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# INTERNATIONAL COMPETITIVENESS AND RECOVERY STRATEGY OF THE AVIATION AND SPACE INDUSTRY OF UKRAINE

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**Abstract.** The influence of the aviation and space industries on the development of the world economy and economic development, industrial potential, competitiveness and position of various countries in the world is shown in the article. Global aviation and space market has been studied and an economic analysis of the aviation and space sector of the industry of the countries that are among ten world leaders in the industry was carried out. The main indicators of the development of the aviation and space industry of world countries-leaders and Ukraine have been systematized. The volumes of income of the leading companies of the industry producers, between which there is fierce competition, have been given. International competitiveness has been analyzed and ways of recovery and development of the aviation and space sector of Ukraine were proposed, taking into consideration the significant losses and damages caused by full-scale military invasion of aggressive neighbor on the territory of Ukraine. Scenarios of competitive behavior were considered and a strategy for the restoration of one of the largest enterprises in the world and single one in the aviation and space industry in Ukraine that has completed the cycle of engine production – Joint Stock Company Motor Sich has been made.

**Keywords:** aerospace market, international partnership, Motor Sich, stagnation, recovery strategy.

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## 1. Introduction

The dialectic of the planetary development of humanity proves that the heft of the aerospace (AS) industry in the world economy is growing rapidly every year. Due to the fact that the AS industry includes critically important structures for the country, the level of its development characterizes both the general economic development and industrial potential, as well as the country's competitiveness and position on the world stage. In addition the AS industry is closely related to the number of other branches of national economy, which use its innovations and technology.

Countries with an underdeveloped AS industry are becoming more and more dependent on developed countries in terms of receiving, processing and transmitting different kinds of satellite information to the consumer. This, in turn, affects the development of related fields of communication navigation equipment development and transmission of large arrays of information over long distances. Thus, today the presence of developed space and aviation sector in the country is considered to be a sign of its economic independence and importance (Voznenko, 2018).

AS industry is one of the most strategically important for the economy of Ukraine. However, since February 24, 2022 and until now, a full-scale military invasion of the russian federation on the territory of Ukraine is causing considerable damage to both AS industry and the country's industry in general (Perun, 2022; Top war, 2022). If before the start of russia's open armed aggression it was about bringing the AS industry of Ukraine out of a state of stagnation at attracting significant funds from foreign investors (Lubinets et al., 2015), then in modern realities it is worth talking about its complete restoration. The main reason for this change in the development strategy is the numerous destruction of property and infrastructure objects of the leading enterprise of the AS branch of Ukraine – plant "Motor Sich", as a result of rocket attacks on Zaporizhzhia city. Currently, this city continues to suffer damage because of constant rocket fire from the aggressor.

At the same time, it is critically important that the current government of Ukraine professionally and carefully determine the main long-term directions for the recovery and further development of the AS industry, since this

significantly affects not only the state of adjacent branches of the national domestic economy, but also:

- All spheres of domestic economy life;
- State of the financial system;
- Restoration of the country's position on the world stage.

The goal of this study is the analysis of international competitiveness and the determination of acceptable strategies for the recovery of the AS of the Ukrainian industry, since this kind of analysis provides an opportunity to determine the priority areas of cooperation with the AS of enterprises of other countries.

To achieve the goal, one need to research:

- World AS market;
- AS branch of Ukrainian economy;
- Scenarios of competitive behavior of the leading enterprise of the AS industry of Ukraine – "Motor Sich" JSC.

## 2. World aviation and space market

The AS branch includes the development, production, handling, maintenance, modernization and repair of air- and spacecrafts, engines and aviation devices, military equipment, etc (Voznenko, 2018).

At present moment the United States of America (USA) is an undisputed world leader in terms of production volumes in this industry, which accounts for 49% of the world production volumes of the industry (Figure 1).

The leaders among European countries are France (8%), Great Britain (6%) and Germany (5%). The leading countries in other regions are Canada (3%), Japan (3%) and China (6%). The rest of the world accounts for only 20% of the value created in the industry.

In the scientific literature AS is commonly divided into the civil aerospace sector, military aerospace sector and defense industry (Voznenko, 2018). At the same time, a very small part of research in the field of AS is in open access. This is because the information is withheld for security purposes, as the industry includes many components that are related to countries' defense activities. In addition, the participation of most countries is differentiated, so it is difficult to characterize the global AS industry in general.

Under the specified conditions, the following industries are mainly engaged in research:

- National organizations, such as Aerospace Research Center, Aerospace Industries Association;
- Large auditing companies, such as Deloitte, KPMG;
- Leading companies, such as Boeing and Airbus.

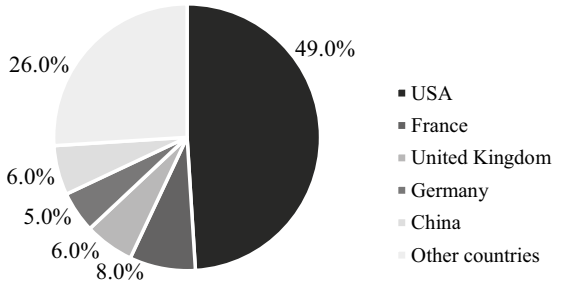


**Figure 1.** The share of producer countries of AS products in the total volume of world production (Voznenko, 2018)

Among international organizations, The Organization for Economic Co-operation and Development (OECD) deals with the analysis and assessment of the competitiveness of countries in AS industry (Voznenko, 2018).

According to OECD data (Organization for Economic Cooperation and Development, 2022), as of 2019, the top ten world industry leaders in terms of exports include: USA (31.4%); France (15.53%); Germany (11.81%); Great Britain (9.42%); Singapore (4.95%); Canada (3.34%); Japan (1.79%); Spain (1.78%); China (1.59%); Ireland (1.26%).

Table 1 shows the indicators of the development of the AS industry of world leaders and Ukraine, according to which:

- The smallest share in the total country's export of goods and services is the AS branch of China;
- The largest share in the total leading countries export of goods and services o is held by the AS industry of France, Great Britain, and the United States;
- The share of the AS industry in the total export of goods and services of Ukraine exceeds this indicator of development of France;
- As of 2020, the largest share of the total volume of country's imports of goods and services is held by the AS industry of the U.S. and Ukraine;
- In other countries under study, the share of imports of AS industry in the total volume of country's imports is less than 0.1%;
- As of 2020, the following countries have an active trade balance: the United States, France, Germany, Great Britain, Canada, Spain, Ukraine, Singapore, Ireland;
- China has the biggest negative surplus as of 2020.

Three leading countries of the AS industry are the historical homelands of such leading companies that produce AS equipment and weapons as: Lockheed Martin Corporation, BAE Systems, The Boeing Company, Thales, Airbus SE, DASA. Embraer and Textron Inc. are also among the most famous players of the AS market.

According to the Deloitte company (Voznenko, 2018), in 2016, the 20 largest global companies in the AS industry accounted for almost 73.7% of revenues. At the same time, for many years Boeing and Airbus were considered the undisputed leaders in the field of production of large commercial aircrafts. However, in 2020, revenues from the commercial segment of the Boeing Company decreased and the global leadership was given to the Lockheed Martin Company. The increase in the level of Lockheed Martin company income in 2020 by 9%, compared to the previous year, is due to both the expansion of the F-35 program and a significant reduction in the production of Boeing and Airbus (PwC, 2021). Among companies specializing in aviation, defense, security and land transport, BAE Systems and Thales take the second and third places in terms of revenue. Thus, the world AS market is dominated by several companies, between which there is fierce competition (Table 2).

**Table 1.** Indicators of AS industry development for the period 2018–2020 (Organization for Economic Cooperation and Development, 2022; The World Bank, 2022; Aerospace Industry Association of Canada, 2021; State Statistics Service of Ukraine, 2022; Ernst & Young Global Limited, 2021)

| N | Country | The share of exports of the aviation and space industry in the total volume of exports of the country, % | | | The share of imports of the aviation and space industry in the total volume of imports of the country, % | | | Trade balance of the aviation and space industry, billion US$ | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Years | | | | | | | | |
| | | 2018 | 2019 | 2020 | 2018 | 2019 | 2020 | 2018 | 2019 | 2020 |
| 1 | United States | 5.61 | 5.50 | 3.91 | 1.81 | 2.05 | 1.64 | 85.40 | 75.10 | 37.00 |
| 2 | France | 7.62 | 8.28 | 5.42 | 0.04 | 0.04 | 0.03 | 32.10 | 34.50 | 18.40 |
| 3 | Germany | 2.74 | 3.00 | 2.11 | 0.02 | 0.02 | 0.02 | 22.30 | 23.20 | 12.20 |
| 4 | United Kingdom | 4.91 | 4.93 | 4.31 | 0.03 | 0.03 | 0.03 | 13.10 | 13,60 | 11.70 |
| 5 | Singapore | 2.82 | 3.46 | 2.95 | 0.05 | 0.05 | 0.04 | –6.5 | –7.6 | –2.6 |
| 6 | Canada | 2.69 | 2.76 | 2.64 | 0.02 | 0.02 | 0.02 | 1.90 | 1.20 | 2.70 |
| 7 | Japan | 0.87 | 0.92 | 0.69 | 0.02 | 0.02 | 0.01 | –6.1 | –6.30 | –2.80 |
| 8 | Spain | 1.44 | 1.68 | 1.53 | 0.01 | 0.01 | 0.01 | 1.60 | 2.90 | 1.90 |
| 9 | China | 0.29 | 0.28 | 0.18 | 0.01 | 0.01 | 0.01 | –28.19 | –19.20 | –10.12 |
| 10 | Ireland | 1.39 | 1.18 | 0.83 | 0.07 | 0.05 | 0.04 | –18.6 | –18.9 | –12.4 |
| 11 | Ukraine | 0.55 | 0.48 | 0.62 | 0.18 | 0.28 | 0.25 | 0.20 | 0.09 | 0.22 |

**Table 2.** Volumes of income of the leading manufacturing companies of AS industry for the period 2018–2020 (PwC, 2021; Investing, 2021; Spanish Association of Defense, Security, Aeronautical and Space Technology Companies, 2019; Science Applications International Corporation, 2022; Motor Sich, 2022)

| N | Manufacturer company (Country) | Revenue, billion US$ | | | Operating profit, billion US$ | | |
|---|---|---|---|---|---|---|---|
| | | Years | | | | | |
| | | 2018 | 2019 | 2020 | 2018 | 2019 | 2020 |
| 1 | Lockheed Martin (United States) | 53.76 | 59.81 | 65.40 | 7.33 | 8.55 | 8.64 |
| 2 | The Boeing Company (United States) | 101.13 | 84.82 | 58.66 | 11.99 | –1.98 | –12.77 |
| 3 | Airbus SE (France) | 63.71 | 70.48 | 49.91 | 5.05 | 1.34 | –0.51 |
| 4 | Thales (France) | 17.8 | 20.6 | 19.4 | 1.31 | 1.44 | 1.54 |
| 5 | MTU Aero Engines (Germany) | 5.39 | 5.18 | 4.54 | 0.76 | 0.85 | 0.47 |
| 6 | BAE Systems (United Kingdom) | 22.50 | 23.40 | 24.80 | 2.20 | 2.40 | 2.50 |
| 7 | Singapore Technologies (Singapore) | 4.90 | 5.77 | 5.19 | 0.41 | 0.48 | 0.41 |
| 8 | Bombardier Aviation (Canada) | 7.30 | 7.50 | 6.49 | 0.47 | 0.53 | –0.1 |
| 9 | Aernnova (Spain) | 0.70 | 0.80 | 0.60 | 0.10 | 0.10 | 0.80 |
| 10 | Mitsubishi Aircraft, Defense and Space (Japan) | 5.89 | 6.22 | 6.61 | –0.33 | –0.34 | –1.96 |
| 11 | SAIC (China) | 4.45 | 4.66 | 6.38 | 0.26 | 0.22 | 0.37 |
| 12 | Eaton Aero-space (Ireland) | 1.90 | 2.48 | 2.22 | 0.40 | 0.60 | 0.41 |
| 13 | Motor Sich (Ukraine) | 0.46 | 0.38 | 0.44 | 0.06 | –0.02 | 0.07 |

Spain, although it does not have its own large national manufacturer of AS products, is considered one of the world leaders of the AS industry in development of (PwC, 2021; Spanish Association of Defense, Security, Aeronautical and Space Technology Companies, 2019):

- Composite materials for aircraft constructions and air traffic control systems;
- Military transport aircraft, especially medium and light ones;
- Technologies for such segments of the space industry as satellite systems, launchers, ground segment, operations and service providers.

Spain achieved the position of one of the few countries capable of covering the entire cycle of aircraft design and production. Thanks to the presence of Airbus, Aernnova, Aciturri Aeronáutica, Héroux-Devtek and ITP (Table 2), Spain became one of the few countries that are capable of covering the entire cycle of aircraft design and production.

In addition, the company Aciturri Aeronáutica is (Spanish Association of Defense, Security, Aeronautical and Space Technology Companies, 2019):

- First-level supplier of leading aviation manufacturers Airbus, Boeing and Embraer of such aircraft constructions as horizontal and vertical rudders, wing and airframe components;
- Manufacturer of components for large projects of such leading companies as Snecma, Rolls Royce and CFM International.

Ukrainian JSC Motor Sich specializes in the development, manufacture, testing, putting into operation and repair of engines that are operated in 120 countries around the world (Motor Sich, 2022; Ernst & Young Global Limited, 2021). This means that following a clear and well-founded strategy for the development of the Motor Sich enterprise can ensure not only the development of the AS industry of Ukraine, but also the strengthening of the country's position on the world stage, despite the fact that the company's revenue is significantly smaller than the revenue of companies leaders (Table 2).

## 3. Aviation and space industry of the economy of Ukraine

### 3.1. General characteristics of the industry

The basis for the development of the AS industry of Ukraine was laid back in Soviet times.

During the years of independence, Ukraine showed itself to be a worthy player on the world AS market, however, during 2006–2022, the export volume of the country's AS products had unstable dynamics (Figure 2).

In 2018–2020, according to (State Statistics Service of Ukraine, 2022) there are only three innovatively active enterprises in the field of air transport in Ukraine, which is seven less than in 2016–2018.

The COVID-19 pandemic and related impacts played a significant role in this deterioration of the industry. This is evidenced by the lowest indicator of the dynamics of the export volume of AS products of Ukraine observed in 2019. Despite this, AS industry is developing and in 2021 the field of rocket engineering shows growth (Figure 2).

The current government of Ukraine is aware that due to the decrease in production volumes in sector of the economy, the country is increasingly losing its competitiveness on the global markets of both final products and components. In April 2020, President Volodymyr Zelenskyi announced the creation of a national air carrier based on the principles of the world-famous Turkish Airlines and Singapore Airlines (Aris, 2020). The newly created companies were supposed to satisfy all the strategic needs of the country, thereby supporting domestic production and becoming a worthy competitor not only on the domestic, but also on the foreign air transport market.

From the very beginning, the implementation of this idea involved the purchase of aircraft from the state-owned enterprise Antonov in order to create additional jobs and develop the aviation industry of Ukraine. However, in May 2021, Prime Minister Denys Shmyhal announced negotiations about the purchasing aircrafts with the world's three largest manufacturers. and proved that Ukraine is not a player on the AS market, but rather plays the role of subject of influence against the background of fierce competition between the main companies that stimulate the development of the industry.

Now a number of other factors also affect the export volume of AS products of Ukraine. Namely: war in the country, economic and political situations in the world, general market and industry conditions.

Today, the largest production and R&D clusters in Ukraine are located in the cities of Kharkiv, Kyiv and Dnipro. The main scientific and research units of international companies of the AS branch of Ukraine are Boeing, Skyrora and Firefly.

Leading Ukrainian state-owned enterprises (SE) of the AS industry, such as SE Antonov, SE Design Bureau Pivdenne named after M. K. Yangel, the engine production center of SE Pivdenmash, the design center of aircraft engines of SE Ivchenko-Progres and the engine production center Motor Sich develop and supply to the international market the world-famous (Ministry of Foreign Affairs of Ukraine, 2021):

- Light space rockets of the "Zenit" and "Zyklon-4" series;
- Military rockets "Neptun", "Vilcha";
- Engines for Antares (USA) and Vega (EU) rockets;

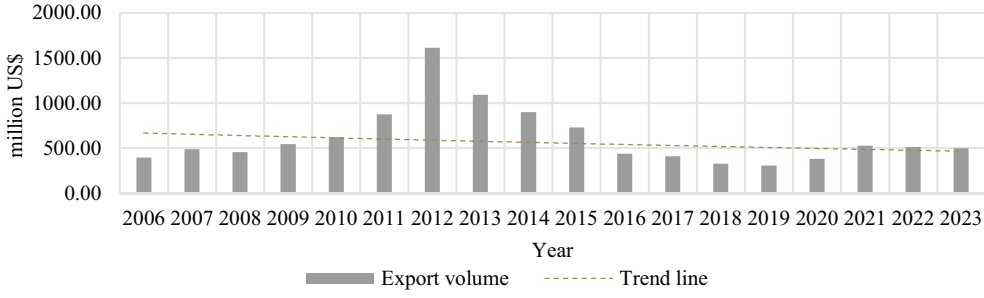


**Figure 2.** The dynamics of export volume of Ukrainian products since 2006 (State Statistics Service of Ukraine, 2022; Ernst & Young Global Limited, 2021)

- Engines for MI series helicopters and unmanned aerial vehicles "Bayraktar Akinci" (Turkey);
- Airplanes of the AN family and small class helicopters;
- Transport aircraft AN225 "Mriya".

Next, one of the leading enterprises of the automative industry in Ukraine – JSC Motor Sich is described.

## 3.2. Analysis of the activity of JSC Motor Sich

JSC Motor Sich currently includes (Motor Sich, 2022):

- Zaporizhzhia Motor Construction Plant;
- Zaporizhzhya Machine-Building Plant;
- Volochysk Machine-Building Plant;
- Motor Cich Airlines;
- 11 affiliated enterprises.

For more than a hundred years of its existence, the Motor Sich company has created a number of reliable aircraft engines for civil and military aviation, which are competitive both on the national and global markets. Currently, JSC Motor Sich is one of the largest in the world and the only enterprise in Ukraine that has a complete engine production cycle, and the quality system of JSC Motor Sich is certified by the transnational firm Bureau Veritas Certification for compliance with the requirements of the international standard ISO 9001:2008 (Global Defence Mart, n.d.) regarding production, repair and maintenance of aircraft engines, gas turbine drives and design of gas turbine power plants.

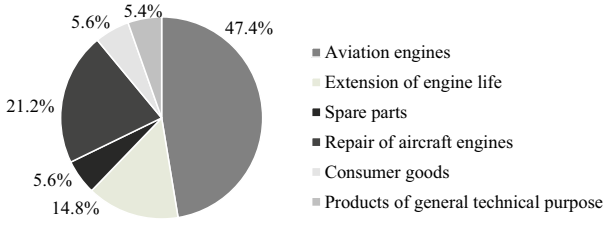


**Figure 3.** Production structure of JSC Motor Sich products in 2020 (Motor Sich, 2022)

The largest share of JSC Motor Sich's activity is the production, sale and repair of aircraft engines installed on aircraft of such companies as Antonov, S.V. Ilyushin Aviation Complex, Aero Vodochody, NAMS (Figure 3).

The main types of activity of JSC Motor Sich according to NACE also include production of (Motor Sich, 2022):

- Air and space aircraft, related equipment (code according to NACE – 30.30);
- Electric motors, generators and transformers (code according to NACE – 27.11);
- Other ready-made metal products, not included in other groups (code according to NACE – 25.99).

The main performance indicators of JSC Motor Sich are given in the Table 3.

According to these data the share of export in the income from sold products and the amount of net profit of the enterprise exceeded the level of 2018 already in 2020.

Table 4 shows that the largest share of the cost price of the company's products is taken by material costs, including the cost of materials used for resale.

**Table 3.** Main performance indicators of JSC Motor Sich (Motor Sich, 2022)

| № | Indicator | Years | | |
|---|---|---|---|---|
| | | 2018 | 2019 | 2020 |
| 1 | Revenue from the sale of products, billion US $ | 0.33 | 0.26 | 0.30 |
| 2 | Share of exports in revenue from sales, % | 81.7 | 84.0 | 81.8 |
| 3 | Cost of sold products (goods, works, services), billion US $ | 0.21 | 0.18 | 0.19 |
| 4 | Net profit, million US $ | 19.4 | 18.25 | 23.40 |
| 5 | Expenses for 1 hryvnia. of sold products, thousand US $ | 0.02 | 0.02 | 0.02 |
| 6 | Research and development (R&D) costs in the enterprise's cost of sales, % | 0.57 | 0.27 | 0.13 |
| 7 | Costs of implementing new promising types of products in the cost of sales (goods, works, services) of the enterprise, % | 6.7 | 4.8 | 3.2 |
| 8 | Number of employees, thousands of people | 22.2 | 21.3 | 17.2 |
| 9 | Labor compensation fund, billion US $ | 0.07 | 0.08 | 0.06 |
| 10 | Average monthly salary, thousand US $ | 0.27 | 0.29 | 0.32 |
| 11 | Labor productivity, thousand US $ per person | 15.00 | 12.27 | 17.27 |

**Table 4.** Structure of the cost price of products of JSC Motor Sich (Motor Sich, 2022)

| № | Cost item | Years | | |
|---|---|---|---|---|
| | | 2018 | 2019 | 2020 |
| 1 | Material costs, including the cost of materials used for resale, %. | 56.99 | 60.95 | 63.37 |
| 2 | Salary expenses, % | 19.85 | 20.61 | 17.65 |
| 3 | Other operating expenses, % | 15.96 | 12.70 | 9.04 |
| 4 | Depreciation, % | 7.20 | 5.74 | 6.16 |

The amount of material costs has a steady upward trend in 2018–2020. On the other hand, labor costs, depreciation and other operating costs decreased significantly during this period. The increase in costs per US $0.03 of products by US $1.56 observed in 2019 is caused by an increase in electricity costs and prices for imported components.

The expenses of JSC Motor Sich for R&D in the cost price of the company's sold products amounted to (Motor Sich, 2022):

- US $1.18 million in 2018;
- US $0.49 million in 2019;
- US $0.24 million in 2020.

In addition to R&D, the company is constantly working on the introduction of new types of products (aviation engines, general technical and medical products, modernization and re-engining of helicopter equipment). Therefore, it is appropriate to analyze the share of this type of costs in the total cost of the cost price of sold products.

For these purposes, the following was spent (Motor Sich, 2022):

- US $13.98 million in 2018;
- US $0.84 million in 2019;
- US $0.70 million in 2020.

Therefore, R&D expenses of JSC Motor Sich decrease every year.

Also, during this period, there is a steady trend towards a decrease in the number of employees. Thus, for the period from 2018 to 2020, the number of working people decreased by almost 1.3 times. This trend occurs due to a significant decrease in production volumes. Due to the decrease in the number of employees at the enterprise, labor productivity in 2020 increased by 1.2 times compared to 2018.

Compensation fund and the average monthly wage at the enterprise have a steady upward trend, which is caused by the increase in the minimum wage in Ukraine. At the same time, the average annual salary in the aviation industry in Ukraine is almost 30 times lower than in the United States. For example, as of 2020, the average annual salary for an engineer in the US working in the AS industry is US $121,100 and in Ukraine this figure is US $3,970 (US Bureau of Labor Statistics, 2021; State Space Agency of Ukraine, 2021). Thus, the main advantages of investing in the Ukrainian AS industry are human capital, experienced engineers and economic efficiency. However, the allocation of funds from international funds and organizations requires a clear and well-founded strategy for the recovery and development of the Ukrainian enterprise JSC Motor Sich.

## 4. Recovery and development strategy of JSC Motor Sich

The process of restoration and development of JSC Motor Sich is possible under three alternative scenarios of the competitive behavior of the Ukrainian company and the leading companies in the AS industry in the USA, France and Great Britain.

### 4.1. Fierce competition

The "fierce competition" scenario implies the refusal of any cooperation. This scenario would be possible if the Ukrainian company Motor Sich came under the control of the Chinese company Skyrizon. In today's realities, the scenario of fierce competition is not even considered, because in this case JSC Motor Sich loses the main opportunities for development and integration into the European community. Moreover, today there are no corporations in Ukraine that could become worthy competitors of the world leaders Airbus and Boeing, between which there is fierce competition on the global AS market. Under such conditions, taking into account the difference in the scale of production and capacities of foreign companies, the situation for the global leaders of the AS industry will remain unchanged, and Motor Sich may suffer significant losses. In this case, JSC Motor Sich will continue to produce products for the domestic market in small quantities and will be forced to change its "focus" to the eastern export market.

### 4.2. Partial competition

The "partial competition" scenario involves the expansion of existing and the search for new sales markets that will replace the Russian one, which has been the main one for many years. This will increase the volume of product exports and improve the position of JSC Motor Sich on the world stage. The main problem of implementing this scenario is the high barriers to entering the world market.

Thus, the European vision of aviation in 2050 includes the following provisions (Lubinets et al., 2015):

- Providing the best services in the field of aeronautics and air transport;
- Ensuring the competitiveness of European industry;
- Attracting the best personnel;
- Protection of environment and use of alternative energy sources;
- Ensuring full security and providing jobs.

On this path, without state support, which the world leaders of the AS industry have, and which Ukraine cannot afford at this stage of development, JSC Motor Sich faces a gradual loss of sales markets, a buyout by another state and, in the long run, bankruptcy.

### 4.3. Consortium

The "consortium" scenario assumes the mandatory participation of the state, which consists of:

- Development of participation strategy of JSC Motor Sich in the consortium;
- Legal support;
- Financial support.

For implementation of the strategy:

1. The board of consortium directors is created with the preference of partners in decision-making;
2. A program and directive schedule for the restoration and development of the enterprise is developed and implemented;

3. An examination of the damaged departments of the enterprise is carried out in order to establish the expediency of their further operation;
4. On the basis of the EU or NATO, the standards and norms of production at the Ukrainian enterprise are brought to a single European system;
5. Scientific and technical developments are exchanged;
6. The production of components and parts for the European market begins.

At the initial stage, cooperation is possible by involving the capacities of Motor Sich for the production of products of one of the NATO members with the parallel involvement of state investments to re-equip production to the above-mentioned standards (such as Turkey). At the same time, the option of using domestic developments for the European market is not excluded.

Step-by-step control and adjustment of the implementation of the cooperation program and the directive schedule of the enterprise's development is carried out by the Board of Directors.

This scenario is realistic, because JSC Motor Sich has a strategic importance for the whole world. For example, Pratt & Whitney, a manufacturer of aircraft engines, showed interest in Motor Sich back in the early 2000s. But at that time, the president of JSC Motor Sich believed that the future of the company was connected with Russia, not with the USA. The reason for another attempt of cooperation between Motor Sich and the helicopter manufacturer Sikorsky in 2012 was the desire of the American company to install Ukrainian engines on its C-61 helicopter. However, the cooperation never took place. Subsequently, three years later, the jet fighter manufacturer Lockheed Martin acquired Sikorsky (Motor Sich, 2022).

Currently, the Ukrainian enterprise is successfully cooperating with international partners, for example, in 2021, Motor Sich and the Turkish drone manufacturing company Baykar Makina signed a cooperation agreement, which is getting stronger due to current events. Now it is difficult to assess the success of this type of cooperation, because the aviation and space industry includes many directions, a significant component of which is related to the country's defense activities. For security purposes, data is hidden.

In today's realities, in our opinion, the significant obstacles to the cooperation of Motor Sich with the world AS leaders of the American defense industry consultant are that (Motor Sich, 2022):

- JSC Motor Sich has Soviet DNA, which is rather difficult to integrate into the production system of American companies;
- Part of Motor Sich JSC's sales are to China and other countries with which the average American defence company may not have the right to do business.

However, regardless of the mentioned obstacles, the "consortium" scenario is the most acceptable, although it requires restoration and improvement of JSC Motor Sich. In order to restore and improve the activities of Motor Sich JSC, this article specifies the company's medium- and long-term development strategy. This strategy can be implemented in three stages.

At the first stage, the main destroyed funds of the enterprise are examined in order to establish the expediency of their further exploitation. Based on the conclusions of the examination, complete dismantling of emergency assets or restoration work is carried out. In parallel with the development of existing production chains and contracts, with state financial support and state guarantees, it is advisable to modernize production facilities with a priority focus on cooperation within the framework of consortium cooperation. This will make it possible to develop advanced approaches and prepare professional personnel for the second stage of interaction.

At the second stage, cooperation with traditional partners continues in the following directions:

1. Continuation of cooperation with the Ministry of Defence and other power structures of Ukraine in the framework of delivery and repair of aircraft engines, main helicopter gearboxes, overhaul and modernization of Mi-8MSB helicopters and delivery of modernized Mi-2MSB and Mi-8 MSB-V helicopters.
2. Cooperation with partners in Ukraine and the UMP countries in the framework of supply and repair of aircraft engines of various types and modifications, supply of spare parts for them, supply, maintenance in operation and repair of gas turbine drives and power plants of various capacities (Motor Sich, 2022).
3. Execution of other previously signed and making new contracts.

It is assumed that at this stage the partially restored JSC Motor Sich is already able to receive and fulfill orders for the manufacture, supply and repair of individual units and constructions, namely:

- AI-322 engines, spare parts for AI-322, AI-25TLK, non-standard equipment and special technological equipment, repair of engines of various types for China;
- Engines of various types and modifications, supply of spare parts for aircraft engines of various types and modifications of India;
- Aircraft engines of various types, repair of engines of the TVZ-117 family of various modifications, AI-9B, AI-25TL, supply and repair of spare parts for them for Algeria;
- Supply of aircraft engines of various types, spare parts for them, repair and provision of services for technical support of aircraft and industrial installations in operation for Bangladesh, Sri Lanka, Singapore, UAE, Pakistan, Myanmar, Ethiopia, South Korea, Great Britain, Canada, Poland, the Czech Republic, Slovakia.

It is also assumed that the developments of the previous stages will contribute to the development of previously initiated programs within the framework of cooperation agreements that Ukroboronprom concluded with such leading American defense companies as Lockheed Martin, Harris Global and GLOBAL ORDNANCE in the amount of 2.5 billion dollars USA, and will also become the basis of new purely individual projects.

At the third stage, extensive cooperation is carried out in the production and supply to the market of finished and self-sufficient elements, constructions, units and aircrafts both within the framework of the consortium and according to individual programs. At this stage, a significant increase in profit is possible due to an increase in the volume of production and sale of products. Reducing the cost of production and sale of products can be achieved by reducing the cost of raw materials, materials, and energy through the search for cheaper suppliers of energy resources, more favorable terms of contracts with suppliers of materials and raw materials.

## 5. Conclusions

Based on the results of the global aerospace market research, the leading countries and leading manufacturing companies in the aerospace industry were defined, and it was also discovered that Ukraine is one of the few countries that have a full cycle of manufacturing rocket and space technology, as well as designing, production, operation and repair of civil and military aircrafts. In addition, the aviation and space industry of Ukraine has such advantages as a significant qualified and cheap human resource, a favorable geopolitical position and many years of technological experience, which in other countries takes years to create.

An analysis of the Ukrainian JSC Motor Sich activity showed that the main source of the company's income is the execution of export contracts for aviation and land technology, which are operated in 120 countries of the world. This means that following a clear and well-founded development strategy of the Motor Sich enterprise can ensure not only the development of the aviation and space industry of Ukraine, but also the strengthening of the country's position on the world stage. However, in modern realities, the recovery and development of this enterprise requires the allocation of funds from international funds and organizations. This, in turn, requires a clear and well-founded strategy for the recovery and development of JSC Motor Sich JSC.

Scenarios of competitive behavior were considered and a strategy for the restoration of the leading enterprise of the aviation and space industry of Ukraine – JSC Motor Sich was proposed.

## Disclosure statement

Authors declare that they do not have any competing financial, professional, or personal interests from other parties.

## Author contributions

S. Terenchuk conceived the study and carried out the formulation of the problem and O. Karpiak carried out data collection and analysis.

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