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COMPLICATIONS OF RUSSIAN INNOVATIVE DEVELOPMENT FINANCING

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ABSTRACT

This study presents problems impeding the development and implementation of Russian innovations in agricultural production. The main problem is the financing of innovation, due to a low proportion of public resources used in the creation and implementation of innovations. In comparison with the developed countries, the amount of state financing for innovations in Russia should be increased by ten times. In addition, working funds to support scientists in a global sense do not solve the problem of new scientific knowledge financing, not to mention the implementation into the real sector of the economy. A small share of public investment in innovation does not contribute to the solution of the problem of advanced innovative development. In addition, the public-private partnership helps to attract innovation in the real sector of the economy in all developed countries but does not work in Russia as it lacks state regulatory functions for this. This study identifies factors and trends that do not contribute to the effective and advanced development of the economy in terms of its innovative development. The need to increase domestic spending on research in agriculture by 5-7 times is substantiated. Negative trends in the reproduction of scientific personnel are revealed. This is the lack of financial motivation to work in the scientific field, inefficient system of postgraduate and doctoral studies. It is proved that the impact of grant support on the level of research funding, which is not more than 6.2% in domestic research costs, is insolvent. To alleviate the problem of innovative activity of economic entities, it is necessary to develop a targeted agricultural innovation policy that determines the goals, objectives, and mechanisms for its implementation, taking into account the priorities defined by the Russian Federation, as well as foreign experiences.

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1. INTRODUCTION

The problems of innovative development of the economy have several reasons. In our opinion, one of the main is the small amount of funding for scientific research and the lack of mechanisms for

innovation at all levels. The state invests no more than 10% of all costs on scientific research. This level of state participation will never contribute to the development of an innovative economy. It should be taken into account that even in countries with developing economies, the share of this indicator is considerably higher than in Russia. Another part of the problem is the possibility of private financing of innovations [14 – 19]. This problem has not been resolved now. Around the world, proven methods of financing innovation in the real sector of the economy have been used for a long time. And these methods work quite successfully in the developed countries of the world, bringing a significant increase in GDP. In recent years, for a number of reasons, there has been a certain decline in the innovative activity of science. Even the existing innovative potential is in the range of 4-5% [3, 4]. For comparison, this figure in the US exceeds 50%. Many scientific and technical developments do not become an innovative product. They remain unused by production. In addition to direct financing of innovations, attention should be paid to such fact as inefficient financing of postgraduate and doctoral studies [20 – 25]. Every year, a significant part of postgraduate and doctoral students do not conduct their research, and at the same time, the state finances budgetary places. If the scientific work is not done and the postgraduate or doctoral student does not defend, the state does not collect previously spent funds from him. These funds could be used for additional funding for research and innovation. And this is not to mention non-financial methods of innovation management. The system of financing innovation requires a radical revision, which will improve its efficiency in the economy [5 – 13].

2. GOALS AND OBJECTIVES

The purpose of this study is to determine the reasons for the backlog of innovative development in Russia. In accordance with the intended purpose, the following tasks are set:

- to identify trends in the use of key resources involved in the innovation process;
- to reveal factors that have a negative impact on innovation processes;
- to determine the level of influence of public financing on the development of innovation;
- to reveal the problems of non-demand of domestic innovations.

3. METHODS AND MATERIALS

This work uses abstract-logical, monographic, system, comparative, economic-mathematical, economic-statistical and other methods. Federal laws, decrees of the President of the Russian Federation, resolutions of the Government of the Russian Federation, published works of research institutions of the Russian Academy of Sciences, statistical materials at the federal and regional levels were used as materials.

4. DISCUSSION AND RESULTS

The first problem is weak public-private support for the formation of the material base for the subsequent creation of innovations. This is due to the long payback period of innovation and the small amount of investment of the state. The share of domestic expenditures on research and development in Russia to GDP does not exceed 1.1% annually (Table 1), not to mention agriculture, forestry and fisheries, for which no more than 600 million rubles are given annually, which is 0.01% of the GDP

of agriculture [3, 4].

In 18 developed countries over the past three decades, the share of expenditure in GDP has increased from 0.96 to 2.2 % in agriculture, including in the US from 1.32 to 2.2 %. And in Australia, the cost of agricultural research for the period increased from 1.5 to 4.42 %, in South Africa from 1.39 to 2.59 %, and in 17 African countries - from 0.42 to 0.58 % of GDP relating to agriculture. Based on the world practice of agricultural research financing, the above analytical data, it is necessary to increase urgently the amount of funding for research in agriculture by 5-7 times!

Without fully-fledged research in agriculture, agrifood policy will come to a standstill. At the same time, it is necessary to define clear strategic priorities, assessment indicators, develop a large analytical material to determine priorities and allocate a decent amount of funding.

Table 1: Share of domestic expenditures in Russia's GDP and per one employee engaged in research

Indicators	Years					
	2000	2005	2010	2014	2015	2016
Domestic expenditures on research and development, bln. rubles	766.9	230.8	523.4	847.6	914.7	943.8
including agriculture, forestry and fisheries	no	no	0.25	0.43	0.58	0.53
Number of employees engaged in research, thousand people	887.7	813.2	736.6	732.3	738.9	722.3
including agriculture	14.3	13.7	12.7	11.9	11.3	11.0
Domestic expenditures on research and development to GDP, %	1.05	1.07	1.13	1.07	1.10	1.10
Domestic expenditures on research and development to agricultural GDP, %	no	no	0.01	0.01	0.011	0.009
Domestic expenditures on research and development per 1 employee engaged in research and development, thousand rubles	180.1	590.1	1418.7	2266.7	2410.8	2548.2
including agriculture	no	no	19.6	36.1	51.3	48.2

Second problem involves with budgetary and extra-budgetary financing, the number of organizations engaged in scientific activities in Russia does not have a clear trend and is not a stable indicator. If in 2000 there were 4099 such organizations, in 2017 - 3944 (Table 2).

Table 2: Organizations carried out research and development in the Russian Federation, by type, at the end of the year

	Years					
	2000	2005	2010	2015	2016	2017
Number of organizations - total	4099	3566	3492	4175	4032	3944
including:						
research organizations	2686	2115	1840	1708	1673	1577
design organizations	318	489	362	322	304	273
project and survey organizations	85	61	36	29	26	23
experimental plants	33	30	47	61	62	63
educational institutions of higher education	390	406	517	1040	979	970
industry organizations that had research, design and development units	284	231	238	371	363	380
other	303	234	452	644	625	658

A negative trend is a decrease in the number of research organizations and universities that are specialized in their field of knowledge, which focus researchers engaged in narrowly focused scientific topics. The number of personnel engaged in research and development is also unstable (Table 3). Every year the number of researchers in Russia is decreasing. In 2017, there were about 360 thousand researchers, among them only 10 thousand people work in scientific units in the agricultural sector, ensuring food security of the country.

Table 3: Number of researchers engaged in research and development in the Russian Federation, (people).

	Years			
	2010	2015	2016	2017
Number of researchers - total	368915	379411	370379	359793
including agricultural sciences	12734	11296	11066	10343
among them				
Candidates of Sciences	5004	4592	4483	4183
Doctors of Sciences	1542	1551	1487	1384

This is catastrophically insufficient, taking into account the demand for agricultural products and the need to produce new products. From 10343 researchers, only 1384 people are doctors of sciences, that is, those who are engaged in fundamental research, providing a technological and scientific breakthrough in the agricultural sector. Personnel problem is relevant for agricultural science today.

In the forming multipolar world, there are four main centers of scientific progress – the United States (35% of global R&D spending on purchasing power parity), the European Union (24%), Japan and China (about 12%). Unfortunately, the Russian Federation is not among the leaders. We account for less than 2% of global R&D spending at purchasing power parity and 1% at the exchange rate.

Thus, Russia lags behind the US in R&D spending by 13 times, China by 11 times, the UK by 1.2 times, Germany by 3 times, Japan by 4.5 times (Table 4).

Table 4: Domestic expenditure on R&D in the world, million USD

Country	Years				
	2000	2010	2013	2014	2015
Russia	10726.9	33083.3	38609.6	39827.4	38143.0
Growth dynamics, %	-	by 3.1 times	116.7	103.2	95.8
Great Britain	25129.9	37609.3	41532.1	44163.8	46259.8
Growth dynamics, %	-	149.7	110.4	106.3	104.7
Germany	53632.8	87131.0	102905.5	109802.5	114778.1
Growth dynamics, %	-	162.5	118.1	106.7	104.5
The USA	269513.0	410093.0	457612.0	479358.0	502893.0
Growth dynamics, %	-	152.2	133.5	104.8	104.9
Japan	98758.0	140603.1	164655.8	170512.3	170003.0
Growth dynamics, %	-	142.4	117.1	103.6	99.7
China	33044.5	213460.1	334135.5	370115.9	408829.0
Growth dynamics, %	-	by 6.4 times	156.5	110.8	110.5

Domestic R&D expenditures in Russia are not growing as fast as in developed countries, and therefore are not able to ensure the qualitative implementation of the priority areas in science and innovation, which are indicated in the legal regulation of scientific and innovation activities over the past 5 years by the President and the Government of the Russian Federation. China's economy, for example, as the second economy in the world, provides at least 10% increase in research and development costs in recent years, and this indicator is catching up with the United States.

In our opinion, the second important problem is the salary level of researchers and the problem of the reproduction of highly qualified personnel. In 2016, the average monthly wage in education in Russia according to FSSS amounted to about 28,808 rubles, and in scientific and technical activities 57,179 rubles. For comparison, in Germany, a professor engaged in scientific research receives at least 7 thousand euros. Taxes on income are about 50%, and thus “net” is about 3.5 thousand euros or more than 210 thousand rubles in a month, and that is without taking into account the consultations carried out for businesses. In practice, the dynamics of low wages of researchers contribute to the “aging” of science and migration of young, promising highly qualified personnel into production.

Based on this, in agricultural science, as in any other scientific direction of research, there are no direct motives for creating innovations, especially by young scientists.

The problem of reproduction of scientific personnel is not solved either. Table 5, every year the number of applicants to postgraduate school decreases and decreases the number of graduates of this school, including the defense of the thesis. So if in 2010 about 34 thousand people graduated from the postgraduate school in Russia, in 2016 about 26 thousand people. In 2010, 9.6 thousand people defended their theses, while in 2016 only 3.7 thousand people defended their theses, while the efficiency of the postgraduate study was 28.4% and 14.3%, respectively. In this area, there is a negative trend in the training of highly qualified personnels. It is obvious that here it is necessary to create motives for scientific research carried out in priority scientific areas identified in the relevant legal acts of the President and the Government of the Russian Federation. Moreover, it is necessary to motivate young scientists, preventing their mass withdrawal to production, where there is no need for a diploma of Candidate of Sciences.

Table 5: Key performance indicators of postgraduate studies in Russia

Years	Number of organizations providing postgraduate training	Number of postgraduates (at the end of the year), people	Admission to postgraduate school, people	The graduation of postgraduate school, people	including thesis defense
1992	1296	51915	13865	14857	3135
2000	1362	117714	43100	24828	7503
2005	1473	142899	46896	33561	10650
2010	1568	157437	54558	33763	9611
2015	1446	109336	31647	25826	4651
2016	1359	98352	25421	25992	3730

The case with doctoral studies is even worse, see Table 6. So if in 2010 1650 doctoral candidates were admitted, 1259 graduated, including 336 with defense, in 2016, 397 people were admitted to the doctoral studies, 1346 graduated, 151 defended theses. The efficiency of doctoral studies in 2010 is 26.6%, in 2016 – 11.2%.

Table 6: Key performance indicators of doctoral studies

Year	The number of organizations providing the doctoral candidates training	Number of doctoral candidates (at the end of the year), people	Admission to doctoral studies, people	Graduation from doctoral studies, people	including thesis defense
1992	338	1644	540	617	247
2000	492	4213	1637	1251	486
2005	535	4282	1457	1417	516
2010	602	4418	1650	1259	336
2014	478	3204	166	1359	231
2015	437	2007	419	1386	181

2016	385	921	397	1346	151
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The narrowed process of reproduction of highly qualified personnel is also one of the main problems of almost any educational and scientific institution. According to FSSS for 2016, 73.3% of the staff engaged in research and development has higher education, and in education, the same figure is 54.2%. All this does not contribute to the quality of education and research. In 2016, the Federal State Statistics Service, the HSE jointly conducted a survey. The following questions were asked:

1. How do you feel about your child becoming a scientist?
2. Would you like your son or daughter to be a researcher?

57% of respondents answered the first question that they would be very disappointed with this choice, and 32% would be happy. 60% of respondents answered the second question – rather no, and 32% - rather yes.

Thus, a significant part of the respondents does not consider prestigious work in the scientific field. Based on this, it is necessary to create financial motives for young scientists, which will obviously raise the prestige of scientific activity.

Third problem: This is unformed state regulation of the processes of planning, creation, and implementation of innovations. First of all, it concerns the grant support for scientific research, which has been formed in the developed countries of the world for a long time. Unfortunately, the emerging grant system of scientific research in Russia does not take into account a number of features. As can be seen from Table 7, subsidies of the federal budget for financial support of the state assignment in domestic R&D costs are 10%. Budget subsidies for the performance of research and development work amount to 3.9% in the structure of internal costs financing. These two positions are allocated directly by the state in the person of the relevant ministries, and the next two positions are grants on which the government relies, with the hope of solving the problem of financing research. The amount of grants funding of funds to support scientific, technical and innovation activities in 2016 amounted to 22.6 billion rubles. This is only 2.4% in the structure of sources of internal R&D costs. The number of funds of other types of competitive financing in 2016 amounted to 58.7 billion rubles, which in the structure of financing of domestic R&D costs is only 6.2%. A common thesis that the grants will largely support scientific research is not justified for the reason that their share in relation to domestic expenditure on research is not more than 10% (subsidies) and 6.2% (grants given by the funds).

Table 7: Grants, subsidies, competitive financing of research and development in 2016

	Total, billion rubles	including those financed from funds		Share of grants, subsidies, competitive financing in internal research and development costs, %
		budgets of all levels	among them the federal budget	
From internal research and development costs:				
budget subsidies for financial support of performance of the state task in the field of scientific (research) activity	94.0	94.0	90.8	10.0
budget subsidies for research and/or development works	36.7	36.7	35.9	3.9
grants of funds to support scientific, technical and innovation activities	22.6	19.5	17.6	2.4

other types of competitive financing	58.7	49.0	47.6	6.2
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Based on these data, it can be seen that research organizations largely finance R&D from internal sources, which, as a rule, are obtained from economic entities.

In foreign practice, one of the main regulatory instruments of activating R&D is tax policy. 21 OECD countries apply tax incentives to private R&D spending. The main indirect ways to encourage innovation are tax credits and preferential taxation for corporations that have government or their own R&D programs. These measures are sometimes called “tax expenditures”.

In the tax systems of most OECD countries, including the United States, research and development expenditures are considered either as capital expenditures and are depreciated within 5 years of their implementation, or as business expenses and are deducted from the tax base in the current reporting period. The choice of the method of writing off R&D costs is up to the entrepreneur.

In the US, a tax credit for R&D allows returning from the already paid tax an amount equal to 20% of the increment in R&D expenditures in the current year. This benefit applies only to R&D conducted in the United States. The tax credit has a powerful incentive effect on companies’ ability to conduct long-term research that is critical to the new economy. Tax credits have a positive impact in the early stages of firm development and are particularly effective in small businesses.

The fourth problem is unclaimed innovation. The main reason for the unclaimed scientific knowledge is the distrust to domestic scientists from business representatives and authorities. Only 4% of agricultural organizations carry out innovations of different types. In crop production, this figure is 4.2%, in livestock –4.7%, which is catastrophically small to solve the problem of an innovative breakthrough in agricultural production. The issue of enhancing innovation activity should be the most important in Russia’s agrifood policy. A significant amount of innovation is for technological innovations – 3.4% in agriculture, 3.7% in crop and 3.9 in livestock production. Almost no attention is paid to marketing innovation when it is in this area a large part of the added value of finished products of agriculture is assigned. Quite modest are the amounts of shipped innovative goods, works, and services in agriculture - 22 billion rubles, which is only 1.4% of the total volume of shipped goods, works and services in agriculture in Russia. Expenditure on technological innovation amounted to 15 billion rubles or 0.5% in the cost structure of the agricultural organizations (Table 8). The situation is not better in the sub-sectors of crop and livestock production.

Table 8: Innovative activity of agricultural organizations, 2016.

	Share of organizations implementing innovations of certain types in the total number of surveyed organizations, %			
	total	technological	marketing	organizational
Total for crop production, livestock, crop production combined with livestock (mixed agriculture), providing services in the field of crop production, ornamental horticulture and animal husbandry, except veterinary services)	4.0	3.4	0.4	0.9
crop production	4.2	3.7	0.2	0.8
livestock	4.7	3.9	0.7	1.1
crop production combined with livestock (mixed	2.7	1.8	-	0.9

agriculture)				
in the field of crop production, ornamental horticulture and animal husbandry, except veterinary services)	1.8	1.5	0.1	0.4

Analysis of the number of agricultural organizations and farms that use innovative development allows saying that farms in most positions are superior to agricultural organizations, Table 9. This is despite the limited financial resources, and a much lower level of state support compared to large agricultural organizations. Farms are more likely to use drip irrigation system by 4 times, biological methods of plant protection from pests and diseases by 3.5 times, the system of individual feeding of livestock more than by two times, the method of cell-free poultry by six times, the system of wastewater and industrial wastewater treatment almost by two times, renewable energy sources by five times. In this regard, the state needs to take a set of measures to encourage agricultural organizations to apply innovations. Similar measures work quite effectively in the United States. Support of farms using innovations is also necessary for this direction.

Table 9: The number of agricultural organizations and farms used innovative technologies as of July 1, 2016

	Agricultural organizations	Farms and individual entrepreneurs
Number of organizations (farms) using innovative technologies:		
drip irrigation system	1158	4279
biological methods of plant protection from pests and diseases	2510	10481
the system of individual cattle feeding	1989	5401
method of without cell maintenance of poultry	368	1878
treatment facilities on livestock farms	1298	1507
wastewater and industrial wastewater treatment system	2431	4257
renewable energy sources:	454	2086
among them:		
biopower plants	10	15
wind power plants	21	85
solar panels	196	1368
precision driving system and remote quality control of technological processes	1731	885

Thus, in innovative development, Russia lags behind developed countries by 10-15 times, and it is innovative products that give greater added value, it is innovative products that give, although a little, but high-tech workplaces and motivate, in turn, the training of highly qualified personnel.. Table 10 presents the volume of innovative goods, works, services and costs of technological innovations in agriculture for Russia in 2016.

5. CONCLUSION

From this study, it is found that the actual problem today is the lack of a targeted state policy in the field of innovation, which determines the objectives of the innovation strategy and mechanisms for maintaining priority innovation programs and projects. The formation and implementation of innovation policy are based on the creation of such a system that will

allow using the intellectual, scientific and technical potential of the country in production in the shortest possible time and with high efficiency.

Table 10. The volume of innovative goods, works, services and costs of technological innovations in agriculture, 2016.

	The number of innovation goods, works, services, bln. rubles	As % of the total amount of shipped goods, works, services	Costs of technological innovation, bln. rubles	Share of expenses on technological innovations in the total amount of shipped goods, works, services, %
Total for crop production, livestock, crop production combined with livestock (mixed agriculture), providing services in the field of crop production, ornamental horticulture and animal husbandry, except veterinary services)	22.0	1.4	15.0	0.9
crop production	6.5	1.1	6.3	1.1
livestock	14.9	1.6	5.7	0.6
crop production combined with livestock (mixed agriculture)	0.6	1.2	2.9	5.7
in the field of crop production, ornamental horticulture and animal husbandry, except veterinary services)	0.1	0.7	0.7	0.7

Russia is on the 82nd place in the world in terms of state orders for advanced technologies. On this indicator, Russia is worse than other countries – participants of the BRICS. In terms of cooperation between universities and industrial production, Russia is on the 61st place in the world, in terms of cost of innovative development on the 50th place, in terms of quality research institute 53rd place in the world. And it is these problems that need to be paid close attention to, including within the framework of the implemented agrifood policy.

The negative factors are the departmental disunity and the weakening of the scientific potential of agricultural science. The domestic agricultural science is characterized with: a high degree of complexity of the organizational structure and departmental disunity (more than 20 ministries and departments involved in solving problems of agriculture); the variety of forms of scientific, technical and innovative activities; a significant share in research problems of regional, sectoral and cross-sectoral nature; the long duration of the some problems studying related to the reproductive process. This specificity creates certain difficulties in the management of agricultural research and agricultural science in general.

6. AVAILABILITY OF DATA AND MATERIAL

Data can be made available by contacting the corresponding authors

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