Research on Human Resource Performance Management in Public Sector under Big Data

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Abstract: Big data is increasingly important to economic and social development. Therefore, in order to adapt to the development of society, the public sector must reform the traditional human resource performance management mode. Aiming at the existing problems of weak innovation consciousness of performance management, backward performance management methods and imperfect performance appraisal system, this paper proposes a new evaluation index through data envelopment analysis (DEA) combined with bench marking which can select effective decision-making units and improve the performance management methods and appraisal system after it is adopted in the department.

Keywords: Big data technology; Performance appraisal; DEA; Bench marking management

1. Introduction

With the rapid development of Internet technology, the third wave of revolution followed. In the era of big data, various application modes have gradually penetrated into people's daily life, and are also indispensable in all key areas of the whole public sector system operation. The public sector is a government organization that makes rational use of state power, safeguards the public interests and provides corresponding services for the public. In the research of quantitative management of human resources strategy in public sector, the research of big data technology shows its strong and unique scientific advantages. Making good use of the advantages of big data is the best way for public sector to improve service level.

2. The connotation and big data' impact on human resource performance management in public sector

2.1 Related concept

1) Big data refers to a collection of data that cannot be captured, managed and processed by conventional software tools within a certain time range. It is a massive, high-growth and diversified information asset that requires new processing modes to have stronger decision-making power, insight and discovery power and process optimization ability. Big data is characterized by large quantity, high speed, variety, low value density and authenticity. It doesn't have statistical sampling methods, it's just observing and tracking what's happening. The usage

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of big data tends to be the use of predictive analysis, user behavior analysis, or some other advanced data analysis approach.

2) The data envelopment analysis algorithm (DEA) was proposed by Char es in 1978, which can be applied to many fields such as management and economics. Its characteristic is that it is used in the multi-input - multi-output system model, which is very effective for evaluating the relative effectiveness of similar types of departments.

3) Bench marking management, also known as bench marking management, is a new management method emerging in the West since the 1980s. Generally used for enterprises to deal with competitors learning means, the object of learning is stronger than their own units. Therefore, the public sector can also use this method to reform the performance management level and improve the service level.

2.2 The impact of big data on human resource performance management

In the era of big data, a systematic and comprehensive analysis of departmental human resources performance management system based on a large number of human resources data analysis can not only greatly improve the operation level of refined human resources management within the whole department, but also help to comprehensively rationalize and standardize the business processes in the existing departmental performance system management. Its main competitive advantages are as follows:

1) Fully tap the value of human resources in the public sector, and improve the information processing ability of internal staff. During the application and implementation of big data technology, we can strengthen the analysis, statistics and real-time collection of all employees' performance data, strengthen the connection of big data, analyze the deep-seated reasons for the substandard performance of departments, and then adopt various best methods to solve problems in due course, so as to improve the overall performance level and stimulate the motivation of all employees.

In addition, strengthening the interaction with employees and giving real-time feedback to employees' performance can better tap the value of human resources within employees and continuously and effectively improve the overall work efficiency of employees.

2) Promote the further optimization of traditional organizational structure. In the era of big data, the main feature is that the public sector takes modern network technology as its main medium and technology as its information base, which promotes the whole department and organization to continuously optimize and move forward in the flat development direction of digitization. While the public sector improves data sharing, it can greatly accelerate the rapid transmission of internal information. In addition, the rational application of technical data such as big data and the reasonable quantitative analysis of performance data can solve the management team problems more effectively, establish harmonious internal relations among departments and promote the healthy development of employee relations within departments.

3) Promote talent planning. Under the background of Internet big data application, scientific and rational department planning and talent strategic planning management are more dependent on related basic work such as management research on human resource performance and evaluation within departments. A variety of working methods related to performance management can promote the better allocation of all kinds of talents, and can also plan and arrange

their strategic development goals with higher priority, thus improving the overall quality of research on talent planning performance and strategic management. In addition, public sector leaders also need to take the big data technology platform of human resources as their own talent base, make full use of the basic data information of big database in practice, systematically and comprehensively excavate and analyze the specific post advantages, condition characteristics and department demand characteristics of employees' posts, and formulate a set of targeted strategies that are most in line with the talent cultivation of their posts, so as to promote the development of performance-based strategic management practice of human resources posts in public sector in China.

3. Existing problem and solution model

3.1 The performance management innovation consciousness is weak.

At present, public sector leaders may be influenced by traditional human resource management ideas when they organize and implement the daily management of human resource performance and management evaluation. The adopted research models of human resource performance management are relatively simple and backward, and are not suitable for being widely used in the information and data era. It has failed to give full play to the revolutionary role brought by big data technology, to quickly obtain more needed information through a convenient and efficient

modern information technology platform, to successfully expand the information sources of human resource performance management, to have a deep understanding of the current talent demand of the department, and to keep an eye on the changes of the market demand situation, so that it cannot optimize and allocate human resources, which will directly bring significant economic losses to the department itself. Secondly, at present, many people generally think that they are iron rice bowls after entering the public sector, which leads to their lack of working attitude and enthusiasm in the actual work process. In addition, the corresponding performance appraisal standards are rather vague, thus losing their motivation to work.

3.2 The performance management method is backward.

At present, most public departments still lack bold innovation on what kind of human resource performance management methods to adopt, and can't achieve a good and effective management effect. The work content of human resource performance appraisal management carried out by some public departments is still a mere formality, and there is no way to really implement it in their own management scope. Copying with the management experience model of other departments' performance, it ignores the characteristics of their own departments' own management practices, and it cannot provide real, scientific, rigorous and reliable data basis for the daily strategic research and planning decision-making of public sector management in China. Secondly, employees themselves may still lack to establish a relatively good, standardized and reasonable personal professional ethics, and their business ability needs to be improved.

3.3 The performance appraisal system is imperfect.

During the public sector's assessment of employees' personal ability, examiners should pay close attention to employees' communication and cooperation skills and team awareness. However, because these two indicators are generally difficult to conduct quantitative comprehensive assessment at the same time, they will indirectly have a significant impact on their assessment or evaluation and other work indicators. In addition, during the assessment period of some key assessment positions in the public sector, people often stand in line with the sense of competent leadership, which will also lead to unscientific subjective judgment. In addition, different department leaders have different ideas and goals, so various considerations will inevitably lead to huge differences in the quantitative results of the final performance target assessment, which will eventually lead to the non-objective results of the quantitative assessment of department performance. Therefore, in order to overcome the subjectivity of assessment weight in traditional department performance evaluation, it is very effective to combine bench marking with data envelopment analysis (DEA) in practical application.

4. Modeling formula

4.1 DEA modeling data and its format

Determination decision unit DMU_j ($j=1,2,\cdots,n$), Input indicators X_{ij} ($i=1,2,\cdots,m$; $j=1,2,\cdots,n$), Output indicators Y_{sj} ($s=1,2,\cdots,r$; $j=1,2,\cdots,n$), The pooled data are shown in Tables 1 and 2.

Tab. 1 Input index

Input index	DMU_1	DMU_2	…	DMU_j	…	DMU_n
v_1	X_{11}	X_{12}	…	X_{1j}	…	X_{1n}
v_2	X_{21}	X_{22}	…	X_{2j}	…	X_{2n}
⋮	⋮	⋮	⋮	⋮	⋮	⋮
v_m	X_{m1}	X_{m2}	…	X_{mj}	…	X_{mn}

Tab. 2 Output index

Output index	DMU_1	DMU_2	…	DMU_j	…	DMU_n
u_1	Y_{11}	Y_{12}	…	Y_{1j}	…	Y_{1n}
u_2	Y_{21}	Y_{22}	…	Y_{2j}	…	Y_{2n}
⋮	⋮	⋮	⋮	⋮	⋮	⋮
u_r	Y_{s1}	Y_{s2}	…	Y_{sj}	…	Y_{sn}

In Tab. 1 and Tab. 2, X_{ij} , $Y_{sj}>0$ ($i=1,2,\cdots,m$; $j=1,2,\cdots,n$; $s=1,2,\cdots,r$).

4.2 Model processing pattern

For each decision making unit DMUj, j =1, 2, …, n,

The following optimal linear programming models (P) were established. Let the DMU model in question be DMU_0,

$$(P)\quad \text{s.t.}\begin{cases}\max \mu^{\mathrm{T}} y_0,\\ \omega^T x_j - \mu^T y_j \geq 0,\ j=1,2,\cdots,n;\\ \omega^T x_0 = 1;\\ \omega \geq 0,\\ \mu \geq 0.\end{cases}$$

x_0, y_0, x_j, y_j is a given vector, $\omega = (\omega_1, \omega_2, \ldots, \omega_n)^{\mathrm{T}}$, $\mu = (\mu_1, \mu_2, \ldots, \mu_n)^{\mathrm{T}}$ is the vector in question.

$$(D)\quad \text{s.t.}\begin{cases}\min \theta;\\ \sum_{j=1}^{n} x_j \lambda_j + s^- = \theta x_0;\\ \sum_{j=1}^{n} y_j \lambda_j - s^+ = y_0;\\ \lambda_j \geq 0,\ j=1,2,\cdots,n;\\ s^- \geq 0,\\ s^+ \geq 0,\end{cases}$$

4.3 Introduce bench marking procedures

Through surveys, interviews, online search and other methods, the department need to collects the optimal performance and indicator data of the same or similar department and establishes the benchmark unit to be evaluated. Then the effective decision making unit is compared with DEA algorithm, and the effective decision making unit is selected.

Therefore, we can see that DEA algorithm and bench marking can be effectively combined. Theoretically, one is to evaluate the relative effectiveness of performance, and the other is to make up for the relative effectiveness (the absolute in the relative). The two complement each other. In the actual operation process, its operation result is effective compared with the single DEA algorithm.

It is important to note that this benchmark is not necessarily the specific data of a certain department. Generally speaking, it should be a synthesis of the best performance extracted from many of the same or similar departments. Of course, it is not easy to find the best data for the same sector. It is possible to collect data from public sectors such as companies, institutions and organizations that have similar functions and eliminate the differences.

The flow diagram is shown in the figure 1.

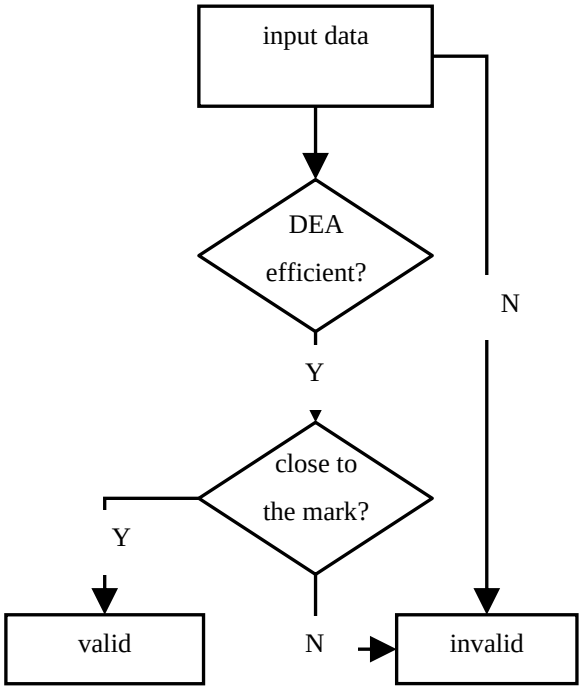

Figure 1 flow chart of effect evaluation

5. Concluding remarks

To sum up, the public sector human resources should pay attention to the rational and application of human resources big data technology to implement human resources performance evaluation management, The following three aspects are the main focus：

5.1 Establish a talent database and collect human resources data.

First of all, we must accurately classify and input the information data of employees in departments, including the basic job information and related job information of all kinds of employees. Basic information of employees, such as the actual name, gender, home address, educational background, work experience, hobbies. The job information can be divided into static information and dynamic information. The dynamic information of employees includes the daily work content, working hours, performance evaluation and self-evaluation results of the specific position of the employee, while the static information of employees includes the completion degree of work objectives and the comparison of job efficiency.

5.2 Establish personnel optimization mechanism and improve performance evaluation standards.

With the introduction of big data technology, employees in the department can set the salary appraisal standard to the following three levels through multi-level design of performance appraisal standard methods, including special needs, comparative needs and basic needs. Then,

all professional and technical personnel can reasonably classify all the above indicators and then make a proper and reasonable plan respectively, finally design the most reasonable performance appraisal standard through their suggestions. In this way, the performance appraisal from various aspects can make employees gradually break away from the boring working machinery brought by the traditional employee appraisal mode, cultivate employees' positive awareness of learning, innovation and development in practice, and cultivate each employee to improve their overall recognition of the value of their own department and improve their overall job satisfaction with the staff team.

5.3 Intensify the development of information construction and make rational use of media resources.

Under the influence of big data economy, the comprehensive and systematic popularization and application of various information technologies, together with various talent evaluation training courses and job guidance training, can quickly and effectively reduce the management labor cost of public departments, thus improving the overall work efficiency of the whole department. Furthermore, efforts should be made to create a big data platform and comprehensively and effectively apply various information technologies. At present, under the restriction of funds or policies, it is difficult for most public departments in China to introduce big data technology quickly and efficiently to carry out work related to optimizing human management and operation. Faced with this situation, the rational and efficient application of Internet multimedia platform can continuously optimize the operational efficiency of human resources and finally achieve the rational allocation of human resources.

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