Development of the region’s pig production market based on the cluster approach

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Abstract. The pork production market is part of the food market, and increasing its competitiveness is a priority both in managing the agro-industrial complex in general and in the region in particular. Cluster interaction in the regional market of pig production is an important direction of its development, ensuring a full exchange of goods of appropriate quality between producers and consumers of pork production. In the proposed study, based on the analysis of statistical information, as well as surveys of consumers of pig production in the Irkutsk region (conducted in 2016), recommendations aimed at developing a regional production base for pig breeding were proposed. The development of a regional production base is proposed by expanding the existing industries, as well as by improving the breeding base of pig production in the region, creating a new model of cluster interaction between producers and consumers in the market under study. The formation of a regional pig cluster will increase the production of pork, open new channels for the sale of manufactured products, as well as start exporting to other regions.

1. Introduction
The problem of interaction in the regional market of pig production between producers and consumers is of particular relevance in modern conditions. First, pig production is one of the main products on the food market in the meat product segment, it is used by processors to make various types of goods. Secondly, more than 60% of pig production is made by industrial complexes, and the rest of the production is distributed between peasant (farmer) farms and households. Third, the existing steady demand for these products stimulates the emergence of a large number of intermediaries in the market and causes an increase in product prices. The market for pork products is an integral part of the agro-industrial complex of both the region and the country as a whole. Solving these problems is part of the regional AIC policy. As one of the objectives of this policy is the formation of an effective competitive agri-food production, contributing to food security, as well as integration into the global agri-food market [1].

In the Irkutsk region, the manufacturers of pig products are forced to act independently in the search for suppliers of equipment, feed, breeding animals, as well as channels for the sale of manufactured products. The reduction of intermediary lines with the appropriate construction of a pig-breeding cluster in the Irkutsk region will lead to a gradual increase in production volumes and self-sufficiency in the region. In addition, the creation of territorial production clusters is an innovative direction for the development of the region [13, 2].
The purpose of the study is to develop recommendations for the formation of a pig breeding cluster in the Irkutsk region, based on the analysis of statistical data and the study of consumer demand for pig production.

2. Materials and Methods
We conducted a study of statistical information for the entire territory of the Irkutsk region. A comparative analysis of data with indicators of the Russian Federation, as well as a study of more than 1,500 consumers of pig production throughout the region were conducted. Consumer research was conducted from spring to autumn 2016. From 2013 to 2017, the collection and analysis of statistical information were carried out. As statistical information, the data of the Federal State Statistics Service of the Russian Federation, the Territorial Body of the Federal State Statistics Service for the Irkutsk Region, as well as the Ministry of Agriculture of the Irkutsk Region and agricultural producers for 2005-2016 were used.

Data processing was carried out using the Microsoft Excel software using the “Data Analysis” package. Indicators of correlation between consumption of pork in the Irkutsk region and its production in the region, price indices for pork and other types of meat, as well as imports of pork from other regions were determined. The probability of increasing the level of consumption of pork, as well as its production in the region and the import of pork from other regions were evaluated.

3. Results
A study of statistical information in the field of pig production in the Irkutsk region showed fluctuations in the quantity of products produced, as well as in the structure of its production. The main producers were households as of 2005. The agricultural producers using industrial production technologies were the main producers by 2016. In addition, over the past three years, production in the whole region is decreasing.

![Figure 1. Production of pork for slaughter in slaughter weight by categories of farms in the Irkutsk region for 2005-2016](image)

Thanks to a comparative analysis of data on the level of consumption of pork in the Irkutsk region and in the whole of the Russian Federation, as can be seen from Table 1, we determined the level of self-sufficiency of the population in the region of pork, which does not exceed 55%. This indicates a high level of import of pig products to the region. In addition, the level of meat consumption per person both in Russia and in the region is lower than the biological consumption rate, which is 75 kg per year [6, 4, 8].
Table 1. Consumption of pork per capita and the level of self-sufficiency of the population of the Irkutsk region pork for the period 2005-2016 [5].

| Years | Meat consumption Russia per 1 person per year, kg | Including pork, kg | Consumption of meat in the Irkutsk region per 1 person per year, kg | Including pork, kg | Production of pork in the Irkutsk region per 1 person per year, kg | The region's self-sufficiency in pork, % |
|-------|-----------------------------------------------|-------------------|-------------------------------------------------|-----------------|-------------------------------------------------|------------------------------------------|
| 2005  | 55                                            | 15                | 53                                              | 16              | 10                                              | 61.8                                     |
| 2010  | 69                                            | 21                | 62                                              | 21              | 11                                              | 54.6                                     |
| 2015  | 74                                            | 24                | 71                                              | 24              | 13                                              | 53.4                                     |
| 2016  | 74                                            | 25                | 70                                              | 24              | 14                                              | 51.6                                     |
| 2016 to 2005, % | 134.5                                          | 166.7             | 132.1                                           | 150.0           | 140.0                                           | 93.5                                     |

During the study period, the pork consumption in the region increased by 1.5 times; at the same time, the growth of pork production over the same period was only 40%. Differences in growth rates of pork production and consumption lead to a decrease in the region’s self-sufficiency. In accordance with the Food Security Doctrine, the level of self-sufficiency in meat should be at 85%. As of 2016, the self-sufficiency of the Irkutsk region in pig meat is below the standard by 33.4% [9, 12].

The correlation analysis of the obtained data allowed to identify the degree of influence on the consumption of pig production in the Irkutsk region of such factors as the population of the region, the average per capita income of the population, the production of pork, its import from other regions, as well as the index of consumer prices for pork. Additionally, we conducted a regression analysis of the data obtained to build a model for predicting pork consumption in the region, depending on the identified factors. A two-factor model for forecasting consumption depending on pork production and import from other regions, as well as a one-factor model for forecasting demand depending on the average per capita incomes of the region's population, were built.

According to the results of forecasting, the production of pork in the Irkutsk region should be 25.5 ± 1 thousand tons by 2019. The forecast value of the regional production of pork is in the range from 25.1 to 25.9 thousand tons. Import of pork from other regions to the Irkutsk region is projected at 27.4 thousand tons.

Based on the analysis, the problems of its functioning were identified. The problems are in reducing the production of pig products with the existing unsecured demand for these products, as well as poor development of the infrastructure of the regional market. It includes the interaction between all market participants from production to sale of finished pig products.

4. Discussion

To solve the identified problems, improving the infrastructure of the market under investigation is necessary. Thus, in order for the manufacturers to receive information about various kinds of support in a timely manner and to use it, they could easily purchase the necessary equipment, feed and biomaterial, they would have simplified methods for entering the market, both internal and external. At the same time, the buyers of final products in this system would have the opportunity to purchase high-quality products without a huge mark-up, working directly with the manufacturers. Creating a pig cluster will solve the identified problems.

The producers of primary pig production – agricultural organizations, peasant farms, and households – will represent the core of the pig breeding cluster. In the inner part of the cluster, the secondary pig producers will enter. From the cluster core, the manufactured products that meet all the necessary requirements will be recycled within the framework of the agreements concluded. Research centers and breeding organizations will provide advice on animal breeding, implement highly productive livestock to increase productivity. Financial organizations such as banks, insurance companies, leasing companies, investment and guarantee funds will provide financial support to pig producers and research
centers. Financial support will be provided through the provision of loans on concessional terms, insurance programs with an expanded package of risks and reduced tariffs, which are not included in the state support programs for minor remarks, as well as investing in the development of innovative production [3, 7].

One of the innovations for the entire cluster system of the region's pig production will be the creation of a network of transport and logistics hubs and centers, storage and distribution centers. It will cover all territorial transport hubs and will increase the availability of products with the possibility of delivery to other regions and countries. Sales services will help to promote the products, providing an opportunity for small and medium producers to enter the market.

The non-governmental organizations, such as the Union of Industrialists and Entrepreneurs of the Irkutsk Region, the Agro-Industrial Union of the Irkutsk Region, and the Public Union of Consumers will act as coordinators of the general activities of the cluster. The non-governmental organizations will coordinate together with the Ministry of Agriculture of the Irkutsk Region (represents the interests of the state). For the purposes of communication interaction between all cluster members and organization of the smooth operation of all cluster systems, the development of information and communication services is possible on the basis of common Internet platforms with the subsequent formation of a system with blockchain elements. Information and communication service will allow applying new marketing technologies to find customers and suppliers, quickly exchange the necessary information, technologies and products between cluster members with the possibility of reducing costs.

The outer contour of the cluster will also combine regional and municipal authorities with an internal system. These include profile ministries, regional and municipal administrations, departments and various services (tax service, customs, veterinary, sanitary and epidemiological, etc.). In the framework of cooperation, manufacturers will be able to receive the necessary services from public services in a simplified mode. This circumstance will reduce the time of movement of products to final consumers. In addition, the pig products produced will have all the necessary documents confirming its quality and safety for entering the foreign market [10].

The cluster will be fully formed after it includes educational and personnel structures, suppliers of production equipment, feed, veterinary drugs, packaging, biological material. Interaction with educational and personnel organizations will allow forming effective labor collectives in all organizations-members of the cluster [11].

5. Conclusion
Creating a pig cluster of the Irkutsk region is subject to one of the main tasks. The main task is the effective production of pig products to provide the residents of the region with quality products, as well as the development of the market for pig products in general in order to fulfill the tasks set by the state to increase exports and increase the income of organizations, the region and the country. These measures will improve the competitiveness of products in the food market of the region.

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