

## Reproduction of the Qualified Personnel of Working Professions in Agriculture

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**Abstract.** Despite the presence of stable demand for food and other agricultural resources, the trend of reducing the number of workers in agriculture in almost all countries of the world in the coming years will continue. This reduction should be partially compensated by the growth of labor productivity and the strengthening of the technical equipment of the industry, innovations and improvements in the applied methods, tools and production technologies. On the other hand, the reduction in the number of personnel in working professions must be compensated for by increasing their professionalism and compliance with professional standards. In these conditions, the requirements for professional competence of workers in working professions in the implementation of production processes for the cultivation, harvesting and post-harvest processing of crop products, maintenance and care of farm animals and poultry, land reclamation and other work should be carried out in strict accordance with the organizational and economic principles of agricultural production. In order to identify factors affecting the turnover of workers in agricultural occupations, we conducted a special correlation and regression analysis, which allowed us to establish that the main ones are: labor remuneration; the number of hospital beds per 10,000 people in rural areas; the proportion of women in the staff of the working professions of agricultural organizations; the level of profitability of agricultural enterprises; the proportion of personnel working professions of agricultural organizations under the age of 30 years; the size of the energy capacity per 100 hectares of sown area of agricultural organizations.

**Keywords:** Labor Resources, Agriculture, Reproduction, Personnel of Working Professions.

## 1 Introduction

The mechanism of reproduction of skilled workers in existing professions for various reasons turned out to be disorganized and no longer justifies itself, and the creation of a new mechanism for reproducing skilled workers in occupations is very relevant and requires study and a science-based approach, taking into account the influence of many-sided external factors environment of the region.

The aim of our study is to study the trends in the reproduction of skilled workers in agricultural occupations.

The materials and methods used in the work include methods of analysis and synthesis, induction, deduction, abstract, logical and tabular method.

The information base of the study was compiled by official data of the Federal State Statistics Service for the Republic of Bashkortostan for the period from 1990 to 2016.

## 2 Literature Review

Modern agricultural production in the countries of the European Union places high demands on the labor force. In the work of Marcel Gerds, Axel Poehis, devoted to the analysis of determining the importance of the various competences and skills of agricultural workers from the point of view of farm managers of Mecklenburg-Western Pomerania (Mecklenburg-Vorpommern), knowledge is defined as the most important characteristic of the labor force. In addition, Marcel Gerds and Axel Poehis [13] note that employee's interest in achieving concrete results, reliability, autonomy, flexibility, motivation, qualifications, abilities, willingness to learn, teamwork and employee honesty are also important characteristics of employees from the point of view of agricultural employers.

In his research, Marcel Gerds [12] also notes that "qualifications, knowledge, and skills are the competitive advantages of employees". Как отмечает в своих исследованиях Thomas Hentschel [4], «Currently, there is a growing demand for more skilled workers in agriculture».

The work of Thomas Hentschel and Theodor Fock [15] are devoted to the changing nature of work in agriculture associated with the growing industrialization of agriculture. In contrast to the often monotonous and repetitive work in industrial production processes, agriculture deals with live animals and plants, which depend on biological and other factors, often subject to considerable fluctuations in the natural process. In this regard, the agricultural worker must have extensive knowledge and experience, both in crop production and in animal husbandry.

In connection with the growth of mechanization, specialization, more complex legal and political conditions and sustainable growth of farms, according to Nicola Guidel, Pamela Laven, Reiner Doluschits [3], the requirements for the professional qualifications of workers are only increasing. Due to the "lack of specialists, it is becoming more and more difficult to find skilled workers».

Among the countries with a high share of employment of skilled workers in agriculture, forestry and fisheries in 2016 stand out: Romania (21.4%), Greece (12%),

Poland (10.4%), Portugal (7.1%) , Croatia (7%), Lithuania (6.1%), Ireland (5%), Austria (4.5%), Slovenia (4.2%), Latvia (3.9%), Finland (3.8 %), Bulgaria (3.7%), France (3.2%) [2]. According to Eurostat, in the period from 2015 to 2025. A further decline in employment of skilled workers in the agriculture, forestry and fisheries sectors is expected to continue by another 15%.

In connection with the increasing requirements for the professionalism and competence of workers, among the main professional requirements for specialists in the field of agriculture, forestry and fisheries, employees employers highlight the responsibility for growing, maintaining and harvesting crops; raising livestock, caring for forests; collecting fish. Among the five key skills required for these workers are teamwork, problem solving, training, ability to plan their work and professionalism. In Latvia, the Kingdom of the Netherlands and Romania there is a shortage of skilled personnel in agriculture, forestry and fisheries, while in Spain, France and Poland, on the contrary, there is an excess of workers.

Despite the presence of stable demand for food and other agricultural resources, the trend of reducing the number of workers in agriculture in the next ten years will continue, accompanied by an increase in labor productivity and the strengthening of the technical equipment of the industry, innovations and improvements in applied production methods. Under these conditions, the requirements for professional competence of specialists in the field of agriculture are strengthened not only in the direction of technological and analytical knowledge and skills, including the operation and maintenance of equipment, knowledge of plant and animal life, but also in smoothing the negative impact of industry development on the environment and environmental processes. As part of the staff of working professions qualified personnel occupy 90% of jobs.

According to Eurostat forecasts for the period up to 2025, the number of highly skilled jobs in the agricultural sector will increase by 300 thousand jobs, while employment in low-skilled jobs will decrease by 1.1 million jobs. For most European countries, as well as for Russia, a tendency of aging personnel is typical. This is clearly manifested in the fact that the proportion of agricultural workers in Europe aged 50 years and older is about 45%. In this regard, in the next ten years, about four million workers in the agricultural sector may retire. Then the total demand for specialists will be 4.5-5 million people. In this regard, the requirements for succession planning, mentoring and career development come to the fore. Senior agricultural workers should have the opportunity to acquire knowledge in the field of technical information, since the prevalence of robotics and advanced technology in agriculture will allow you to get away from the old methods of farming, manual labor and basic maintenance of machines, to support robots ("agribots").

Analytical software and cloud computing in the agricultural sector will allow large and medium-sized farmers to become owners of electronic tools that can be used in the precision farming system. At the same time, the software will become digital evidence and the basis for national agricultural regulators and the European Union to fulfill the conditions of subsidies. Data management will be one of the most important skills in farming practice, allowing workers to process information obtained from various sensors and display systems. Foreign experience in agricultural production has a high

scientific and practical interest, since there are many examples when small countries do not only fully provide their people with quality food, but also export them to other countries.

The works of numerous other foreign and Russian scientists are devoted to the study of the problems of reproduction of skilled agricultural personnel. Our work has been published on this topic (Akhmetyanova A.I. [5], Kolevid G.R., Saitova R.Z. [6], Kuznetsova A.R. [7]).

### **3 Trends in the Reproduction of Skilled Labor in Agriculture**

The reproduction of skilled workers is a multi-faceted task. On the one hand, this is a systematic replenishment of the number of labor resources employed in the agricultural sector and capable of performing the labor functions of service and technical personnel, and on the other, the growth of professionalism and competence of existing staff members.

We have developed the content of the notion of the category “skilled workers in agricultural professions” is clarified: these are competent professionally trained workers who work with a certain complexity, labor-intensiveness and physical activity, with a high degree of subordination to the organizers of labor and employers to perform production tasks and improve the effectiveness of agricultural production performed in adverse weather and climatic conditions (heat, drought, precipitation, wind, humidity, sunshine hydrochloric radiation, atmospheric pressure, etc.) and production conditions in differentiated microclimate (illuminance, air movement, humidity, odor, temperature, etc.).

As a result of studying the category “cadres of working professions in agriculture”, it was established that the category “worker” can be classified according to the following criteria: 1) according to the degree of mechanization of labor; 2) according to the degree of qualification of labor; 3) the intensity of labor; 4) on working conditions; 5) the intensity of the labor process; 6) the level of intellectual activity of workers.

The formation of the labor resources of the country and its regions is based on the natural demographic processes of population reproduction. The demographic situation directly affects the amount of formed labor resources and the security of agricultural organizations with human resources. For the period from 1990 to 2016. the population of the Republic of Bashkortostan increased by 3.3%, the number of labor resources - by 4.5%, the number of people employed in the economy decreased by 10%. The number of students in working age increased by 5.1%. At the same time, there is a significant increase in the number of people of working age who are not employed in the economy – 4.1 times.

As of January 1, 2018, the resident population of the Republic of Bashkortostan was only 4,063.3 thousand people. Out of the total population, the population under working age is 828.3 thousand people (20.4%), at working age - 2261 thousand people (55.6%), older than working age - 974 thousand people (24%). Settlement differences in the age

proportions of the population persist: a higher proportion of the working-age population is observed in urban populations, and an increased prop of the population older than the working-age population is in the rural (Table 1).

**Table 1.** Composition of the population of the Republic of Bashkortostan by integrated age groups (at the beginning of the year) [8, 9, 10].

Years	younger than able-bodied		at working age		older than the able-bodied	
	total, thousand people	in% to total population size	total, thousand people	in% to total population size	total, thousand people	in% to total population size
1990	1059.1	26.9	2183.2	55.4	699.1	17.7
city	646.5	25.7	1474	58.7	392.0	15.6
village	412.6	28.9	709.2	49.6	307.1	21.5
2000	966.3	23.5	2348.2	57.0	805.3	19.5
2005	790.6	19.4	2517.6	61.7	773.1	18.9
2010	736.8	18.1	2525.2	62.1	806.5	19.8
2017	822.6	20.2	2294.1	56.4	950.3	23.4
2018	828.3	20.4	2261.0	55.6	974.0	24.0
city	506.2	20.1	1442.6	57.2	573.2	22.7
village	322.1	20.9	818.4	53.1	400.8	26.0
2018 y. in % to 1990 y. city 2018 y. in % to 1990 z. village	78.2	-6.5	103.6	0.2	139.3	6.3
2018 y. in % to 1990 y. city 2018 y. in % to 1990 z. village	77.7	-5.6	97.2	-1.5	145.2	7.1
2018 y. in % to 1990 y. city 2018 y. in % to 1990 z. village	79.0	-8.0	117.1	3.6	131.7	4.4

For the period from 1990 to 2018. the total population of the region in working age decreased by 22%, in working age it increased by 3.6%, in older than working age it increased by 39.3%. Population in under working age in urban areas from 1990 to 2018 decreased by 22.3%, in rural - by 21%.

Consider the migration increase (decrease) of the population aged 14 years and older in the agricultural sector and by status in employment for the period from 2010 to 2016. in the Table 2.

From the data presented in Table 2, it follows that in the structure of the loss of workers from the agricultural sector over the past seven years, workers occupying the positions of workers predominate. Their share was 63.6%; specialists - 20.5%, other employees - 19.2%, self-employed - 1.9%. And only in terms of leadership positions there was an increase in the number of only 35 people. Consider the migration increase

(decrease) of the rural population due to circumstances that necessitated a change of place of residence, by age group for 2016 in Table 3.

**Table 2.** Migratory increase (decrease) in the population aged 14 years and older to the branch of agriculture by employment status, (person) [13, 14].

Indicators	2010 y.	2011 y.	2012 y.	2013 y.	2014 y.	2015 y.	2016 y.	Total
Before resettlement, they carried out labor activities - total	129	-3466	-2962	3509	-163	-2184	-4112	-9249
from among those employed were engaged in agriculture, hunting and forestry including:	-210	-230	-203	327	-79	-249	35	-609
for hire - total	-163	-211	-153	347	-59	-242	-3	-484
of them as:								
head	13	4	-3	12	-9	14	4	35
specialist	14	-23	-20	-30	21	-38	-23	-99
other employee	-29	-25	-17	6	-7	-4	-17	-93
worker	-142	-167	-113	359	-64	-214	33	-308
self-employed	-19	9	-10	23	-25	-12	25	-9

**Table 3.** Migration increase (decrease) of the rural population the circumstances that necessitated a change of residence, age groups for 2016, person [13].

Indicators	Total migrants aged 14 and over	including relocation due to			
		with study	with work	return to the former place of residence	reasons of a personal, family nature
Total	-1087	-11201	-2971	2095	605
in able-bodied	-1289	-10181	-2949	1476	-407
older able-bodied	1078	-	-22	614	1000

From the data of table 3 it follows that in the structure of migration growth over working age in rural areas, according to the circumstances that necessitated a change of residence, the largest share was taken by returning to the previous place of residence - 57%; personal, family reasons - 23% and other reasons. In connection with studies in 2016, 10181 people left the region, in connection with work - 2949 people.

Information on the migration of labor resources from the agricultural sector by level of education for the period from 2010 to 2016 presented in Table 4.

**Table 4.** Migration of labor resources from the agricultural sector by education level (at the age of 14 and more), person [13].

Migration increase (decrease)	2010 y.	2011 y.	2012 y.	2013 y.	2014 y.	2015 y.	2016 y.	Total
Before the resettlement were employed in the agriculture, hunting and forestry including had education:	-210	-230	-203	327	-79	-249	35	-609
higher professional	-21	-23	-21	-6	7	-7	-20	-91
doctors of science	-	-	-	-	1	-2	1	0
candidates of science	-1	-2	1	-	-3	1	-1	-5
incomplete higher professional	-3	-15	3		6	-5	-7	-21
secondary vocational	-69	-116	-79	39	-55	-60	26	-314
initial professional	-15	-3	-5	4	-18	-7	12	-32
average total (full)	-72	-46	-72	32	-20	-14	-29	-221
basic general	-14	-21	-14	207	-140	-28	4	-6
initial total	-5	-2	-5	54	139	-129	52	104
education level not specified	-10	-4	-10	-	2	1	-3	-24

From the data presented in Table 4, it follows that the qualitative composition of migrants by level of education from the agricultural sector for the period from 2009 to 2016. It was represented by the following structure: 51.6% migrated with secondary vocational education; with average general (full) - 36.3%, with higher professional - 14.9%, with primary professional - 5.3%, with no indication of the level of education - 3.9%, with incomplete higher - 3.4%, with the main general - 1%, candidates of science - 0.8%. According to official statistics, about 17% of the labor force with primary general education has arrived in the agricultural sector.

Consider the number of people employed in the economy of the Republic of Bashkortostan by industry in Table 5.

**Table 5.** The average annual number of people employed in the economy of the Republic of Bashkortostan by industry for the period from 1990 to 2016 (thousand people.) [1].

Indicators	1990 y.	1995 y.	2000 y.	2010 y.	2014 y.	2015 y.	2016 y.	2016 y. in % to 1990 y.
Total employed in the economy	1926.7	1747.7	1746.2	1752.4	1761.9	1759.9	1742.5	90.4
Industry	592.7	480.1	456.1	365.7	357.3	368.0	356.3	60.1
Agriculture, Forestry	326.4	331.5	366.1	278.6	265.6	222.2	206.2	63.2
Building	239.0	191.7	109.1	144.4	156.3	157.5	164.1	68.7

Indicators	1990 y.	1995 y.	2000 y.	2010 y.	2014 y.	2015 y.	2016 y.	2016 y. in % to 1990 y.
Transport and communication	122.9	97.6	98.4	100.4	108.7	117.4	115.7	94.1
Wholesale and retail trade	139.9	141.3	164.8	271.6	287.7	290.5	297.4	2.1 times
Housing and communal household	67.0	65.6	52.9	51.1	54.0	55.5	58.0	86.6
Health, physical culture and sports	105.0	111.7	111.3	119.7	115.9	114.6	114.3	108.9
Education, culture	218.7	219.9	186.9	180.6	165	160.3	155.8	71.2
	10.2	18.3	13.6	20.2	24.9	26.1	23.5	2.3 times
	104.9	90.0	187.0	220.1	226.5	247.4	251.2	2.4 times

From the data of table 5 it follows that, according to official statistics, the number of people employed in the regional economy decreased by 9.6%, including the number of people employed in industry decreased by 39.9%, in agriculture - by 36.8% in construction - by 31.3%, in education - by 28.8%, in housing and communal services - by 13.4%, in the field of transport and communications - by 5.9%.

In order to identify factors affecting staff turnover in agricultural organizations in 54 municipal districts of the Republic of Bashkortostan on average for 2014-2016, we used the indicators presented in Table 6.

**Table 6.** Factors affecting the turnover of workers in agricultural occupations.

Factors affecting the turnover of blue-collar occupations in agriculture		Power of influence
I	X1 - the proportion of workers who do not have special professional education, in percent;	R = 68,2 D = 46,5 (average connection tightness)
	X2 - the proportion of women in the composition of the work force of agricultural organizations, in percent;	
	X3 - the proportion of labor costs, as a percent;	
	X4 - the level of profitability, in percent;	
	X5 - the proportion of working people older than working age in the composition of the workforce in agricultural organizations, in percent;	
	X6 - the number of hospital beds per 10,000 population;	
	X7 - the proportion of personnel in the working professions of agricultural organizations under the age of 30 years, as a percentage;	
	X8 - the proportion of personnel working professions of agricultural organizations with a category (klassnost)	



Factors affecting the turnover of blue-collar occupations in agriculture		Power of influence
X9 - the size of energy capacity per 100 hectares of sown area of agricultural organizations, horsepower per 100 hectares		
<b>II</b>	<b>Regression equation</b>	
$Y = 32,47 + 0,07X_1 + 0,25X_2 - 0,84X_3 - 0,61X_4 + 0,08X_5 - 0,16X_6 + 0,45X_7 - 0,17X_8 + 0,02X_9$		
<b>III</b>	<b>The most significant factors of direct influence:</b>	Elasticity coefficients
1	the proportion of women in the composition of the work force of agricultural organizations, in percent	$X_2 = 0,41$
2	the proportion of personnel working professions of agricultural organizations under the age of 30 years, as a percentage	$X_7 = 0,25$
3	the size of the energy capacity per 100 hectares of sown area of agricultural organizations, hp / ha	$X_9 = 0,23$
4	percentage of workers who do not have special vocational education, in percent	$X_1 = 0,09$
5	the proportion of working people older than working age in the composition of the work force of agricultural organizations, in percent	$X_5 = 0,03$
<b>IV</b>	<b>The most significant factors of reverse influence:</b>	
1	share of labor costs, in percent	$X_3 = -0,96$
2	number of hospital beds per 10,000 population, units	$X_6 = -0,51$
3	level of profitability, in percent	$X_4 = -0,31$

If there are differences in the units of measurement of factor signs, as a rule, elasticity coefficients are used. These elasticity coefficients show how much percent on average in aggregate the effective indicator y can change when the factor signs x change by 1% of its average value.

The average elasticities can be compared with each other and, accordingly, the factors are ranked according to the strength of their impact on the result.

As a result of the study, it was found that the key factors affecting the increase in the level of staff turnover in blue-collar occupations in agricultural organizations are “by module”: 1) the share of labor costs - 96%; 2) the number of hospital beds per 10,000 population — 51%; 3) the proportion of women in the composition of the work force of agricultural organizations - 41%; 4) profitability level - 31%; 5) the proportion of personnel working in professions of agricultural organizations under the age of 30 years - 25%; 6) the size of energy capacity per 100 hectares of sown area of agricultural organizations - 23%.

Since among the factors that we identified as a result of the correlation-regression analysis, it was found that the turnover rate is the proportion of labor costs, the relationship between the energy activity costs of workers in the agricultural sector and the level of their remuneration is studied.

Relying on the norms of physiological energy and nutrient requirements for various groups of the population of the Russian Federation (2009), developed by the Research Institute of Nutrition of the Russian Academy of Medical Sciences, put into effect on December 18, 2008, the cadres of working agricultural professions can be attributed to the highest groups of physical activity in men: group IV, which includes workers of heavy physical labor, including workers in forestry, hunting and agriculture, and group

V, especially heavy-duty manual workers, machine operators and agricultural workers in sowing and harvesting periods.

Calculations have shown that the working branches of agriculture cannot satisfy their need for good nutrition, which is necessary and sufficient for the reproduction of physical effort costs due to the low level of remuneration (Table 7).

**Table 7.** Indicators for assessing the level of income of the population in rural areas of the Republic of Bashkortostan and the energy value of food consumed for the period from 2010 to 2016 years.

Indicators	2010 y.	2011 y.	2012 y.	2013 y.	2014 y.	2015 y.	2016 y.
Consumer spending, per person per month, rubles.	6872.1	7230.9	11130.2	10800.5	12130.1	10189.3	12006.4
the proportion of consumer spending on the purchase of food and food out of home, in percentage	35.4	33.2	23.4	27.0	34.3	38.9	34.6
Consumer family expenses for the purchase of food per month, rubles.	7294.8	7209.0	7829.7	8755.8	12484.5	11901.6	12462.6
The cost of non-food items, per person per month, rubles.	2918.7	3304.0	6610.8	6019.3	5953.0	3961.2	5585.6
The size of the subsistence minimum (average per capita), rubles per month	5388.0	5992.0	6014.0	6789.0	7577.0	9175.0	9105.0
Average monthly wages of workers in agriculture, hunting and forestry, rubles.	8663.0	9939.0	10862.0	11571.0	13910.0	14635.0	15886.0
The energy value of food consumed per person per day, kilocalories.	3516.4	3407.5	3342.3	3231.4	3188.3	2823.1	3031.7
Required daily rate of consumption for agricultural workers, kilocalories.	3600.0	3600.0	3600.0	3600.0	3600.0	3600.0	3600.0
Under consumption of food, kilocalories.	83.6	192.5	257.7	368.6	411.7	776.9	568.3

The costs of workers' physical energy exceed the costs of specialists' physical energy by 1.6 times, and the costs of managers' energy - by 2 times. Regular non-receipt of the necessary and sufficient number of kilocalories for the reproduction of the costs of

physical and mental efforts due to low wages lead to an outflow of workers from the agricultural sector to more paid ones.

In fact, for the period from 2010 to 2016. in the Republic of Bashkortostan, the proportion of agricultural workers who received wages at a level below the subsistence minimum increased from 6.9% to 9.8%. In agriculture, the share of low-paid workers increased from 21.4% to 36.8%. This trend evolved in the country and its regions for a long time. In the structure of the energy value of the daily ration of home food of rural residents, the largest share is occupied by bread products - 40.5%. It is proved that in order to compensate for the costs of physical effort, a villager must eat calorie and properly, to achieve this, the wage level of a worker in the agricultural sector must increase at least 2-3 times.

## **4 Conclusion**

**Firstly**, for the period from 1990 to 2016. the number of labor resources in the region increased by 4.5%, while the number of labor resources in rural areas increased by 17% over the same period.

**Secondly**, according to official statistics of the Republic of Bashkortostan, the number of personnel working in agricultural organizations for the period from 1990 to 2016. decreased by 8 times. At the same time, the number of released workers and employees in agricultural working professions decreased by 79%.

**Thirdly**, cadres of workers with special vocational education mostly leave the industry (51.6% migrated with secondary vocational education, 36.3% with general secondary education, 14.9% with higher vocational education, with the initial professional - 5.3%, with no indication of the level of education - 3.9%, with an incomplete higher education - 3.4%, with the main general - 1%, candidates of science - 0.8%.

**Fourthly**, a special correlation-regression analysis revealed the main factors affecting the turnover of workers in agricultural work. As a result of the study, it was found that the key factors affecting the increase in the level of staff turnover in blue-collar occupations in agricultural organizations: 1) the share of labor costs; 2) the number of hospital beds per 10,000 population; 3) the proportion of women in the composition of the work force of agricultural organizations; 4) profitability level; 5) the proportion of personnel working in professions of agricultural organizations under the age of 30 years; 6) the size of energy capacity per 100 hectares of sown area of agricultural organizations.

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