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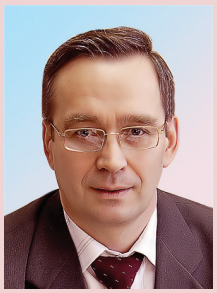
Methodological Aspects in Forecasting Innovation Development of Dairy Cattle Breeding in the Region

Natal'ya Aleksandrovna
MEDVEDEVA
Vologda State Dairy Farming Academy named after N.V. Vereshchagin
8, Mira Street, Molochnoye Rural Settlement, Vologda, 160555, Russian Federation
named35@mail.ru



Valentin Alekseevich
BIL'KOV
Vologda State Dairy Farming Academy named after N.V. Vereshchagin
8, Mira Street, Molochnoye Rural Settlement, Vologda, 160555, Russian Federation
valentinbilkov@gmail.ru

Abstract. Due to the fact that Russia is now a member of the World Trade Organization, long-term forecasting becomes an objectively necessary condition that helps choose an effective science-based long-term strategy for development of dairy cattle breeding that would take into consideration intellectual and innovative characteristics. Current structure of available statistical information does not meet modern challenges of innovation development and does not reflect adequately the trends of ongoing changes. The paper suggests a system of indicators to analyze the status, development and prospects of dairy cattle breeding in the region; this system provides timely identification of emerging risks and threats of deviation from the specified parameters. The system included indicators contained in the current statistical reporting and new indicators of innovation development of the industry, the quality of human capital and the level of government support. When designing the system of indicators, we used several methodological aspects

of the Oslo Manual, which the Federal State Statistics Service considers to be an official methodological document concerning the collection of information about innovation activities. A structured system of indicators shifts the emphasis in the analysis of the final results to the conditions and prerequisites that help achieve forecast performance indicators in the functioning of Russia's economy under WTO rules and make substantiated management decisions.

Key words: forecasting, dairy cattle breeding, region, system of indicators, innovative development, information base.

One of the major current tasks that Russia has to deal with is the transition of its economy to an innovation path of development that will significantly improve the standard of living and quality of life of the population and ensure food security. Quality forecasting will improve the accuracy of development strategies for each economic sector and reduce risks in the agricultural sector. Economic forecasting issues are considered in the works of many domestic and foreign scientists. A scientific knowledge base that defines the features of forecasting in the conditions of innovation development has been formed. However, insufficient attention is given to the issues of methodological support of long-term forecasting in dairy cattle breeding on the basis of promoting innovation activity and enhancing the quality of human capital. The aim of the present study is to develop a forecasting methodology in dairy cattle breeding in the region and to develop practical recommendations for the substantiation of long-term strategies and conditions for their implementation on the basis of a structured system of indicators.

Vigorous innovation activity is one of the ways to change the situation in regional agriculture [14]. Basic directions of innovations implementation are as follows:

– organizational (innovation in the sphere of production organization and management, staff selection, systems of management, labor remuneration, document management, etc.);

– breeding and genetic (innovation aimed to increase the yield and fertility of soils, productivity of animals, etc.);

– technology (application of more productive agricultural equipment, advanced technology, introduction of information and telecommunication technology, etc.);

– financial and economic (innovation in the financing of the functioning and development of agriculture, loan technology, insurance, state support, etc.).

Innovation development of agriculture should be one of the priority areas, which also does not contradict the conditions of functioning of the Russian economy under WTO rules and necessitates the development of conceptual approaches in forecasting methodology.

Forecasting in the field of innovation, including scientific and technological discoveries and inventions and assessment of conditions that contribute to their implementation in practice becomes one of the most important forecasting areas [9]. We agree with the opinion of N.D. Kondratiev who points out: "Obviously, there is no reason to think about a random and transient nature of changes in technology.... The very development of technology is included in the rhythmic process of development of large cycles" [8, p. 176]. Karl Marx wrote: "Economic epochs differ in not what is produced, but how it is produced, by what means of labor" [10, p.94].

Forecasting innovations allows us to estimate their possible directions and consequences and substantiate strategic priorities. However, without strategic plans and target programs, possible innovations and priorities selected will not be implemented due to the inertia of the system. Therefore, the relationship between long-term forecasting and strategic planning is a prerequisite for transition to innovation path of development of the economy.

Ignoring science as a driving force of technological progress leads to the country's lagging behind the most economically developed nations. According to Russian Academician A.A. Dynkin, Director of RAS Institute of World Economy and International Relations, "in the modern world, globalization and innovation have become the main drivers of global economic growth. Globalization affects quantitative parameters of growth; innovation affects the quality and the very paradigm of development... The future of globalization after the crisis is, according to all estimates, uncertain... Money circulation will resume only if there emerge the products of a new quality, which can revive demand. These problems are solved by innovation" [7, p. 9].

The essence of the term "innovation" was revealed at the end of the 20th – beginning of the 21st century by K. Marx and N.D. Kondratiev. In the 1930s the theory of innovation was developed in the works of J. Schumpeter. Its further elaboration is connected with the names of Western economists such as J. Allen, K. Bowman, F. Valenta, P. Whitfield, R. Johnson, G. Mensch, etc., and also Russian scientists A.A. Dynkin, V.Ya Gorfinkel', V.L. Inozemtsev, G.A. Korolenko, B.N. Chernyshev, etc. Innovation is "new or improved technology, products or services, other organizational and technological solutions of industrial, administrative, commercial or other nature that are created or mastered and that promote technology, commercial products and services in the market" [6, p. 250]. Innovation is associated with obtaining certain effect. Back at the end of the 19th century, the outstanding Russian scientist A.S. Popov, assessing the importance of entrepreneurial activity of Guglielmo Marconi, said: "It is not about personal glory, but general benefit of a person. After all, why would you deny the usefulness of Marconi's work? A

businesslike and commercial approach to invention is sometimes no less valuable than the invention itself" [13, p. 56].

Most often, the effectiveness of innovative solutions is assessed with the help of the following types of impact: scientific, technological, social, and economic. The scientific effect is understood as the amount of new knowledge accumulated. The technological effect is usually evaluated through the growth of parameters and indicators of particular products; it is the result of implementation of the innovation in production. The social effect shows the contribution this innovation has made to improving people's lives. Such indicators can be the increase in people's incomes, increase in employment, reduction of production waste, etc. The economic effect is a quantitative characteristic of the social utility of innovation [11].

When forecasting the development of agriculture it is important to define indicators that help assess the development of phenomena taking into account scientific and technological progress aimed to improve the quality and competitiveness of products [4]. The following parameters reflect the introduction of innovation most accurately:

– growth of labor productivity due to the introduction and dissemination of innovations;

– reducing the material intensity of production as a result of the use of innovations;

– growth of actual annual economic effect due to the implementation of innovations;

– reduction in the share of manual labor due to the introduction and dissemination of innovations;

– increase in the share of products of the highest quality through the development of new products, equipment, and technological processes;

– reduction in the share of obsolete machinery, equipment, etc.

All these indicators are dynamic in nature. When assessing the indicators of innovation implementation, it is important to consider that they not only measure the phenomenon, but also provide a mechanism of direct influence. It is advisable to introduce a set of indicators that have a "threshold" value beyond which crisis phenomena emerge [3].

Indicators that reflect the level of innovation processes are not exposure but resulting. They reflect the combination of these two factors:

• comparative effectiveness, progressiveness of individual innovations introduced in relation to their analogues being replaced.

• extent of distribution of these innovations.

These indicators are less manageable than exposure indicators. Thus, controlled indicators of innovations implementation are:

• growth rate of the main technological and economic parameters of the innovation

(new product, equipment, technology) compared to the counterparts being replaced;

• volume of production and extent of use of innovations associated with the production and use of their analogues.

Indicators of performance and resource pace of innovation implementation are not the indicators that are managed directly. When making forecasts, it is necessary to use the indicators that would include comparative effectiveness of innovations in relation to the analogues being substituted, their volume of distribution and share of resources allocated to innovation; besides, these indicators should be subject to immediate management and planning. According to S.V. Valdaitsev, indicators of the pace of production renewal meet these requirements. Production upgrading is the material basis that provides certain productive pace of scientific and technological progress, and at the same time, it is a process, the preparation (in science) and implementation (in production) of which determine appropriate resource rate [5]. It is necessary to identify the factors that play a leading role in the development of agriculture.

The majority of regions in the European North specialize in dairy cattle breeding due to climate specifics and historical traditions [15]. Constraints to its development are as follows: reduction in the number of cows (in 3 times for the analyzed period), poor quality of forage of own production, its high self-cost, instability of prices for purchased material and technological resources and for agricultural products *(tab. 1)*.

Table 1. Number of cattle in farms of all categories in the regions of the European North of the Russian Federation at the end of the year, thousand head

Region	1990	2000	2005	2010	2011	2012	2013	2014	Position in Russia, 2014
Russian Federation, million tons	57043.0	27519.8	21625.0	19967.9	20133.8	19981.2	19564.0	19264.3	
Republic of Karelia	126.3	56.2	34.9	28.2	25.4	23.1	23.6	23.4	72
Republic of Komi	173.5	83.3	45.3	38.7	38.4	37.8	36.2	35.7	71
Arkhangelsk Oblast	354.7	129.4	74.1	56.9	54.3	52.7	50.6	45.8	69
including Nenets Autonomous Okrug	9.1	4.1	2.7	1.7	1.6	1.5	1.4	1.4	82
Vologda Oblast	613.3	317.0	233.1	196.7	184.9	179.0	166.7	162.6	44
Murmansk Oblast	43.8	11.9	8.7	7.8	7.8	7.8	7.6	7.5	79
Source: compiled by the authors using the data of the Federal State Statistics Service of Russia [1, 2].									

Table 2. Milk yield per cow in agricultural organizations of the regions of the European North of Russia, kg

Region	1990	2000	2005	2010	2011	2012	2013	2014	2014 in % to 1990, %
Russian Federation	2783	2341	3280	4189	4306	4521	4519	4841	
Republic of Karelia	3893	2900	4608	5494	5848	6480	6417	6811	174.9
Republic of Komi	2711	2096	2810	3491	3624	3999	3842	4008	147.8
Arkhangelsk Oblast	2662	1870	3593	4480	4772	5075	5124	5728	215.2
including Nenets Autonomous Okrug	3089	3088	3723	4543	4590	4574	4515	4713	152.6
Vologda Oblast	2736	2975	4218	4888	5127	5525	5521	6025	220.2
Murmansk Oblast	4869	4876	6414	7527	7910	7423	7182	5938	122.0

Source: compiled by the authors using the data of the Federal State Statistics Service of Russia [1, 2].

Production growth is achieved by increasing the productivity of cows *(tab. 2)*.

Specifics of medium-term and long-term forecasts of dairy cattle breeding development in the region are determined by the comprehensive nature of the issues of analysis of the status and dynamics of the most important parameters and by the need to identify the relationships with the factors that influence the development of this sector. Development of requirements to the system of statistical indicators, corresponding to the goals and objectives of medium-term and long-term assessment of the prospects of dairy cattle breeding development is one of the main conditions for improving the reliability and accuracy of the forecasts made.

Current structure of available statistical information does not meet modern challenges of innovation development and does not reflect adequately the trends of ongoing changes. When using a hierarchical organization of information flows that helps provide high efficiency of the processing, that is, the high speed of obtaining the data requested, there is no possibility of introducing additional indicators in the system. It is proposed to use the relevant arrangement of databases, which makes it possible to establish logical links between the essence of the phenomenon under study, the type and direction of information flow and get the necessary information about dairy farming in the region in the conditions of economic globalization. This problem is solved by developing a structured system of indicators. All the indicators included in the system have their own place, method of collecting and processing data for each indicator on the basis of clear written instructions. A structured system of indicators shifts the emphasis in the analysis from the final results to the conditions and prerequisites that help achieve forecast indicators in terms of

functioning of Russia's economy under WTO rules, it also shifts the emphasis on innovation development of the sector, the quality of human capital, and the level of state support. When designing a system of indicators, we took into account methodological aspects of the Oslo Manual, which is considered by the Federal State Statistics Service as an official methodological document that determines the collection of information about innovation activities. The structure of the system that we developed includes indicators contained in the current statistical reporting and new indicators that depend on contemporary challenges of statistics and agriculture development.

Having conducted an analysis and comprehensive evaluation of indicators of the information field, we determine that the system of indicators for forecasting the development of dairy cattle breeding should include the following analytical units *(tab. 3)*:

– socio-economic environment;
– size and composition of the population;
– employment and unemployment;
– indicators of the standard of living;
– agriculture;
– educational potential of the population;
– scientific and technological potential;
– innovation activity;
– quality of innovation policy.

Table 3. System of forecasts of development of dairy cattle breeding in the region

No.	Indicator	Data source
1.	**Socio-economic environment**	
1.1.	GRP per capita in the region, thousand rubles	Rosstat, Central Statistics Database
1.2.	Volume of investments in the development of dairy cattle breeding in the region, million rubles	Rosstat
1.3.	Share of investment in dairy cattle breeding in the total volume, %	Rosstat
2.	**Size and composition of the population**	
2.1.	Average annual population of the region, people	Rosstat
2.2.	Proportion of rural population in total population, %	Rosstat
2.3.	Share of working age population in rural areas at year-end, %	Rosstat
3.	**Employment and unemployment**	
3.1.	Number of economically active population, people	Rosstat
3.2.	Average number of employees in agriculture of the region, people	Rosstat
3.3.	Unemployment rate, %	Rosstat
3.4.	Unemployment rate in rural areas, %	Calculated
4.	**Indicators of the standard of living**	
4.1.	Per capita money income (monthly), rubles	Rosstat
4.2.	Real money income, % to the previous year	Rosstat

Continuation of Table 3

4.3.	Average nominal accrued wage in agriculture, rubles	Rosstat
4.4.	Actual consumption of milk per capita in the region per year, kg	Rosstat
4.5.	Coefficients of satisfying the demand for milk in the region	Calculated
5.	**Agriculture**	
5.1.	Agricultural products, total, in actual prices, million rubles	Rosstat
5.2.	Agricultural production indices in comparable prices to the previous year, %	Rosstat
5.3.	Milk production in the region, thousand tons	Rosstat
5.4.	Area of agricultural land at the end of the year, hectares	Rosstat
5.5.	Area of arable land at the end of the year, hectares	Rosstat
5.6.	Cow population in the farms of all categories at the end of the year	Rosstat
5.7.	Milk yield per cow, kg	Rosstat
5.8.	Profitability of milk production without subsidies, %	Rosstat
5.9.	Profitability of milk production with subsidies, %	Rosstat
5.10.	Profitability of livestock production without subsidies, %	Calculated
5.11.	Profitability of livestock production with subsidies, %	
5.12.	Share of unprofitable agricultural organizations, %	Rosstat
6.	**Educational potential of population in the region**	Rosstat, survey of the population on the subject of employment
6.1.	Proportion of population aged 25–64 with higher education in the total population of respective age group, %	
6.2.	Number of students enrolled in educational programs of higher education per 10,000 population, people	Rosstat, Form HPE-1
6.3.	Average score at the unified state exam among the students admitted to agricultural universities	FIS
7.	**Scientific and technological potential**	
7.1.	Domestic expenditures on research and development in agriculture on dairy cattle breeding, as a percentage of GRP, %	No reporting
7.2.	Domestic expenditures on research and development in agriculture calculated per researcher, thousand rubles	No reporting
7.3.	Share of persons engaged in research and development in agriculture in dairy cattle breeding in the average annual number of people employed in the economy of the region, %	No reporting
7.4.	Share of persons aged under 39 in the number of researchers engaged in scientific research on agriculture, %	No reporting
7.5.	Share of persons with academic degrees, the number of researchers in agricultural universities, research institutes, %	No reporting
7.6.	Number of articles on agriculture, published in peer-reviewed journals covered in the Russian Science Citation Index, per 100 researchers	No reporting

End of Table 3

7.7.	Number of patent applications for inventions in agricultural areas filed with Rospatent by national applicants, per 1,000 economically active population of the region	No reporting
8.	**Innovation activity**	
8.1.	Expenditure on technological innovation in dairy farming, thousand rubles	No reporting
8.2.	Proportion of agricultural products produced on the basis of innovation technology, %	No reporting
8.3.	Proportion of regional agricultural organizations that assess the reduction of material and energy consumption as the main result of innovation, in the total number of organizations engaged in technological innovation, %	No reporting
8.4.	Expenditures for advisory services in agriculture, thousand rubles	No reporting
9.	**Quality of innovation policy**	Internet portals, websites of state authorities of the subjects of the Russian Federation, specialized databases of regional legal acts
9.1.	Presence of innovation development strategy or a section in the strategy for the region's development that considers innovation development of dairy cattle breeding	
9.2.	Presence of a specialized legislative act that defines the basic principles, directions and measures of state support of innovation activities in dairy farming in the region	
9.3.	Presence of regional and district advisory services	

Grouping of the parameters in the blocks makes it possible to:

– identify the impact of individual factors on the efficiency of dairy cattle breeding;

– consider the goals and objectives of agricultural production;

– measure the consumption and production of agricultural products;

– link the forecast of scientific and technological progress to the forecast of production and economic activity in agriculture.

For the purpose of assessing the current state of dairy cattle breeding we propose to use an aggregate index as a tool for monitoring the system. The basis of this algorithm of calculation of the index is a comparison of the values of some indicators of development of the sector with the forecast scenario values, and strategic decision making on the basis of this comparison. The index should provide comparable information on the elements of the system.

For calculating the index of development of dairy cattle breeding it is advisable to use the following combination of effective indicators:

– agricultural products of the region in actual prices, million rubles (B_1=0.3);

– number of cows in all categories of farms in the region (B_2=0.25);

– milk yield per cow in the region, kg (B_3=0.25);

– profitability of milk with subsidies in the region, % (B_4=0.2).

The calculation of the index of development of dairy cattle breeding is determined by the formulas 1 and 2:

$$I = \sum_{i=1}^{6} B_i \times I_i, \qquad (1)$$

where B_i is a weight significance coefficient of the i-th indicator;

$$\text{Ii} = \frac{\text{actual value of the i - th indicator}}{\text{value of the i - th indicator according to the scena}}. \qquad (2)$$

If I > 1, then the level of development of the sector is high;

if I ≥ 0.75 – the level is median, but there is a possibility for taking measures to stabilize the situation;

if I < 0.75, then the level of development is low, dairy farming in the region is in crisis, it is not possible to improve the situation in the near future.

The values of weight coefficients expressing the degree of importance of each indicator is established by experts.

The composition of indicators and their degree of importance may vary depending on the region, the accessibility of statistical information and objectives of the research. The main purpose of the index consists in the fact that it provides an opportunity to conduct a comparative analysis to evaluate current dairy farming development. The use of qualitative methods of analysis of the situation helps make substantiated management decisions to correct the situation.

The state of the information base of the unified system of forecast calculations determines the quality of the forecasts made.

Currently, the main sources of information are:

– results of statistical observations conducted by Rosstat in the framework of official agricultural statistics;

– data of Rosstat, developed on the basis of the results of statistical surveys using different forms of accounting and statistical reporting;

– information obtained from departmental sources of statistical data;

– data obtained from foreign sources representing the results of developments and comparative studies of international organizations.

The main sources of formation of the initial system of indicators used in the development of medium-term and long-term forecasts are the data contained in the following forms of state statistical observation:

– Form No. 24-Agr. “Information on the situation in livestock breeding”, Order of Rosstat No. 319 dated September 17, 2010;

– Form No. 2-science “Information on scientific research and development”, Order of Rosstat No. 580 dated September 24, 2014;

– Form No. 21-Agr. “Information on the sales of agricultural products”, Order of Rosstat No. 319 dated September 17, 2010;

– Form No. 4-innovation "Information on innovation activity", Order of Rosstat No. 580 dated September 24, 2014;

– Form No. 9-AIC (meat) "Information on the processing of livestock and poultry and yield of meat products", Order of Rosstat No. 235 dated September 23, 2008;

– Form No. 14 "Information on the assessment of livestock and poultry, and area under crops in the farms of the population", Order of Rosstat No. 441 dated August 09, 2012;

– Form No. 2 "Agricultural production in personal subsidiary plots and other individual farms of citizens", Order of Rosstat No. 319 from September 17, 2010;

– Form No. P-1 (Agr.) "Information on production and shipment of agricultural products", Order of Rosstat No. 540 dated August 29, 2014;

– Form No. 1-Agr.-price "Information on the prices established by agricultural producers", Order of Rosstat No. 321 dated August 09, 2013;

– Form No. 2-MP innovation "Information on technological innovations of the small enterprise", Order of Rosstat No. 349 dated August 29, 2013;

– Form No. 3-farmer "Information on livestock production and livestock head", Order of Rosstat No. 309 dated August 06, 2013;

– Form No. 10-Mech (short), "Information on availability of tractors, agricultural machinery and energy capacities", Order of Rosstat No. 309 dated August 06, 2013;

– Form No. 21-Agr. "Information on the sales of agricultural products", Order of Rosstat No. 319 dated September 17, 2010 and others.

Information needs of innovation economy management should be satisfied by the formation of an effective system for statistical accounting and reporting. The availability of such information will help:

– work out a strategy for development of dairy cattle breeding in the region;

– implement current monitoring and operational management of the sector;

– forecast the main processes associated with the development of agriculture, science and innovation, including professional education;

– effect current and perspective planning of development of dairy cattle breeding.

Given the fact that development of science is global in its nature and goes beyond national boundaries, it is possible to say that each scientific discovery becomes the property of mankind. It is therefore important to study trends in the development of science in agriculture abroad. Undoubtedly, foreign experience was used quite extensively when strategies for the country's development were worked out, but in any case, it needs to be adjusted so that it could correspond to domestic environment.

Regional differences in the levels of innovation activity can be substantial, and identifying the main characteristics and factors contributing to innovation activity

and development of agriculture at the regional level can help understand innovation processes and be useful for the formulation of state policy [9]. Innovation processes in the regions can develop along with national innovation systems. These conditions create the potential for the development of contacts with suppliers, consumers, competitors and public research institutions.

Currently, there are problems with collecting data on innovation processes. First, a comprehensive analysis often requires additional economic data on the economic entities. Therefore, the data of research on innovation often have to be combined with the data obtained from other sources. Second, the implementation of innovation is a continuous process. Therefore, it is difficult to measure in general, especially in agricultural organizations, the innovative activity of which is mainly characterized by small improvement changes as opposed to single, significant measures to implement considerable change. We shall define innovation in agriculture as significant changes. Nevertheless, it is important to keep in mind that innovation can consist of a series of small improvement changes. Third, the data on expenditure on innovation are typically not reflected in financial documents of organizations, making them difficult to estimate. Fourth, when conducting the surveys, it is difficult to record the time of implementation of innovations and manifestation of their impact. Expenditures on innovation are made in hopes of obtaining potential future profit. However, it often happens that the benefit from the development and implementation of innovation manifested in increasing the innovation capacity of firms and their effectiveness does not have time to occur during the survey. Innovation survey should be linked to the education system, labor market and financial structures [12].

These types for innovation surveys can be defined in the following way:

1. Open sources of information: information in the open access, it does not require the purchase of technology or intellectual property rights, or interaction with the source of information.

2. Commercial sources of knowledge and technology: purchase of external knowledge and/or technology embodied in machines, equipment and services that do not involve interaction with the source.

3. Innovation cooperation: active cooperation with other enterprises or public research institutions for the purpose of innovation activities.

The issue concerning the staffing of agriculture in the region remains most urgent today. Forecasting the need for staff is considered to be an important part of the information required in order to develop measures on regulating and monitoring the changes on the market of educational services, measures on the strategic planning of the system for training and retraining of personnel focused on the needs of successful

functioning of Russia's economy as a WTO member. Staffing needs of the region should be forecasted for not less than 5–7 years, because plans of admission to vocational education institutions formed on the basis of the forecast results define the structure of training of professionals. Forecasting staffing requirements for agriculture should be focused on a practical outcome: evaluation and adjustment of the amount of training in the system of vocational education in the region in accordance with the future needs of socio-economic development and demands of production. Currently available statistical data do not allow us to assess the dynamics of employment in the context of professional qualification structure of employment in agriculture in the region. Economic development programs are based on the information that is received from state statistics bodies and reflects the structure of employment in sectors only. This information is insufficient for planning and forecasting the development of the staff training system.

The results of the research carried out by the authors of the paper will help make well-grounded management decisions using the forecast indicators of dairy cattle breeding development in the region taking into account the innovations and conditions for the development of higher education in the long term, and also improve the quality of the information base for analyzing, forecasting and monitoring the development of this sector.

References

1. Regiony Rossii. Sotsial'no-ekonomicheskie pokazateli. 2014: stat. sb. [Regions of Russia. Socio-economic indicators. 2014: statistics collection]. *Rosstat* [Federal State Statistics Service]. Moscow, 2014. 996 p. [in Russian].
2. Statisticheskii ezhegodnik Vologodskoi oblasti 2014: stat. sb. [Statistical yearbook of the Vologda Oblast 2014: statistics collection]. *Vologdastat* [Regional Office of the Federal State Statistics Service of the Russian Federation in the Vologda Oblast]. Vologda, 2015. 378 p. [in Russian].
3. Baryshnikov N.G., Samygin D.Yu. Stsenarii razvitiya sel'skokhozyaistvennogo biznesa v Penzenskoi oblasti: prognozirovanie i otsenka riskov [Scenarios for the development of agricultural business in the Penza Oblast: forecasting and risk assessment]. *Problemy prognozirovaniya* [Studies on Russian economic development], 2015, no. 1, pp. 84-89. [in Russian].
4. Ganieva I.A. Teoreticheskie i metodologicheskie aspekty prognozirovaniya sel'skokhozyaistvennogo proizvodstva v usloviyakh tsiklicheskikh kolebanii [Theoretical and methodological aspects of forecasting agricultural production in conditions of cyclical fluctuations]. *Vestnik Kemerovskogo gosudarstvennogo sel'skokhozyaistvennogo instituta* [Bulletin of Kemerovo State Agricultural Institute], 2014, no. 5, pp. 204-216. [in Russian].
5. Valdaitsev S.V. *Ekonomicheskoe obosnovanie tempov nauchno-tekhnicheskogo progressa* [Economic justification of the rate of scientific and technological progress]. Leningrad: Izdatel'stvo LGU im. A.A. Zhdanova, 1984. 176 p. [in Russian].
6. Demchuk M.I., Yurkevich A.T. Sistemnaya metodologiya innovatsionnoi deyatel'nosti [System methodology of innovation activity]. Minsk: RIVSh, 2007. 289 p. [in Russian].
7. Dynkin A.A. Mirovoi krizis – impul's dlya razvitiya innovatsii [Global crisis – an impetus for the development of innovation]. *Problemy teorii i praktiki upravleniya* [Issues of management theory and practice], 2009, no. 4, pp. 8-15. [in Russian].

8. Kondratiev N.D., Yakovets Yu., Abalkin L. *Bol'shie tsikly kon"yunktury i teoriya predvideniya* [Long cycles of economic conjuncture and the theory of foresight]. Moscow: Ekonomika, 2002. 764 p. [in Russian].
9. Kostyaev A.I. *Politika regional'nogo razvitiya APK s uchetom uslovii chlenstva Rossii v VTO: materialy Mezhdunarodnoi nauchno-prakticheskoi konferentsii "Aktual'nye voprosy ekonomiki i upravleniya APK"* [Policy for regional development of the agro-industrial complex taking into account the conditions of Russia's membership in the WTO: materials of the International research-to-practice conference "Topical issues of economics and management in the agro-industrial complex"]. Ryazan, 2013. Pp. 7-11. [in Russian].
10. Marx K., Engels F. *Kapital. Sochineniya* [Capital. Writings]. 2nd edition. Moscow: Izdatel'stvo politicheskoi literatury, 1955–1974. Vol. 25. Part 1. Pp. 94-95. [in Russian].
11. Medvedeva N.A. *Metodologiya stsenarnogo prognozirovaniya razvitiya ekonomicheskikh sistem* [Methodology for scenario forecasting of development of economic systems] Vologda–Molochnoe: ITs VGMKhA, 2015. 200 p. [in Russian].
12. Nabokov V.I., Lyamina T.M., Gorbunova O.S. Innovatsionnaya deyatel'nost' organizatsii zhivotnovodstva regiona i chelovecheskii kapital [Innovation activity of animal husbandry organizations in the region and human capital]. *Agrarnyi vestnik Urala* [Agrarian bulletin of the Urals], 2015, vol. 132, no. 2, pp. 91-93. [in Russian].
13. Orlov V.I. *Traktat o vdokhnovenii, rozhdayushchem velikie izobreteniya* [A treatise on the inspiration that gives birth to great inventions]. Moscow: Znanie, 1980. 336 p. [in Russian].
14. Sandu I.S. Ekonomicheskie aspekty realizatsii innovatsionnykh proektov v agropromyshlennom komplekse [Economic aspects of implementation of innovation projects in the agro-industrial complex]. *Prikladnye ekonomicheskie issledovaniya* [Applied economic research], 2015, no. 1, pp. 43-46. [in Russian].
15. Uskova T.V., Selimenkov R.Yu., Anishchenko A.N. *Monitoring funktsionirovaniya sel'skogo khozyaistva Vologodskoi oblasti: zaklyuchitel'nyi otchet o NIR* [Monitoring of the functioning of agriculture in the Vologda Oblast: the final research report]. Vologda: ISERT RAN, 2012. 70 p. [in Russian].

Information about the Authors

Natal'ya Aleksandrovna Medvedeva – Ph.D. in Economics, Associate Professor, Vice-Rector for Education, Vologda State Dairy Farming Academy named after N.V. Vereshchagin (8, Mira Street, Molochnoye Rural Settlement, Vologda, 160555, Russian Federation, named35@mail.ru)

Valentin Alekseevich Bil'kov – Doctor of Agricultural Sciences, Associate Professor, Vologda State Dairy Farming Academy named after N.V. Vereshchagin (8, Mira Street, Molochnoye Rural Settlement, Vologda, 160555, Russian Federation, valentinbilkov@gmail.ru)