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Case Report

Profile Matching and Competency Based Human Resources Management Approaches for Employee Placement Decision Support System (Case Study)

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Abstract

Background: The web-based development of decision support system is proposed for allocating employees to next position in accordance with company's standards. **Methodology:** The proposed solution has handled the problem that appeared in Presisi Cimanggis Makmur Co., Depok West Java Indonesia, where there was not enough information to describe the actual condition of employee's. **Results:** Moreover, the information is in the form of printed paper, it easily lost or scattered. Profile matching is one of approach methods, which has been used to help Human Resource Department to determine employee competency gap against position's standard of competence. **Conclusion:** To build the system, it used a simplified development process with UML models, PHP and MySQL as tools.

Key words: Profile matching, human resources management, decision support system, employee, placement

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Presisi Cimanggis Makmur Co. is a company engaged in the field of molding injection plastic since, 1983 in Cimanggis Depok, West Java Indonesia. For almost thirteen years, the company processed 57 times of high potential employee's placements, which consist of 8% demotion, 35% rotation and 16% promotion process¹. The process is carried out to meet the vacancy from internal sources. Employee's placement is an effort to retain employee's themselves, facilitate the fast adaptation, saving recruitment costs and help to develop the careers of employee's. The standard in the selection of employees is seen from their own performances. Therefore, the selection of employee's placement based on the recommendation from Head of Human Resource Department (HRD). Moreover, data related to the employee are still separated in the form of documents and excel sheets. Towards employee's placement, head of HRD collect all documents i.e., performance assessment and employee personal data, then compare both data and make a decision for eligibility to join placement orientation program. This process required more than a week. Therefore, to help manager of HRD for determining employee's performance based on their competencies, DSS is required to speed up this process in order to get the employee to be promoted, rotated or even demoted. Moreover, DSS is not limited for ranking but also the placement mapping information of employee's.

RELATED WORKS

Previous studies indicated that decision support system of employee's performance for promotion is a flexible system which can make the selection in accordance with variety company standards and required short time process². A considerable study that has been published, describes the research efforts to build a web-based decision support system of employee's placement with apply profile matching method to select employees in accordance with vacant positions and obtain a level recommendation³. However, the results indicated position placement for promotion only, while placement can cover a wider scope such as demotion or rotation. Other researcher built a decision support system with gap analysis method that gets results of employee performance. This study used questionnaires in data collection and application interface is less attractive⁴. Previous studies showed that decision support system that used gap and AHP to derive the only level of employee performance, not give alternative position for the employee. However, the system delivers specific criteria which influenced for profile matching

calculation^{5,6}. Another application result has stated that competency should cover all the necessary required aspects of an employee to perform his job effectively. It was found that every an employee in a different job position requires competence with different levels. Not only with the perspective of organizational competency is important but also for their individual character to play the important role⁷. The use of profile matching also applied to generate decision making for poor houses beneficiaries process faster and accurately in accordance with standard that prescribed by Baitul Mal in Aceh Darussalam Indonesia⁸. Also, gap analysis applied to improve quality management system in higher education, not only in short term but also in a long-term (5 years and longer) which, anticipated impacts, such as changing in the orientation of teachers on quality and on components contributing to quality⁹. Abbate *et al.*¹⁰ investigated an automatic/semi-automatic process to support decisions of Human Resource Management in Public Administrations Department of Health Service in Italia with skill gap analysis. The experiment shows that the results appear to be good and encourage authors to continue the research to find out employee's suitability for the roles they perform and extending to other wider contexts of the public administrations.

Decision support system is model-based of a set of procedures for data processing and assessment in order to help managers make decisions. To present that system is successful, it should be simple, fast and easy communicates. The system's component consists of data management and interface subsystems. The data management subsystem is the database that contains relevant data to make a decision, which is a set of software that including a model of management or model of quantitative. Interface subsystem is subsystem which users can instruct and communicate with decision support system¹¹. Meanwhile, employee's placement means allocating employee to a job position that must compatible with their interests and skills. It consists of promotion or displacement to a high level with different salary and responsibilities, where it represents as a reward. The rotation is displacement to a different level with the same salary and responsibility as before that uses for increase job experience and the demotion is displacement to low level with lower salary and responsibility that uses for push an employee who cannot do their job instead of discontinuing employee job relationships¹².

Competency Based Human Resources Management (CBHRM) is using competency and the results of competency analysis process for information and improvisation performance management, recruitment and selection,

employee development and reward. This is a very important part to be applied in all human resource activities¹³. It is basically the concept of behavioral and technical competencies. Behavioral competencies are defined as behavioral expectations and types of behaviors which needed to deliver results under headings such as teamwork, communication, leadership and decision-making, sometimes known as soft skills. Technical competencies are defined as what people should know and able to do (knowledge and skills) to carry out their role effectively. They are associated with either the generic or individual role. The competencies are usually not part of a competency-based framework of behavior although of course these two are closely linked when considering and assessing the role demands and requirements. This competency is sometimes known as the hard skills¹⁴.

Profile matching is a process of comparing individual competencies into position competencies that can be known the differences (gap method). The smaller gap of result the greater of weight value, which means, it has a greater chance for the employee to take that position^{15,16}. In other words, profile matching is a mechanism to make a decision that assumes a level of variable prediction which should be completed by employees¹⁵. Calculation of profile matching consists of four stages¹⁷:

- Competency of gap mapping
- Core factor
- Total value
- Ranking

Decision Support System (DSS) is a set of model-based procedure for data processing and assessment to help managers make decisions. The DSS will be successful if the system is simple, fast and easy to communicate. The DSS consists of three interacting components¹¹:

- Language system, in which the mechanism for communicating with users and other DSS components
- Knowledge system, in which the problem domain knowledge repository of existing DSS either as data or procedure
- Problem processing system, in which the relationship between two other components consists of one or more common problem manipulation capabilities are necessary for decision-making

The decision-making process consists of three main phases, namely intelligence, design and choice¹¹. The following phases are:

- **Phase of intelligence:** This stage is a process of tracing and detecting of a scope of problems and process of recognition of a problem. Data input is obtained, processed and tested in order to identify problems
- **Phase of design:** This stage is a process of discovering, developing and analyzing alternative actions that could be done, which includes the process to understand a problem, create solution and test feasibility of a solution
- **Phase of choice:** At this stage, selection among alternative actions that may be executed. The selection results are implemented in the decision-making process

METHODOLOGY

The DSS development of employee performance evaluation refers to a simplified development process which, covers four stages, i.e., system initiation, system analysis, system design and system implementation^{18,19}.

In Fig. 1, it depicts a simplified development process, wherein each stage needs particular requirements and tasks to build DSS, with UML models^{20,21}, PHP²² and MySQL^{23,24} as tools for building the system. For details of each stage, it described in next section.

RESULTS AND DISCUSSION

System development: Refer to process that described in Fig. 1, DSS development for proposed system as follow.

In the system initiation stage, identification of problems in four parameters Performance, Information, Economic, Control, efficiency and Service (PIECES) framework to categorize the issues, opportunities and constraints as a basis for consideration^{25,26}. It is noted some problems at Presisi Cimanggis Makmur Co. and described in PIECES parameters that shown in Table 1.

Refer to identification of problems, scope of system as follow:

- Type of required data for placement is performance, employee and department
- Business process of placement system consists of employee data management, performance assessment data management, orientation value management, profile management positions (position weight, position criteria weight and position factor weight), replacement management, result management and report management
- The user interface to system consists of Head of HRD, Supervisor and HR staff (admin)

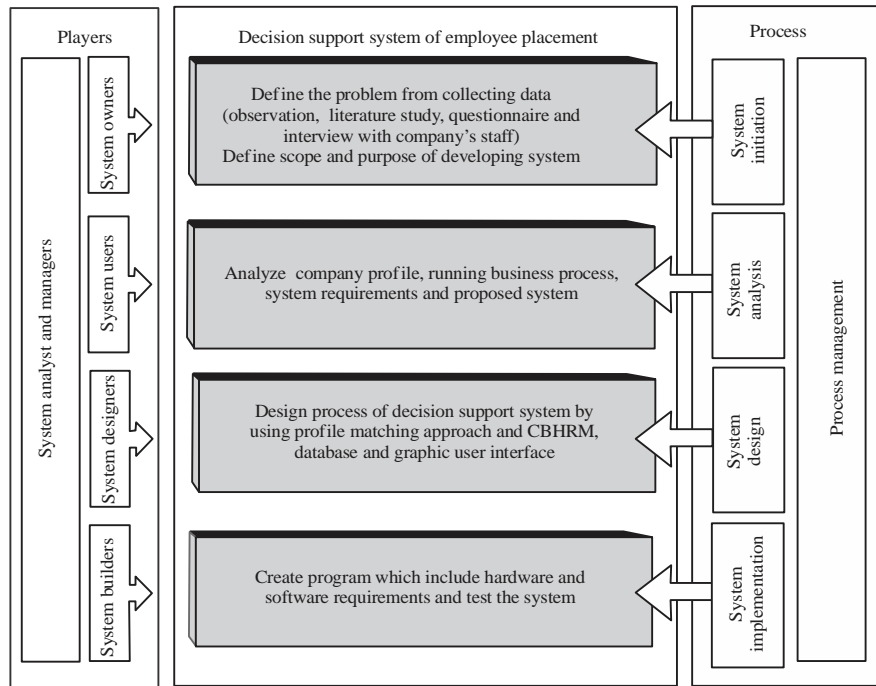


Fig. 1: Simplified development process

Table 1: Four parameters of PIECES

Performance	Need to improve response time which is response time for data storage, data searching and to calculate value performance maximum a day
Information	Necessity to improve output and input system, as follow: <ul style="list-style-type: none"> • Output: Data in Ms. Excel form only presents average scores of performance, detail of performance and orientation results are stored in hard-copy (paper) • Input: Data which stored in Ms. Excel form was limited by an average score of performance and no detail score for the employee position
Control	Need to improve data security that stored in papers is easy to lose or scattered (10% cases every year)
Efficiency	Improving required material to keep performance and orientation data. Also, assist work in collecting and managing data for staff and help to keep and calculate orientation score for supervisor
Service	Need to improve the manual system in presenting information of decision support that only average score of performance. Also need to help interaction process for all parties that involved

To create a system that can provide information for decision makers to select the employee's placement, which the output is ranking and placement mapping by detailed information about actual gap with expected position. Furthermore, this system can help the involved parties, the particular placement process, i.e., finding, managing, storing the data placement and basic information of employee's.

Then, to the next stage, it is system analysis stage. In this stage, it covers company profile, running business process, system requirements and proposed system. As mention briefly on the previous introduction section, company's profile provides concise an overview of the history, main area business Presisi Cimanggis Makmur Co. and goals which cover vision, mission, organizational structure and financial reports. The running business process is described by the rich picture and then analyzed based on PIECES framework and

summarized into a matrix of a problem, opportunity and objective (Table 2) to obtain purpose of improving the system.

Based on analysis of running business process and interviews, system requirements are needed in developing system can be decomposed into two parts, i.e.:

Function requirements: The requirements that include activities and services which have provided by a system are as follow:

- **Input system:** Employee, department, section, position, performance, criteria and weight data
- **System process:** Storage data to the database, deleted data, searching data, calculate and edit data
- **Output system:** Results validation show ranking results, placement mapping and printing reports

Table 2: Matrix of problem, opportunity and objective

Causal analysis		Improvement purpose	
Problem	Cause and effect	Purpose of system	Constraint of system
<ul style="list-style-type: none"> The company does not have an employee's placement system Therefore, information which related to the placement separately in paper and electronic files 	<ul style="list-style-type: none"> Managing the data (store, search, calculate) each takes a day Information of distributed decision support cause decision-making process took more than a week 	<ul style="list-style-type: none"> Reduction of time managing data from a day to minutes each process Creation a system that provides information that supporting decision simultaneously 	<ul style="list-style-type: none"> The system is not designed to handle printing's letter problems The system is not developed in the old settings for automatic data storage (it means the old data can be deleted or backed up by a user) The system is not developed for making internal memo which related to placement application

Table 3: Matrix of candidate

Characteristic	First candidate
Part of computerized system	Collection information for placement related to create chart replacement and orientation process related to orientation employee data distribution, orientation result value distribution and also orientation value calculation distribution
Benefit	Support business process of employee's placement which starts from a collection of alternative information (employee) till orientation process added by efficient interaction among factors
Server	Minimum Windows XP SP 2 (server)
Software	AppServer, Notepad++, Adobe fireworks, Opera, Chrome
Data processing	Client/server
Output device	Printer
Input device	Keyboard and mouse
Storage device	MySQL

Table 4: Matrix of feasibility analysis

Feasibility criteria	Weight (%)	First candidate	Score
Operational feasibility	40	Fully support for required functionality users and bring some business processes modification in addition to the process (data criteria, position weight data, criteria weight data, placement analysis)	81
<ul style="list-style-type: none"> Functional: A description of level of candidate will provide benefit to organization and how well the system will work Politics: A description of how well the solution is acceptable from the perspective of user management, user and organization 			
Technical feasibility	40	Web-based technology is used because it is cheaper and even free license costs and ease of implementation. Requires staff who master the field of web-based systems development and understanding in the management and maintenance	95
<ul style="list-style-type: none"> Technology: Maturity assessment, availability of computer technology that supports candidates Expertise: Technical expertise assessment that required to develop and maintain the system 			
Schedule feasibility			
<ul style="list-style-type: none"> Assessment of how long it will take to design and implement solutions 	20	Development takes three months	80
Ranking	100		86.4

Non-function requirements: The requirements that include features, characteristics and other constraints determine whether the system is satisfaction or not. Non-functional requirements are PIECES framework to improve deficiencies that described in PIECES as a problem.

Refer to system requirements; it can be considered candidate solutions, which categorized into matrix of candidate as shown in Table 3.

Each candidate solution has to be analyzed for feasibility by user or owner of the system. The feasibility analysis matrix is shown in Table 4.

Refer to analysis feasibility, the first candidate might reasonably be inferred to be developed. Therefore, proposed system is shown in Fig. 2, the business process proposed system is depicted in Fig. 2, the system has three users, which is the administrator that in charge of entering data master, supervisor on duty to manage data that related to an assessment of orientation, calculating the score of an employee then the results can be validated by the Head of HRD. The Head of HRD analyze the placement and then the system will calculate employees score using profile matching at this stage and next stage of calculating orientation value.

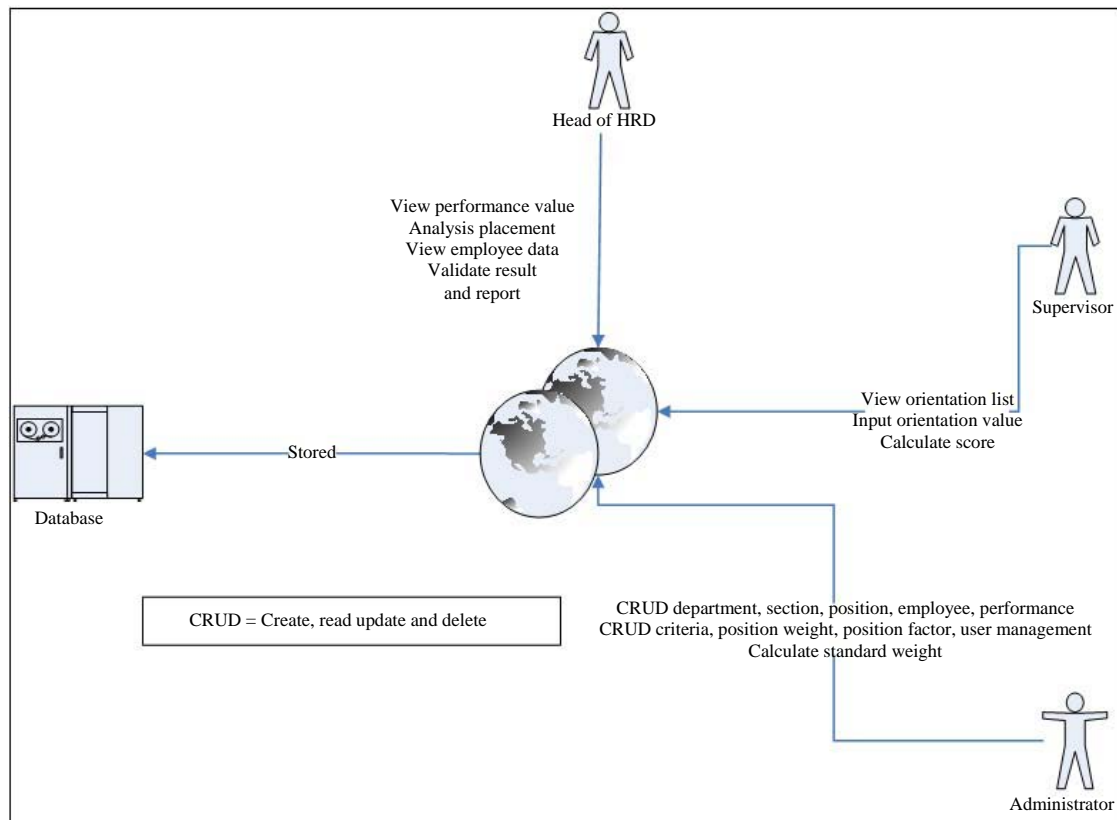


Fig. 2: Proposed DSS of employee placement

Table 5: Weight of gap competency

Level competency	Weight	Definition
4	5	More than four level of standard
3	4.5	More than three level of standard
2	4	More than two level of standard
1	3.5	More than one level of standard
0	3	Suitable to standard
-1	2.5	Less than one level of standard
-2	2	Less than two level of standard
-3	1.5	Less than three level of standard
-4	1	Less than four level of standard

Table 6: Indicator of placement

Indicator	Definition
>3	Potential to promotion
=3	Potential to rotation
>3	Settled
>2	Potential to demotion

Table 7: Level of competency authority

Score	Level authority	Code
0 - <0.25	Knowing	MG
0.26 - <0.50	Capable	MU
0.51 - <0.75	Competent	TR
0.76 - 1	Skilled	MH

The system will generate rank and placement information for decision support to selecting potential employee's get a promotion/rotation or even demotion.

The proposed system is designed to enable Head of HRD as decision makers that obtain information about placement that has been adjusted with his competency. The advantages of the proposed system compared with an earlier system that data related to employee's placement could be in with a good management; the supervisor can do calculation quickly and Head of HRD can get supporting information that displayed a sequence of alternatives to choose and mapping of placement along with details of real gap analysis against expectations.

At system design stage, it includes design process, which involves profile matching calculation and CBHRM, database and graphic user interface. In this process, first design decision support system with a profile matching approach, which called intelligence phase that describes identification and classification of problems. Second, design phase that used profile matching involved stages of profile matching calculation. The calculation consists of:

- Determination of gap weight of performance evaluation from company standard that shown in Table 5-7. Table 8 shows an example of assessment of performance evaluation for operator position and will be promoted as head of a group

Table 8: Assessment of performance evaluation

Aspect	Competency	STD	Value	Performance score	Gap weight
Basic	K1 Attitude to work	3	3	0	3
	K2 Attitude toward company	3	4	1	3.5
	K3 Discipline	3	4	1	3.5
Specific	K4 Quality of work	3	3	0	3
	K5 Quantity of work	3	2	-1	2.5
	K6 Knowledge of work	3	3	0	3
Managerial	K7 Work settings	3	2	-1	2.5
	K8 Reliable	3	4	1	3.5
	K9 Initiative	3	2	-1	2.5
	K10 Cooperation	3	4	1	3.5

Table 9: Core factor value (NCF)

Criteria	Core	iC	NC	NCF
Basic	K1	1	3/1	3
Specific	K4+K5	2	3+2.5/2	2.75
Managerial	K7+K8	2	2.5+3.5/2	3

Table 10: Secondary factor value (NSF)

Criteria	Core	iC	NS	NSF
Basic	K1+K3	2	2.5+3.5/2	3.5
Specific	K6	1	3/1	3
Managerial	K9+K10	2	2.5+3.5/2	3

Table 11: Ranking

Name of employee	Nd	Nk	Nm	Total	Rank
X	3.2×20%	2.85×40%	3×20%	2.523	Demotion

- Calculation core and secondary factor according to Eq. 1 and 2. The results are shown in Table 9 and 10, where a standard of performance evaluation has described in Table 8

$$NCF = \frac{\sum NC(d, k, m)}{\sum (iC)} \quad (1)$$

Where:

- NCF : Average of core factor value
 NC (d, k, m): Number of core factor value (basic, specific and managerial)
 iC : Number of core factor items

$$NCS = \frac{\sum NS(d, k, m)}{\sum (iC)} \quad (2)$$

Where:

- NCS : Average of secondary factor value
 NS(d, k, m): Number of secondary factor value (basic, specific and managerial)
 iC : Number of secondary factor items

- Calculation number of all aspect value that includes variables NCF and NSF in Eq. 3

$$(\chi)\% NCF(d, k, m) + (\chi)\% NSF(d, k, m) = N(d, k, m) \quad (3)$$

Where:

N (d, k, m) : number of all aspect value

Weight for core = 60% and secondary = 40%. Therefore, total value is:

$$\begin{aligned} Nd &: 3(60\%) + 3.5(40\%) = 1.8 + 1.4 = 3.2 \\ Nk &: 2.75(60\%) + 3(40\%) = 1.65 + 1.2 = 2.85 \\ Nm &: 3(60\%) + 3(40\%) = 1.8 + 1.2 = 3 \end{aligned}$$

- Determination ranking in Eq. 4:

$$(\chi)\% Nd + (\chi)\% Nk + (\chi)\% Nm \quad (4)$$

Where:

- Nd : Value of basic aspect
 Nk : Value of specific aspect
 Nm : Value of managerial aspect
 (χ)% : Percent value

Results from Table 11, it can be categorized based on the indicator of placement (Table 6), where employee X is potential to demotion. Then, continue to the third, selection phase where selection alternative from design phase will be recommended to a decision maker to choice placement employee. Next, the proposed system is translated into use case diagram (Fig. 3) that illustrates the function of the system from a user perspective, use case narration, activity diagram, class diagram and sequence diagram.

Then, the design continued to database designs, it's based on a class diagram that mapping into database logical model. To obtain a normal database for Employee's Placement Decision Support System, the steps are performed as follow:

- Mapping class to database logical model from mapping classes to a relational database logic then do normalization to avoid anomalies when changing, adding and deleting data

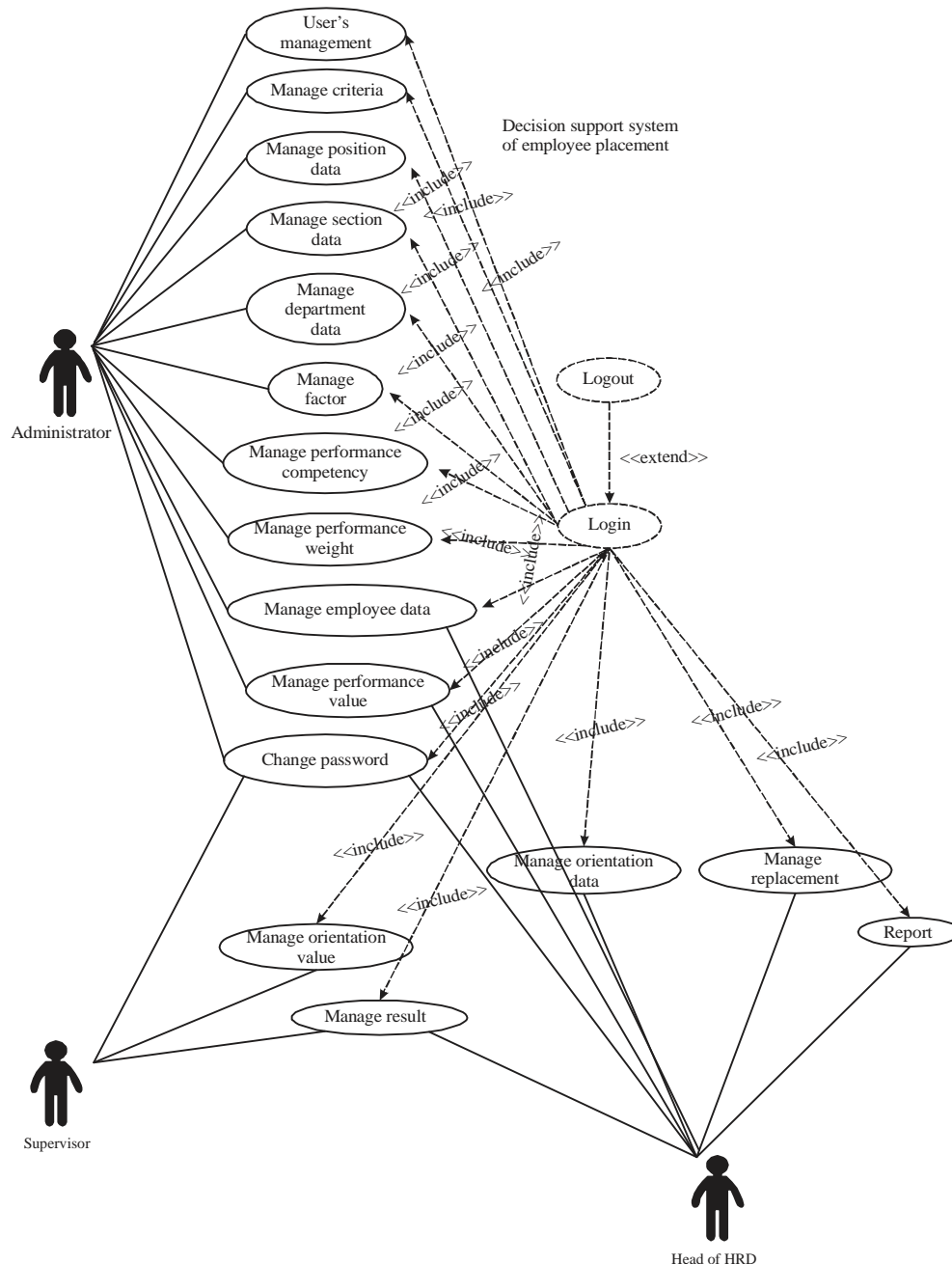


Fig. 3: Use case diagram DSS of placement

- Normalization once the database model is obtained, it can be normalized to minimize data anomalies
- Database based on the results, it can be made 17 normalized database table

At this stage, it designed user interface (Fig. 4 and 5) that display simple interface that makes user easy to understand.

After system design, the development conducted the system implementation that makes a real of the proposed

system. At this stage, we create application code with PHP programming and test system with User Acceptance Test (UAT) involved administrator and staff of Human Resource Department. Figure 6 and 7 show the system interface.

Important findings: As mentioned in the related works, the result of position placement with profile matching is only for promotion³, meanwhile this proposed DSS employee placement at Presisi Cimanggis Makmur Co., it combine with CHBRM that in accordance with company standard. First, the

The interface for the admin user is divided into three main sections. The top header contains the company logo, the title 'Decision support system of employee placement', and buttons for 'Change password' and 'Logout'. The middle section features a sidebar with the user's name 'Good morning, Rizal Admin' and a list of modules: 'Department's modul', 'Profile position's modul', 'User management's modul', and 'Employee's modul'. The main content area is titled 'Welcome to admin's page' and contains a 'Change password' form with fields for 'Username' (pre-filled with 'Admin') and 'Password', and 'Save' and 'Cancel' buttons.

Fig. 4: Design of user interface of DSS homepage (admin)

The interface for the supervisor user is divided into three main sections. The top header is identical to the admin page. The middle section features a sidebar with the user's name 'Good morning, Mita Tatum Supervisor' and a list of modules: 'Placement's modul' and 'Result's modul'. The main content area is titled 'Welcome to supervisor's page' and contains a 'Value data' section. This section includes a search bar with 'See 10 data' and a 'Search data' field. Below this is a table with columns: 'No.', 'NIK', 'Name', 'Calculation check', and 'Action'. The table displays one row of data for 'Sukiyo' with a calculation check of '0'. At the bottom of the table, it says 'Display 1 of 2 data' and includes navigation buttons: 'Pervious', 'Back', '1', 'Next', and 'Last'.

No.	NIK	Name	Calculation check	Action
1.	92042026	Sukiyo	0	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Fig. 5: Design of user interface for orientation value page (supervisor)

interesting finding is the result of profile matching calculation that an employee could be addressed to get a promotion, demotion and rotation. This case is shown in Table 11 as a result of final calculation of each employee and compared with Table 6 as a company standard whether an employee is rotated, promoted, or demoted.

The second finding is in comparison with the previous study⁴. The application interface, it is also concerned, because the objective of design interfaces, it must be user-friendly. For

this reason, system design has become the significant stage that could gather more information what the user's need. Therefore, the less attractive application interface it should avoided.

Third, the result of usage of profile matching in Human Resource Management in Public Administrations Department of Health Service in Italia¹⁰ showed that can classify employee profile within three position administration manager, administration secretary and legal expert. As a matter of fact,

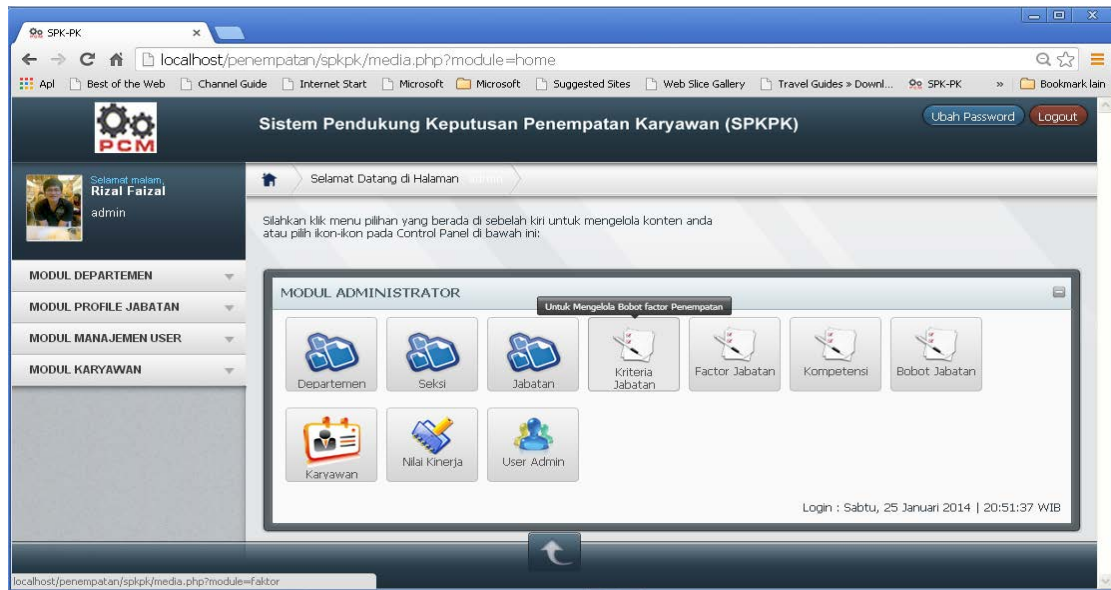


Fig. 6: Homepage of DSS (admin)

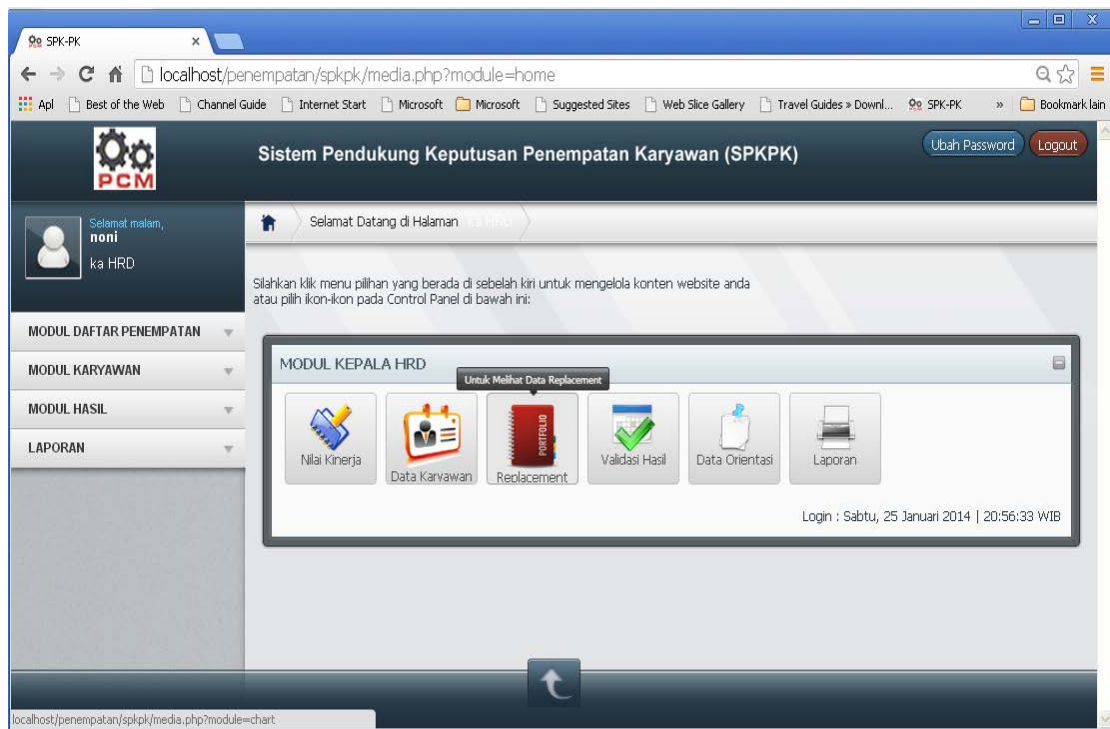


Fig. 7: Homepage of DSS (head of HRD)

the classification could be developed for promoted or rotated employee to new position with high performance. Compare with the current case study at Presisi Cimanggis Makmur Co., the rank value for each employee become significant result for employee performance evaluation.

CONCLUSION

The employee placement for a private company has an important issue as one of the strategic ways to increase profits. Analysis of determining the employee placement criteria is

conducted by referring the company's competency standard. A profile matching method can determine the priority of the employee placement with a gap between actual condition and company expectation. Therefore, the smallest gap, the greater chance of an employee can be selected to be promoted. The development of DSS used simplified model with tools PHP, MySQL, Astah Community and AppServer. Based on an interview with Head of HRD and supervisor at Presisi Cimanggis Makmur Co., DSS of employee placement with CBHRM and profile matching is efficient and assist in determining selection priority of employee.

Development of DSS for employee placement should be designed according to the needs of the company itself. For other company is not only profile matching and CHBRM methods that can represent the performance of an employee. For further research, it should be added evaluation of recruitment to monitor the quality of employee's from beginning and psychology criteria for strengthening the analysis.

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