

TIES 2020
International conference «Trends and innovations in economic studies»

**INVOLVEMENT IN VOCATIONAL EDUCATION OF
EMPLOYEES RUSSIAN ORGANIZATIONS OF DIFFERENT AGE
GROUPS**

Olga N. Baeva (a)*, Nina P. Sherstyankina (b)

*Corresponding author

(a) Baikal State University, 11, Lenin str., Irkutsk, Russia, baeva-on@mail.ru

(b) Irkutsk National Research Technical University, 83, Lermontov str., Irkutsk, Russia, nina_21@mail.ru

Abstract

The research results of people participation of different age groups in life-long-learning in the Russian Federation are summarized. Relying on the data of federal statistical observation on the participation of Russian employees in additional vocational training (VET) for 2013 and 2016, factors that affect the level of employee involvement in VET are considered. Using ANOVA, it was found that industry differentiation most strongly affects involvement in education, the influence of age is less significant, and these two factors combined effect is also traced. Intersectoral coefficients of variation in the proportion of trained people in different age groups for all types of economic activity are calculated. They indicate a high variability of the indicator. Based on ANOVA, it is proved that intersectoral differentiation of the share of trained is significant in groups of employees up to 50 years old. The individual coefficients of variation in the involvement' level of personnel of different age groups in vocational education for each type of activity are identified. It was found that, despite significant intersectoral differences in the involvement' level of personnel of different age groups in VET (coefficient of variation from 45 to 70 %), there are general trends for all types of economic activity without exception. Investments in VET of employees over 50 are the least significant (compared with the average for the type of economic activity). Moreover, when moving to an older age group, the deviation from the average becomes more significant.

2357-1330 © 2020 Published by European Publisher.

Keywords: Vocational education and training, age, investment in educations.



This is an Open Access article distributed under the terms of the Creative Commons Attribution-Noncommercial 4.0 Unported License, permitting all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

1. Introduction

An aging population is one of the significant trends in the modern world. A probable consequence and effective counteraction to this process is an increase in the share of older workers in the workforce (Bylkov, 2017; Mayer, 2014). At the same time, according to most employers in Europe (Johnson, 1993) and Russia, there is a decrease in the employees productivity of when they reach a certain age (usually 40–50 years). Investments in human capital (education) are also inversely dependent on age due to a shorter payback period (Becker, 1975). Only investments in the specifical human capital of older employees can have a positive return, since it depends on the expected duration of the current job, the change of which is less likely for such employees (Roshchin & Travkin, 2017). VET is becoming increasingly important for improving the knowledge and skills of employees—new technologies, the need to increase labour productivity and introduce innovations (Korshunov, Gaponova, & Gaponova, 2019; Tatarinov, 2019), as well as to preserve the social and labour functions of older workers (Shestakova & Vasiliev, 2016), ensuring a decent living (Trokhirova & Zimina, 2012; Zimina & Trokhirova, 2013). The inverse relationship is also noted. Production efficiency, intensive economic growth increasingly depend on the availability of highly qualified personnel, innovation and the use of high technologies (Davydova & Kozlova, 2017; Zharkova, 2017). The results of the motivation study of VET by older employees are contradictory. Researchers note that there is great interest in education by intellectual employees (Chernykh, Vitvitsky, & Kuzmina, 2018; Yankovskaya & Babkina, 2018), and reluctance to have an excessive load associated with training from due to health problems (Leonova, 2019). Researchers also note that periods of highest professional achievement occur at different times depending on the activity field, and depend on the type of intelligence involved, the skills used in the work, the level of work organization and of team interaction (Mayer, 2014).

2. Problem Statement

Theoretical explanations and the research results describing the relationship between age and involvement in vocational education and training are contradictory. In this regard, it seems important to the authors to clarify the relationship between the involvement of employees of Russian organizations of all types of economic activity (EA) in VET and age.

3. Research Questions

The studies describing the involvement of Russian organizations employees in VET are relatively few in view of the limited analytical base. There are estimates of the participation of the population in continuing education (including additional vocational education) as a whole. According to the Monitoring of education markets and organizations, in Russia there is a significant differentiation in the involvement level in formal and non-formal education between the age groups of 25–34 and 55–64 years (16 % and 7 percent, respectively). In EU countries, similar figures are 54 % and 33 %. Moreover, the self-assessment of need for new knowledge and skills in the older age group is significantly lower: 7 % in the group of people over 55 and 27 % in the group from 25 to 35 years. According to the data for 2017, 10 % of Russians aged 25–34 years and 4 % aged 55 to 64 years had specific plans to undergo training. It is noted that among the employed, the need for new skills is also higher: 20 % (among the unemployed – 9 %). The key motives

of participation in life-long-learning are professional: maintaining and strengthening their position at their current workplace. Employers' funds are the third most important source of funding for formal and non-formal education since 2014. Every fourth Russian citizen (24 %) received training from this source. The probability of participation in VET depending on age was considered on the basis of the Longitudinal Monitoring Survey – HSE: the probability of being trained to a certain age increases, then decreases (Travkin, 2014). The most significant is the intersectoral differentiation of the involvement level of employees in VET (Baeva & Sherstyankina, 2018). It is also proved that the causes of inter-industry differences are the characteristics of the labor demand (Baeva & Sherstyankina, 2019): staff stability, the share of highly skilled and semi-skilled workers, relative wages, and the share of staff with higher education. This study examines the hypothesis that there is a relationship between the age category of employees and their involvement in VET. Using various research methods, the authors test the hypothesis that there are significant intersectoral differences in the involvement level in VET for each age group of employees.

4. Purpose of the Study

The purpose of this study is to identify the correlation between the involvement level in VET of employees of organizations of various foreign economic activity in the Russian Federation and their age group based on statistical monitoring data «On additional professional education of employees of organizations for 2013 and 2016».

5. Research Methods

The analysis of variance is widely used in various studies, for example, ANOVA is used to study urban traffic (Gefan & Bazilevsky, 2018). In addition to economic and sociological studies, two-factor and multivariate analysis of variance is used in the oil and gas complex and mechanical engineering (Soler & Nguyen, 2017; Zharkova, 2017). ANOVA is based on the hypothesis that one or more qualitative factors do not influence the change in the resulting indicator. Acceptance or rejection of the hypothesis is carried out using the Fisher test. The authors used MS Excel.

6. Findings

The age structure of employees of Russian organizations didn't change in 2016 compared to 2013. The largest share of personnel in any type of activity is made up of employees from 30 to 50 years old (the level of variability is minimal and amounts to 16 and 12 percent, respectively). The most significant intersectoral differences are in the group of employees from 65 years of age and older (coefficient of variation of 70 %), up to 25 years (55 %) and 60-64 years (42 %). The most attractive for young people are Wholesale and retail trade (G) and Financial and insurance activities (J). The largest number of employees over 60 years old is in Education (M), Human health and social work activities (N), and Other service activities (K). The involvement level in VET has increased over 6 years. Perhaps due to the inclusion in the observation of 2016 of such training forms as short-term seminars, trainings, etc. Obviously, involvement in training depends on type of the economic activities (Figure 01).

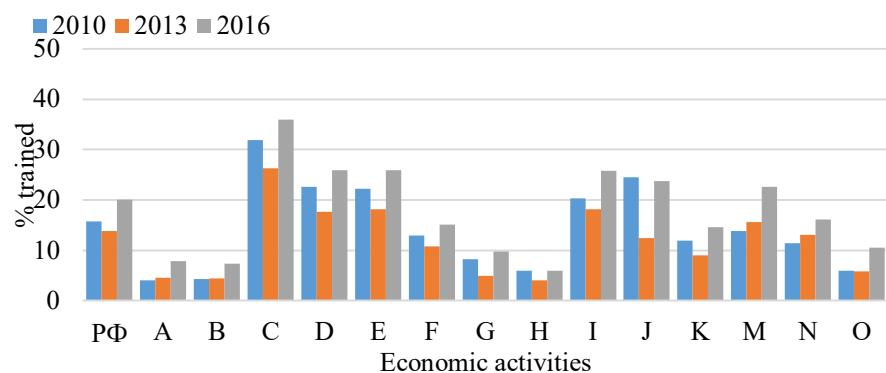


Figure 01. Dynamics of the share of trained in the total number of employees

The share of trained is above the average for all age categories in such activities as: Mining and quarrying (C), Manufacturing (D), Electricity, gas, steam and air conditioning (E), transport and communications (I). In age groups over 30, the involvement level in VET above average is also recorded in Education (M) and Human health and social work activities (N). Moreover, in the age groups over 60 years old, the share of trained in these sectors is maximum (Table 01).

Table 01. Proportion of trained employees in 2013 and 2016 in groups by age and by type of economic activity

Economic activities	till 25 years		25-29		30-39		40-49		50-59		60-64	
	2013	2016	2013	2016	2013	2016	2013	2016	2013	2016	2013	2016
RF	14.1	20.2	16.5	23	16.2	23	15.2	22.3	10.8	16.6	7.5	11.9
A	5.6	9.6	6.3	10.8	5.4	9.4	4.4	8	3.3	5.8	2.3	4.9
B	8.0	10.3	7.4	8.7	6.5	10	3.6	7.9	2.2	4.1	2.3	3.6
C	33.3	41.1	35.6	43	30.0	40.1	24.9	35.6	16.5	27.1	8.5	16.3
D	24.2	33.4	25.1	33.7	21.4	30.1	18.1	27.2	10.6	18.2	6.5	12.2
E	23.7	30.7	25.0	33.2	22.1	30.9	19.6	28.4	13.4	20.8	8.6	14.8
F	11.6	16.6	14.0	19.3	13.2	17.8	10.7	15.2	7.3	10.7	4.9	8.3
G	4.2	9.6	5.0	9.4	5.3	10	5.3	10.5	4.5	9.6	3.1	7
H	3.9	5.4	4.9	6.7	4.7	7.6	4.2	6.4	3.2	4.7	2.4	3.3
I	22.1	28.3	24.4	31.7	21.8	30	18.4	27	12.0	19.2	7.2	13.5
J	15.6	28.3	13.4	25	13.0	24.3	11.0	23.7	7.8	16.7	5.8	11.1
K	10.1	16.6	11.0	16.8	10.6	17.3	9.8	16.1	7.6	12	5.6	9.2
M	9.2	17.4	14.1	22.2	17.9	25	19.6	27.7	14.9	21.6	9.8	15.5
N	9.0	12.3	13.7	17.2	15.2	18.9	15.0	18.6	11.8	14.6	9.7	11.1
O	4.3	8.5	6.5	11.5	7.4	13	7.1	12.9	5.3	9.6	3.3	6.3
\bar{x}	13.2	19.2	14.8	20.7	13.9	20.3	12.3	18.9	8.6	13.9	5.7	9.8
σ	9.2	11.1	9.4	11.3	7.9	10.0	7.0	9.3	4.6	7.0	2.8	4.4
V, %	70	58	64	54	57	49	57	49	54	50	48	45

\bar{x} – average, σ – standard deviation, V – coefficient of variation

The obtained coefficients of variation confirm the assumption that the intersectorial impact on the involvement level in education for each age group is very high. Thus, the data confirm the assumption that the sectoral influence on the involvement level in VET is very large for each age group.

We will test the H_0 hypothesis using ANOVA: factor A – the industry does not significantly affect the number of trained in different age categories: Y_1 – up to 25 years old, Y_2 – 25-29 years old, Y_3 – 30-39 years old, Y_4 – 40-49 years, Y_5 – 50-59 years old, Y_6 – 60-64 years old, Y_7 – over 65 years old. For each resulting indicator Y_i , $i = 1, \dots, 7$ we calculated the coefficient of determination R^2 . It characterizes the effect of factor A on Y_i . The calculation results are presented in Table 02.

Table 02. ANOVA results (factor A) for the data on the number of trained for 2013, 2016

Y_i	Hypothesis Test Result (H_0) at different α			R^2 – share of factor A, %	100 – R^2 – share of unaccounted factors, %
	$\alpha = 1\%$	$\alpha = 5\%$	$\alpha = 10\%$		
If the hypothesis H_0 is rejected for α , then factor A affects Y_i ; if H_0 is accepted, then A doesn't affect Y_i					
Y_1	+	+	+	91.8	8.2
Y_2	+	+	+	90.2	9.8
Y_3	+	+	+	85.6	14.4
Y_4	+	+	+	82.0	18.0
Y_5	-	+	+	77.7	22.3
Y_6	-	-	+	68.4	31.6
Y_7	-	-	+	73.5	26.5

«+» – significant, «-» – not significant

The intersectoral differences in the share of trained people are significant for the first four age groups (up to 50 years old), starting from 50 years old. The influence of factor A is weakening, since there is a general downward trend in the share of trained people in older age categories.

Using ANOVA, we determine the influence of two factors: A – industry (hypothesis H_{0A}) and B – age category of employees (hypothesis H_{0B}), and their joint influence (hypothesis H_{0AB}) on the resulting indicator X – percentage of trained employees based on data for 2013, 2016. Table 03 presents the results.

Table 03. ANOVA results (factors A and B) for data on the number of trained employees for 2010, 2013, 2016

Factor	Hypothesis Test Result H_{0A} , H_{0B} , H_{0AB} , at different α			R^2 – share of factor, %
	$\alpha = 1\%$	$\alpha = 5\%$	$\alpha = 10\%$	
A	+	+	+	51 %
B	+	+	+	25 %
AB	-	+	+	13 %
unaccounted factors	-	-	-	11 %

«+» – significant, «-» – not significant

We see that the differentiation of activities has the most significant impact on the involvement level in training (51 %), the influence of the age category of employees is less (25 %), the influence of these factors as a whole is 13 %, and unaccounted factors account for 11 % of the impact.

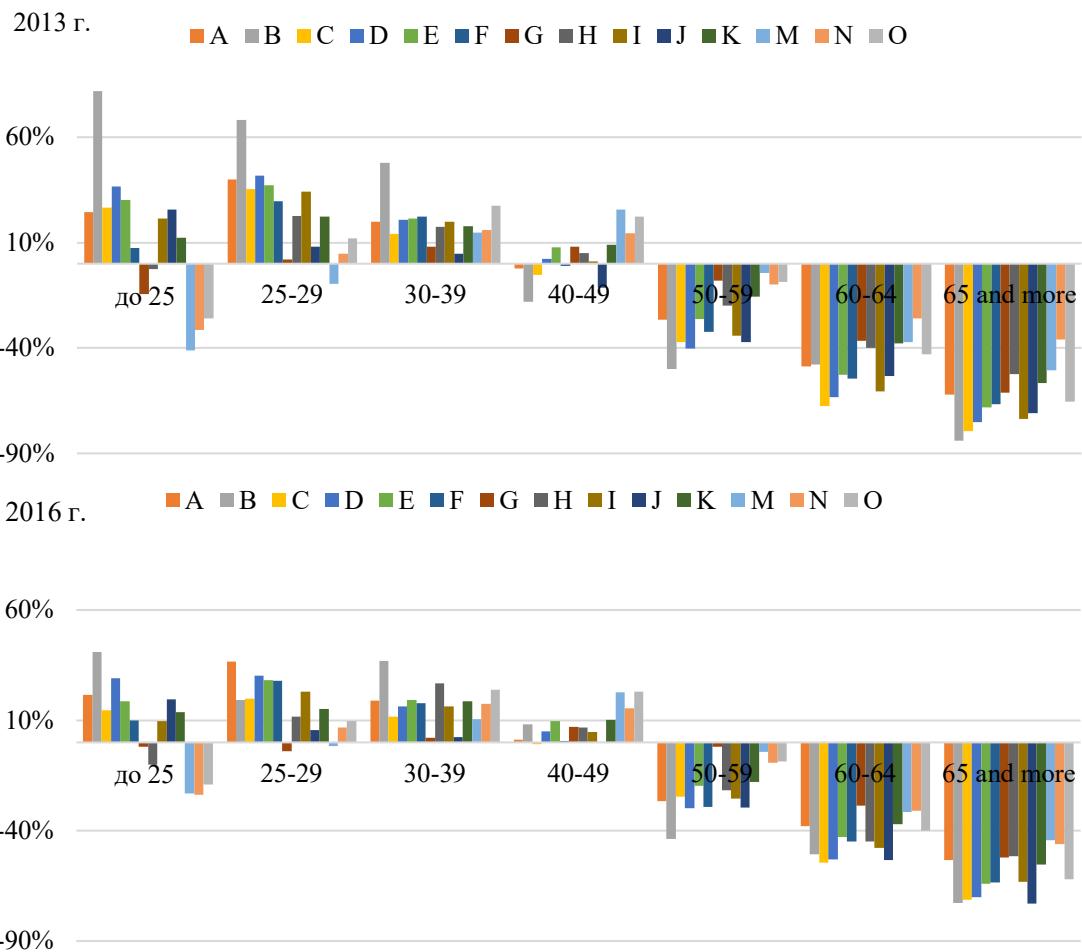


Figure 02. Individual coefficients of variation by type of activity and by age group for 2013 and 2016

We calculate the coefficients of variation in the share of trained employees in different age groups for each type of activity according to the formula:

$$V_{ij} = \frac{x_{ij} - \bar{x}_i}{\bar{x}_i} \cdot 100 \%,$$

x_{ij} – the share of those trained at a certain age j and economic activities i , \bar{x}_i – the average for the industry. This coefficient, calculated not for a group of values (types of economic activity), but for a separate indicator (type of activity), allows obtaining values that do not depend on their initial values, are relative and comparable between different age groups, and allow determining the trend (Figure 02).

The results show general trends. Firstly, there is a low involvement level in VET of employees aged 50 years and older (compared with industry average values). Secondly, when moving to an older age group, the deviation from the average becomes more significant. The situation is complicated in the field of education. With the aging of staff in this industry, a steadily low involvement level of the youngest workers (up to 30 years) in the continuing professional education is observed. We believe that this case can be considered as a direction for our further research.

7. Conclusion

The results of our study indicate that despite significant intersectoral differences in the involvement level of employees of Russian organizations in VET, there is a general trend – a lower level of involvement in VET of employees in age groups older than 50 years, decreasing with the transition to an older age group.

References

- Baeva, O. N., & Sherstyankina, N. P. (2018). Evaluation of the participation of organizations' workers in vocational education (training). *Trud i sotsial'nyye otnosheniya – The "Labour and social relations"*, 3, 16–26. <https://doi.org/10.20410/2073-7815-2018-29-3-16-26>
- Baeva, O. N., & Sherstyankina, N. P. (2019). The reasons for the intersectoral differences in the level of involvement in additional professional education (training) of employees of organizations of various types of economic activity. *Bulletin of Tomsk State University. Economics*, 47, 130–142. <https://doi.org/10.17223/19988648/47/9>
- Becker, G. S. (1975). *Human Capital and Personal Distribution of Income: An Analytical Approach Human capital: a theoretical and empirical analysis, with special reference to education*, 2 rd ed. New York: Columbia University. Press.
- Bylkov, V. G. (2017). Predlozhenie na rynke truda: metodologiya, priroda formirovaniya [Proposal on the labor market: methodology, nature of formation]. *Baikal Research Journal*, 8(4). [https://doi.org/10.17150/2411-6262.2017.8\(4\).1](https://doi.org/10.17150/2411-6262.2017.8(4).1)
- Chernykh, Yu. A., Vitvitsky, D. S., & Kuzmina, O. I. (2018). Algorithm for calculating the integral index of the effectiveness of publication activity of the teaching staff and research staff of the university. *Bulletin of Irkutsk State Technical University*, 22(7), 96–101. <https://doi.org/10.21285/1814-3520-2018-7-96-101>
- Davydova, G. V., & Kozlova, O. S. (2017). Sources of economical growth. *Izvestiya vuzov. Investitsii. Stroitel'stvo. Ned-vizhimost'= Proceedings of Universities. Investment. Construction. Real*, 7(4), 52–64. <https://doi.org/10.21285/2227-2917-2017-4-52-64>
- Gefan, G. D., & Bazilevsky, M. P. (2018). Comparison of variance and regression approaches based on the analysis of data on urban transport traffic. *Bulletin of Irkutsk State Technical University*, 22(1), 58–68. <https://doi.org/10.21285/1814-3520-2018-1-58-68>
- Johnson, P. (1993). *Aging and European economic demography Labor markets in an ageing Europe*. Cambridge University. Press.
- Korshunov, I., Gaponova, O., & Gaponova, N. (2019). Adult training and education in the context of economic development of regions. *Economy of region*, 1(1), 107-120.
- Leonova, O. V. (2019). Population Death Rate Modeling by Means of Analytical Laws Illustrated by the Example of Russia. *Bulletin of Baikal State University*, 29(1), 95–106. [https://doi.org/10.17150/2500-2759.2019.29\(1\).95-106](https://doi.org/10.17150/2500-2759.2019.29(1).95-106) [In Russ.]
- Mayer, E. V. (2014). Systematization of personnel ageing studies: definitions and practical application specific features. *Department of Economics Security, Voronezh State University of Engineering Technology*, 2, 27–32.
- Roshchin, S. Y., & Travkin, P. V. (2017). Determinants of on-the-job training in enterprises: the russian case. *European Journal of Training and Development*, 41(9), 758–775.
- Shestakova, N. N., & Vasiliev, I. G. (2016). Additional general and vocational education of the older people. *Coll. of works on the probl. of continu. professional ed.*, 30, 260–277.
- Soler, Ya. I., & Nguyen, M. T. (2017). Search for variance analysis models for roughness prediction taking into account the grinding mode of 06H14N6D2MVT-W steel parts by highly porous nitride-boron wheels. *Irkutsk State Technical University*, 21(1), 40–53. <https://doi.org/10.21285/1814-3520-2017-1-40-53>
- Tatarinov, K. A. (2019). Preconditions and terms of development of continuous education. *Baltic human. Journal*, 8(1), 285–288.

- Travkin, P. V. (2014). The involvement of employees in the program of additional training in Russia. *Proc. of Voronezh State University Series Economy and Management. Communication*, 2, 33–41.
- Trokhirova, U. V., & Zimina, E. V. (2012). Problems of availability of education in large siberian city (by results of poll of Irkutsk citizens). *Bulletin of the Irkutsk state economy academy (The Baikal state univer. of econ. and law)*, 6, 31.
- Yankovskaya, V. V., & Babkina, L. N. (2018). Development of the potential of scientific and pedagogical staff to prepare bachelors in the building sphere. *Proc. of University. Investment. Construct. Real estate*, 8(1), 121–132. <https://doi.org/10.21285/2227-2917-2018-1-121-132>
- Zharkova, E. V. (2017). Investment projects and innovative performances of oil-and-gas mining complex in Irkutsk region. *Proc. of University Investments. Construction Real estate*, 7(1), 30–36.
- Zimina, E. V., & Trokhirova, U. V. (2013). Problems and strategic priorities of educational system development in the context of improving life quality. *Bulletin of the Irkutsk state economy academy (The Baikal state university. of economy. and law)*, 4, 18.