16

Intelligent Techniques for Decision Support System in Human Resource Management

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1. Introduction

Nowadays, the evolution of information technology applications makes it an absolute obligation on behalf of the decision makers to continuously make the best decisions in the shortest possible time. Decision Support System (DSS) is a technology and application that assists managerial decision makers utilizing data and models to solve semi-structured and unstructured problems (Qian et al., 2004). This chapter discusses general issues on DSS technologies and an idea to apply DSS technologies into Human Resources Management (HRM) field. Recently, the collaboration between DSS technologies and Artificial Intelligent techniques has produced another type of DSS technology known as Active DSS, it is a technology that will take place in the new millennium era (Shim et al., 2002). Active DSS is an outcome of new DSS technologies and also known as a part of Intelligent System applications. Active DSS applications such as Expert System, Knowledge-based System, Adaptive DSS and Intelligent Decision Support System (IDSS) are categorized as part of Intelligent System studies. Expert systems technology, which was a crucial area for enterprise capital in 1985-1990, is now being replaced by the intelligent system applications (Faye et al., 1998). Intelligent systems are developed to fulfill the two main functions. Firstly, to screening, shifting and filtering the increasing overflow of data, information and knowledge. Secondly, as a supporter of an effective and productive decision making that is suitable to the user needs. Intelligent systems can be developed for these purposes; range from self-organizing maps to smart add-on modules to make the use of applications more effective and useful for the users (Shim et al., 2002).

Human is important and a very valuable asset for an organization and managed by Human Resource professional. HRM system is an important element in the success of an organization, known as an integrated and interrelated approaches to managing human resources (DeNisi & Griffin, 2005). Activities in HRM involve a lot of unstructured processes such as staffing, training, motivation and maintenance (DeCenZo & Robbins, 2005). Besides that, decision making for unstructured processes in HRM usually depends on human judgment and preference. However, human decisions are subject to the limitation because sometimes people forget the crucial details of the problem, and besides, fairness and

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consistency are very important in any types of decisions. Computer applications as decision support tool can be used to provide fair and consistent decisions, and at the same time it can improve the effectiveness of decision making process (Palma-dos-Reis & Zahedi, 1999). In general, the traditional functions of DSS is used to support managerial decision makers in semi-structured and unstructured decision situations, a part from being assistant to the decision makers to extend their capabilities but not to replace their judgment(Turban et al., 2007). In the enhancement to DSS traditional approach, advance intelligent techniques are available in designing an intelligent system application. DSS applications which are embedded with intelligent components can improve the traditional DSS such as for reasoning and learning capabilities, and also known as IDSS. In order to improve human resource decisions, the high-quality HRM applications are required to produce precise and reliable decisions. Due to these reasons, this study presents an idea to apply IDSS approach in human resources decision making activities by using some of the potential intelligent techniques.

2. Artificial intelligent in decision support system

2.1 Intelligent ability and behaviors

In general, intelligence is the ability to think and understand instead of doing things by instinct or automatically (Negnevitsky, 2005). The basic ideas of intelligence are the studying thought processes of humans, dealing with representing and duplicating those processes via machines (e.g., computer, robots), and exploring the behavior by a machine but performed by human being. Artificial Intelligence (AI) study is how to make computers do things at which, at the moment people are better, some of intelligent behaviors in a computer system are:

- Learn and understand from experience
- Conclude in situation where exist fuzziness and uncertainty
- Use knowledge and experience to manipulate the environment
- Think and reasoning
- Understand and infer in ordinary, rational ways.
- Respond quickly and successfully to new situations.
- Recognize the relative importance of different elements in a situation
- Make sense out of ambiguous or contradictory messages (Turban et al., 2007)

Intelligent abilities and behaviors integrate with computer system will produce an intelligent machine. The machine should help humans to make decision, to search for information, to control complex objects, and finally to understand the meaning of words. In order to develop intelligent computer system, we have to capture, organize and use human expert knowledge in some narrow areas of expertise; upgrade the computational power of the system's brain with the sophistication of algorithms using sensory processing, world modeling, behavior generation, value judgment and global communication; the amount of information and values the system has stored in its memory; and the sophistication of the process of the system functioning (Negnevitsky, 2005). Besides that, intelligent system is defined as the ability of a system to act appropriately in an uncertain environment to increase the probability of success, and the success is the achievement of behavioral sub goals that support the system's ultimate goal (Meystel & Albus, 2002). In system development, some AI features that can be used to develop an intelligent system are:

- Symbolic processing which is non algorithmic methods of problem solving
- Heuristics which is intuitive knowledge or rules of thumb, learned from experience.
- Inference that includes reasoning capabilities that can build higher-level knowledge from existing heuristics (from facts and rules using heuristics or other search approaches)
- Machine learning that allows system to adjust their behavior and react to changes in the outside environment (e.g: Inductive learning, Artificial Neural Networks and Genetics Algorithms and etc.) (Turban et al., 2007)

2.2 The families of DSS

An application uses to support decision making is usually known as DSS and can be categorized into three categories which are passive DSS, active DSS and proactive DSS (Kwon et al., 2005). Passive DSS is a traditional DSS with functionalities to react as a personalized decision support built-in knowledge, no content and only for static user preference. Besides that, the components of passive DSS are Data warehouse, OLAP and rule-based. The second category of DSS is active DSS which is known as a personalized decision support with learning capability, no content and for static user preference. Expert system, adaptive DSS, knowledge-based system (KBS) are categorized as part of Intelligent DSS (IDSS). In this category, agent and machine learning are the main component of active DSS. Finally, the third category is proactive DSS, which known as Ubiquitous Computing Technology-based DSS (ubiDSS) which contains decision making and context aware functionalities. This type of DSS has mobility, portability and pro-activeness capabilities. Pull-based proactive, push-based proactive and push-based automated are the proactive DSS applications. In this study, we focus on active DSS, which known as Intelligent DSS (IDSS) using machine learning approach.

3. Intelligent Decision Support System (IDSS)

3.1 IDSS application

An Intelligent Decision Support System (IDSS) is developed to help decision makers during different phases of decision making by integrating modeling tools and human knowledge. IDSSs are tools to help decision making process where uncertainty or incomplete information exists and where decisions involving risk must be made using human judgment and preferences. IDSS as its name implied, is used to support decision making and not intended to replace the decision maker's task. In addition, IDSS works under an assumption that the decision maker is familiar with the problem to be solved. In that case, IDSS gives full control to the user regarding information acquisition, evaluation and making the final decision. IDSS is an interactive system, flexible, adaptable and specifically developed to support the solution of a non-structured management problem for improved decision-making (Quintero et al., 2005).

Besides that, an IDSS is also known as a possible theoretical model of incorporation by adapting an existing DSS system to execute in an Expert System style, such adapted systems are considered by many DSS researchers to be IDSS with the focus on the functioning of 'man and machine' together. An IDSS is more cognitive rather than a technological system, the fundamental difference is that even basic characteristics of intelligence cannot be captured in mechanistic(Malhotra et al., 2003). Most researchers agree that the purpose of

IDSS is to support the solution of a non-structured management and enable knowledge processing with communication capabilities (Qian et al., 2004; Quintero et al., 2005). IDSS can incorporate specific domain knowledge and perform some types of intelligent behaviors, such as learning and reasoning, in order to support decision-making processes (Qian et al., 2004; Viademonte & Burstein, 2006). IDSS applications are developed in various areas such as in product development and planning; management decisions; enterprise and manufacturing industries; services and etc (Table 1). In this study, we categorize the application areas into seven areas i.e medical, management, development, planning, business, manufacturing and web services. Most of the applications are specific to problem domain in that area. For example, in business industries, IDSS is used for sales prediction (Baba & Suto, 2000), stock trading forecasting (Kuo et al., 2001), financial investment (Palma-dos-Reis & Zahedi, 1999) and etc. From the literature, we list the application areas for the specific problem domains in Table 1. Most of IDSS applications that are listed in Table 1 use IDSS conventional name and of course they are different in purpose, implementation, design and intelligent techniques applied. In this study we found that, there are many

Application Area	*Problem Domain*
Medical	Veterinary medicine (Gorzalczany & Piasta, 1999) Breast Cancer (Malhotra et al., 2003)
Management	Organizational Memory System (Linger & Burstein, 1998) Irrigation System (Faye et al., 1998) Environment (Seder et al., 2000) Petroleum-contaminated (Liqiang et al., 2001) Air pollution Control (Qian et al., 2004) Urban infrastructure (Quintero et al., 2005) Flood (Sajjad & Slobodan, 2006) Boiler breakdown (Adla & Zarate, 2006)
Development	Product development (Matsatsinis & Siskos, 1999) Urban development (Shan & Lida, 1999) Weather forecasting (Viademonte & Burstein, 2006) Information visualization (Tong et al., 2001) Digital preservation (Ferreira et al., 2007)
Planning	Aerial Combat Identification (Brain, 1999) Service network planning (Waiman et al., 2005) Budget planning (Wen et al., 2005) IT outsourcing planning (Buyukozkan & Feyzioglu, 2006)
Business	Financial-Investment (Palma-dos-Reis & Zahedi, 1999) Stock trading (Kuo et al., 2001) Sales prediction (Baba & Suto, 2000) Evaluating state-owned enterprises (Wei-Kang et al., 2007)
Manufacturing	Dairy Industry (Hussein et al., 1998) Manufacturing system (Delen & Pratt, 2006)
Web services	Personalized E-services (Yu, 2004) UbiDSS - Proactive services (Kwon et al., 2005)

Table 1. IDSS Application Area

areas and problem domains that can be explored by the intelligent system researchers or system developers. This can help to increase the IDSS products in market place as alternative tools to support and improve decision making processes for the specific problem domains.

3.2 Intelligent techniques in IDSS

Recently, there are quite a number of computer applications that have applied intelligent techniques and used DSS concepts and components. However, some researchers claim it as an essential of DSS which uses the conventional name known as IDSS and others classified it as a member of intelligent system. In this case, the application's name is given based on the intelligent techniques that they use, such as expert system which uses rules based system, knowledge based system (KBS), fuzzy sets, Neural Network for reasoning and learning capabilities. In this study, we focus our discussion on IDSS applications, which are embedded with the related intelligent techniques. In fact, there are various types of Artificial Intelligent technologies that are used for reasoning, machine learning, automatic programming, artificial life, data mining and data visualization. For example, the reasoning process can use specific rules, categorization, past experience, heuristics and expectations approaches. Computer can do the reasoning through frames (e.g.: Semantic Network), rule-based, case-based and pattern recognition. In addition, the examples of machine learning approaches are Artificial Neural Network (ANN), genetic algorithms and fuzzy logic [7]. IDSS is expected to incorporate specific domain knowledge and perform certain types of intelligent behavior such as learning and reasoning, in order to support decision making process. The need to incorporate domain knowledge and intelligent capabilities in decision support system has been identified in various forms and models by many researchers [6]. IDSS incorporating knowledge component (through case base, rule base, knowledge acquisition subsystem or domain models) and intelligent component (through an intelligent advisory system, intelligent supervisor or model solver) can produce the intelligent applications.

Intelligent behaviors presented by an intelligent system are related to the abilities of gathering and incorporating domain knowledge, learning from the acquired knowledge, reasoning about such knowledge and when enquired, being able to issue recommendations and justify outcomes. These intelligent behaviors are potential intelligent techniques that can be corporated with intelligent component in IDSS. IDSS has consolidated the intelligent behaviors in its inference engine component. In this case, with the intelligent behaviors, IDSS applications can have abilities to do learning and reasoning. These abilities are used to support the decision making processes. There are various types of intelligent techniques that are applied in IDSS applications such as knowledge base system(Quintero et al., 2005),(Adla & Zarate, 2006), (Waiman et al., 2005),(Malhotra et al., 2003),(Palma-dos-Reis & Zahedi, 1999),(Matsatsinis & Siskos, 1999),(Linger & Burstein, 1998) and (Seder et al., 2000), data warehouse(Yu, 2004), fuzzy set theory(Liqiang et al., 2001), ANN(Sajjad & Slobodan, 2006), rough set classifier (Gorzalczany & Piasta, 1999), multi agent (Kwon et al., 2005) and etc. From the literature study, we found that most applications use Knowledge Based System, especially for rules based approach in their methodology and system implementation. In fact, most researchers agree with the advantage of using this technique. Not only it is easier to understand and implement, but the KBS using rule-based also supports the basic reasoning capabilities. However, intelligent system and soft computing technologies are

new technological platforms, whereby intelligent logic is now usually inherent in the processing of all decision support tools [2].

3.3 Research trends in IDSS

Research and system developments in this field increase year by year with new ideas and approaches. In that case, there are some IDSS applications using hybrid techniques to develop IDSS applications. They integrate more than one intelligent technique in their application system development. This approach makes IDSS applications more capable to do learning and reasoning processes. Table 2 lists some of IDSS applications that use hybrid approach. From the literature, we found that IDSS applications used hybrid approach by integrating the intelligent techniques such as Data Mining, Artificial Neural Network, Fuzzy logic, Knowledge-based system, Agent and Genetic Algorithm. Most researchers agree that these intelligent techniques are more suitable for learning and reasoning activities. In that case, the integration between DSS and hybrid intelligent techniques will advance the capabilities of IDSS applications. However, some studies are needed to validate the abilities of IDSS applications with hybrid techniques, because in some cases may be single technique can produce the same result as hybrid techniques, and it also depend on the nature of the problems that to be solved.

Hybrid Intelligent Techniques	***Task***
Data Mining and ANN	Weather forecasting (Viademonte & Burstein, 2001), Selection and allocation of sires and dams (Hussein et al., 1998)
Artificial Neural Network (ANN) and TD Learning method	Sales prediction (Baba & Suto, 2000)
Genetic Algorithm based Fuzzy Neural Network	Measure the qualitative effect on the stock market (Kuo et al., 2001)
Fuzzy set and Gaussian dispersion model	Air pollution control at coal-fired power plants (Qian et al., 2004)
Case-based, mobile agent and multi-agent	Strategic choices in term of technical interventions on municipal infrastructure (Quintero et al., 2005)
Model based and Rule based	Measure enterprise performance (Wen et al., 2007)
Knowledge-based system and ANN	Evaluation of urban development (Shan & Lida, 1999)
Knowledge-based system and Fuzzy theory	Effective IT outsourcing management (Buyukozkan & Feyzioglu, 2006)

Table 2. Hybrid Intelligent Techniques in IDSS

4. IDSS for Human Resource (HR IDSS)

4.1 Application and techniques

Today's HR has been linked to increased productivity, good customer service, greater profitability and overall organizational survival. To reach such link, management must not only face current issues of human resource management but also deal with future challenges to HRM effectively (Stavrou-Costea, 2005). Recently, among the challenges of HRM

professionals are development and technology (Okpara & Wynn, 2008). On the other hand, the major potential prospect for HRM is technology selection and implementation. The benefits of technology applications in HRM are easily to deliver information from the top to bottom workers in an organization, convenient to communicate with employees and it is easier for HR professionals to formulate managerial decisions. For these reasons, HR decision application can be used to achieve the HR goals in any types of decision making tasks. The potentials of HR decision applications are increased productivity, consistent performance and institutionalized expertise which are among the system capabilities embedded into specific programs (Hooper et al., 1998). However, HRM involves a lot of managerial decisions, where according to DeCenzo (DeCenZo & Robbins, 2005), HR professionals need to focus the goal for each of HR activities as follows:

- Staffing is to locate and secure competent employees,
- Training and development - to adapt competent workers to the organization and help them obtain up-to date skill, knowledge and abilities
- Motivation is to provide competent and adaptable employees who have up-to date skill, knowledge and abilities with an environment that encourages them to exert high energy level
- Maintenance is to help competent and adaptable employees who have up-to date skill, knowledge and abilities and exerting high level energy level to maintain their commitment and loyalty to the organization.

Research in HR IDSS can be classified into four categories according to HRM main activities; staffing, training and development, motivation and administration. There are some studies on HR IDSS applications and the intelligent techniques used are shown in Table 3. HR IDSS is used for the specific HRM domains and most of them use expert system or Knowledge-based system (KBS) approaches. The commercial emergence of Knowledge-based information technology systems (KBS) is representing a tremendous opportunity to enhance the practice of human resource management (Martinsons, 1995). The KBS benefits are more permanent, easier to duplicate, less expensive and automatically documented. Besides that, the limitations of KBS systems are difficult to capture informal knowledge; knowledge has not been documented and difficult to verbalize. The techniques used to verify and validate conventional systems are considered to be inadequate and KBS-specific methods are still immature. For these reasons, most of the new HR decision system research use other intelligent approaches such as in personnel selection, they use Data Mining and Neural Network approaches. From this study, we found that not many research have been done in HR decision systems area. Besides, the problem domains that they try to solve are also limited to specific domains. In this study, we found that most of the human resource DSS applications use expert system approach. Expert system in HRM activities has its limitations such as incorrect knowledge because of the difficulty in obtaining knowledge from appropriate experts, difficulty in representing that knowledge in a computer model and not being able to handle complex cognitive tasks (inability of the system to learn)(Hooper et al., 1998). Due to these reasons, to solve problems in expert system approach, other intelligent techniques such as hybrid intelligent techniques can be most effective when they are embedded with the HR IDSS. In HRM, there are several tasks that can be solved using this approach, for examples, selecting new employees, matching people to jobs, planning career paths, planning tanning needs for new and old employee, predicting current employee performance, predicting future employee and etc. Those problems can be solved using some machine learning approaches especially for prediction task. Recently, researches show some interest on applying machine learning approach in HRM field.

Category	*Intelligent Techniques*
Staffing Personnel Selection	Expert system/ Knowledge-based system (Hooper et al., 1998) and (Mehrabad & Brojeny, 2007) Data Mining (M. J. Huang et al., 2006) and (Chien & Chen, 2008) Artificial Neural Network (L. C. Huang et al., 2004)and (M. J. Huang et al., 2006)
Training and Development Training Development	Knowledge-based system (Liao, 2007) Expert System (Chen et al., 2007) Rough Set Theory (Chien & Chen, 2007)
Motivation Job Attitudes Performance appraisal	Artificial Neural Network (Tung et al., 2005) Fuzzy logic (Ruskova, 2002)
Administration Meeting scheduling	Software agent (Glenzer, 2003)

Table 3. Intelligent Techniques in HR IDSS

4.2 Knowledge Discovery in Database (KDD) for HR application

Knowledge Discovery in Database (KDD) or Data mining is an approach that is now receiving great attention and is being recognized as a newly emerging analysis tool (Tso & Yau, 2007). Data mining has given a great deal of concern and attention in the information industry and in society as a whole recently. This is due to the wide accessibility of enormous amounts of data and the important need for turning such data into useful information and knowledge (Han & Kamber, 2006). Computer application such as DSS that interfaces with Data mining tool can help executives to make more informed and objective decisions and help managers retrieve, summarize and analyze decision related data to make wiser and more informed decisions.

Data mining problems are generally categorized as clustering, association, classification and prediction (Chien & Chen, 2008; Ranjan, 2008). Over the years, Data mining has used various techniques including statistics, neural network, decision tree, genetic algorithm, and visualization techniques. Besides that, Data mining has been applied in many fields such as finance, marketing, manufacturing, health care, customer relationship and etc. Nevertheless, its application in HRM is rare (Chien & Chen, 2008). Prediction applications that use Data mining in HRM are infrequent, such as to predict the length of service, sales premiums, to persistence indices of insurance agents and analyze mis-operation behaviors of operators (Chien & Chen, 2008). The research to date has listed researches in HRM problems domain uses Data mining approach. Table 4 lists some of the HR applications that use Data mining, and it shows that there are few discussions about prediction tasks that use Data mining technique in human resource domain.

Data Mining method used	*Activity in HRM*
Fuzzy Data Mining and Fuzzy Artificial Neural Network	Employee development – Project Assignment (M. J. Huang et al., 2006)
Decision tree	Personnel selection (Chien & Chen, 2008) Job attitudes (Tung et al., 2005)
Association rule mining	Employee Development – Training (Chen et al., 2007)
Rough Set Theory	Personnel Selection – Recruit and Retain Talents (Chien & Chen, 2007)
Fuzzy Data Mining	Personnel Selection (Tai & Hsu, 2005)

Table 4. HR Applications using Data mining Techniques

Data mining is among the best approach to analyze records in databases. The analyzed results can be used for future planning. From the literature that we have discussed before, Data mining method had been also implemented in HR problem domains but focusing on personnel selection task and not many apply in other activities such as planning, training, managing talent and etc. Recently, the new demands and the increased visibility of HRM to seeks a strategic role by revolving to Data mining methods (Ranjan, 2008). This can be implemented by identifying generated patterns from the existing data in HR databases as useful knowledge. The patterns can be generated by using some of the major Data mining techniques i.e. clustering, association, prediction and classification. There are many human resources tasks that can be solved by using Data mining techniques such as employee performance evaluation, counseling techniques and performance management for effective and efficient decisions (Ranjan, 2008). In order to produce relevant Data mining results that are suitable to human resource tasks, several processes in Data mining process should be followed. The first step of data mining process is getting the main data sets for data set selection. These may be collected from human resource operational databases or where the human resource data warehouse is selected. The selected data then goes through cleaning and preprocessing for removing discrepancies and inconsistencies of data set and at the same time to improve quality of data set. Next, the data set is analyzed to identify patterns that represent relationship among data by applying algorithms, such as Neural nets, Decision Tree, Rough Set Theory and so on. Then patterns are validated with new human resource data sets. In addition, it should be possible to transform the generated patterns into actionable plans that are likely to help human resource people to achieve their goals. The steps in the mining process are repeated until meaningful knowledge is extracted. A pattern that satisfies these conditions becomes organizational knowledge and can be used in any related HR applications for human resource tasks. Fig 1 gives us an overview of fundamental Data mining process.

4.3 HR IDSS framework using KDD

The proposed HR IDSS framework employs the traditional DSS components (i.e. model management system, data management system and user interface) along with a knowledge-

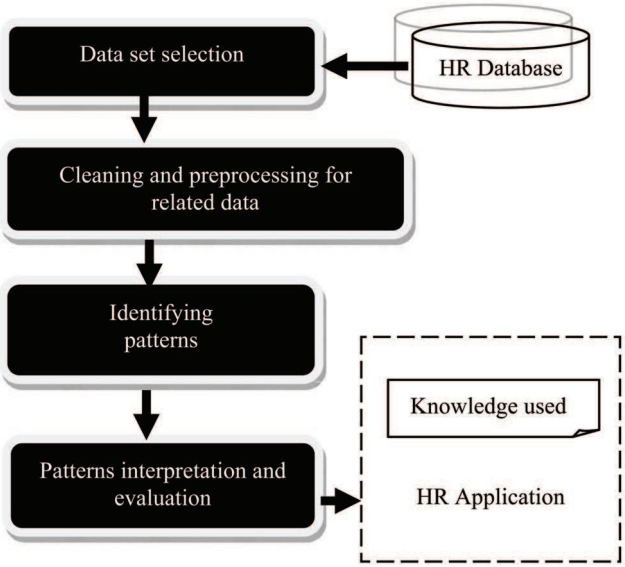

Fig. 1. Fundamental Data Mining Process

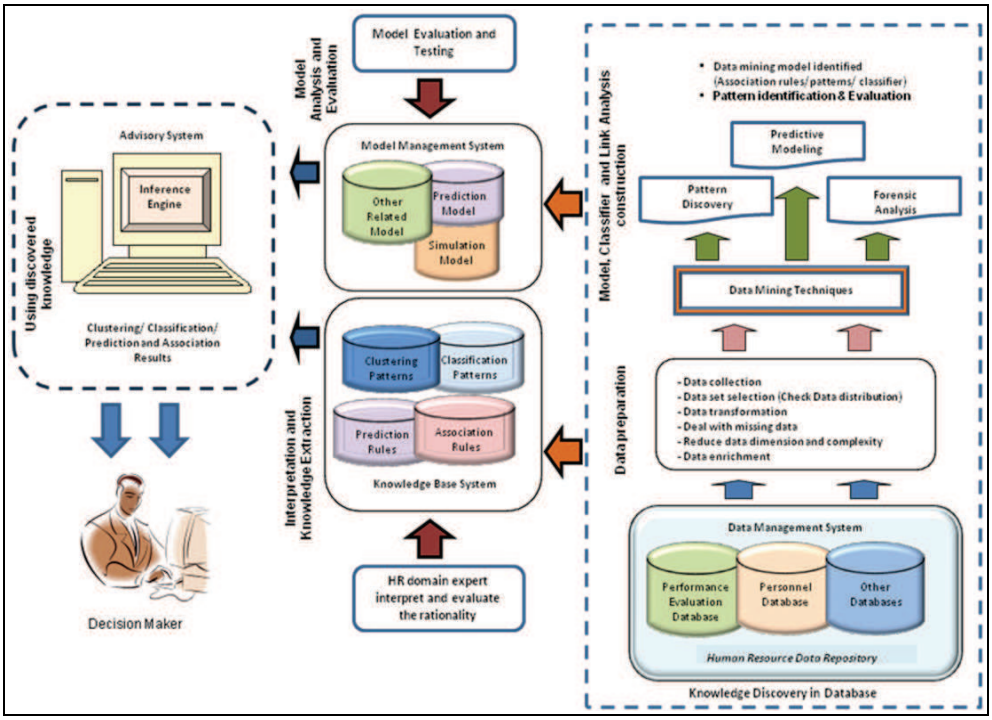

Fig. 2. Suggested HR IDSS Framework

based system component) (Delen & Pratt, 2006; Marakas, 1999; Shim et al., 2002). However, a typical IDSS consists of five main components, database system, model base system, knowledge-based System, user interface and kernel/inference engine (Delen & Pratt, 2006; Hussein et al., 1998; Matsatsinis & Siskos, 1999). In this study, we use Data mining techniques as inference component to solved HR problems. Fig.2 illustrates the proposed HR IDSS framework for HR problems. The proposed HR IDSS framework contains four main components:

a. *Knowledge Discovery in Database (KDD)* approach is used to develop predictive model and to find out the possible pattern and rules from existing database system. HR databases that is related to problems such as for employee performance prediction we can use personnel information, performance evaluation data and other related databases. The relevant data will be transformed into useful knowledge as predictive model through predictive modeling, generated rules by pattern discovery and extracted patterns to find unusual data elements by forensic analysis. All these discovery knowledge are useful for some of HR task.
b. *Model Management System is* a model based system, which store constructed model, existing simulation model and related models that can be used in appropriate decision making process. In fact, before using predictive model, the model must be evaluated and tested in model analysis and evaluation process.
c. *Knowledge Base System (KBS)* contains a set of facts and rules. In the suggested framework, KBS will contain information about patterns, association rules and any related facts and rules. The rules and patterns will be evaluated and interpreted by the HR domain experts.
d. *Advisory System* is as inference engine in HR DSS application that supervises the interactions among the various parts of HR application. Basically, this component will react as interface between user and the system itself, especially to display the prediction results, justify and explain the decision and sometimes if needed can instruct KBS to update the existing knowledge. In this study, the advisory system will display the results with some reasons, and suggest possible solutions.

On the other hand, this HR IDSS framework embedded Data mining techniques with other DSS components such as knowledge-based and model-based. On the other hand, this framework not only for prediction but also applied to other Data mining tasks such as association, classification and clustering.

5. Discussion and suggestion

HR IDSS as a part of Intelligent System applications play the same roles to assist decision making process. Applications and intelligent techniques of HR IDSS need a lot of attention and efforts, from both academicians and practitioners. In this study, we can see the potential of HR IDSS applications for future works. Firstly, there are many problem domains in HRM that can be explored by intelligent system researchers. In this case, the researchers should have teffort to identify problem domains where tools are needed to transform uncertain and incomplete data into useful knowledge. For that reason, we are trying to explore HR IDSS applications for human resource problems using machine learning approach. Secondly, researchers agree that hybrid intelligent techniques are the best approach to support

decision making especially in reasoning and learning. In that case, we embedded HR IDSS framework using hybrid techniques i.e., Knowledge-based system and machine learning approaches. Thirdly, the academicians and practitioners should continuously improve the core knowledge on effective HR IDSS. This process can be enhanced through continuous development in web-enable tools, wireless protocol and group decision support system, which can expand the inter-activities and perverseness decision support technologies. For system development, we plan to use this technology to expand the capabilities of the application. Most researches were discussed from different categories. However, we would like to see more HR IDSS application and intelligent techniques applied to different problem domains in HRM field published in order to broaden our horizon of academic and practice work on HR IDSS. For that reason, we recommend the proposed HR IDSS framework as part of IDSS research in HRM problem domains.

6. Conclusion

This chapter has described the IDSS concepts, applications, related research in HRM, potential intelligent techniques and the suggested HR IDSS framework using machine learning approach. There are many areas, problem domains and intelligent techniques to be explored by academicians and practitioners. We conclude that IDSS applications and intelligent techniques applied are developed towards the expertise orientation and IDSS application development is a problem-oriented domain. Finally, the ability to continually change and obtain new understanding is the power of IDSS, and will be the IDSS applications for future work.

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This book by In-Tech publishing helps the reader understand the power of informed decision making by covering a broad range of DSS (Decision Support Systems) applications in the fields of medical, environmental, transport and business. The expertise of the chapter writers spans an equally extensive spectrum of researchers from around the globe including universities in Canada, Mexico, Brazil and the United States, to institutes and universities in Italy, Germany, Poland, France, United Kingdom, Romania, Turkey and Ireland to as far east as Malaysia and Singapore and as far north as Finland. Decision Support Systems are not a new technology but they have evolved and developed with the ever demanding necessity to analyse a large number of options for decision makers (DM) for specific situations, where there is an increasing level of uncertainty about the problem at hand and where there is a high impact relative to the correct decisions to be made. DSS's offer decision makers a more stable solution to solving the semi-structured and unstructured problem. This is exactly what the reader will see in this book.

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