A Fuzzy Expert System for Talent Pool Management in Indonesia

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A R T I C L E I N F O

A B S T R A C T

Addressing the VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) situation, one of the company's strategies is to design a talent management strategy program to identify talent needs based on the company's vision, mission, strategy, and values. Talent is the knowledge and abilities possessed by a person relevant to the company's needs, supporting the company's goals and strategies. The company has a system that designs and manages the talents of its employees to acquire and retain their employees, namely talent management (TM). Talent management is an organizational scheme that systematically guides, directs, and guides in obtaining, developing, and retaining employees with talent or talents to achieve organizational goals. Therefore, this study aims to assist companies in making it easier to identify employees based on a 3x3 talent mapping matrix based on AI (Artificial Intelligence) in the E-Fillment Division, making it easier for companies to determine the right development program for these employees

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INTRODUCTION

Addressing the VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) situation, one of the company's strategies is to design a Talent Management (TM) strategy program to identify talent needs based on the company's vision, mission, strategy, and values (Ahram, 2019; Hamid et al., 2023; Wagner & Hollenbeck, 2020). Talent is the knowledge and abilities possessed by a person relevant to the company's needs, supporting the company's goals and strategies (Nijs et al., 2014; Yasin, 2017). The company has a system that designs and manages the talents of its employees to acquire and retain their employees, namely Talent Management (TM) (Liu et al., 2021). TM is an organizational scheme that systematically guides, directs, and guides in obtaining, developing and retaining employees with promising talent to achieve organizational goals (Rustiawan et al., 2023).

Generally, the method for determining employees entitled to the development program is known by the company conducting a selection or assessment for each program (Stadler, 2011). Besides, through Human Resource Development (HRD) division, commonly determining employees to receive team member development programs still uses a selection system proposed by the team member concerned, recommendations from superiors and job requirements (Wagner & Hollenbeck, 2020). In addition, TM with a 3x3 talent mapping matrix makes it easy to determine team member positions and makes it easier for companies to determine the right team member development programs and career strategies (Azmi et al., 2016; Sparrow et al., 2015).

Today, Artificial Intelligence (AI) is applied in the role of human resources, including the TM process (Liu et al., 2021). TM now challenges intelligent TM and uses intelligent systems (including AI) in all parts of the TM process. Today's companies and organizations have large-scale data management requirements and require data intelligence to manage this problem (Hamid et al., 2023). Besides, AI could be an excellent system to accommodate the complexity of the TM process, especially in identifying good talented people.

Therefore, this study aims to assist companies in making it easier to identify employees based on a 3x3 talent mapping matrix based on AI (Artificial Intelligence) in the E-Fillment Division, making it easier for companies to determine the right development program for these employees.

THEORETICAL FRAMEWORK

Related work regarding using intelligent systems, including AI, for the TM process are diverse. Different intelligent system methods would be proposed to provide specific TM process solutions. Research by Siregar and Kartika (2020) used the Analytical Hierarchy Process (AHP) to identify how talent is managed and develop future TM objectives and strategies. Santoso et al. (2021) used a similar method to analyze the current position of competence and future needs in Indonesia's banking and financial technology sectors. The result showed that the competence and future needs have been very fragmented. In addition, three priority areas of expertise in Industry 4.0 were identified: cooperation and networking, adapting to change, entrepreneurialism and business thinking.

Sjachriatin (2019) used the Structural Equation Modeling (SEM) method to manage the TM performance by the management system, so the relationship between TM and the organization's performance could be managed. The system identifies talented employees, integrates restructuring strategies, and strengthens employee-management relationships to improve organizational performance.

Furthermore, recent studies used AI for TM study, including Expert Systems (ES). Hamid et al. (2021) use the certainty factor method for TM employee development that provides three different ranks of talent: bad, standard, and high. Each talent rank has been calculated for the confidence level percentage, within 93.55%, 52.38%, and 98.73%, respectively. Besides, Louzada et al. (2016) developed a web-based ES to analyze real-time sports data through R software. This system is a powerful tool for identifying soccer talent. Besides, Papić et al. (2009) used a different method, like fuzzy for scouting and evaluating young sports talents, which human experts validated for reliability and accuracy.

METHODS

The study used a waterfall-type Software Development Life Cycle (SDLC). The following procedures are conducted in the study, including analysis, design, coding, and testing. The tools used in this study include Microsoft Excel 365 version 2304, Draw.io, Sublime Text, and Django framework version 3.3. Figure 1 shows the research flowchart.

Implementation of a career development program through mapping operational warehouse employees with Talent Management (TM) has not been carried out comprehensively at PT. Adi Sarana Logistik. To find out the implementation of Talent Management (TM) at PT. Adi Sarana Logistik, the assessment was analyzed using descriptive analysis and the Human Asset Value (HAV) matrix. The assessment will be carried out between January and June 2022 by assessing the competence and performance of operational warehouse employees. Automated team member grouping in the Human Asset Value (HAV) matrix uses fuzzy logic. It is used to analyze career development quickly under the operational warehouse team member grouping so that the employee development program becomes more focused and is expected to become recommendations and suggestions for PT. Adi Logistics Facilities.
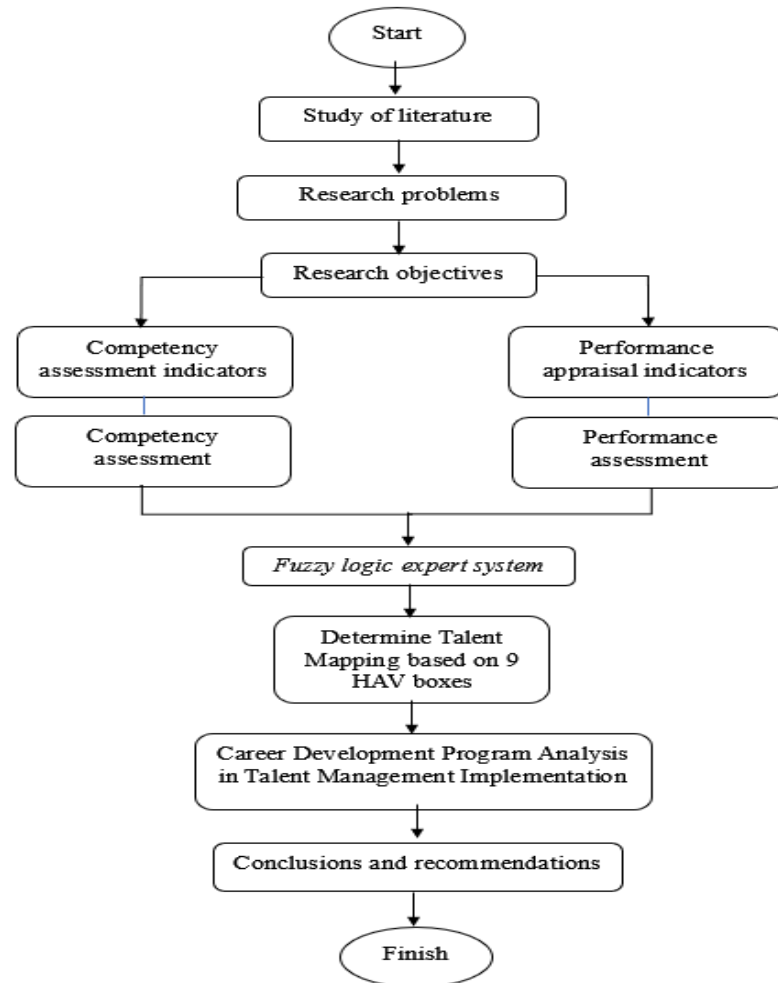
Figure 1. Research Flowchart

RESULTS
Fuzzification, Inference, and Defuzzification

The proposed expert system uses Sugeno's fuzzy logic method; the parameter values obtained will be processed in several stages, namely fuzzification, inference and defuzzification. The initial stage, which is fuzzification, can be seen in Figures 2 and 3.
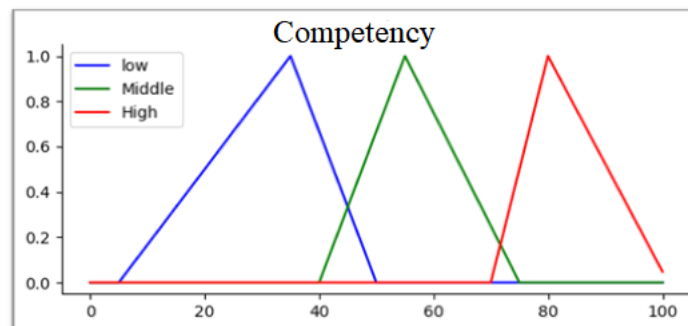

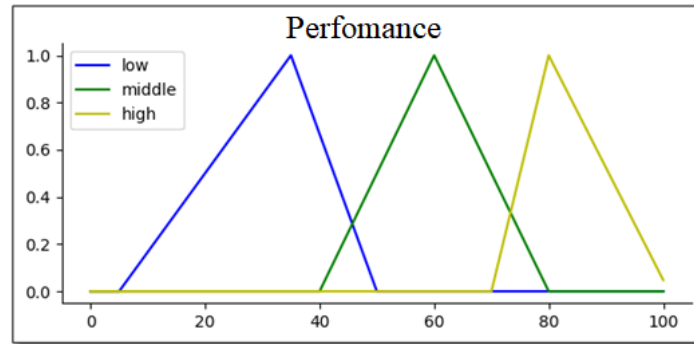Figure 2. Competency Membership Degree Values

Figure 3. Performance Membership Degree Values

Competence fuzzification process = 80
Degree of membership for Competency = 80 is High with a value of 1
Performance fuzzification process = 80
Degree of membership for Performance = 80 is High with a value of 1

The second stage is inference. The inference process is carried out at this stage using the Sugeno 1st order method. The final stage is defuzzification. The authors use the weighted average model in this process, namely the weighted average for defuzzification. So, using the Sugeno Order-1 method, with a variable score of competence is 80, performance is 80 getting a performance value of 80 in the fuzzy logic stage, the company has determined the existing parameter values, and the author only includes these values in fuzzy logic.

Design Result

The proposed use case contains actor identification and system design interaction. This designed system is used by two actors, namely the admin and the user. The interaction of actors with this system will be explained in Table 1.

Table 1. Proposed Use Case Design

Actor	Use Case
Admin/HC Officer	Login
	Logout
	Manage Employee Competency and Performance Data
	Manage Data Talent Management
	Print Talent Management Result Data Report
HC Head	Login
	Logout
	Manage Employee Competency and Performance Data
	Manage Data Talent Management
	Print Talent Management Result Data Report
	Approve Talent Management Data
VP Human Capital	Login
	Logout
	Approve Talent Management Data

Meanwhile, the use case would be a proposed design for a class diagram. A class diagram is a diagram that describes the objects involved in an application or system design. Class diagrams also show the properties and operations of a class and the constraints contained in the object relationships. Figure 4 (in Indonesian) shows the class diagram in this study.
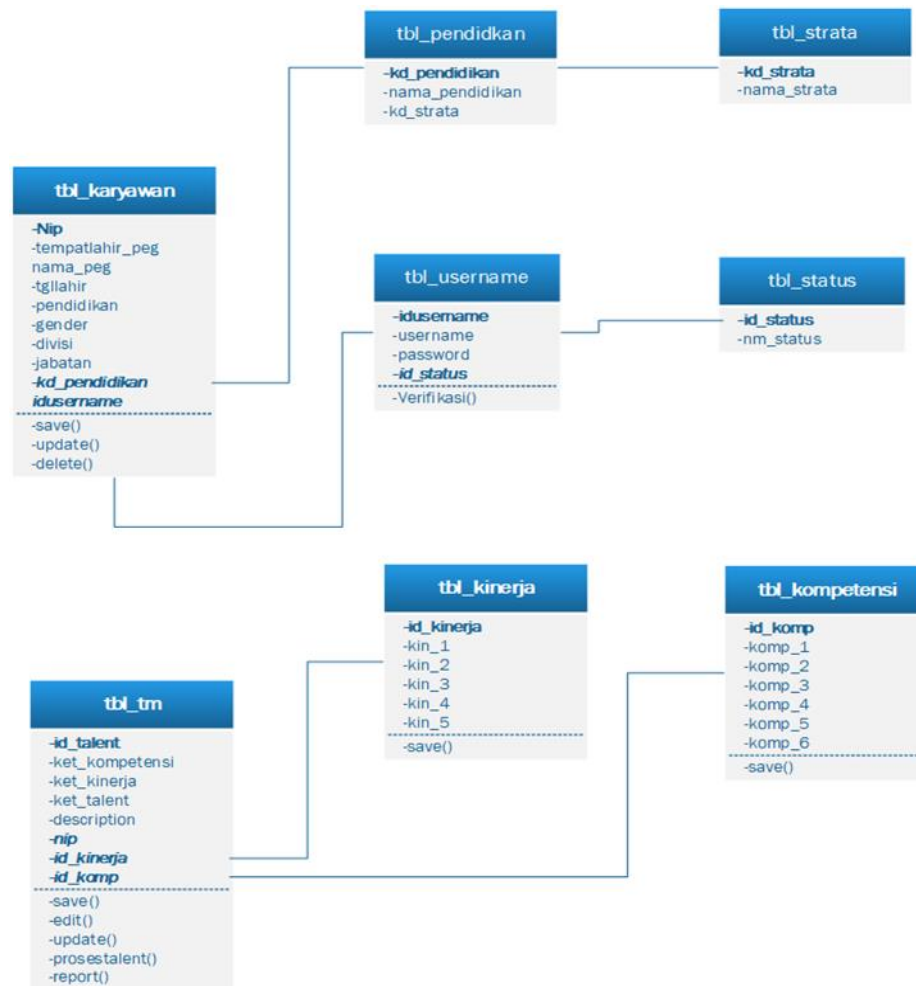

Figure 4. Class Diagram Design

User Interface Result

The expert system's proposed User Interface (UI) based on the fuzzy Sugeno method is developed into a web-based version. The following Figure 5 shows the login page, Figure 6 shows the employee data input page, Figure 7 shows the employee data page, Figure 8 shows the details of employee data, Figure 9 shows the page of employee data competency and performance input, Figure 9 shows the talent management assessment page, and Figure 10 shows the detail of talent management assessment data.
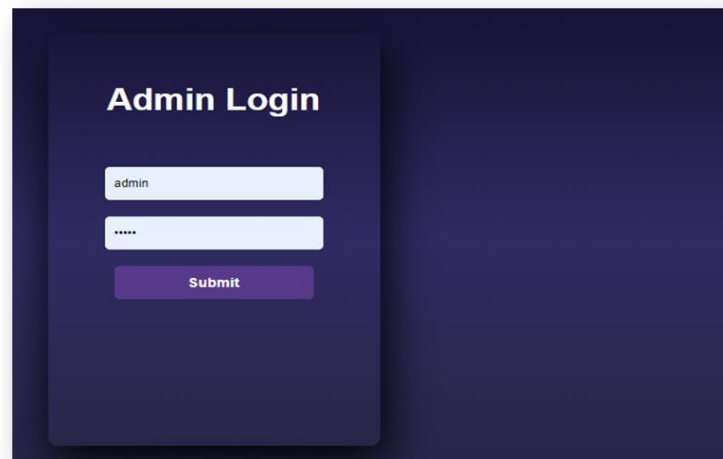
Figure 5. Login Page Design

Figure 6. Employee Data Input User Interface

Figure 7. Design Page View Employee Data

Figure 8. Design View Employee Details Page

Figure 9. Design of Employee Competency and Performance Input Pages

Figure 10. Talent Management Assessment Page Design

Figure 11. Design of Talent Management Assessment Data View Result

System Testing Result

Unit test is carried out to test each component in the system. Testing is focused on the application of fuzzy logic to the system. Testing of this system was carried out at PT. Adi Sarana Logistik on February 12, 2023, between researchers and the party concerned, Mr. Muhammad Chikal Akbar. Table 2 shows the system testing result.

Table 2. System Testing Result

No	Module	Precondition	Expected results	Test results
1	Save employees	Login as admin	Can add employee data and employee data entered databases	OK
2	Edit employees	Login as admin	Can change employee data and update employee data in databases	OK
3	Delete Employee	Login as admin	Can delete employee data in databases	OK
4	Add Position Data	Login as admin	Can add employee position data into databases	OK
5	Delete Position Data	Login as admin	Can delete job data in databases	OK
6	View more	Login as admin/HC Head/VP HC	Can view talent data and employee data from the database	OK
7	Parameter input	Login as /HC Head	Can enter the value of competence and performance parameters	OK

8	View assessment results	Login as HC Head/VP HC	Can see the results of the competency values and performance values of the 9 Box Talent categories	OK
9	Print Assessment Results	Login as Admin/HC Head	Can print the results of the talent management category	OK
10	Result Approval	Login as HC Head/VP HC	Can approve the results of employee data categories that are included in the 9 Talent Boxes	OK
11	Logout	Login as admin/HC Head/VP HC	Can exit the system	OK
12	Login	Login as admin/HC Head/VP HC	Can enter the system	OK

DISCUSSION

The system contains all talent management's knowledge adopted from the human expert, in this case, the division of E-Fillment (like the HR Division). Besides, within this system, the company has a system that designs and manages the talents of its employees to acquire and retain their employees. It is to implement the Talent Management (TM) expert system. To assist companies in making it easier to identify employees based on a 3x3 talent mapping matrix based on AI (Artificial Intelligence) could use this system, making it easier for companies to determine the right development program for these employees.

User Interface (UI) is designed to help the division's staff make any assessment and evaluation of employees. Figures 5 and 6 contain the standard secret-based web information system in the login form interface. Figures 7 and 8 contain detailed information about the employee, including the bibliography. If selected one employee is, the system will display the employee's assessment page, and it should be calculated by fuzzy system and can be seen in the process of assessing in Figures 9, 10, and 11.

CONCLUSIONS AND RECOMMENDATIONS

The conclusion is that the system created can be used to identify competency and employee performance values in the E-Fullfillment division of PT. Adi Sarana Logistik can map the talent management of PT. Adi Sarana Logistik employees according to good accuracy.

The system can recommend and determine employee development programs for the PT. Adi Sarana Logistik's division quickly based on the results obtained from the talent mapping matrix using AI (Artificial Intelligence) to make it easier for HC Heads to make decisions on talent development strategies.

FURTHER STUDY

Based on the conclusions that exist, the author provides suggestions for developing this system in the form:

1. Adding other parameters that can support team member competency and performance assessment in all divisions.
2. Connecting this system with other systems in the company from the same or other divisions.
3. Using other fuzzy methods to find out the differences between other fuzzy methods.
4. Create a more interactive view for the user.

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