RAILWAYMAN SHALL NOT LIVE BY WAGES AND SALARY ALONE

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ABSTRACT

The article is devoted to the study of regional features of social and economic relations in railway transport, which are directly related to stability of labor collectives, quality of human resources. A system of factors influencing staff turnover is offered, methods for analyzing the impact of these factors are considered taking into account regional aspects, approaches to modeling of functional dependencies and the use of correlation matrices are exemplified by the structural subdivisions of Central Directorate of Infrastructure, a branch of JSC Russian Railways.

Keywords: railway, infrastructure directorate, subject of the Russian Federation, labor relations, regional features, labor market, staff turnover, turnover factors.

Background. *One of the key economic problems in the sphere of labor relations in railway transport is ensuring stability of labor collectives. An indicator that allows to obtain a quantitative characteristic of movement of personnel in the organization is the level of staff turnover [6]. This is a complex result indicator, influenced by various factors.*

Objective. *The objective of the authors is to consider issues of staff turnover: management in the light of regional peculiarities.*

Methods. *The authors use general scientific methods, comparative analysis, economic evaluation, scientific description, graph construction.*

Results.

I.

The level of staff turnover in the largest functional branches of JSC Russian Railways has a significant variance, which is due to the peculiarities of corporate culture, the structure of personnel, its qualifications and the level of labor remuneration. However, the regional labor market remains a common factor that significantly affects the level of turnover [11]. And taking into account this significance, a balanced approach, especially strict differentiation of market conditions, is needed to evaluate the processes connected with it [12].

In this regard, for an objective economic assessment of the consequences of staff turnover, it is necessary to analyze, first of all, the data of employees whose dismissal has brought losses to the company.

As a result of studies that included consultations with experts, an analysis of management reports of JSC Russian Railways, a study of domestic and foreign publications on the problems of turnover [9, 10], a model was developed for the relationship between the level of staff turnover and factors affecting this level. From our point of view, such factors include:

S_{av} – average level of salary, rub.;

Ksal – ratio of average salary in JSC Russian Railways to average salary in the region;

T_{sal} – rates of growth of salary in JSC Russian Railways, %;

C_{zon} – average size of the zonal (regional) supplement, rub./person[1];

$C_{soc.}$ – average size of social payments, rub. / person;

SL – level of employee satisfaction, % (measured by sociological research);

I_{in} – index of employee involvement, % (measured by sociological research);

I_{con} – integral index of working conditions, units;

I_{rlm} – competitiveness index of the structural division of JSC Russian Railways (railway, regional directorate, linear division) in the regional labor market.

Of the parameters proposed in the model, the most complex indicators are represented by the derived indicators: integral index of working conditions and competitiveness index of the structural division of JSC Russian Railways in the regional labor market.

The integral index of working conditions is a quantitative characteristic in the broad sense of the word, including such factors as the work schedule, temperature regime, climatic characteristics, labor intensity, the degree of responsibility, harmful and dangerous working conditions, etc.

The index of competitiveness of the structural division of JSC Russian Railways in the regional labor market, according to the authors, should take into account the impact of local features of labor relations on the level of staff turnover. For the correct definition of the index in the region, it is necessary to know the number of jobs in comparable professions, the possibilities for finding jobs for railway workers from competitors, the level of salaries, their dynamics, working conditions at other enterprises and other information that characterize the conjuncture of regional labor markets.

Thus, the model of the functional dependence of the level of turnover on the factors affecting it will look like this:

$$T = f(S_{av}, K_{sal}, T_{sal}, C_{zon}, C_{soc,} SL, I_{in}, I_{con,} I_{rlm}). \quad (1)$$

II.

The results of the research, stated in previously published works [2, 4], showed that in Central Directorate of Infrastructure – the largest branch of JSC Russian Railways (hereinafter – CDI), the salary level in only 30 % of cases affects the staff turnover level. The rest is the zone of action of other factors, where a special economic and mathematical tool performs its role.

The most common methods of analyzing and forecasting labor indicators are:

1. Methods of correlation-regression analysis, which are used to study the forms of connection, establishing quantitative relationships between the random variables of the process being studied. In socio-economic forecasting, these methods are used to construct conditional forecasts and forecasts based on the evaluation of stable cause-effect relationships [3].

[1] The zonal supplement is applied in the system of labor remuneration of JSC Russian Railways to regulate the value of the average salary, taking into account the level of tension in the formation of professional staff, the peculiarities of regional labor markets.

Table 1

Average indicators on salary and staff turnover in CDI in the context of the subjects of the Russian Federation for 2012–2014

Regional directorates	Average number of employees of CDI, people	Average level of staff turnover in CDI, %	Average salary in CDI, rub.	Average salary in the subject of the Russian Federation, rub.	Average ratio of average salary in CDI to average salary in the subject of the Russian Federation
Moscow	9272	11,24	50439	55174	0,92
Tver region	3453	7,35	31229	22187	1,41
St. Petersburg	7916	7,29	39916	36825	1,09
Leningrad region	4766	9,31	32766	29173	1,12
Novgorod region	1148	5,81	31426	23339	1,35
Pskov region	2151	5,74	27395	19650	1,40
Vologda region	3499	7,14	31884	24842	1,28
Karelia Republic	3865	6,32	38359	27223	1,41
Murmansk region	2741	5,69	50465	39930	1,27
Kaliningrad region	1649	8,47	32690	24333	1,35
Moscow region	4606	6,12	44864	35530	1,26
Vladimir region	2561	10,61	30463	20617	1,48
Ryazan region	2671	6,87	34258	21725	1,58
Kaluga region	1605	6,47	34768	25905	1,34
Oryol region	1338	6,93	34067	19015	1,79
Smolensk region	3520	6,35	35892	20373	1,77
Tula region	2211	5,93	33978	23008	1,48
Bryansk region	3871	5,27	35450	18805	1,89
Kursk region	1817	5,08	31481	21008	1,50
Nizhny Novgorod region	6950	8,24	30736	23343	1,32
Kirov region	3243	9,27	28909	19067	1,52
Tatarstan Republic	4733	11,46	27534	25854	1,07
Chuvashia Republic +Mariy El Republic	1101	11,69	26356	18973	1,39
Udmurtia Republic	2362	7,28	28696	20845	1,38
Sverdlovsk region	12349	12,86	31768	27413	1,16
Perm region	6595	9,15	29983	24546	1,22
Komi Republic	3889	7,77	46390	37303	1,25
Arkhangelsk region (without Nentsky AD)	5497	6,15	40046	29901	1,34
Yaroslavl region	3872	8,88	34211	22945	1,49
Kostroma +Ivanovo regions	2707	8,65	25763	18945	1,36
YaNAD+KhMAD	2935	9,93	58458	58812	1,00
Dagestan Republic	1210	4,92	23563	16230	1,46
Stavropol region	2101	12,82	25740	20570	1,25
Krasnodar region+Adygea Republic	9354	11,93	27108	23642	1,15
Rostov region + Kalmykia Republic	8955	11,07	27530	21566	1,28

2. Analysis of time series taking into account seasonality.

3. Balance method of analyzing labor indicators.

In particular, using the correlation-regression analysis, the effect of the average salary level in CDI and the ratio of salary levels in regional directorates of infrastructure and salary in subjects of the Russian Federation that gravitate toward these directorates was studied.

However, regional directorates are very heterogeneous in their composition. The labor market in the zones of such large regional directorates as Krasnoyarsk, Sverdlovsk, Moscow, October, is characterized by considerable differentiation in terms of competition, salary and other indicators. Therefore, it is important to know the regional peculiarities in a much greater degree when choosing tools to manage staff turnover [11].

Taking into account the fact that the number of personnel of JSC Russian Railways divisions in different subjects of the Russian Federation differs significantly from each other, to increase reliability of the results of analysis, it seems advisable to combine the indicators of some subjects either taking into account the geographical factor or taking into account the peculiarities of their economy (see Table 1).

III.

Let's consider the following set of researched indicators: the resulting variable – the level of staff turnover of CDI in the subject of the Russian Federation (T, %), average salary in CDI in the subject of the Russian Federation (S_{av}, rub.), ratio of average salary in CDI in the subject of the Russian Federation to average salary in the subject of the Russian Federation (K_{sal}). Note that the original set was wider. In particular, average salary in the subject of the

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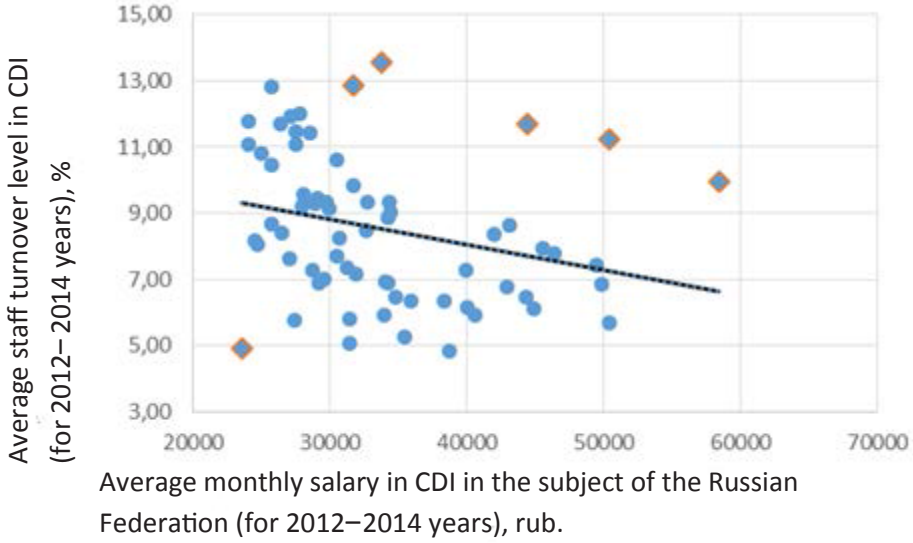
Regional directorates	Average number of employees of CDI, people	Average level of staff turnover in CDI, %	Average salary in CDI, rub.	Average salary in the subject of the Russian Federation, rub.	Average ratio of average salary in CDI to average salary in the subject of the Russian Federation
Republics Chechnya+ Ungeshetia + Severnaya Osetia+Kabardino-Balkaria+Karachaevo-Cherkessia	1495	8,15	24497	18919	1,30
Belgorod region	2833	7,64	27060	22069	1,23
Lipetsk region	2573	8,38	26516	21314	1,25
Tambov region	2757	8,03	24736	18893	1,31
Saratov region	7731	9,56	28039	20494	1,37
Voronezh region	6127	9,21	27998	21788	1,29
Penza region	2518	10,81	24989	20721	1,21
Volgograd region	4732	10,47	25773	20819	1,24
Astrakhan region	2648	6,90	29207	22278	1,31
Mordovia Republicя	1488	11,10	24097	17877	1,36
Ulyanovsk region	2349	11,77	24099	19189	1,26
Samara region	7254	12,00	27787	23385	1,19
Orenburg region	5210	7,01	29615	21444	1,38
Chelyabinsk region	11877	9,84	31756	25278	1,26
Bashkortostan Republic	5241	11,41	28498	22543	1,27
Tyumen region (without aut. districts)	3704	13,57	33764	31441	1,08
Omsk region	5069	9,43	29141	24328	1,20
Kurgan region	3415	7,68	30540	19254	1,59
Novosibirsk region	8337	9,32	34355	25329	1,36
Altai region	4755	9,31	29754	17826	1,67
Kemerovo + Tomsk regions	9429	9,03	34407	25432	1,35
Krasnoyarsk region	10526	5,90	40568	31371	1,29
Khakasia Republic	1860	4,82	38731	26207	1,48
Irkutsk region	12545	6,44	44300	28780	1,54
Buryatia Republic	4333	7,93	45530	25626	1,78
Zabaikalsky region	12394	8,37	41987	26939	1,56
Amur region+ Yakutia Republic	11154	11,69	44483	30836	1,45
Primorsky region	6058	8,65	43113	29951	1,44
Khabarovsk region	8937	7,44	49482	33996	1,46
Sakhalin region	1417	6,85	49841	49370	1,01
Jewish AR	1856	6,75	42963	27288	1,57
Average		8,51	33821	25600	1,35
Variation coefficient		0,26	0,23	0,32	0,14

Russian Federation and unemployment rate in the subjects were taken. However, calculations have shown that there is practically no connection between the level of staff turnover and average salary in the Russian Federation. The unemployment level is more complicated. On the one hand, its impact on staff turnover was weak, on the other, there was a tendency to strengthen this connection over time. Given the increasing economic situation in the country, we can assume that in 2016–2017, the unemployment rate in the subjects of the Russian Federation will have a more significant impact on staff turnover.

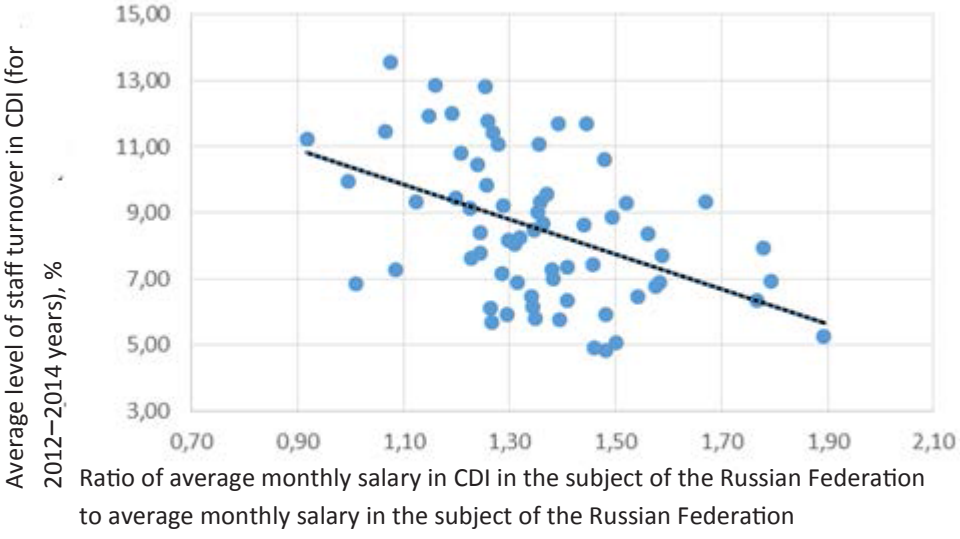
For a more detailed analysis of dependencies between the indicators, we use the matrix of pair correlation coefficients. Despite the fact that the values of coefficients characterizing the strength of the relationship between the turnover level and two selected factors seem to be not very high (-0,274 and -0,452), the influence of these factors is recognized as statistically significant at the 5 % level. In addition, the matrix indicates the absence of a connection between the factors themselves, since the correlation coefficient between them is practically equal to 0.

Correlation analysis makes it possible to construct three different models:

- *dependence of the level of staff turnover T on average salary in CDI in the subjects of the Russian Federation (S_{av});*
- *dependence of the level of staff turnover T on the ratio of average salary in CDI in the subject of the Russian Federation to average salary in the subject of the Russian Federation (K_{sal});*
- *dependence of staff turnover level T on average salary in CDI in the subjects of the Russian Federation (S_{av}) and the ratio of average salary in CDI in the subject of the Russian Federation to average salary in the subject of the Russian Federation (K_{sal}) (two-factor model);*



Pic. 1. Dependence of the level of turnover (in%) on average salary (in rubles) in CDI in the subject of the Russian Federation (average for 2012–2014).



Pic. 2. Dependence of the level of staff turnover on the ratio of average monthly salary in CDI in the subject of the Russian Federation to average monthly salary in the subject of the Russian Federation.

Let's consider each model separately.

The correlation field, reflecting the dependence of the average level of turnover on average salary in CDI (see Pic. 1), shows, on the one hand, an obvious inverse relationship between these indicators, on the other – some heterogeneity in the sample (which was not observed in a similar study in the section of regional directorates).

In particular, there are a number of subjects of the Russian Federation, which «broke away» from the correlation cloud (they correspond to markers in the form of diamonds on the diagram). This is Moscow, Amur region with Republic of Yakutia, Yamalo-Nenetsky and the Khanty-Mansiysky Autonomous Districts, Tyumen region and Sverdlovsk region, where relatively high rates of turnover remain along with relatively high salary. On the other hand – the Republic of Dagestan, where, with almost the lowest salary in CDI, the turnover level is one of the lowest in the Russian Federation. In addition, there is a bizarre form of the correlation field, deviating from the linear trend very significantly. This once again says that the absolute value of salary is a factor that cannot be considered unique in explaining the level of turnover. But, as already noted, a linear relationship between the selected indicators is statistically justified, and attempts to use nonlinear forms have not resulted in noticeable improvement in the quality of the model.

The relationship between the average level of turnover in the subject of the Russian Federation and the average salary in CDI in the subject of the Russian Federation is described using a linear regression equation

$$T = 11{,}09 - 0{,}000076 \cdot S_{av} \qquad (2)$$

At a significance level of 5 %, this equation as a whole is statistically significant according to the F-criterion of Fisher. Both of its parameters are statistically significant according to Student's t-test,

Table 2

Relative deviations of the observed values of turnover from the calculated values obtained with the aid of equation (4)

Subjects of the Russian Federation, in which the level of turnover in DI is significantly higher than the calculated level (in brackets, deviation in %)	Subjects of the Russian Federation, in which the level of turnover in DI slightly deviates from the calculated (in brackets deviation in %)	Subjects of the Russian Federation, in which the level of turnover in DI is significantly lower than the calculated (in brackets deviation in %)
Amur region + Yakutia Republic (63 %)	Tatarstan Republic (9 %)	Dagestan Republic (-44 %)
Buryatia Republic (49 %)	Penza region (8 %)	Kursk region (-36 %)
Tyumen region without aut. Districts (36 %)	Saratov region (8 %)	Khakasia Republic (-35 %)
Sverdlovsk region (33 %)	Volgograd region (7 %)	Pskov region (-35 %)
Stavropol region (32 %)	Chelyabinsk region (7 %)	Novgorod region (-33 %)
Chuvashia Republic + Mariy El Republic (31 %)	Kemerovo + Tomsk region (7 %)	Krasnoyarsk region (-29 %)
Vladimir region (31 %)	Smolensk region (3 %)	Murmansk region (-26 %)
Altai region (30 %)	Jewish AR (2 %)	Moscow region (-25 %)
Zabaikalsky region (24 %)	Kurgan region (2 %)	Sakhalin region (-24 %)
Samara region (22 %)	Voronezh region (-1 %)	Tula region (-24 %)
Bashkortastan Republic (22 %)	Kaliningrad region (-2 %)	Astrakhan region (-24 %)
Ulyanovsk region (20 %)	Omsk region (-3 %)	Kaluga region (-24 %)
Mordovia Republic (20 %)	Irkutsk region (-4 %)	Arkhangelsk region (-24 %)
Primorsky region (18 %)	Perm region (-4 %)	St. Petersburg (-23 %)
Moscow (18 %)	Komi Republic (-4 %)	Belgorod region (-21 %)
Rostov region + Kalmykia Republic (18 %)	Bryansk region (-4 %)	Vologda region (-21 %)
Krasnodar region + Adygea Republic (18 %)	Kostroma + Ivanovo regions (-5 %)	Karelia Republic (-20 %)
YaNAD +KhMAD (17 %)	Leningrad region (-5 %)	Orenburg region (-19 %)
Kirov region (16 %)	Ryazan region (-5 %)	Udmurtia Republic (-17 %)
Yaroslavl region (15 %)	Nizhny Novgorod region (-8 %)	Tambov region (-15 %)
Oryol region (13 %)		Republics Chechnya+ Ingushetia + Severnaya Osetia+Kabardino-Balkaria+Karachaevo-Cherkessia (-15 %)
Khabarovsk region (11 %)		Lipetsk region (-13 %)
Novosibirsk region (10 %)		Tver region (-13 %)

the average error of approximation is 22 %. This indicates the reliability of the obtained equation and the possibility of its use for predicting the level of turnover in CDI in the regions, depending on average salary in CDI.

Some practical conclusions from equation (2):

• with an increase in average salary in CDI in the subject of the Russian Federation, S_{av} by 1000 rubles average level of staff turnover in CDI in the subject T is reduced by 0,076 points;

• average coefficient of elasticity is -0,30 (varies from -0,193 for the Republic of Dagestan to -0.673 in Yamalo-Nenetsky and Khanty-Mansiysky Autonomous Districts), that is, with an increase in average salary of employees of CDI in a certain subject S_{av} by on average 1 %, the turnover level T is reduced by an average of 0,3 % of its mean value.

IV.

The relationship between the level of staff turnover T and the ratio of average monthly salary in CDI in the subject of the Russian Federation to average monthly salary in the subject of the Russian Federation (K_{sal}) will first be considered on the correlation field (Pic. 2).

Visual analysis of the correlation field allows us to conclude that the quality of the connection is higher than in the previous case. In addition, it can be noted that the sample is fairly uniform, which increases the quality of the model.

The described connection is given by the equation of pairwise linear regression

$$T = 15{,}64 - 5{,}26 \cdot K_{sal}. \qquad (3)$$

The quality of equation (3) at the significance level of 5 % is confirmed by Fisher's F-criterion (for the equation as a whole), and Student's t-test (for each of the parameters), the average relative error of approximation was 21 %. It can be noted that the factor K_{sal} accounts for 20 % of the variance of staff turnover T. The equation obtained can be used for forecasting.

Equation (3) allows us to state:

• with an increase in the ratio of average monthly salary in CDI in the subject of the Russian Federation to average monthly salary in the subject of the Russian

Federation (K_{sal}) by 0,1 the average level of staff turnover in CDI (T) is reduced by 0,526 points;

• average coefficient of elasticity is -0.84 (varies from -0,446 for Moscow to -1,755 in Bryansk region), that is, when the ratio of average monthly salary in CDI in the subject of the Russian Federation to average monthly salary in the subject of the Russian Federation (K_{sal}) on average 1 % the level of turnover in CDI in the subject (T) is reduced by an average of 0,84 % of its average value.

Let's construct the multiple linear regression equation describing the dependence of staff turnover level T on average salary in CDI in the subject of the Russian Federation (S_{av}) and on the ratio K_{sal} of average monthly salary in CDI in the subject of the Russian Federation to average monthly salary in the subject of the Russian Federation:

$$T = 18,39 - 0,000079 \cdot S_{av} - 5,33 \cdot K_{sal} \quad (4)$$

By reducing two factors into one equation, it is possible to significantly improve its quality, which is confirmed by the F-criterion of Fisher. The coefficient of determination for this equation is 0,28, that is, it accounts for 28 % of the variance of turnover level. At the same time Student's t-test confirms the significance of each parameter of the equation. The average error of approximation was 20 %.

It should be noted that the values of the regression parameters for the factors K_{sal} and S_{av}, in fact, did not change in comparison with equations (2) and (3). This was largely due to the almost complete lack of correlation between the factors.

Having carried out interpretation of the parameters, we make conclusions summarizing the analysis:

• with an increase in the ratio of average monthly salary in CDI in the subject of the Russian Federation to average monthly salary in the subject of the Russian Federation (K_{sal}) by 0,1, the average level of staff turnover in CDI in the subject of the Russian Federation (T) is reduced by 0,533 points with the same average salary in CDI;

• with an increase in average salary in CDI in the subject of the Russian Federation (S_{av}) by 1000 rubles the average level of staff turnover in CDI in the subject (T) is reduced by 0,079 points with the same ratio of average monthly salary in CDI in the subject of the Russian Federation to average monthly salary in the subject of the Russian Federation fixed at the average level;

• average coefficient of elasticity with respect to K_{sal} is -0,85 (varies from -0,451 for Moscow to -1,788 in Bryansk region), that is, when the ratio of average monthly salary in CDI in the subject of the Russian Federation to average monthly salary in the subject of the Russian Federation (S_{av}), on the average by 1 %, the level of turnover in CDI in the subject falls, on average, by 0,85 % of its average value with the same average salary in CDI;

• average coefficient of elasticity for salary S_{av} is -0,31 (varies from -0,199 for the Republic of Dagestan to -0,702 in the Yamalo-Nenetsky and Khanty-Mansiysky Autonomous Districts), that is, with an increase in the average salary in the regional infrastructure directorate by an average of 1 %, the level of turnover T is reduced by an average of 0,31 % of its average value, while the average monthly salary in CDI in the subject of the Russian Federation is constant against average monthly salary in the subject of the Russian Federation fixed at the average level;

• using relative deviations of the observed turnover values from the calculated values, it is possible to divide the subjects of the Russian Federation according to their sensitivity to salary factors (see Table 2).

V.

The staff turnover in the subjects of the Russian Federation, which are part of the second group and having the least deviations from the trend, in our opinion, will be the most sensitive to the changes in two presented salary factors. Of course, one cannot say that their turnover is within the norm. Let's take, for example, Leningrad region. The average level of staff turnover in three years under review is 9,31 %, which is a fairly high level. Let's calculate how the turnover in a given subject of the Russian Federation will change with an increase in salary in CDI in it by 15 % of the average for 2012–2014 (or 5,8 % of the salary for 2014), i.e. by 2052 rubles. We assume that the average salary in the region will grow by 10 % of the average for the years 2012–2014 and will be 31215 rubles. – in the forecast period, the ratio K_{sal} = 1,21. Substituting the data in the formula (4), we get the predicted value of the turnover of 8,99 %. Thus, for the region, the expected change in salary indicators will lead to a decrease in turnover by 0,32 percentage points, while ignoring the remaining unaccounted factors.

Let's estimate the costs necessary to reduce staff turnover. The average number of employees in CDI in Leningrad region in 2014 was 5677 people. If the number decreases, for example, by 4 %, then to reduce the turnover in the area by 0,3 % it will be necessary to $5677 \cdot 0,96 \cdot 2052 \cdot 12$ = 134 million rubles. You can compare this result, say, with the costs of paying zonal supplements in Amur region[2]: more than 1,2 billion rubles with an average number of 3447 people in 2014.

Similarly, one can find in this group those subjects of the Russian Federation that do not have turnover problems, and for them also build a forecast that will save payroll expenses.

Amur region (together with the Republic of Yakutia) is the leader in the group of subjects for which the turnover rate is much higher than the estimated one. Although at a fixed level of salary in this group, the level of turnover should have been much lower.

Application of the formula (4) to such subjects of the Russian Federation, especially to the «leaders» of the first group, should be very cautious, and in fact most of them have a high staff turnover. But this turnover is due to the most likely non-salary reasons. And even if the turnover in such regions has an acceptable figure, attention should be paid to internal and external factors that «tear» them from the trend and in the future can exacerbate the problems.

The subjects of the Russian Federation, which are part of the third group, have real indicators of turnover, which are substantially lagging behind the calculated values. This does not mean that in the next year salary can be reduced in them. Causes of low turnover may be factors associated with the economy of the region, the characteristics of the labor market. But, certainly, in this group there are also such subjects in which it is possible to «hold» salary increase, without fear of catastrophic consequences.

Thus, according to the regression equation (4) so far only 28 % of turnover is due to the influence of two factors having a common «salary» nature. Further research will be to find additional internal (in CDI) and

[2] Turnover in Amur region remains one of the highest in CDI in the Russian Federation.

external factors (unemployment rate has not yet been able to become such). It is possible to divide the subjects of the Russian Federation into clusters by qualitative indicators (geographical location, industrial development, etc.). But already now with the help of equation (4) it is possible to give some recommendations on management of turnover in each of the subjects of the Russian Federation.

Conclusion. *To manage staff turnover it is important to learn to determine its critical level in relation to each mass profession. At the same time, one should take into account that staff turnover affects the safety of movement, the costs of training, retraining and upgrading the skills of personnel, the social and economic situation in the region, and many other indicators.*

To determine the reasons for deviation of the index of turnover from the average in some regions of the Russian Federation, at some enterprises in future studies it is proposed to use the so-called survival tables, Kaplan–Mayer procedures and Cox regression. These methods allow not only to determine the average term of work of personnel at the enterprise and to forecast possible dismissals of employees, but also to identify factors that affect the related processes.

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