

Knowledge management component in managing human resources for enterprises

Li Zhang · Hong Wang · Xiongfei Cao ·
Xin Wang · Kun Zhao

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Abstract Both human resources and knowledge are valuable assets for enterprises; therefore, effective management of these assets becomes inevitably critical for business success. While human resource management systems have been a research topic for more than two decades, knowledge management systems applied to human resource management are relatively new to both academia and industry. This study examines the use of knowledge management in a business environment such as human resource management. The evolution of information systems and information processing in the human resource management domain is presented, and a knowledge-based decision support system for human resource management is proposed.

Keywords Human resource management · Knowledge management · Intelligent information processing · Decision support system

L. Zhang
School of Economics and Management, Beijing Jiaotong University, Beijing 100044, China

H. Wang (✉)
School of Business and Economics, North Carolina A&T State University, Greensboro, NC 27411, USA
e-mail: hwang@ncat.edu

H. Wang · K. Zhao
School of Information, Yunnan University of Finance and Economics, Kunming 650221, China

X. Cao
School of Management, University of Science and Technology of China, Hefei 230026, China

X. Wang
Transportation Management College, Dalian Maritime University, Dalian 116026, China

1 Introduction

Ever since the computer technology was developed and applied to business operations, business world had never been the same. Today, widespread use of the Internet in business applications inspires drastic changes in business world [6, 20, 44]. Early applications of computers basically focused on routine tasks such as in business transactions, accounting procedures, and inventory management [1, 33]. More advanced information technologies (IT) have been used in decision making process, knowledge management, business intelligence, expert systems, among others. The impact of IT on today's business is evident in at least two ways: (1) improvements in efficiency, effectiveness, and productivity; and (2) a transition to new practices in the way people create, organize, manage, and operate an enterprise [68]. As we all know, both knowledge and human resources are valuable assets for enterprises, and therefore, effective management of those assets becomes inevitably critical for business success. While human resource management systems have been a research topic for more than two decades, knowledge management systems are relatively new to both academia and industry. This study examines the use of knowledge management in a business environment such as human resource management. The evolution of information systems and information processing in the human resource management domain is presented, and a decision support system for human resource management is proposed.

1.1 Human resource management

Human resource management (HRM) practices have a long history. Like many early business applications of computer systems, computerized human resource management

focused on low level, routine tasks such as recruiting, record keeping, rewards and wages before the mid-1980s [52]. In 1984, Fombrun et al. [19] became one of the first researchers who developed the concept of strategic human resource management (SHRM) and started linking HRM functions with the overall organizational strategy. Unlike the early age HRM systems, SHRM mainly focuses on activities involving HR planning and HR policies, such as internal career opportunities, training systems, performance appraisals, profit-sharing plans, employment security, voice mechanisms, decision making, and job definition [42, 50, 52]. SHRM made human resource management a more meaningful concept. In addition, SHRM perceives people as critical organizational investments, strategic resources and competitive advantages that determine the success and failure of an organization [2, 3, 18, 34, 37, 43, 57]. Therefore, human resource management has transitioned from task-oriented HRM to people-oriented SHRM. Due to large amount of information processed in this new type of human resource management, information technology inevitably plays an important role in the HRM domain [53].

The evidence of human resource management systems evolving from managing fundamental routine tasks such as recruiting, record keeping, rewards and wages to more advanced functions such as employee training systems, performance appraisals, profit-sharing plans, employment security has been witnessed in the last several decades. The use of the Internet technology and the emerging concept of business intelligence and knowledge management makes the ways in which information systems are used and information is processed for human resource management dramatically improved over the last decade [10, 14, 45, 54, 60, 62–64, 72]. In the mid-1990s, the Internet became available for business operations and the concept of e-business was born. Using Internet technology or information technology in general to run business functions, including human resource management, is widely accepted as electronic business (e-business) [22, 26]. Meanwhile, another related concept called e-HRM or e-HR was created using the Internet and other IT technologies in managing human resources. Ulrich [56, 57] is one of many early e-HR advocates. Straus et al. [53] researched several impacts of Internet technologies on managing human resources and concluded that the “advances in communication technologies and organizational form suggest the re-evaluation of traditional personnel practices”. IT has been believed by many practitioners and researchers to be able to create competitive advantages for businesses [11, 25], however, Powell and Dent-Micallef [45] argued that IT alone has not produced competitive advantages, but using IT to leverage intangible, complementary human and business resources has helped organizations gain

competitive advantages. Nonetheless, proper application of IT in HRM has been proved to be an important way helping business succeed.

1.2 Knowledge and knowledge management

In the last decade or so, increasing attention has been paid to the knowledge management issues in organizations. Efficient knowledge management leads to superior business performance such as organizational creativity, operational effectiveness, and quality of products and service [4, 8, 27, 36, 40, 73]. Generally speaking, knowledge can be divided into two categories, tacit knowledge or undocumented knowledge and explicit knowledge or documented knowledge. Even though it is closely related to data and information, knowledge is different from data and information and cannot be interchangeable with data and information [13]. Data is about raw facts and information is about data being processed in various meaningful ways. Knowledge is believed to be at higher level than data and information. Knowledge is about concepts, experiences, problem solutions, business practices, etc. In decision-making processes, decision makers require a combination of different types of data, information, and knowledge. Multiple examples demonstrate that many of the world’s most successful organizations are those that are best at managing their knowledge [41]. The fact that more and more decisions are made using limited amount of time and large quantity of information makes a knowledge management system an indispensable component of decision support systems [15].

Knowledge management is the process of acquiring, processing, codifying, storing, distributing and applying knowledge [35, 36, 48, 49]. Since knowledge is created by professionals from different functional areas and will be applied to solve problems in those areas in enterprises, knowledge management normally is used by different business functions or a multifunctional system. By using computer systems and networks, knowledge management can be a stand-alone system that provides services to other systems in different business functions such as accounting, marketing, finance, procurement, as well as human resource management.

2 System development

2.1 Human resource management system design issues

In a research work we have done in 2006, we used a Chinese enterprise example to explore issues in designing human resource management systems [78]. We summarize some of them in [Appendix](#). A set of general criteria should be followed below,

1. Put forward the managerial principle to enable the managers to grasp the essence of HRM.
2. Carry out goal management to scout and control the whole process and enable each department/each position to reach its set goal.
3. Optimize managerial procedure to ensure the shortest procedure, the mightiest functions, the lowest cost, and simplicity of operation. It also makes each job go smoothly according to the procedures.
4. Regulations should be clear, reasonable, scientific, applicable, and ensuring normalized HRM.
5. Develop software modules out of normalized managerial procedures.

To ensure the HRM system to be developed successfully, we utilize the classical system development life cycle (SDLC) to specify the steps to develop the HRM system [66]. They are summarized in Fig. 1,

2.2 Decision support system and its applications in human resource management

Decision support system (DSS) is a concept as well as a type of information systems. It was developed in 1970s. It is believed that Keen, Morton, Sprague, and Whinston were among the pioneers who developed the concept and the academic discipline of decision support systems [23]. Decision support systems utilize a variety of related information, decision criteria or rules, and decision models to help

people make decisions [17]. They do not make decisions for people instead provide necessary support for people to better understand the problems in hands and to find a solution for the problems. The need for decision support systems originated from the growth of ever increasing complexity of modern decision problems [58, 59]. The birth of model-oriented DSS marks the beginning of information systems specifically designed for top management [23]. Great progress has been made in both DSS theory and practice since the 1980s. Through integration with networking technology, artificial intelligence, and enterprise systems, various types of DSS, such as distributed decision support systems (DDSS), intelligent decision support systems (IDSS), and integrated decision support systems (IDSS), appeared [9, 16, 21, 38, 67, 69–71, 76, 77]. In the mid-1990s, web-based DSS also became an active research field.

Decision support systems have been designed to solve many business problems including human resource management problems. As aforementioned, human resource management problems are complex business problems. HR planning, position design and analyses, selection of recruits, evaluation of talents, training and development of HR, staff performance management, wage and welfare management, long-term senior talents stimulation plan, HR policy development, this list can go on and on. As other factors kick in such as globalized human resource, globalized business environment, young generation of workforces in Generation Y, virtual organizations [55], telecommuting, the requirements for human resource managers to make any decision today become extremely difficult to meet. It is not only because more time to be spent, more factors to be considered but also because more intelligence and more knowledge are needed to make decisions.

Most of decision support systems utilize modeling techniques because models provide a simplified representation of a decision situation that is understandable to a decision maker [46, 51]. There are a variety of models being used in decision support systems that include quantitative models such as algebraic and differential equation models, various decision analysis tools including analytical hierarchy processes, decision matrices and decision trees, multi-attribute and multi-criteria models, forecasting models, network and optimization models, Monte Carlo and discrete event simulation models, and quantitative behavioral models for multi-agent simulations [7, 24, 28–32, 65, 75, 79]. Particle Swarm Optimization (PSO), among other more complex decision techniques, has been used to build DSS [5, 47, 61].

In our recent study of decision support systems applied to human resource management, we constructed a decision support system that helps managers manage employee turnover risks [62]. The DSS system utilizes data warehouses, knowledge warehouses, data analysis, data-mining, analytic systems and system interfaces. It has eight

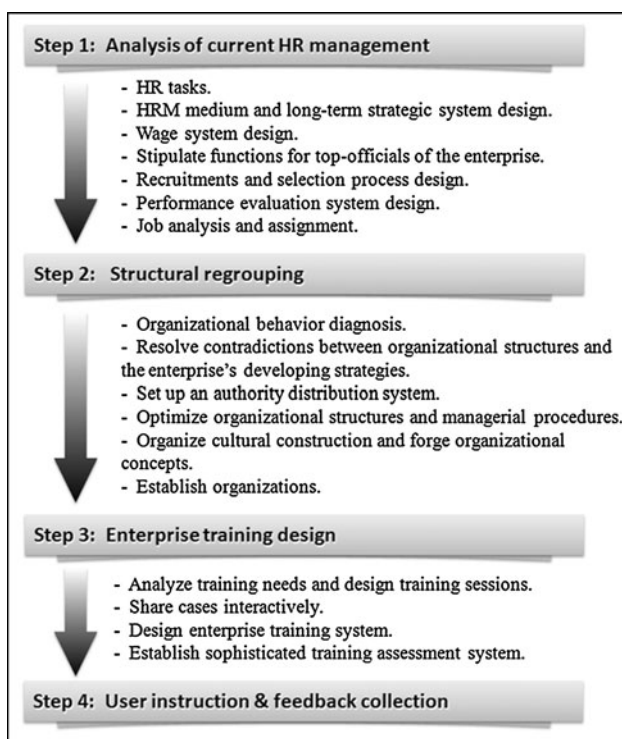


Fig. 1 Human resource management system development model

subsystems or components (see Table 1) and the relationship among these components is given in Fig. 2.

2.3 Knowledge management component of the DSS

The decision support system for employee turnover risk management is a loose-coupled system. According to the coordination theory and cooperative system concept [39], we designed three types of coordination in the system: (1)

The coordination between subsystems, including coordination of shared resources and problem solutions, is accomplished by an analytic system (AS); (2) The coordination of shared resources, including both the coordination of diversity of time, space and the combination of resources, is based on the connections between those resources; and (3) The coordination of problem solutions refers to the discussion between subsystems in the attempt to achieve one optimized solution.

Table 1 Components of DSS for employee turnover risk management

Type	Contents and functions
Platforms	Include hardware platforms (i.e. internet systems), computers, memory systems, fire walls, and software platforms (i.e. operating systems)
Database systems	To deposit enterprise internal and external information (i.e. on-job/off-job employee information, employee dynamic performance information, and employee supply & demand information in the same industry)
Data warehouses	To deposit risk-oriented comprehensive information
Data-mining systems	To obtain data, information and knowledge for decision making purpose
Algorithm and model systems	Includes algorithms, models, and exploitation tools
Knowledge warehouse systems	Includes knowledge warehouses and knowledge management systems
Analytic systems	Directly relating to data mining, data warehouses, knowledge warehouses, and related tools
Client interfaces	To execute human–computer interaction functions in order to communicate with the above systems

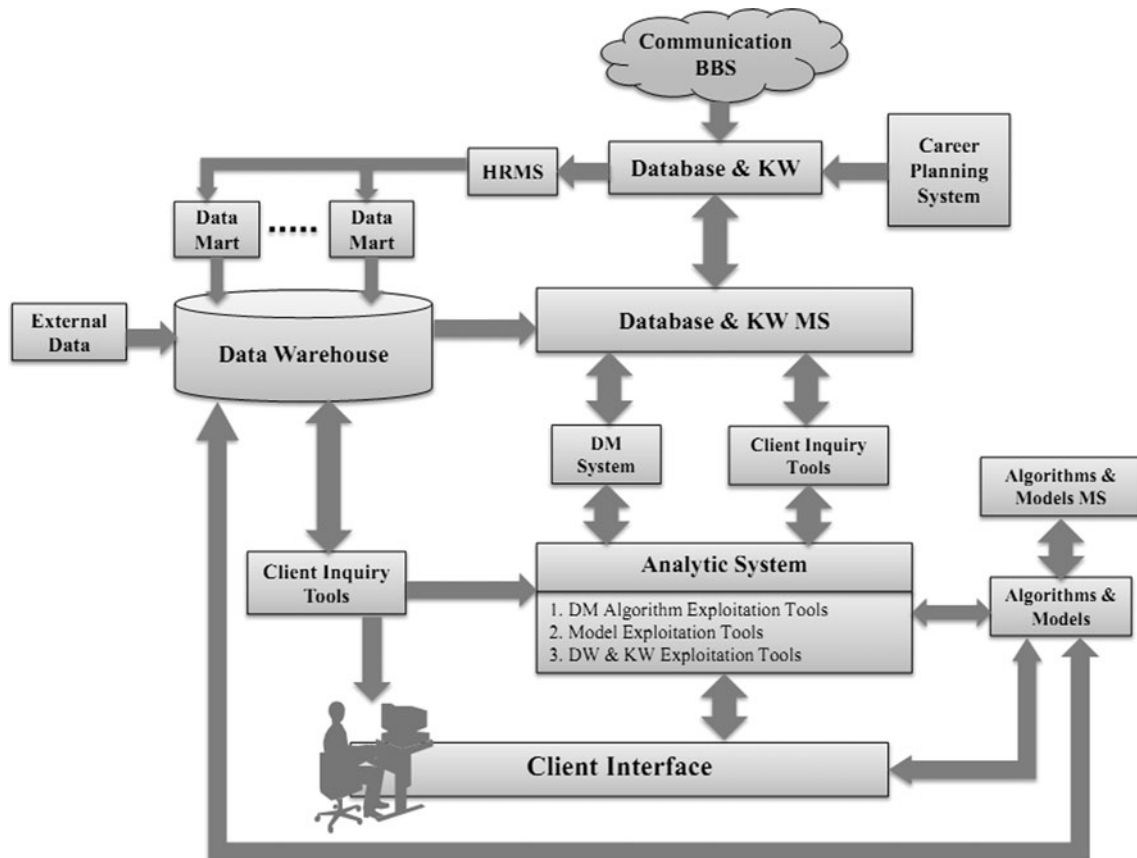


Fig. 2 Decision support system model for employee turnover risk management

As seen in Fig. 3 (the integrated AS model), all the interfaces of knowledge systems and models are encapsulated universally by Web Services and registered in the AS UDDI (Analytic System Universal Description, Discovery and Integration) register center following the mechanisms of UDDI. The required knowledge and possible solutions can be provided by the AS UDDI register center for decision-makers. The AS UDDI can also invoke searching the

relevant knowledge or model provided by the message mechanisms of SOAP (Simple Object Access Protocol) [12].

The key component of the decision support system is the analytic system (AS). Using knowledge management concepts the analytic system has a self-learning mechanism. It aggregates feedbacks from users and other systems as well as new algorithms through the self-learning mechanism. New knowledge, models, algorithms are added to the

Fig. 3 Integrated AS model based on web services

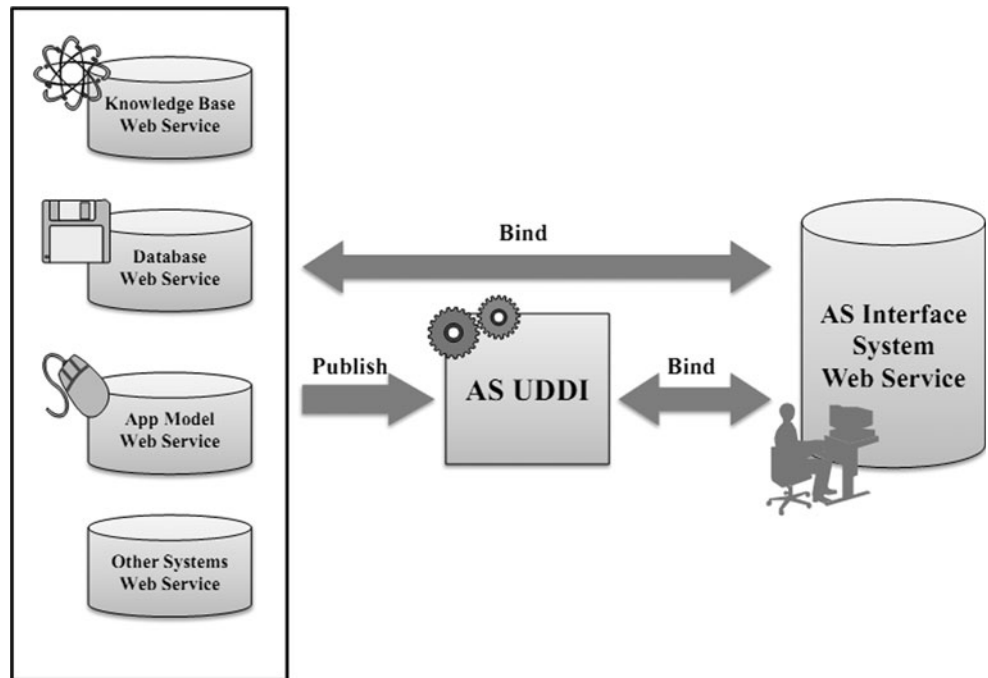
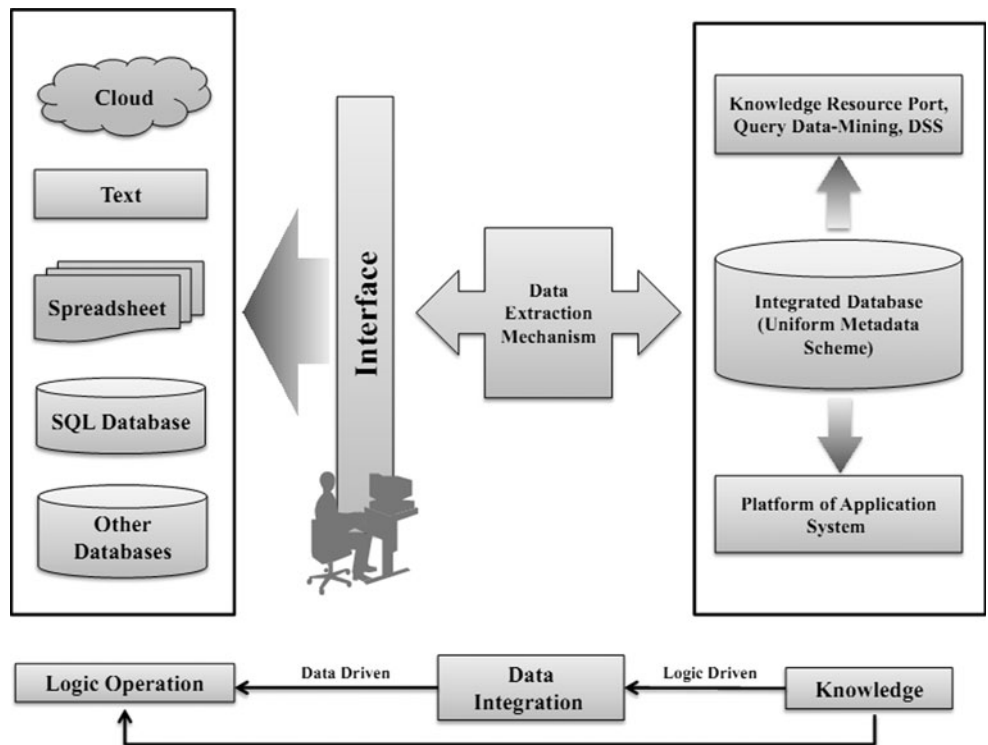


Fig. 4 Integration of heterogeneous data



system as upgrades. The process of self-learning is evaluated and recommended as follows:

- The knowledge, models, or algorithms related to the solution are analyzed and compared regarding their effectiveness and efficiency.
- The award-based mechanisms are applied. The decisions from the AS are compared with those of experts and suggestions and knowledge never used in the solution are provided.
- Adjust the conditions and scopes of each algorithm and model, according to the results of the specific cases.

Another important component of the DSS system is data integration (see Fig. 4). The heterogeneous data collected from all sources by enterprises are in different formats and need to be integrated to provide unique, reliable and consistent data, information, and knowledge for various business applications.

3 Conclusion

Human resource management is one of the most important business functions. As business environment changes rapidly and significantly, human resource management becomes extremely complicated. It requires more and more knowledge for managers to make any decision today [74]. Decision support systems appear to be a perfect fit in decision making process for human resource management.

Knowledge management as an organizational learning process has been applied to many business functional areas such as accounting, marketing, finance, procurement, as well as human resource management. Knowledge management can be used to acquire process, codify, store, distribute, and apply knowledge where they are needed. With knowledge and knowledge management, functional systems therefore become intelligent.

Our study discusses knowledge, knowledge management, human resource management (HRM), HRM system design, decision support system (DSS) and its use in HR management, knowledge management in DSS design, etc. It also shows a knowledge management component in the design of DSS for HR management. Self-learning mechanism used in the analytic system helps the DSS collect and aggregate feedbacks from users and other systems. New knowledge, models, and algorithms are constantly added to the system and are to be used to solve various human resource management problems.

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Appendix

See Table 2.

Table 2 The tasks, goals and the software modules [18, 34, 37, 78]

Number	1	2	3	4	5
Tasks	HR planning	Position design and analyses	Selection of recruits	Evaluation of talents	Training and development of HR
What to be done	The enterprise's overall strategy of competition is the basis of its HRM planning, which refers to the process of decomposing and redefining the needs of HRM and the possibility of meeting them	Job analysis is a method of systematically collecting and analyzing various kinds of job-related information, which includes specific duty of each job, its requirement and working conditions and environments	Recruitment of personnel aims at selecting potential employees for the enterprise, searching for qualified applicants for job vacancies. This is the most crucial step of HR development. Done in a less refined way, it may cost the enterprise a lot of time on firing employees	Test for the quality of talents measure and assess the basic qualities on morality, hard work, ability, achievements and health of all kinds of talents in a series of quantified and qualified ways. It uses various types of measuring tools, collecting interactive data between talents and jobs as much as possible to inspire their potential	Training is a process in which knowledge is acquired, skills are developed and attitude is improved by proper guidance. It helps the staff to define their missions, duties and goals, and to gain qualities and abilities that enable them to achieve the enterprise's goals
Goals	HR utilization rate must be raised by at least 5 % to ensure the enterprise's smooth development and HRM planning and to achieve its various goals	Job analysis aims at defining the mission, duty and responsibility of a given job and paving the way for the training, wage determination, checking and career planning of the personnel	A scientific system of recruitment will help the enterprise find suitable talents and thus decrease the huge cost on the itinerancy of talents and increase the rate of success in recruitment	Test for the quality of talents aims at helping the enterprise to develop and utilize HR in an effective way, to stimulate the staff and to optimize the HRM	Training aims at improving the personnel's working efficiency, helping them master the operational procedures and communication skills needed. It has an apparent economic and cultural benefit. A good training and development of HR may increase HR utilization ratio by 7 %
e-HRM modules	HR planning system	Intelligent job analysis management system	Recruitment system	Talents quality system	Training and development management system

Table 2 The tasks, goals and the software modules [18, 34, 37, 78]

Number	6	7	8	9	10
Tasks	Staff performance management	Wage and welfare management	Long-term senior talents stimulation plan	HR policy development	E-HR system
What to be done	Performance management is a process in which to achieve a particular goal and to fulfill the customers' expectations by planning, organizing and using the enterprise's resources. It is also a process in which managers continuously communicate with the staff on their duties and improving performances	Wage and welfare management refers to the policies and measures dedicated to setting up a scientific and reasonable system of wage and a sophisticated system of pay according to the enterprise's pay strategy during its developing stage, taking into account both the interests of the enterprise and the personnel. It also integrates principles of stimulation, competition, economy and lawfulness	Stock option rewarding plan is a long-term stimulating measure used to make up the deficiencies of fixed wage and annual bonus. Stock option rewarding plan takes various forms. It mainly includes stock rewarding plan, stock preferential plan, stock moratorium plan, and stock option plan. Enterprises with different backgrounds of ownership structure carry out this plan in different ways. Stock option rewarding plan must accord with the business types and operational features of the enterprises. There are generally four types: publicly listed enterprises, publicly unlisted enterprises, high-tech enterprises and traditional enterprises	HR policy impacts all aspects of the enterprise's management of its staff. It mainly includes the employment and management policy, daily working policy, promotion policy, safety policy, penalty and contract termination policy and personnel rights and conflict resolution policy	E-HR system is a kind of integrated system providing information necessary for HR decision-making. It includes files of personnel affairs and HR information (such as HR analysis and HRM reports)
Goals	Performance management aims at inspiring the personnel's potential, improving their performance and even the enterprise's performance by binding their personal goals with the enterprise's strategy. A good performance management may increase HR utilization rate by 3 %	Wage and welfare management aims at striking a balance on distributing the enterprise's profit between its own accumulation and the distribution among the personnel, at repaying personnel who contribute to the enterprise in an objective, equal and reasonable way and thus ensuring the personnel of economic and psychological satisfaction in a favorable way for the enterprise's development	Stock option rewarding plan aims at establishing a long-term stimulating and restraining system, binding the interests of the staff, particularly that of the top-level managers with the enterprise's interests, and thus effectively reducing the opportunistic behavior of the managers and making them contribute to the interests of the enterprise and the shareholders as much as possible, resolving the disputes between commission and surrogate, reducing the cost of surrogate and improving the enterprise's performance. Research results in China and abroad show that where stock option rewards are carried out, enterprises perform better	HR policy aims at promulgating the enterprise's business ideas and management methods, providing the staff with a clear guide of behavior, safeguarding the interests of the enterprise and the personnel, maintaining good management and reducing HR avoidable disputes	E-HR system aims at increasing the efficiency in compiling HR files, providing the managers with information required for decision-making in a quick and easier way, drawing strategic plans for enterprises and offering HR forecasting services
e-HRM modules	Performance management system	Wage management system Welfare management system Security management system	Stock option management system	Policy management system	Staff information management system

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