

Informatization Management and Optimal Allocation of Human Resources in Engineering Projects

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Abstract. Based on the engineering projects in progress, this paper aims to explore the improvement of human resource informatization management in engineering projects from the perspective of personnel allocation benchmark, automatic recommendation of professional title evaluation and visual management of cadre gap. In terms of optimal allocation of human resources, it focuses on optimizing the allocation of human resources in the engineering projects from the aspects of recruitment cycle, channel management and inter-project personnel recommendation, which provides a new development idea for the human resources management of engineering projects in the face of the digital transformation of enterprises today.

Keywords: Human resources optimizations; enterprises digital transformation; enterprises human resources informatization.

1. Introduction

With the rapid development of the country in recent years, human resources are scarce in the engineering construction industry. The power project is different from other construction projects. On the one hand, there are many projects to be started and human resources are in short supply. On the other hand, the complexity of power plant construction has many requirements for human resources allocation, so it is necessary to consider different types and stages of engineering projects and rationalize the allocation of different professional and technical personnel[1]. Better optimal allocation of human resources can improve engineering efficiency, save costs[2] and speed up the process of engineering construction, which also makes the optimal allocation of human resources gradually become one of the key concerns of enterprises, especially for engineering project enterprises. At the same time, as an important means to optimize the allocation of human resources, the upgrading of human resources informatization has become one of the businesses vigorously promoted by enterprises in recent years[3]. In the era of information economy, digital transformation of enterprises is imperative, which also requires strengthening enterprise empowerment, accelerating enterprise transformation, agile business processing[4], and human resource informatization management is the enterprise's new requirements for the optimal allocation of human resources in engineering projects[5].

This paper is organized as follows. Related work is described in Section 2. Section 3 presents the the improvement of human resource informatization management in engineering projects daily management . Section 4 describes aspects in optimizing the allocation of human resources . Finally, Section 5 presents the conclusion and suggestions for future work.

2. Related Work

In recent researches, Cooke, F.L et al.[6] outlined the evolution and development of six areas of human resources management research that are highly relevant to the policy and practice in the current global political-economic context. Xiao et al.[7] thought Chinese firms were governed, directly and indirectly, by international institutions and sought to influence global governance at the same time, with human resource management implications. The large and diverse literature on top management teams (TMTs) that had focused on international business (IB) issues were reviewed and critically assessed by Cuypers et al.[8]. They applied an organizing framework that centered

around four key elements of TMTs – TMT composition, structure, processes, and governance and the most commonly studied IB-related choices and outcomes. Catherine et al.[9] provided some context to how and why gig economy should be studied, with a particular emphasis on Human Resource Management. And concluded with some suggestions for future research on the gig economy.

Rex et al.[10] identified facilitators and restraints of using Human Resource Analytics(HRA) and deduced recommendations for organisations to effectively employ HRA. Their analysis showed that HRA was ready to add value towards organisational effectiveness, although barriers existed in realising its potential for the same. Keegan et al.[11] challenged the proposed links between value/uniqueness of human capital, employment mode and human resource management(HRM) practices that were assumed by the HR architecture model based on developments in digital technologies and algorithmic management epitomized by online labor platforms. Cafferkey et al.[12] extended knowledge by examining the diffusion of HR processes as an indication of HRM system strength using employee data. This paper focuses more on human resource management in engineering projects and some improvement and optimization in HR informatization.

3. Project Daily Informatization Management Level Improvement

Due to the complex personnel employment forms in the field of engineering projects, in terms of human resource management, it is necessary to pay close attention to the increase and decrease of different personnel types in various projects, so as to ensure that the enterprise does better macro-control for projects under construction according to the project plan and construction cycle. However, due to the low level of informatization in human resource management, many businesses, such as submitting personnel basic information, transferring between projects, as well as staff performance appraisal, salary and other aspects of management, still use Excel for information transmission. On the one hand, it leads to many problems such as information loss and damage in the process of information transmission and low management efficiency. On the other hand, because of manual data input, some information statistical dimension is not standardized. Manual input error will produce a large number of unstructured data, which also greatly increases the complexity and difficulty of human resources information statistics. Based on the requirements of engineering project management, transferring the human module from offline paper management to online systematic management can improve the efficiency of business communication between the project management department and the engineering projects, which also avoids errors in the process of information transfer, and improves the informatization level of daily management of the projects. Informatization management improvement can be divided into three parts, which are human resource allocation warning, professional title review automatic recommendation management and cadre gap visual management.

3.1 Human Resource Allocation Warning

In terms of managing personnel allocation, it is necessary to horizontally control the human resource allocation of each departments in each project and track the actual human resource allocation according to the human resource allocation benchmark calculated at the initial stage of the project. Controlling of the staff allocation can better evaluate the overall progress of the projects. Paying attention to the actual number of staff allocation, especially focusing on the upper limit rate and lower limit rate can provide better data support for the project department's recruitment. Human resource allocation chart is shown in Figure 1.

Human resource allocation warning chart in real time can be used to monitor actual human resource allocation. The human resource allocation warning chart is shown in Figure 2. Green represents the number of staff in the department is within the upper and lower limits of the standard manpower allocation, which can maintain the number of staff or carry out small-range recruitment. Yellow represents that the number of staff is lower than the lower limit, and it is necessary to recruit

new staff as soon as possible or transfer staff from other projects whose manpower allocation exceeds the upper limit. Red indicates that the number of personnel exceeds the upper limit, and the recruitment work and personnel transfer work should be stopped immediately.

Project	Project A	Project B	Project C
Upper Limit	100	220	140
January Actual Number	80	240	100
Lower Limit	80	150	110
Upper Limit Rate	80.00%	109.09%	71.43%
Lower Limit Rate	100.00%	160.00%	90.91%

Fig. 1 Human resource allocation chart

Project	General Management Department	Schedule Controlling Department	Cost Controlling Department	Quality Safety Department	Construction Management Department	Summary
Project A	●	●	●	●	●	●
Project B	●	●	●	●	●	●
Project C	●	●	●	●	●	●

Fig. 2 Human resource allocation warning chart

3.2 Professional Title Review Automatic Recommendation Management

With the implementation of talent strategy, professional title review has become an important branch of human resource management. The process of enterprise professional title review is more standardized, and the demand is expanding day by day. In the aspect of information management of employee professional title review, automatic recommendation system is particularly important. In the process of title review, the human resources system will automatically screen the list of qualified personnel according to the title application requirements, such as educational requirements, working years, current title and several information dimensions of the title application, so that the human resources specialist can timely know the title application situation and remind the relevant personnel meeting the conditions to apply for the process in time. The recommendation form is shown in Table 1.

Table 1. Professional title review automatic recommendation form

Name	Education	Working Years	Professional Title	Applicable Title
A	Postgraduate	2	Engineer	Senior Engineer
B	Undergraduate	5	Assistant Engineer	Engineer
C	Undergraduate	5	Assistant Engineer	Engineer

3.3 Cadre Gap Visual Management

The traditional talent training system is not enough to adapt to the existing personnel structure and talent development channel, resulting in long training cycle of new staff, talent gap, cadre selection difficulties and other industry talent reserve problems in the projects. It is urgent to copy the excellent experience, optimize the talent training system, accelerate the growth of talent, and quickly build a team. The visualization of the cadre gap of each project department is the basis of talent cultivation and reserve. According to the transfer, appointment and removal of cadres in the projects every month, the human resources system automatically executes statistics and visual analysis of the cadre gap. The information statistical dimension is shown in Figure 3. For the cadre gap in different departments and different fields, it is convenient for the enterprises to timely get to know the cadre situation of the foreground project and make overall planning.

Project		Title	General Management Department	Schedule Controlling Department	Cost Controlling Department	Quality Safety Department	Construction Management Department	Summary
Project A	2	Manager	0	1	0	0	0	1
		Deputy Manager	0	0	0	1	0	1
Project B	2	Manager	1	0	0	0	0	1
		Deputy Manager	0	1	0	0	0	1
Project C	1	Deputy Manager	0	1	0	0	0	1

Fig. 3 Cadre gap chart

4. Human Resources Allocation Optimization

In China there are many power projects to be started, and personnel number are facing serious shortage. However, there is a long recruitment cycle caused by incomplete connection between recruitment demand and recruitment implementation in the recruitment process[3], which leads low allocation efficiency of human resources in the projects. After the recruitment demand is proposed, the recruitment process cannot be timely followed up. The recruitment cycle and efficiency of subsequent posts are not systematically recorded and managed, resulting in passive personnel recruitment management. It is urgent to implement the informatization of recruitment process.

4.1 Recruitment Cycle Management

Traditional recruitment process informatization mostly uses data mining algorithms to automatically collect and screen resumes as required, but the effectiveness of the whole recruitment process cannot be guaranteed. Optimizing the recruitment process, improving the professional matching of posts and shortening the recruitment cycle is an important indicator to consider the completion of recruitment requirements in current engineering projects.

For project department, data analysis can be carried out according to the positions of recruitment demands to link the issuing time of recruitment demands with the completion of demands and the personnel arrival time. The personnel recruitment process approval is carried out on the system, and the completion rate of recruitment demands at different time nodes of each project department can be tracked. Example of recruitment cycle tracking is described in Figure 4. The statistical results analysis is conducive to better optimize process management and improve efficiency.

Project Human Resource Requirements	Position Requirements	Amount	Start Time	End Time	Time Cycle	Average Time Cycle
Project A	Schedule Controlling Engineer	4	2022/1/4	2022/1/24	20	5
	General Management Engineer	3	2022/2/14	2022/2/24	10	3.3
Project B	Cost Controlling Engineer	2	2022/2/14	2022/2/24	10	5
Project C	Project Management Engineer	5	2022/1/4	2022/1/20	16	3.2

Fig. 4 Recruitment cycle tracking

4.2 Recruitment Channel Management

In addition to mastering the recruitment cycle, there are many recruitment channels at present, and China also actively promotes the combination of online and offline social recruitment and campus recruitment through multiple channels. For enterprises, knowing the contribution rate of

different channels to the completion of recruitment can be more targeted to adjust the recruitment efforts and recruitment methods, so as to achieve twice the result with half the effort.

Through the recruitment channels management, the recruitment channels are registered when the employees register their entry information. The successful recruitment of project positions through various recruitment methods is displayed through the system, and the contribution of each channel is counted to provide an important reference for the form selection of subsequent recruitment work. Example of recruitment channel contribution rate management is shown as Figure 5.

Project Department Human Resource Requirements	Position Requirements	Amount	Campus Job Fair	Contribution Degree	Internal Referral	Contribution Degree	Job Intermediary A	Contribution Degree
Project A	Schedule Controlling Engineer	4	1	25%	2	50%	1	25%
	General Management Engineer	3	0	0%	0	0%	3	100%
Project B	Cost Controlling Engineer	2	1	50%	0	0%	1	50%
Project C	Project Management Engineer	5	2	40%	1	20%	2	40%

Fig. 5 Recruitment channel contribution rate

4.3 Personnel Gap Deployment Recommendation

According to the human resource allocation gap of each project department and the demand conditions of the gap position, the system will automatically select and recommend appropriate personnel in the remaining project department with excess manpower allocation. Human resource specialist can carry out macro-control according to the specific progress of the project and the personnel allocation requirements of different project nodes, so as to ensure the balanced allocation of personnel in each project, which can further ensure the smooth progress of the project. Personnel recommendation figure is shown as Figure 6. While selecting screening conditions, the priority from high to low is position, project, number of redundancy, name, education, years of work and title of personnel. Human resource specialist can select appropriate personnel to deploy according to position gap and actual work demand.

Position	Project	Number of Exceeding Lower Limit	Name	Education	Working Years	Professional Title
Schedule Controlling Engineer	Project A	2	A	Postgraduate	2	Engineer
			B	Undergraduate	5	Assistant Engineer
	Project B	1	D	Undergraduate	10	Engineer

Fig. 6 Personnel gap deployment recommendation

5. Summary

5.1 Conclusion

This paper discusses human resource management informatization mode of engineering project enterprises and the optimization direction of human resource allocation on the project site. On the one hand, that personnel information management, human resource specific allocation quantity detection, professional title recommendation management and cadre gap statistics is achieved, through the implementation of human resource management system. On the other hand, based on personnel recruitment and personnel transfer between project departments, the optimal allocation of human resources has been carried out, which is of great significance to the construction of engineering projects.

5.2 Future Work

While managing the existing staff, it is also of great significance to pay attention to the turnover of employees. Only by scientific analysis of the reasons leading to the dismissal of different types employees, timely countermeasures should be taken before the possible dismissal of employees, so as to reduce the cost of staff turnover.

Collecting the reasons for employees' dismissal through questionnaires and surveys should be done firstly, and then choosing the top10 dismissal reasons for labeling processing is applied. The text features of the reasons for employees' dismissal through TF-IDF technology can be extracted, which is input of deep neural network prediction. The personnel who may have dismissal possibility will be mined by natural language processing(NLP) technology, which human resource specialist can focus on and prepare for the next step work arrangement as well as minimizing the impact on the project schedule.

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