# STRATEGIC SECURITY ASSESSMENT MODEL FOR INNOVATION PROJECTS IN THE AVIATION INDUSTRY

**Boris Alekseevich Gorelov, Moscow Aviation Institute (National Research University)**
**Anna Anatolyevna Burdina, Moscow Aviation Institute (National Research University)**
**Anna Viktorovna Bondarenko, Moscow Aviation Institute (National Research University)**
**Natalia V. Moskvicheva, Moscow Aviation Institute (National Research University)**

## ABSTRACT

*This paper shows the vital foundations of the development of industrial high-tech enterprises in the aviation industryand substantiates the problems of analyzing the strategic security of innovative projects in the aviation industry. Based on the study of the legal and methodological support of the process of evaluating the effectiveness of projects in modern economic conditions, generalizations and analysis of existing practice in Russia and abroad, the main shortcomings in approaches to assessing the effectiveness of innovative projects. A model has been developed for assessing the strategic safety of structural elements of an innovative project to create high-tech products in the aviation industry, taking into account the specifics of the industry. The practical implementation of the model has been carried out, which proves the hypothesis of the study.*

**Keywords:** Enterprise Resource Planning System, Cloud Data Processing Technologies, Big Data, Strategic Project Security, Conceptual Model.

## INTRODUCTION

The production system is exposed, among others, to systemic international force majeure risks, for example, the coronavirus COVID-19 pandemic caused by the SARS-CoV-2 coronavirus. In difficult isolation conditions, enterprises and in the post-isolation period need to ensure the reproduction process, to maintain the competitiveness of products. There are real problems with the supply of materials, components from other countries. Particularly relevant is the question of improving the mechanisms for evaluating innovative projects with the purpose of considering in the methods of analysis of the systemic and crisis conditions for the implementation of projects. Sustainable development of Russian aviation industry (AI) enterprises in systemic crisis conditions, under conditions of sanctions regimes is possible only with the creation of Russian construction materials and advanced technologies, the creation of high-tech (HT) types of aviation products in the Russian Federation (RF). These factors contribute to improving the technological safety of the AI of the RF. It is possible to solve the problem of strategic development of the industry and improving the technological security of the



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AI of the RF on the basis of a unified state development strategy, bringing the organizational and production system of each individual enterprise in line with the real needs of the domestic and world markets for the production of HT aviation products. Currently, the HT AI is implementing many system-forming technologically complex innovative projects that are strategic for the industry and the country.

In this paper, strategic security is proposed to be considered in the economic aspect, which accumulates the effects of all the above types of security. The issues of economic security are devoted to the work of such domestic scientists as Asfatullin (2007); Goncharenko (2018); Manakhova (2019); Rukinov (2016).

With the growing number of innovative projects in the field of AI requiring state support and limited financial resources, the task of developing criteria for selecting the highest priority ones, considering the specifics of the industry and developing appropriate software using cloud and fog technologies, becomes urgent. The methodologies for evaluating an IP existing in theory and practice are based on world-wide approaches to assessing project performance, primarily modeling cash flow, scenario forecasting of the market environment and other external factors, achieving the required rate of return, and considering the uncertainty and risks associated with the implementation of the project. However, in world practice there is no model for assessing the strategic security of an IP in the AI.

Research hypothesis: in the process of evaluating the effectiveness of innovative projects, especially in sectors that are significant for the state, for example, in the aviation industry, it is necessary to take into account the level of strategic security of projects. The indicator of strategic security of innovative projects should take into account the degree of use of materials, technologies, and components of a new generation in the project. The effect of such projects is proposed to be considered in the context of the development of social, technological, material and technical, informational components of the activities of enterprises and the state.

## MATERIALS AND METHODS

In theory, methods for assessing the economic efficiency of projects are divided into two main groups: static and dynamic, which considering the influence of the time factor and form the basis of the theory of discounted cash flow. These criteria are presented in more detail in the order of the Ministry of Economic Development of Russia dated 12/14/2013 No. 741 with the latest amendments (Bondarenko et al., 2019). In the practice of evaluating the effectiveness of investment projects of a group of oil and gas and petrochemical organizations of the Russian Federation, there is a methodology based on an integrated indicator that includes the following characteristics of the economic efficiency of a project (Bondarenko et al., 2019):

$R$ – Total project risk (%),
$\sum CF_0$ – Total undiscounted cash flow from operating activities;
$\sum CF_i$ – Total undiscounted cash flow from investing activities;
$PPD$ – Discounted payback period;
$N$ – Planning horizon.

Using these basic parameters, the integral indicator of project efficiency is determined F:



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$$F = (1 - \frac{R}{100\%}) * \frac{\sum CF_0}{\sum CF_i} * (1 - \frac{PPD}{N}),$$

$F$ is an integrating efficiency indicator of commercial project.

The most attractive investment project is considered with a maximum value of $F$ . This criterion is considered for commercial projects. If a comparison of investment projects by the value of the $F$ indicator is not possible (for example, for two projects the value of F is the same), then the following lower order (from the list) criterion, etc., is applied to carry out the ranking procedure, as long as the priority of one project over others will not be justified.

A well-grounded approach to identification, analysis of factors for the implementation of an IP in the AI, which is peculiar to implement them in a wide cooperation of enterprises, will make it possible to achieve the maximum possible efficiency of projects by increasing the value of the level of development of human, technical, technological, material, service potentials, and, therefore, restore and to develop the competencies of the domestic AI in the field of technologies for the production of aviation products (including such the final product as an aircraft), ensure the national security of the country, comprehensively develop the industry. Thus, we think that it is necessary to supplement the system of criteria for evaluating the effectiveness of an IP by analyzing the strategic security of the project in the AI. This analysis is based on the definition of a comprehensive indicator of strategic security. At the stage of developing innovative projects, this approach will make it possible to assess the level of development of the existing key resource and production base (for example, the correspondence of the level of development of materials to the available processing technologies and the qualifications of personnel working with these resources) and to increase the value of the projects due to management decisions. Also, this approach will allow managers and developers of an IP to justify the state bodies of the RF the need for their participation in its financing.

In the study, the strategic security of an IP of an industrial enterprise is considered as a complex indicator characterizing the state of security of an IP and its ability to produce a certain effect in accordance with the development strategy of a HT industry. The strategic security of an IP is determined on the basis of determining the SS of the structural elements of a project to create HT products. We consider it expedient for project managers, who form a business plan and strategy for implementing an IP, to consciously determine not only the commercial effectiveness of the projects (if any), but also their strategic security.

The strategic security of an innovative project of an industrial enterprise forms the interconnection of four critical parameters (component) (Bondarenko & Burdina, 2019a, 2019b):

- The material potential of the project, characterized by the level of development of material security of the IP;
- Technical and technological potential, characterized by the level of development of technical and technological security of the IP;
- Personnel potential, characterized by the level of development of personnel support for the security of the IP - both the top management of the project and the industrial and production main and auxiliary personnel;
- Service potential, characterized by the level of development of after-sales service (current and major repairs) to ensure the safety of an IP.



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A conceptual model was proposed for assessing the strategic security of an IP in the AI, which allows taking into account the degree of development of the above potentials. The general view of the logistic function is as follows:

$$f(x) = \frac{1}{1+e^{-x}},$$

Where:

$x$ – is a variable value.

Thus, the conceptual model for assessing the strategic security of the structural elements of the innovation project of industrial enterprises of the aviation industry has the following form:

$$SS_m(\overline{X^t}) = \frac{1}{1+e^{-K_m^{fa}(\overline{X^t})}},$$

$SS_m(\overline{X^t})$ – is the strategic safety indicator of the *m*- structural element of the final aviation product;

$\overline{X^t}$ – is the vector of parameters that determine the level of development of the strategic security potentials of the project at time t (personnel, technical and technological, material, service).

$K_m^{fa}(\overline{X^t})$ – is a comprehensive assessment of the m- structural element of the final aviation product at the stage of final assembly.

This model allows getting an integrated assessment based on the construction of rating expert ratings. The great importance in conducting expert assessments are the procedures for selecting experts, ranking indicators and processing results (Table 1). The weakening of the SS of the project is permissible only to some extent. The study allowed us to determine the ranges of values (threshold values) of the SS indicator of the structural element of the final aviation product and the IP as a whole, non-compliance with which impedes the effective implementation of the project and leads to an increase in the likelihood of negative and sometimes destructive trends in the field of strategic efficiency of the industry as a whole. Also, the model incorporates the considering of international force majeure risks by introducing a country risk coefficient for the production and assembly of the structural element of the final aviation product at various stages of production and assembly $CR_m$.

**Table 1**
**RANGES OF VALUES OF THE STRATEGIC SECURITY INDICATOR OF THE STRUCTURAL ELEMENT OF THE FINAL AVIATION PRODUCT AND PROJECT**

| Structural Safety Indicator Values | Project Strategic Security Indicator Values | Comment |
|---|---|---|
| $0,95 < SS_m(\overline{X^t}) \le 0,98$ | $0,60 < SS_{\text{project}}(\overline{X^t}) \le 0,63$ | The value of the indicator is high. |
| $0,88 < SS_m(\overline{X^t}) \le 0,95$ | $0,56 < SS_{\text{project}}(\overline{X^t}) \le 0,60$ | The value of the indicator is above average. |
| $0,73 < SE_m(\overline{X^t}) \le 0,88$ | $0,52 < SS_{\text{project}}(\overline{X^t}) \le 0,56$ | The value of the indicator is average. |
| $0,50 < SE_m(\overline{X^t}) \le 0,73$M | $0,50 < SS_{\text{project}}(\overline{X^t}) \le 0,52$ | The value of the indicator is low. |

Source: compiled by the authors



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Strategic security should be considered as the basis of a dynamic theory, where the time factor affects its changing parameters. To analyze and monitor the strategic security of the project, it is advisable to develop a module for the enterprise Enterprise Resource Planning (ERP) system. Thus, along with the modules of the operating unit covering the organization's activities to create products and services and the necessary functions to support these processes, it is proposed to implement an information-analytical submodule for analyzing the strategic safety of innovative projects of an industrial enterprise, thereby organizing conscious project planning. In most systems, the following groups of operating modules have formed (Kuhn, 1989; Chen et al., 2014):

a) The logistics units of the operational module: supply, relationship management with suppliers, supply chain and transportation management, inventory, warehouse, inventory management;
b) Operating unit manufacturing units: bill of materials (in discrete industries) and recipes (in process manufacturing), production planning, product accounting, production program management;
c) Supporting units of the operating module: maintenance and repair of equipment, capacity planning, transport management;
d) Sales units of the operational module: pricing, processing and configuration of orders, sales, distribution, after-sales service.

Recommended using a submodule of strategic security analysis of IP of industrial enterprises. To implement the functions of the recommended storage module). An online storage model in which data is stored on multiple servers distributed on a network. In contrast to the model for storing data on its own dedicated servers, purchased or leased specifically for such purposes, the number or any internal structure of the servers is not visible to the client, in general. Data is stored and processed in the so-called *"cloud",* which, from the point of view of the client, represents one large virtual server (Ryapukhin et al., 2019; Gorelov et al., 2018). Physically, such servers can be located remotely from each other geographically. This is especially actual for the aviation industry, as the aviation enterprises involved in the implementation of the IP are located in different cities or countries. The development of the new module is recommended to use computer-aided software engineering (CASE) technology, that is, a set of tools and software engineering methods for software design, which helps to ensure high quality programs, the absence of errors and ease of maintenance of software products. Also, CASE is understood as a combination of methods and means of designing information systems using CASE-tools.

The structural approach involves the decomposition (separation) of the task into functions that need to be automated. In turn, the functions are also divided into subfunctions, tasks, procedures. The result is an ordered hierarchy of functions and transmitted information between functions. Along with CASE technology, for designing a module for analyzing the strategic security of IP, it is necessary to use big data technology. Its essence lies in the systematization of structured and unstructured data of huge volumes and significant diversity, which are processed by horizontally scalable software tools.

## EMPIRICAL RESULTS

The practical implementation of the conceptual model for assessing the strategic security of an innovative project of an industrial enterprise using cloud storage technology was carried



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out on the example of the passenger aircraft MS-21-300. A fragment of the calculations is presented in Table 2.

**Table 2**
**STRATEGIC SAFETY ASSESSMENT OF THE MS-21-300 AIRCRAFT GLIDER**

| Airframe structural elements | Country risk factor for the production of purchased components | Weighted assessment of structural elements of a glider by a group of SS potentials | Comprehensive glider assessment | Comprehensive assessment of airframe components for a group of SS potentials |
|---|---|---|---|---|
| | 19 | | | |
| 1. Brackets, levers, flanges | 0.00 | 0.00 | 1.97 | 0.00 |
| 2. Power set design, bolts, rivets | 1.00 | 0.18 | | 1.90 |
| 3. Cockpit glazing | 1.00 | 0.17 | | 1.75 |
| 4. Interior trim for passenger compartment | 0.00 | 0.00 | | 0.00 |
| 5. Center wing and protective cover | 1.00 | 0.21 | | 2.09 |
| 6. Flap Mounting Units | 1.00 | 0.15 | | 1.59 |
| 7. Piping, hoses, gaskets, gaskets, shock absorbers | 1.00 | 0.09 | | 1.75 |
| 8. Heat and sound insulation | 1.00 | 0.10 | | 2.09 |
| 9. Fuel tanks | 1.00 | 0.15 | | 1.59 |
| 10. Fuselage glider | 1.00 | 0.33 | | 2.25 |
| 11. Floor glider | 1.00 | 0.00 | | 1.42 |
| 12. Sanitary equipment | 1.00 | 0.10 | | 2.00 |
| 13. Oxygen equipment | 1.00 | 0.10 | | 2.01 |
| 14. Fire system | 1.00 | 0.10 | | 2.00 |
| 15. Water supply and waste disposal system | 1.00 | 0.14 | | 2.83 |
| 16. Aircraft rescue equipment | 1.00 | 0.14 | | 2.83 |
| 17. Comprehensive assessment of the level of development of the SS potential of the airframe | - | - | | - |
| 1.8 Strategic Security Potential Weight | - | - | | - |
| 19. Comprehensive assessment of the strategic safety of the airframe | 1.97- 2 level of development (out of four) | | | |

Source: compiled by the authors

Thus, the study carried out the practical implementation of the conceptual model for assessing the strategic safety of the structural elements of an innovative project in the aviation industry using cloud and big data technologies, which showed a low level of strategic safety of the structural elements of the aircraft. The analysis revealed the project's bottlenecks and weaknesses and structural elements of the aircraft that were strategically ineffective for the innovation project, showed the high technological dependence of the Russian aviation industry



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on foreign components, quantified the low level of after-sales service, and the insufficient use of composite materials.

Authors suggest assessing a systemically significant HT innovation project using the SS indicator of the project, which considers the industry's development strategy, the effect of this project for the Russian AI and the level of development of the strategic security potentials of the project (personnel, technical, technological, material, service). Strategic security analysis is proposed to be carried out as a whole on an IP and individually for each of the structural elements of the final aviation product in accordance with the developed method. An actual and significant model for assessing the SS of an IP of industrial enterprises of the AI has been developed.

## CONCLUSION

Research hypothesis: in the process of assessing the effectiveness of innovative projects, especially in industries significant for the state, it is necessary to take into account the level of strategic security of projects. We believe that in modern conditions the strategic security of innovative projects of industrial enterprises of the country is of paramount importance.

A conceptual model has been developed for assessing the strategic safety of the structural elements of an innovative project for industrial enterprises of the aviation industry, characterized by the possibility of assessing in terms of the level of development: human, technical, technological, material, service potentials taking into account the specifics of aviation enterprises, as well as the technological safety of the project, which allows to clarify the procedure for evaluating the effectiveness project by creating a specific submodule in the enterprise ERP system. The feasibility of analyzing the strategic security of innovative projects is substantiated to improve the enterprise ERP system by introducing cloudy, foggy information technologies for data storage and processing, big data technologies. The proposed approach will mitigate possible global risks of emergency.

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## REFERENCES

Asfatullin, S.G. (2007). *The economic security of the country*. Jilem, Ufa.

Bondarenko, A.V. (2019). *The mechanism for evaluating the strategic effectiveness of a project to create high-tech products in the aviation industry*. The dissertation of candidate of economic sciences: 08.00.05, Moscow State Technological University STANKIN, Moscow.

Bondarenko, A.V., & Burdina, A.A. (2019a). Assessment method of the development level of personnel structural characteristics of the strategic project effectiveness to create high-tech products in the aviation industry. *Espacios*, *40*(42), 14.

Bondarenko, A.V., & Burdina, A.A. (2019b). Technology and structure of the development of personnel strategy of a project in the aviation industry. *International Journal of Recent Technology and Engineering*, *8*(3), 416-422.

Chen, M., Mao, SH., Zhang, Y., & Leung, V.C.M. (2014). *Big data. related technologies, challenges, and future prospects*. Spinger.



**Citation Information:** Gorelov, B.A., Burdina, A.A., Bondarenko, A.V., & Moskvicheva, N.V. (2021). Strategic security assessment model for innovation projects in the aviation industry. *Academy of Strategic Management Journal, 20*(6), 1-8.

Goncharenko, L.P. (2018). *Economic security: a textbook for universities. Series: Specialist*. Yurayt Publishing House, Moscow.

Gorelov, B.A., Davydov, A.D., Silaev, A.V., & Tikhonov, A. (2018). Models for managing the development of distributed technical systems. Proceedings of universities. *Mechanical Engineering*, *3*, 92-103.

Kuhn, D.L. (1989). Selecting and effectively using a computer aided software engineering tool. In *Annual Westinghouse computer symposium*, Pittsburgh, PA (USA), November 6-7, 1989. DOE Project.

Manakhova, I.V. (2019). *Economic security: A textbook for students in the specialty 38.05.01 Economic security*. Saratov Socio-Economic Institute (branch) REU named after G.V. Plekhanov, Saratov.

Rukinov, V.A. (2016). *Security: political and social aspects*. Conflict Development Fund, St. Petersburg.

Ryapukhin, A.V., Kabakov, V.V., & Zaripov, R.N. (2019). Risk management of multimodular multi-agent system for creating science-intensive high-tech products. *Espacios*, *40*(34), 19.



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