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Statistical Evaluation of Cost-effectiveness Investing in Staff Development
(by the Example of JSC «Volyn-AUTO»)

In this article method for evaluation of cost-effectiveness investing in staff development was improved. We analyzed the qualitative and quantitative indexes movement of the staff at JSC «Volyn Auto». The structure and dynamics of the cost of maintenance and development were examined during five years. We conducted regression analysis that revealed a strong link between staff costs and gross profits of enterprise. Developed linear regression model allowed evaluating the level of economic cost-effectiveness investing in staff development, that affect the growth rate of productivity and profitability.

Key words: linear regression model, statistical evaluation, staff, staff costs, cost-effectiveness.

Formulation of Scientific Problem and its Significance. Among the important factors, that effect on the efficiency of the company the intellectualization of the company based on high quality staff should be named. At the same time in terms of profit maximization, an important issue is the appropriateness of investing in staff development, the impact of such costs on the final results of the enterprise economic activity, and also the compliance of staff development principles to the strategic objectives of the organization.

Research Analysis on this Issue. Amidst the authors who work towards evaluating the effectiveness of staff development. The work of M. Armstrong [1], N. V. Noble, N. Doroschuk, P. V. Zhuravleva, S. A. Kartashov, D. I. Kyrkpatrika, T. N. Lobanov, R. P. Kolosov, G. G. Melikyana, J. Fitz-Entsa D. Phillips [2] and others should be mentioned.

Analysis of Last Researches and Publications. Despite significant scientific results, the problem of economic cost-effectiveness investing in staff development is considered fragmentary, and its evaluation is determined by indirect methods through other types of the staff efficiency. Defined one actualizes the subject of research.

The Purpose and Objectives of the Article. Realization of the statistical analysis for evaluating the spending effectiveness on personnel development with purpose to maximize profit of JSC «Volyn-AUTO» and to predict its future development.

Statement of the Main Material and Substantiation of Researched Results. In home dictionaries it is indicated that the evaluation is determined as definition of quality, value, value of something; forming representation, conclusion about the character, values, roles of anything [3].

Evaluation of cost-effectiveness of staff development, we interpreted as the level of economic cost-effectiveness of staff development of the company that is comprehensive and detailed, according to all available sources of information, to studying the ratio of profit to the amount of expenses for personnel development in order to create additional economic benefits related to the development of personnel intellectual activity.

The evaluation of cost-effectiveness on staff development JSC «Volyn-AUTO» can be performed in the following order:

1. Setting goals of evaluating the effectiveness of spending on staff development.
2. Justification of methods for assessing cost effectiveness to staff development.
3. Analysis of qualitative and quantitative indicators of staff.
4. Analysis of costs for maintenance and staff development.
5. Evaluation of the economic efficiency of spending on staff development.

The first stage is the setting goals of the cost-effectiveness evaluating investing in staff development. The goals of the cost-effectiveness evaluating investing in staff development include maximizing profits through effective use of staff development costs; reducing costs by optimizing enterprise expenditure on staff development; intellectual development of the company and so on.

Further, there is a need in the choice of approaches and methods for the cost-effectiveness evaluating investing in staff development. To determine the quantitative and qualitative characteristics of staff development we use empirical research methods and statistical analysis. To determine the cost-effectiveness evaluating investing in staff development it is used the cost approach.

The third step is the analysis of qualitative and quantitative indicators of staff, which helps to identify and evaluate staff moving, educational and professional qualification structure, the average tenure in the specialty.

On the fourth stage, the evaluation of the cost investing in staff development is conducted. This stage allows determining the structure of staff costs, share of each of them.

The fifth step is to assess the cost-effectiveness of maintenance and staff development. The purpose of this phase is to identify the link between expenditure on staff retention and profitability.

The last step is to develop conclusions and recommendations on the cost-effectiveness investing in staff development.

Analysis of qualitative and quantitative indicators of personnel. The average number of employees in 2016 is 138 people, including 27 women and 111 men. The average monthly salary for the reporting year was 2393 UAH. The company makes upgrading of the team, which involves the employment of highly qualified professionals and deepen their knowledge and skills through training. 88 people have higher education, partial – 50 people, including 79 people under the age of 35 years. The company has a practice of selecting employees according to the contest. JSC «Volyn-AUTO» works with recruitment agencies, Employment Center and universities of Volyn region. Meetings with pupils and students are holding, during which there is a review of activity of the company, opportunities for self-realization.

Staff movement; educational structure of staff; average professional experience; vocational qualification staff structure are described in Tab.1 and Fig.1-2.

Table 1

The Evolution of the Staff Movement of JSC «Volyn-AUTO» for the Period 2012–2016 y.

| Indexes | Years | | | | | Absolute growth of + / - | | | | Growth rate, % | | | |
|--------------------------------------|-------|------|------|------|------|--------------------------|-----------|-----------|-----------|----------------|-----------|-----------|-----------|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2013–2012 | 2014–2013 | 2015–2014 | 2016–2015 | 2013/2012 | 2014/2013 | 2015/2014 | 2016/2015 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Average number of employees, persons | 205 | 187 | 175 | 164 | 138 | -18 | -12 | -11 | -26 | -8,8 | -6,4 | -6,3 | -15,9 |

Table 1

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|--------------------------------------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|------|-------|-------|
| It is during the year, people | 7 | 9 | 10 | 13 | 11 | 2 | 1 | 3 | -2 | 28,6 | 11,1 | 30,0 | -15,4 |
| Released during the year, those are: | | | | | | | | | | | | | |
| voluntarily | 14 | 17 | 18 | 16 | 25 | 3 | 1 | -2 | 9 | 21,4 | 5,9 | -11,1 | 56,3 |
| for violation of labor discipline | 2 | 1 | 1 | 1 | 2 | -1 | 0 | 0 | 1 | -50,0 | 0,0 | 0,0 | 100,0 |
| Turnover ratio of acceptance | 0,034 | 0,048 | 0,057 | 0,079 | 0,080 | 0,014 | 0,009 | 0,022 | 0,000 | 40,9 | 18,7 | 38,7 | 0,56 |
| Turnover ratio for the release | 0,078 | 0,096 | 0,109 | 0,104 | 0,196 | 0,018 | 0,012 | -0,005 | 0,092 | 23,3 | 12,8 | -4,5 | 88,7 |
| Turnover ratio | 0,068 | 0,091 | 0,103 | 0,098 | 0,181 | 0,023 | 0,012 | -0,005 | 0,084 | 33,1 | 13,1 | -5,2 | 85,7 |

The company for the period 2012–2016 y. traces the trend to staff downsizing. Over the past 5 years the average number of employees decreased by 67 persons.

This is linked with the crisis of the economy, which leads to decreasing the purchasing power of consumers of the services provided by the company.

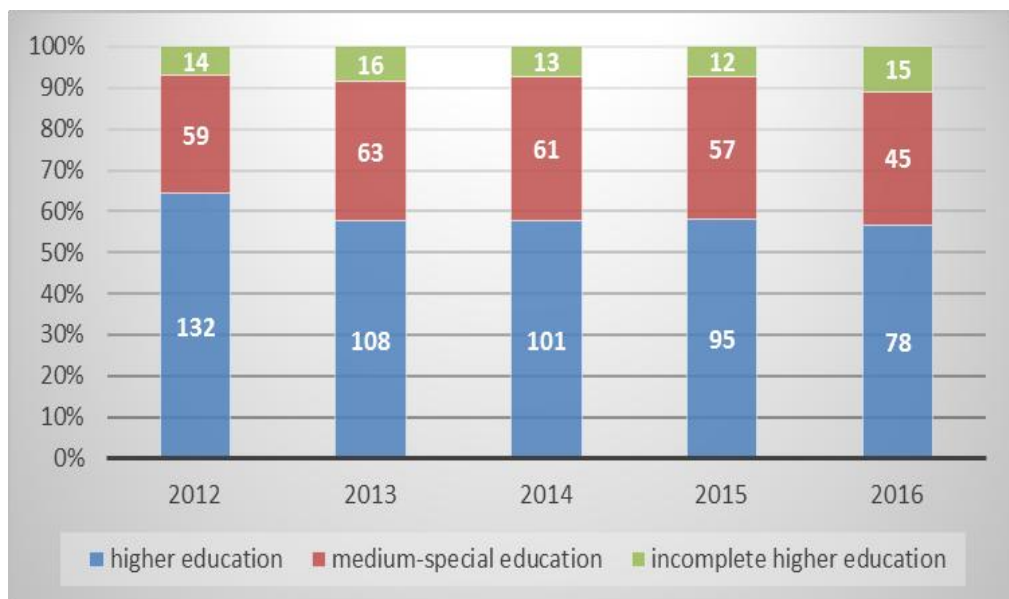


Fig. 1. Dynamics of Staff Structure of JSC «Volyn-AUTO» Based on the Level of Education in 2012–2016, %

The share of workers with higher education in 2016 is 57 %. The indicator value is the higher in average industry and has positive impact on the quality of management, as well as the services that it provides.

The analysis of staff by age shows that despite the crisis conditions of workers with experience over 10 years they continue to work in the company, while the part of workers with experience less than 10 years retire at will.

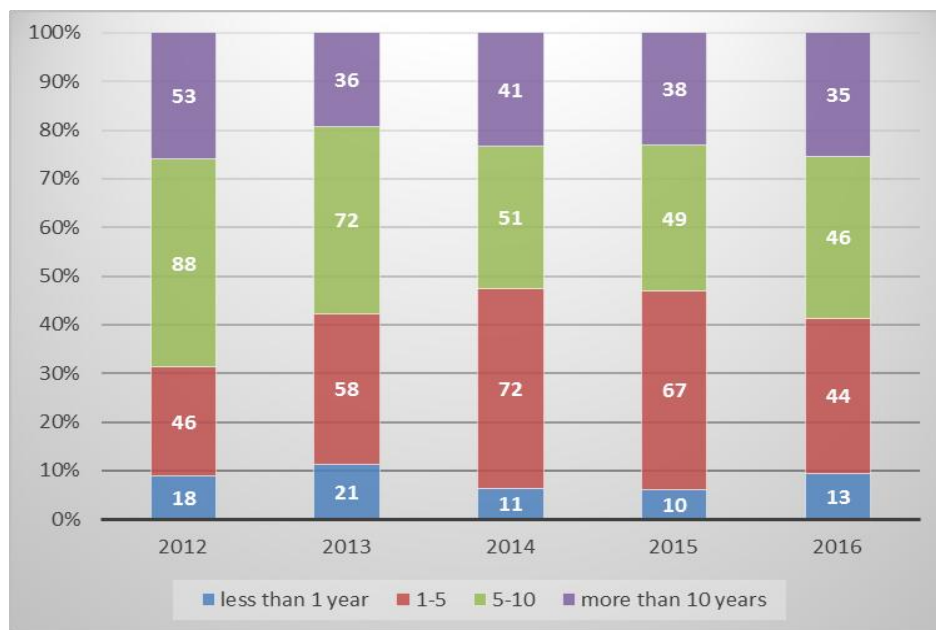


Fig. 2. Dynamics of Staff Structure of JSC «Volyn-AUTO» Based on the Level of Experience in 2012–2016, %

Despite the fact that in 2012–2016 at the JSC «Volyn-AUTO» there is a significant decrease of the employees number associated with the crisis of the economy, the majority of personnel have higher education and work experience over 5 years.

Characteristics of the costs for maintenance and staff development. Costs for maintenance and staff development include the annual average payroll, the average payroll for one employee, the cost of professionals’ maintenance; the cost of training; hospital costs and so on.

Table 2

Expenses Dynamics of JSC «Volyn-AUTO» Staff for the Period 2012–2016 y.

| Indexes | Staff maintenance cost thousand. UAH | | | | | The share of costs, % | | | | | Growth rate, % | | | |
|--|--------------------------------------|--------|--------|--------|--------|-----------------------|-------|-------|-------|-------|----------------|-----------|-----------|-----------|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2012 | 2013 | 2014 | 2015 | 2016 | 2013/2012 | 2014/2013 | 2015/2014 | 2016/2015 |
| Direct pay | 4108,0 | 3891,0 | 4267,0 | 4537,0 | 4545,0 | 75,3 | 73,6 | 74,1 | 73,3 | 73,2 | -5,28 | 9,66 | 6,33 | 0,18 |
| Accumulated amount of single fee for obligatory state social insurance | 1218,6 | 1266,7 | 1312,5 | 1505,1 | 1532,2 | 22,4 | 24,0 | 22,8 | 24,3 | 24,7 | 3,95 | 3,62 | 14,67 | 1,80 |
| The cost of hospital | 72,6 | 65,8 | 78,6 | 62,9 | 54,1 | 1,3 | 1,2 | 1,4 | 1,0 | 0,9 | -9,37 | 19,45 | -19,97 | -13,99 |
| The cost of training | 6,1 | 5,4 | 6,3 | 5,8 | 4,1 | 0,1 | 0,1 | 0,1 | 0,1 | 0,1 | -11,48 | 16,67 | -7,94 | -29,31 |
| The costs of cultural and community services | 9,8 | 12,4 | 13,2 | 12,5 | 11,0 | 0,2 | 0,2 | 0,2 | 0,2 | 0,2 | 26,53 | 6,45 | -5,30 | -12,00 |
| Other expenses for the maintenance of labor | 36,8 | 42,1 | 78,3 | 70,1 | 64,2 | 0,7 | 0,8 | 1,4 | 1,1 | 1,0 | 14,40 | 85,99 | -10,47 | -8,42 |
| The total amount of staff costs | 5451,9 | 5283,4 | 5755,9 | 6193,4 | 6210,6 | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 | x | x | x | x |

After analyzing the staff cost structure we can confirm the low spending on training, which can adversely effect on the quality of staff.

At JSC «Volyn-AUTO» studying in the form of training workshops and seminars conducted by members of UkrAVTO is continuously carried out. The staff are constantly training in educational

institutions on the basis of contracts. However, with a decrease of the employees number tends to reduce their teachings.



Fig. 3. Dynamics of the Staff Structure of JSC «Volyn-AUTO» in 2012 – 2016 Years, %

Thus, during the period in costs for employees training are still low; training costs and the proportion of workers who receive it are reducing.

Little training, retraining and advanced training costs did not allow company to establish a process of continuous staff development, and discourage employees to improve productivity. In addition, the enterprise does not have bonus system for trained employees, and as a result, improved their abilities and skills.

Evaluation of the cost effectiveness of staff maintenance and development. To determine the relationship between expenditure on staff and its profitability we will use a method of comparing parallel rows [4]. Factor variable trait will be costs investing on staff development and effective variable trait – gross profit of company.

Based on the comparison of parallel rows we will define the direction and strength of link with Fechner coefficient:

Table 3

The Link Between the Cost Investing on Staff Development and Gross Profit of JSC «Volyn-AUTO» in the Years 2012–2016

| Years | Expenditure on staff development, th. UAH | Gross profit, th. UAH | $X - \bar{X}$ | $Y - \bar{Y}$ | Match or mismatch | x^2 | y^2 | xy | \tilde{y} |
|----------|---|-----------------------|---------------|---------------|-------------------|-------------|------------|-------------|-------------|
| 2012 | 5451,9 | 4124,0 | - | - | M | 29723213,6 | 17007376,0 | 22483635,6 | 4009,4 |
| 2013 | 5283,4 | 3806,0 | - | - | M | 27914315,6 | 14485636,0 | 20108620,4 | 3908,8 |
| 2014 | 5755,9 | 4215,0 | - | + | Mm | 33130384,8 | 17766225,0 | 24261118,5 | 4190,8 |
| 2015 | 6193,4 | 4297,0 | + | + | M | 38358203,6 | 18464209,0 | 26613039,8 | 4451,9 |
| 2016 | 6210,6 | 4581,0 | - | - | M | 38571552,4 | 20985561,0 | 28450758,6 | 4462,2 |
| Together | 28895,2 | 21023,0 | X | X | X | 167697669,9 | 88709007,0 | 121917172,9 | 21023,0 |

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n} = \frac{28895,2}{5} = 5779,04 \text{ tys. grn}$$

$$\bar{Y} = \frac{\sum_{i=1}^n Y_i}{n} = \frac{21023,0}{5} = 4204,6 \text{ tys. grn}$$

$$K_F = \frac{\sum C - \sum H}{\sum C + \sum H} = \frac{4 - 1}{5} = 0,6.$$

Fechner coefficient ($K_F > 0$ – direct connection, $0,5 < K_F < 0,7$ – noticeable connection) states on the existence of significant direct link between the magnitude of spending on staff development and gross profit.

To determine the impact of costs spending on staff development on gross profit we use regression linear model $\hat{y} = a_0 + a_1 x$ where: y – gross profit th. UAH.; x – expenditure on staff development, th. UAH.; r_{xy} – correlation coefficient, R^2 – coefficient of determination.

$$a_1 = \frac{Cov(xy)}{Var(x)}, \text{ where:}$$

$$Cov(xy) = \overline{xy} - \bar{x} \times \bar{y} = 24383434,58 - 5779,04 \times 4204,60 = 84883,00$$

$$Var(x) = \overline{x^2} - \bar{x}^2 = 33539533,98 - 33397303,32 = 142230,66$$

$$a_1 = \frac{Cov(xy)}{Var(x)} = \frac{84883,00}{142230,66} = 0,5986$$

$$a_0 = \bar{y} - \bar{x} \times a_1 = 4204,60 - 5779,04 \times 0,5986 = 755,679.$$

This regression linear model will look like:

$$\hat{y} = 755,679 + 0,5968 x.$$

To assess the narrowness of communications, we apply linear Pearson correlation coefficient:

$$r_{xy} = \frac{Cov(xy)}{\sqrt{Var(x)} \times \sqrt{Var(y)}} = \frac{Cov(xy)}{S_x \times S_y}, \text{ where:}$$

$$Var(y) = \overline{y^2} - \bar{y}^2 = 17741801,40 - 17678661,16 = 63140,24$$

$$r_{xy} = \frac{84883,00}{\sqrt{142230,66} \times \sqrt{63140,24}} = 0,8957.$$

For test of the connection materiality we use F-Fisher criterion:

$$F = \frac{R^2}{1 - R^2} \times \frac{k_2}{k_1}; k_1 = m - 1; k_2 = n - m$$

$$F = \frac{0,8957}{1 - 0,8957} \times \frac{5}{2} = 12,18.$$

Let's find the critical value of F-test table.

At the level of significance $\alpha = 0,05$, $F_{tab}(0,05) = 10,13$.

If the correlation coefficient is $R = 0,8957$, then between staff costs and gross profit of the enterprise there is a strong connection. So, if personnel costs of JSC «Volyn-AUTO» will increase by 1% then the gross profit will increase by 755,679 thousand UAH. The calculated value of the criterion more tabular Fisher ($F_{Est} \geq F_{Tab}$, $12,18 > 10,13$) confirms the adequacy of the model to experimental data. The overall results confirm the economic model of cost effectiveness investing in staff development of JSC «Volyn-AUTO».

Conclusions and Prospects for Further Research. In the article the method of the valuation of cost-effectiveness of staff development is improved. The qualitative and quantitative characteristics of staff, namely performance of personnel, the educational structure of staff, the average professional experience are analyzed. Structure and dynamics of the cost of maintenance and development are reviewed. A regression analysis that revealed a strong link between staff costs and gross profits is conducted. Thus, the increase in staff costs by 1% would increase gross profit to 755,679 th. UAH. Developed linear regression model allows

evaluating the level of economic cost-effectiveness investing in staff development, which, in turn, effects on the growth rate of productivity and profitability. Consequently, it is advisable for the company JSC «Volyn-AUTO» to invest in staff.

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Светлана Бегун, Виктория Мялковская. Статистическое оценивание эффективности затрат на развитие персонала (на примере ОАО «Волинь-АВТО»). В статье усовершенствован метод статистической оценки эффективности затрат на развитие персонала предприятия с целью максимизации прибыли ОАО «Волинь-АВТО» и прогнозирования его дальнейшего развития. Рассмотрена суть эффективности затрат на развитие персонала и определена их целесообразность. Сформулированы основные этапы проведения оценки эффективности затрат на развитие персонала. Проанализированы качественные и количественные статистические показатели движения персонала ОАО «Волинь-Авто» на протяжении 2012–2016 годов. Оценены структура и динамика затрат на содержание и развитие персонала. Проведен регрессионный анализ, который позволил выявить сильную связь между затратами на содержание персонала и валовой прибылью предприятия. Полученная линейная регрессионная модель позволяет оценить уровень экономической эффективности затрат на развитие персонала, которые, в свою очередь, влияют на рост производительности труда и уровень доходности предприятия. На основе проведенного исследования установлено, что предприятию ОАО «Волинь-Авто» инвестировать в развитие персонала предприятия целесообразно.

Ключевые слова: линейная регрессионная модель, статистическое оценивание, персонал, расходы на персонал, эффективность расходов.

Світлана Бегун, Вікторія Мялковська. Статистичне оцінювання ефективності витрат на розвиток персоналу (на прикладі ПАТ «Волинь-АВТО»). У статті вдосконалено метод оцінювання ефективності витрат на розвиток персоналу підприємства з метою максимізації прибутку ПАТ «Волинь-АВТО» та прогнозування його подальшого розвитку. Розглянуто сутність ефективності витрат на розвиток персоналу й визначено їх доцільність. Сформульовано основні етапи проведення оцінювання ефективності витрат на розвиток персоналу. Проаналізовано якісні та кількісні показники руху персоналу ПАТ «Волинь-Авто» впродовж 2012–2016 рр. Оцінено структуру та динаміку витрат на утримання й розвиток персоналу. Проведено регресійний аналіз, що дав підставу виявити сильний зв'язок між витратами на утримання персоналу та валовим прибутком підприємства. Розроблена лінійна регресійна модель допомагає оцінити рівень економічної ефективності витрат на розвиток персоналу, які впливають на зростання продуктивності праці й рівень прибутковості підприємства. На основі проведенного дослідження визначено, що підприємству ПАТ «Волинь-Авто» інвестувати в розвиток персоналу підприємства доцільно.

Ключові слова: лінійна регресійна модель, статистичне оцінювання, персонал, витрати на персонал, ефективність витрат.

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