

# Intelligent human resources systems in the information technology era

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## Abstract

Effective human resource management facilitates the success of an organization and the progress of a society. We describe an evolutionary computer model that simulates different modes of interaction between people and their environment. A two-level genotype-phenotype structure is used to represent the characteristics of an individual. The environment is modelled as a two-dimensional array of regions in which each region is characterized by a set of regional features and organizational culture (e.g., leadership strategies). Human resource decisions are subject to limitations, because they always depend on human knowledge, judgment and preference. Decision support applications can be used to provide fair and consistent decisions, besides to improve the effectiveness of decision making processes. This study consists of three parts; the first part is to understand the IDSS concepts, applications and related research in human resources decision making application known as HR DSS. The second part is to identify the potential intelligent techniques that can be used in HR DSS application, and the third part is to suggest the HR DSS framework that is related to human resource decisions. Finally, the paper proposed the HR DSS framework and the potential intelligent techniques that can be used to develop the IDSS application in any phases of decision making processes.

*Keywords:* human resource decision support, human resource management systems, human resource strategy

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## 1 Introduction

At this point, information technology (IT) can play an essential role, providing the tools for the modeling of an integrated system. However, IT is not enough to convert information into knowledge. Appropriate qualitative and quantitative models must be added to analyze the information and produce outputs that support the decision procedure [1]. Operational research (OR) can provide these models. In the rapidly changing knowledge-based economy, organizations that manage knowledge effectively survive and develop through the years. Knowledge is acquired, retrieved and created by people [2]. Thus, high quality human resources (HR) is the determinant factor that can lead to a competitive and inimitable advantage. In that respect, both HR academics and HR professionals have turned their focus to the strategic role of human resource management (HRM) [3]. In order HRM to perform this role, individual HR practices should be engaged in a way to build a coherent HRM system that supports decision making at corporate level.

The vast majority of human beings are genetically distinctive from each other. Furthermore, as we grow physically and develop mentally, each of us becomes unique in the world. There is no single mechanism that can underlie all human behaviour [4]. In some cases, people want to conform, while in others they want to be

different. The immediate decisions made by individuals are sometimes unpredictable. The diversity of human beings makes human resource management more of an art than a science. The common approach for studying human resource management problems has involved statistical measurements. Individual behavior has been totally neglected. However, under certain circumstances, a small number of people can cause a system to change drastically. That is, a system might respond unexpectedly when slight turbulence is introduced. In the real world, human resource management problems are extremely complex [5-8]. A fair measure of fitness for people is a very subjective and controversial notion. As we know, an individual might respond differently to the same things at different times or places, or with different people. Schelling wrote, "People are responding to an environment that consists of other people responding to their environment, which consists of people responding to an environment of yet other people's responses."

It is difficult to predict what behavior will emerge from such intensive human interactions. As a consequence, it is not feasible to conduct experiments on people in various environments and with different management strategies, and to study the effect of altering environments and management strategies on human satisfaction. It is becoming increasingly clear that the HR system is one important component that can help an organization become more

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effective and achieve a competitive advantage. However, a larger question remains unanswered: How does HRM contribute to firm performance? Disappointedly, this question has not been answered until now, thus, the relationship between HRM and organizational performance is called a 'black box' problem. Much of the debate over the relationships between HRM and organizational performance has been based on the distinction between two views typically referred to as 'best practice' and 'best fit' [9-11]. The best practice perspective identifies a set of HR practices that is associated with improved performance in all types of organization and, by implication, for all kinds of employees. The best fit approach argues that performance is maximized when the HR policies adopted are consistent with the business strategy. Both of these perspectives assume that the HR policies adopted will be implemented as intended and have the same effect on all employees who work for the organization. Various authors have questioned these assumptions because of the differences between intended HR policies and employees' experience, because complex organizations have different types of employees who may be managed successfully through diverse sets of HR policies.

This paper presents a new modeling platform for human resource management using computer simulation and evolutionary computational techniques. Our objective was to construct a computer model that served as a tool for investigating the phenomena that could occur in a human resource management system. In this model, individual behavior was taken into account. Through computer simulation, we were allowed to perform a variety of experiments in a feasible manner. The application of evolutionary computational techniques to solve real-world problems has received more attention in recent years. Our model, an artificial world simulation system, abstracts the above essential features of human resource management. Likewise, the goal of our model is not to draw every possible aspect of human resource management into the system and then try to optimize it. Instead, it should be pictured as a large relational model better thought of, like an evolutionary ecosystem, as an existential game. Self-organizing dynamics are the essence of this model. The criterion for the success of this model is reproduction of the essential features of human resource management. If we generate a new phenomenon that is unknown, then either something new has been discovered that could come into effect under appropriate circumstances, or there is some universal constraint that is operative that quenches this effect. However, we cannot describe all of the human resource management features in great detail. Simplifying assumptions and compromises are thus unavoidable.

## 2 Related work

Human resources refers to a production capacity in the human body, it is reflected in workers who, as measured

by the quantity and quality of resources of laborers, it play a productive role in economic, the national income growth. It is the most active labor factor of production is the most active, create and accumulate material capital, development and utilization of natural resources, and promote the development of national economy, and promote the social transformation of infinite power [12]. Rural human resources refers to the total rural population has a range of physical and mental, it includes two aspects of quality and quantity, the total is the product of the two. The number of rural human resources, refers to the number of the population of the rural labor range; the quality of rural human resources, rural human resources refers to has the physique, intelligence, knowledge, skills, generally reflected in the rural labor population fitness level and culture level [13,14].

According to the resource – based view of the firm [15], the basis for competitive advantage lies primarily in the resources it possesses. Even though this point of view has received much criticism, it is widely accepted that the way an organization manages its own resources can contribute to a superior or inferior performance. Considering also the fact that HR are an organization's most valuable asset, HRM can indeed plays a significant role to the excellence of a firm. In that respect, the concept of strategic HRM (SHRM) has been developed. SHRM focuses on organizational performance rather than individual performance. It also emphasizes the role of HRM systems rather than individual HR practices in isolation as solutions to business problems [16]. Before proceeding with the concept of this study, it is important to remind the definition of a "system". It is a set of interacting or interdependent entities, each one being described by a number of characteristics, forming an integrated whole that is in constant communication with the external environment. One of the main features of a system is the relationships among the entities. That differentiates a system from a sum / group of entities. So, in particular, we cannot consider a HRM system only as a sum of unrelated HR practices. The interactions among practices lead to what Ichniowski et al. [17] declared: The basic assumption is that the effectiveness of any practice depends on the other practices in place. If all of the practices fit into a coherent system, the effect of that system on performance should be greater than the sum of the individual effects from each practice alone.

According to Tannenbaum [18], HRIS is a systematic procedure to acquire, store, manipulate, analyze, retrieve, and distribute information about an organization's HR. Usually, HRIS is restricted to a transaction processing or record-keeping role. Even though the above mentioned tasks are included in the responsibilities of a HRIS, the important strategic role is neglected. HRIS support an organization's operations in two ways, by facilitating the daily tasks of the personnel and by providing useful outcomes to decision makers.

### 3 The proposed artificial human resource system

With our understanding of the human resource structure, we built an artificial human resource system that uses an agent-based simulation method to model and simulate human resource dynamics in PM. Using the basic elements

that comprise the human resource system, employees are modeled as the main agents. Each agent has its own properties, such as age, gender, working experience, grade, and so on. Accordingly, each agent has five types of behaviors: recruitment, retirement, grade promotion, position promotion, and leaving, which is shown in Figure 1.

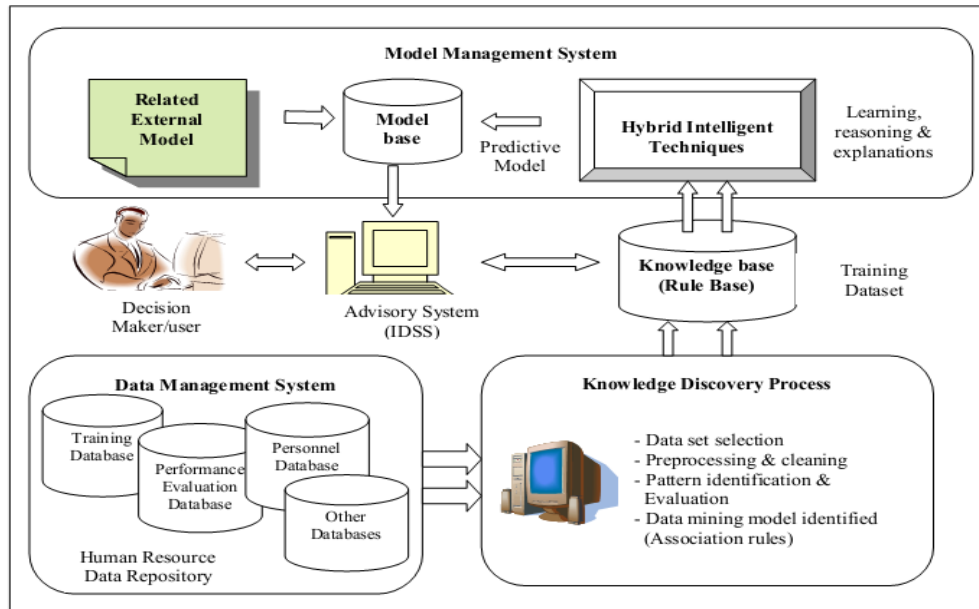


FIGURE 1 The proposed HR system

#### 3.1 SYSTEM LEVEL

Personnel selection is one of the most critical functions of HRM. Apart from the straightforward fact that an organization should be staffed with the right people, a wrong hiring decision can lead to serious consequences. This is more obvious at high level managerial positions (e.g. director of department) where the decision may drive the future overall performance. Extensive literature can be found on selection methods, their validity and reliability [26]. Recently, endeavors from operations research and decision support fields strived to highlight the complexity of the selection function [8,9]. In general, the problem of hiring or promoting the right person should be considered in its multidimensional and incorporate all these parameters that influence the final decision.

An important factor that is linked to long term success and growth of an organization is its capacity to evaluate employees' performance and in addition the capacity to use the relevant information in order to improve employees' as well as organizational performance. Employee appraisal should not be conducted only against the outputs / results but also against behaviors and attitudes come into practice. Employee appraisal is the backbone of the concept called performance management. The latter links the main functions of HRM, aiming at improving the performance of a firm as a whole.

Compensation system has become more and more a really complicated issue for employers. It is not only to determine the base salary, considering the years of experience. Many other rewards do motivate and retain employees and might determine even the organizational performance. Compensation strategy can be used as a motivation and satisfaction incentive and as a recruitment and retain tool. In parallel, it is the mirror of the values and beliefs that form the organizational culture.

HR development (HRD) is a wider concept than the one of HR training. Training is mainly applied to improve the technical skills that cover short term needs of an organization. It is essential for workers in industry production business environments. Development includes training but is considered as a more strategic aspect. It refers basically to the key personnel of the organization. HRD facilitates the development of core capabilities that are critical in developing and maintaining sustained competitive advantage [14]. Core capabilities include positive behavior and ability to adapt to a rapidly changing environment and rational decision making, creativity development, motivation, human behavior understanding skills. The above mentioned are some examples of what is called management development [12], i.e., the development of specific capabilities of the future leaders of an organization.

3.2 APPLICATION LEVEL

Related enterprises and organizations should adjust their roles, to change service providers play by the traditional role of the manager's role, but also to change the location of mechanical, routine of their own, to play the initiative for the rural human resources to provide services. Management Department of rural human resource in its basic functions of the case, to make the management and practice to coordinate, and vigorously in practice, of course, said the enthusiasm to help the enterprises to mobilize human resources from the fundamental, to serve the development of enterprises.

Operation of the system, the rural human resources system maintenance work can take the relevant departments within the system of mutual cooperation; reduce the manpower, financial expenditure. Of course, with the overall quality of rural human resource enhancement, grasp the computer level, also can let them finish related work, so as to mobilize the enthusiasm of the migrant workers, the enterprise management personnel, also can liberate part of the labor force, to spend more time and energy into the development strategy of the enterprise. Migrant workers, give full play to the spirit of master, which is shown in Figure 2.

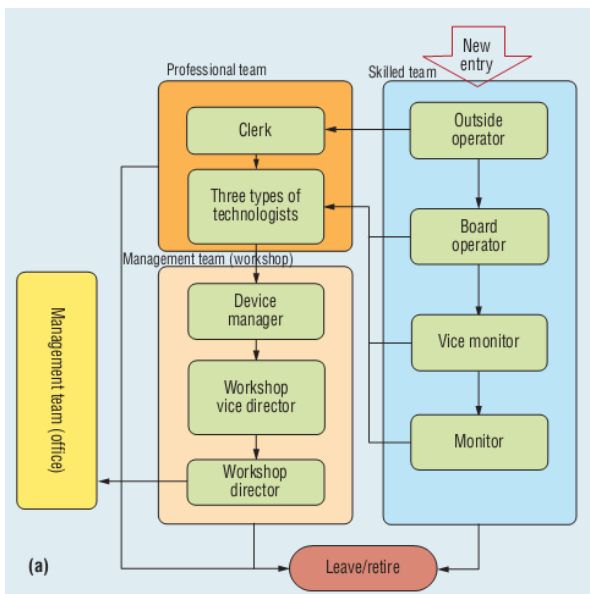


FIGURE 2 Potential employee career paths.

Enterprise organization should according to the characteristics of the rural human resources present and characteristic of the enterprise, make the rural human resources development management system continuous improvement system function, make the platform more open, more flexibility and innovation ability value, increasing rural human resource management information system and the outside resources embedded together, so as to enhance the efficiency, reduce the cost of.

Of course, with the maturity and application of the system of rural human resources, a bridge of communication with management system to complete between managers and workers, this time facing managers rely too much on the computer and the opportunity to meet the workers reduced risk, as a communication tool, we don't want is highly dependent on the human resource management system on how to improve the quality and reduce labor, enhance enterprise mission. At the same time, with the development of network technology, as well as to the rural human resources system to recognize and its operation process standardization, in particular with the advanced idea promotion, how to make the rural human resources information system more flexible, excellent price, more humane and the function is more perfect, for the design of the HRIS producers is grim the challenge, for enterprises using the HRIS system is a very real problem.

3.3 RELATION BETWEEN COMPONENTS

During personnel selection process, information on technical skills, abilities, professional experience and even personality is gathered through either self-report tests or interviews, methods that does not picture the future performance. For instance, successful management of a project team in a previous workplace does not ensure the success in managing a similar team in this organization. Selection process can only be a predictor of performance. Thus, the objective is to design as better a predictive system as possible. Employee appraisal is the phase that confirms the application of particular competences, based on performance standards and demands of the specific position. Employee appraisal can comprise a critical tool monitoring the relevance of the selection process. For example, following a specific methodology for the selection of an IT manager, the organization leads to the choice of a candidate with many years of experience in similar position, with strong academic background and with developed interpersonal, team management and creativity skills, among others. In case employee appraisal reveals behaviors and performance results that do not correspond to the initial evaluation (during selection process), there are several issues to be considered. Either the wrong person for the organization and the position was selected or external factors (e.g. the current situation of the market and the economy) affected the performance negatively or the standards and the criteria of the appraisal had not been set correctly.

The first one of the above mentioned potential reasons is closely related to the selection process. Wrong selection methods, wrong selection criteria or bad choice of criteria weights can result in wrong decisions. Moreover, inadequate evaluators/interviewers usually affect the whole process. Thus, a well-designed employee appraisal, can give feedback, through learning mechanisms, to the



selection process in order that the right people are hired, placed and promoted in the right positions.

There are two dominant compensation strategies. The first one uses academic titles and professional experience as the only decision criteria in order to set the level and type of salary. The other follows the concept of linking each job position with a respective wage. These two practices, bearing in mind that high level positions are occupied by experienced personnel, tend to become identical. As an employee acquires more experience, he occupies higher positions and receives higher wage. With these approaches, two employees, just having the same years of experience and the same studies, get equal pay. Similarly, two employees, just being at the same level of hierarchy, get equal pay. The fact that one may have achieved the targets set in comparison to the other is not taken into consideration in the compensation process. In addition, one may add value to the organization in financial (e.g. contribution to sales increase, cost reduction) or social terms (contribution to colleagues motivation, creativity behavior) and not be rewarded for this. The above mentioned situations can lead to injustice feelings and negative attitudes. For these reasons, compensation should be associated to a well-designed, objective employee appraisal process so that a good organizational environment to be secured. In parallel, compensation strategy can play a motivational role to performance improvement. That means a two way relationship between employee appraisal and compensation.

### 3.4 CONFIGURATION OF HRM SYSTEM

As mentioned in a previous section, HRD plays a dual, both tactical and strategic role, targeting on the one hand the coverage of specific short term technical needs of an organization (mainly through technical training) and on the other hand the management and development of potential future leaders and their careers. The decisions that should be made refer to when, on what and who to be trained. The answer can be supported by the employee appraisal process. Appraising employees, it is possible to sort them into categories, each one to be linked to particular training and development programs or even to create individual programs for each one of them. Giving an example, the appraisal of a programmer/developer can reveal weaknesses on specific features of performance (e.g. inefficiency on programming techniques). A personal training program can be designed using material relevant to these weaknesses. Similarly, a positive output of an appraisal of a programmer can be an indication for further development of the technical skills and in parallel a guide for future evolution into higher hierarchical levels (e.g. IT manager). Thus, an appropriate development program must be designed, with all necessary technical and managerial knowledge to be provided.

In general, there is a two way relationship between training/development and employee appraisal process. Theoretically, training output advances an improved

future performance for the trainee. This indeed must be proved in practice. An effective training can be confirmed through the next employee appraisal. If this appraisal is positive, it could be at a certain degree due to the applied training program. If not, it is possible that the training practice should be redesigned. In other words, a learning mechanism is essential, which allows the respective HR practices to be adjusted dynamically.

Training can be closely linked to personnel selection practice. It is common, due to limited time or budget or because of the inadequacy of the recruitment phase to attract high quality candidates, the final selection decision not to be the ideal one. In that case, a gap analysis between the required and the available competences of the employee should be conducted so that the latter to be trained accordingly. Thus, training and development practice should receive feedback from selection process and provide the necessary tools to close a potential competence shortage.

## 4 Discussions and suggestions

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. HR DSS as a part of Intelligent System applications play the same roles to assist decision making process. In addition, applications and intelligent techniques of HR DSS need a lot of attention and efforts, from both academicians and practitioners. From this study, we can see the potential of HR DSS 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 the effort 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 DSS applications for human resource decision. Secondly, researchers agree that hybrid intelligent techniques are the best approach to support decision making especially in reasoning and learning. We have embedded the HR DSS framework using hybrid techniques i.e., Knowledge-based system and Artificial Neural Network (ANN) approaches. Thirdly, the academicians and practitioners should continuously improve the core knowledge of effective HR DSS. This process can be enhanced by continuous development in web-enable tools, wireless protocol and group decision support system, which can expand the interactivities and perverseness decision support technologies. In our system development, we plan to use this technology to expand the capabilities of the application.

## 5 Conclusions

Effective human resource management facilitates the success of an organization and the progress of a society. We describe an evolutionary computer model that simu-

lates different modes of interaction between people and their environment. A two-level genotype-phenotype structure is used to represent the characteristics of an individual. The environment is modelled as a two-dimensional array of regions in which each region is characterized by a set of regional features and organizational culture (e.g., leadership strategies). Human resource decisions are subject to limitations, because they always depend on human knowledge, judgement and preference. Decision support applications can be used to provide fair and consistent decisions, besides to improve the effectiveness of decision

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