hasil'] = $hasil;
if ($data['hasil'] == null) {
$data['cek'] = '0';
$this->load->view('Login', $data);
} else {
redirect('Login');
}
```

Figure 6. Login page coding

The coding in Figure 6 explains that the system will call the getLogin function which is used to check the username and userpass entered by the admin. If the username and user are found, they will be directed to the wait.php page, whereas if they are not found, the message "wrong username or password" will be displayed. and return to the index.php page and delete the login session.

Admins who have logged into the system will be directed to the dashboard. Menu that can be selected according to initial planning. The criteria data page is used by the admin to manage assessment criteria data in the system. The appearance and coding are presented as in figure 7:

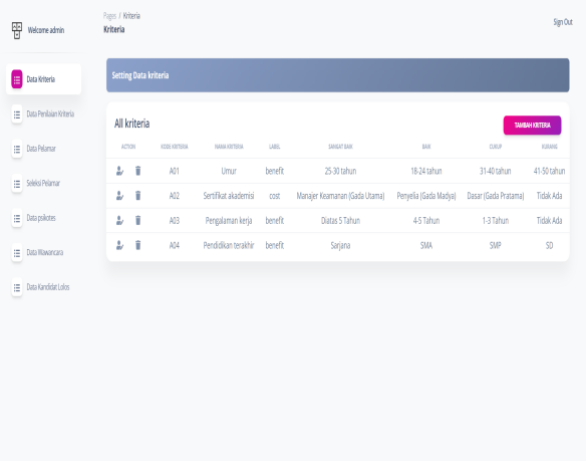

Figure 7. Display of the criteria data dashboard page

```
public function tambah(Request $request)
{
    DB::table('kriteria')->insert([
        'name' => $request->nama,
        'kode' => $request->kode,
        'label' => $request->label,
        'sb' => $request->sb,
        'b' => $request->b,
        'c' => $request->c,
        'k' => $request->k
    ]);
    $kriteria = DB::table('kriteria')->get();
    return redirect()->route('kriteria');
```

Figure 8. Code the criteria data page

The coding in Figure 9 explains the process of adding criteria data where the data input by the admin in the view is sent to the controller using the POST method. If the data is complete then the DB system: table('criteria')->insert ([]); to add data to the database and redirect back to the data criteria page.

The last page in this system is the page for calling qualified participants. This page is used by the admin to see successful candidates in the Laravel-based information system for monitoring recruitment activities for security forces (security guards). The appearance and coding are as in figure 9:

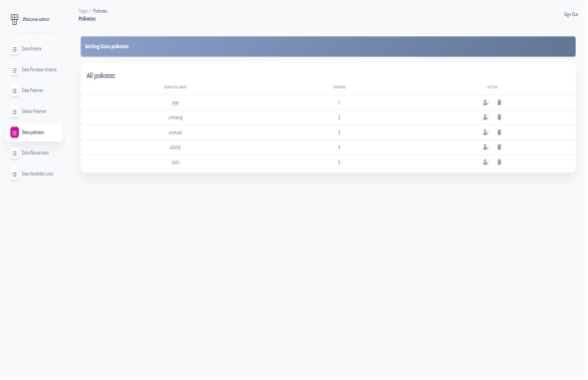

Figure 9. View the page for participants who passed

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```
public function index()
{
    // mengambil data dari table penilaian
    $penilaian = DB::table('lolos')->get();

    // mengirim data penilaian ke view index
    return view('laravel-examples/penilaian')
    ->with(['penilaian' => $penilaian]);
}
```

Figure 10. Code the pages of successful participants

3.2 System Testing

System testing was carried out using black box testing and AHP-MOORA testing. Based on the black box test, the following are obtained:

Table 8. Black box testing

Test Cases	Actions	Function	Result
Login	Enter Username and Password	Displays the Admin Dashboard	Success
Menu Data Kriteria	Click the Criteria Data Menu	Display Criteria Data	Success
Menu Data Pelamar	Click the Applicant Data Menu	Displaying Applicant Data	Success
Menu Penilaian Kriteria	Click Criteria Assessment	Displays Criteria Assessment Settings	Success
Menu Seleksi Kandidat	Click the Candidate Selection Menu	Displays the Ahp-Moora Calculation Flow	Success
Menu Kandidat psikotes	Click the Psychological Test Candidate Menu	Displays Candidate Psychological Test Assessment	Success
Menu Kandidat wawancara	Click Menu Interview candidates	Displays Candidate Interview Assessments	Success
Menu Kandidat lolos	Click Menu Candidates pass	Displays Candidates who have passed the Assessment	Success

The black box testing results in Table 10 show that the system is running well. The entire menu can be accessed and get the title of success. The next test is the AHP-MOORA approach. The first stage is to compare criteria based on their importance. By AHP rules, all possibilities will be compared and assessed for their scale of importance. If option (a) is considered to be more important than another option (b), then option (a) will be given a value of 9, while option (b) will be given a value of 1/9. These calculations will be processed in the application to produce priority weights for each option which will be the basis for determining the right employee candidates to be recruited by the company. The results of the assessment criteria are attached as follows.

Table 9 Comparison matrix between criteria

CRITERIA	C1	C2	C3	C4
C1	1,0000	1,0000	3,0000	5,0000
C2	1,0000	1,0000	3,0000	5,0000
C3	0,3333	0,3333	1,0000	5,0000
C4	0,2000	0,2000	0,2000	1,0000

Tabel 10 Assessment weights based on criteria

CRITERIA	CRITERIA NAME	PRIORITY WEIGHT
C1	Age	**0,380**
C2	Academic certificate	**0,380**
C3	Work experience	**0,179**
C4	last education	**0,062**

Based on the results of the weighting test, it is known that the main priorities in selecting employees are age and academic certification. Next, the researcher tried to simulate data using the MOORA approach by using secondary data originating from the results of applicant tests conducted by the company, the assessment results were as follows:

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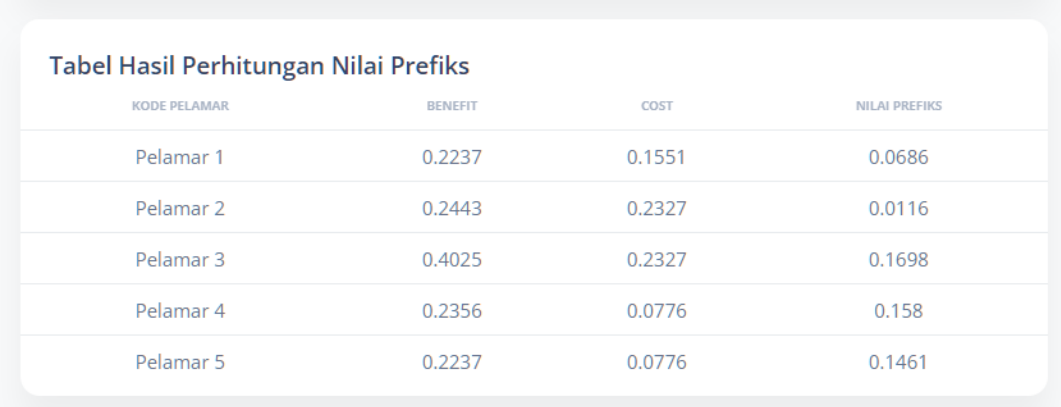
Table 11 MOORA calculation result

Alternative name	Benefit C1+C3+4	Cost C2	Prefiks	Rangking
Applicant 1	0,135 + 0,065 + 0,024 = 0,224	0,155	0,224 - 0,155 = 0,069	**4**
Applicant 2	0,135 + 0,098 + 0,012 = 0,245	0,233	0,245 - 0,233 = 0,012	**5**
Applicant 3	0,269 + 0,098 + 0,036 = 0,403	0,233	0,403 - 0,233 = 0,17	**1**
Applicant 4	0,135 + 0,065 + 0,036 = 0,236	0,078	0,236 - 0,078 = 0,158	**2**
Applicant 5	0,135 + 0,065 + 0,024 = 0,224	0,078	0,224 - 0,078 = 0,146	**3**


Tabel Hasil Perhitungan Nilai Prefiks

KODE PELAMAR	BENEFIT	COST	NILAI PREFIKS
Pelamar 1	0.2237	0.1551	0.0686
Pelamar 2	0.2443	0.2327	0.0116
Pelamar 3	0.4025	0.2327	0.1698
Pelamar 4	0.2356	0.0776	0.158
Pelamar 5	0.2237	0.0776	0.1461

Figure 11 Prefix Calculation (system view)


Tabel Perangkingan

NAMA PELAMAR	NILAI	RANKING
Pelamar 3	0.1698	1
Pelamar 4	0.158	2
Pelamar 5	0.1461	3
Pelamar 1	0.0686	4
Pelamar 2	0.0116	5

Figure 12 Applicant ranking (system view)

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Based on Figure 14, it is known that 3 applicants have the highest criteria in fulfilling the aspects determined by the company. These applicants are applicants 3, 4, and 5. This indicates that these three applicants are worthy of entering the next stage.

4. Conclusion

This research concludes that the application that has been built can provide clear references because the applicant ranking process is measurable and transparent based on the AHP-MOORA approach. The AHP-MOORA algorithm in this application runs well by producing concrete calculations so it is hoped that the selected applicants will be superior job candidates who will have an impact on the progress of PT XYZ in the future.

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