

# A synergetic approach to the development of the economic potential of the aviation complex enterprises

*Dmytro Bugayko*<sup>\*1</sup>, *Mykhaylo Podrieza*<sup>1</sup>, *Danylo Bugayko*<sup>1</sup>, *Anton Borysiuk*<sup>1</sup>, and *Sergey Yekimov*<sup>2</sup>

<sup>1</sup>National Aviation University, 1, Liubomyra Huzara ave., 03058, Kyiv, Ukraine

<sup>2</sup>Czech University of Life Sciences Prague, Kamycka 129, 16500, Praha - Suchdol, Czech Republic

**Abstract.** The potential of aviation enterprises makes it possible to increase the volume of development and production of aviation equipment, in particular: regional passenger and transport aircraft; aircraft engines and units; on-board radio-electronic equipment aimed at the use of satellite communication, navigation and observation systems; helicopters and general aviation aircraft, including unmanned ones; military goods and dual-use products. It is substantiated that the harmonization of the modern system of state regulation of the integration of the foreign trade sector of Ukraine into the EU should be carried out based on the fact that the parties have excellent reasons for forming an integration association. The consistent implementation of worldview and methodological procedures for maximizing the use of potential is, first of all, a tool for overcoming the low level of economic development, efforts through unification to create better conditions for the industrialization and development of aviation enterprises, the possibility of qualitative transformation of the foreign trade sector by attracting foreign investments and high technologies. This approach should contribute to the fundamental restructuring and diversification of export supplies, increase the opportunities to use positive development trends, and increase the level of international competitiveness of domestic economic entities. The results of the diagnostics of aviation enterprises made it possible to reveal the expediency of forming a new structure of interaction of enterprises and systematizing them into an aviation complex, which is considered as a set of organizations involved in the development, testing, production, sale, operation, modernization and repair of aviation equipment, which form several interconnected clusters.

## 1 Introduction

Each country has its own competitive advantages in the world market. One of the main advantages of Ukraine is many years of experience and a powerful material base of the aviation industry. Therefore, the development of the national aviation complex is a strategic priority of the country's development [1]. On November 11, 2020, the Decree of the

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\* Corresponding author: [bugaiko@nau.edu.ua](mailto:bugaiko@nau.edu.ua)

Cabinet of Ministers of Ukraine No. 1412-r "On the approval of the Concept of the State targeted scientific and technical program for the development of the aviation industry for 2021-2030" was published [2]. In fact, the government updated the provisions of the Strategy for the Revival of the Domestic Aircraft Industry until 2022, put into effect by the Order of the Cabinet of Ministers of Ukraine No. 429 dated May 10, 2018, and extended the terms of its implementation until 2030 [2]. The goal of the Strategy is to restore the stable development of the aircraft industry and ensure the profitability of high-tech production of aviation equipment in Ukraine [2]. The action plan of the Strategy provides for the modernization and production of passenger and transport aircraft of the Antonov family, Mil helicopters, unmanned aerial vehicles and import substitution of components. The comprehensive implementation of the Strategy will contribute to the technical re-equipment of the production capacities of aircraft manufacturing enterprises, the creation of modern centers for basic maintenance, the repair of domestically produced aircraft equipment and the certification of aircraft equipment according to international standards [2]. Among the priorities of innovative measures in the air transport market, it is proposed to create a state regional airline and equip it with a fleet of aircraft of the Antonov family of its own production [2, 5].

However, unfortunately, the beginning of the aggression had a negative impact on the prospects for the development of the aircraft industry. From the first days of the war, the flight test station of the Antonov State Enterprise was under enemy attack. As a result of the hostilities, many aircraft were destroyed and seriously damaged, including the unique *Mriya* aircraft, the business card of Ukraine. Unfortunately, the war continues, and the objects of the industry continue to be under the enemy's sights. But even under such conditions, we should not abandon the search for a new toolkit of a synergistic approach to the development of the economic potential of the enterprises of the aviation complex of Ukraine, as one of the factors of ensuring the sustainable development of the industry with an orientation to the future [5].

## 2 Literature Review

At the current stage, the strategic management of the development of air transport in Ukraine is created on the basis of the target institutions and tasks of the National Transport Strategy of Ukraine for the period until 2030 [3], the State Target Program for the Development of Airports for the period until 2023 [4], the concept of the State Target Scientific and Technical Program for the Development of the Aviation Industry for 2021-2030 [2].

The latest publications by authors were devoted to the following areas of research. Tsuzuki, R. (2022) devoted the publication to the development of automation technologies and artificial intelligence in the aviation industry [6]. Todd, D., & Simpson, J. (2019) conducted a comprehensive analysis of the global aviation industry [7]. Lin W, Lu J, Zhu J, Xu L. (2022) devoted research for the aspects of sustainable development and dynamic capabilities of China's aircraft leasing industry based on system dynamics theory [8]. Rawahi, S. H. A., Jamaluddin, Z. B., & Bhuiyan, A. B. (2020) identified a conceptual framework for resource management attributes and aircraft maintenance performance in the aviation industry in Oman [9]. Ho, G. T., Tang, Y. M., Tsang, K. Y., Tang, V., & Chau, K. Y. (2021) proposed a blockchain-based system to improve aircraft assembly tracking for inventory management [10]. Modelling risk factors for the defense system of the aircraft industry using interpretive structural modelling, interpretive ranking process and dynamics is proposed in Pitchaimuthu, S., Thakkar, J. J., & Gopal, P. R. C. (2019) [11]. Milambo, D., & Phiri, J. (2019) investigated supply chain management of aircraft spare parts for the aviation industry in Zambia based on a reference supply chain model [12]. Gallego-García,

S., Gejo-García, J., & García-García, M. (2021) developed a maintenance and spare parts distribution model to improve aircraft efficiency [13]. Yadav, D. K., Kulkarni, A., & Yao, H. (2022) conducted a comparative study of project management using traditional management methods and critical chain project management methodology in aircraft maintenance [14]. In the work of Gurina Ganna (2018), the main platform of transformation and adaptation of the general potential to the export potential of enterprises of the aviation complex of Ukraine was achieved [15]. In the work of Gurina Ganna, Serhiy Podreza and Nazarii Liskovich (2018), a conceptual understanding of the analysis of the potential of aviation complex enterprises in the process of development of a strategically important branch of Ukraine's economy was achieved [16].

Continuous systematic studies on the development of the safety management system of the developers and manufacturers of aviation equipment are provided by experts of the International Civil Aviation Organization (ICAO) [17-21], the Council of the Aerospace Industry Association (ICCAIA) [21], the European Aviation Safety Agency (EASA) [22, 23] and the EUROCONTROL [24]. A significant contribution to the process of aviation industry trends forecasting make leading manufacturers of the aviation industry Boeing [25] and Airbus [26]. The goals and objectives of the aviation industry are established taking into account the strategic goals of the national security of Ukraine, which are set forth in the Law of Ukraine "On the National Security of Ukraine" dated June 21, 2018 No. 2469-VIII [27].

The article is a logical continuation of a series of publications by the authors in the direction of the development of the aviation complex of Ukraine [1, 5, 28]. An unresolved part of the study is the clarification of the theoretical foundations of a synergistic approach to the development of the economic potential of aviation complex enterprises.

**The purpose of the article** is to determine the theoretical foundations of a synergistic approach to the development of the economic potential of the enterprises of the aviation complex of Ukraine in order to develop an effective toolkit for ensuring the sustainable development of the industry with an orientation to the future.

### 3 Methods

In the process of carrying out this scientific work, the following methods were used in the research process: system - for systematization of aviation complex enterprises ; terminological - to improve the terminological base of aviation complex by harmonizing the terminology with the standards of the world and regional levels of aviation regulation; systemic and structural - for the assessment of synergistic effects of aviation complex activity at the level of the national economy; comparative - to compare traditional and modern forms of activity of organizations and enterprises involved in the development of aviation complex activity; marketing research - when segmenting the market and evaluating the competitive advantages of aviation complex of Ukraine.

### 4 Results

In the implementation of the process of the synergistic approach, formulas based on deviations ( $x_{ij} - a$ ) and standardized variation range ( $x_{max} - x_{min}$ ) are used to determine the normative indicators of the aviation complex enterprises activity:

1) for stimulator indicators (the more, the better), the normalized  $U_i$  indicator is calculated as follows:

$$Y_{ij} = (X_{ij} - \min X_{ij}) / (\max X_{ij} - \min X_{ij}), \quad (1)$$

where  $Y_{ij}$  is the normalized  $i$ -th indicator in the  $j$ -th population;  
 $X_{ij}$  – the value of the  $i$ -th indicator in the  $j$ -th population;  
 $\min X_i$  – the minimum value of the  $i$ -th indicator;  
 $\max X_i$  is the maximum value of the  $i$ -th indicator.

That is, the greater is the actual value of  $X_{ij}$  within their range, the closer to 1 will be the value of  $Y_{ij}$ .

2) for disincentive indicators (the less, the better), which is calculated using the formulas:

$$Y_{ij} = (\max X_{ij} - X_{ij}) / (\max X_{ij} - \min X_{ij}) \quad (2)$$

The integral indicator for each component of the economic potential is calculated as the average value of the selected coefficients for a certain calendar period, which is due to the equivalence between all indicators of each group:

$$I_j = \frac{\sum y_{ij}}{n} \quad (3)$$

where  $y_{ij}$  is the normalized  $i$ -th indicator in the  $j$ -th population;  
 $n$  is the number of indicators of a certain group.

To calculate the integral indicator of the level of economic potential of the enterprise, it is necessary to determine the weighting coefficients for each component of the potential using the method of expert assessments (Table 1).

The integral indicator of the level of economic potential of the enterprise is calculated according to the formula:

$$I = \sum_{i=1}^n I_j \times r_j, \quad (4)$$

where  $I_j$  is the integral indicator of the  $j$ -th component of the economic potential;  
 $r_j$  is the weight of the  $j$ -th group of indicators.

**Table 1.** Weighting coefficients of the components of the general economic potential of the enterprise of the aviation complex (based on the expert method)

Constituents	Point assessment	Weighting coefficients
Production and technological	22	0,22
Labor	17	0,17
Financial	21	0,21
Marketing	14	0,14
Organizational and managerial	12	0,12
Sanitation	8	0,08
Strategic	6	0,06
Total	100 points	1

*(developed by the authors)*

For a qualitative assessment of the level of economic potential, we suggest using a system of classification features developed on the basis of the well-known Harrington scale, but slightly modified by the authors relative to the calculated data and available statistical information (Table 2).

The next stage of the synergistic approach is to determine the life cycle phase of the enterprise's economic potential. At the same time, not only the quantitative and qualitative

level of economic potential is important, but also the changes associated with the passage of time.

This is due to the fact that the same quantitative value can correspond to different phases, because the graphic form of the life cycle provides for the possibility of points with the same coordinates on the Y axis (level of economic potential) falling on different intervals of the curve and, accordingly, in different stages of the life cycle.

**Table 2.** The scale for evaluating the integral indicator of the level of economic potential of the enterprise

The interval of the integral indicator of the level of economic potential	The level of economic potential of the enterprise
[0; 0,2]	critical
(0,2; 0,37]	low
(0,37; 0,57]	acceptable
(0,57; 0,7]	sufficient
(0,7; 0,9]	high
(0,9; 1]	reference

*(developed by the authors)*

In order to solve the mentioned problem, it is suggested to take into account the general economic condition of the studied business entity. The proposed method is based on a score evaluation of the pace of changes in the main indicators of the enterprise's activity.

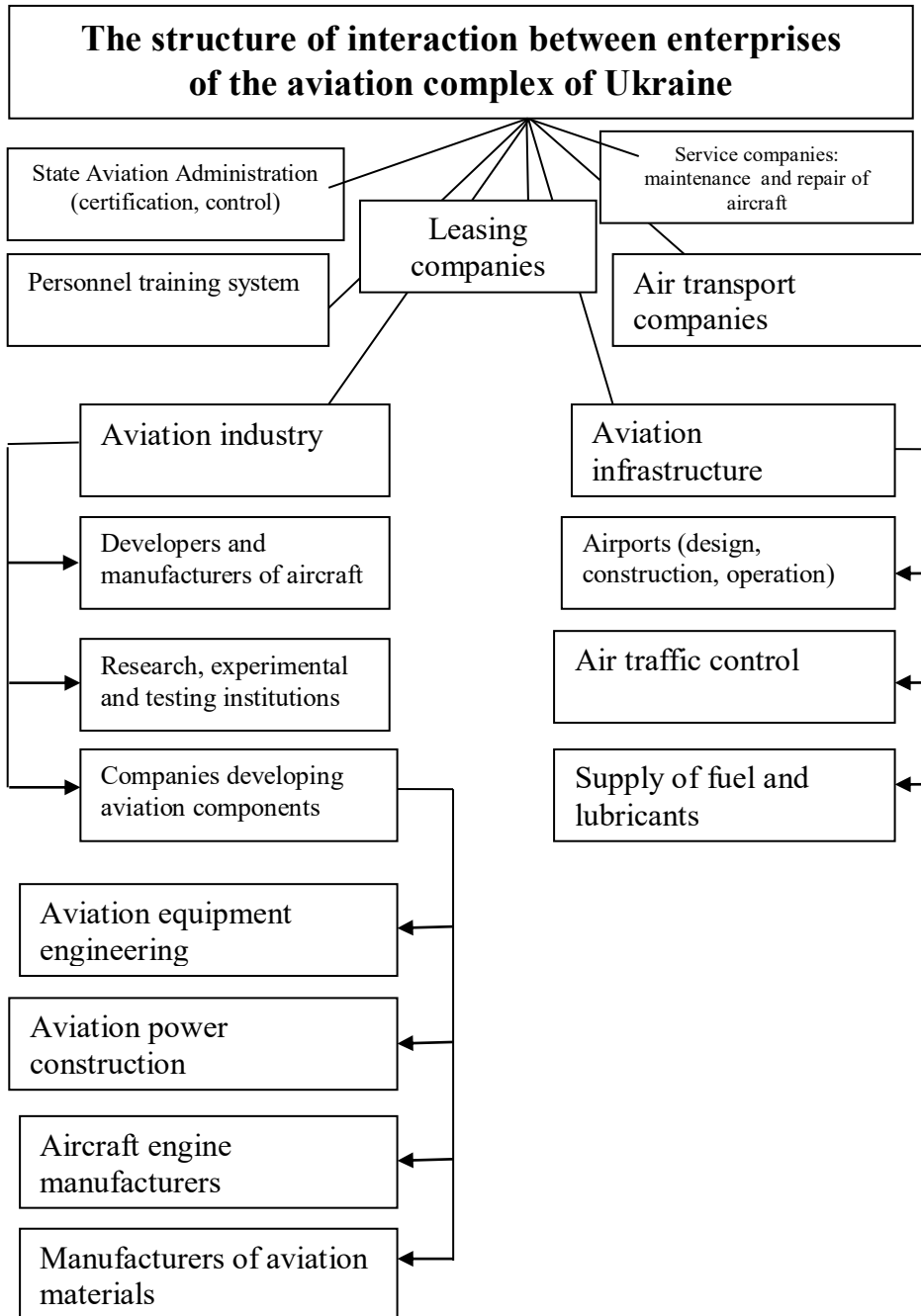
## 5 Discussion

The potential of aviation enterprises makes it possible to increase the volume of development and production of aviation equipment, in particular: regional passenger and transport aircraft; aircraft engines and units; on-board radio-electronic equipment aimed at the use of satellite communication, navigation and observation systems; helicopters and general aviation aircraft, including unmanned ones; military goods and dual-use products.

It is substantiated that the harmonization of the modern system of state regulation of the integration of the foreign trade sector of Ukraine into the EU should be carried out based on the fact that the parties have excellent reasons for forming an integration association. The consistent implementation of worldview and methodological procedures for maximizing the use of potential is, first of all, a tool for overcoming the low level of economic development, efforts through unification to create better conditions for the industrialization and development of aviation enterprises, the possibility of qualitative transformation of the foreign trade sector by attracting foreign investments and high technologies. This approach should contribute to the fundamental restructuring and diversification of export supplies, increase the opportunities to use positive development trends, and increase the level of international competitiveness of domestic economic entities.

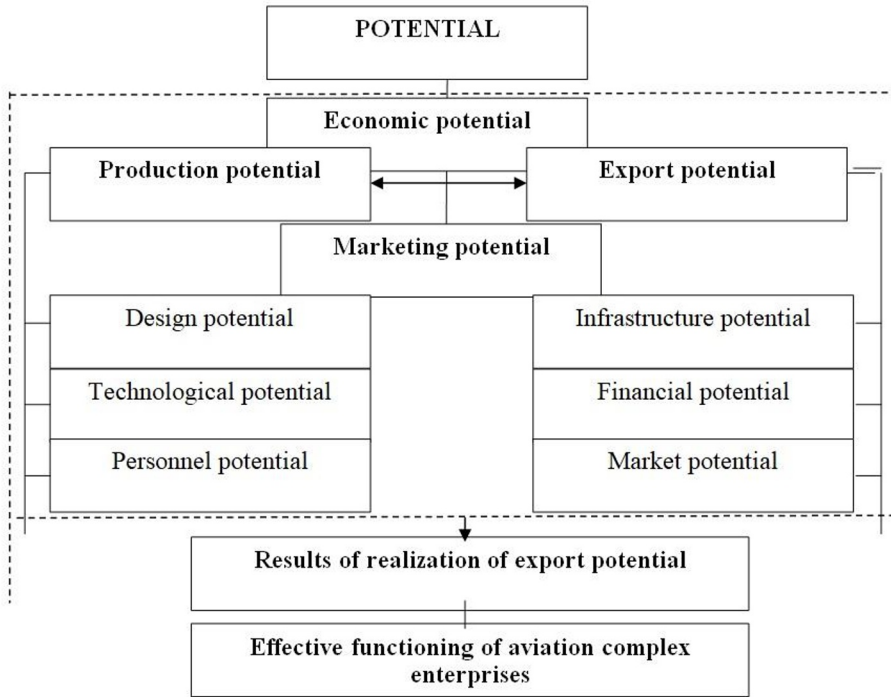
The results of the diagnostics of aviation enterprises made it possible to reveal the expediency of forming a new structure of interaction of enterprises and systematizing them into an aviation complex, which is considered as a set of organizations involved in the development, testing, production, sale, operation, modernization and repair of aviation equipment, which form several interconnected clusters.

In Fig. 1, we propose a structure of cooperation between the enterprises of the aviation complex of Ukraine, which will ultimately make it possible to form and implement a strategic plan of balanced development and obtain a synergistic effect from its implementation.



**Fig. 1.** The structure of interaction between enterprises of the aviation complex of Ukraine (developed by the authors)

Based on this, for the further development of the aviation potential, it is necessary to form a strategy for the production of aircraft equipment, taking into account the state of the foreign market, the scientific and technical, production and financial potential available in Ukraine. The coordination and interaction of potentials is substantiated (Fig. 2).



**Fig. 2.** Scheme of interaction of potentials of aviation complex enterprises (developed by the authors)

Features of the aviation complex products include a high level of manufacturability, a large initial cost of some financial, technological and personnel resources for the organization of production; high terms of development, testing and creation of products, a complex level of cooperation between manufacturers, a high level of certification and quality control of products, a high level of safety guarantees, a high level of training of specialists in the operation of products of aviation complex enterprises, availability of guarantees after the sale of products, service support for their operation.

It has been proven that for the successful operation of aviation complex enterprises, it is necessary to have a clear understanding of the prospect of entering the foreign market, and before that, the export potential and the volume of the foreign market were analysed.

## 6 Conclusions

So, as a result of the research:

- proposed the author's definition of the concept of "state aviation complex" and a theoretical approach to the interpretation of this definition, which is based on the distinctive features of the formation of an integration association and ensures the harmonization and systematization of the economic interests;
- the weighting coefficients of the components of the general economic potential of the enterprise (based on the expert method) were determined and the scale for evaluating the integral indicator of the level of economic potential of the enterprise of the aviation complex was proposed
- the structure of cooperation between enterprises of the aviation complex of Ukraine was developed;

- the scheme of interaction of potentials of aviation complex enterprises was introduced.

Based on the above, we can come to the conclusion that the definition of the theoretical foundations of a synergistic approach to the development of the economic potential of the enterprises of the aviation complex of Ukraine is an effective basis for ensuring the sustainable development of the industry with an orientation to the future.

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