SOFTWARE PACKAGE SELECTION FRAMEWORK BY USING DECISION TREE MODEL : A CASE STUDY OF ORACLE'S PEOPLESOFT ENTERPRISE HCM

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ABSTRACT

This research arises from the problem of the product of Oracle PeopleSoft HCM. The product consists of modules that cover HR works and are available for all sizes of organizations. However, this product is big and expensive overall. Consequently, some organizations decided to use the cheaper and smaller products. It demonstrates that the product lacks opportunity to be sold in some organizations by either the product owner or outsourcing company.

This research gives a dual model framework. First, The Firm’s Resource Model defines the package by 2 factors, given as: the number of employees and the budget per head. The second model is the HCM Module Model. This package is defined by only one factor, which is the desired module of company.

The experimental results show that the framework could reduce the operation time for the package selection compared to the traditional model. The salesperson can use this framework to represent their customer by providing the suitable suggestion/package. The product can be sold easily and quickly. Moreover, the customers are able to choose their own packages based on the three factors; the number of employees, the budget per head, and the desired module of company.

KEY WORDS: HCM / DECISION TREE / PACKAGE SELECTION

45 pages

การจัดการกรอบการเลือกรูปแบบของซอฟต์แวร์โดยใช้โมเดลต้นไม้ตัดสินใจ: กรณีศึกษาของผลิตภัณฑ์ Oracle's PeopleSoft Enterprise HCM

SOFTWARE PACKAGE SELECTION FRAMEWORK BY USING DECISION TREE MODEL : A CASE STUDY OF ORACLE'S PEOPLESOFT ENTERPRISE HCM

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บทคัดย่อ

การศึกษาเรื่องการจัดการกรอบการเลือกรูปแบบของซอฟต์แวร์โดยใช้อัลกอริทึ่มต้นไม้ตัดสินใจ: กรณีศึกษาของผลิตภัณฑ์ Oracle's PeopleSoft Enterprise HCM เกิดขึ้นจากผลิตภัณฑ์ Oracle PeopleSoft HCM ที่มีขนาดใหญ่ และมีฟังก์ชั่นการทำงานของระบบที่ครอบคลุมกระบวนการทำงานทางธุรกิจของระบบงานการจัดการทรัพยากรบุคคล แต่จากที่กล่าวมา บางองค์กรมีมุมมองกับผลิตภัณฑ์ว่ามีราคาแพงและไม่เหมาะสมกับขนาดของธุรกิจขององค์กร ส่งผลให้บริษัทผู้ผลิตและบริษัทรับพัฒนาผลิตภัณฑ์ขาดโอกาสในการขาย รวมถึงยังขาดความเข้าใจในการกำหนดงบประมาณในการพัฒนาผลิตภัณฑ์

การวิจัยนี้ได้สร้างกรอบมาตรฐานของผลิตภัณฑ์ออกมาในรูปแบบของแบบจำลองคู่ที่ช่วยในการตัดสินใจเลือกรูปแบบซอฟต์แวร์โดยใช้ปัจจัยหลักสามอย่างได้แก่ จำนวนพนักงาน งบประมาณการพัฒนาผลิตภัณฑ์ต่อพนักงาน 1 คน และ โมดูลงานที่องค์กรต้องการ ซึ่งผลการวิจัยครั้งนี้ แสดงให้เห็นว่า ในแบบจำลองแรก The Firm’s Resource Model มีความแม่นยำที่ 86.67 เปอร์เซ็นต์ และ แบบจำลองที่สอง The HCM Module Model มีความแม่นยำที่ 100 เปอร์เซ็นต์ โดยผลของงานวิจัยนี้ช่วยในเรื่องการลดเวลาการเลือกชุดรูปแบบซอฟต์แวร์เมื่อเทียบกับการแบบจำลองแบบเก่า ผู้ขายผลิตภัณฑ์สามารถใช้กรอบมาตรฐานนี้ในการนำเสนอลูกค้าและให้คำแนะนำที่เหมาะสมกับธุรกิจ รวมถึงช่วยให้สามารถขายผลิตภัณฑ์ได้ง่ายและเร็วขึ้น และในส่วนลูกค้าสามารถเลือกผลิตภัณฑ์ที่เหมาะสมกับองค์กรได้ด้วยตนเอง

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CHAPTER I
INTRODUCTION

1.1 Background and Problem Statement

Human Resource Management (HRM) in organizations mainly applies computer software as a managing tool for HR tasks. It helps to decrease working time and minimize mistakes of HR officer such as administering job data of employees, absence, or payroll data. HR Management can be different in various organizations. Therefore, there are many software applications developed to meet requirements of every level in the organizations.

PeopleSoft HCM is a product that is especially developed to manage human resources for organization. The product consists of modules that cover HR works and available for all sizes of organizations. Generally, this product is large and expensive. Consequently, some organizations decide to use cheaper and smaller products.

According to the mentioned evident above, it demonstrates that the product lacks of opportunity to be sold in some organization either by product owner or outsourcing company. The product can be implemented in all sizes of organizations and the price depends on which modules that firm wants to implement. There is no decision framework to help the organization to determine in order to select product with specified criteria including number of employees, business processes of HR works and budget.

To provide framework for the development of Oracle HCM product, creating decision framework is a solution for the product owner and outsourcing company to present it to customers. On the other hand, customers can use this framework for decision making to buy product of their own because there are scopes of manpower, budget and business processes of HR works mapping with modules.

1.2 Research Objective

To build a decision framework of Oracle PeopleSoft HCM product.

1.3 Research Scopes

1.3.1 Creating a framework for core module of Oracle PeopleSoft HCM product only.

1.3.2 A framework is developed to be used in organization with criteria including:

- Number of employees;
- Budget;
- Business processes of HR works.

1.4 Expected Results

1.4.1 To make the product available to use.

1.4.2 To help in reducing time to select the product of HR Management.

1.4.3 To increase opportunity to sell the product for product owner and Outsourcing Company.

1.4.4 Outsourcing company can use the framework to implement an application to their customer.

1.4.5 To help customers make decision easier in using the application.

1.5 Outline Summary

The organization of thematic paper is as follows. Chapter 2 introduces the literature review and related work. Chapter 3 describes the methodology of modeling framework. The data analysis, the final framework and the experimental results are given in Chapter 4. Lastly, Chapter 5 is given a modeling framework conclusion.

CHAPTER II
LITERATURE REVIEWS

The literature review is presented in this chapter. It consists of documentations collection, concluding the model and related research to create the framework.

2.1 Human Resource Information System (HRIS)

Nowadays, Human Resource Information System or HRIS has become more important to the organization than in the past. There are many software to help HR works not only for hiring or firing an employee, but also managing and developing employees in the organization. HRIS is a key to move the firm forward from HRM to electronic HRM (e-HRM).

2.1.1 HRIS Definition

Originally, Desanctis (1986) [6] defined the term HRIS as "a specialized information system within the traditional functional areas of the organization, designed to support the planning, administration, decision-making and control activities of HRM". However Kavanagh (2012) [6] mentioned that HRIS included hardware and software. It also included people, forms, policies, procedures, and data.

Recently, the focus of HRIS has shifted to more strategic applications of the organization such as recruitment, performance, compensation management, self-service technologies [3] [7], and HR planning alignment with the organization's planning [9].

2.1.2 HRIS Works

There is a taxonomy of HRIS which divides functional requirements according to three different sizes of firm as shown in Figure 2.1 [5]. This breakdown

provides a general sense of complexity in the ascending order of HRIS as firm size with increasing complexity.

HRIS Capabilities

	HR Professionals	Firm Managers	Employees
Small Organizations	• Benefits Admin • Payroll	• Team/Project Mgmt • Time/Attendance • Employee Scheduling • Succession Planning	• Training/Skills Mgmt
Mid-Size Organizations	• COBRA • Benefits Admin • Compensation Admin • Compliance Tracking and Reporting • Health Claims Admin • Payroll	• Performance Appraisals • Skills Testing • Team/Project Mgmt • Time/Attendance • Employee Scheduling • Succession Planning	• Career Development • Training/Skills Mgmt • Web-Enabled Training • Flexible Benefits • Employee Self-Service
Large Organizations	• ADA Compliance • EEO Compliance • COBRA • Benefits Admin • Compensation Admin • Compliance Tracking and Reporting • Health Claims Admin • Payroll • Employee Screening • Resume Processing and Tracking	• Performance Appraisals • Skills Testing • Team/Project Mgmt • Time/Attendance • Employee Scheduling • Succession Planning	• Career Development • Training/Skills Mgmt • Web-Enabled Training • Flexible Benefits • Employee Self-Service

Figure 2.1 - HRIS Capacities.

2.1.3 Firm Size

SMEs can be further divided into 3 sizes of organizations: Micro organization (0-9 Employees); Small organization (10 – 99 Employees); Medium organization (99 – 499 Employees) [4]. Infer from SMEs organization size, a large organization is employing over 500 people.

2.2 PeopleSoft Human Capital Management Products

2.2.1 Overview

Oracle's PeopleSoft Human Capital Management is an integrated suite of applications and business processes that are based on PeopleSoft's Pure Internet Architecture (PIA) and portal technologies. This product enables customers to architect a global foundation for HR data and improved business processes. PeopleSoft Human Capital Management delivers a robust set of best-in-class human resources functionality that enables customers to increase productivity, accelerate business performance, and lower their cost of ownership [1].

2.2.2 Product Integrations

PeopleSoft HCM uses Integration Broker (IB) to integrate with:

- **Other PeopleSoft HCM applications inside of the database.**

  Integrations between modules.

- **PeopleSoft applications outside of HCM.**

  Many PeopleSoft application without HCM, such as PeopleSoft Financials receive General Ledger data from Payroll module, PeopleSoft Workforce Analytics and PeopleSoft Learning Management integrate data with job and personal data.

- **Third-party applications.**

  Application Integration Framework extends PeopleSoft Integration Broker (IB) functionality to provide a standard way to represent, classify, store, query, publish, acquire, and invoke data that maps element names, structures, and values between PeopleSoft Application Business Messages (ABMs) and other applications. PeopleSoft Integration Broker provides the framework to send and receive messages with other PeopleSoft systems or third-party systems.

  PeopleSoft-delivered integrations transform messages to the Enterprise Business Message (EBM) format for directing integration with other Oracle products. Figure 2.2 is a diagram that illustrates PeopleSoft message transformed to common value.

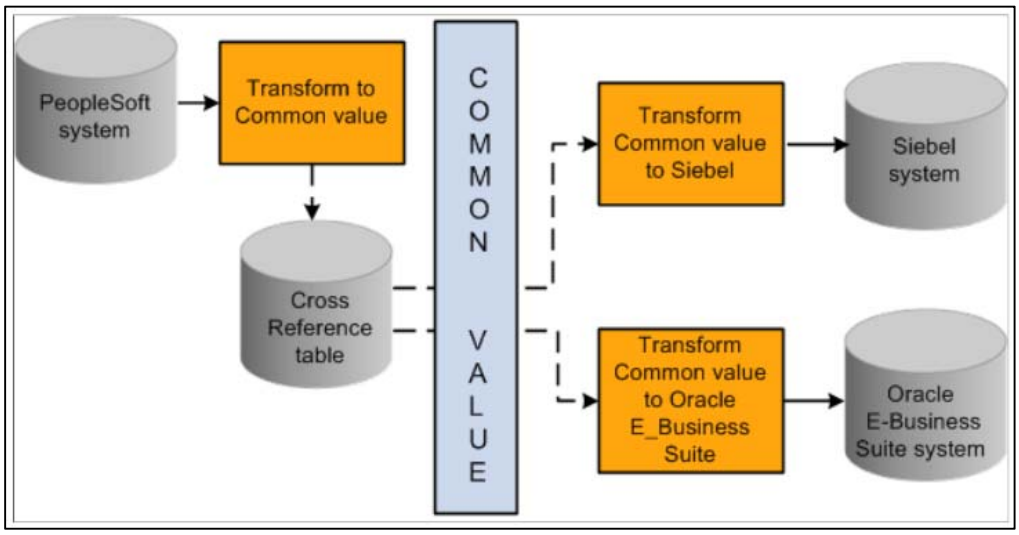

Figure 2.2 - Common value mapping for outgoing message.

In the use case in which PeopleSoft Integration Broker performs all of the transformations with a third party, the message is transformed into the third-party Application Business Messages (ABMs). Figure 2.3 is a diagram that illustrates an outbound point-to-point request or post to a third party.

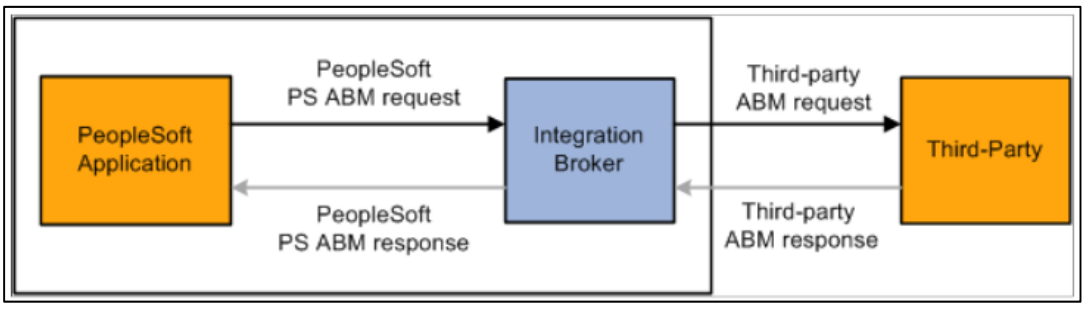

Figure 2.3 - Outbound point-to-point request to a third party.

2.2.3 Modules

PeopleSoft HCM Product provides the four main modules that companies should install as a robust set of business process as follows:

Human Resources (HR): Human Resources contains three main functions: Organization Structure; Workforce Administration; Personal data's employee Self-service.

Organization Structure: The structure of an organization is the first level of configuration. The design of the structure contains business unit, company, location, department, and position, which are prepared for another module to use these master data.

Function Organization Chart viewer is shown in Figure 2.4. After finishing designing an organization structure in system, it shows the level of position or department in the format of the organization chart.

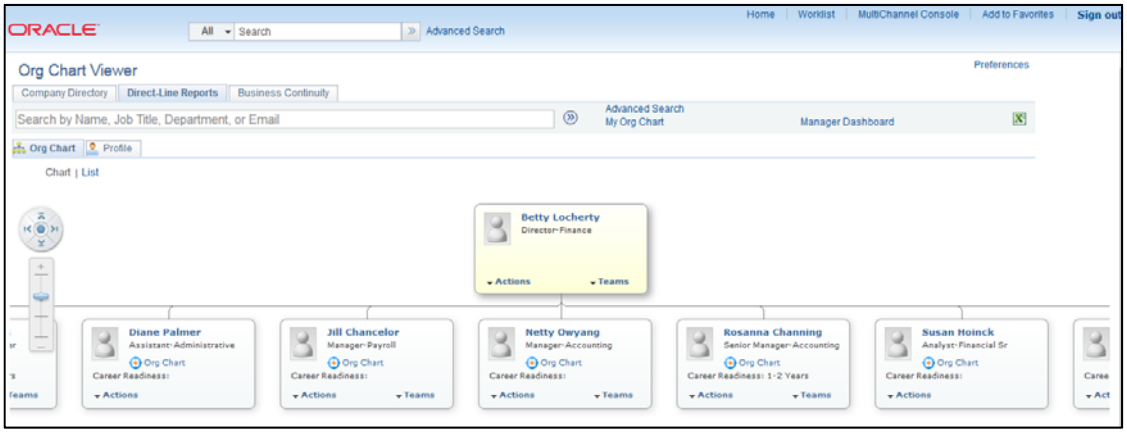

Figure 2.4 - Organization Chart viewer function in PeopleSoft HCM.

Workforce Administration: Administer Workforce provides the foundation for human resource management system. The data entered into the Administer Workforce business process is available to all of the Human Resources business processes as well.

The major function of Workforce Administration is maintaining employee data. Job data function in Figure 2.5 use data from organization structure design such as Company, Business, and Department to define general job descriptions of employees. In part of Action, PeopleSoft HCM provides many actions to support the movement of an employee while employee is working. For example, "Data Change"

action is used when an employee changes department or “Termination” action is used when an employee is terminated from organization.

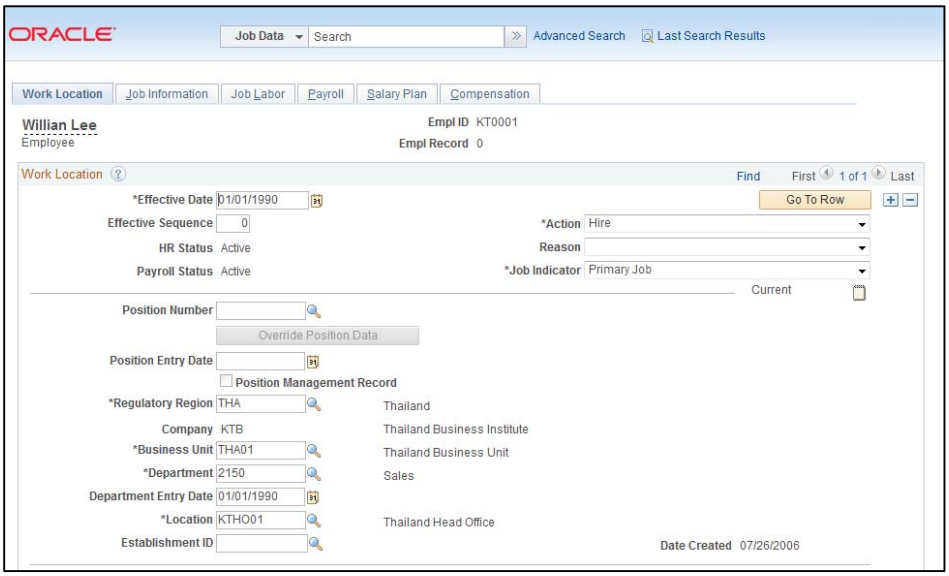

Figure 2.5 - Job Data function in PeopleSoft HCM.

Personal data’s employee Self-service: PS HCM provides employees Self-service function to allow them to manage their own personal data. Figure 2.6 shows Employee Self-service function.

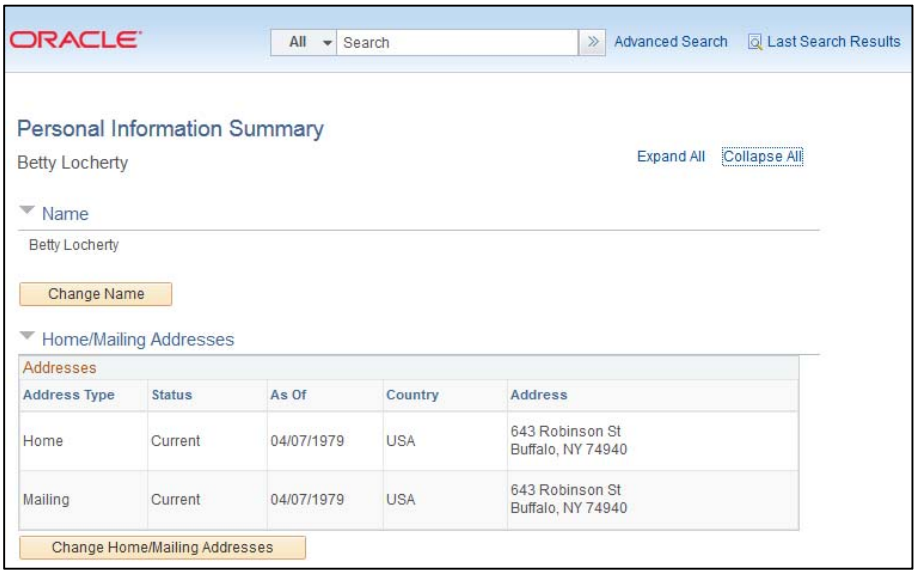

Figure 2.6 - Employee Self-service functions in PeopleSoft HCM.

Time and Labor (TL): Time and Labor facilitate the management, planning, reporting, time approving, calendar, and creation and usage schedule. Employee's time is also integrated from 3rd parties.

Time and Labor provides these business processes:

- Report time;
- Create schedules;
- Organize employee groups;
- Approve time;
- Track compensatory time off;
- Manage security;
- Manage reported time;
- Track attendance;
- Process payable time;
- Create rules for processing time;
- Distribute and dilute labor costs.

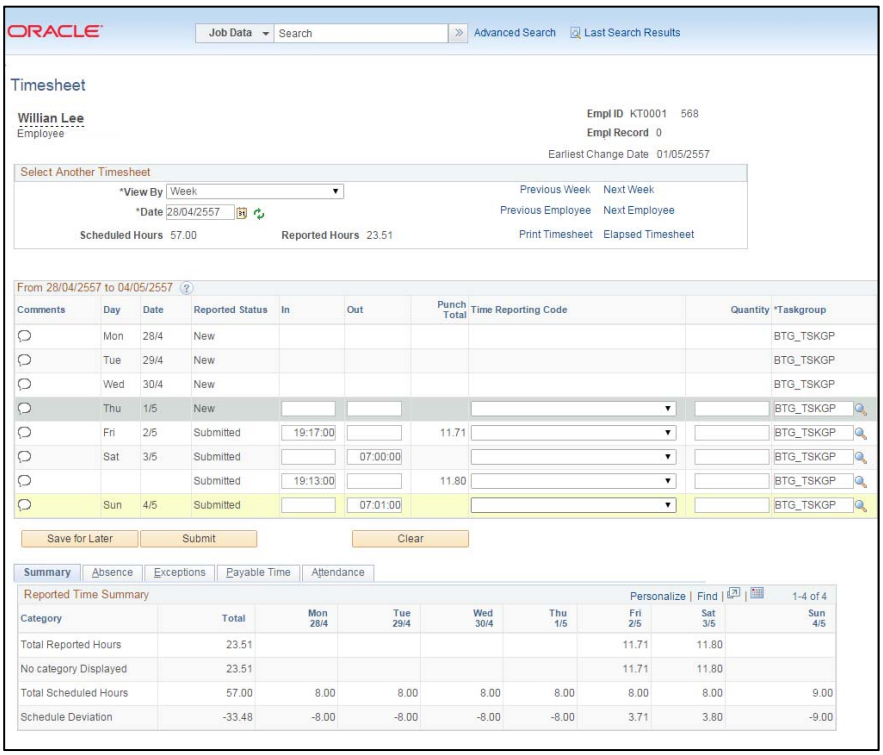

Figure 2.7 - Manage Timesheet function.

Manage Timesheet function in Figure 2.7 is the one of the major function in Time and Labor module. To manage time attendance of employees, supervisor must use this function to approve Time Reporter Code (TRC) to pay in Payroll module.

Absence Management (AM): The employee can use self-service when they want to take leave. The supervisor or manager has options to approve or not approve the leave request by using approval workflow.

Absence Management provides these business processes:

- Absence entitlement processing;
- Absence take processing;
- Transfer of converted absence data to payroll.

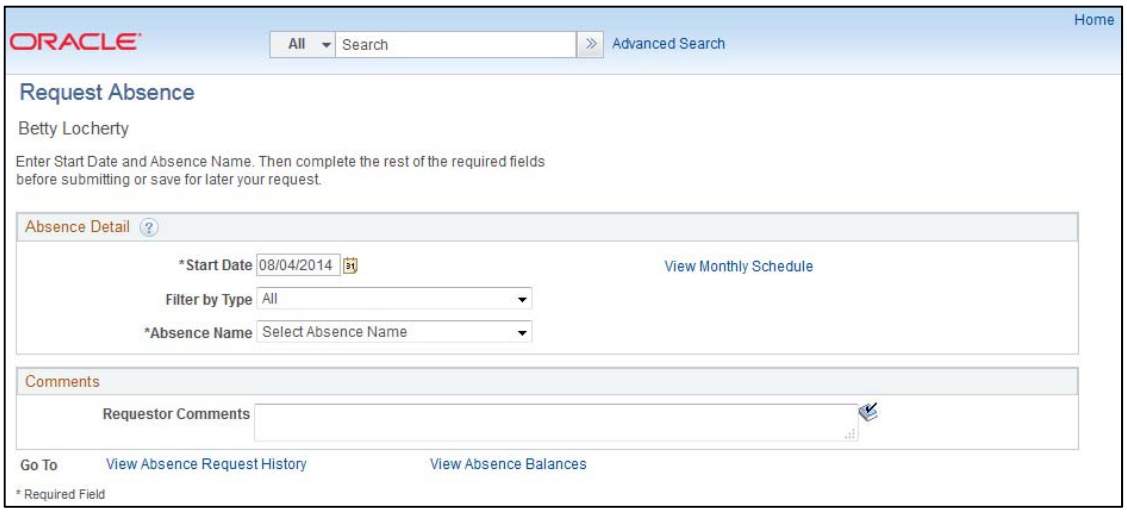

Figure 2.8 - Request Absence Self-service function in PeopleSoft HCM.

Global Payroll (GP): Absence Management and Global Payroll share many of the same components. In addition, some of the fields and pages in the shared components apply only to Global Payroll.

Once Global Payroll is set up to meet the organization's needs, processing payroll involves:

- Determining which payees are to be paid for each payroll run;
- Running the payroll calculation process;
- Rerunning the payroll calculation process, if necessary, until you obtain the correct results;
- Finalizing the payroll run;
- Performing post processing functions such as banking, reporting, and generating pay slips.

Figure 2.9 shows the result of payroll processing. There are lists of earnings and deduction, and description of each earning or deduction. The Net Result Value is an employee net amount payroll.

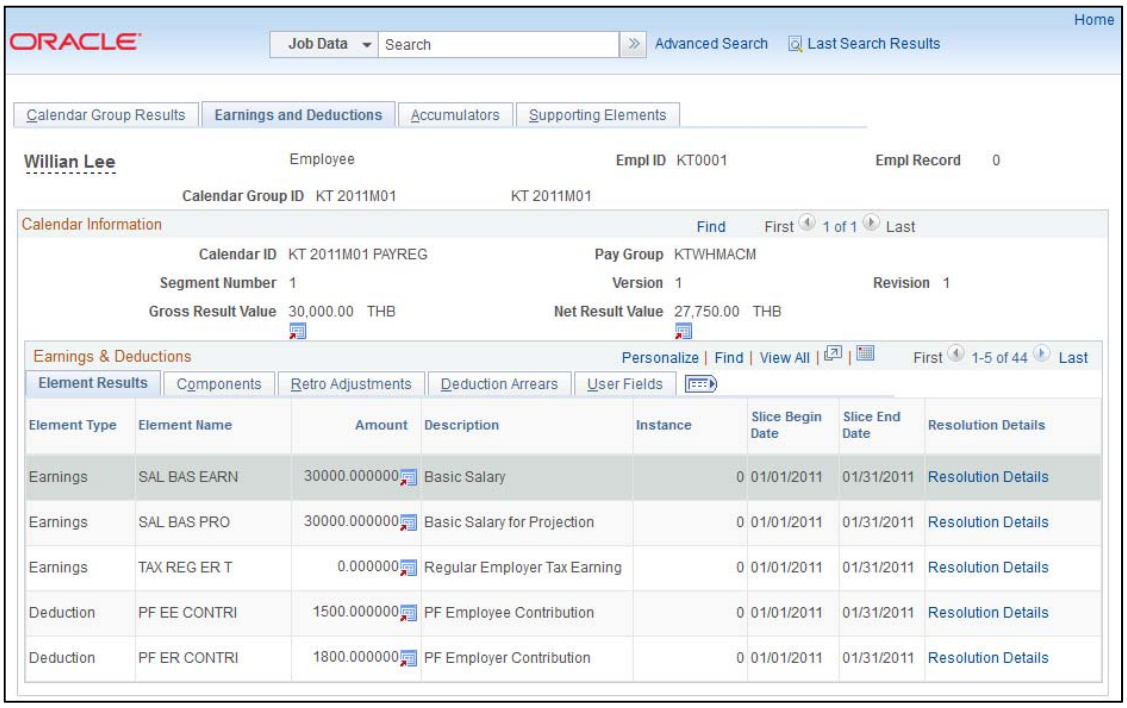

Figure 2.9 - The result of payroll processing.

The PeopleSoft HCM operation workflow in Figure 2.10 is an explanation of business process operation linkages between 4 modules in PeopleSoft HCM. From Workforce Admin, the role recruiter hires employee in the system by adding personal data, which is the general data of employee, and job data such as position or department of the employee. HR Shared Service (HRSS) is responsible for maintaining employee's data after the employee has been hired into the system. The wage, salary, tax and social security data of employee in the PeopleSoft HCM are called payee data.

In Time and Labor, and Absence Management modules, there is a supervisor role which may be the manager or anyone who has an authorization to approve and manage a time attendance (in PeopleSoft HCM called Time Reporter Code (TRC)) and absence data of employees. The supervisor can approve and manage data only before Payroll processing. The approved data is then ready for Payroll processing.

In Payroll module, the role HRSS-Payroll is a role to perform all payee data including earning and deduction to pay salary to employee. HRSS-Payroll will calculate payroll processing until all data are completely correct. There are interface that transfers files between banks, General Ledger (GL), file interface to accounting department, pay slip sent to employees, and the reports such as social security report and tax report sent to the government offices, and provident fund report sent to the provident fund company.

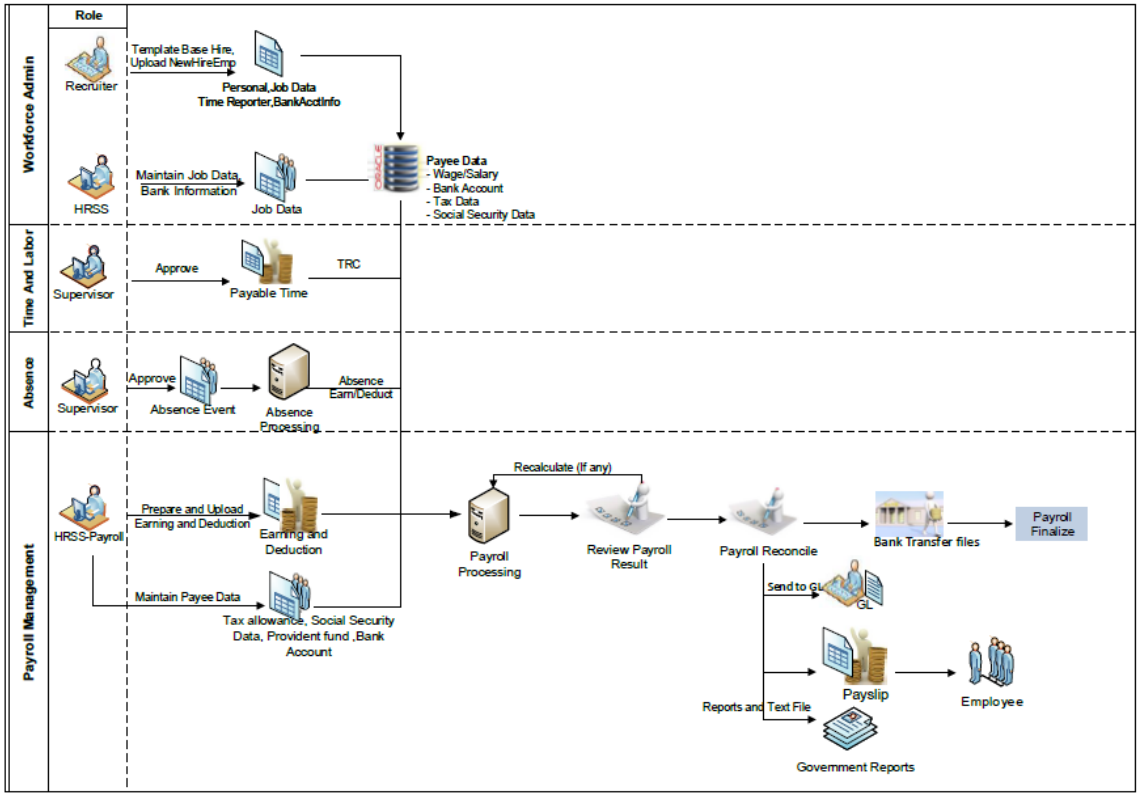

Figure 2.10 - PeopleSoft HCM Operation Workflow.

The other 5 modules are independent from each other. The system does not require these modules to be installed but depends on business process of each organization. These modules are described as follows:

Benefits Administration (BA): With Benefits Administration module, the organization can build and manage comprehensive employee benefits with Consolidated Omnibus Budget Reconciliation Act (COBRA) which is a law passed by the U.S. Congress on a reconciliation basis.

COBRA does not deploy for Thailand affect to Benefits Administration and cannot be used in Thailand. However, there is another benefit function in PeopleSoft HCM called Base Benefit which allows HR Admin to assign a benefit plan to employee and employee can know what benefit they have by self-service.

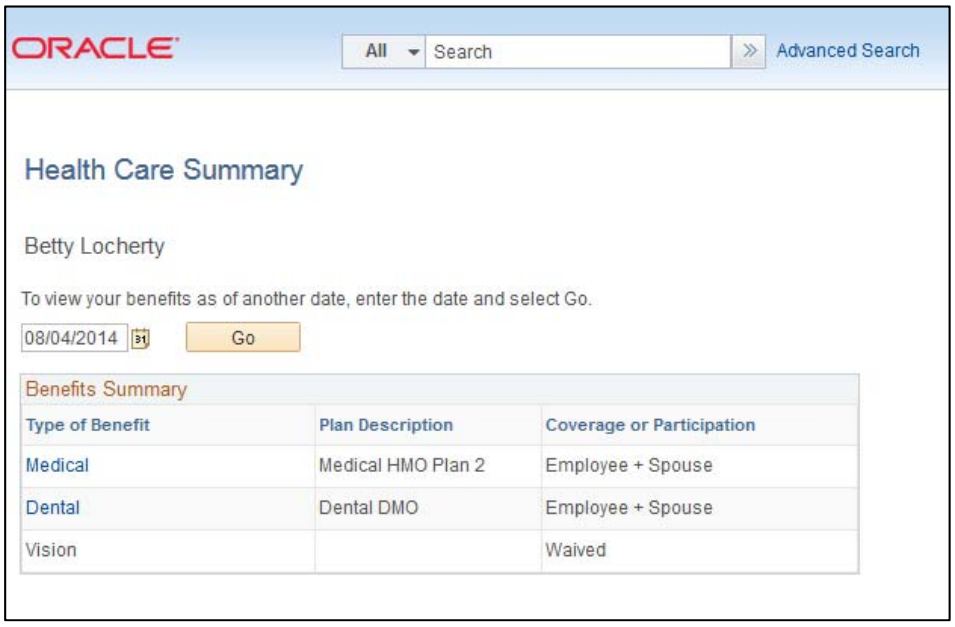

Figure 2.11 - Base Benefit Self-Service functions in PeopleSoft HCM.

ePerformance (EP): HR administrators can collaborate on performance evaluations and goals, review performance history, monitor and manage the overall performance process of employee. The rating Summary in Figure 2.12 shows a graph after evaluating employees which can be divided by group of employees.

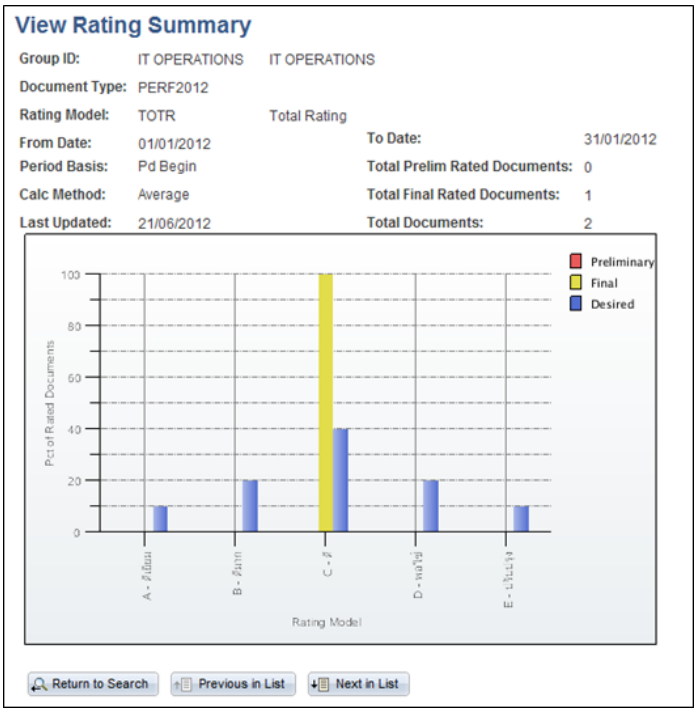

Figure 2.12 - View rating Summary function.

eCompensation (EC): eCompensation is able to administer compensation programs for employees. The compensation program can use the factor for salary adjustment from other modules. For example, when a score performance of employee meets the point, compensation program will automatically adjust the salary.

Recruiting Solutions (RC): This module provides recruiting and career search tools for candidates, recruiters, and managers, allowing employees and external candidates to search, view, and applies for jobs online with applicant tracking. For example, with external candidates they can: View job postings; Receive new job opening; Apply for a job.

Succession Planning (SP): The Succession Planning process enables customer to develop and maintain succession plans for individual jobs, employees and positions in addition to managing and tracking employees.

To create succession plan, candidates can be selected by criteria such as position or department of the employee. The application will retrieve employee data who meets the criteria and show in the matrix.

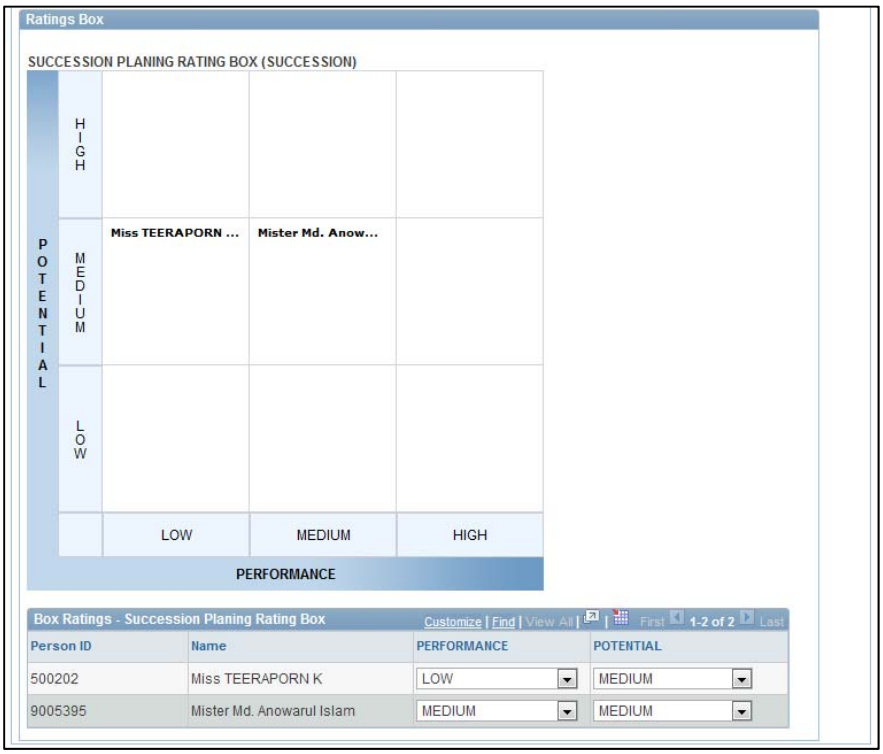

Figure 2.13 - Succession Planning Rating Box.

2.2.4 Component Price List

A component license price of this product uses a license metric by the employees and modules, which means that implementation price depends on the number of employees in the organization and the size of firm. There is also a maintenance cost per year about 22 percent for each module. A component license price list is presented in Figure 2.14.

	Component License Price (US Dollars)	Software Update License & Support (US Dollars)
Human Capital Managenent (HCM)		
Absence Management	52	11.44
Benefits Administration	85	18.70
eCompensation	35	7.70
ePerformance	105	23.10
Human Resources	185	40.70
Payroll	225	49.50
Recruiting Solutions	75	16.50
Succession Planning	70	15.40
Time and Labor	110	24.20

Figure 2.14 - A component license price list.

The approximate cost without maintenance cost is calculated by:

$$P = N \sum_{i=1}^{n} (M_i), \tag{2.1}$$

where

P is total cost (USD),

N is Total number of employee in organization,

M_i is cost of $i - th$ module (USD).

For example, if there are 300 employees in the organization and customer decide to implement an Absence Management and Benefit Administration module. Let N= 300, M_1= 52 (Absence Management), M_2 = 85 (Benefit Administration) From equation (2.1), it is given

$$P = 300 \sum_{i=1}^{2} (M_i)$$

$$P = 41{,}100$$

2.3 Design Science Research Process Model

The Design Science Research Process Model is an adaptation of a computable design process model developed by Takeda (1990). The key focus of this model is knowledge contribution. This is a need of design science research [10].

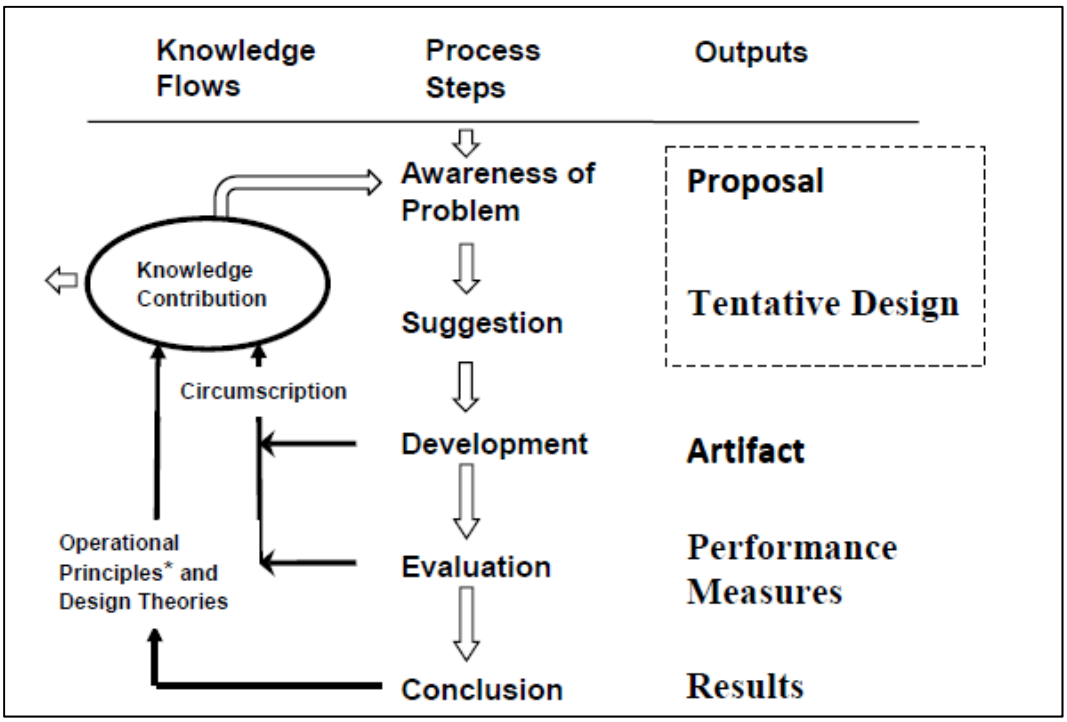

Figure 2.15 - Design Science Research Process Model.

According to Figure 2.15 a typical DSR effort proceeds as follows:

Awareness of Problem: An awareness of an interesting problem may come from multiple sources including new developments in industry or in a reference orderliness. The output of this phase is a Proposal for new research effort.

Suggestion: The Suggestion phase follows immediately after the proposal and is intimately connected with it as the dotted line around Proposal and Tentative Design indicates. A Tentative Design, Output of this phase is a prototype based design on the Proposal.

Development: The Tentative Design is further developed and implemented in this phase. The techniques for implementation depend on the artifact to be created.

Evaluation: This phase is to measure performance of an artifact that has been released.

Conclusion: This is the finale of a specific research effort or it could just end a research cycle. It depends on judgement on the result, if it is not good enough, the artifact can be revised.

2.4 Decision Tree Model

Decision Tree is a hierarchy data structure used to support decision making. A characteristic of this model looks like an upside down illustration of a real tree with a root node at the top and branch out to the bottom node as a leaf. A decision tree consists of 3 types of nodes:

- A Root Node - There is no incoming edge and one or more outgoing edges.
- Internal Node - An incoming edge has exactly one and outgoing edges have two or more.
- Leaf or terminal Node - Each of which has exactly one incoming edge and none of outgoing edges.

The non-terminal nodes, which are the root node and internal nodes, include attribute test conditions to separate data that have different types. An example of the root node is shown in Figure 2.16 [11].

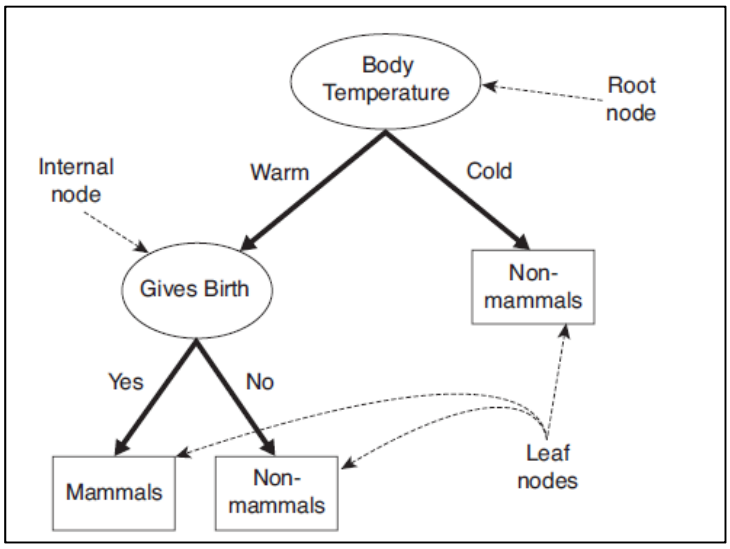

Figure 2.16 - A decision tree for the mammal classification problem.

Decision tree classifies a set of data by instance. Nodes of tree are attribute and method for expressing an attribute test condition is as below:

- Binary Attributes: The test condition for a binary attribute creates two outcomes.

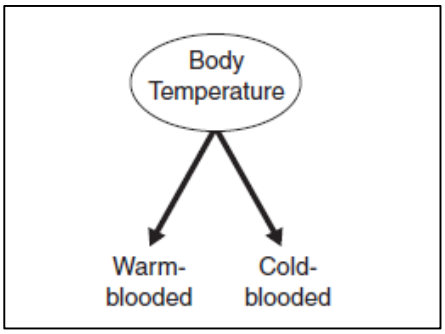

Figure 2.17 - The binary attributes.

- Normal Attributes: Normal attributes can have multiple outgoing or two outcomes like Binary. The number of outgoing depends on the number of distinct values for the corresponding attribute.

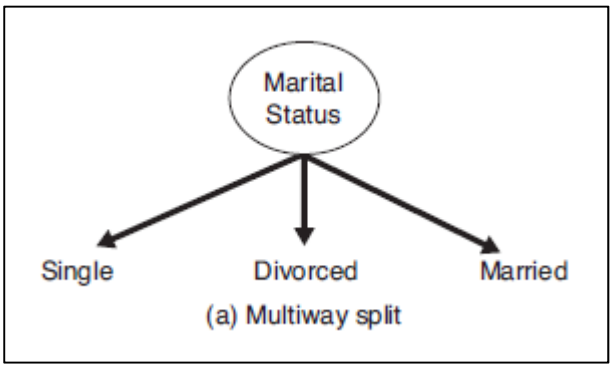

Figure 2.18 - The normal attributes.

- Ordinal Attributes: Ordinal attributes can also express binary or multiple outcomes. Ordinal can be grouped as long as the grouping does not infringe the order property of attribute values.

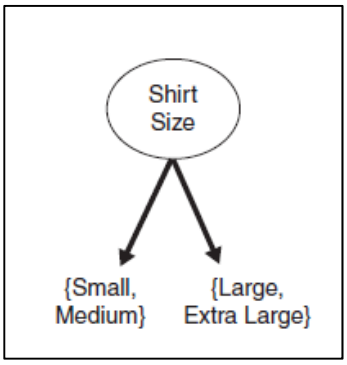

Figure 2.19 - An ordinal attributes.

- Continuous Attributes: With continuous attributes, the test condition can be performed as a comparison test $(A < v)$ or $(A \geq v)$ with binary outcomes or a range query with outcome of the form $v_i \leq A < v_i + 1$, for $i = 1, \ldots, k$.

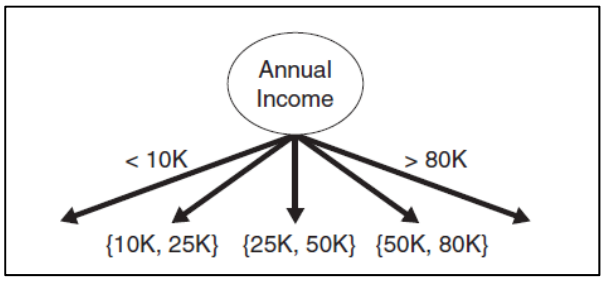

Figure 2.20 - The continuous attributes.

C4.5 Algorithm

There are many ways to make a decision tree, but the famous algorithm are ID3 and C4.5. A C4.5 algorithm was developed by Ross Quinlan (1993) who also developed ID3 algorithm. Both use information to classify data but C4.5 was developed to solve problems of ID3 as below:

1. Ability to apply to continuous attributes and discrete in which the continuous uses a threshold and separate attributes into 2 paths which are a costly value and a less value as a start node;

2. Ability to compile with missing training data that represent with “?” and not used in entropy;

3. Ability to use with abnormal data;

4. Ability to customize a tree while making a tree with stability.

2.5 Related Research

To create a framework of specific products that still does not have papers and research prevalently. Most of the frameworks aim to support the decision making to help organizations move forward.

2.5.1 Framework for organizations

There is a research about creating a framework for comparing business-IT alignment models. (Mohamed El-Mekawy, Lazar Rusu, Erik Perjons, 2015). The use of a DSR model to develop their framework is communicated to five business consultants and use seven key IT managers for evaluating their framework.

2.5.2 Software packages selection

To make decision for software selection, there is methodology for selecting the packages of software. However, it is just a generic stage based methodology for selecting the packages of software, not for specific products.

(Anil S. Jadhav, Rajendra M. Sonar, 2011) Methodology for software packages selection includes six stage, Requirement definition; Preliminary investigation of software packages availability; Short listing packages; Establishing criteria for evaluation; Evaluating software packages; Selecting software package. In addition, there is software evaluation criteria that could be used for evaluating any software packages. It depends on what the criteria that an evaluator needs to focus.

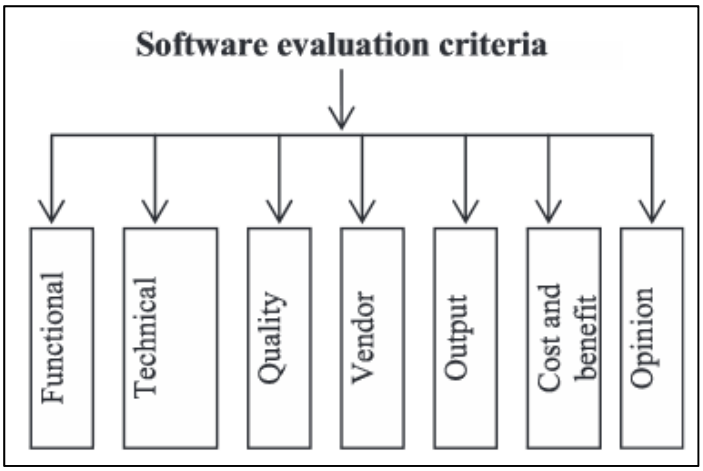

Figure 2.21 - Software evaluation criteria.

CHAPTER III
METHODOLOGY

This chapter gives reviews on research methodology including data that are used to perform the modeling a framework. The research tool is Weka explorer. The data analysis and modeling method will also be described.

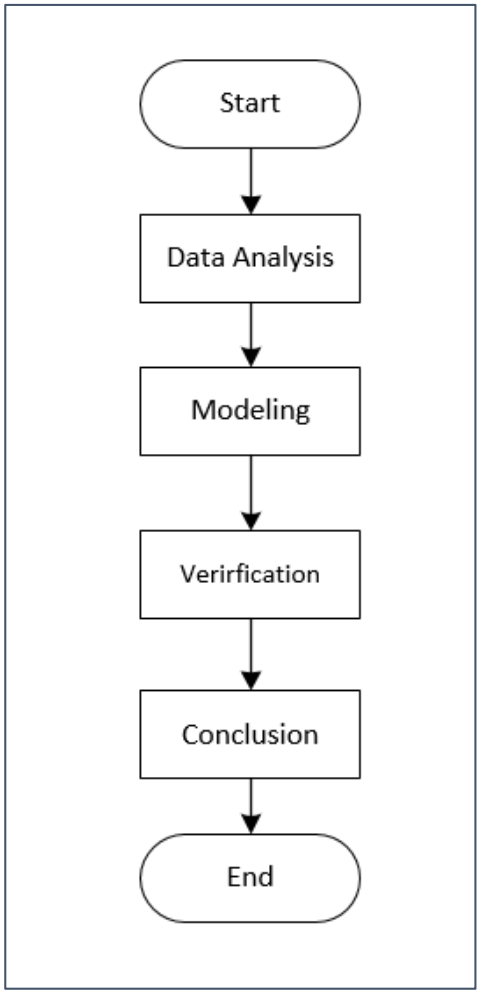

Figure 3.1 - Research Workflow.

3.1 Analyzing Data

The data to be analyzed come from one of the outsourcing companies where an Oracle PeopleSoft HCM product is implemented. Data can be divided into 2 topics as follows:

3.1.1 Historical Data

The historical data from the outsourcing company contains data about the number of people in customer organization, the modules that the customer has installed and the implementation budget.

Currently, the outsourcing company is essentially considers as a business process of an organization. Each module can be mapped with business process. Mostly, the four main modules plus the Recruiting Solution module which is mentioned in chapter two can be mapped and implemented with the general business process of organization. We can call it as a module of HRM (HR Management). The other four modules are about HRD (HR Development), generally implemented with officers not with labors. Some organizations only hire officers but no labors such as hospital business or bank. Labors are mostly hired in any business that has factory for manufacturing.

3.1.2 Old Models

The current method that the outsourcing company uses to sell a product, according to 3.1.1, depends on the customer's business process as-is and present with a gap analysis to sell a man day for customizations.

3.2 Modeling Framework

To model a framework, the data from analyzing data phase will be used. After analyzing data, there will be a set of data containing:

- Packages of product
- Number of employees
- Implementation Modules
- Budget

All the attributes is compiled and a model is performed using a tool named Weka. It uses data from the organizations which PeopleSoft HCM product has already been implemented as a training set.

3.3 Verification

The newcomers act as a testing set to verify an accuracy and measure reliability of the model. The result of model will represent a package of implementation product which includes the price for each package.

3.4 Conclusion

This chapter summarized an accuracy of the framework which can be proved in two ways: First, the performance of model and second, the benefit for business of company. This includes guideline for applying framework for development.

CHAPTER IV
RESULT

In chapter three, the research methodology briefly analyze data from the one of the consulting companies. This chapter will analyze data in the details in order to model the framework, verification and results. The topics are presented as below.

4.1 Analyzing Data

4.1.1 Historical Data

To model the framework, there are bullets to be analyzed as follows:

Packages of product

From the historical data, all nine modules are grouped into two main packages. First is a package of HRM (HR Management) and second is a package of HRD (HR Development).

1) Human Resource Management Package.

Human Resource Management package or HRM package consists of five modules: Human Resources; Time and Labor; Absence Management; Payroll; Recruiting Solution. These are general modules that cover HR works with the organizations.

The necessary two modules are required to install, at first, Human Resources and Payroll because it is a real core module of HCM PeopleSoft Product. It is the simple way to pay salary to employee by only managing their data, recruiting those data into the system and then make payment.

The other modules depend on customer business process. If Time and Labor are installed, Absence Management will be installed also. On the other hand, Absence Management can be installed without Time and Labor.

Last, Recruiting Solutions can be installed independently from the others. The evident that distinguish modules of HRM into five subordinate modules are shown in the table 4.1.

Table 4.1 – The HRM Module Package.

HRM Module Package					
Module / Package	**Human Resource**	**Payroll**	**Absence Management**	**Time & Labor**	**Recruiting Solutions**
HRMa	✓	✓			
HRMb	✓	✓	✓		
HRMc	✓	✓	✓	✓	
HRMd	✓	✓	✓		✓
HRMe	✓	✓	✓	✓	✓

2) Human Resource Development Package.

Human Resource Development is part of Human Resource Management. The Human Resource Development package or HRD package composes of four modules: Benefits Administration; Succession Planning; ePerformance; eCompensation. These are optional modules to serve an HR officer to develop their employees. Mostly, a company that has implemented the HRD modules will not implement HRM modules at the same time. Some do not implement the HRD modules at all. If any, the HRD module will always be implemented after HRM module has completely implemented. The reason is that the HRD development phase can wait and it is important to focus on HRM first since it is the core module.

The modules from HRD are independent from each other but from historical data, a company that implemented ePerformance module always implemented eCompensation also. The taxonomy of HRD package is shown in table 4.2.

Table 4.2 – The HRD Module Package.

HRD Module Package				
Module / Package	Benefit Administration	Successions Planning	ePerformance	eCompensation
HRDa	✓			
HRDb		✓		
HRDc			✓	✓
HRDd		✓	✓	✓
HRDe	✓		✓	✓
HRDf	✓	✓	✓	✓

Budget and Cost

According to chapter two about a license price and maintenance price are separated from each other. The maintenance price is count for 22 percent from each module as shown in the Figure 4.1.

	Component License Price (US Dollars)	Software Update License & Support (US Dollars)
Human Capital Managenent (HCM)		
Absence Management	52	11.44
Benefits Administration	85	18.70
eCompensation	35	7.70
ePerformance	105	23.10
Human Resources	185	40.70
Payroll	225	49.50
Recruiting Solutions	75	16.50
Succession Planning	70	15.40
Time and Labor	110	24.20

Figure 4.1 - A component license price list.

Budget from the number of employees in the firm is a difficult to estimate because the license price of PeopleSoft HCM Product is estimated using quantity of employee that customer want to record into the system, not the actual number of employees in the firm. For example, the company has 10 business units but there are employees from only 4 business units managing in the system. Also, from historical data, the number of employees and implementation budget is going the same way,

which means that the more employees, the company has the more budget it needs to spend.

Thereat, an implementation budget will use budget according to the actual number of employee in the firm. This is the elementary method to know which package the firm should implement. Tally with the package price list that shows the price of package per employee in the table 4.3 and table 4.4.

Table 4.3 – The HRM Package Price List.

HRM Package Price List		
Packages	**Price per Employee (US Dollars)**	**Maintenance cost per Year**
HRMa	410	90.20
HRMb	462	101.64
HRMc	572	125.84
HRMd	537	118.14
HRMe	647	142.34

Table 4.4 – The HRD Package Price List.

HRD Package Price List		
Packages	**Price per Employee (US Dollars)**	**Maintenance cost per Year**
HRDa	85	18.7
HRDb	70	15.4
HRDc	140	30.8
HRDd	210	46.2
HRDe	225	49.5
HRDf	295	64.9

4.1.2 Old Models

Currently, the company does not have legible model to implement product to customer. But the most of all, implementation depends on ‘to be’ business processes of the firm. This means that if customers have time attendant recorder in the company, then the Time and Labor module will be implemented. On the other hand, the employee must use self-service to request for leave of absence, and the

implementation of an Absence management module is also necessary. However, the 'to be' business processes will go along with the implementation budget as well.

4.2 Modeling Framework

The HRM and HRD modules are completely unrelated. It is too tough to define which package of HRD modules will be implemented after customer finished implementing HRM modules. There are many factors involved to define the HRD package for a company to implement. Some company does not implement HRD module at all. Therefore, a HRD package will not be used for modeling the framework. However, customer can use HRD package listed in table 4.2 and HRD price listed in table 4.4 to help them in deciding to implement HRD after completely implementing the HRM modules.

The framework contains two models. Both models are decision tree that defined package of HRM. These two models are performing on parallel and the results of the model are supporting each other.

4.2.1 Preparing Data

There are historical data from 15 companies that already implemented the product. The data contains values of company, number of employees that are recorded into the system, implementation budget in US dollars currency and HRM modules that the company has implemented. The historical data is shown in table 4.5

Table 4.5 – The Historical Data.

Company	No. of Employee	Budget	HR	TL	AM	GP	RS
A	150	61,500	Y	N	N	Y	N
B	300	129,000	Y	N	N	Y	N
C	300	174,000	Y	N	Y	Y	Y
D	500	287,500	Y	Y	Y	Y	N
E	500	325,000	Y	Y	Y	Y	Y
F	750	346,500	Y	N	Y	Y	N
G	750	345,000	Y	N	N	Y	N
H	800	436,000	Y	N	Y	Y	Y
I	850	459,000	Y	N	Y	Y	Y
J	1,000	600,000	Y	Y	Y	Y	N
K	1,200	782,400	Y	Y	Y	Y	Y
L	4,000	1,840,000	Y	N	Y	Y	N
M	4,500	2,947,500	Y	Y	Y	Y	Y
N	13,000	8,515,000	Y	Y	Y	Y	Y
O	28,000	17,640,000	Y	Y	Y	Y	N

To perform a framework with the Weka program, the training set must be used. According to chapter tree, after analyzing data, we will have a set of data contains:

- Packages of product
- Number of employees
- Implementation Modules
- Budget

Analyzing data phase mentioned that the implementation budget cannot be used to make framework. So the Budget of training data set will turn into the Budget per head instead. The budget per head comes from implementation budget divided by the number of employees.

In table 4.5, the company does not map with the packages yet and also does not have the budget per head. Therefore, the historical data has been converted to the training set data to perform the first model in the Weka program. The training set data of the Firm’s Resource Model is shown in the table 4.6.

Table 4.6 – The training set data of the Firm's Resource Model.

Company	No. of Employee	Budget per Head	Package
A	150	410.00	HRMa
B	300	430.00	HRMa
C	300	580.00	HRMd
D	500	575.00	HRMc
E	500	650.00	HRMe
F	750	462.00	HRMb
L	750	460.00	HRMa
G	800	545.00	HRMd
I	850	540.00	HRMd
H	1,000	600.00	HRMc
K	1,200	652.00	HRMe
J	4,000	460.00	HRMb
M	4,500	655.00	HRMe
N	13,000	655.00	HRMe
O	28,000	630.00	HRMc

The data dictionary of training set of the Firm's Resource Model is described in the table 4.7.

Table 4.7 – Data Dictionary of the training set of the Firm's Resource Model.

Column	Type
Company	Varchar
No. of Employee	Number
Budget Per Emp.	Number
Packages	Varchar

Table 4.8 is another training set data to perform the second model. The HCM Module Model contains HRM modules and packages.

Table 4.8 – The training set data of HCM Module Model.

Human Resource	Payroll	Time and Labor	Absence Management	Recruiting Solution	Package
Y	Y	N	N	N	HRMa
Y	Y	N	Y	N	HRMb
Y	Y	Y	Y	N	HRMc
Y	Y	N	Y	Y	HRMd
Y	Y	Y	Y	Y	HRMe

Table 4.9 – The Data Dictionary of the training set of HCM Module Model.

Column	Type
Human Resource	Boolean (Yes/No)
Payroll	Boolean (Yes/No)
Time and Labor	Boolean (Yes/No)
Absence Management	Boolean (Yes/No)
Recruiting Solution	Boolean (Yes/No)
Packages	Varchar

4.2.2 Performing Framework

The framework is built for the purpose of HRM package selection. It contains dual models that are working together to support the package result of each other. First, the Firm's Resource Model classifies criteria with the number of employees and the budget per head. Second, the HCM Module Model classifies criteria with the modules only as the data preparation. The details of performing framework are described as below.

1) The Firm's Resource Model

The use of the Firm's Resource Model is about defining package of HRM by budget per head and number of employees. A model is performed by Weka program with the data from Table 4.6 the training set data of the Firm's Resource Model. To perform a model, the classifier must be chosen from trees with J48 algorithm and run the program with the data of training set that has been prepared. The

classifier model and summary result of the Firm's Resource Model are shown in order in Figure 4.2 and Figure 4.3.

```
=== Classifier model (full training set) ===

J48 pruned tree
------------------

BudgetperHead <= 462
|   NUMBEROfEmp <= 500: HRMa (2.0)
|   NUMBEROfEmp > 500: HRMb (3.0/1.0)
BudgetperHead > 462
|   BudgetperHead <= 630
|   |   NUMBEROfEmp <= 850: HRMd (4.0/1.0)
|   |   NUMBEROfEmp > 850: HRMc (2.0)
|   BudgetperHead > 630: HRMe (4.0)

Number of Leaves  :     5

Size of the tree :      9
```

Figure 4.2 – The Classifier model.

```
=== Summary ===

Correctly Classified Instances          13               86.6667 %
Incorrectly Classified Instances         2               13.3333 %
Kappa statistic                          0.8324
Mean absolute error                      0.0756
Root mean squared error                  0.1944
Relative absolute error                 23.8095 %
Root relative squared error             48.8463 %
Total Number of Instances               15
```

Figure 4.3 – The Summary Result of the Firm's Resource Model.

The classifier model in Figure 4.2 shows that there are five numbers of leaves which are five packages of HRM and nine tree node. In Figure 4.3 summary result of the Firm's Resource Model, there are thirteen correctly classified instances of fifteen instances. Accounted for 86.6667 percent accuracy of this model, incorrectly

classified instances is accounted for 13.3333 percent from some instance that cannot define the package. The consistency data of this model is show in kappa statistic = 0.8324 which means the attributes of set data rather consistency. The relative absolute error and root relative squared error are 23.8095 percent and 48.8463 percent respectively. The visualize tree is shown in the Figure 4.4

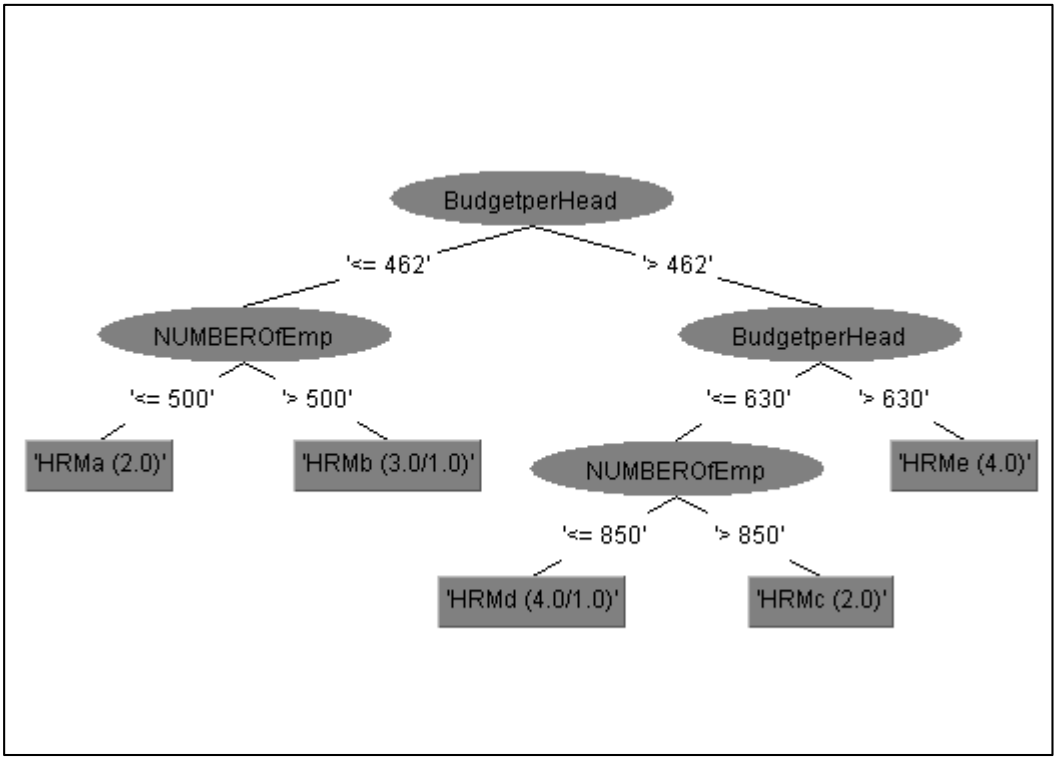

Figure 4.4 – The Firm's Resource Model decision tree.

As a result, in the Figure 4.4, there are the packages: HRMa, HRMb, HRMc and HRMd that has been defined by two factors: budget per head and number of employees. It is an evident that the HRMe package is only defined by one factor which is budget per head. From the historical data, there is variation in size of employee that implement HRMe package.

2) The HCM Module Model

To help the customer to easily select the package, the module of the product should perform as a tree also. After customer gets a package from the Firm's

Resource Model, this decision tree is performed to support customer to select the package from the first model. This tree is defined by module of the product.

The accuracy of the HCM Module Model is absolutely 100 percent correct because the module and package are fixed together. For example, package HRMa always contains modules of Human resource, Payroll or package HRMb always contains modules of Human Resource, Payroll and Recruiting Solution. The module and packages never change. The summary result of HCM Module Model is shown in Figure 4.5 and the visualize tree of HCM Module Model is shown in Figure 4.6.

```
=== Summary ===

Correctly Classified Instances          10               100      %
Incorrectly Classified Instances         0                 0      %
Kappa statistic                          1
Mean absolute error                      0
Root mean squared error                  0
Relative absolute error                  0      %
Root relative squared error              0      %
Total Number of Instances               10
```

Figure 4.5 – The summary result of the HCM Module Model.

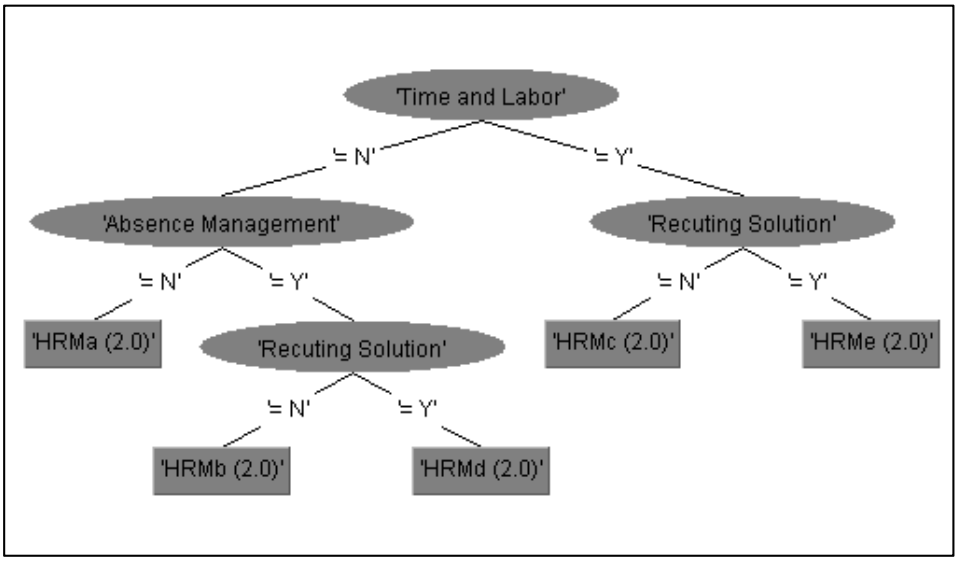

Figure 4.6 – The HCM Module Model's decision tree.

The Human Resource and Payroll is a required module. Also the answer to implement both are always ‘yes’. Therefore, these two modules are not necessary to be shown on the model.

4.3 Verification

To verify the dual model, the testing set of five new customers will need to be used and run the models manually. The budget per head, number of employees and modules that the customer wants to implement are the necessary factors to validate the models. The testing set of the customer are separated for the Firm’s Resource Model and the HCM Module Model is shown in table 4.10 and table 4.11.

Table 4.10 – The testing set data of the Firm’s Resource Model.

Company	No. of Employee	Budget per Head
P	450	458
Q	800	460
R	1,500	600
S	1,000	485
T	5600	650

Table 4.11 – The testing set data of the HCM Module Model.

Company	HR	GP	AM	TL	RS
P	Y	Y	N	N	N
Q	Y	Y	N	N	Y
R	Y	Y	Y	Y	N
S	Y	Y	Y	Y	N
T	Y	Y	Y	Y	Y

The use of dual model will start with the Firm’s Resource Model first. The Figure 4.7 shows the test of company P. The company P has 450 employees and 458 for budget per head. At the first node, decision on budget per head will go to the left side because 458 is less than 462. After that, the second node will go to the left side

again because the number of employees is less than 500. Therefore the result of company P of Firm's Resource Model is HRMa package.

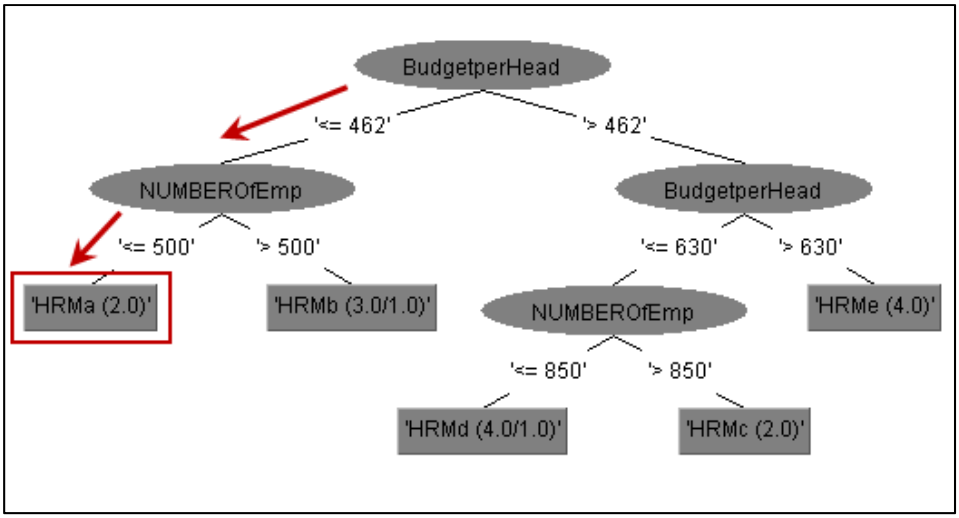

Figure 4.7 – The validation of the Firm's Resource Model of company P.

The HCM Module Model is used to verify the module of the customer company. The testing set data of HCM Module Model shows that the company wants to implement which module.

Since the answer of Human Resource and Payroll are always 'yes', the decision will use Absence Management, Time and Labor and Recruiting Solution. Figure 4.8 shows the validation of company P. The first node of Time and Labor is 'N', then the path will go to the left side. Afterward, on the node Absence Management is 'N', then the path will go to the left side again. Therefore the result of company P of HCM Module Model is HRMa package which is the same as the Firm's Resource Model.

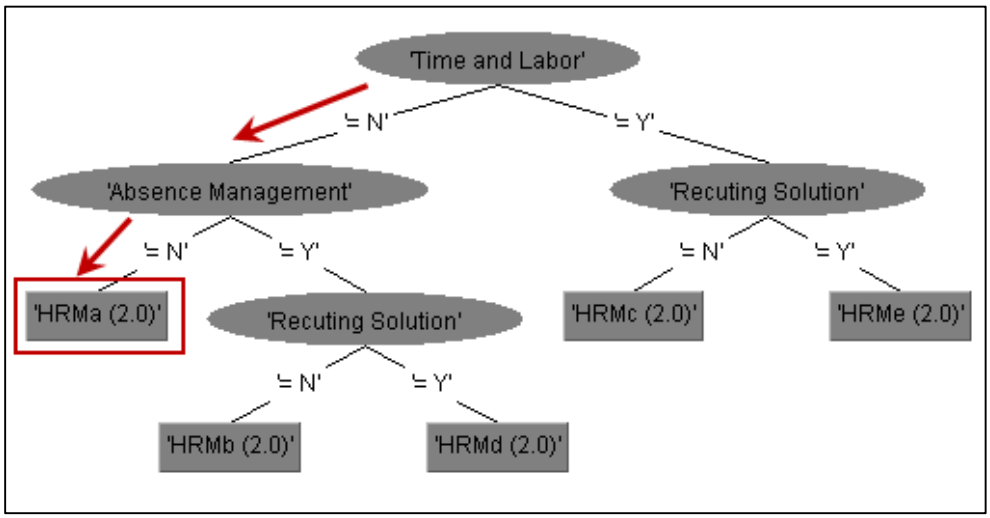

Figure 4.8 – The validation of the HCM Module Model of company P.

4.4 Result

The results of all testing set data are shown in table 4.12.

Table 4.12 – The result of dual model.

Company	Package of Firm's Resource Model	Package of HCM Module Model	Result Consistency
P	HRMa	HRMa	Yes
Q	HRMb	HRMd	No
R	HRMc	HRMe	No
S	HRMc	HRMc	Yes
T	HRMe	HRMe	Yes

As a result, there are result consistencies between two models. The P, S and T company are yes, which means these companies can implement the package from the result of the models. The consulting company can provide the availability product to the customer, prepare team to implement the product and estimate the customization cost including customization package. Last of all, salesperson can sell the suite module to the customer.

For the result consistency is no, the salesperson can use a result package from the HCM Module Model because the accuracy of the model is 100 percent correct. The salesperson can suggest the customer to consider adjusting budget to

implement product or if the customer does not have enough budget, the salesperson can suggest the customer to decrease modules to implement the product instead.

CHAPTER V
CONCLUSION

The research of the Software Package Selection Framework by Using Decision Tree Algorithm : A Case Study of Oracle's PeopleSoft Enterprise HCM are standing on the one objective which is to build a decision framework of the Oracle PeopleSoft HCM product. With the historical data of 15 companies that implemented the product to modeling the framework and 5 newcomers companies to validate it. The final framework are made by dual model. The summary of modeling framework is given in this chapter as below.

5.1 The summary of results

As result in the chapter 4, the framework are divided into 2 models. First, The Firm's Resource Model defines the package by 2 factors: the number of employees and the budget per head. The accuracy of this model is 86.67 percent. The second model is the HCM Module Model. This package is defined by only one factor which is the desired module of company. The accuracy of the second model is 100 percent as described in the previous chapter.

After validating the framework, the package results of the first and second model are possibly different. This research gives a recommendation to salesperson of consulting company to occupy the result of HCM Module Model first.

The essential benefit of the framework is mostly for consulting to the company. The use of framework has reduced the time to select package when comparing with the old model. The salesperson can use this framework to present their customer, give a suite suggestion with a suite package; the product can be sold easily and shortly. The consulting company can prepare an implementer team to support their customers in time. Even the customer can self-service to choose their own package with the three factors.

5.2 Future work

The final framework in this thematic paper is only for HRM module of Oracle PeopleSoft HCM product. The historical data to perform a framework is only from one of outsourcing companies which the result of the framework may be inappropriate with all the outsourcing companies. Therefore, we have summarized the suggestion as follows:

- Concluding the historical data from more outsourcing companies to perform more reliable framework.
- Performing the HRD module packages framework.
- Performing the other product packages framework.

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