

Knowledge Discovery Techniques for Talent Forecasting in Human Resource Application

Hamidah Jantan, Abdul Razak Hamdan, and Zulaiha Ali Othman

Abstract—Human Resource (HR) applications can be used to provide fair and consistent decisions, and to improve the effectiveness of decision making processes. Besides that, among the challenge for HR professionals is to manage organization talents, especially to ensure the right person for the right job at the right time. For that reason, in this article, we attempt to describe the potential to implement one of the talent management tasks i.e. identifying existing talent by predicting their performance as one of HR application for talent management. This study suggests the potential HR system architecture for talent forecasting by using past experience knowledge known as Knowledge Discovery in Database (KDD) or Data Mining. This article consists of three main parts; the first part deals with the overview of HR applications, the prediction techniques and application, the general view of Data mining and the basic concept of talent management in HRM. The second part is to understand the use of Data Mining technique in order to solve one of the talent management tasks, and the third part is to propose the potential HR system architecture for talent forecasting.

Keywords—HR Application, Knowledge Discovery in Database (KDD), Talent Forecasting.

I. INTRODUCTION

RECENTLY, research in Human Resource (HR) applications that are embedded with Artificial Intelligent (AI) techniques can solve unstructured and indistinct decision making problems. These applications can help decision makers to solve inconsistent, inaccurate, inequality and unpredicted decisions. In the advancement of AI technology, there are many techniques that can be used to upgrade the capabilities of HR application. Knowledge Discovery in Database (KDD) or Data Mining is one of AI technology that has been developed for exploration and analysis in large quantities of data to discover meaningful patterns and rules. In actual fact, such data in HR data can provide a rich resource for knowledge discovery and decision support tools. So far, the techniques and application of Data Mining have not attracted much attention in Human Resource Management (HRM) field[1]. In this study, we attempt to use this approach to handle the issue in managing talent i.e. to identify existing talent by predicting their performance using the past experience knowledge.

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Basically, HRM is a comprehensive set of managerial activities and tasks concerned with developing and maintaining a competent workforce-human resource. HRM aims to facilitate organizational competitiveness; enhance productivity and quality; promote individual growth and development; and complying with legal and social obligation[2]. Besides that, in any organizations, they need to compete effectively in term of cost, quality, service or innovation. All these depend on having enough right people, with the right skills, deployed in the appropriate locations at appropriate points in time.

Nowadays, in HRM field, among the challenges of HR professionals are managing talent, especially to ensure the right person for the right job at the right time. These tasks involve a lot of managerial decision, and which it is sometime very uncertain and difficult to make the best decisions. In reality, current HR decision practices depend on various factors such as human experience, knowledge, preference and judgment. These factors can cause inconsistent, inaccurate, inequality and unforeseen decisions. As a result, especially in promoting individual growth and development, this situation can often make people feel injustice. Besides that, in future, this can influence organization productivity. In talent management, to identify the existing talent is one of the top HR management challenges[3]. This challenge can be manage by using Data Mining technique in order to predict the suitable talent based on their performance. For that reason, this study aims to suggest HR system architecture using Data Mining technique for talent performance prediction. This application can be use to help managers to allocate the right person at the appropriate locations at the right time.

The rest of this paper is organized as follows. The second section describes the background of HR application; and the prediction applications and intelligent techniques used. The third section explores the overview of Data Mining and how Data Mining techniques apply in HR application. The basic concept of talent management is presented in Section 4. Section 5 describes the Data Mining techniques for talent management. Then, section 6 discusses the potential HR system architecture for talent forecasting. Finally, the paper ends with Section 7 where the concluding remarks and future research directions are identified.

II. HUMAN RESOURCE APPLICATION AND PREDICTION Vol.3, No.2, 2009

A. Human Resource(HR) Application

Nowadays, 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 human resource management effectively[4]. Human Resource Management (HRM) tasks involved a lot of managerial decisions, according to DeCenzo[5], HR professionals need to focus the goal for each of HR activities: Staffing 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 to provide competent and adapted employees who have up-to date skill, knowledge and abilities with an environment that encourages them to exert high energy level and maintenance to help competence and adapted 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.

The challenges of HRM professionals are health, HIV/AIDS, managing talent, employee rewards, retention, training and development, technology, tribalism, nepotism and corruption. On the other hand, among the major potential prospects for HRM is technology selection and implementation[6]. The benefits of technology applications in HRM are to easily deliver information from the top to bottom workers in an organization, easily 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 type 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[7].

In this study, we found that research in HR Decision Systems basically focuses only for the specific HRM domains such as in personnel selection, training, scheduling and job performance. Besides that, most of the HR decision applications are using expert system or Knowledge-based system (KBS) approaches such as for personnel selection and training[8]. The commercial emergence of Knowledge-based information technology systems (KBS) represents a tremendous opportunity to enhance the practice of human resource management[9]. 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. Techniques used to verify and validate conventional systems are considered to be inadequate and KBS-specific methods are still immature. For that reasons, new HR decision system research are using other intelligent approaches such as for personnel selection, they use Data Mining approach [10, 11] and Neural Network approach [12, 13]. From this study, we found that not many research done in HR decision systems area. Besides, the problem

that they tried to solve are also limited to the specific domains. In information technology era, HR applications are used as a tool to support human resource managers in their decision making process.

B. Intelligent Techniques in HR Application

HR application is a part of Decision Support System (DSS) which is used to support decision making process. Nowadays, the advancement of Artificial Intelligent technologies has contributes to new DSS application than known as Intelligent Decision Support System (IDSS). IDSS is developed to help decision makers during different phases of decision making by integrating modeling tools and human knowledge. IDSSs are tools for helping decision making process where uncertainty or incomplete information exists and where decisions involving risk must be made using human judgement and preferences. Basically, 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. Most researchers agree that the purpose of IDSSs is to support the solution of a non-structured management and enable knowledge processing with communication capabilities[14, 15].

Besides that, 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[15, 16]. The need to incorporate domain knowledge and intelligent capabilities in decision support system has been identified in various forms and models by many researchers. 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 are presented by an intelligent system 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.

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. IDSS gives full control to the user regarding information acquisition, evaluation and making the final decision. Nowadays, there are quite a number of computer applications that apply intelligent techniques and use DSS concepts and components. However, some researchers claim that it is an essential of DSS which uses the conventional name known as IDSS and others classify 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 is uses rule based system, knowledge based system (KBS), fuzzy sets, Neural Network for reasoning and learning capabilities. Most of the IDSS applications are specifically used for problem domain in that

particular area. IDSS has consolidated the intelligent behaviors in its inference engine component. These abilities are used to support the decision making processes. In our study, we found that there are various types of intelligent techniques that are applied in IDSS applications such as knowledge base system data warehouse, fuzzy set theory, ANN, rough set classifier, multi agent and etc.[8] From the literature, we found that most applications used knowledge-based system and they agree with the advantage of using this technique. Besides it is easier to understand and implement, the KBS using rule-based and it also supports the reasoning capabilities. Research and system developments in this field increase year by year with new ideas and approaches. In that case, some of the IDSS applications use hybrid techniques to advance the system capabilities by integrating more than one intelligent technique in their application. This approach makes the IDSS applications more capable to do learning and reasoning processes. Most researchers agree that these intelligent techniques are more suitable for learning and reasoning activities. In this study, we found that most of the HR applications use expert system and some of them use data mining approaches. For these reasons, to solve problems in expert system approach, hybrid intelligent techniques can be the most effective when they are embedded with the HR application. In HRM, there are several tasks that can be solved using this approach, for examples, selecting new employees, matching people to jobs, planning careers paths, planning training needs for new and old employee, predicting current employee performance, predicting future employee and etc. In this study, we focus our study on how to embed the HR application with Knowledge Discovering in Database (KDD) approach especially for prediction purposes. HR applications can produce precise decisions when incorporated with intelligent capabilities. From the literature study, some intelligent techniques that use in HR applications are listed in Table I.

TABLE I
INTELLIGENT TECHNIQUES USED IN HR APPLICATIONS

Intelligent Techniques	HR DSS Applications
<i>Knowledge-based System/ Expert System</i>	Web-based Training Expert System [17], Job applicants selection [18] Personnel selection [7],E-training [19]
<i>Data Mining</i>	Job Attitudes [20], Recruit and Retain Talents [21],Personnel selection [12] & [10], Project Assignment [22]
<i>Software agent</i>	Meeting Scheduler [23]
<i>Fuzzy set/logic</i>	Prioritization of Human Capital [24]
<i>Artificial Neural Network</i>	Personnel selection [12]

Basically, most of them use expert system or Knowledge-based system (KBS) approach and some of them use Data mining approach. 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[9]. For those reason,

the current HR applications use other intelligent techniques to advance the capabilities of the applications. In this study, we have found researches that use AI techniques in HR field are very limited. Besides, the problem domains that they try to solve are also limited to the specific problem domains especially in personnel selection and training.

Researches and system development in this field increase year by year with new ideas and approaches. In that case, some HR applications use hybrid intelligent techniques to advance the capabilities of the existing techniques. They integrate more than one intelligent technique in their application to be more capable in explaining, learning, reasoning and forecasting processes, which can produce quite similar decisions as human decisions. Nowadays, researches have shown an increase interest in predicting human performance [22, 25, 26]. However, there has been little discussion about prediction employee's performance which relates to human resource problem domains[22]. Basically, prediction applications by using past experience knowledge or Data Mining can be used for several tasks in HR activities such as selecting new employees, matching people to jobs, planning careers paths, planning training needs for employees, predicting employee performance, predicting future employees and etc. All these need a lot of attention and efforts, from both academicians and practitioners to explore and analyze the existing data and to discover useful knowledge.

C. Prediction: Applications and Techniques

Prediction is a process to gain knowledge about uncertain events that are important to present decisions[27]. Besides that, prediction methodology can be categorized into two approaches; statistical and intelligent techniques. In this study, we focus on intelligent techniques approaches. Some of intelligent techniques used in prediction application are listed in Table II.

TABLE II
PREDICTION TECHNIQUES AND APPLICATION

Techniques used	Applications
<i>Decision Tree</i>	Electricity energy consumption [28] Medicine [29] Accident frequency [30]
<i>Artificial Neural Network</i>	Electricity energy consumption [28] Country investment risk [31] Stock market returns [32] Medicine [29] Interest rates [33] Disease [34] Corporate failure[35]
<i>Bayesian Belief Networks (BBN)</i>	Student performance [26] & [25]
<i>Fuzzy Clustering</i>	Newspaper demand [36]

The most popular intelligent techniques for prediction are Artificial Neural Network, Decision Tree, Case-based Reasoning, Genetic Algorithm, Rough Set, Soft Computing (known as Hybrid Intelligent System), Operational Research and others techniques such as SVM, Fuzzy logic and etc. [28]. Basically, most of the prediction applications in Table

1 are used to predict stock, demand, rate, risk, event etc., and a few apply on human or people. Besides that, the applications are mainly developed in business and industries fields, and only a limited discussion involved human resource in an organization.

Recently, with the advancement of technologies many researches use hybrid intelligent techniques to advance the capabilities of the single intelligent techniques. Most of them agree that hybrid technique can produce better results. In that case, they integrate the existing intelligent techniques, for example Fuzzy Artificial Neural Network, Fuzzy Data mining, Genetic Algorithm and Data mining and etc. In actual fact, in some cases that need the statistical concerns, the researchers integrate the intelligent techniques and statistical approaches to produce the best quality of results. For examples, the discrete choice theory and Data mining are used to predict the criminal events in the selected area; Data Mining and Fuzzy Artificial Neural Network is used to predict a suitable person for the project and etc. Table III shows some of the prediction applications that use hybrid intelligent techniques.

TABLE III
HYBRID TECHNIQUES FOR PREDICTION APPLICATIONS

Techniques used	Application
<i>Soft Computing Adaptive Neuro-Fuzzy Inference System (ANFSI) & ANN</i>	Reservoir management [37]
<i>Auto-regressive Moving Average (ARMA) and Time delay neural network (TDNN)</i>	Service request [38]
<i>Neural networks and Case-based reasoning</i>	Interest Rate [39]
<i>Discrete choice theory & Data mining</i>	Criminal event[40]
<i>Data mining and mobile computing</i>	Location in mobile environment [41]
<i>Genetic Algorithms (GA) and ANN</i>	Financial forecasting [42]
<i>ANN and Multivariate Adaptive Regression Splines (MARS)</i>	Breast cancer [43]
<i>Data Mining and Fuzzy Artificial Neural Network</i>	Project Assignment[22]

III. KNOWLEDGE DISCOVERY IN DATABASE

A. Data Mining

Knowledge Discovery in Database (KDD) or Data mining (DM) is an approach that is now receiving great attention and is being recognized as a newly emerging analysis tool[28]. 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[44]. Computer application such as DSS that interfaces with DM tool can help executives to make more informed and objectives 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[1, 10]. Over the years, the Data mining has involved 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[10].

B. Data Mining in HR Applications

Prediction applications in HRM are infrequent, as examples to predict the length of service, sales premiums, to persistence indices of insurance agents and analyze mis-operation behaviors of operators [10]. The research to date has listed researches in HRM problems domain uses DM approach. Table 4 lists some of the HR applications that use Data Mining, and it shows that there are few discussions about performance predictions that use DM technique in human resource domain.

TABLE IV
DATA MINING IN HR APPLICATIONS

Data Mining method used	Activity in HRM
<i>Fuzzy Data Mining and Fuzzy Artificial Neural Network</i>	Employee development – Project Assignment [22]
<i>Decision tree</i>	Personnel selection [10] Job attitudes [20]
<i>Association rule mining</i>	Employee Development – Training [17]
<i>Rough Set Theory</i>	Personnel Selection – Recruit and Retain Talents [21]
<i>Fuzzy Data Mining</i>	Personnel Selection [11]

IV. MANAGING TALENT IN HUMAN RESOURCE MANAGEMENT

In an organization, talent management is becoming an increasingly crucial way of approaching HR functions. Talent is considered as any individual who has the capability to make a significant difference to the current and future performance of the organization[45]. In fact, managing talent involved human resource planning that regards processes for managing people in organization. Besides that, talent management can be defined as an outcome to ensure the right person is in the right job; process to ensure leadership continuity in key positions and encourage individual advancement; and decision to manage supply, demand and flow of talent through human capital engine[46]. The talent management process consists of recognizing the key talent areas in organization, identifying the people in the organization who constitute its key talent, and conducting development activities for the talent pool to retain and engage them and have them ready to move into more significant roles (see Fig.1).

There are several ways to identify talent in an organization and one of the methods is from employee performance records. The previous performance records

can be used to predict the right talent for the right job. The records can be analyzed using Data Mining method in order to find out the patterns and rules related to employee performance. The generated rules and patterns can perform a prediction model related to talent performance. These processes involve HR activities that need to be integrated into an effective system[47]. The decision support system can be used to forecast the right talent for the right job at the right time. In HRM, among the top current and future talent management challenges are developing existing talent; forecasting talent needs; attracting and retaining the right leadership talent; engaging talent; identifying existing talent; attracting and retaining the right leadership and key contributor; deploying existing talent; lack of leadership capability at senior levels and ensuring a diverse talent pool [3]. In this study, we focus one of the talent management challenges to identify the existing talent by predicting their performance.

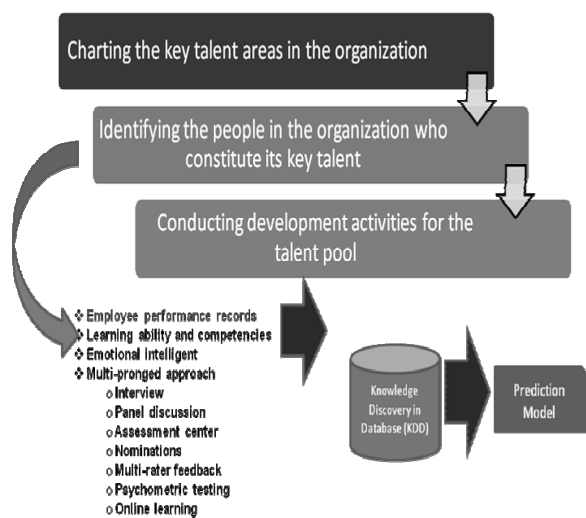


Fig. 1 Talent Management Process

V. DATA MINING FOR TALENT MANAGEMENT

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 discussed before, Data mining method also implemented in HR problem domains and most of researches in HR problems domain are focused on personnel selection task and few apply in other activities such as planning, training, managing talent and etc. Recently, the new demands and the increased visibility of HR management, HRM seeks a strategic role by revolving to Data Mining methods[1]. This can be done 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 evaluation, counseling techniques and performance management for effective and efficient decisions [1]. The tasks related to managing talent are summarized in Fig. 2.

For the example, by using prediction and classification techniques we can produce the percentage accuracy in

performance, predict employee's behavior and attitude, predicting performance progress, identify the best profile for different category of employee and etc. The matching of Data mining problems and talent management needs is very important, in a way to determine the suitable Data Mining techniques. In this study, we focus on identifying the patterns that relate to the talent by using prediction technique. This Data mining technique will produce prediction rules on how to identify talent for the right job.

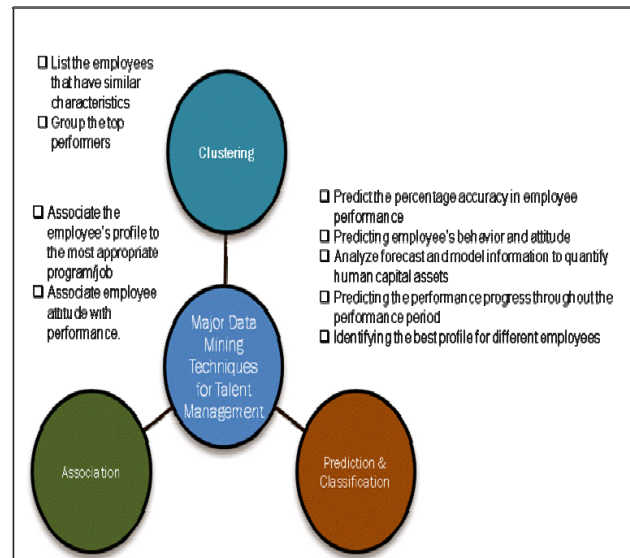


Fig. 2 Data Mining for Talent Management

In order to produce relevant Data Mining results that suitable to talent management tasks, there are several process in Data mining process should be followed. Fig. 3 gives us an overview of Data Mining task.

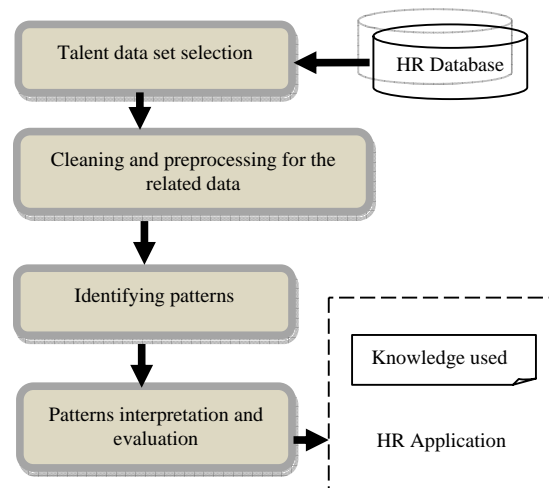


Fig. 3 Data Mining Process for Talent Management Tasks

According to Fig. 3, the first step is getting the main data set for Data mining. 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. Besides that, it should be possible to transform the generated patterns into actionable plans that are likely to help the 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 talent management tasks.

A. Factors Related to Talent Forecasting

In this study, Data mining process will select data from the related human resources databases and transform it into useful knowledge. Data set selection process involve a study about the related competencies factors which can be identified from the actual data or databases. This is very important task in order to determine the significant attributes. Each employee has different competencies factors and that are depends on the type of their work. In this study we are focus on academician factors which is from Malaysian higher institutions. Fig. 4 shows some of the related factors for academic competencies. This involves process to determine the standard individual factors. Individual factors contains three main aspects; knowledge and expertise; management skill; and personal characteristics[48]. The academicians can also uses these individual factors which can be represented through academic context. Basically, as academician, they have to

- Professional qualification* – this is a main activity for academicians, which are related to knowledge and expertise aspect. Each of academicians needs to focus their works on teaching, supervising, doing research and publication, organize and attend conferences and involve themselves in student activities. All these will contribute knowledge and expertise in their field.
- Training* – an academician should involve in any related training activities because these activities will upgrade their knowledge, management skill and coinciding can also contribute to their personal characteristics.
- Administrative and contribution to university* – usually in Malaysian higher institutions, most of the administration positions are occupied by the academicians. These positions involve a lot of decision making process, which are considered as a part of management skill and at the same time they will contribute to the achievement of university.
- Social obligation* – this activity usually necessitate something which are not related to their main job such as involve in any internal or external committees. The social obligation to the community will contribute to the development of university and country itself.
- Award and appreciation* – sometime an academician received honor for an achievement from their universities or community of interests towards their contributions. These are quite important in order to motivate them in their work and to develop the relationship between academicians with people coming from the outside.

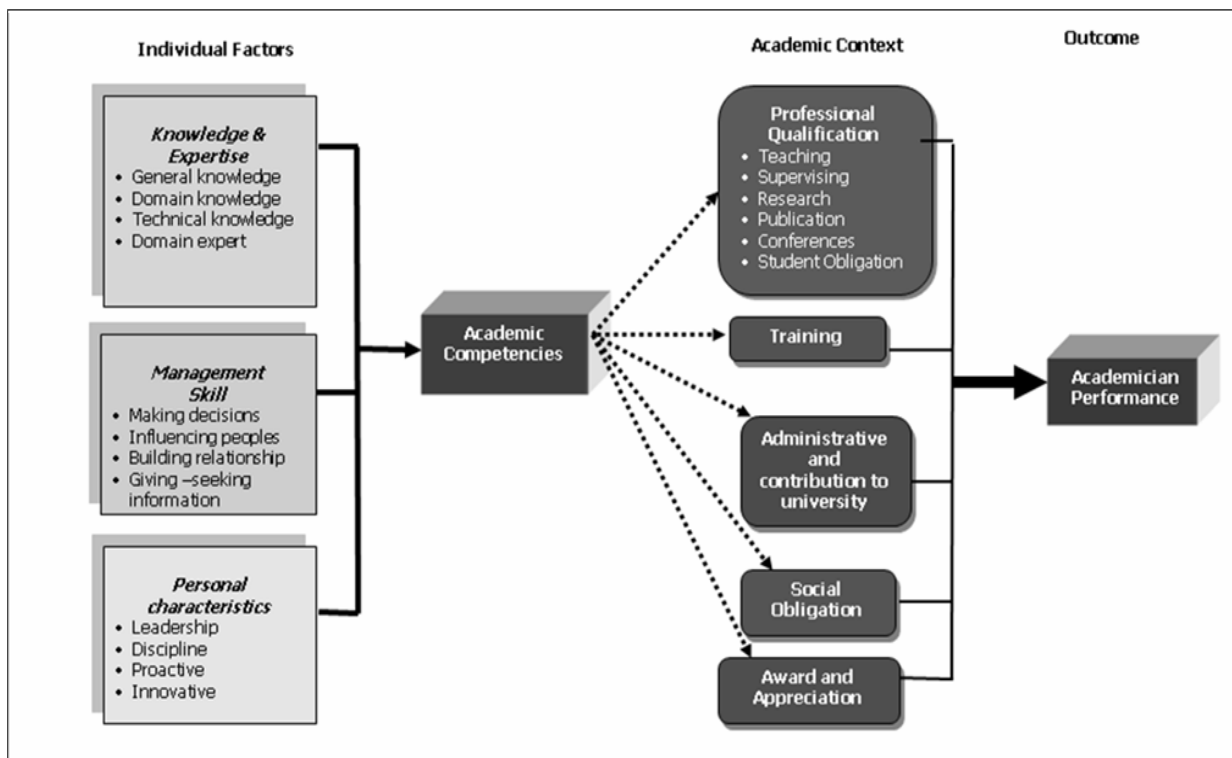


Fig. 4 Academic Talent Factors

In order to achieve academicians performance as well as their decision [17]. Besides that, the Decision Tree outcome of the performance evaluation process, academicians are demanded to prepare themselves with all this factors. Data selection is a beginning step in Data mining process, this step is a process to study attributes or parameters for each of the factors that could be represented as a group of data set.

B. Potential Data Mining Techniques

Data mining technique is the best linear unbiased estimator, decision tree and neural network is found useful in developing predictive models in many fields [28]. From the literature study, we list some of the characteristics for the popular intelligent techniques used in prediction application are listed in Table V.

TABLE V
POTENTIAL DATA MINING TECHNIQUES FOR PERFORMANCE PREDICTION IN HR APPLICATION

Data Mining Techniques	Characteristics
Artificial Neural Network(ANN)	Provide a variety of powerful tools for optimization, function approximation, pattern classification and modeling
Decision Tree	<ol style="list-style-type: none"> 1. Usually used for classification and prediction tasks. 2. Produces a model which may represent interpretable rules or logic statement and more suitable for predicting categorical outcomes 3. Non-parametric: suited to capturing an functional form relating independent and dependent variables 4. Easy to interpret, computationally inexpensive and capable to dealing with noisy data. Model prediction is explainable to the model user. 5. Automatic interaction detection – find quickly significant high-order interactions 6. More informative outputs
Rough Set Theory	Can explain and explore how the decision was made with simple, understandable, and useful rules in the presence or uncertainty and vagueness
Fuzzy Clustering	More general than conventional methods Used to construct relations among data and to transform relations into knowledge
Support Vector Machine (SVM)	Can be used for prediction as well as classification and provide a compact description of the learned model and highly accurate.

The techniques are also the potential techniques for prediction in HR applications. Some of the techniques are very well known among the researchers and they have proven as good prediction techniques. But in many cases it depends on the type of problems that they have. Table 5 lists some of the Data Mining prediction techniques that also suitable for the human resource data especially in managing talent such as Artificial Neural Network, Decision Tree, Rough Set Theory, Fuzzy Clustering and Support Vector Machine. In actual fact, Decision Tree has the advantages of easy interpretation and understanding for decision makers to compare with their domain knowledge for validation and

can analyze various data without requiring the assumptions about the underlying distribution [10]. Recently, the hybrid methodology is another alternative to advance the capabilities of the application and to produce better results. The technique can also be hybrid with other techniques such as Artificial Neural Network (ANN), Knowledge-Based System, fuzzy logic, software agent and etc. In fact, some studies are needed to evaluate which technique is the best technique for human resource data, especially to handle issues in talent management. In that case, HR data that relate to talent such as age, position, race, gender, evaluation marks and etc. can be tested to several Data mining techniques in a way to find out the best technique. For that reasons, for future works we attempt to hybrid the suitable Data mining technique and knowledge-based system (KBS) approach for the system application. This integration can allow users to interact with the system and get the forecasting results and explaining about the decision made by the knowledge discovered from the database.

VI. HR SYSTEM ARCHITECTURE FOR TALENT FORECASTING

As a result from the literature study and the possibility to implement IDSS technology in human resource problem domains, we suggest the potential HR system architecture that uses past experience knowledge shown in Fig. 5. Basically, HR system architecture contains four main components:

- 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. In this study, we will use HR databases that relate to talent performance such as personnel information, performance evaluation data and other related databases. The relevant data will be transformed into useful knowledge as predictive model, generated rules or classification of patterns. Decision tree and fuzzy logic techniques are among the potential intelligent techniques in this architecture.
- Model Management System* is a model base system that can store the constructed model, existing simulation model and related models that can be used in appropriate decision making process. In fact, before using talent performance predictive model, the model must be evaluated and tested in model analysis and evaluation process.
- Knowledge Base System (KBS)* contains a set of facts and rules. In the suggested architecture for HR application, KBS will contain information about talent patterns, association rules related to the potential talent in future and any related facts and rules. The rules and pattern will be evaluated and interpreted by the HR domain experts.
- 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 potential talent with some reasons, and suggest the possible tasks for them.

Vol.3, No.2, 2009 of the techniques can be hybrid with other techniques which can produce better decision making results. Finally, the ability to continuously change and obtain new understanding is the power of HR application, and this can be the HR applications of future work.

This HR system architecture embedded KDD techniques with other DSS components such as knowledge-base and model-base. In this study, the suggested architecture is focusing on prediction purposes which are used to predict academician future performance. On the other hand, this architecture can also be applied to other Data Mining tasks such as association, classification and clustering in talent management tasks as mentioned in Fig. 2.

VII. CONCLUSION

This article has described the significance of study, literature review on HR applications; prediction and intelligent techniques used; talent management concepts; related research in HRM known as HR application; intelligent techniques used in HR applications; the overview about KDD or Data Mining; and potential intelligent techniques for prediction. From the literature study, most researchers have discussed HR applications from different categories. However, there should be more HR applications that use intelligent techniques applied to different problem domains in HRM field research, in order to broaden our horizon of academic and practice work on HR applications. Due to these reasons, we propose HR system architecture for talent performance prediction based on past experience data; and it is developed towards problem-oriented domain. For future work, the data in HR can be tested using some of the prediction techniques to find out the suitable and best techniques, especially in HR problem domains. Besides

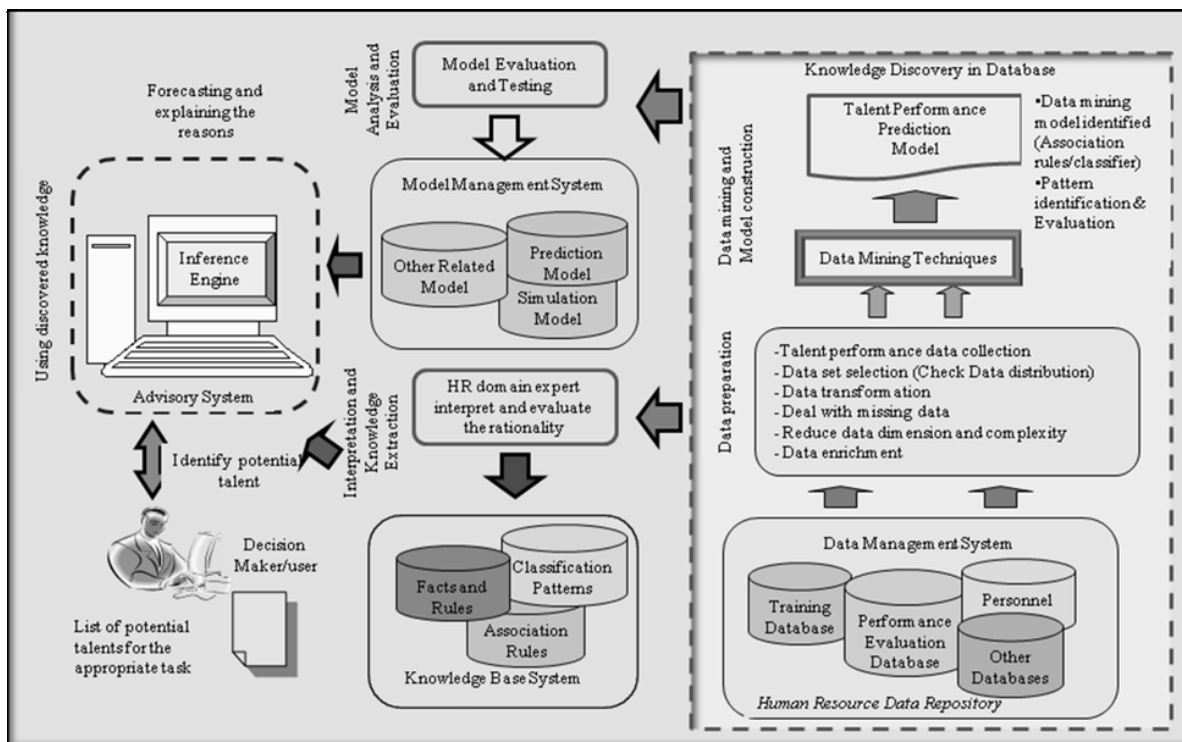


Fig. 5 Suggested HR System Architecture for Talent Forecasting

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