

## AN INVESTIGATION INTO RUSSIA'S CURRENT LEVEL OF SELF-SUFFICIENCY IN GRAIN

Svetlana Viktorovna PANASENKO, Ibragim Agaevich RAMAZANOV,  
Oksana Sergeevna KARASHCHUK, Elena Aleksandrovna MAYOROVA,  
Alexander Fedorovich NIKISHIN

Plekhanov Russian University of Economics, Stremyanny Lane, 36, 117997, Moscow, Russia,  
Email: svpanasenko@mail.ru

*Corresponding author:* svpanasenko@mail.ru

### *Abstract*

*The market for grain is vital to the achievement of a nation's food security, promoting development in adjacent sectors of its economy, and driving its economic development in general. This paper attempts to determine the degree to which reductions in grain production in 2018 may affect Russia's self-sufficiency in grain and grain prices. To this end, the authors analyzed the formation and use of grain resources in the Russian Federation, assessed Russia's self-sufficiency in grain, and assessed the correlation between grain production and grain prices in the Russian Federation. The findings indicate that Russia's grain production is currently characterized by positive trends, with boosts posted in grain production, reserves, and exports. With Russia's increasing self-sufficiency in grain, its robust grain production levels are making it possible to fully provide for the nation's internal need for grain, as well as produce enough grain to export. In the authors' view, reductions in grain production in 2018 should not jeopardize Russia's self-sufficiency in grain or cause its shortages. Reduced grain production should not result in a rise in prices for grain and related food products (bread, macaroni, flour, etc.), as Russia's domestic market for grain has no reverse correlation between production and prices. Despite the positive trends, Russia's grain production sector has been faced with a number of issues, like low economic efficiency levels, low productivity levels, and poor grain quality. These issues could be resolved through modernizing the nation's grain production sector, with a focus on directing the Russian economy to an innovation-focused path of development.*

**Key words:** grain, grain production, food sovereignty, self-sufficiency, price, exports, imports, consumption

### INTRODUCTION

Grain is a strategically important product that is crucial to the steady operation of a nation's market for food and ensuring its food security, which, in turn, is an element of its national security [19]. Grain is needed to produce many other food products, like flour, breads, pastry, macaroni, starch, and food concentrates. Products made from grain have high nutritional value and contain a number of important nutrients that people need: carbohydrates, proteins, fats, phosphorus, potassium, magnesium, calcium, as well as B, PP, and E vitamins [8]. Since it contains many nutrients and possesses high energy value, grain is a crucial item of food for livestock and poultry, as it facilitates high weight gains, high milk yield, and high egg production [5]. In addition, some scholars have noted the social significance of the market for grain,

associated with the fact that there is a high share of rural residents among the population and there are significant labor resources engaged in the reproduction process [1].

In the summer of 2018, the Ministry of Agriculture of the Russian Federation [11] made projections that in 2018 the nation would harvest 100 million tons of grain, i.e. 35.5% less than in 2017. Despite the fact that by November 19, 2018 the nation's grain harvest had reached 115.6 million tons, it was, nevertheless, smaller than in 2017 by 15.6%. This decline in crops has triggered a concern about the nation's ability to meet the need of the state and regions for grain, as well as possible spikes in prices for grain and related food products (above all, bread). These warnings have been voiced by many of Russia's famous media outlets (e.g., Rossiyskaya Gazeta, Nezavisimaya Gazeta, Gazeta.ru, IF Regnum, AEI Prime, etc.) and

have had a wide appeal among the general public. Russia's self-sufficiency in grain has taken on special significance under conditions of the imposition of economic sanctions and in a climate of the pursuit of a policy of import substitution, one of the key objectives in which is the achievement of food sovereignty.

In this regard, the authors undertook to investigate how drops in Russia's grain production in 2018 may affect its grain self-sufficiency and grain prices. To this end, they analyzed the formation and use of grain resources in the Russian Federation, assessed the nation's self-sufficiency in grain, and assessed the correlation between grain production and grain prices in Russia.

The current level of development of Russia's agricultural sector as a whole is insufficient to ensure its food security, which is due to the lack of a single mechanism for the development of the nation's agro-industrial complex, the use of outmoded production technology, a poorly developed infrastructure, the underestimation of the role of farmers in the development of the nation's agri-business sector, and the lack of support on the part of the state while lending levels are quite high [7]. Enterprises within the actual grain sector are constantly faced with nonpayment, great risks in running the business, a lack of qualified personnel, increased plant and equipment wear and tear, and insufficiently effective mechanisms of government support and regulation [9]. Scholars A.N. Osipov, D.Iu. Fediushin, and A.N. Davletshin [12] have noted that among the many issues facing Russia's grain sector today the most significant one is the poor technical capacity of its production base. In addition, O.A. Eremchenko [3] is pointing to a worsening in the quality of Russia's grain output.

Note, however, that in the period 2012–2016 the Russian Federation enjoyed steady boosts in grain production [5]. According to M.L. Vartanova and E.V. Drobot [17], Russia's current level of grain production has matched the Soviet level – following a major slump during the 1990s and the early 2000s. In 2016, the nation's gross grain harvest totaled 120.7 million tons, which matches the 1970s level.

At present, Russia's total grain planting area is greater than half of its total area under crops, with grain accounting for over a third of the nation's gross crop farming output [8]. In the structure of the nation's land under grain production, the share of food crops accounts for nearly two-thirds of all plantings [16]. Grain production is concentrated mainly in agricultural enterprises, while the share of farming enterprises in the overall structure of production is around 1% [8]. With that said, Russia's self-sufficiency in grain is greater than in any other type of agricultural produce (e.g., milk, meat, vegetables, etc.), the indicator of self-sufficiency being 100% [7].

For the Russian Federation, grain is a strategic export product, with a quarter of all Russian grain exported [8]. In 2014, after the West imposed economic sanctions on Russia and Russia introduced a food ban against it in return, Russia's grain exports rose by 46.7% in value terms [14]. Having said that, certain scholars view the present-day state of Russia's grain sector as ambiguous, as boosts in grain exports are accompanied by low levels of economic efficiency of grain production [5]. Scholars G.I. Andriushchenko and A.N. Davletshin [1], who have analyzed a set of indicators of the economic efficiency of Russia's grain production, are noting an increase in grain production costs based on increased expenditure on the cultivation of grain crops, and are pointing to the volatility of production despite the nation's planted acreage staying the same, which is associated with unstable crops due to high dependence on natural-climatic conditions. M.L. Vartanova and E.V. Drobot [18], likewise, view the situation as ambiguous, as increases in grain exports may lead to grain shortages and price hikes in the domestic market.

Thus, the findings from a set of earlier studies characterize Russia's grain production quite equivocally. On the one hand, the nation's boosts in grain production and exports and its high level of self-sufficiency in grain (as opposed to other agricultural products) are viewed as a success. But, on the other hand, Russia's grain sector is faced with a set of major issues, including poor technical capacity and low economic efficiency.

Conclusions drawn from an overview of the literature may provide a proper insight into the current condition of Russia's grain sector, as well as some of the possible implications of reductions in grain production in Russia in 2018.

## MATERIALS AND METHODS

The study consisted of three stages.

The first stage involved analyzing a set of general trends for change in indicators characterizing grain resources and the use of grain in the Russian Federation. In particular, the authors examined the nation's grain production, grain imports and exports, production-based and personal grain consumption, volumes of processed grain, and grain losses.

In the second stage, the authors analyzed Russia's self-sufficiency in grain based on the following coefficient:

$$K = \frac{P}{PC + C + CC + L}$$

where:

K was the coefficient of grain self-sufficiency;

P was the grain production, million tons;

PC was the amount of grain used for production-based consumption, million tons;

C was the processed grain, million tons;

CC was the amount of grain used for personal consumption, million tons;

L was the amount of grain that was lost, million tons.

In the third stage, the authors assessed the relationship between grain production and grain prices through the example of wheat, barley, corn, and buckwheat. In 2017, the first three of the grain crops, combined, accounted for 88.4% of Russia's entire grain harvest (wheat – 63.4%, barley – 15.2%, and corn – 9.8%) [13]. The choice of buckwheat was associated with its high price. In 2016, Russia's average price for a ton of buckwheat was 2.9 times higher than the price of wheat, while in 2017 this figure was 2.1 times higher [13]. To assess the strength of the relationship between production and prices across particular grain crops, the authors constructed relevant scatter plots, examined various types

of relationships (linear, exponential, logarithmic, and second-degree polynomial), and computed the coefficient of determination ( $r^2$ ) and the linear pair correlation coefficient ( $r$ ):

$$r = \frac{\sum(PR - \overline{PR}) * (P - \overline{P})}{\sqrt{\sum(PR - \overline{PR})^2 * \sum(P - \overline{P})^2}}$$

where:

$r$  was the coefficient of correlation;

PR was the grain crop production for the year, thousand tons;

$\overline{PR}$  was the average grain crop production, thousand tons;

P was the average annual grain crop price, rubles per ton;

$\overline{P}$  was the average average-annual grain crop price, rubles per ton.

To interpret the results and measure the strength of the relationship, the authors employed the Chaddock scale. In performing their calculations, the authors drew upon official data from Rosstat [13] (more specifically, data provided in the 'Balances of Food Resources. Grain Resources and the Use of Grain' section) and from the Ministry of Agriculture of the Russian Federation [11].

## RESULTS AND DISCUSSIONS

Despite Russia's 2018 grain harvest being 19.8 million tons (14.6%) smaller than the figure from the previous year, it, nevertheless, may be regarded as good. The nation's grain harvest achieved in the period 2016–2017 is its record-high harvest in the last 18 years (Figure 1). 115.6 million tons of grain, harvested as of November 19, 2018, cannot beat the harvest achieved in the period 2016–2017, but the figure is beating the annual figures for 1991–2015. The current, 2018, harvest is also greater than the average annual grain harvest achieved in the last 10 years, which is 99 million tons. The share of grain produced in Russia in the nation's total volume of grain resources (exclusive of carry-over stocks) has exceeded 95% since 2001 and 99% since 2014. In 2017, the share of grain produced in Russia was 99.5% of the nation's grain production and imports combined.

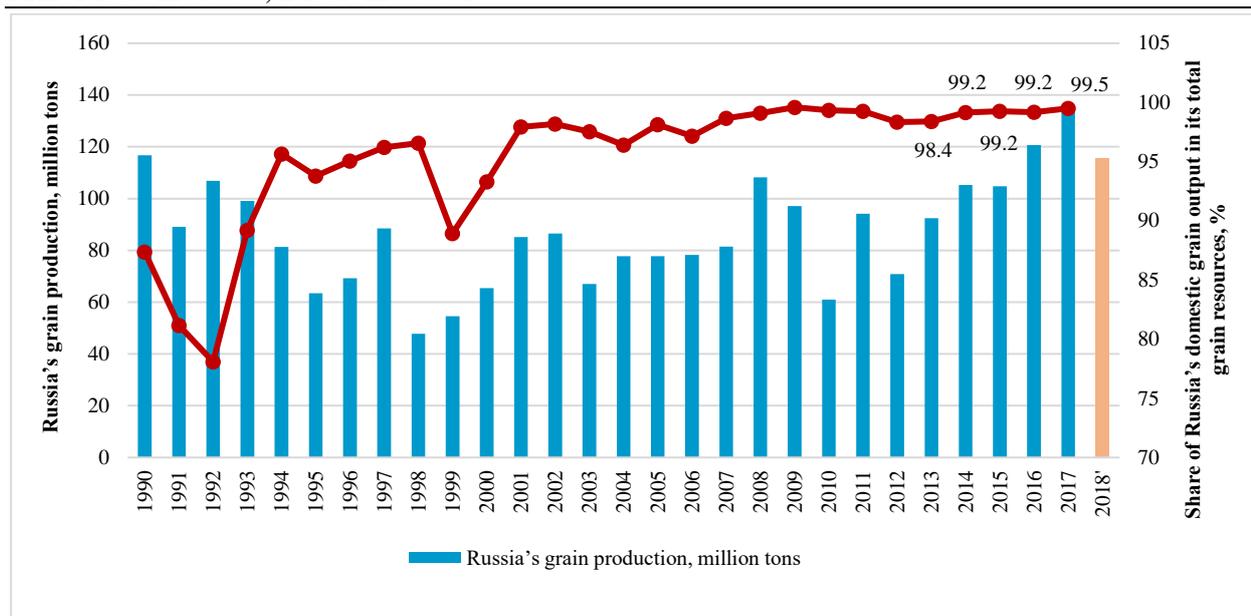


Fig. 1. Grain production in the Russian Federation. Data from Rosstat [13] and Ministry of Agriculture of the Russian Federation [11]. Calculations by the authors.

In the period 1990–1993, Russia’s foreign grain trade turnover was based mainly on imports. Later on, it declined, and in the period 1994–2001 it totaled less than 8 million tons per year. However, starting in 2002 the nation has witnessed a trend of increases in its foreign trade turnover as a

result of boosts in exports (Figure 2). In 2017, Russia exported 43.3 million tons of grain, which was 13.1 times more than in 2001 and 3.1 times more than in 2010. With that said, in 2017 the share of imports in the nation’s foreign grain trade turnover was just 1.6%.

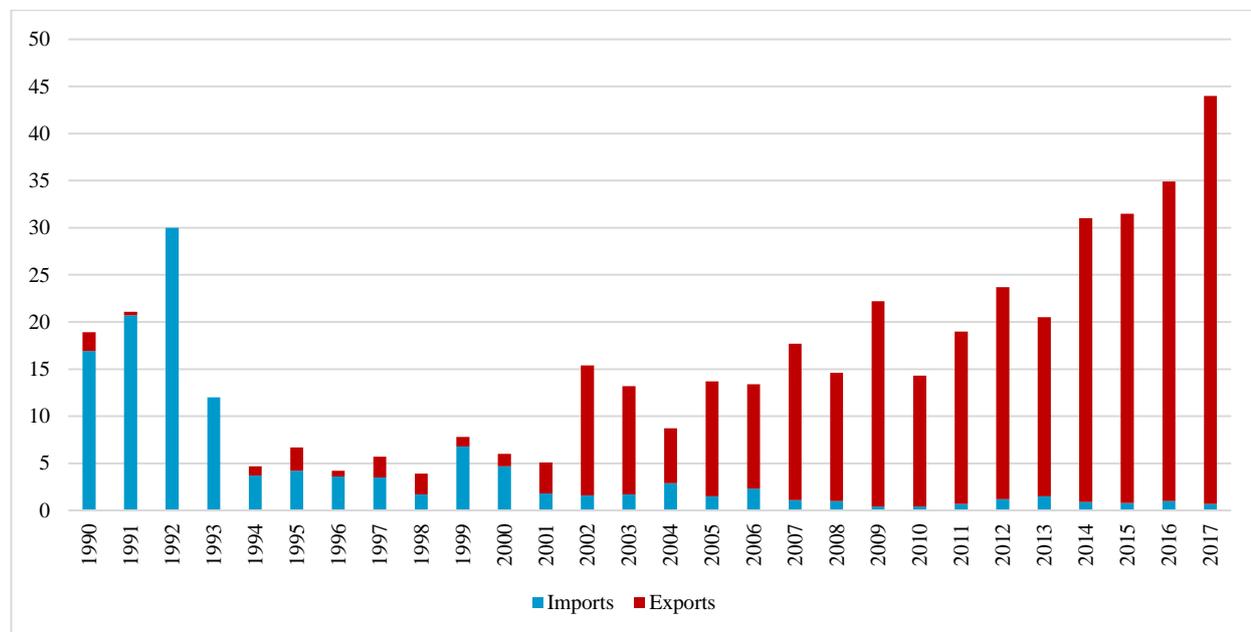


Fig. 2. Russia’s grain imports and exports, million tons. Source: Data were taken from Rosstat [13]. Calculations were made by the authors.

A major portion of Russia’s internal need for grain deals with its being processed into flour, groats, animal feed, etc. Starting in 2013, the

nation’s grain processing volumes have gradually increased. In 2017, the figure reached 53.3 million tons, which, however,

was about 1.4 times less than in 1992. The average volume of production-based grain consumption (the use of grain for the seeds and livestock and poultry feed) between 2010 and 2015 was around 20 million tons. In 2016, the figure rose to 22.4 million tons, and in 2017 it reached 24.3 million tons. The production-based consumption levels registered in 2017 were the highest in the period 1999–2017. Prior to 2018, the nation’s grain losses almost always were less than 1% of its total volume of grain resources (exclusive of 1990). Personal consumption was a steady 0.1 million tons per year (Table 1).

In measuring a nation’s food security, the most significant indicator is the coefficient of security, i.e. the ratio between production and domestic consumption (inclusive of losses). In the period 1990–1996, as well as in the period 1998–1999, in 2003, and in 2010 the coefficient of grain security in the Russian Federation was less than 1. All other years, including in the period 2011–2017 the coefficient of self-sufficiency was greater than 1, which was testimony to the nation’s grain production prevailing over its domestic grain consumption.

Table 1. Grain Production and Consumption in the Russian Federation (million tons)

Year	Production	Production-related consumption	Processed into flour, groats, animal feed, etc.	Losses	Personal consumption	Grain self-sufficiency coefficient
1990	116.7	30.5	94.7	2.3	0.0	0.92
1991	89.1	32.2	89.7	1.7	0.1	0.72
1992	106.9	31.7	76.7	1.8	0.1	0.97
1993	99.1	32.3	71.1	1.6	0.1	0.94
1994	81.3	31.2	63.1	1.5	0.1	0.85
1995	63.4	30.1	56.4	1.5	0.1	0.72
1996	69.2	27.6	44.7	1.0	0.1	0.94
1997	88.5	27.7	46.9	1.0	0.1	1.17
1998	47.8	26.5	44.7	1.0	0.1	0.66
1999	54.6	22.9	40.8	0.8	0.1	0.85
2000	65.4	22.3	40.6	0.8	0.1	1.03
2001	85.1	23.8	45.7	0.9	0.1	1.21
2002	86.5	24.0	49.3	0.8	0.1	1.17
2003	67.0	22.4	46.3	0.9	0.1	0.96
2004	77.8	22.9	44.7	0.9	0.1	1.13
2005	77.8	22.0	44.0	0.9	0.1	1.16
2006	78.2	21.8	46.2	0.9	0.1	1.13
2007	81.5	20.8	45.1	1.0	0.1	1.22
2008	108.2	22.6	49.4	0.9	0.1	1.48
2009	97.1	22.1	48.8	1.0	0.1	1.35
2010	61.0	20.4	43.9	0.9	0.1	0.93
2011	94.2	20.9	47.4	0.9	0.1	1.36
2012	70.9	20.5	43.8	1.1	0.1	1.08
2013	92.4	20.0	44.5	1.2	0.1	1.40
2014	105.3	21.0	46.4	1.0	0.1	1.54
2015	104.8	20.9	48.2	1.1	0.1	1.49
2016	120.7	22.4	51.7	1.2	0.1	1.60
2017	135.4	24.3	53.3	1.6	0.1	1.71

Source: Data were taken from Rosstat [13]. Calculations were made by the authors.

On top of that, starting in 2013 Russia's grain production has been 1.4 times more than its grain consumption. In the period 2014–2017, the coefficient of grain self-sufficiency in Russia had the greatest value in the entire period under review, coming in at 1.71 in 2017 (Table 1).

To analyze the correlation between grain production and prices, the authors examined the situation with wheat, barley, and corn, which, combined, accounted for 88.4% of the nation's total grain production, as well as Russia's most expensive grain crop – buckwheat. The approximation (determination) validity coefficients, computed in Excel for various types of relationships (linear, exponential, logarithmic,

and second-degree polynomial), had the greatest values for all the grain crops in the event of a linear trend.

Figure 3 evidences that there is no reverse dependence of prices on production for any of the grain crops. Just on the contrary, corn prices exhibit quite a high direct dependence on production (coefficient of correlation equals to 0.92), wheat prices – high direct dependence on production (coefficient of correlation equals to 0.75), and buckwheat prices – tangible direct dependence on production (coefficient of correlation equals to 0.6). The correlation between barley production and prices is a direct moderate one.

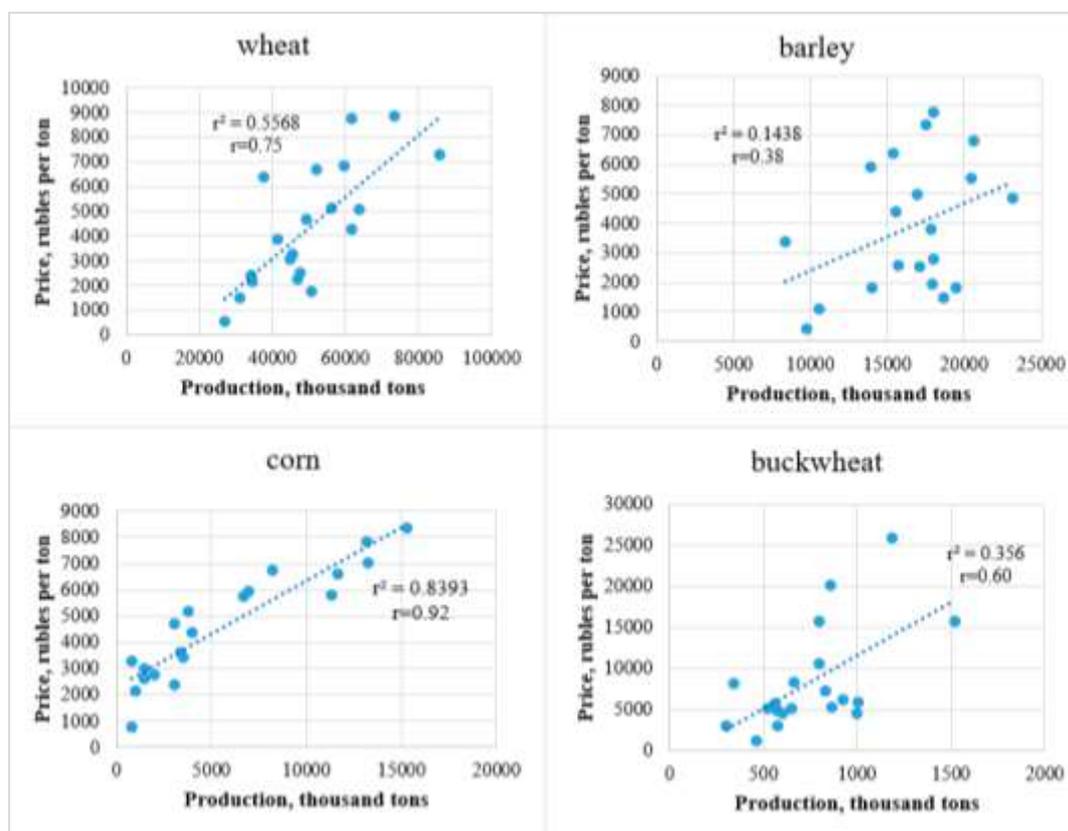


Fig. 3. Correlation between production and the average prices for particular grain crops in the Russian Federation in the period 1990–2017.

Source: Data were taken from Rosstat [13].

Thus, Russia's domestic need for grain has been fully met via domestic production, which is sufficient to be able to export grain as well. Reductions in grain production in 2018 have been preceded for five years by trends of increases in grain production, grain exports,

the share of domestic grain output in the nation's total grain resources, and the share of grain exports in its foreign grain trade turnover.

There is no reverse correlation between grain production and prices. On the whole, the

development of the Russian market for grain has been characterized by positive trends in the context of the nation's grain self-sufficiency levels.

The nation enjoyed continued boosts in grain production in the period 2013–2017, achieving between 2016 and 2017 record-high volumes in the last 18 years. Reductions in production in 2018 vis-à-vis the previous year should not be a concern. Firstly, in 2017 the nation's grain harvest was record-high, while in 2018 it was greater than the nation's average. Secondly, by the late 2017 Russia accumulated record-high reserves of grain – 90.7 million tons [13]. Given the nation's harvests of the last few years, the Russian Federation can be officially considered self-sufficient in grain, in terms of both food and feed consumption, with the nation currently consuming 72–75 million tons of grain per year [8].

In addition, the findings from the research reported in this paper indicate that there is no reverse correlation between grain production and grain prices. Just on the contrary, certain grain crops are characterized by varying-level direct linear correlations. Thus, reductions in production should not cause a sharp rise in grain prices and, consequently, in prices for related food products (e.g., bread, macaroni, flour, etc.). In addition, in 2017 the average grain prices from producers were lower than in the period 2015–2016, while there was an increase in grain reserves [13]. The authors are of the view that grain prices in the Russian market for grain depend more not on production but on world prices. In particular, the current increase in grain prices in the world market is associated with poor harvests in Europe, caused by natural-climatic phenomena.

The findings from a research study by Deppermann et al. [2] attest that the Russian Federation (along with Ukraine) has the potential to increase the nation's grain production levels further. However, it will be possible to achieve substantial boosts in grain production and grain harvesting efficiency only through modernizing the sector technologically [3]. There are a number of studies [1, 12] that have pointed out the grain

sector's relatively poor technical and technological condition as a key issue that needs to be addressed in the near term. Scholar N.Iu. Shovunova [16] notes that in the above indicator Russia is currently lagging behind not only economically developed nations but the world economy as a whole. M.L. Vartanova and E.V. Drobot [18] view the digitalization of grain production as a solution to issues of low productivity and high production costs. However, the scholars warn that new technology, which can help boost production efficiency, can only be afforded by large and medium-sized businesses, not farmers.

Despite Russia's shift to a path of innovation-focused development, to which the nation has committed formally, the issue of creating and implementing new technology remains a concern with many of the sectors within the Russian economy. The Russian Federation is significantly lagging behind world leaders in the number of patents issued and in effect [10], with the national economy currently characterized by institutional gaps and an imbalance between the government, science, and the business community [4, 15]. Thus, the need for technical modernization of the grain sector is part of a broader issue related to innovation-driven economic development in Russia. Work on resolving the issue must be systematic; it must be carried out by reference to the degree to which companies are actually prepared for change and to possible effects of modernization [6, 20]. The authors are of the view that modernization must be a key area for the development of Russia's grain sector, which should help resolve issues of low economic efficiency and productivity, high production costs, poor quality, as well as help fulfill the nation's grain potential to the fullest.

## CONCLUSIONS

The research reported in this paper study has produced the following findings and conclusions.

-In recent years (starting in 2013), Russia's grain production has been characterized by positive trends, with boosts posted in

production, reserves, and exports. The share of the nation's domestic grain output in its total grain resources is over 99%, with grain exports accounting for over 98% in the nation's foreign grain trade turnover. In 2017, the figures were the highest in the last 18 years.

-The Russian Federation is highly self-sufficient in grain. Starting in 2013, the coefficient of Russia's self-sufficiency in grain has increased. In 2017, it was 1.71. In other words, grain production in the Russian Federation is 1.71 times higher than its levels of production-related and personal consumption, processing, and loss. Thus, Russia's current levels of grain production are making it possible to fully provide for the nation's internal need for grain, as well as produce enough grain to export.

-Reductions in grain production in 2018 should not jeopardize Russia's self-sufficiency in grain or cause its shortages. This is substantiated by the nation's positive trends indicative of boosts in its grain production, reserves, and exports, the absolute prevalence of domestic grain output in its total grain resources and of grain exports in its foreign grain trade turnover, its high grain self-sufficiency levels, as well as the fact that its 2018 grain harvest is greater than its average grain harvest achieved in the last 10 years, with its grain reserves being record-high at the moment.

-Reductions in Russia's grain production in 2018 should not result in a rise in prices for grain and related food products (bread, macaroni, flour, etc.), as the domestic market for grain has no reverse correlation between production and prices. Just on the contrary, certain grain crops (e.g., wheat, barley, corn, and buckwheat) are characterized by varying-level direct linear correlations. Grain prices in the Russian market are more dependent on prices in the world market than on domestic production.

-Despite the positive trends, Russia's grain production sector has been faced with a number of issues, like low economic efficiency levels, low productivity levels, and poor grain quality. These issues could be resolved through modernizing the nation's

grain production sector, with a focus on directing the Russian economy to an innovation-focused path of development.

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