

# Digitalization of crop production as a factor in strengthening the economic security of the region

*Alexey Pstryakov, Nadezhda Sbrodova, and Alisa Titovets*

Ural State University of Economics, 620144, Yekaterinburg, Russia

**Abstract.** Digitalization determines the development of all processes in the economic and public areas, including the issue of strengthening economic security. The article discusses the problem of digitalization of one of the types of economic activity of the region. The relationship between the development of agriculture and economic security of the region is presented. The authors identify the degree of damage and threshold values in the estimation of the economic security of the region and approve the original method in the Sverdlovsk region. The article discusses the aspects of the existing level of economic security of the Sverdlovsk region and identifies the problems. The paper provides recommendations for solving these problems and makes calculations of benefits from the introduction of certain Russian digital technologies into operation.

## 1 Introduction

The year of 2020 stimulated activation of various digitalization processes. Many business entities, regardless of the type of activity, as well as the authorities of different levels, introduced digital technologies into their operations. It should be noted that the use of digital technologies has passed from the category of additional advantage in competitiveness into the category of mandatory elements of economic security. Thus, as part of the Economic Security Strategy of the Russian Federation until 2030, it was determined that poor development of the technologies of the digital economy is a challenge to economic security and it threatens successful development [1].

In traditional view, economic security characterizes the state of economic processes from a qualitative perspective; it determines the ability of the economy to provide all economic entities with the necessary conditions and resources [2]. In the Economic Security Strategy of the Russian Federation up to 2030, it is clarified that economic security is not just a quality of economic processes, but it is rather security of the economy and its resistance to threats (external and internal), which, at the same time, ensures freedom, unity and sustainability in development [1].

With regard to the fact that the Russian Federation is a federal state, the general situation in the country is determined by the conditions in the regions, including the field of economic security. The economic security of the region is the state of the regional economy, "generating growth of regional competitiveness and resilience to the effects of

internal and external threats" [3]. T. V. Uskova and I. A. Kondakov under the economic security of the subject of the Russian Federation understand "a set of conditions and factors characterizing the stability of the economy, the sustainability and graduality in its development, the degree of independence and its integration with the economy of the country, as well as the ability of regional government bodies to create mechanisms for the implementation and protection of interests of economic entities, maintaining the economic stability of the territorial community" [4].

One of the priority tasks of ensuring economic security at any level is to forecast challenges and threats. The most important global challenge today is digitalization. Digitalization is a change associated with the use of digital technologies in all aspects of human society [5]. It can also be designated that digitalization is the adoption or expansion of the use of digital or information technologies by the organization, a branch, country, etc. The effective functioning of the economy has become dependent on the digital medium [6, 7].

One of the threats for economic security connected with digitalization is a growing technological lag and increase of financial dependence on the state of those activities that, by virtue of conservatism, cannot start transition to new technologies. This fact has been mentioned by V.B. Bethelin, Academician of the Russian Academy of Science, who wrote that "it is impossible to form the necessary future "on the basis of borrowing technologies and components" [8].

One of these activities is agriculture, particularly crop production, which is especially vulnerable. The relevance of this research is determined by the following problems: to the absence of a competent digitalization process [9], poor communication between the consumer and producers of rural equipment, conservative attitude of workers and a number of concomitant reasons associated with the problem of self-sufficiency of the region

The interconnection between economic security and agricultural activities has been proven by many researchers: agriculture plays a significant role in the country's economy, so the activities of agricultural entities affect economic security, and modern conditions require comprehensive approaches to the "recovery" of the food sector [10,11,12].

The experts argue that there is a serious impact of agriculture on economic security of a country as a whole and a separate region and/or enterprise. Summing up, ensuring self-sufficiency of production inside the country and the region it is possible to bring the security to a qualitatively new level of development.

## 2 Materials and methods

It is necessary to assess the impact of crop production on economic security with the help of indicators of the economic security of the region. The basis for such analysis is the Decree of the President of the Russian Federation of May 13, 2017 No. 208 "On the Strategy of Economic Security of the Russian Federation for the Period until 2030" [1].

Considering the degree of influence of crop production on the economic security of the region, it is possible to reveal the following pattern, which is reflected in the specific indicators presented in Table 1. Interpretation of these indicators may help to determine the positive and negative trends in strengthening the economic security of the region.

**Table 1.** Relation to crop production and threshold values of indicators for economic security of the region assessment

Name of economic security indicator	Threshold value	Degree of relation to crop production, from 1 to 3
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**Table 1.** Continued

Gross regional product per capita	min. 100%	3
Unemployment level	max. 8%	2
Proportion in imports of foods	max. 30%	3
Proportion in manufacturing	min. 70%	2
Wear-and-tear of the assets	max. 60%	3
Proportion of investment in Gross regional product	min. 25%	1-2
Proportion of expenditures for R&D in Gross regional product	min. 2%	1
Balanced financial result		2
Production index		2
Correlation between the foods produced and consumed in the region	min. 1	3
Income per capita		2

We have made an expert assessment of the degree of influence of crop production on a 3-point scale. Evaluation of these indicators makes it possible to assess the contribution of each type of economic activity to the economic security of the region, which will allow in the future to adjust the activities in order to strengthen economic security.

### 3 Results and discussion

It is necessary to describe the impact of crop production and the indicators for the economic security of the region assessment on the example of the Sverdlovsk region (table 2).

**Table 2.** Indicators of economic security of the region in crop production in the Sverdlovsk region in 2018 [13,14]

Name of economic security indicator	Threshold value	Real value
Gross regional product per capita	min. 100%	97%
Unemployment level	max. 8%	1,98% in rural areas /1,17% in cities
Income per capita	As the average in the region or higher	25199 roubles per month (2017)
Proportion in imports of foods	max. 30%	14%-60% depending on the type of product
Proportion in manufacturing	min. 70%	82,76%
Depreciation of fixed assets	max. 60%	57,50%
Share of investments in GRP	min. 25%	31,66%
Balanced financial result of the crop production industry	more than 0	72 mln. rub.
Industry production index	min. 100%	99%
The ratio of produced food products in the territory region to consumed	min. 1	0,3-0,6
Share of R&D expenditures in GRP	min. 2%	1,30%

These data demonstrate that the state of crop production in the Sverdlovsk region is unsatisfactory in terms of a number of significant indicators, which has a great impact on the economic security of the region, creating risks that may affect the future. In other words, if at the moment the situation does not seem particularly dangerous, in 10-15 years (provided that there are no corresponding regulatory measures) it is likely that the region may become dependent on imported agricultural products.

Thanks to this research methodology, the relevance of the problem is revealed, which is associated with a number of reasons.

1. Lack of production of the necessary food products for domestic consumption in the region;

2. Volatility of production with a relatively stable level of consumption;

3. The need to introduce new technologies, since the existing technologies do not maintain the crop yield at the proper level;

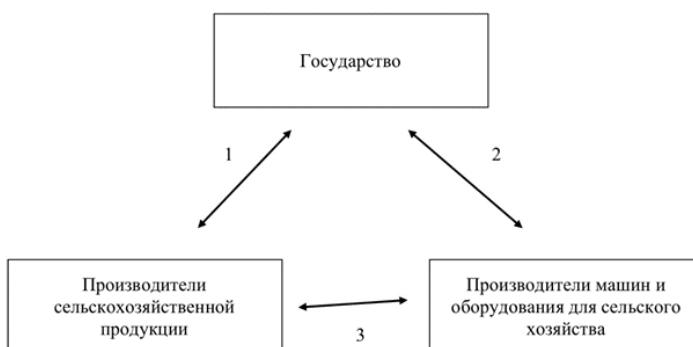
4. The need for an integrated development of the territory, since this situation is caused, among other things, by a decrease of the resource base for industrial production.

In the Sverdlovsk region, the share of crop production in agriculture is only 36.3%, while cattle breeding is 63.7% [13]. Such disproportion indicates a weak diversification of the economy, as a result, dependence on one type of manufactured product, which creates risks for the economic security of the region.

Despite the fact that for the Sverdlovsk Region, as well as for the entire Ural Federal District, agriculture is not a priority area of activity, an important issue for any region is the complexity of the development of the territory and self-sufficiency in mass crops. Rigid specialization is dangerous and always creates the basis for the emergence of risks for the economic security of the region.

It is important to take into account that the economic security of cattle breeding is also directly affected, since more than 50% of all areas in the region are used specifically for the fodder base. As a consequence, crop production security creates a safety bag for cattle breeding.

Ensuring the economic security of the Sverdlovsk region through the development of crop production implies the participation of 3 categories of entities: regional government bodies, manufacturers of machinery and equipment for agriculture and manufacturers of agricultural products (Fig. 1).



**Fig. 1.** The influence of entities on economic security of the region

Where: Государство – State; Производители сельскохозяйственной продукции – manufacturers of agricultural products; Производители машин и оборудования для сх - manufacturers of machinery and equipment for agriculture.

Almost all processes in agriculture become more automated every year. The more up-to-date the tools are, the better and more efficient the results will be. At the same time, the technical and technological backwardness of the agricultural industry is an important

problem affecting import substitution process; it also prevents increase of the efficiency of agricultural enterprises. The income of agricultural producers is insufficient to modernize the equipment.

A comprehensive analysis of the Russian agricultural machinery market by experts identifies the following important aspects:

- An import-oriented model has been formed in the Russian agricultural machinery market;
- The structure of the agricultural machinery market in 2018 was characterized by a 13.4-fold increase in the volume of imports compared to domestic production, and the trade balance was negative and amounted to -3 million units;
- China became the leader in import supplies at the end of 2018 (over 38%);
- Belarus buys most of the products of Russian exporters (over 72%).

If the import of agricultural equipment is systematically reduced and support for domestic goods is provided, then manufacturers of agricultural machinery and equipment will be able to:

- increase profits from the sale of equipment and components;
- strengthen their own performance efficiency;
- enhance the prestige of the activity;
- increase the number of jobs.

Thus, thanks to the effective interaction between the subjects, it is possible to make a step towards import substitution and strengthen the economic security of the region, while reaching the strategic goals of the state and the region as well.

The main methods for achieving these goals are: increase of investments in agriculture, effective land use and land reclamation, elimination of industrial stagnation, stimulation of domestic mechanical engineering to address the needs of agriculture and use of modern technologies.

And since one of the subjects is the state, we studied the activities of the authorities. Thus, on the territory of the Sverdlovsk region, 49 different programs are being implemented for the development, support, and introduction of areal agriculture. At the same time, it is important to note that this indicator is more associated with the cattle breeding sector than the crop sector.

According to the action plan of the state program of the Sverdlovsk region "Development of the agro-industrial complex and the consumer market of the Sverdlovsk region until 2024", the total funding is 6,436,604.5 thousand rubles. At the same time, the total financing of measures for the development of agriculture is 61.7%, development of cattle breeding is 31%, crop production development is only 7.3%, which includes support for the purchase of seeds for growing forage crops, the provision of unrelated support to agricultural commodity production in the field of crop production and increasing soil fertility.

By identifying these three main subjects of relations, it is possible to achieve the economic security of the region, taking into account modern trends in the most optimal way and reaching the required level of self-sufficiency of the region.

Currently, there are the following reasons for the violation of relations between the subjects shown in Figure 1 (1,2,3):

- lack of interest of manufacturers of agricultural machinery in the modernization and provision of the necessary units of equipment for agriculture;
- low investment activity due to the opinion that modernization of agriculture is unprofitable;
- government support for unprofitable enterprises;
- dependence on imports;

- low wages and low prestige of work in the industry.

In order to restore the broken ties between the subjects, it is proposed to purchase and integrate a number of innovations, paying particular attention to Russian technologies (Table 3), since this directly affects the economic security of the region.

**Table 3.** Economic calculations of integration of some technologies

Technology	Name of producer	Name of service	Cost of service	Total cost	Calculation	
Control system for feeding, fertilizing and planting based on data from sensors located in the field	Crop control system «Magrotech» (Russia )	Calculation of minimal fertilizing	From 30000rub per field	30000rub	Saves up to $24*112*3=8064\text{rub}$ per one fertilizing component, where 24 rub is the cost of one kg of nitrate fertilizer, 112 is the amount of saved kilograms, 3 – seasons when the system is working (spring, summer, autumn)	
		Agricultural consulting	From 330*50 =16500rub	330*50 =16500rub		
		Online access	From 150000rub a year	15000rub		
	Service “MyDataPlant” by the company Kleffmann (Germany)	Online access	140 to 560 rubles per hectare	7000-28000rub		
Complex systems of farm management	Cropio(USA)	Online access	60-300rub a year per hectare (without the cost of installing)	3000-15000rub	Total: <b>45000-12000rub</b> , the system increases production by 3, so the number of staff reduces by 3 as well, the average salary of combine operator is 15000 – 40000P, 8 people usually works on one field.	
	Company "InfoBiS" (Russia )	«Agrosygnal» System	Subscription is 400-700 rub per month	4800-8400rub		
Meteorological stations and sensors located in the field collecting environmental data	Sensors by «Pynco» (USA)	1 sensor	22500-32000rub		In one region, 34 companies were affected by overwatering. The damage to each of them amounted to more than 2 million rubles, while compensation was only about 1 million rubles.	
		2 sensors	45000-65000rub			
	Sensors by «AllMeteo» (USA)	Wind sensor	6400-32000			
		Humidity/temperature sensor	16000rub			
	Meteorological station by «Dives» (USA)	Meteorological station	55000rub			

So, there are 288 farms in the Sverdlovsk region in the sphere of crop production, the equipment will cost approximately 100,000 rubles, that is, 28,800,000 rubles will be needed for all farms in the region, and this is only 6.13% of the funds allocated for the development of crop production. Therefore, redistribution of the rest of the funds will provide enterprises with basic technologies.

When introducing such a process as digitalization in the crop production industry, there may be some problems. Therefore, we have compiled a map of risks (table 4) that can be faced in the current realities or in the near future.

**Table 4.** Map of risks.

	Risks	Occurrence probability	Amount of loss	Impact	Party
CURRENT	Employee's conservatism	1	1	2	Agriculture, state
	The belief that digital transformation is unprofitable	2	1	3	Agriculture
	Insufficient stimulation of domestic machine building	2	2	4	State, machine building
	Irrational use of resources	2	3	5	Agriculture
	Insufficient financing of new technologies purchase	2	3	5	State, machine building
POTENTIAL	Bureaucracy(slow process of money acquisition)	2	2	4	State
	Poor IT knowledge of specialists working in agriculture	2	2	4	Agriculture, machine building
	Absence of technological solutions	2	3	5	State, machine building, agriculture
	Weak responsibility of recipients of funds	2	3	5	Agriculture, machine building
	Loss of connections with international partners	2	3	5	State, machine building, agriculture
	Sales: poorly developed logistics, lack of granaries, lack of information.	3	3	6	Agriculture

Assessment of the impact of risks has shown that negative trends in the digitalization of agriculture are quite obvious. Despite the fact that in the nearest future there are risks of possible losses, these losses can be avoided with the help of careful planning and good communication between the three main subjects of relations.

## 4 Conclusions

Summing up the results of the study, we analyzed crop production from a different position, not typical of the state. Comprehensive development of the region, economic security and focus on results are the factors that were taken into account in this research. As a result, crop production has an impact on the economic security of the region, which is proved by the list of indicators that we demonstrated earlier. This means that the authorities are interested in improving these indicators and should develop programs for the digitalization of agriculture. Moreover, we reviewed the successful experience of technologies implementation in other regions of the Russian Federation and calculated the average cost of technologies in order to understand the necessary threshold for launching digital development of farms. Thus, we have identified one of the most probable and promising methods for the development of crop production, not only to increase indicators in each area, but also to strengthen the economic security of the region as a whole.

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