

PERSPECTIVE ASSESSMENT OF PERSONNEL COMPENSATION LEVEL

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Abstract: The paper substantiates the need for a perspective assessment of personnel compensation in accordance with the strategic goals of doing business since the information set of an analytical system is the basis for decision-making. The scientific and practical aspects of the compensation modeling for employees in the oil industry have been studied: the goal has been set, and the tasks for the perspective assessment of the compensation level have been determined. The possibility of applying the regression model for revealing the dependence of the level of compensation to corporate personnel on quantitative and qualitative factors is estimated. The following indicators were identified for their inclusion in the regression model: the number of employees, length of service, and the index of labor distribution. The factors that have the strongest impact on the compensation to employees are highlighted. Qualitative indicators have been introduced in order to take into account qualitative variables that have an impact on the amount of personnel compensation in the future: possession of a higher vocational education and knowledge of foreign (English) language. A linear multiple regression equation is derived taking into account the specified qualitative factors. As a result, it was concluded that the most significant factor in the growth of the compensation to personnel of an oil company developing oil deposits not only within the Russian Federation but also abroad is command of English. Consequently, this factor serves as a basis for introducing incentive types of compensation for personnel in oil industry.

Keywords: compensation, analysis, stochastic analysis, correlation, regression, management decisions, ANCOVA-model.

1 Introduction

In modern conditions of free competition and speeding-up of information flows, the problems of analytical support of labor costs management and its compensation are actualized (Barrett et al, 2007), (Nesterov et al, 2014).

The analytical system allows us to evaluate the quantitative and qualitative changes occurring within strategic management of compensation costs, to identify trends in the development of favorable and adverse events and phenomena in the practice of employee compensation (Sungatullina et al, 2016). Thus, the information set generated in the analytical system serves as a basis for making and implementing decisions within the framework of personnel compensation management.

2 Method

In practice, not all economic phenomena and processes can be studied using the method of deterministic factor analysis, since in most cases they can not be reduced to functional dependencies., stochastic models are often used in economic

research of personnel compensation, because all factors on which the reward depends, operate in a complex and are interrelated. Depending on how optimally the various factors combine, there will be a different impact degree of each of them on the compensation value.

The purpose and objectives of a perspective assessment of the compensation level for personnel using stochastic analysis methods are to determine the main factor affecting the amount of compensation. For this, regression models can be used, where explanatory variables are both quantitative and qualitative, that is, ANCOVA models (Beehner,2016), (Lu et al , 2016), (Rajkumar et al, 2015).

It is possible to present the following quantitative factors affecting the level of personnel compensation:

- the category of employees;
- work experience;

- percentage of overfulfilment of the plan by the volume of output (index of labor distribution - ILD).

Qualitative variables:

- possession of higher education;
- command of English.

In this case, the regression will look like:

$$y = a + b_1 \cdot x_1 + b_2 \cdot x_2 + b_3 \cdot x_3 + y_1 \cdot D_1 + y_2 \cdot D_2 + e \quad (1)$$

Where:

a - the tariff rate;

x_1 - the class of an employee;

x_2 - length of service;

x_3 - percentage of overfulfilment of the plan in terms of output (index of labor distribution - ILD);

D_1 - possession of a higher vocational education;

D_2 - knowledge of foreign (English) language.

3 Result

We investigate the dependence of personnel compensation on quantitative and qualitative factors on the basis of materials presented by an oil company from the Republic of Tatarstan.

Table 1. Data on the compensation to employees of the integrated treatment and pumping out department of an oil company from the Republic of Tatarstan for a month (fragment)

Item No.	Full name	Amount of compensation (rubles)	Class of the worker	Work experience of the employee (years)	Percentage of overfulfilment of the plan (index of labor distribution)	Higher education	Knowledge of a foreign language (English)
1	2	3	4	5	6	7th	8
1	Babanov A.A	17100	4	2	1	0	1
2	Maksimov L.N.	19900	5	6	1.5	0	0
3	Kondratyuk S.E.	9600	2	10	0.5	0	0
4	Apraksin N.D.	12500	3	5	1	0	0
etc.							
47	Ivanova I.S.	15400	4	8	1	1	0
48	Ziyatdinova I.F.	17300	4	12	1.2	1	1

49	Zolova I.A.	16950	4	14	1	1	0
50	Abdullin A.Sh.	21100	6th	9	1.1	1	1

Using the "Correlation" tool from the Excel software package, we build the pair correlation linear coefficients matrix.

Table 2. Pair correlation linear coefficients matrix

	Y	X ₁	X ₂	X ₃
Y	1			
X ₁	0.947726	1		
X ₂	0.680576	0.620713	1	
X ₃	0.381595	0.306414	0.371912	1

The analysis shows that there is the greatest close statistical relationship between the employee compensation and his/her class ($r_{yx1} = 0.948$), strong statistical relationship between the employee compensation and his/her length of service ($r_{yx2} = 0.681$), and moderate statistical relationship between the employee compensation and index of labor distribution (ILD) ($r_{yx3} = 0.382$).

Factors X₁ and X₂ are closely interrelated ($r_{x1x2} = 0.621$), but the value is less than 0.7, so both factors can be retained, just like the factor X₃ which is weakly related to other factors.

In our study, the number of observations was $n = 50$, and the number of independent factors $m = 3$. Thus, we form a three-

factor multiple regression linear model. The selection of factors can be performed manually (based on the analysis of the pair correlation coefficients matrix) in the software package Excel:

$$Y_x = a + b_1x_1 + b_2x_2 + b_3x_3 \quad (2)$$

The regression estimate is carried out by the least square method using the "Data Analysis and Regression Tool" package.

The following results are obtained.

Table 3. Regression statistics

Multiple R	0.957516744
R-square	0.916838315
Normalized R-square	0.911414727
Standard Error	1263.823621
Observations	50

The coefficient of multiple correlation equal to 0.958, indicates a close relationship between the amount of compensation, class, length of service, and the index of labor distribution (ILD) of an employee.

The coefficient of determination which is equal to 0.917, shows that 91.7% of the compensation amount is formed as a result of the influence of the class, length of service and the index of labor distribution (ILD) of the employee, and only 8.3% of the compensation amount variance is formed under the influence of factors which are not considered in this model.

Table 4. Dispersion analysis

	df	SS	MS	F	The importance of F
Regression	3	810028391.30	270009463.800	169.046448	7.5945E-25
Residual	46	73473506.72	1597250.1146		
Total	49	883501898.00			

The factor dispersion of the compensation amount is 270009463.8; the residual dispersion is 1597250.15.

The observed value of the Fisher test 169 (the importance is of 7.5945E-25 <0.05) confirms the statistical reliability of the regression equation and the determination coefficients.

Table 5. Factor dispersion of the personnel compensation amount for the complex treatment and pumping out department of an oil company from the Republic of Tatarstan

Index	Coefficient	Standard Error	t-statistic	P-value	Lower 95%	Upper 95%
Y-intersection	2423.12	854.31	2.84	0.01	703.48	4142.76
X ₁	2.278.21	177.92	15.50	0.00	2400.08	3116.34
X ₂	103.80	45.34	2.29	0.03	12.53	195.06
X ₃	1234.72	758.41	1.63	0.11	-291.88	2761.32

We write the regression equation (we specify the standard error of the coefficients and the observed t-statistic in parentheses):

$$Y = 2423.12 + 2758.21 * x_1 + 103.80 * x_2 + 1234.72 * x_3$$

According to the regression coefficients obtained, the amount of compensation increases by 2758.21 rubles with an increase in the employee's class by one with the index of labor distribution (ILD) equal to 1, and no change in the length of service of the employee. With each year of work, the amount of compensation increases by 103.80 rubles, regardless of the increase in the class and influence of ILD. While maintaining the class and the length

of service of employees, the amount of compensation increases by 1234.72 rubles, with the increase in ILD value by 1 (100%).

Next, we introduce the fictitious variable D. To select a variable from D₁ and D₂, we analyze the data presented in Table 6, linear coefficients of pair correlation with the participation of qualitative factors D₁ and D₂.

Table 6. Linear coefficients matrix for pair correlation

	Y	X ₁	X ₂	X ₃	D ₁	D ₂
Y	1					
X ₁	0.947726	1				
X ₂	0.680576	0.620713	1			
X ₃	0.381595	0.306414	0.371912	1		
D ₁	0.408322	0.3339676	0.436695	-0.02873	1	
D ₂	0.285738	0.221564	-0.06491	-0.05252	0.088301	1

The results obtained show that the factor D₁ (possession of higher education) which is equal to 0.408, has the greatest relation with Y. The factor D₂ (command of the English) is 0.3 and has not much less relation, in comparison with the factor D₁. Hence, we select both factors as fictitious variables.

Next, we use the "Regression" analysis tool and write down the multiple regression linear equation, including qualitative features in it: possession of higher education and command of English.

The following results are obtained.

Table 7. Regression statistics and variance analysis

Multiple R	0.96711
R-square	0.93529
Normalized R-square	0.92794
Standard Error	1139.86311
Observations	50

Dispersion analysis					
	df	SS	MS	F	Importance of F
Regression	5	826333229.5	165,266,645.9	127.19786	5.31163E-25
Residue	44	57168668.47	1,299,287.92		
Total	49	883501898			

The multiple correlation coefficient which is equal to 0.967, indicates a close relationship between the amount of compensation, class, length of service, ILD, possession of a higher education, and command of English.

a result of the influence of employees' class, length of service, ILD, possession of a higher vocational education and command of English, and only 6.5% of the compensation amount variance is formed under the influence of factors not taken into account in this model.

The coefficient of determination equal to 0.935 shows that 93.5% of the amount of compensation to employees is formed as

Table 8. Factor dispersion for the complex oil treatment and pumping out department personnel compensation of an oil company from the Republic of Tatarstan per year

Index	Factors	Standard Error	t-statistics	P-value	Lower 95%	Upper 95%
Y	2048.50	797.20	2.57	0.01	441.85	3655.15
X ₁	2553.32	171.29	14.91	0.00	2208.11	2898.52
X ₂	106.10	45.31	2.34	0.02	14.79	197.40
X ₃	1674.22	705.63	2.37	0.02	252.11	3096.33
D ₁	673.53	383.79	1.75	0.09	-99.95	1447.01
D ₂	1143.55	393.37	2.91	0.01	350.76	1936.33

As a result, we obtain the linear multiple regression equation taking into account the qualitative factors D₁ (possession of higher education) and D₂ (command of English):

Let's compare the quality of the model with a fictitious variable with the usual regression model (Table 9).

$$Y = 2048.50 + 2553.32 \cdot X_1 + 106.1 \cdot X_2 + 1674.22 \cdot X_3 + 673.53 \cdot D_1 + 1143.5 \cdot D_2 + e$$

Table 9. Comparative table for indicators of the model with fictitious variable and the usual regression model

Indicators	Without fictitious variable	With fictitious variable
Multiple R	0.96	0.97
R-square	0.92	0.94
F - Statistics	169.00	127.20

Regression sum of squared deviations	810,028,391.30	826,333,229.50
Error sum of squares	73,473,506.72	57,168,668.47
t _a	2.84	2.57
t _{b1}	15.50	14.91
t _{b2}	2.29	2.34
t _{b3}	1.63	2.37

The results of the comparison show that when a fictitious variable is introduced, the quality of the model practically does not change, although small changes towards improving the quality of the model are observed in such regression analysis indicators as:

- multiple R;
- R-square;
- regression sum of squared deviations.

To make a conclusion about the influence of qualitative factors on the amount of personnel compensation, we use Student's statistics. T-statistics for the differential coefficient of Y-intercept before the variable D₁ is 1.75, and before the variable D₂ - 2.91. The critical value of t-statistics is 2.0154 (t - 0.05; 44). Consequently, possession of higher education does not affect the amount of compensation, and command of English increases it by 1,143.55 rubles.

Thus, for the perspective assessment of the average amount of personnel compensation in an enterprise, the following model can be recommended:

$$Y = 2048.50 + 2553.32 \cdot X_1 + 106,1 \cdot X_2 + 1674.22 \cdot X_3 + 1143.55 \cdot D_2 + e$$

In the case of command of English:

$$Y = (2048.50 + 1143.55) + 2553,32 \cdot X_1 + 106,1 \cdot X_2 + 1674,22 \cdot X_3 + e$$

Without command of English:

$$Y = 2048.50 + 2553.32 \cdot X_1 + 106,1 \cdot X_2 + 1674.22 \cdot X_3 + e$$

We introduce the following assumptions. For the following year, it is planned to increase the average class index of employees (x₁) to 4 due to training activities; length of service (x₂) can not be changed due to increased production, attraction of staff and their training, and will be 8 years; the percentage of fulfillment of the plan (in other in words: the index of labor distribution, ILD) x₃ is planned to be increased to 1.1. Taking into account this information, the projected compensation to personnel of the complex oil treatment and pumping out department of the oil company from the Republic of Tatarstan will be:

In the case of command of English:

$$Y = (2048.50 + 1143.55) + 2553.32 * 4 + 106.1 * 8 + 1674.22 * 1.1 = 16095.78 \text{ rubles.}$$

Without command of English:

$$Y = 2048.50 + 2553.32 * 4 + 106.1 * 8 + 1674.22 * 1.1 = 14952.22 \text{ rubles.}$$

Consequently, command of English is a more promising factor in the amount of compensation than possession of a higher vocational education. This is because the oil company being under study develops oil deposits not only within the Russian Federation, but also abroad. Proceeding from this, the presence in the reserve of employees who speak a foreign language is a significant factor. Therefore, the introduction of incentive allowances is recommended, what will affect the amount of personnel compensation.

4 Discussion

As studies show, a perspective assessment of compensation should be built taking into account the qualitative variables that characterize the development of knowledge and skills of staff. These properties have an impact on the formation of the principles of compensation to personnel in conjunction with the strategic objectives of a company (Sum, 2010). Many specialists (Chen et al, 2005) emphasize the relevance of business strategies and human capital strategies to motivate employees to work effectively. In particular, P. Boxall (Boxall,1998) notes the relationship between the company's competitive advantage, business strategy and reward system. B.K. Boyd and A. Salamin (B.K. Boyd and A. Salamin,2001) give the key role of sustainable enterprise development to bonus programs, T.J. Bush (T.J. Bush,2003) emphasizes that a bonus system is a significant factor, R. White (White,2005) and F.Yuliyaty (F.Yuliyaty,2017) also indicate the need for development of a logically based employee incentive scheme.

Our studies confirm the findings of specialists. A perspective assessment of the level of compensation to personnel based on the ANCOVA-model promotes the formation of information for building incentive programs for rewarding employees in conjunction with the concept of sustainable development of a company.

5 Summary

Modern business conditions are aimed at identifying factors that have an impact on the facts of financial and economic activities of organizations in the long term. In this context, the most precisely economic phenomena are described using probabilistic stochastic models, since they allow us to give a perspective assessment of economic processes (Kadochnikova et al,2015).

The results of the ANCOVA model application where the explanatory variables are both quantitative and qualitative, make it possible to assess changes in the amount of personnel compensation in the long term. In our study, we have determined that the variation in the level of personnel compensation occurs depending on the deviation from the planned level of such quantitative variables as employees' class, length of service, and index of labor distribution. At the same time, the qualitative characteristics are influenced by the level of compensation to employees: possession of higher education and knowledge of foreign (English) language. Consequently, these variables must be taken into account upon prospective assessment of the level of compensation to personnel in the oil industry and when forming incentive compensation types.

6 Conclusion

Thus, a long-term assessment of the compensation to employees contributes to the growth of analytical capabilities of information flows in the development and adoption of decisions related to strategic management of a company's human capital (Sungatullina, 2015). In this connection, when building an integrated system of personnel compensation, it is necessary to rely on the results of an analysis. In aggregate, the results of the perspective assessment of compensation make it possible to give strategic importance to the variables that determine the effectiveness of the personnel compensation system, to assess the degree of their influence, and the emerging trends.

Acknowledgement

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

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