Key factors in the development of the poultry industry in the Russian Federation

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Abstract. Poultry farming is actively developed in most countries of the world, as it is the basis for the livelihood of many people regardless of income level. It is a rapidly growing, low-cost industry that does not require much labor. Over the period from 1990 to 2017, the total number of birds in the Russian Federation decreased by 15%. At the same time, the laying capacity of laying hens in large-scale formations increased by almost 32%. If in the 90 years of the 20th century poultry production in Russia began to decline due to the high growth of imports from abroad, from 2000 the market of chicken and egg meat began to grow. In the course of the study, we found that the disparity of prices for energy resources and the cost of agricultural products, and the reduction in the number of able-bodied rural population, are the main deterrents for the development of the poultry industry. The main goal of the development of the poultry industry in the Russian Federation is the creation of an efficient, competitive and optimal in its structure poultry products and raw materials for the processing industry, which will increase the level of self-sufficiency of the main types of poultry products and raw materials, as well as develop exports outside the country. Achieving this goal provides for the development of the poultry industry on an innovative basis based on the preservation of reproduction and improvement of land and other natural resources used in agro-industrial production, increasing the competitiveness of poultry products and raw materials produced.

1. Introduction
Poultry farming as one of the fastest growing, low-cost industries emerged more than three thousand years ago in India. Currently, poultry farming is actively developed in most countries of the world. Domestication of poultry for obtaining eggs and meat was and is relatively inexpensive and quick payback for not only self-sufficiency, but also for business development. The development of poultry farming is closely related to other related sectors of the economy: feed milling industry, machine building and processing industry. The production of poultry products does not require much labor. The main directions of development of the poultry industry are egg, meat, egg-meat and pedigree, and to the results of the functioning of the industry, in addition to eggs, poultry meat, offal, pedigree youngsters, fluff, feathers and organic fertilizers are added. Poultry meat and eggs are important social products, the price of which is attractive to the general public, and, consequently, the demand for them will always be high. In the world, the production of poultry meat annually increases by 3-5% and by specific weight ranks second among other types of meat. In the Russian Federation, the production of poultry meat takes the 1st place in the world in terms of specific gravity (in 2016, 5674 thousand tons of meat were produced). The world produces about 1 trillion. 360 billion eggs. The leader in terms of
the volume of this product is China - almost 40% of world production (436 billion units). The second place is occupied by the USA (91 billion units). Russia is on the sixth place - 41.3 billion eggs. More than 90% of eggs produced in the world are chicken.

The Russian poultry industry has been actively developing the last decade both in the field of creating new modern productions and in increasing the volume of products. If in the 90 years of the 20th century poultry production in Russia began to decline due to the high growth of imports from abroad, from 2000 the market of chicken and egg meat began to grow. Poultry farming provides the country's population with high-quality protein, useful microelements.

2. Materials and methods of research
In this study we used monographic, statistical, methods of analysis and synthesis, induction and deduction methods, economic-statistical methods of correlation-regression analysis, tabular, graphical methods and others. The information basis for this study was the work of foreign scientists, as well as official statistics for the period from 1990 to 2016.

3. Literature review
The issues of providing the population with relatively inexpensive and valuable products produced by the poultry industry are given to the works of domestic and foreign scientists. Some authors pay attention to the social importance of the development of the poultry industry in solving the problems of providing the most vital segments of the population with vitally important food products. According to the studies of Dey, A., Kamal, R., Bhatt, B.P. (2018), poultry farming in India is an important food supply system for the poor, and labor productivity in poultry farming largely depends on agroclimatic conditions [3], as global warming trends affect the lack of water for the development of the industry and this entails additional costs labor. The high social importance of livestock development in his work is emphasized by Jabir Ali (2007) [5]. In his opinion, «Livestock sector supplements income from crop production and other sources and absorbs income shocks due to crop failure».

Other scientists pay the greatest influence to the economic aspects of the development of poultry farming, the profitability and economic feasibility of reproductive processes. The works of A. Husseina, S. Sherifa, A. Al-Juboobrib, A. Al-Mansorrib, and K. Alsharafib (4) [4] are devoted to the study of the economic efficiency of poultry farm operations in the United Arab Emirates. The global problem for the development of the industry in this hot country is food. The authors note that 70-75% of operating costs (cost price) are spent on fodder at the United Arab Emirates' broiler farms. The authors note that in 2010 self-sufficiency of the country with poultry meat was 23%, and eggs - 54%, which gives significant opportunities for import substitution of 77% of poultry meat and 46% of eggs.

The third scientists pay the greatest attention to the ecological safety of poultry development. For example, M.de Vries I.J.M.de Boer (2010) [11] notes that the impact on the livestock environment is due to three main factors: "differences in feed efficiency, differences in methane emissions and differences in reproduction rates." The authors note that the choice of more environmentally friendly livestock products in the diet can reduce the impact on the environment.

Other scientists understand that a strict guideline for preventive veterinary activities can be associated with negative consequences for the people themselves. Charles L. Hofacre (2002) notes that in the poultry industry of the United States, such preventive programs that do not have a harmful effect on the end products of poultry farming, and the antibiotics used do not affect the reduction of resistance to various infections and parasites are of paramount importance [2]. In this regard, the demand for organic products is increased in developed countries, where food safety for humans is put on the first place.

In Takeshima, Hiroyuki & Shrestha, Rudra Bahadur & Karhle, Basu Dey & Karkee, Madhab & Pokhrel, Suroj & Kumar, Anjani (2016), special attention is paid to the mechanization of labor processes in the farming of small farms. The authors note in their work that "mechanization is an opportunity to mitigate growing labor costs" and that "the government should continue to promote specialized tractor services not only for medium and large farmers, but also for small farmers" [14].
According to our research, mechanization of labor processes in poultry farming can increase labor productivity by 6-9 times.

According to Cesare Castellini, Simone Bastianoni, Claudio Granai, Alessandro Dal Bosco, Mauro Brunetti (2006), the organic production system is an important strategy compatible with sustainable agriculture, avoiding the use of chemicals, limiting the intensity of production and providing control over the entire production chain [1]. The authors argue that the cost of development of organic poultry is much greater than using traditional technologies.

The author of a study on bird health and disease control in developing countries - Trevor J. Bagust argues that in developed countries, preventive measures that are associated with the regular exchange of information between industry veterinarians (despite the fact that their companies are commercial competitors), public medical institutions (laboratories) and universities. This cooperation, carried out on a regular "quarterly basis, allows to obtain much greater mutual benefits from the transmission of information about the state of health of birds, which far outweigh collective losses from silence" [16].

The availability of a good information base on the state of livestock development and the directions for its further development is of great economic importance. This is also noted in his work by Kumar P., Kher S.K., Dwivedi S. (2012) [7], Kumar, Anjani and Singh, Dhiraj K. (2008) [8]. With the help of a study on various methods of growing animals, they found that "the awareness of respondents about the need to maintain a balanced feed is only 30%, only 28.3% of respondents knew how to make silage themselves, 11.7% of respondents had knowledge of how to dispose waste of animals and only 20% had knowledge about vaccination of livestock "[7].

Each of the directions considered by us (both social, economic, ecological, biological, and informational) should work in close interconnection to achieve the greatest social and economic effect.

In the Russian Federation, thanks to the institutions that manage the agro-industrial complex in general, the management of veterinary issues, environmental problems, timely epidemiological and sanitary control, as well as preventive measures for the development of the poultry industry.

4. Results of the study

Based on the official data of the Federal Service for State Statistics of the Russian Federation, we will consider the number of poultry stock, the structure of livestock by forms of management, the dynamics of changes in average egg production, including the federal districts of the Russian Federation, the level of consumption of eggs and egg products, and imports and exports.

![Figure 1. The number of poultry in farms of all forms of ownership in the Russian Federation for the period from 1990 to 2017 (thousands of goals).](image-url)
Over the period from 1990 to 2017, the total number of birds in the Russian Federation decreased by 15%. The number of birds in large-scale organizations decreased by 0.4%. The number of birds in private households decreased by 55%. The number of birds in peasant (farm) farms has increased 920 times, but its specific weight does not exceed 1.7% in 2017.

![Figure 2](image_url)

**Figure 2.** The structure of the poultry stock in the farms of all forms of ownership in the Russian Federation for the period from 1990 to 2017. (thousands of goals).

If we consider the structure of the number of birds by forms of management, the largest proportion of the number of livestock during the entire period from 1990 to 2017 was the largest in agricultural organizations. In 1990, the value of this indicator was equal to 70.5%, in 2017 it was equal to almost 83%. Specific weight of the number of birds in private households decreased from 30% in 1990 to 15.7% in 2017.

The most important reflection of the quality of development of the poultry industry is egg production. Let us consider the average egg production of birds in agricultural organizations of the Russian Federation for the period from 1990 to 2017 in figure 3.

During the analyzed period, the average egg-laying of laying hens in large-scale formations increased by almost 32%. This indicates the application of innovations, the improvement of the applied technologies in agriculture, the processes of intensification. According to official statistics, the level of marketability of eggs in agricultural organizations was 88%. The level of intensification of egg production in the federal districts of the Russian Federation is not the same (table 1).

In the Urals Federal District, the average annual egg production of laying hens increased by almost 29% between 1990 and 2016, and in 2016 it was 326 eggs per year. In the Siberian Federal District, the egg production increased by 27% and amounted to 325 eggs per year. In the North-West Federal District, the egg production increased by 25% and amounted to 311 eggs per year. In the Volga Federal District, the egg production increased by 47% and amounted to 311 eggs per year. In the Southern Federal District, egg production increased by 42% and averaged 300 eggs per year. In the Far Eastern Federal District, the egg production rate increased by 31%, and egg production averaged...
294 eggs per year. In the Central Federal District, the egg production increased by 24% and amounted to 291 eggs per year.

**Figure 3.** Average egg production of one laying hen in agricultural organizations of the Russian Federation for the period from 1990 to 2017 years.

**Table 1.** The average annual laying of laying hens in the agricultural organizations of the Russian Federation by federal districts for the period from 1990 to 2016.

| Indicators                  | 1990 y. | 1995 y. | 2000 y. | 2005 y. | 2010 y. | 2015 y. | 2016 y. |
|-----------------------------|---------|---------|---------|---------|---------|---------|---------|
| Ural federal district       | 253     | 236     | 293     | 322     | 329     | 331     | 326     |
| Siberian Federal District   | 237     | 207     | 265     | 304     | 311     | 321     | 325     |
| North-West Federal District | 249     | 230     | 281     | 306     | 311     | 313     | 311     |
| Volga Federal District      | 211     | 203     | 246     | 303     | 312     | 310     | 311     |
| Southern Federal District   | 211     | 203     | 246     | 269     | 301     | 309     | 300     |
| Far Eastern Federal District| 225     | 187     | 210     | 276     | 294     | 299     | 294     |
| Central Federal District    | 235     | 204     | 259     | 292     | 292     | 292     | 291     |

The natural and climatic conditions of the country have not the same impact on the development of poultry. In the Southern Federal District, plant growing is well developed. The Urals Federal District is actively developing industry. In the North-West Federal District, both industry and dairy cattle breeding are actively developing. In the Volga and Central Federal Districts, all branches of agriculture are harmoniously developed.

**Table 2.** Structure of egg production by federal districts of the Russian Federation for the period from 1990 to 2016.

| Indicators                  | 1990 y. | 1995 y. | 2000 y. | 2005 y. | 2010 y. | 2015 y. | 2016 y. |
|-----------------------------|---------|---------|---------|---------|---------|---------|---------|
| Volga Federal District      | 21.6    | 24.7    | 24.8    | 26.4    | 27.4    | 26.0    | 26.0    |
| Central Federal District    | 26.3    | 26.3    | 24.0    | 22.0    | 21.9    | 21.5    | 21.8    |
The largest share of egg production in 1990 belonged to the Central Federal District of the Russian Federation. 26.3% of the total egg production was produced here. In the Volga Federal District, 21.6% of eggs were produced, in the Siberian and Southern Federal Districts - by 14.3%, in the North-Western Federal District - 10.1%, in the Far Eastern Federal District - 4.8%. In 2016, egg production in the Volga Federal District was 26%, in the Central Federal District - 21.8%, in the Siberian Federal District - 15.4%, in the Southern Federal District - 13.2%, in the Urals Federal District - 10.8%, in the Northwest Federal District - 9.9%, in the Far Eastern Federal District - 2.8%.

The total number of eggs produced in farms of all categories in the Russian Federation decreased by 8.2% during the analyzed period. In the Urals Federal District, the number of eggs produced increased by 11.2%, in the Privolzhsky Federal District - by 6.8%. In the Siberian Federal District, the volume of production decreased by 3.8%, in the North-West Federal District by 13%, in the Southern Federal District by 18%, in the Far Eastern Federal District by 48%, in the Central Federal District by 26% 3%. This led to the fact that the level of consumption of eggs decreased by 8%.

If we compare the consumption of meat and meat products per capita in the Russian Federation, it becomes evident that during the period from 1994 to 2002 they were significantly lower than in the period from 1990-1991, from 2003 to 2016.

Despite the fact that the Russian Federation fully provides itself with eggs and egg products in comparison with the consumption norms determined by the Institute of Nutrition of the Russian Academy of Medical Sciences (260 eggs per year), the level of import surplus over exports persists (figure 4).

![Figure 4. Imports and exports of eggs and egg products (millions of eggs).](image-url)
The balance of imports and exports of eggs and egg products for the period from 1990 to 2016, there have been some changes. In particular, from 1992 to 1994, exports of eggs and egg products exceeded imports. In the remaining time periods, imports significantly exceed exports. In 1990, this difference was 7.6 times, in 2017 it was equal to 2.7 times.

According to official data of the Ministry of Agriculture of the Russian Federation, currently the main channels for the sale of eggs are: Mongolia, Abkhazia, Georgia, Azerbaijan and other countries.

The volume of eggs and egg production in the country decreased by 8%, industrial consumption decreased by 16.3%.

In order to identify the factors that affect the amount of egg production in the country, we performed a special correlation regression analysis. The number of eggs per resident in the Russian Federation is taken as a dependent variable. The following factors have been chosen as influencing factors:

- \( X_1 \) - the proportion of able-bodied rural population in the total number of rural population, %;
- \( X_2 \) - indices of consumer prices for eggs (as a percentage of the previous year), %;
- \( X_3 \) - indices of consumer prices for motor gasoline (in percentages to the previous year), %;
- \( X_4 \) - indices of consumer prices for electricity (in percentages to the previous year), %.

As information base for the study, the data of the Federal State Statistics Service of the Russian Federation were used.

The coefficient of multiple correlation was 0.89. The coefficient of multiple determination is 0.79. This means that the tightness of the connection between the selected factors is quite high. The regression equation took the form:

\[
y = 656.6 - 2.53 \cdot X_1 - 0.24 \cdot X_2 - 1.24 \cdot X_3 - 1.19 \cdot X_4
\]

As can be seen from the obtained result, absolutely all the selected factors exert a reverse influence on the dependent variable \( y \). In this case the strongest reverse influence (in descending order) is provided by the factors: \( X_1 \) - the proportion of the able-bodied rural population in the total number of rural population; \( X_3 \) - indices of consumer prices for motor gasoline (in percentages to the previous year); \( X_4 \) - indices of consumer prices for electricity (in percentages to the previous year) and \( X_2 \) - indices of consumer prices for eggs (as a percentage of the previous year).
The problem of development of the poultry industry is widely discussed in the Russian Federation. Many scientists and responsible government agencies realize that it is necessary to adopt a comprehensive state program for the development of the poultry industry. Among the main problems hindering the progressive development of poultry and poultry products in the country, it should be noted:

- High level of competition with cheap imported products, the presence of illegal imports.
- Lack of own fodder base, its uneven distribution throughout the country.
- Lagging of prices for poultry and eggs from the rate of increase in production costs (due to a more intensive rate of growth in prices for energy resources and fuel and lower growth rates of purchasing prices for poultry products).
- Use of obsolete technological equipment at poultry farms.
- The high cost of fodder bioadditives, which affect the growth of the cost of production.
- Insufficient opportunities for introducing innovations due to low profit margins.
- Underutilization of production facilities at existing poultry enterprises.
- Dependence of the cost of finished products on the cost of feed and on natural and climatic conditions (natural phenomena - droughts, rains), epidemics (avian flu and others).
- Insufficiently active diagnostic veterinary work and sanitary control.

5. Conclusion

The disparity of prices for energy resources and the cost of agricultural products, the reduction in the number of able-bodied rural population, are the main deterrents for the development of the poultry industry.

Over the period from 1990 to 2017, the total number of birds in the Russian Federation decreased by 15%. The number of birds in large-scale organizations decreased by 0.4%. The specific weight of the number of birds in agricultural organizations in 2017 became almost 83%. At the same time, the laying capacity of laying hens in large-scale formations increased by almost 32%.

The largest share of egg production in 2016 belongs to the Volga Federal District - 26%, the Central Federal District - 21.8%, the Siberian Federal District - 15.4%, the Southern Federal District - 13.2%, the Urals Federal District - 10, 8%, the North-West Federal District - 9.9%, the Far Eastern Federal District - 2.8%.

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The total number of eggs produced in farms of all categories in the Russian Federation for the analyzed period decreased by 8.2%. In the Urals Federal District, the number of eggs produced increased by 11.2%, in the Privolzhsky Federal District - by 6.8%.

The balance of imports and exports of eggs and egg products for the period from 1990 to 2017, there have been some changes. In particular, from 1992 to 1994, exports of eggs and egg products exceeded imports. In the remaining time periods, imports significantly exceed exports. In 1990, this difference was 7.6 times, in 2017 it was equal to 2.7 times.

In order to identify the factors that affect the amount of egg production in the country, we performed a special correlation regression analysis. As a dependent variable, the number of eggs per resident is assumed. In this case, the strongest reverse effect (in descending order) is provided by the factors: X1 - the proportion of the able-bodied rural population in the total number of the rural
population, as well as the factor X3 - indices of consumer prices for motor gasoline (in percentages to the previous year).

The main goal of the development of the poultry industry in the Russian Federation is the creation of an efficient, competitive and optimal in its structure poultry products and raw materials for the processing industry, which will increase the level of self-sufficiency of the main types of poultry products and raw materials, as well as develop exports outside the country. Achieving this goal provides for the development of the poultry industry on an innovative basis based on the preservation of reproduction and improvement of land and other natural resources used in agro-industrial production, increasing the competitiveness of poultry products and raw materials produced.

The main directions for improving the development of the poultry production system in the short term should be:

- Intensification, accompanied by a qualitative improvement in the breeding and productive qualities of the poultry population.
- Transition to the maintenance of the most productive cross-country poultry, as well as the breeding of waterfowl (geese, ducks), turkeys, guinea fowl, quail, exotic birds (pheasants, ostriches). The most important direction in the development of Russian poultry farming, which distinguishes it from many other countries, is the breeding and production of waterfowl. In Russia, more than 20 breeds of geese are bred, of which the most popular are Lindonian, Italian, large gray, Ural white and gray, etc.
- Improvement of production technologies, feed, poultry feeding systems, batteries for incubators.
- A scientifically grounded approach to the observance of technologies for growing poultry.
- Increasing the level of mechanization of technological processes.
- Reduction of labor costs for production of a unit of production and maintenance of a certain area of poultry houses.
- Improvement of breeding work, development of genetic engineering. Targeted breeding and breeding work and rational use of the genetic potential of productive birds is a priority task. The total number of breeding studs in Russia, according to the State Pedigree Register, specializing in poultry farming - 135. The experience of advanced countries in the field of breeding work in poultry farming has shown that the most effective measures to create sustainable competitive advantages in this area are: the availability of systematic state support for breeding through the implementation state and long-term targeted programs; a significant number of breeding herds in poultry farming, a different direction of breeding work (a breeding plant, a selection and genetic center, a breeding reproducer, a gene pool, etc.); high breeding stock of breeding birds; specialization in a certain direction in breeding work (in-depth specialization - tribal work on turkey, on waterfowl); presence of international relations with the purpose of sharing experience and tribal material, as well as entering foreign markets with breeding products.
- Reduction of non-production costs and time losses.
- Introduction of new feed mixtures, rich in amino acids, vitamin supplements, increasing the immunity of birds.
- Improvement of technologies for controlling infectious diseases in birds, development of vaccines used in the poultry industry to improve the immune resistance of birds and other measures.
- Introduction of innovative technologies, programs to increase energy efficiency and energy saving and transition to innovative waste-free and environmentally friendly technologies for the production of poultry products. Only Elinar-Broiler has introduced more than 300 technological innovations, put into operation more than a thousand units of modern equipment that was never used before in Russian poultry farming. Example, the introduction of modern technologies for growing broilers allowed to achieve shortening of the terms of fattening, increasing the number of technological cycles during the year (turnover of poultry houses), and so on.
- Creation of an information and analytical system for improving the efficiency of poultry industry management.
13. Concentration of production, construction of large poultry complexes, such as CJSC Prioskolie, Miratorg Agribusiness Holding, Uralbroiler Company, Ravis Agroholding, Ural Meat Company LLC, CJSC White Bird. The predominance of the large holdings with the full production cycle: from growing fodder to the sale of finished products and waste disposal. In this case, concentration of production, construction of large poultry complexes, such as Prioskolie, Miratorg Agribusiness Holding, Uralbroiler, Ravis agroholding, Ural Meat Company LLC, White Bird CJSC. The predominance of large holdings with a full production cycle: from growing fodder crops and production of mixed fodder to the sale of finished products and waste disposal. At the same time, it is necessary to maintain the support and development of family farms, especially for the production of poultry meat, for breeding waterfowl and exotic birds. Positive is the experience in the development of gusevodstva and utkovodstva in the cooperation of large producers with personal subsidiary farms and small peasant (farm) farms, which are fed to fattening young birds.

2. Diversification of primary and secondary production. High level of deep processing, providing a wide range and deep coverage of the market - from dietary poultry meat with low fat content, products for children to threonine production, ethnic products, and organic fertilizers.

3. Development of trade and logistics chains and penetration of new sales markets, including foreign markets (to Hong Kong, Iran, Kazakhstan and others), access to large regional and federal trade networks; diversification of the structure of distribution channels; liquidation of a large number of unnecessary intermediary links in the sale of poultry products, leading to their appreciation, developed warehouse logistics.

4. Construction of poultry enterprises on modern fundamentally new schemes based on the territorial division of individual parts of poultry farms - separate production sites with large hatcheries, parent flock shops, broiler production plants, feed mills, large processing complexes.

5. Production of environmentally friendly products (with the receipt of an environmental certificate), including the use of maintenance technologies based on the minimum contact of birds with humans, minimum human participation in all stages of manufacturing products, and others.

It is important to note that the development of the poultry industry should be carried out on an integrated and systemic basis, taking into account the impact of economic, social, technical and technological, biological, and environmental factors to achieve the greatest production effect

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