Research Article

Human Resource Management of Internet Enterprises Based on Big Data Mobile Information System

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With the progress of science and technology, the advent of VR panorama, the era of Big Data has arrived, which has set off a revolution in the development and future destiny of Internet companies. Human resource management (HRM) is an important department of Internet companies. This paper introduces the principle and value of Big Data and related theories of HRM. This paper discusses three aspects of HRM in our company using Big Data theory: employee turnover prediction, salary comparison, and talent evaluation method, and puts forward suggestions for optimization and improvement of the company's HRM. The results show that, through the company's project manager's ability to quantify data and analyze a set of data quantitative research, comparative analysis of the ability of three candidates Q, W, and E showed that W is the most suitable for the company's project manager staff.

1. Introduction

With the increasingly fierce competition among enterprises, it is more and more important to use the market to allocate resources. The competition of enterprises is actually the competition of talents. There are two levels of talent competition. It is important to have talents, and it is more important to use them. Talent ownership refers to how to "seize" external talent resources, how to use talents, and how to rationally allocate internal talent resources. As the traditional data analysis method can only obtain the surface information of these data but cannot obtain its internal attributes and implicit information, it is necessary to change the concept and analyze the original data with the idea of Big Data, so as to effectively use a large amount of data information.

Chen proposed a distributed framework MR-ELM based on MapReduce to realize large-scale elm training. In this framework, ELM submodel is trained in parallel with the data blocks distributed on the cluster to form a complete single hidden layer feed-forward neural network [1]. Zang and Ye discuss the application of Big Data in the main modules of HRM, including recruitment, talent training, and talent evaluation. In addition, Zang and Ye proposed the main challenges faced by HRM and corresponding solutions [2]. Taking 6000 employees from six European countries as samples, Guerci et al. analyzed how HRM practices aimed at developing organizational ethics affect the ethical atmosphere of benevolence, principle, and self-centered within the organization and also investigated the moderating effect of their employees on the sustainability of enterprises [3].

De Mauro proposed a new semiautomatic and fully replicable analysis method based on machine learning algorithm and expert judgment. De Mauro et al.'s analysis uses a large number of online recruitment positions [4]. Angrave et al.'s HR analysis is a "must have" capability, which will ensure that HRs become a strategic management function in the future and make the organizational performance better transformed. It believes that unless the HRs industry can recognize the potential and shortcomings of this emerging field and develop better methods and methods from the business and strategic perspectives, the existing HR analysis practice is unlikely to bring about change [5]. Chowhan et al. study the relationship between HRM practices and workplace-level innovation outcomes using the method of continuous feature analysis. Innovators are classified according

to their success in achieving new products/processes and/or improving product/process outcomes. The HRM practices discussed include the use of high-quality talents, skills improvement, motivation promotion, and opportunity promotion [6].

The main purpose of this article is to study the human resource management of Internet companies based on Big Data mobile information systems. This paper combines the idea of Big Data and data indicators in HRM with the idea of Big Data and analyzes the application of Big Data in employee turnover prediction.

2. HRM of Internet Enterprises in the Era of Big Data

2.1. Introduction to Big Data

2.1.1. Principle of Big Data. The essence of Big Data is a group of data, but traditional methods cannot process it in a short time. Its data scale is huge, and the information is chaotic at first sight. Only special processing and screening of Big Data can provide better analysis and decision-making help for production and life [4].

The characteristics of Big Data can be summarized as 5V, that is, large amount, diversity, value, speed, and accuracy. Volume refers to a large amount of information, including the amount of data collected, stored, and processed. The initial calculation unit of Big Data is at least Pb (1000 tb), and even EB (1000 tb) or ZB (1000 tb). "Diversity" refers to various sources and data types, including unstructured, semistructured, and structured data information reflected in documents, images, videos, sounds, and location information. Various types of data also put forward higher requirements for information processing technology. "Value density" means that the data is large, but only a small part contains valuable information. In other words, the value density of information is relatively low, or looking for a needle in a haystack. With the era of network, the society constantly produces tens of thousands of data information every day. How to combine with the actual needs, use powerful technology to penetrate into massive data and find useful information is an urgent problem in the era of Big Data [6]. In this process, if many industries work together and innovate constantly, Big Data can create more value for human beings.

2.1.2. Maximum Likelihood Estimation Algorithm. Maximum likelihood estimation (MLE) is defined as follows.

Given a dataset a, a is composed of samples $(A_1, A_2, A_3, ..., A_n)$. For the parameter θ, the conditional probability $N(A/\theta)$ of a is called the likelihood degree of θ, the formula is as follows:

$$M\left(\frac{\theta}{A}\right) = N\left(\frac{A}{\theta}\right). \tag{1}$$

Likelihood is probability, so MLE becomes maximum likelihood estimation. The greater the possibility, the greater the probability. In other words, when the corresponding θ value is taken, the greater the probability of sample data appearing. If a remains unchanged, then the above formula θ is a function of $\hat{\theta}$, and the value of the variable represents $\hat{\theta}$. The formula of $\hat{\theta}$ is

$$\hat{\theta} = \arg\sup_{\theta} M\left(\frac{\theta}{A}\right). \tag{2}$$

In order to simplify the calculation of MLE, the following assumptions are generally made:

(1) θ of each sample in a is independent, and the formula is as follows:

$$M\left(\frac{\theta}{A}\right) = N\left(\frac{A}{\theta}\right) = \coprod_{x=1}^{y} N\left(\frac{A_x}{\theta}\right). \tag{3}$$

(2) Each sample A_x, $x = 1, 2, ..., N$, has the same conditional probability as $P(D_x/\theta)$.

In the calculation of maximum likelihood estimation, sometimes the calculation is more complex or the logarithmic form is relatively simple. Therefore, the maximum θ can be calculated by calculating the logarithmic form of MLE. The log likelihood function is as follows:

$$m\left(\frac{\theta}{A}\right) = \log M\left(\frac{\theta}{A}\right). \tag{4}$$

Obviously, the maximum likelihood estimator is equivalent to its pair form, that is, when the pair likelihood function changes, when the maximum value of θ is obtained, the variable θ in the maximum likelihood function also gets the maximum value.

2.1.3. Pearson Correlation Coefficient Algorithm. Pearson correlation coefficient is used to calculate the similarity between user x and user y as follows:

$$\text{sim}(x, y) = \frac{\sum\limits_{i \in I(x) \cap I(y)} \left(R_{xi} - \overline{R_x}\right)\left(R_{yi} - \overline{R_y}\right)}{\sqrt{\sum\limits_{i \in I(x) \cap I(y)} \left(R_{xi} - \overline{R_x}\right)^2} \sqrt{\sum\limits_{i \in I(x) \cap I(y)} \left(R_{yi} - \overline{R_y}\right)^2}}, \tag{5}$$

where $\overline{R_x}$ and $\overline{R_y}$ in the formula are the average scores of all items of user and y.

2.2. HRs.
HR is the first resource among human, financial, material, and credit resources [7–9]. It is a kind of sensitive economic resources and an element of economic resources [10, 11]. HR is an important resource of an enterprise unit, and it is essential for the development and growth of an enterprise.

2.2.1. HRM. Although scholars have different views on the definition, expression, and different aspects of the concept, its essence is the same [12, 13]. The so-called HRM refers to the management of the introduction of organizational members, the determination of job allocation, wage level,

potential development, and employee relations [14]. These six modules are the core connotation and core concept of HRM, as shown in Figure 1.

2.2.2. The Role of HRM in Enterprise Strategy.

As one of the basic management functions of an enterprise, HRM is, of course, to achieve the basic goal of an enterprise, that is, to provide products and services needed by the society, so that the enterprise can survive and develop in the market competition. Therefore, its own purpose is to "attract, retain, motivate, and develop" the HRs needed by enterprises. Specifically, it is to attract the necessary HRs to the enterprise, retain them, mobilize their working enthusiasm, develop their potential, and give full play to their positive role in serving the enterprise. In order to achieve the basic purpose of HRM, HRM must fully embody the following four basic functions, namely,

(1) It is helpful for enterprises to adapt to the changes of external environment.

HRM can provide some data for managers, such as the potential ability of employees and the salary of competitors. These data can reflect the external opportunities and threats faced by enterprises [15]. If enterprises do not attach importance to the information of HRM, they will not be aware of the external environmental threats they will face [16, 17]. As a result, enterprises are in a disadvantageous position in the labor market or talent market.

(2) It can help enterprises analyze their advantages and disadvantages.

HRM can provide managers with information reflecting internal strengths and weaknesses [18]. The managers of enterprises are also human beings, and a large part of the internal advantages of enterprises come from internal employees, so the role of HRM cannot be ignored.

(3) It is helpful to the successful implementation of enterprise strategy.

The cooperation between employees is very important, which requires the active participation of HRM department. HRM can play an active role in employee recruitment and career development. Good HRM will have a positive impact on employees. If employees treat their work positively, the implementation of the company's strategy will be smooth.

(4) HRM plays a guiding role in the strategic management of enterprises. The strategic development of enterprises is closely related to HRM. The strategy of an enterprise is realized by its employees. If the HRs are well done, it will create a positive atmosphere within the enterprise by recruiting talents suitable for the enterprise, or training and developing the employees [19].

2.3. Research on HRM by Big Data.

In the ocean of data, the difficulty of HRM lies in finding talents who collect, screen, analyze, and use these data. HRM supported by Big Data can realize quantitative management. Big Data has brought good opportunities and fresh air for the management innovation of small- and medium-sized enterprises. More and more small- and medium-sized Internet enterprises think that they are starting to test the water and consider carrying out new reform in this field [5, 20].

2.3.1. HR Performance Management.

HR performance management was originally restricted by the traditional HRM mode, and its role in corporate governance will be greatly reduced when managers lack energy or information asymmetry [21]. Nowadays, with the help of Big Data technology, the level of HR performance management has been greatly improved, from perceptual cognitive management to rational decision-making based on data analysis, which further improves the ability to assist corporate governance. The analysis index based on the actual data is also an effective basis for enterprises to carry out performance management, which has a positive role in improving the performance of enterprises and individuals.

Big Data technology promotes the refinement and scientization of HR performance management, which mainly has the following important impacts [22]:

(1) Use advanced Big Data technology to collect important data from all angles of the whole industry for horizontal analysis and comparison, so as to understand the market trend, control the industry trend, and timely revise the internal performance indicators of the enterprise; then conduct vertical analysis and comparison. In the process of the enterprise's own development, integrate the internal short-term, medium-term, and long-term strategic objectives to form indicators suitable for the enterprise's own development system, make performance management more scientific [23, 24].

(2) HRM under Big Data can reduce errors in analysis conclusions as much as possible and evaluate the performance level of employees or departments more fairly [25]. At the same time, the source data comes from the automatic collection of the whole process, which greatly reduces the possibility of human intervention on performance indicators and makes the basis of performance management more real [26].

(3) All data extraction will be automatically realized by Big Data platform, and the data source is more comprehensive and scientific than the traditional manual collection method. HR staff can put more energy into the follow-up work of performance appraisal. Performance appraisal process should not and no longer be the focus of managers. Big Data technology makes the focus of HR performance management return to the evaluation and improvement of evaluation results [27, 28].

2.3.2. Talent Evaluation.

HRM is the most important part of Internet enterprises. As a special technology of HRM, talent quality evaluation has been paid more and more attention by enterprises [29].
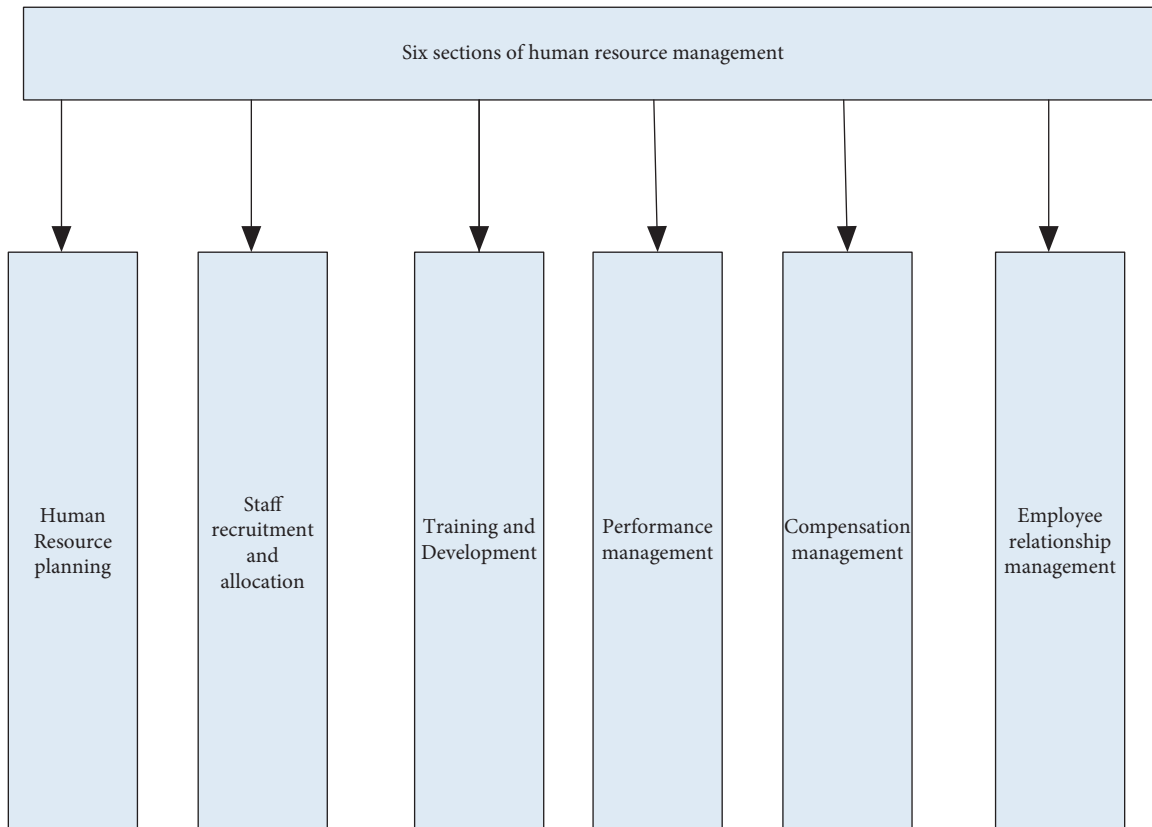
Figure 1: HRM is divided into six parts.

2.3.3. Recruit Employees and Foresee Staff Gap. More and more enterprises begin to promote data resources and data value to the important position of enterprise core strategy, re-examine the industry positioning, develop or derive new products or services that keep pace with the times. This trend is increasing at a very fast speed. The major recruitment websites in China fully combine the products and all-round services developed by Big Data technology for enterprises. As enterprises themselves, they can also use Big Data technology to improve the recruitment process, improve the quality of recruitment work, and quickly find suitable candidates from a wider range of channels.

3. Big Data Application Analysis Ideas in the Company's HRM

3.1. Analysis of Big Data in HRM of the Company. In this paper, due to the small scale of the company, the data cannot meet the basic conditions of Big Data analysis. Our data come from Big Data of 58 cities, providing reference for the decision-making of HRM recruitment project manager.

The idea of data analysis can be combined with HRM:

(1) Through objective and effective data analysis, it can solve the problems of HR planning and allocation in enterprise operation

(2) Let the data speak, find the key factors in enterprise operation, formulate corresponding solutions, and improve management efficiency

Collect data, and use the collected data for analysis. Today, with the continuous improvement of enterprise informatization, the gradually improved HR information system is connected with the business system showing the business status of the enterprise.

Analyze the data, and integrate the isolated basic data, such as performance data, business data, and HR data. The macroenvironment analysis methods of enterprises mainly include macroanalysis method and social environment analysis method.

3.2. Application Steps of Big Data in HRM of Internet Enterprises. Through the organic combination of Big Data theory and easy to operate small data analysis, determine the relevant variables, find the analysis method, output effective results, and finally solve the practical problems. The steps are as follows:

(1) Identify the business issues to be analyzed

(2) Set the output result of achievement index and determine the analysis unit of change output result

(3) Find out the variable with difference

(4) Determine the analysis method

(5) Using simple tools to analyze the data and find out the key parts of the problem

(6) Formulate corresponding strategies to solve business problems

This method provides value for business decision-making by focusing on business issues, finding out relevant relationships, analyzing and forecasting. It can tell us what factors affect employee performance and help us to analyze what kind of performance a good business employee has, what kind of behavior employees can predict, all of which can enter the enterprise talent development plan.

4. Application of Big Data in HRM

The positioning of strategic HRM in the industry has been widely recognized by modern enterprise management, emphasizing the promotion of business departments. A sound HRM system is conducive to the realization of corporate strategic objectives, and the professionalism and objectivity of relevant personnel help them become real business partners. Big Data provides a new perspective for HRs practitioners, creates an environment for data analysis, and is also a tool to help HRs practitioners improve their discourse power and professional quality.

4.1. Predicting the Staff Gap in Advance. Due to the popularity of Internet technology, the pace of society is faster and faster. Until today, we have entered an era full of turbulence and uncertainty. The unstable business model leads to the change of business strategy.

As a member of the Internet company, our company is also facing an unstable business model. Our business strategy will also change with the change of environment, which will affect the formulation of HR strategy. The company's strategic adjustment cycle is basically half a year. In terms of HR planning, the company is still short of personnel recruitment, so it will not predict staff turnover in advance, nor will it recruit employees in advance. Big Data can tell us the supply-demand ratio of market employment. We can track the development trend of key positions and predict the number of vacancies. The Big Data we got from 58 cities is shown in Table 1.

From Figure 2, we can see that in the Big Data provided by 58 cities, employees in the Internet industry change their jobs every 12 months on average, and the sale posts change every 18 months on average. As can be seen from the above Big Data table, IOS software engineer and data mining engineer are at key positions with high liquidity and scarcity. The company should recruit and reserve talents in advance to ensure sufficient staffing.

4.2. Big Data Comparison of Salary Level. In the face of fierce competition, salary is an important indicator to motivate employees. The brand image and perfect promotion system of large Internet companies can better retain employees, but for our company, competitive salary is the key to our foothold in the talent competition mechanism. At this time, Big Data provides a reference value for us to determine the salary of the post. The Big Data provided by the city is compared with the salary of the company as follows.

It can be seen from Figure 3 and Table 2 that the average salary of the Internet is 10% to 15% higher than that of the company in the Big Data provided by 58 cities. In order to attract high-quality elites, the salary level must be 10% to 15% higher than the average Internet salary to attract elites.

4.3. Using Big Data to Evaluate Talents. The company recruits talents through the network platform. After preliminary screening, select talents suitable for the position. This process can be solved through Big Data analysis, which is based on cloud technology and uses Big Data analysis and mining to help companies find the right people. Big Data analyzes job seekers from three dimensions, namely, professional background, career orientation, and behavior pattern.

4.3.1. Establishing the Competency Model of These Three Dimensions. Each dimension has quantifiable evaluation subitems. Based on the original HR model of the company, quantifiable subitems are set for the three dimensions, and the model is applied to the recruitment of project managers Q, W, and E.

(1) The evaluation subitems of professional background are set as working years, original enterprise scale, and post level. The scale of the original enterprise is divided into 0 to 99 people, 100 to 500, and 500 or more, with scores of 10, 20, and 30, respectively.

(2) Career orientation is divided into achievement test, scenario simulation, and ability test, and the score is professional test score.

(3) The behavior pattern can be divided into team spirit, communication ability and adaptability, and the score is professional test score. Three recruiters' scores are shown in Table 3 and Figure 4. Weight coefficient is shown in Table 4.

4.3.2. Calculating the Job Competency Score of the Candidate and Selecting the Appropriate Candidate according to the Score. According to the inventory weighting coefficient of the project manager, the candidate's ability evaluation score is weighted for the scores of Q, W, and E, the calculation formula is as follows:

$$HK_x = \sum_{xy} l_{xy} M_{xy}. \tag{6}$$

For example, we can calculate that the score of Q in the ability test dimension is 0.19, the score of W is 0.25, and the score of E is 0.15. We can also calculate the scores of these three people in other dimensions and then put their total scores as shown in Tables 5 to 7.

As shown in Figure 5, we can see that the scores of candidates W are basically ahead of those of candidates Q and E. The highest total score is W. The results showed that W was the best of the three.

TABLE 1: Job supply and demand ratio and job-hopping frequency in the Internet industry.

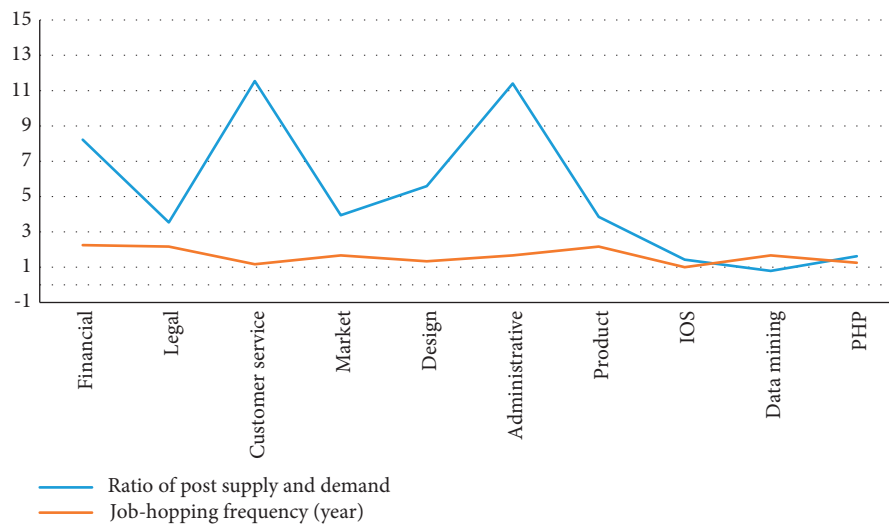| Jobs	Ratio of post supply and demand	Job-hopping frequency (year)	The average pay
Financial	8.22	2.25	5400
Legal	3.54	2.17	7524
Customer service	11.54	1.17	4400
Market	3.94	1.67	7800
Design	5.59	1.33	7920
Administrative	11.4	1.67	4800
Product	3.85	2.17	9872
IOS	1.43	1.00	8004
Data mining	0.79	1.67	11255
PHP	1.62	1.25	6701

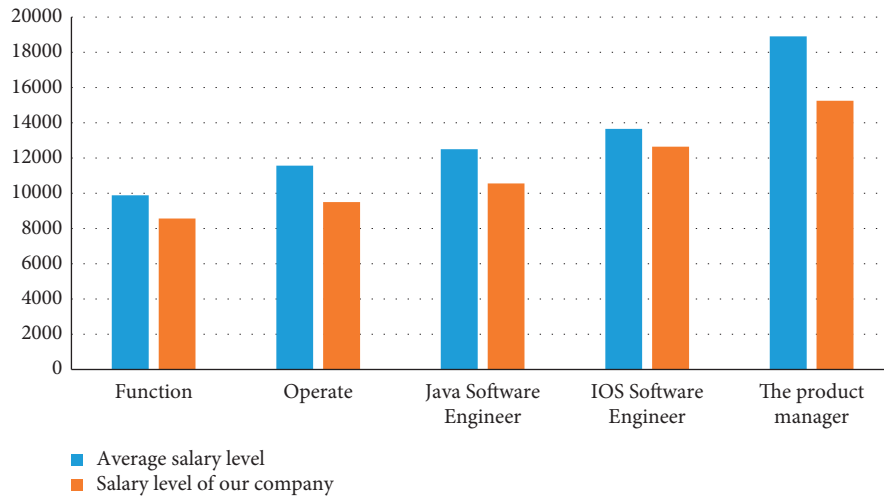FIGURE 2: Job supply and demand ratio and job-hopping frequency in the Internet industry.

FIGURE 3: Comparative analysis of the company's salary level and the average Internet salary level.

TABLE 2: Comparative analysis of the company's salary level and the average Internet salary level.

Department	Average salary level	Salary level of our company
Function	9889	8567
Operate	11569	9500
Java software engineer	12500	10560
IOS software engineer	13654	12650
The product manager	18902	15249

TABLE 3: Three recruiters' scores.

Dimension	Candidates								
	Q			W			E		
1	20	20	20	30	30	20	20	20	30
2	39	41	43	42	45	46	39	45	41
3	42	45	35	45	48	48	39	42	45
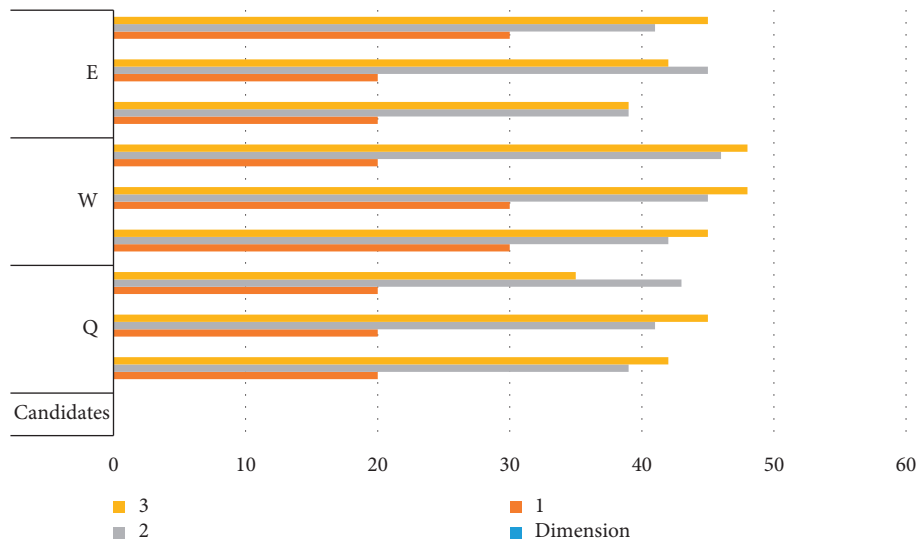
FIGURE 4: Three recruiters' scores.

TABLE 4: Weight coefficient.

M_{xy}	$y = 1$	$y = 2$	$y = 3$
$x = 1$	0.03	0.02	0.01
$x = 2$	0.08	0.06	0.04
$x = 3$	0.01	0.02	0.01

TABLE 5: Q candidate's score.

Dimension	Candidates						
	Q			Weight coefficient			Score
1	20	20	20	0.03	0.02	0.01	2.56
2	42	45	35	0.05	0.05	0.06	6.52
3	42	45	35	0.04	0.05	0.07	8.91
	Sum scores						17.99

TABLE 6: W candidate's score.

Dimension	Candidates					
	W			Weight coefficient		Score
1	30	30	20	0.03	0.02	0.01	2.76
2	42	45	46	0.05	0.05	0.06	7.68
3	45	48	48	0.04	0.05	0.07	10.68
			Sum scores			21.12

TABLE 7: E candidate's score.

Dimension	Candidates					
	E			Weight coefficient		Score
1	20	20	30	0.03	0.02	0.01	2.66
2	39	45	41	0.05	0.05	0.06	6.78
3	39	42	45	0.04	0.05	0.07	9.55
			Sum scores			18.99
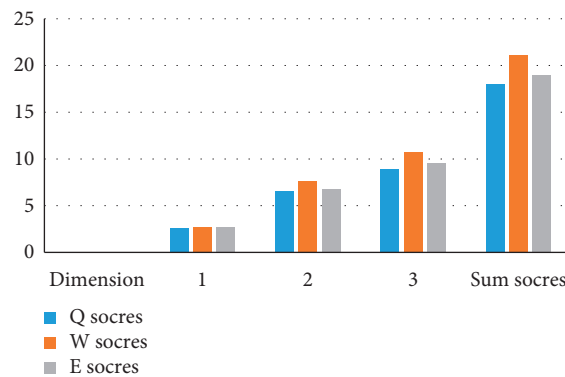
FIGURE 5: Q, W, and E candidates' scores and total scores.

5. Discussion

With the continuous progress of the times, human society has entered the era of network economy. As the carrier of information resources, talent is also the creator and user of information resources, which has become the most important factor affecting economic growth, especially high-quality talents. In the era of Big Data becoming one of the new production factors, the coordination of Big Data and talents will bring new changes in thinking and even management. The concept of Big Data enables all modules of HRM to be included in the quantitative category, providing a better environment for the efficiency, accuracy, and specialization of HRM.

HRM plays a decisive role in the development of enterprises. HRM relies on the Big Data thinking mode to establish a new management mode from a global perspective. Only in this way can we realize the synchronization with enterprise strategic management and give full play to the most important role of enterprise HRM great value.

This article mainly studies Big Data in Internet companies with the help of Big Data mobile information systems, salary comparison, and talent evaluation with the help of Big Data of the third party. In particular, in terms of talent evaluation, this paper summarizes the various abilities of the project manager of the company, and on this basis, predicts which of the three candidates, Q, W, and E, is the best. The results show that W is the best and most suitable project manager for the company. Since the Big Data in this paper relies on the Big Data of the third party, it has some limitations.

Data Availability

No data are involved in this article.

Conflicts of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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