

Research and Innovation on Performance Management of Administrative Personnel in Higher Vocational Colleges under the "Double-High Plan" Based on Matlab

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Abstract—Under the new situation of the national comprehensive promotion of the "double-high plan", the comprehensive ability and professional quality of the administrative personnel in higher vocational colleges are facing new challenges. In this paper, under the requirements of college construction of the "double-high plan" project, the balanced scorecard is introduced, the strategic objective is converted into specific indicators, and the importance of indicators is studied by using the analytic hierarchy process, so as to establish a scientific and effective performance appraisal indicator system for the administrators of higher vocational colleges. A case is studied at last, which results calculated with Matlab prove the validity of the method.

Keywords-Analytic hierarchy process, Balanced scorecard, Double-high plan, Administrative personnel, Performance management.

1 INTRODUCTION

In order to thoroughly implement the spirit of the national education conference and implement the national implementation plan for vocational education reform, the ministry of education and the ministry of finance issued the opinions on the implementation of the plan for the construction of high-level vocational college (HLVC) and majors with Chinese characteristics in April 2019, referred to as the "Double High Plan (DHP)". The Opinions pointed out that by 2035, a number of higher vocational colleges and specialty groups in China should reach the international advanced level, and the construction of HLVCs and specialties with Chinese characteristics should be officially started.

DHP puts forward higher request to all aspects of HLVCs, such as party construction, talent cultivation, innovation service, construction of teaching staff and governance level. Among them, the innovation of governance model and the improvement of governance level are particularly critical, which directly affects the implementation of the whole plan smoothly.

According to educational office's opinion [1], the appraisal mechanism of teachers should be innovated, which is oriented by performance contribution and ability level. And a dynamic adjustment mechanism of performance pay should be established, which focuses on management and appraisal of objectives, so as to achieve more rewards for more work and better performance. Li et al. [2] proposed a professional promotion system for administrative personnel that reflect their moral and talent quality, as well as personal qualifications and actual work achievements. However, the management of higher vocational colleges, especially to the appraisal of administrative personnel evaluation, still adopts traditional administrative management mode. The traditional model is single and extensive, which is difficult to effectively quantify the role and contribution of administrative personnel in the situation of DHP. In face of new requirements and new environment, it is urgent to explore a more accurate and scientific performance management system for administrative personnel in HLVCs.

2 PROBLEM OF PERFORMANCE APPRAISAL OF ADMINISTRATIVE PERSONNEL

At present, most of the HLVCs have not disclosed the administrative personnel evaluation plan. In order to find content about annual performance appraisal related administrative personnel, we retrieved 10 selected HLVCs' websites. Five of them announced appraisal plan, four of which released detailed regulations. After a summary, their appraisal plans focus on five aspects, i.e., morality, ability, diligence, performance and self-disciplined. By and large, these plans are composed of department and individual appraisal. Individual appraisal includes self-assessment, mutual assessment of the department staff and evaluation of the department head. To sum up, these plans have the following three aspects of the problem.

2.1 Lack of quantitative indicators

According to the appraisal plan announced by HLVCs, the individual assessment score mainly reflect the subjective evaluation and scoring of colleagues and supervisors, which is lack of scientific and objective, and fails to meet the DHP requirements. Of course, some colleges and universities, such as a college in Shenzhen, added a "service object" scoring in the evaluation index, expanding the scope of the assessment subjects. It is still subjective impression scoring and lack of objectivity.

2.2 Depends on subjective experience

The weight coefficient of each assessment index is set empirically, which lacks clear basis. For example, for the annual appraisal of non-teaching staff in a HLVC, the self-assessment and departmental mutual assessment account for 35%, the evaluation and scoring of service objects account for 35%, and the rating of department head accounts for 30%. In another HLVC in Zhejiang province, the personal score of the administrative staff accounts for 10%, the score of mutual evaluation of the staff in the department accounts for 40% and the score of evaluation by the department head accounts for 50%. There is a large difference for the weight of the assessment indexes, because lacks scientific weight setting method.

2.3 Emphasis on assessment and light management

Once the appraisal system is established, it is not easy to be changed and feedback from the assessed objects is not heard. This means that it will not evolve iteratively. However, performance management is a closed ring. It will constantly improve and evolve with a spiraling upward by virtue of the performance appraisal objectives, evaluation, feedback, and so on. The ultimate goal of performance management is to fully develop and utilize the resources of each employee to improve organizational performance, that is, to improve organizational performance through improving employee performance [3]. The DHP clearly puts forward that only by improving the school governance level, promoting the modernization of governance ability, and enhancing the learning and growth ability of administrative staff through performance management, can realize the modernization of governance ability. However, in the current performance management process of vocational colleges, the participation and feedback of assessment objects are ignored. So it is difficult to achieve the ultimate goal of improving performance.

3 INNOVATION OF PERFORMANCE APPRAISAL OF ADMINISTRATIVE PERSONNEL IN DHP

In view of the shortcomings of traditional appraisal system, based on the reference into the multidimensional performance evaluation index of Harvard business school, and the weights of decision-making optimization procedure from hierarchical analysis model [4], we proposed a new performance management system, as shown in figure 1. The performance management process is divided into four processes, i.e., evaluation index establishment, index weight determination, Comprehensive assessment and scoring, and performance feedback and improvement.

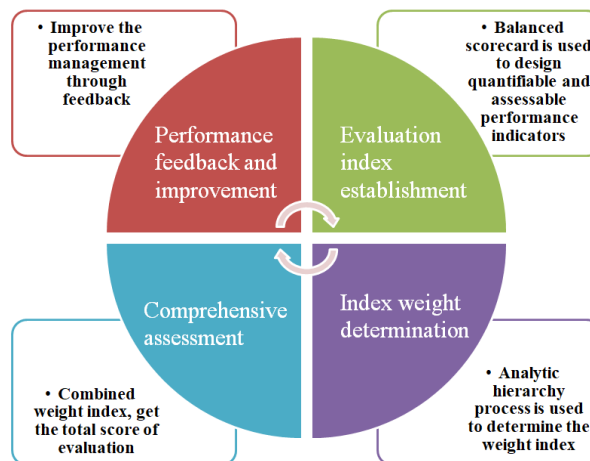


Figure 1 Performance management process

3.1 Index quantification based on balanced scorecard

Balanced scorecard is proposed by Kaplan and Norton at Harvard business school [5], which divides the strategy into four operational objectives, i.e., financial, customer, internal process, learning and growth. Meanwhile, it designs appropriate quantifiable, measurable and assessable performance indicators respectively, so as to promote the achievement of the strategic and long-term goals. The theory of balanced scorecard is consistent with the goal of performance assessment of administrative departments in colleges and universities. So it is introduced here to design quantitative index. According to the requirements of the DHP, the assessment indicators are divided into four dimensions: customer, internal business process, learning and growth, and finance. An appropriate amount of quantifiable, measurable, and assessable performance measurement indicators are designed, as shown in Table 1, where the symbols and numbers in parentheses are used for computational programming.

Financial dimension: For non-profit organizations such as colleges and universities, financial dimension provides a constraint effect. Whether the annual budget of each department is used reasonably and accurately, and whether the process conforms to the financial system, is an important yardstick to measure whether the work of the department reaches the standard, and also an important baseline for the work of administrative staff.

Customer dimension: The service objects of university administrative personnel mainly include students, teachers, superior leaders and peers of other units. Administration work in HLVCs should take the service level and the contribution size as the main assessment index. In order to construct the performance evaluation, service object can be equal to the customer of balanced scorecard. Satisfactions of teachers and students and superior departments or leaders are selected as the evaluation indexes of customer dimension, so as to gradually overcome the administrative tendency of colleges and universities.

Internal business process: Internal business process mainly refers to the colleges' internal management service level and quality, which comprehensively evaluates the basic workload and quality of non-full-time teachers. In principle, the basic workload consists of technical work, scientific research and teaching research, enterprise practice and public service, etc. The basic workload of administrative personnel is determined by the unit itself. Performance, characteristic work, department information announcement, information platform construction and other indicators affect the overall level of the college and its external influence. The education work content is added into the assessment indicators, aiming at implementing the fundamental task of education, and running the education of socialist core values through the whole process of technical and technical personnel training [1].

Learning and growth: The construction of the HLVC cannot be separated from the high-level teaching staff, and also cannot be separated from the high-level management services. Administrators are implementers and participants in university management. The promotion of administrative personnel quality and ability plays an important role in the promotion of the overall strength of colleges and universities. Scientific and technological research results, teacher training and continuing education directly reflect the learning and growth ability of administrative personnel, which are important means to promote the quality of management and the satisfaction of service objects, and important measures for the development of colleges and universities.

TABLE 1. PERFORMANCE APPRAISAL INDEX OF ADMINISTRATIVE PERSONNEL

First index dimension	level	Strategic target	Specific indicators	Implementation measures
Financial dimension (A)		The annual budget is used reasonably and accurately	Reasonable degree (A1)	Evaluated by the financial section
			Compliance degree (A2)	Evaluated by the financial section
Customer dimension (B)		Improve the service consciousness and level of administrative personnel	Teachers' satisfaction (B1)	Questionnaire survey
			Students' satisfaction (B2)	Questionnaire survey
			leaders' Satisfaction (B3)	Direct valuation from leader
			Attendance rate (B4)	Attendance system
Internal business process (C)		Improve the overall level of colleges and their influence abroad	Daily workload (C1)	Personal work report
			Achievements and characteristic work (C2)	Personal work report
			Educational work (C3)	Personal work report
			Departmental information release, platform construction (C4)	Personal work report
Learning and growth (D)		Improve the quality and competence of administrative personnel	Teaching and research achievements (D1)	Articles, book, patent, etc
			Training and continuing education (D2)	Annual training requirements
			Social services and business practices (D3)	Relevant requirement

3.2 Weight setting based on analytic hierarchy process

In order to avoid subjective disadvantages, this paper adopts the analytic hierarchy process (AHP) to set weight. The AHP proposed by Saaty who is an American operations researcher, is a combination of qualitative and quantitative analysis method [6]. It is particularly suitable for personnel evaluation of university administrative management where there are both qualitative and quantitative indexes.

(1) Questionnaire survey is conducted to determine the importance of indicators. By sending questionnaires to the management department and teachers, referring to the ratio of grade 1 to grade 9 scale of Saaty, we can assign the importance level of indexes by 1/9-9, as shown in table

2, where W_i represents any dimension index. By comparing with the financial, customer, internal business processes and learning and growth, the important degree of each index is determined.

TABLE 2. IMPORTANCE LEVEL ASSIGNMENT TABLE

	W_i/W_j								
Value	1/9	1/7	1/5	1/3	1	3	5	7	9
Degree	Absolutely	Significantly	Relatively	Slightly	/	Slightly	Relatively	Significantly	Absolutely

(2) The judgment matrix is constructed, the weight is calculated and the consistency is tested. According to the results of the questionnaire survey, the average score is calculated as the importance degree of pairwise indicators. The pairwise judgment matrix of each dimension is constructed, and the consistency judgment is made to calculate the consistency ratio (CR). CR is proportional to the consistency index (CI) while is inversely proportional to the random index (RI), as shown in Equation 1.

$$CR = \frac{CI}{RI} = \frac{(\lambda_{\max} - n)/(n-1)}{RI} \quad (1)$$

Where λ_{\max} is the maximum eigenvalue of the judgment matrix, n is the size of the judgment matrix, as shown in Table 3.

TABLE 3. RANDOM INDEX (RI)

n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51

When $CR < 0.1$, it is considered that the judgment matrix has satisfactory consistency. The judgment matrices under each dimension are listed successively, and the consistency judgment is calculated. Finally, the single layer weight and the total ranking weight of the judgment result are listed in the general table.

(3) The performance appraisal scores of administrative personnel is Calculated. After determining the weight index, the administrative personnel participating in the appraisal should also be scored according to the appraisal indicators in Table 1. Here we use a hundred-mark system. 90-100 is excellent, 80-89 is good, 70-79 is medium, 60-69 is bad. Finally, the total score of the comprehensive evaluation of the administrative staff is obtained by multiplying the score with the index weight.

3.3 Improvement of performance feedback

Performance management cannot be blindly implemented. Appraisal is not a goal but a process. People will do better if they can get feedback on how well they are doing in achieving their goals, because feedback helps them see if there is a difference between what they are doing and what they want to do. Only through a sound feedback mechanism can the college management clearly understand and grasp the actual recognition of staff performance, and combine the strategic goals of the college with the personal development goals of the staff. At the same time, combined with the appraisal results, through the provision of training opportunities, salary level adjustment, post title promotion and other positive incentive work, with the help of performance improvement management, promote the effectiveness of DHP construction.

4 CASE STUDY

A vocational college (Named as X) is one of the first batch of construction units selected for DHP. Its recent strategic goals are as follows: by 2023, comprehensive strength and a number of major groups will rank steadily in the forefront of national higher vocational colleges; the quality, service ability and international reputation will be significantly improved; some of the college indexes will reach the international advanced level; and it will initially be built into a world-class vocational college with Chinese characteristics. Around its strategic goal, the value orientation of the administrative department should be as follows: within the scope of responsibilities of the department, improving the service ability, serving the teaching and teachers, and helping the DHP construction of the college. We take the personnel department of X as an example to explore the innovative mode of administrative personnel appraisal system.

The questionnaire survey was carried out and the judgment matrix was constructed. Forty senior professors and functional department leaders were selected for the questionnaire survey. In this survey, 47 questionnaires were sent out and 47 questionnaires were returned. In addition to the invalid questionnaires without consistency matrix, 41 valid questionnaires were finally obtained.

The weight set of evaluation indicators is represented by $W = (A, B, C, D)$, where A, B, C, D are the weights of four first-level indicators in the index evaluation system, i.e., financial dimension, customer dimension, internal business process, learning and growth respectively. $A=(A1, A2)$ is used to represent the second-level indicators, where A1 stands for the reasonable level of budgeting within the department and A2 stands for whether the use of funds conforms to the financial system. The weight set of other indicators is inferred as the same way. Taken the first-level the first-level indicator as an example, by virtue of software based on MATLAB, we can obtain $W=(0.0713, 0.4816, 0.2608, 0.1864)$, $CR = 0.0512 < 0.1$. The judgment matrix and consistency test can be seen as Table 4.

TABLE 4. JUDGMENT MATRIX AND CONSISTENCY TEST OF STRATEGIC TARGET LAYER

	A1	B1	C1	D1	W0
A1	1	1/5	1/4	1/3	0.0713
B1	5	1	3	2	0.4816
C1	4	1/3	1	2	0.2608
D1	3	1/2	1/2	1	0.1864

Similarly, the weight value of the second-level indicators and the total weight of the administrative personnel can be obtained, as shown in Table 5.

TABLE 5. SINGLE LAYER WEIGHT AND HIERARCHY TOTAL SORTING WEIGHT

First level indicators	First level index weight	Second level indicators	Second level index weight	Total weight
A	0.0713	A1	0.3333	0.0238
		A2	0.6667	0.0475
B	0.4816	B1	0.615	0.2962
		B2	0.1027	0.0495
		B3	0.2823	0.136
C	0.2608	C1	0.3509	0.0915
		C2	0.3509	0.0915
		C3	0.1091	0.0285
		C4	0.1891	0.0493
D	0.1864	D1	0.6571	0.1225
		D2	0.1963	0.0366
		D3	0.1466	0.0273

According to the weight of each assessment index, combined with the scores of each central department, the total score of performance assessment of each administrative staff in the personnel department is finally calculated. The performance appraisal results are divided into four grades: excellent, good, medium and bad. It should be noted that the proportion of excellent is not more than 15%. Performance appraisal results are linked to employee salary level adjustment, post title promotion, etc. At the same time, according to the appraisal results, department interviews and feedback on work performance, work content and improvement measures are carried out to help each administrative staff improve their own work performance and formulate a new round of work plan.

From the weight calculation results of X college, we can see that customer dimension has the highest weight among the four dimensions of strategic objective. This is in line with the DHP strategy under the development of work performance and teachers and students' satisfaction as the main basis for the assessment and evaluation of administrative staff. In the financial dimension, whether the fund use process conforms to the financial system and the reasonable degree of the fund use within the department have the same weight, aiming to restrain the department's control of the rationality and accuracy of the fund use process. In the customer dimension, the weight of teacher satisfaction is the highest, because the assessed object is the administrative personnel of the personnel department and the main service object is the teachers, so whether the teacher is satisfied is the most critical index for the evaluation of the customer dimension. In the internal business process, the workload of daily work, performance and characteristic work have a relatively high weight, indicating that the content and quality of daily work of administrators directly affect the overall level of a university and its external influence.

In the dimension of learning and growth, the weight of teaching and research achievements is the highest, which indicates that scientific and technological research achievements can directly reflect the learning and growth ability of administrative personnel, and are also an important factor in the construction of HLVCs.

5 CONCLUSION

Based on the balanced scorecard theory, the appraisal of administrative personnel in HLVCs is a good combination of the DHP construction strategic target and evaluation indexes. It also makes the quantitative index more scientifically. Meanwhile, this method can effectively avoid the disadvantages of relying on subjective experience to set weight by virtue of the AHP. In the concrete practice process, according to the actual situation, the work characteristics of each department, as well as the feedback results of the assessment object, colleges should adjust the relevant indicators and weights timely, and build a set of operable performance management system of administrative personnel.

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