Dynamics of agricultural human resources potential in the Russian Federation

Karpova, Daria P.; Chimitdorzhieva, Ekaterina Ts.; Vanchikova, Elena N.; Sangadieva, Iraida G.; Bambaeva, Natalya Ya.

Исследование динамики

хозяйства в Российской Федерации

ЕКАТЕРИНА ЦЫРЕНЖАБОВНА ЧИМИТДОРЖИЕВА[a]

НАТАЛЬЯ ЯКОВЛЕВНА БАМБАЕВА[b]

ДАРЬЯ ПАВЛОВНА КАРПОВА[b]

ЕЛЕНА НИКОЛАЕВНА ВАНЧИКОВА[c]

ИРАИДА ГОМБОЕВНА САНГАДИЕВА[c]

a Бурятский государственный университет им. Д. Банзарова
b Российская академия народного хозяйства и государственной службы
при Президенте Российской Федерации
c Бурятская государственная сельскохозяйственная академия им. в.Р. Филиппова

Аннотация: Динамика численности работников в сельскохозяйственных организациях свидетельствует, что количество трудовых ресурсов, занимающих должности руководителей и специалистов, в целом по стране сократилось более чем в два раза. Кадровый потенциал сельского хозяйства в первую очередь обеспечивается наличием определенного количества студентов, обучающихся по сельскохозяйственным направлениям подго-товки. Анализ динамики приведенного контингента студентов вузов по отрасли наук «Сельское хозяйство и сельскохозяйственные науки» за период с 2016 по 2020 год показывает, что по УГН(С) 35.00.00 Сельское, лесное и рыбное хозяйство темп роста составил 7,7 %, по УГН(С) 36.00.00 Ветеринария и зоотехния показатели роста составили 4,3 %, в целом по всей отрасли наук – 6,1 %. На темп роста приведенного контингента значительное влияние оказывают результаты и возможности региональной политики в области сельского хозяйства. Построенная авторами модель с фиксированными эффектами говорит о том, что на темп роста приведенного контингента не влияет темп роста валовой добавленной стоимости сельского хозяйства. Наиболее важным фак-тором является количество предприятий, работающих в сельскохозяйственном производстве, при этом влияние этого фактора в текущем периоде более значимо по сравнению с предыдущим. Темп роста приведенного кон-тингента студентов тем выше, чем ниже темп роста сельскохозяйственных предприятий в регионе.
Ключевые слова: трудовые ресурсы, студенты, сельское хозяйство, рост числа студентов, предприятия **Дата поступления статьи в редакцию:** 16 сентября 2022 года.

Dynamics of agricultural human resources potential in the Russian Federation

EKATERINA Ts. CHIMITDORZHIEVA[a]

NATALYA Ya. BAMBAEVA[b]

DARIA P. KARPOVA[b]

ELENA N. VANCHIKOVA[c]

IRAIDA G. SANGADIEV[c]

a Banzarov Buryat State University
b Russian Presidential Academy of National Economy and Public Administration
c Buryat State Agricultural Academy Named After V.R. Filippov

RESEARCH ARTICLE

Abstract: Figures on employment in agricultural organizations show that the number of labor resources occupying the positions of top managers and specialists has decreased by more than two times. First of all, the human resource potential of the agricultural sector is filled by involving the students engaged in agrarian specialties. Analysis of the number of students at universities in the areas of «Agriculture and Agricultural Sciences» for the period from 2016 to 2020 shows that the EGD(S) (enlarged group of directions and specialties) 35.00.00 Agriculture, Forestry and Fishery growth rate was 7.7 %, for EGD(S) 36.00.00 Veterinary and Zootechnics growth rate was 4.3 %, and in general, for the entire branch of science it was 6.1 %. The growth rate of students is significantly influenced by the results of the regional policy in the field of agriculture The fixed effects model shows that the growth rate of the number of students is not affected by the growth rate of gross agricultural value added in the region. The key factor is the number of enterprises operating in agricultural production, while the importance of this factor in the current period is more significant than in the previous one. The growth rate of the number of students is higher, when the growth rate of agricultural enterprises in the region lowers.
Keywords: labor resources, students, agriculture, increase in the number of students, enterprises **Received:** September 16, 2022.

Introduction

The issues of federal and regional policy balance in providing labor resources to agricultural enterprises are complex and do not have simple solutions. The demand for qualified specialists in agricultural enterprises remains high due to the high level of migration of the rural population. The provision of regions with labor resources for agriculture depends on a set of factors which we can summarize in three main groups: state policy aimed at ensuring sustainable development of rural areas; state policy to support agricultural producers and increase their innovative activity; educational strategy aimed at providing professionalization to rural youth. These policies have specific features of implementation at the regional level and depend on: the rate of agricultural development in the region; the contribution of agriculture to the regional economy; the number of agricultural enterprises, and the budgetary potential of the region.
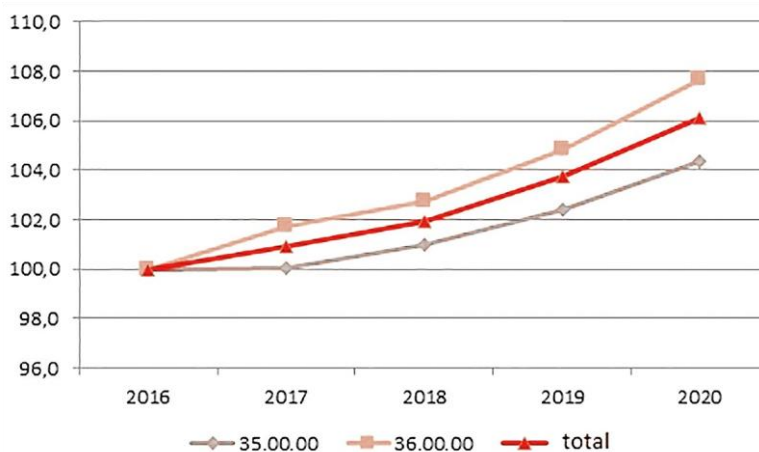
Dynamics in labor resources

Analysis of the dynamics of the number of employees occupying positions of managers and specialists in agricultural organizations for the period from 2001 to 2019 shows that the total number of labor resources in the country among agricultural organizations in the system of the Ministry of Agriculture of the Russian Federation has decreased by more than two times. At the same time, specific structural changes took place in the educational level of the labor resources of agricultural organizations. In 2001, the share of specialists with higher education was 31.5 % of the total number of specialists, while in 2019, it was 52.5 %. The rate of specialists with secondary education in 2001 was 52.3 %, and in 2019 this figure was 36.5 % (**Table 1**).

According to Rosstat, in 2020, for all types of economic activity the average share of employees with higher education in the Russian Federation is 35.4 %, and for "Agriculture, Forestry, Hunting, and Fishery" the rate of employees with higher education is 14.5 %, which is the lowest ratio of persons with higher education among all types of economic activity. The total number of qualified graduates with different levels of educational training in 2020 is 1.5 % of the total average annual number of employees in "Agriculture, Forestry, Hunting, and Fishery" (4 554), which indicates difficulties in human resources recovering even due to the personnel movement in agricultural organizations.

Table 1. Analysis of the dynamics in the number of employees occupying positions of managers and specialists in agricultural organizations in the system of the Ministry of Agriculture of the Russian Federation for the period from 2001 to 2019 [Demishkevich, Karmazina, Khristenko, 2020]

Year	Including specialists of them persons employees Actually employed, number, persons	Total number of persons	% of the total education	with higher education		with secondary vocational	
					%	persons	%
2001	595 150,0	499 010,0	83,8	187 610,0	37,6	311 400,0	62,4
2002	572 268,0	482 223,0	84,3	179 072,0	37,1	303 151,0	62,9
2003	544 100,0	459 559,0	84,5	173 946,0	37,9	285 613,0	62,1
2004	495 608,0	422 468,0	85,2	161 820,0	38,3	260 648,0	61,7
2005	456 160,0	390 022,0	85,5	153 742,0	39,4	236 280,0	60,6
2006	387 480,0	335 939,0	86,7	139 951,0	41,7	195 988,0	58,3
2007	358 170,0	312 935,0	87,4	135 789,0	43,4	177 146,0	56,6
2008	339 847,0	298 368,0	87,8	134 573,0	45,1	163 795,0	54,9
2009	330 106,0	292 174,0	88,5	140 212,0	48,0	151 962,0	52,0
2010	328 279,0	286 514,0	87,3	137 962,0	48,2	148 552,0	51,8
2011	331 590,0	288 659,0	87,1	141 333,0	49,0	147 326,0	51,0
2012	327 133,0	286 440,0	87,6	143 698,0	50,2	142 742,0	49,8
2013	322 895,0	274 545,0	85,0	140 566,0	51,2	133 979,0	48,8
2014	310 354,0	289 984,0	93,4	158 737,0	54,7	131 247,0	45,3
2015	307 188,0	270 667,0	88,1	146 519,0	54,1	124 148,0	45,9
2016	308 490,0	269 773,0	87,4	149 745,0	55,5	120 028,0	44,5
2017	295 795,0	262 616,0	88,8	149 938,0	57,1	112 678,0	42,9
2018	289 710,0	257 786,0	89,0	149 100,0	57,8	108 686,0	42,2
2019	284 841,0	253 531,0	89,0	149 673,0	59,0	103 858,0	41,0

Figure 1. Dynamics in the number of students in "Agriculture and Agricultural Sciences" (35.00.00 Agriculture, Forestry and Fishery, 36.00.00 Veterinary and Zootechnics)

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Dynamics in the number of students

Analysis of the dynamics in the number of students in the "Agriculture and Agricultural Sciences" for the period from 2016 to 2020 shows that the EGD(S) 35.00.00 Agriculture, Forestry and Fishery growth rate was 7.7 %, the EGD(S) 36.00.00 Veterinary and Zootechnics growth rate was 4.3 %, and in general, for the entire branch of science it was 6.1 % (**Figure 1**).

Over the past four years, the growth rate of students' number in the agricultural sciences as a whole and individually in EGD(S) 35.00.00 and 36.00.00 has not differed much from one another. However, if we consider the dynamics of growth rates in terms of federal districts, we will see more significant differences (**Figure 2**).

As a whole, all federal districts have a growing number of students. From 2016 to 2020, the Volga (11.3 %) and Siberian (11.1 %) federal districts have the highest growth rates in the number of students. The Southern (0.4 %), North Caucasian (0 %), and Ural (2.9 %) federal districts have the lowest growth rates. We can see that this growth is due to an increase in the number of students in the field of EGD(S) 36.00.00 Veterinary and Zootechnics.

The growth rate of the number of students of the EGD(S) 36.00.00 Veterinary and Zootechnics is significantly higher than that of the EGD(S) 35.00.00 Agriculture, Forestry and Fishery in all federal districts, except the Far Eastern. In the Far Eastern Federal District, the number of students in EGD(S) 36.00.00 Veterinary and Zootechnics decreased, and the drop was 3.5 % while, in EGD(S) 35.00.00 Agriculture, Forestry and Fishery, we can see the highest growth rate in the number of students by more than 12 %. The highest growth rate for EGD(S) 36.00.00 Veterinary and Zootechnics is in the Volga Federal District – almost 24 %.

A comparison of the agricultural development indica-tors by federal districts and the growth rate in the num-ber of students is demonstrated in **Figure 3**.

On average, the volume of agricultural production in all federal districts increased by 29.3 %. However, in the Ural Federal District, there were almost no changes. The rural population decreased in all districts from 1 % to 2 %, and a slight increase was observed only in the North Caucasus Federal District. The number of agricultural enterprises decreased by about 20 % in all federal districts, except for the Northwestern Federal District and the North Caucasus Federal District, where the reduction reached 50 % and 40 %, correspondingly.

Table 2. Dynamics of qualified workers training for "Agriculture, Forestry, Hunting, and Fishery" sphere, thousand people (according to Rosstat)

Training of qualified employees for en-larged groups of pro-fessions, thousand people			Training of mid-level specialists by educational organizations for the enlarged groups of specialties, thousand people thousand people			Training of specialists with undergraduate and graduate degrees by educational organizations of higher education and scientific organizations in the enlarged groups of specialties and training areas,			Total, thousand people		
2018	2019	2020	2018	2019	2020	2018	2019	2020	2018	2019	2020
Agriculture, Forestry, and Fishery											
17,2	15,6	15,5	18,4	19,2	20,3	23,303	23,72	22,3	58,903	58,52	58,1
Veterinary and Zootechnics											
0,4	0,3	0,3	3,2	3,3	4,0	8,4	8,5	8,4	12	12,1	12,7
Total											
17,6	15,9	15,8	21,6	22,5	24,3	31,703	32,22	30,7	70,903	70,62	70,8

∗ Russian statistical yearbook. Moscow, 2021.

Figure 2. The growth rate of the students of higher education institutions in "Agriculture and Agricultural Sciences" in 2020 in comparison with 2016 by federal districts (35.00.00 Agriculture, Forestry and Fishery, 36.00.00 Veterinary and Zootechnics)
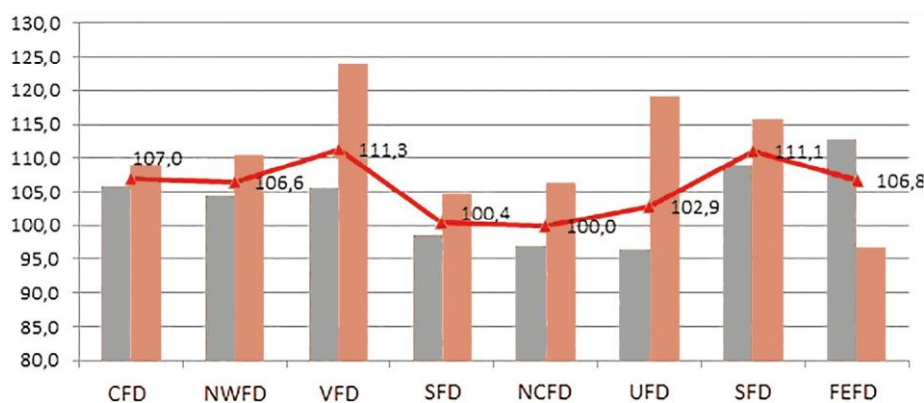
Analyzing the trends

The analysis of trends in agricultural development and the number of students does not provide any visual conclusions regarding general development patterns. In this regard, the need to use econometric models has arisen.

The analysis of the dynamics in the number of students in EGD(S) 35.00.00 and 36.00.00 was conducted on two key factors:

• the growth rate of gross value added created by "Agriculture, Forestry, Hunting, and Fishery" in the current and previous year in the region to the gross value added created in the Russian Federation in the present and earlier year (*TR_dobav_st _sx*);

• the growth rate of enterprises related to "Agriculture, Forestry, Hunting, and Fishery" *(TR_chislo_pred, %)*.

The first factor considers the difference between the regions in agricultural development in the Russian Federation in natural conditions, and the second factor indirectly characterizes the attention to the agricultural development in the region. Both factors allow us to assess in an aggregate form the effectiveness of state policy in agriculture by regions of the Russian Federation and consider their impact on the growth rate of the number of employees.

Table 3 shows the simulation results for the number of students in the EGD(S) 35.00.00 Agriculture, Forestry and Fishery.

According to the simulation results, we can conclude that the growth rate of the number of students in EGD(S) 35.00.00 Agriculture, Forestry and Fishery is significantly influenced by the results of regional agricultural policies; also, we found that the model with fixed effects is preferable to the model with random effects and the combined model (based on three types of testing). The created model with fixed effects shows that the growth rate of the number of students in EGD(S) 35.00.00 Agriculture, Forestry and Fishery is not affected by the growth rate of the gross value added of agriculture in the region, both in the cur-
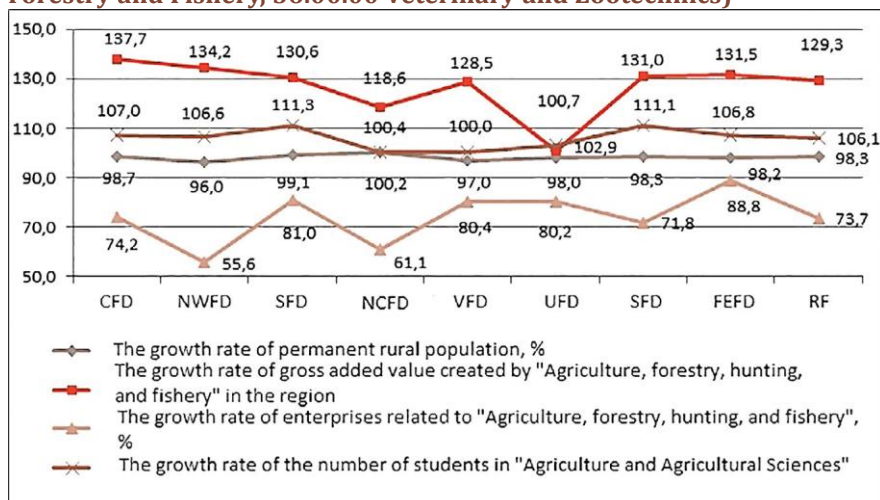
Table 3. Results for all types of models for the growth rate of the number of students in EGD(S) 35.00.00 Agriculture, Forestry, and Fishery

Combined model	Model with fixed effects	Model with random effects	
Constant	156,203***	232,284***	163,545***
TR_chislo_pred	−0,14475	−0,40374***	0,17805
TR_chislo_pred_1	−0,59369**	−0,76555**	−0,60523**
TR_dobav_st _sx	0,058863	−0,12410	0,041532
TR_dobav_st _sx_1	0,077458	−0,065482	0,066205
Test for the difference of constants in the groups (p-value)	1,05183e-008 (The model with fixed effects is preferable to the combined model)		
Breusch-Pagan test (p-value)	0,302575 (the combined model is preferable to the model with random effects)		
Hausman test (p-value)	0,219931 (the model with fixed effects is preferable to the model with random effects)		

Table 4. Results for all types of models for the growth rate of the number of students in EGD(S) 36.00.00 Veterinary and Zootechnics

Combined model		Model with fixed effects	Model with random effects
Constant	189,022***	187,982***	185,771***
TR_chislo_pred	−0,56989***	−0,54174***	−0,56968***
TR_chislo_pred_1	−0,30760	−0,06312	−0,23269
TR_dobav_st _sx	−0,13765	−0,20783	−0,138123
TR_dobav_st _sx_1	−0,019429	−0,17523	−0,053856
Test for the difference of constants in the groups (p-value)		5,03324E-041 (The model with fixed effects is preferable to the combined model)	
Breusch-Pagan test (p-value)			0,002529
Hausman test (p-value)			0,73225

Figure 3. Growth rates of regional agricultural indicators and growth rates of the number of students in "Agriculture and Agricultural Sciences" from 2017 to 2020 by federal district (35.00.00 Agriculture, Forestry and Fishery, 36.00.00 Veterinary and Zootechnics)

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rent and in the previous year. The key factor is the number of enterprises working in agricultural production, while the importance of this factor in the current period is more significant than in the previous one. If the growth rate of agricultural enterprises is high in the region, then the higher growth rate of the number of students. The more large agricultural enterprises there are in the region, the more job opportunities we have for graduates, therefore the number of trained professionals is growing.

Conclusion

According to the simulation results, we can make similar conclusions as for the model for EGD(S) 35.00.00 Agriculture, Forestry and Fishery – the growth rate of students in EGD(S) 36.00.00 Veterinary and Zootechnics is signifi-

cantly affected by the results of the regional policy in agriculture. Additionally, we found that the model with fixed effects is preferable to the model with random effects and the combined model (based on three types of testing). The created model with fixed effects shows that the growth rate of the number of students in EGD(S) 36.00.00 Veterinary and Zootechnics does not affect the growth rate of the gross added value of agriculture in the region, both in the current and in the previous year. The main factor is the number of enterprises working in agricultural production, and the influence of this factor is significant only in the current period. As in the previous model, the more large agricultural enterprises there are in the region, the more job opportunities we have for the graduates, and thus the number of trained professionals is growing.

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Информация об авторах:

ЕКАТЕРИНА ЦЫРЕНЖАБОВНА ЧИМИТДОРЖИЕВА, кандидат экономических наук, доцент, доцент кафедры прикладной экономики
Бурятский государственный университет им. Д. Банзарова (Российская Федерация, 670000, улан-удэ, ул. Смолина, 24а). E-mail: katrin_c@mail.ru
ORCID: https://orcid.org/0000-0003-3269-6172

НАТАЛЬЯ ЯКОВЛЕВНА БАМБАЕВА, кандидат экономических наук, доцент, профессор кафедры управления проектами и программами института государственной службы и управления
Российская академия народного хозяйства и государственной службы при Президенте Российской Федерации (Российская Федерация, 119571, Москва, проспект вернадского, 82). E-mail: ny.bambaeva@igsu.ru

ДАРЬЯ ПАВЛОВНА КАРПОВА, кандидат экономических наук, доцент, профессор кафедры экономики и финан-сов общественного сектора института государственной службы и управления
Российская академия народного хозяйства и государственной службы при Президенте Российской Федерации (Российская Федерация, 119571, Москва, проспект вернадского, 82). E-mail: dp.karpova@igsu.ru ORCID: https://orcid.org/0000-0003-4975-6805

ЕЛЕНА НИКОЛАЕВНА ВАНЧИКОВА, доктор экономических наук, профессор, профессор кафедры менеджмента Бурятская государственная сельскохозяйственная академия им. в.Р. Филиппова (Российская Федерация, 670024, улан-удэ, ул. Пушкина, 8). E-mail: evanch@mail.ru
ORCID: https://orcid.org/0000-0002-6206-0178

ИРАИДА ГОМБОЕВНА САНГАДИЕВА, доктор экономических наук, профессор кафедры экономики и организа-ции аПК
Бурятская государственная сельскохозяйственная академия им. в.Р. Филиппова (Российская Федерация, 670024, улан-удэ, ул. Пушкина, 8). E-mail: Sangadieva@mail.ru

Information about the authors:

EKATERINA TSYRENZHABOVNA CHIMITDORZHIEVA, Candidate of Sci. (Economics), Associate Professor, Department of Applied Economics
Banzarov Buryat State University (24a, Smolina St., Ulan-Ude, 670000, Russian Federation). E-mail: katrin_c@mail.ru
ORCID: https://orcid.org/0000-0003-3269-6172

NATALYA YAKOVLEVNA BAMBAEVA, Candidate of Sci. (Economics), Associate Professor, Professor of the Project Management and Program Administration Department, Institute of Public Administration and Civil Service
Russian Presidential Academy of National Economy and Public Administration (82, Vernadsky Prospekt, Moscow, 119571, Russian Federation). E-mail: ny.bambaeva@igsu.ru

DARIA PAVLOVNA KARPOVA, Candidate of Sci. (Economics), Associate Professor, Department of Public Sector Economy and Finance, Institute of Public Administration and Civil Service
Russian Presidential Academy of National Economy and Public Administration (82, Vernadsky Prospekt, Moscow, 119571, Russian Federation). E-mail: dp.karpova@igsu.ru
ORCID: https://orcid.org/0000-0003-4975-6805

ELENA NIKOLAEVNA VANCHIKOVA, Doctor of Sci. (Economics), Professor, Department of Management Buryat State Agricultural Academy Named After V.R. Filippov (8, Pushkina St., Ulan-Ude, 670024, Russian Federation). E-mail: evanch@mail.ru
ORCID: https://orcid.org/0000-0002-6206-0178

IRAIDA GOMBOEVNA SANGADIEVA, Doctor of Sci. (Economics), Professor, Department of Economics and Organization of the Agro-industrial Complex
Buryat State Agricultural Academy Named After V.R. Filippov (8, Pushkina St., Ulan-Ude, 670024, Russian Federation). E-mail: Sangadieva@mail.ru