Coherence degree characteristic of production, industrial and food security of agro-industrial complex subsystems

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Abstract. The article substantiates the urgent need to assess the coherence degree of production, industrial and food security in the framework of the state agricultural development program implementation. The authors combine two approaches to assessing industrial and production security, and also the processes of ensuring industrial security are considered using the example of dairy production. The small-scale coherence degree of the industrial component in ensuring the food security of Russia is shown.

1. Introduction

It is well known that the successful development of the modern Russian agro-industrial complex is possible only taking into account the achievement of national independence, in particular, production and food security issues of the country [1;2;3]. In 2010, the Government approved the Food Security Doctrine, which prescribes the necessary ratio of domestic and imported products in the country, as well as market risk zones. In this regard, indicators for the production of domestic grain (99.4% at a rate of 95%), sugar (95.6% at a rate of 80%), vegetable oil (81.5% at a rate of 80%), as well as meat and meat products (92.8% at a rate of 85%) have been met.

The specialists of the Ministry of Agriculture determined that in recent years Russia has achieved food security values in almost all key areas: grain, vegetable oil, sugar, meat and meat products. The lag in milk production is observed, however, the implementation of state support measures allowed an increase in raw materials production in 2018 by 1.5% compared to 2017 - up to 30.6 million tons. The Government Agency expects that the positive trend will continue in 2019, and the increase in production will be 1.6% - up to 31.1 million tons.

The authors' trends analysis of the main AIC production subsystems functioning notes the need of import-substituting orientation of their development to ensure, first of all, production security (since the imported products intervention is caused not only by food products supply but also resource-technological and technical components for food production, as well as ancillary and supporting types of economic activity) [1 3; 14; 15].

2. Materials and methods

In 2018, the share of Russian milk in the domestic market was 84.2% with a threshold value not less than 90%. The milk-processing production AIC subsystem in Russia is a combination of organizational and economic relations that significantly reduce the food security of Russia. The low
investment attractiveness of dairy cattle at the beginning of the post-sanction period severely limited activity in the industry.

In our opinion, in the milk processing subsystem, it is advisable to create an agri-food formation which will ensure that interrelated interests of its participants are taken into account [4] and achieve the benefits of integration based on such properties as self-determination, self-regulation, self-financing, self-development, etc., in accordance with the emergence law and, as a result, increased integration of economic entities.

In this regard, the authors combined two approaches to the production security assessment:

1) the potential of ensuring industrial and production security by agro-food formation is estimated;

2) after creation of agro-food formation, the results of its activities are evaluated - contribution of the cluster to food security.

To characterize the coherence degree of production, industrial and food security of the formations in the agro-industrial complex, we propose to determine the import intervention levels in tabular form.

| Stages of import intervention | Dairy and milk processing production | Coherence degree of security |
|------------------------------|--------------------------------------|-----------------------------|
| 1-import of sub-sub-raw materials | Purchase of zooveterinary drugs | Production |
| 2-import of sub-raw materials | Purchase of breeding males | Production |
| 3-import of raw materials | Supply of fresh (frozen) meat and milk powder | Industrial and production |
| 4-import of similar finished products | Supply of meat and milk processing products | Food |

The first stage of import intervention involves the supply of zooveterinary preparations components, which analogues are not produced by Russian chemical organizations, and currently, the import is the only possible option to comply with technological regulations (that is, an economic assessment of the agri-food formation potential at this level is not advisable). Since the results of the import intervention at this stage primarily affect the competitiveness of domestic cattle breeds, and as a result their use, it seems necessary to determine the domestic breeding potential on two main components: agricultural and production.

The sanctions imposed against Russia by a number of Western countries and the response of the Russian government had a stimulating effect on import substitution in the economy. Import substitution in 2019 is within 30%, which means that all goods, products and services produced in Russia make up only 30%, the rest has to be purchased abroad [5;6;8]. Import substitution is possible under the condition of good production capacities and the creation of competitive enterprises, able to produce quality products at the appropriate prices. Further import decline is possible due to development and stimulation of new technologies and additionally created production.

In response to foreign sanctions, the Russian government has banned some products shipped from the United States and the EU. The list of banned products includes beef and other cattle meat, poultry, pork, fish and some crustaceans, as well as sausages, cheese, vegetables and fruits.

The main directions of import substitution in agriculture are seed production, cows breeding (based on the method of embryo transplantation), fish processing, gardening, and vegetable growing. Small and medium-sized businesses have a chance to realize their potential. In the absence of foreign competition, entrepreneurs have unlimited opportunities [7; 9].
Table 2. Production of the main types of import-substituting food products in the Russian Federation

| Product Description                                                                 | 2017   | 2018   | 2017 in percentage correlation to 2018 |
|-------------------------------------------------------------------------------------|--------|--------|----------------------------------------|
| Fresh, chilled or frozen cattle meat (beef and veal), including for baby nutrition | 205    | 227    | 110.7                                  |
| Frozen cattle meat (beef and veal), including for baby nutrition                    | 56.7   | 70.7   | 124.5                                  |
| Fresh, chilled or frozen pork, including for baby nutrition                         | 2171   | 2414   | 111.2                                  |
| Meat and poultry by-products, including chilled poultry meat, including for baby nutrition | 4839   | 4877   | 100.8                                  |
| Live marine fish, not fish farming products                                         | 112    | 154    | 138.1                                  |
| Fresh or chilled marine fish, not fish farming products                              | 855    | 847    | 99.1                                   |
| Fish fillet, other fish meat (including minced meat), fresh or chilled               | 17.3   | 17.4   | 100.5                                  |
| Frozen fish                                                                         | 3087   | 3057   | 99.0                                   |
| Frozen fish fillet                                                                  | 148    | 155    | 104.7                                  |
| Dried, salted and fresh fish or fish in brine                                       | 106    | 111    | 105.2                                  |
| Smoked fish, including fillet                                                       | 58.4   | 65.3   | 111.9                                  |
| Frozen crustaceans                                                                  | 69.9   | 82.4   | 117.9                                  |
| Frozen vegetables (except potatoes) and mushrooms for short-term storage            | 63.0   | 55.7   | 88.4                                   |
| Canned vegetables (except potatoes) and mushrooms                                   | 34.5   | 38.3   | 111.0                                  |
| Fresh or heat-processed, frozen fruits, berries and nuts                            | 17.3   | 16.6   | 95.8                                   |
| Liquid processed milk, including milk for baby nutrition                             | 5390   | 5466   | 101.4                                  |
| Cream                                                                               | 133    | 150    | 113.1                                  |
| Cottage cheese                                                                      | 486    | 501    | 103.2                                  |
| Butter                                                                              | 270    | 267    | 98.7                                   |
| Cheese                                                                             | 464    | 467    | 100.6                                  |
| Condensed milk products, million standard tins                                      | 837    | 806    | 96.3                                   |
| Cultured milk products (except cottage cheese and cottage cheese products)          | 2896   | 2820   | 97.4                                   |

3. Discussion of results
Food security is considered one of the main indicators of socio-economic development of the state. At the World Food Summit, it was stated that food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life, therefore, at the top of the rating are those countries in which food is most accessible to the population. According to the Food Security Doctrine food security of the Russian Federation is the state of the country’s economy that ensures food...
independence of the Russian Federation, physical and economic availability of foodstuffs to every citizen that meet the requirements of the laws of the Russian Federation on technical regulation, in quantities no less than the balanced food consumption rates required to support active and healthy lifestyle.

The cumulative value of the industrial and production security degree is determined by the lowest value of agricultural and production components:

$$K_1 = \text{MIN} (K_{1C}, K_{1P}),$$

$$K_1$$ - potential stage of production security, %;

$$K_{1C}$$ - potential stage of agricultural component of production security, %;

$$K_{1P}$$ - potential stage of production component of production security, %;

The agricultural component is the aggregate ability of organizations to provide the necessary amount of domestic pedigree livestock in the country. The choice of these coefficients is due to the negative dynamics of changes in the number of breeding farms throughout the territory of the Russian Federation, including farms specializing dairy cattle breeding.

At the second stage, the main factors of import intervention are the supply of breeding males, as well as agricultural equipment and components:

$$K_2 = \text{MIN} (K_{2C}, K_{2P}),$$

$$K_2$$ - potential stage of production security, %.

At the third stage of the import intervention, the authors identified only one component – industrial, since the intervention is mainly characterized by the import of fresh (frozen) meat and milk powder. Therefore, there is a correlation:

$$K_3 = K_{3II}.$$  

In this regard, the level of industrial component is determined as follows:

$$K_{3II} = \frac{\sum M_{\beta_3j}}{O_{\text{cr},\text{neoh}3}} \times \Pi_{\text{cr}3} \times B_{\text{cr}3} \times 100\%,$$

$$K_{3II}$$ - potential level of industrial component, %;

$$M_{\beta_3j}$$ - production capacity of the j-th raw material processing plant (actual), tpd;

$$O_{\text{cr},\text{neoh}3}$$ - the amount of milk necessary to ensure the physiological needs of the population, tons;

$$\Pi_{\text{cr}3}$$ - production season duration of plants (standard), days;

$$B_{\text{cr}3}$$ - finished products output of plants (normative).

Due to expansion of the directions and volumes of state support for the dairy industry, the production of commercial milk is increasing and in 2018 the growth amounted to 0.5 million tons. An increase in demand for Russian dairy products in both domestic and export markets - 76.1% in 2013 to 84.2% in 2018-is also a serious incentive to maintain investment activity [10;11;12].

4. Conclusion

In conclusion, we note that the potential level of ensuring production and, consequently, food security in Russia is characterized by the lowest value of agricultural or industrial components since the level of one determines the effectiveness of the other.
Now the Russian authorities are reviewing the Food Security Doctrine. The new document will take into account economic restrictions, WTO accession, as well as closer interaction of countries within the EAEU. The country’s food independence will be assessed not only in terms of self-sufficiency but also export potential of industries. Physical and economic accessibility of products for citizens will also be analyzed.

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