

Empirical Analysis of the Influencing Factors of Human Resource Management Mode of Petroleum Enterprises in China

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Received 6 October 2014, www.cmnt.lv

Abstract

Human resource management is considered as a practical art. Enterprises in various industries have different human resource management modes. By taking Chinese petroleum enterprises as an example, empirical analysis was performed on the influencing factors of human resource management mode by conducting questionnaire investigation. Results show that there are 8 principle factors influencing the human resource management mode, which can be divided into three categories, including internal constraint factors, external constraint factors, and strategic interests. The research indicates that the construction of human resource management mode of adapting to current economy requires to be green and low carbon, the eight factors can be considered to reduce the blindness and repeatability of petroleum enterprises in human resource management and improve the management efficiency and effectiveness.

Keywords: Human Resource Management; Mode; Influencing Factors; Petroleum Enterprises

1 Introduction

Technological Development of Petroleum and Chemical Industry in 12th Five-Year Plan that formulated by China Petroleum and Chemical Industry Federation put forward that the promotion of energy saving and emission reduction and green and low carbon development is the development trend of petroleum and chemical industry and the internal requirements for their sustainable development in future. Therefore, petroleum enterprises need to build a human resource management mode which is consistent with green and low carbon development. Aiming at this, empirical analysis was carried out on the factors that influence the construction of human resource management mode of petroleum enterprises. The research provided reference for the construction of human resource management mode which is suitable for the green and low carbon development.

2 Influencing Factors of Human Resource Management Mode

2.1 CONCEPT OF HUMAN RESOURCE MANAGEMENT MODE

In view of overseas research on human resource management mode, the human resource management mode is defined with three aspects as following: first, it is an abstract and concise management method and its formation is associated with the development environment and strategy of the enterprises; second, it accommodates the development mode and characteristics of the enterprises, and its application is not limited in the traditional functions of human resource management; third, its components interact with each other. The interaction relation is the internal dynamic mechanism for realizing the effect of

human resource management and can be represented by certain flow chart or frame diagram [1]. The authors agreed with the definition made by Xiao Mingzheng (2006) and modified it as: human resource management mode is an operable method for managing human resource that sufficiently considers the environmental factors of an enterprise; it is oriented by certain aim and has internal dynamic transmission mechanism [2]. The method can be represented as solid implementation process or implementation frame abstractly and concisely.

2.2 INFLUENCING FACTORS OF HUMAN RESOURCE MANAGEMENT MODE

Based on contingency theory, there is no generally applied management practice and the management of an enterprise has to match the surrounding environment. Contingency theory includes the following factors: first, there is no optimal management mode; second, the management methods are not equally effective; third, the optimal management mode relies on the environment characteristics that an enterprise depends on for operation [3]. In other words, there is no method which is suitable for multiple enterprises, and the management therefore depends on the real conditions. Hence, the human resource management should be determined by comprehensively considering the relevant variables influencing the management effect and taking the variables as basic basis for determining human resource management mode. There are multiple factors influencing the determination of human resource management mode of an enterprise, including enterprise's strategy, ownership, life circle, information structure, scale, culture, industry characteristics, labor market, law, etc. [2].

Compared with common enterprises, petroleum enterprises show different production characteristics and specific human resource management. Furthermore, inside

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petroleum enterprises, different departments pay attention to various aspects considering human resource management. So, to analyze the influencing factors of green human resource management mode, primary data are obtained by spot investigation and relevant methods are used to process and analyze the data.

3. Questionnaire Design and Data Collection

3.1 QUESTIONNAIRE DESIGN

The content of the questionnaire contains two aspects: the basic information of the interviewees and the descriptive questions for their departments, including age, academic degree, position, company nature, etc., and questions about the investigated topic. Eight categories which are strategic interest, industry characteristics, labor, related supervision, ownership, information structure, scale, and culture environment corresponding to 21 questions are set in the questionnaire. Each question corresponds to an influencing factor, as demonstrated in Table 1. The first part of the questionnaire applies descriptive statistical method, while the answers to all the questions in the second part are collected using Likert Scale. To ensure the final questionnaire is intelligible with low error and reflects the real situation of interviewed samples, the first draft of the questionnaire is modified by the correction of several experts and the interview and feedback of research objects.

TABLE 1 Factors correspond to investigated questions

Strategic interests	X ₁	Economic interest
	X ₂	Political interest
	X ₃	Social interest
Ownership	X ₄	ownership structure
	X ₅	Attribute of enterprises
Information structure	X ₆	Organizational structure
	X ₇	Decision-making mechanism
Scale	X ₈	Operating income
	X ₉	Production scale
Culture environment	X ₁₀	Internal cultural characteristics
	X ₁₁	Social ethics
Industry characteristics	X ₁₂	Technological development level
	X ₁₃	Production management characteristics
	X ₁₄	Business development prospect
Labor	X ₁₅	Safety regulation
	X ₁₆	Talent market development level
	X ₁₇	Talent supply and demand
Relevant supervision	X ₁₈	Comprehensive abilities of employees
	X ₁₉	Laws and regulations
	X ₂₀	Administrative system
	X ₂₁	Social supervision

3.2 INVESTIGATION AND DATA COLLECTION

Whether the investigation can be performed successfully influences the quality of data collection and indirectly influences the final analysis results. The questionnaire is collected on spot collection and email. To guarantee the accuracy of the investigation, the questionnaire is mainly conducted for employees (of different business department) of petroleum enterprises. They learn the production and operation management of petroleum enterprises. For email questionnaire, matters which require to be stressed in the

filling are demonstrated in the front of the questionnaire; while for spot investigation, the matters are described in advance and relevant theory about green human resource management is explained. To ensure the questionnaire content reflects the real opinion of the research objects, the questionnaire is anonymous.

3.3 DATA PROCESSING METHODS

The data processing methods are as follows:

Step 1: Define variables. The factors in the investigation table are defined as analysis variables and represented as

$$X_i (i = 1, 2, \dots, 21) \tag{1}$$

Step 2: Standardized processing for original data. The scores of each variable in Table 1 are standardized as X_{ij} .

Following formula is used to standardize the original data: $X_{ai}' = \frac{X_{ai} - \bar{X}_i}{\sigma}$. Sample mean is calculated using

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n}$$

Sample variance is obtained using $\sigma^2 = \frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n-1}$.

Where α is the number of samples and n is the number of variables of a single sample, $i, j, t = 1, 2, \dots, n$.

Step 3: SAS analysis is performed for variables and the correlation coefficient matrix R of the variables is constructed.

$$R = (r_{ij}) p \times p,$$

$$r_{ij} = \frac{\sum_{\alpha=1}^n (X_{\alpha i} - \bar{X}_i)(X_{\alpha j} - \bar{X}_j)}{\sqrt{\sum_{\alpha=1}^n (X_{\alpha i} - \bar{X}_i)^2} \cdot \sqrt{\sum_{\alpha=1}^n (X_{\alpha j} - \bar{X}_j)^2}} \tag{2}$$

Where α is the number of samples and p represents variable form $i, j = 1, 2, 3, \dots, p$.

Step 4: the eigenvalue and eigenvector of R are computed using SPSS software.

Step 5: Factor loading matrix $A = (\alpha_1, \alpha_2, \alpha_3, \dots, \alpha_p)$ is established, where $\alpha_{ij} = u_{ij} \sqrt{\lambda_i}$, $i, j = 1, 2, 3, \dots, p$.

Step 6: Each index is classified and described according to the load.

4. Data Processing and Results Analysis

The data in first part obtained from the questionnaire are statistically described using SPSS19.0, while factor analysis is applied to analyze and process the data obtained in the second part of the questionnaire.

4.1 DESCRIPTIVE STATISTICAL ANALYSIS

A total of 200 pieces of questionnaire are released in the

investigation, among which 120 pieces are released through email and the other 80 pieces are distributed on spot. There are 189 pieces of questionnaire returned with a return rate of 94.5%. Among the 189 pieces, there are 162 pieces of valid questionnaire, accounting for 81% of the total questionnaire distributed. The relevant data of the first part of the questionnaire are illustrated in Table 2.

TABLE 2 Basic situation of research objects

Basic information	Items	Sample number	proportion
Business divisions	Natural gas business	36	19.1%
	Professional technique service	29	15.3%
	Exploration and development of oil field	52	58.4%
	Refinery and marketing	41	21.7%
	Others	31	16.5%
	Total	189	100%
Positions	Administrative staff	4	2.2%
	Business department principal	7	3.7%
	Low-level managers	32	16.9%
	Frontline employees	146	77.2%
	Total	189	100%
Age	≤35 years old	91	48.1%
	In the range of 36-50 years old	57	30.2%
	Above 51 years old	41	21.7%
	Total	189	100%
Academic degree	Junior college and bellow	37	19.6%
	Bachelor degree	92	48.7%
	Master degree	32	16.9%
	Doctor degree and above	28	14.8%
	Total	189	100%

4.2 CONFIDENCE AND VALIDITY TEST

4.2.1 Confidence test

The questionnaire confidence refers to its reliability. There are many method for confidence analysis, and Cronbach’s α coefficient method is applied in the research. Meanwhile, the commonly used empirical standard is adopted, that is, when the Cronbach’s α coefficient is or higher than 0.7, the confidence test is passed through. In other words, it means that the questionnaire is reliable.

SPSS19.0 is applied to analyze the 21 factors of 8 categories and the obtained test results of the 8 categories are demonstrated in Table 3.

TABLE 3 Confidence test results

Categories	Number of questions	α value	Reference value
Strategy	3	0.787	$\alpha \geq 0.7$
Ownership	2	0.795	

TABLE 5 Total variance of factor analysis

Information structure	2	0.876
Scale	2	0.913
Culture	2	0.892
Industry	4	0.811
Labor	3	0.903
Supervision	3	0.853

Table 3 shows that all the Cronbach’s α coefficients of the eight categories are larger than the reference 0.7. It indicates that the confidence passes through the internal consistent test, and therefore the questionnaire is reliable.

4.2.2 VALIDITY TEST

Validity is to reveal the relationship between structural variable and its measuring index. KMO test and Bartlett test of sphericity are used to analyze the data distribution and the independence of the eight factor categories. According to common empirical standard, when KMO value is larger than 0.7 and P value of Bartlett test of sphericity is less than 0.05, the questionnaire shows construct validity.

The sample measuring value of KMO that obtained in the analysis of the 21 factors of 8 categories using SPSS19.0 is 0.795, which is significantly larger than 0.7; meanwhile, the P value of Bartlett test of sphericity is less than 0.01 (as displayed in Table 4). Obviously, they both support the factor analysis.

TABLE 4 KMO value and value of Bartlett test of sphericity

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.795
Bartlett's Test of Sphericity Approx. Chi-Square	861.254
df	124
Sig.	.000

4.3 EMPIRICAL ANALYSIS

4.3.1 Extract public factors

Principal component analysis is carried to extract public factors according to the standard that accumulative contribution rate is higher than 80%. The situation that the factors extracted using SPSS19.0 software are used to explain the total variance of original variables is illustrated in Table 5.

Table 5 shows that the accumulative contribution rate of variance of the first three factors is 82.369%, which indicates that the information represented by the three factors sufficiently reflects most of the information of the original measuring variables. Additionally, Figure 1 illustrates that the characteristic root of the first three factors is significantly higher than the characteristic value of other following factors, and the characteristic value reduces gradually from the forth factor. This further reveals that it is proper to extract three factors. Therefore, three public factors are extracted and denoted as F1, F2, and F3. The obtained factor loading matrix is demonstrated in Table 6.

Component	Initial characteristic value			Extraction of square and load			Rotation of square and load		
	Total	Variance (%)	Accumulation (%)	Total	Variance (%)	Accumulation (%)	Total	Variance (%)	Accumulation (%)
1	8.673	39.926	39.926	8.673	39.926	39.926	7.328	33.726	33.726

4.3.2 Denomination and explanation of factors

As factors are difficult to be described using factor loading matrix, the matrix is rotated by using varimax method of SPSS19.0 statistically software to better explain the factors. The rotated factor loading matrix is illustrated in Table 7.

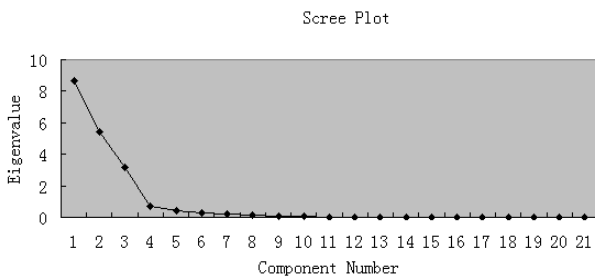


FIGURE 1. Screen plot

TABLE 6 Factor loading matrix

	The main factor		
	1	2	3
X9	.891	.122	-.011
X10	.925	-.332	-.023
X12	.829	-.336	-.021
X18	.793	.187	.035
X13	-.847	.073	.053
X4	-.856	.183	-.116
X6	-.736	.121	-.314
X11	.161	-.316	.321
X16	-.657	-.357	.323
X14	-.635	-.039	-.521
X20	.131	-.405	-.065
X19	-.517	.812	.092
X21	-.458	.763	-.212
X15	-.513	-.653	.207
X7	.312	-.581	.252
X2	.341	.139	.787
X17	-.365	.381	-.608
X8	.352	-.521	.111
X5	-.158	.175	.431
X1	.275	.161	-.914
X3	.263	.454	.215

Table 6 demonstrates that the first factor F1 presents large loading coefficients for factors of production scale, internal culture characteristics, technological development level, and comprehensive ability of employees. As the four factors are internal factors, they are called internal constraint factors.

The second factor F2 exhibits large loading coefficients for laws, regulations and social supervision, which are the external factors that limit the enterprises. Therefore they are regarded as external constraint factors.

The third factor F3 shows large loading coefficients for political interest and economic interest, which are factors of strategic interests. So, F3 is strategic interest objective factor.

4.4 RESULTS ANALYSIS

It is observed from Table 6 that production scale, internal culture characteristics, technological development level, and comprehensive ability of employees are highly correlated with the first factor F1; laws and regulations and social supervision are significantly correlated with the second factor F2; and political interest and economic interest are significantly associated with the third factor F3. The result is consistent with the rotated result that shown in Table 7, indirectly indicating the reliability of the research results. Therefore, the factors in Table 8 are considered as principle factors that influence the human resource management mode of petroleum enterprises.

The eight factors obtained from above empirical analysis are the principle and significant factors that influence the construction of human resource management mode of petroleum enterprises. Therefore, in the construction of green human resource management mode, they have to be sufficiently considered. The specific influences of the 8 factors on the construction of green human resource management mode are explained in the following section.

TABLE 7 Rotated factor loading matrix

		Principle factors		
		1	2	3
X9	Production scale	.913	.134	-.021
X10	Internal culture characteristics	.902	-.358	-.025
X12	Technological development level	.834	-.341	-.031
X18	Comprehensive ability of employees	.822	.192	.041
X13	Production and management characteristics	-.827	.058	.053
X4	Ownership structure	-.816	.167	-.125
X6	Organization structure	-.746	.133	-.213
X11	Social ethics	.168	-.329	.309
X16	Development level of talent market	-.617	-.345	.314
X14	Development trend	-.665	-.042	-.481
X20	Administrative supervision	.152	-.414	-.072
X19	Laws and regulations	-.547	.844	.087
X21	Social supervision	-.398	.797	-.352
X15	Safety regulations	-.483	-.703	.126
X7	Decision-making mechanism	.321	-.491	.344
X2	Political interest	.312	.169	.813
X17	Talent supply and demand	-.314	.321	-.515
X8	Operation income	.302	-.541	.121
X5	Attribute of enterprises	-.158	.103	.531
X1	Economic interest	.215	.150	.895
X3	Social interest	.233	.399	.267

TABLE 8 Major factors that influence the human resource management mode of petroleum enterprises

	Factors	Rotated loading coefficient
X9	Production scale	.913
X10	Internal culture characteristics	.902
X12	Technological development level	.834
X18	Comprehensive ability of employees	.822

X19	Laws and regulations	.844
X21	Social supervision	.797
X2	Political interest	.813
X1	Economic interest	.895

5. Conclusions



Petroleum enterprise, as energy enterprise with high input, risk and pollution, its production characteristics and specific human resource management determine that it has more serious problems in sustainable development comparing with common enterprises. Considering the long-term goal of sustainable development of petroleum enterprises, the enterprises are expected to stress human and construct corresponding human resource management mode to supply dynamic resource for the sustainable development. Questionnaire was conducted to analyze the influencing factors of human resource management mode of petroleum enterprises in China, and empirical analysis was performed for the collected data. The results showed that the major factors that influence the human resource management mode of petroleum enterprises are production scale, internal culture characteristics, technological development level,

comprehensive ability of employees, laws and regulations, social supervision, political interest, and economic interest. Eight factors are divided into internal constraint factors, external constraint factors, and objective factors of strategic interest.

The research implies that petroleum enterprises need to build human resource management mode of catering to the development and transmission of social economy by considering the factors including production scale, internal culture characteristics, technological development level, comprehensive ability of employees, laws and regulations, social supervision, political interest, and economic interest. Besides, the internal and external constraint factors should be analyzed. By doing so, petroleum enterprises can reduce the blindness and repeatability of in human resource management and improve the management efficiency and effectiveness. Of course, further research is needed to conducted on the method of constructing human resource management mode that suitable for the green and low carbon development trend of social economy.

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