

MECHANISM TO ANALYZE ECONOMIC RELIABILITY OF THE INNOVATIONAL POTENTIAL OF AIRCRAFT ENTERPRISES

Aleksandr Nikolaevich Troshin^{*}, Anna Anatolievna Burdina^{*},
Nataliya Valerievna Moskvicheva^{*}, Elena Nikolaevna Nikulina^{*},
Elena Vladimirovna Tarasova^{*} and Tatiana Mikhailovna Rogulenko^{**}

Abstract: *This research analyzes approaches to estimating the innovational potential of enterprises. It gives authors' interpretations of such notions as the innovational potential default and reliability of the innovational potential. Methodological tools to analyze the innovational potential of enterprises taking into account the specificity of aircraft enterprises have been developed. A conceptual model of estimating the economic reliability of the innovational potential has been offered. Its essence is in taking into account structural and functional relations of aircraft enterprises. It is recommended to apply the offered model for analytical superstructure of management to increase the efficiency of management solutions on implementing industrial projects on the strategic, tactical and operative levels of planning taking into account organizational structures and peculiarities of business processes at industrial enterprises.*

Keywords: *Integrational structures, import substitution, innovational potential, default of the innovational potential, economic reliability of the innovational potential.*

1. INTRODUCTION

In many countries large integrational processes in economy caused the formation of global enterprises. State programs related to developing the aircraft industry have been developed. The basic idea of the programs is to create unified integrational structures with a high innovational potential to implement large system-forming projects. Tasks of the aircraft enterprises integration are the establishment of global corporations in the context of globalization, import substitution, promotion of aircraft products on internal and external markets, joint implementation of all stages of large industrial projects, and improvement of the Russian aircraft enterprises competitiveness (The Law "On State Regulation of Aviation Development"). However, an economic mechanism to analyze the innovational potential is required for enterprises to efficiently integrate. Besides, in order to select enterprises

* Moscow Aviation Institute (National Research University), 125993, Russia, Moscow, Volokolamskiy Highway, 4

** State University of Management, 109542, Russia, Moscow, Riazanskiy Avenue, 99

participating in the project and forming an integrational structure, there is a need to analyze economic reliability of the innovational potential (Troshim, et. al. 2013). The enumerated circumstances stipulate the urgency of the demand for this research.

On the other hand, the process of estimating the economic reliability of the innovational potential is restrained by methodological, regulatory, informational, and organizational reasons. Insufficient consideration of these issues in references stipulates the need to deepen scientific researches in this area.

The most important aspects of estimating the innovational potential were stated in works of Russian and foreign authors (G. Van Horn, A. Shlafer, R. Coze, G. Kleiner, A. Liebman, Yu. Golikova, A. Makarian, E. Savoskina, E. Dracheva et al.). Works of such researchers as S. Vinokurova, R. Timofeev, M. Kvint, S. Sokolov, S. Nysanova, A. Gusakova, A. Korostelev, S. Veremeenko, V. Koziy et. al. are devoted to analyzing economic reliability. In spite of considerable contribution of researchers to the development of issues related to analyzing the innovational potential and estimating the economic reliability, the level of mastery of problems in this area as applied to the aircraft industry of the Russian Federation remains low. Thus, the analysis of various researches showed insufficient consideration of the issues related to analyzing the innovational potential in the aircraft industry in terms of methodology on the basis of estimating the economy reliability that are both theoretically and practically important for a wide range of specialists. It proves the theme urgency.

The goal of the research is to develop an economic mechanism to analyze the reliability of the innovational potential of aircraft enterprises that contributes to implementing system-forming industrial projects.

2. METHODS

The methodological basis of the research includes provisions of the economic theory, production, innovational management, investment analysis, as well as national and foreign researchers' works on estimating the innovational potential and economic reliability. In order to solve the tasks of this research, system and value approaches, as well as methods of economic analysis were used.

The research methodology includes the following:

1. Researching the current state and tendencies of the development of industrial enterprises and problems of forming integrational structures in the aircraft industry in the context of globalization; giving the authors' interpretation of such notions as innovational potential and innovational potential default.
2. Revealing basic disadvantages in the approaches to estimating the innovational potential of aircraft enterprises on the basis of regulatory and methodic provision of the process related to forming integrational structures under the current

economic conditions, generalizations and analysis of the current practice in Russia and abroad.

3. Stipulating the need to develop the economic mechanism of analyzing the innovational potential of aircraft enterprises on the basis of the economic reliability estimation.
4. Developing methodic tools to analyze the economic potential of enterprises taking into account the aircraft industry specificity.
5. Developing the economic mechanism to analyze the reliability of the innovational potential of aircraft enterprises and its practical implementation.

The changes that have taken place in the Russian economy over the recent years, introduction of the import substitution strategy defined ways of the aircraft industry development. The State Program of Aircraft Industry Development up to 2025 provides the following (State Program of the Russian Federation “Development of Aircraft Industry for 2013-2025”):

- Increase in the revenues of the aircraft engineering industry up to RUB 1,775 bln.,
- Achieving 3.6% and 11.9% of the global market share in monetary terms in the civil and military segments of the aircraft engineering, respectively,
- Achievement of the labor capacity of industrial enterprises of the area in the amount of RUB 14,496 thous. per person per year,
- Increasing the profitability of sales according to the net profit of industrial enterprises of the aircraft engineering area to the level of 8.5%,
- Increasing the profitability of assets of industrial enterprises of the area to the level of 7.5%, and
- By 2025 the Share of Russian producers of airplanes in monetary terms will have been 3.2% and 10.9% in the civil and military aircraft engineering, respectively, 12.0% and 16.5% - in helicopters production, 4.4% and 5.4% - in aggregates production, 1.4% and 12.9% - in production of aircraft engines, and 10.9% and 21.0% in instrument engineering.

Russia intends to take active part in promising scientific researches in the area of aviation within international programs subject to urgent provision of needs in creating the technology advance on the part of the national aircraft engineering. The creation of the technology advance in the area of developing civil aircraft equipment assumes the achievement of the following target indicators by 2025 (it is impossible to do it without increasing the economic reliability of the innovational potential of aircraft enterprises) (State Program of the Russian Federation “Development of Aircraft Industry for 2013-2025”):

- Decrease in the accident risk - 7.0 times,
- Decrease in the level of noise by 25 EPNdB,
- Decrease in the NOx emission in relation to the ICAO 2008 standards by 65%,
- Decrease in the fuel consumption rate and CO2 emission by 45%, and
- Decrease in the cost factor related to the development and life cycle of BC by 15%.

In order to achieve the set tasks at Russian aircraft enterprises, it is necessary to firstly form, develop and implement the innovational potential. It means that there is the task to analyze the reliability of the innovational potential of aircraft enterprises to implement large system-forming projects.

The Great Soviet Encyclopedia defines the notion “potential” (from Latin “potential” - power) as available means, reserves, and sources that can be mobilized, put into operation, and used to achieve a specific goal, fulfill a plan, and solve a task; opportunities of an individual, society, and state in a specific area (Great Soviet Encyclopedia). There are a lot of works of national and foreign researchers devoted to this problematics. Table 1 shows the review of the existing points of view on the essence of the “innovational potential” notion.

Table 1
Review of Interpretations of the “Innovational Potential” Notion

<i>Innovational Potential IS</i>		
Fathutdinov, R. A. (2011)	This is a degree of the enterprise readiness to initiation and implementation of innovations.	Tool
Gukasian, G.M. (2007)	This is an ability of various areas of the national economy to manufacture science-driven products that comply with the requirements of the global market.	Factor
Lobova, S.V. (2014)	A system of final research and technical results, interrelating specialists, all required resources, as well as organizational forms of their interrelation that characterize opportunities of subjects of the research activity in the area of research and technical development and provide the innovational process in the industrial complex.	System

Thus, *the innovational potential* of the aircraft enterprise can be considered in terms of highly research and technical infrastructure of the production base, availability of certain subdivisions on research and development works, development of venture investment projects (development of new products, entering new sales markets, etc.), as well as the use of new approaches in managing the enterprise. It will provide economic reliability of the innovational potential. When estimating the economic reliability of the innovational potential of the aircraft enterprise, it is necessary to emphasize opportunities and perspectives of implementing new technologies in all areas of the enterprise activity (Skrypnik 2016; Badalova and

Shebarov, 2011). The conducted analysis showed that the developing industrial aircraft enterprises had various levels of the innovational potential. Consequently, it is reasonable to introduce the hypothesis of the minimum value of the potential (default).

Default of the innovational potential is a state of the enterprise when technical and economic indicators that characterize the innovational potential have the minimum values.

In the economic literature there is no single opinion among researchers about the notion of “economic reliability” and its estimation. A number of specialists understand economic reliability as a process, i.e. the creation of such organizational conditions of the system functioning and development when “possibilities of production failure from the established rhythm would be entirely eliminated or reduced to the minimum for achieving the maximum production results with the minimum expenditures of resources” (Polovko and Gurov, 2006).

Besides, other authors offer to interpret the economic reliability as an economic state of the organization that provides efficient use of resources of the enterprises, and content all parties in interest in the context of a specific economic risk (Korshunova and Ilicheva, 2012; Melik-Aslanova and Moskvicheva 2015; Nikulina and Tarasova, 2014).

The disadvantage of the above definitions is that research does not emphasize the components of economic reliability that are required and efficient to implement system-forming projects, and does not offer methods and methodologies of their estimation.

This research **interprets economic reliability of the innovational potential of the aircraft potential** as a probability of the stability (failure-free) of functioning of the innovational and technological component of its economic activity to implement large important system industrial projects.

Components of economic reliability of the innovational potential of aircraft enterprises are characterized by a number of indicators. Thus, a comprehensive estimation of the economic reliability must be a simultaneous and agreed study of the aggregate of indicators that are characteristic of the innovational potential of the aircraft industry and contain generalized conclusions about the results of activity (Somina 2005). In order to analyze economic reliability of the innovational potential of aircraft enterprises, it is recommended to use basic provisions of the reliability theory.

3. METHODOLOGY

Analysis of approaches to estimating the innovational potential: There are Russian and Western methodologies to estimating the innovational potential. If we mean international experience of estimating innovations at enterprises, the

basic document that regulates the order of such estimation in the OECD countries is the Oslo Manual. The Oslo Manual offers a system approach when estimating the innovational process at enterprises. It is integrated in the general approach to estimating economic efficiency and other methodologies of the Frascati Family. This manual divides all innovations of the enterprise into 4 basic types (OECD, 2005):

- Product innovations,
- Process innovations,
- Organizational innovations, and
- Marketing innovations.

Figure 1 shows the general scheme of all existing approaches in issues related to estimating innovations at enterprises.

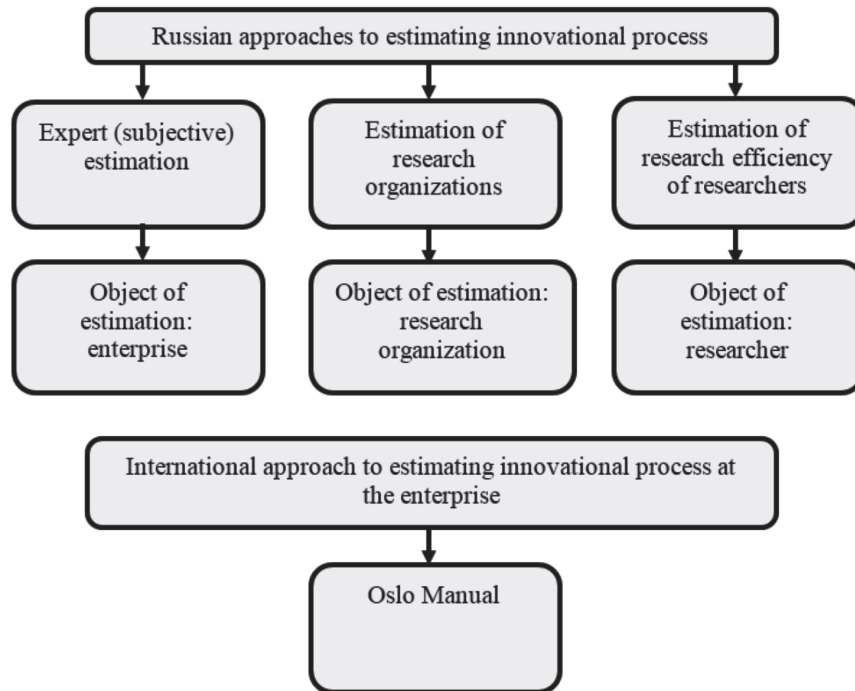


Figure 1: Current Approaches to Estimating Innovational Activity

The conducted analysis of the references and practical situation shows that the aircraft enterprise and its subdivisions, as well as all elements of the production and economic system are developed through the development and implementation of the innovational potential. Selection and implementation of the innovational strategy depends on the state of the innovational potential. That is why the estimation of its economic reliability is very important.

The innovational potential of the enterprise may develop only subject to the development of all its subdivisions, as well as all elements of the production and economic system. That is why, in order to estimate the innovational potential, it is necessary to make a thorough analysis or diagnostics of the internal environment of the organization. The internal environment of the aircraft enterprise consists of the elements that form its production and economic system. For the analysis to be convenient, these elements are usually grouped into the following blocks:

- Product (project) block – the area of the enterprise activity and its results in the form of products and services (projects and programs),
- Functional block – transformation of resources and management into products and services in the process of labor activity of employees of the aircraft enterprise (implementation of the intellectual potential),
- Resourceful block – a complex of material and technical, labor, informational and financial resources of the aircraft enterprise (implementation of the investment potential),
- Organizational block – an organizational structure, technology of processes related to all functions and projects, organizational culture, and
- Management block – general management of the organization, management system and style.

It is recommended to estimate the innovational potential according to the following scheme:

Resource → Function → Project

Herewith, Project means the issue and sale of a new product (service) or a new area of activity. The scheme of estimating the innovational potential of the organization when making a detailed analysis of the internal environment is as follows (Troshim, et. al. 2012):

- The standard model of the state of the organization innovational potential is described, i.e. those qualitative and quantitative requirements to the state of the potential for all blocks that provide the achievement of the set innovational goal are accurately determined,
- The actual state of the innovational potential for all above blocks and their components is defined,
- The non-coincidence of the standard and actual values of the potential parameters is analyzed, strong (corresponding to the standard) and weak (considerably varying from the standard) points of the potential are singled out, and
- A list of works related to strengthening weak points of the organization is made.

Terms limitations, non-availability of specialists who can make a system analysis, lack of the information about the organization (especially when analyzing the competitors' innovational potential) force to use diagnostic approaches to estimating the innovational potential of the organization. The diagnostic analysis requires certain skills and informational base. Available information characterizing various aspects of the company activity (for example, number of employees, average wage level, labor efficiency, product cost, products and services price, etc.) is used as diagnostic parameters. The scheme of the diagnostic analysis and estimation of the enterprise innovational potential includes the following stages (Troshim, et. al. 2012):

- Estimation of managing impacts,
- Estimation of the external environment,
- Keeping a catalogue of diagnostic parameters that characterize external manifestations (political, economic, social, etc.),
- Keeping a catalogue of structural parameters that characterize the internal state of the organization,
- Determining the interrelation of structural and diagnostic parameters of the system,
- Compliance with diagnostic parameters and processing of statistical data,
- Estimation of structural parameters, and
- Defining the integral estimation of the organization potential.

The parameters that characterize the innovational potential are usually divided into two groups: indicators that define the innovational activity of the enterprise, and indicators that characterize potential opportunities of the enterprise. It is possible to classify the indicators that characterize the innovational activity of the organization and its innovational competitiveness into the following groups: cost-based, temporal, indicators of updatability and structural (Troshim, et. al. 2012; Burdina 2007).

Cost-based indicators are the following:

1. Expenses for research and development in the volume of sales that characterize the indicator of the products research intensity,
2. Expenses for acquiring licenses, patents and know-how,
3. Expenses for innovational projects, and
4. Availability of funds for the initiative development.

Indicators that characterize the dynamics of the innovational process are the following:

1. TAT innovativeness indicator,
2. Duration of the process related to developing a new product (new technology),
3. Duration of preparing a new production, and
4. Duration of new production cycle.

Indicators of updatability are the following:

1. Number of development or implementations of product and processes novelties,
2. Indicators of the dynamics related to updating the product portfolio (ratio of the product that has been produced for 2, 3, 5 and 10 years),
3. Number of the acquired (transferred) new technologies (technical achievement),
4. Volume of the exported innovational products, and
5. Volume of the provided new services.

Structural indicators are the following:

1. Composition and number of research, developing, and other research and technical structural subdivisions (including experimental and testing complexes),
2. Composition and number of joint enterprises involved in using a new technology and creating new products,
3. Number and structure of the employees involved in research and development, and
4. Composition and number of the creative initiative temporary brigades and groups.

The indicators that display the expenses for research and development in the volume of its sales and number of research and technical subdivisions are used most often. TAT innovativeness indicator is widely used. It derives from a phrase "turn-around time". It means the time since cognizing the need or demand for a new product till the moment it is supplied to the market. Other indicators are used less often, for example, structural indicators that show the number and character of innovational subdivisions. Such indicators are usually found in special analytical reviews. When estimating the innovational activity, it is necessary to have a basis for comparing. The specified indicators of enterprises that are leaders in this are in the region, country or world-wide are used as such basis.

The feasibility of the innovational project is based on the results of the most important resources estimation. It is essential for the need to make the project comply with all financial, research and technical, technological, production, personnel, ecological and other limitations that arise when implementing it. The goal of the estimation of the project feasibility is to define the degree of the balance between works and research and technical measures and the forecasted opportunities related to their performance in the context of the current limitations.

In order to analyze the innovational potential, researchers offer the following indicators (Troshim, et. al. 2012; Korshunova and Ilicheva, 2012; Nikulina and Tarasova, 2014). We will settle on the content of every indicator in more details.

Economic safety indicator must characterize the stability of the enterprise in terms of its financial and resourceful potential. Herewith, it is necessary to emphasize the fact that the internal stability of science-driven productions of the aircraft cluster is extremely low because their activity is related to a high risk and cyclicity of development, and is characterized by the availability of a long-term temporal lag between the term of investing in the development and term of pay-off period and funds return. That is why when analyzing the economic safety indicator, it is reasonable to apply the normative approach in the long-term aspect. Coefficients of financial stability that define the long-term stability of reliability of the company; coefficients of the business activity that show how efficiently the enterprise uses its funds; and coefficients of the capital structure that characterize the degree related to protecting creditors who have long-term investments in the company (this indicator is especially important because it is possible to consider the state as the main investor of science-driven productions) were used for the estimation (Orlova 2014).

Technological safety indicator estimates the level of research, production and technological and marketing potential.

Intellectual attractiveness indicator characterizes the availability and level of intellectual potential of the company and science-driven productions, i.e. resources that are actually a part of the company capital are used by it in business, and define competitive advantages.

Social stability indicator estimates the level of life of the human capital of science-driven companies.

Then indicators are ranged as follows: if the indicator is within the values of the stable state (normal level of stability), it is assigned 1; if the indicator is within the partially stable state (critical level of stability) – 0.5; and if it is within the unstable state (crisis level of stability) – 0.

Table 2 shows indices within each of four indicators and their threshold values when estimating the level of productions development innovativeness (Troshim, et. al. 2012).

Table 2
Indicators of Stability of Science-driven Productions Development

<i>Indicator</i>	<i>Normal level of stability</i>	<i>Critical level of stability</i>	<i>Crisis level of stability</i>
<i>Economic Safety Indicator</i>			
Equity Ratio (equity-assets ratio)	1-0.8	0.79-0.6	<0.59
Current assets to equity ratio	1-0.7	0.69-0.4	<0.39
Ratio of long-term investments structure	0-0.3	0.31-0.5	>0.51
Financial stability index	1-0.8	0.79-0.5	<0.49
Return on assets	>10	9-1	<0.9
Factor of wear of basic production assets	<0.3	0.31-0.5	>0.51
Factor of intensity related to updating the basic production assets	>0.2	0.19-0.1	<0.09
Real level of production capacities loading	1-0.9	0.89-0.7	<0.69
Level of production profitability	>1	0.99-0.5	<0.49
<i>Technological Independence Indicator</i>			
Research intensity of production	>0.4	0.39-0.2	<0.19
Index of investing in research and development	>0.3	0.29-0.1	<0.9
Own patent protection	1-0.6	0.59-0.4	<0.39
Index of innovations acquisition	>0.6	0.59-0.4	<0.39
Profitability of commercial expenses	>1	0.99-0.5	<0.49
Indicator of dependence on external doers	<0.3	0.31-0.5	>0.51
<i>Intellectual Attractiveness Indicator</i>			
Research intensity of labor	>0.4	0.39-0.2	<0.19
Age level of research personnel potential	<45	From 46 to 55	>56
<i>Social Stability Indicator</i>			
Level of personnel stability	0-0.1	0.11-0.2	>0.2
Competence level	>0.3	0.29-0.1	<0.09
Compensation rate	>1	0.99-0.7	<0.69

Many foreign researchers note that the target indicators of the innovations estimation include those characterizing the degree of updating production factors and manufactured product, as well as reflecting the growth of competitiveness of production as a whole, and acceleration of the production process and relative economy of resources (Ferrer 2012).

They include the following:

- Indicators of using materials and raw materials per product unit,
- Indicators of labor efficiency and their change when moving from the development and implementation stage to the stage related to acquisition when producing,

- Indicators of the wage and labor ratio of products according to stages of the life cycle,
- Indicators of using working assets, and
- Indicators related to updating and using basic assets.

However, in the above approaches researchers do not analyze economic reliability of the innovational potential of the aircraft enterprise. It is not sufficiently stipulated. We think that in order to estimate economic reliability of the innovational potential of the aircraft enterprise, it is necessary to consider issues related to the impact of innovations on the final products. It is stipulated by the fact that the products innovativeness is a basic factor of the innovational activity of the enterprise and has a direct impact on the competitiveness of both the product and the developing aircraft enterprise as a whole. The conducted analysis of approaches to estimating the innovational potential of enterprises allows to single out the following stages of the methodology to analyze economic reliability of the innovational potential of the aircraft enterprise.

Mechanism to Analyze Economic Reliability of Innovational Potential

At the first stage of the methodology related to analyzing economic reliability of the innovational potential indicators that characterize the degree of the manifestation of the innovational potential at the aircraft enterprise are defined. Based on the analysis of the existing indicators of estimating the innovational potential of aircraft enterprises, a system of indicators was developed:

1. Indicator of the share of new technologies in the technologies used by the company.
2. Indicator of the share of innovational materials in the total number of materials (according to the nomenclature).
3. The indicator of the share of expenses for innovational materials in the total volume of expenses for materials.
4. Indicator of the share of innovational components in the total number of components (according to the nomenclature).
5. Indicator of the share of expenses for innovational components in the total volume of expenses for components.
6. Indicator of the share of innovational basic assets in the total number of basic assets (according to the nomenclature).
7. Indicator of the share of expenses for the innovational basic assets in the total volume of expenses for basic assets.

8. Indicator of the share of expenses for research and development in total expenses.
9. Indicator of the share of expenses for the implemented research and development in the total expenses.
10. Indicator of the share of expenses for the implemented research and development in the total expenses for research and development.
11. Indicator of the share of employees who are able to work with innovational technologies and by using innovational equipment as to the total number of employees.
12. Indicator of the share of manufacturing and other employees (rather than managers) who can work with innovational technologies and by using innovational equipment as to the total number of manufacturing and other employees.
13. Indicator of the share of employees who can work with innovational technologies and by using innovational equipment as to the total number of employees involved in innovational projects.
14. Indicator of the share of manufacturing and other employees (rather than managers) who can work with innovational technologies and by using innovational equipment as to the total number of manufacturing and other employees involved in innovational projects.
15. Indicator of the share of employees involved in innovational projects as to the total number of employees.
16. Indicator of the share of manufacturing and other employees (rather than managers) involved in innovational projects as to the total number of manufacturing and other employees.

It is recommended to apply the Bayes model (Mileris 2010; Bayes Bayes Theorem, 1763) to this group in the thesis, and define economic reliability of the innovational potential of the aircraft enterprise.

At the second stage of the methodology related to analyzing economic reliability of the innovational potential of the aircraft enterprise, every value of the indicator of the enterprises selection is arranged in ascending or descending orders depending on the impact on the innovational potential, and is subject to interval ranging. Every interval has a specific value of the rating point. The total number of points group is estimated by using the Sturges rule formula based on the selection volume (Gnedenko, et. al. 1965).

$$n_{\text{innov}} = 1 + 3.322 \times \lg N \quad (1)$$

where, n_{innov} is a number of points groups for the innovational potential,

N is a number of the enterprises under analysis in the selection.

The third stage calculates the total rating point using the following formula:

$$SE_{\text{innov}} = \sum_{i=1}^{16} E_{\text{innovi}} \quad (2)$$

where, SE_{innov} is a total rating point of the i indicator of the innovational potential, E_{innovi} is a rating point that corresponds to the value of the i indicator of the innovational potential of the aircraft enterprise.

The fourth stage of the estimation defines the rating for every interval from the selection.

The fifth stage of the methodology of the innovational potential uses the Bayes classifier for estimating the antecedent probability of the innovational default (Mileris 2010).

Based on the information obtained according to the results of the classification, antecedent probabilities of the innovational default is estimated. It can be done using the Bayes theorem for every value of the rating (Bayes Theorem, 1763):

$$P_{\text{innov}}(R_i | \text{Default}) = \frac{P_{\text{innov}}(\text{Default} | R_i) \times P_{\text{innov}}(R_i)}{P_{\text{innov}}(\text{Default})} \quad (3)$$

where, $P_{\text{innov}}(R_i | \text{Default})$ is the probability that the enterprise with the R_i value of the innovational rating will undergo the innovational default,

$P_{\text{innov}}(\text{Default} | R_i)$ is the probability that the enterprise that undergoes the innovational default will have the R_i rating,

$P_{\text{innov}}(R_i)$ is the probability that the enterprise will have R_i rating, and

$P_{\text{innov}}(\text{Default})$ is the probability of the innovational default.

The probability of the innovational default is calculated for every value of the innovational rating by using the above formula.

The sixth state estimates the economic reliability of the innovational potential of the aircraft enterprise by using the offered model. The closer the value of this indicator is to 1, the higher is the economic reliability of the innovational potential of the aircraft enterprise for implementing large and system-important projects:

$$N_u(\bar{X}^t) = e^{-P_u(\bar{X}^t)} \quad (4)$$

where, $N_u(\bar{X}^t)$ is the indicator of economic reliability of the innovational potential of the aircraft potential,

$P_u(\bar{X}^t)$ is the probability of the enterprise innovational default defined according to the Bayes model, and

\bar{X}^t is the vector of parameters that define the state of the aircraft enterprise at the t moment of time.

4. RESULTS AND DISCUSSION

The developed mechanisms related to analyzing the reliability of the innovational potential has been tested at two aircraft enterprises JSC “Ulan-Ude Aviation Plant” (U-UAZ) and JSC “Reduktor-PM” (Third-quarter 2015). Table 3 shows the rating interval of the innovational potential.

Table 3
Defining the Rating Interval for the Innovational Potential

Rating	A	BBB	BB	B	CCC	CC	C	D
Rating interval	[83; 95]	[71; 83)	[59; 71)	[48; 59)	[36; 48)	[24; 36)	[12; 24)	[0; 12)

The function related to allocating 40 enterprises of the selection according to ratings of the innovational potential has been formed. Figure 2 shows the allocation of aircraft enterprises according to rating groups.

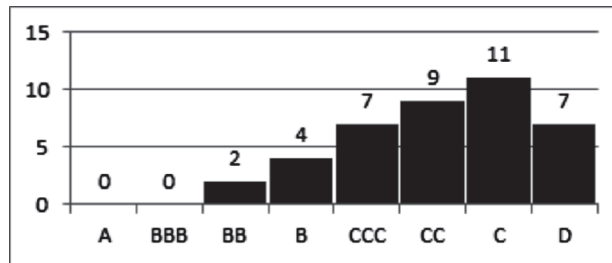


Figure 2: Allocation of Ratings of the Innovational Potential of Aircraft Enterprises in the Selection

We classify aircraft enterprises from the selection into eight rating groups (A-D) that include enterprises with a low level of the innovational default R and enterprises that are close to the innovational default N. Using the data about antecedent probabilities, we estimate the probabilities of the innovational default according to the ratings of enterprises on the basis of the Bayes classifier model. Based on the information obtained according to the results of the classification, we estimate the antecedent probability of the innovational default. Using the Bayes formula, we define the antecedent probability that the enterprise will suffer the innovational default. It will be the following for aircraft enterprises:

$$P_{\delta}(\text{Default}) = 0,425$$

The innovational default for the C rating will be:

$$P_{\delta C} = 24\%$$

Table 4 shows the results of estimating the antedecent probability (hereinafter referred to as the probability) of the innovational default.

Table 4
Estimating Probability of the Innovational Default for Aircraft Enterprises from the Selection

<i>Rating</i>	<i>A</i>	<i>BBB</i>	<i>BB</i>	<i>B</i>	<i>CCC</i>	<i>CC</i>	<i>C</i>	<i>D</i>
Probability of innovational default	0%	0%	0%	6%	12%	18%	24%	41%

As a result of the implemented mechanism, we have estimated the indicator of the economic reliability of the innovational potential for every enterprise. Table 5 shows the rating and indicator of the economic reliability of the innovational potential of the enterprises under analysis.

Table 5
Indicators of the Economic Reliability of the Innovational Potential of Enterprises

<i>Aircraft enterprises</i>	<i>JSC "Ulan-Ude Aircraft Plant"</i>	<i>JSC "Reduktor-PM"</i>
Rating of the innovational potential	CC	CCC
Probability of the innovational default	18%	12%
Indicator of the economic reliability of the innovational potential	0.84	0.89

The results of the conducted research contain theoretical and methodological, and scientific and practical results on the issues related to analyzing the innovational potential of aircraft enterprises on the basis of estimating economic reliability. As a result of the research, it has defined that at the present time the aircraft industry is undergoing the development of the innovational potential in accordance with the provisions of state programs related to developing the aircraft industry, and conditions of the global economy globalization. Besides, the analysis has shown that, along with specific positive changes achieved over the latest decade in the industry as a whole, there are still unsolved problems that have a system nature and require to be taken into account in methodologies to estimate the innovational potential. Such problems that are characteristic of the aircraft industry include the following:

- High level of tear and wear of basic assets of aircraft enterprises,
- Low sensibility to implementing innovations,
- Impossibility to implement large system-forming industrial projects without creating corporate establishments,
- Import substitution problems, etc.

This work gives the authors' interpretation of the notion "innovational potential default". The conducted analysis of interpretations of the "economic reliability of

the innovational potential” notion allowed to clarify this notion in this work. The authors think that in this research the interpretation of the economic reliability of the enterprise and integrational structure is peculiar of the probability of stability (failure-free) of functioning of the innovational and technological component of the economic activity of the enterprise to implement industrial projects.

The existing theoretical and practical approaches to analyzing the innovational potential and its reliability have been analyzed. The analysis of methods has shown that they do not take into account the risk of defaults of the innovational potential. It is offered to consider them as structural elements of the economic reliability indicator.

This work stipulated the mechanism of analyzing economic reliability of the innovational potential and practically implemented it at certain aircraft enterprises. The veracity of the results obtained by the authors is stipulated by using the data published in official issues of the Russian Federation, official reports of enterprises and organizations. It is proved by using the materiality guidelines (mathematical statistics).

5. CONCLUSION

The scientific novelty is represented by the following basic provisions and results:

On the basis of studying the regulatory, methodological and methodic provision, analysis of the current Russian and foreign practice, the authors give their interpretation of the notion “innovational potential in the aircraft industry”. Its peculiarity is the target focus on implementing large industrial projects in accordance with the requirements of state development programs. The notion “economic reliability” is clarified. Unlike famous definitions, it is based on the principle of division, and takes into account the risk of the innovational and technological default.

Methodical tools to analyze the innovational potential of industrial enterprises taking into account the specificity of the aircraft industry have been developed. They allow to account non-linear dependence of the innovational failure (default) on factors that to the greatest degree reflect peculiarities of large aircraft enterprises functioning. This provides a higher accuracy of the estimation as compared to the existing models.

The conceptual model of estimating the economic reliability of the innovational potential has been developed. Its novelty is in defining the level of the innovational and technological failure (default) taking into account the specificity of aircraft enterprises. It allows to select enterprises to enter the integrational structure in order to implement industrial projects.

The research is theoretically important due to the development of the theory related to organizing, managing large industrial enterprises and integrational structures, as well as the theory of estimating the economic reliability.

The research is practically important due to the possibility to use the developed methodical tools as the methodic provision and recommendations by specialists of industrial enterprises when developing and taking management decisions focused on large industrial projects.

Acknowledgements

The team of authors expresses their acknowledgement to specialists of the Financial Management Faculty of the Moscow Aviation Institute for the essential participation in the research and constructive review of the results.

References

- Badalova, A.G. and A.I. Shebarov, (2011). Organizatsionnoe upravlenie strategicheskim innovatsionnym razvitiem aviatsionno-promyshlennogo kompleksa [Organizational Management of Strategic Innovational Development of the Aircraft and Industrial Complex]. Bulletin of the Moscow Aviation Institute, 18 (3): 315-321.
- Bayes Theorem, (1763). Date Views 10.08.2016 https://en.wikipedia.org/wiki/Bayes%27_theorem.
- Bolshaya Sovetskaya enciklopedia [Great Soviet Encyclopedia]. (1969-1978). In Prohorov A.M. (Eds.). Moscow: Soviet Encyclopedia, pp: 1575
- Burdina, A.A., (2007). Metodologiya upravleniya konkurentosposobnostiyu rossiyskih promyshlennyh predpriyatiy [Methodology to Manage Competitiveness of Industrial Enterprises]. Thesis of D.Ph. in Economics, Moscow Aviation Institute Moscow, pp: 392.
- Fathutdinov, R.A., (2011). Innovatsionny menedgment [Innovational Management]. Saint-Petersburg: Peter, pp: 448.
- Ferrer, R.C., (2012). An Empirical Investigation of the Effects of Merger and Acquisition on Firms' Profitability. Academy of Accounting and Financial Studies Journal, 16 (3): 31-55.
- Gnedenko, B.V., Yu.K. Beliaev and A.D. Solovyov, (1965). Matematicheskie metody v teorii nadezhnosti [Mathematical Methods in Reliability Theory]. Moscow: Nauka, pp: 524.
- Gukasiyan, G.M., (2007). Ekonomika on A do Ya [Economy from A to Z]. Moscow: INFRA-M, pp: 455.
- Korshunova, E.D. and E.S. Ilicheva, 2012. Upravlenie innovatsionnym potentsialom promyshlennogo predpriyatiya: konceptualnye osnovy, etapy upravleniya, metod otsenki [Managing the Innovational Potential of the Industrial Enterprise: Conceptual Basics, Management Stages, and Estimation Method]. Research Journal of the KubSAU, 81(07), Date Views 10.08.2016 <http://ej.kubagro.ru/a/viewaut.asp?id=2261>.
- Lobova, S.V., (2014). Formirovanie i ispolzovanie trudovogo potentsiala v regionah [Formation and Use of Labor Potential in Regions]. Bulletin the SUU University, 10: 225-229.
- Melik-Aslanova, N.O. and N.V. Moskvicheva, (2015). Analiz osobennostey modernizatsii proizvodstvennyh moshchnostey predpriyatiy aviatsionnoy promyshlennosti [Analysis of

- Peculiarities Related to Modernizing Production Capacities of Aircraft Enterprises]. *Bulletin of the Moscow Aviation Institute*, 2 (4): 208-213.
- Mileris, R., (2010). Estimation of Loan Applicants Default Probability Applying Discriminant Analysis and Simple Bayesian Classifier. *Economics and Management*, 15: 1078-1084.
- Nikulina, E.N. and E.V. Tarasova, (2014). Tehnologiya kommercheskoy i innovatsionnoy otsenki investitsionnykh proektov v aviatsionnoy otrasli [Technology of Commercial and Innovational estimation of Investment Projects in Aircraft Industry]. *Bulletin of the Rybinsk Soloviyov State Aviation Technological University*, 1 (28): 151-157.
- OECD (2005) *Oslo Manual: Guideline for Collecting and Interpreting Innovation and Data*. Paris: OECD, p. 108.
- Orlova, L.N., (2014). Problemy otsenki investitsionnoy privlekatelnosti ekonomicheskikh subjektov na razlichnykh urovnyakh hoziaystvovaniya [Problems Related to Estimating Investment Attractiveness of Economic Subjects on Various Levels of Economic Activity]. *Science Studies*, 4 (23): 106.
- Polovko, A.M. and S.V. Gurov, (2006). *Osnovy teorii nadezhnosti [Basics of the Theory]*. Saint-Petersburg: BHV-Petersburg, pp: 702.
- Skrypnik, I.V., (2016). *Razrabotka organizatsionno-ekonomicheskogo mehanizma formirovaniya korporativnogo obrazovaniya [Development of Organizational and Economic Mechanism to Form Corporate Education]*. Thesis of D.Ph. in Economics, Moscow State University of Technology „STANKIN“, Moscow, pp: 190.
- Somina, I.V., (2005). *Innovatsionnaya komponenta ustoychivosti funktsionirovaniya promyshlennogo predpriyatiya [Innovational Component of Stability related to Industrial Enterprises Functioning]*. Thesis of D.Ph. in Economics, Belgorod State Technological University named after V.G.Shoukhov, Belgorod, pp: 169.
- State Program of the Russian Federation “Development of Aircraft Industry for 2013-2025”. Date Views 10.08.2016 docs.cntd.ru/document/499091776.
- The Law “On State Regulation of Aviation Development” of 08.01.1988 No. 10-FZ.
- Third-quarter 2015 Global Aerospace and Defense Industry Mergers and Acquisitions Analysis, (2015). Date Views 08.03.2016 www.pwc.com/us/en/industrial-products/publications/assets/pwc-aerospace-defense-industry-mergers-acquisitions-q3-2015.pdf.
- Troshim, A.N., V.I. Fomkina and N.V. Moskvicheva, (2013). *Voprosy ekonomicheskogo obosnovaniya processov reorganizatsii predpriyatii aviatsionnoy promyshlennosti [Issues of Economic Stipulation of Processes Related to Reorganizing Aircraft Enterprises]*. Moscow: MAI Publishing House, pp: 177.
- Troshin, A.N., Burdina, A.A. and D.V. Razzhevaykin, (2012). *Tehnologiya otsenki innovatsionnoy aktivnosti predpriyatii aviatsionnoy otrasli [Technology of Estimating Innovational Activity of Aircraft Enterprises]*. Moscow: MAI Publishing House, pp: 176.

