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CURRENT CHALLENGES OF AVIATION IN INDUSTRY AND AGRICULTURE

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Formulation of the problem. The economic sectors in their complex form the gross domestic product of Ukraine and consist of industry, construction, agriculture, trade, and management. The industrial sector uses resources, semi-finished, and finished products for production. The aviation industry is characterized by high-tech processes, scarce resources used in such processes, and the professional skills of the personnel involved. Digital technologies and artificial intelligence are expanding the possibilities of using aerial vehicles. The classic triangle of industry, aviation, and agriculture forms a new machine control system. The aim of the work is to highlight the main problems of the interaction of the triangle of industries: industry, aviation, and agriculture. The tasks of the scientific work are to determine the role of national industry in the development of aviation, to consider the main directions of the production of aerial vehicles, and to determine the impact of aviation on the further development of agriculture.

The main research materials the key sub-sector of the economy is the processing industry, which develops the gross domestic product of Ukraine in 2021. It is equal to 61.3% of the total value of sold products [1]. The main economic activity in the industrial sector of the economy is the production of food products. It is equal to 16.3% of the total value of the sold products of Ukraine, or UAH 585.1 billion. The second sector is metallurgy and the production of finished metal products. It is equal to 17.8% or UAH 640.2 billion of the total value of sold products in Ukraine.

Because aircraft imports increasing and economies declining over the last ten years, metallurgy, engineering, and industry are raw materials for the aviation industry. These industries create a vector of development in the aviation industry: the production of aircraft components, helicopters, drones, spare parts, and electronic media. The Ukrainian industry is more a part of the supply of resources than a segment of the aviation goods and services market. At the same time, the analytical agency Tractica provided a forecast for the sharp growth of the commercial drone market (Fig. 1.)

It is predicted that, the number of drones sold for commercial usage will be 2.7 million units in 2025. The revenue from their sale will be almost four times more compared to the income of 2021. Also, Tractica notes that the

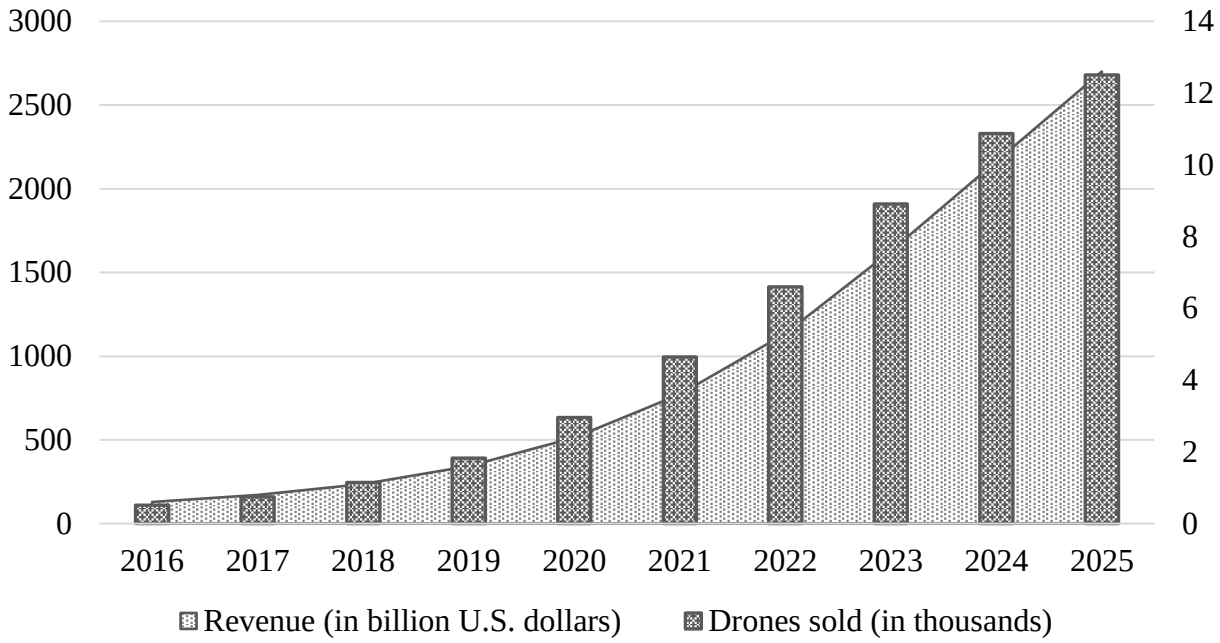

Fig. 1. Sales of commercial drones, 2016-2025 [2]

world's leading drone manufacturers will have revenues of $5.3 billion at the end of 2022. Scientists identify several reasons for the growth of the drone market in the industrial market. One of the reason is a utilization of crafts with an intelectual control. The second reason is the low level of fuel consumption and lubricants compared to airplanes and helicopters, which determines the use of alternative types of energy (Fig. 2.)

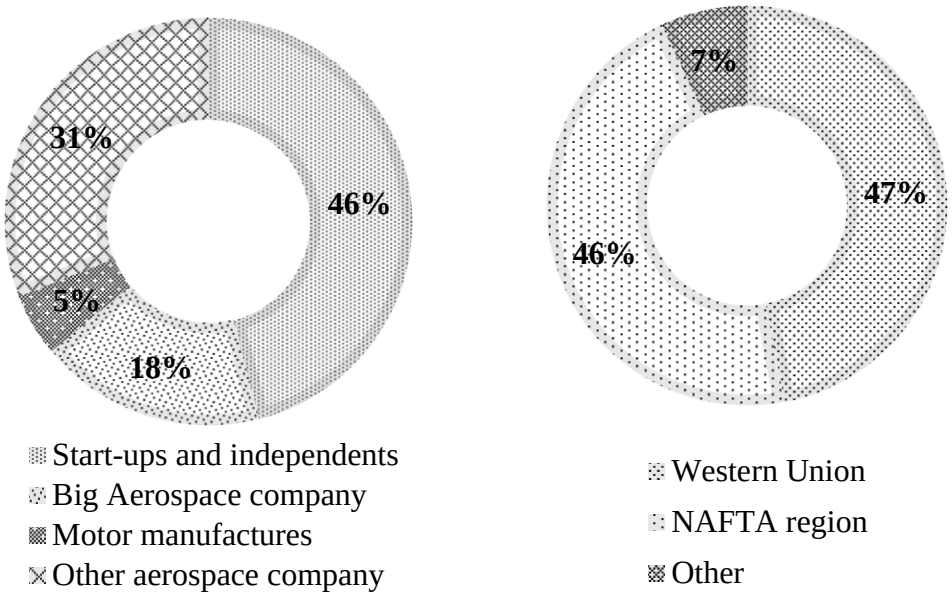

Fig. 2. Start-ups propelling the electrification of Aircrafts, 2021 [3]

According to the report of the German consulting company Roland Berger, the electrification of the automobile industry is taking place. Moreover, the interest of energy companies in the electrification of air

transport is increasing. Roland Berger notes that 18% of all electrification start-ups come from aviation companies and 46% from independent researchers. Innovations are claimed to develop general aviation, urban air taxi, business aircraft, and large commercial aircraft.

According to the classification of economic activities, the production and repair of aircraft and flying machines have codes 30.3 and 33.16. [4]:

– production of aircraft for the transportation of goods or passengers;
– production of helicopters;
– production of gliders, hang gliders;
– production of airships, balloons, balloons;
– production of parts and equipment for aircraft;
– production of ground simulators for pilots;
– production of spacecraft and launch vehicles;
– production of intercontinental ballistic missiles (ICBM).

It should be noted that over the last decade, the volume of production of air transport in Ukraine has been significantly reduced (Fig. 3.).

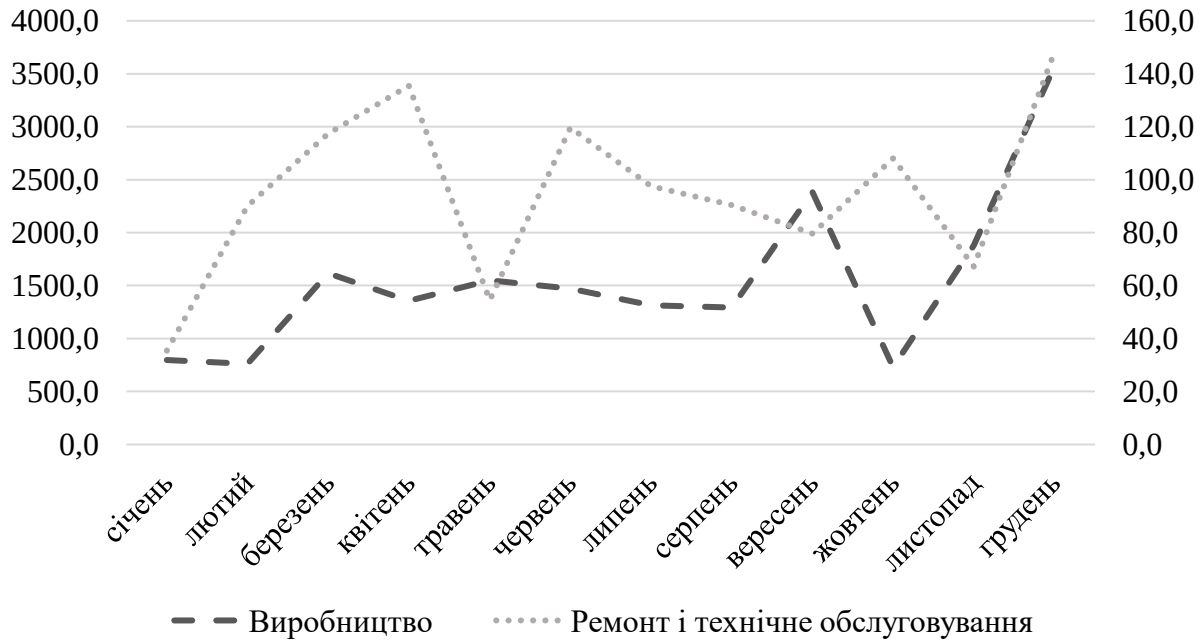

Fig. 3. Production, repair and maintenance of air and space aircraft, additional equipment, 2021, UAH million [5]

The aerial vehicles and equipment volume amounted to UAH 3.5 billion in December 2021. Such costs were directed to the repair of the equipment. In general, aviation is not the core strategic branch of industry. In 2021, the value of the volumes of manufactured products was equal to UAH 18.7 billion, or 0.5% of the total value of industrial goods. The cost of repairing aircraft and related equipment provided the budget with an additional 1.14 UAN billion or 0.32% of the total costs.

Because of production processes and use of biological resources,

agriculture has different management monitoring systems in crop production and livestock. In current conditions of agriculture, farmers utilize aviation only to care crops. They monitor the results of growing and the degree of damage to animals with the help of drones. When growing plants, small-sized aircraft are used to cultivate fields with plant products, apply mineral fertilizers, and fight fires in forest belts. Drones are used to control the movement and preservation of herd stock during a free-range system of animal care. In connection with long distances in the USA, aviation is actively used to transport animals from one region to another, reducing the time of transportation and the risk of animal death [6].

The aviation industry is quickly entering the market of services provided by agricultural producers. All types of transport are used as much as possible: low-power airplanes, helicopters, drones, and satellites.

Aviation has the strong demand among various types of aerial vehicles in agriculture. First of all, aviation is used to care for crops. In the autumn, the land is fertilized with liquid mineral fertilizers with the help of airplanes. Small-sized air machines are actively used in the spring period for chemical protection against pests and diseases. There are several types of revenue generation from aviation service:

- aircraft rental for the period of tillage;
- provision of comprehensive chemical protection services;
- equipment leasing;
- repair and maintenance of farmers' own equipment;
- organization of aerial monitoring of crops.

The practice of airplane usage to transport animals is now actively developed in the U.S. [10]. The main factors that make it possible to transport livestock over long distances are:

- settings of the aircraft environmental control system (ECS),
- animal physiology,
- the environment at the airport and on the route,
- possibility of ground service.

The use of artificial intelligence in the control of drones provides an opportunity for farmers:

- timely information about crop changes;
- reduces operational costs;
- improves crop quality;
- permanent separate monitoring by fields;
- use of precise sowing of grain crops;
- use of irrigation;
- ensuring the safety of the use of machinery and equipment;
- increasing the yield of agricultural crops.

The use of helicopters in most cases is used in huge lands, where the size of land plots exceeds 10 thousand hectares. It is also an effective practice to use helicopters if there are broad gardens, forests, and forest strips in the

farm for a timely response to a fire.

Conclusions. The aviation industry is characterized by high-tech processes, scarce resources used in such processes, and the professional skills of the personnel involved. Because aircraft imports increasing and economies declining over the last ten years, metallurgy, engineering, and industry are raw materials for the aviation industry. The number of drones sold for commercial usage will be 2.7 million units in 2025. 18% of all electrification start-ups come from aviation companies and 46% from independent researchers. Innovations are claimed to develop general aviation, urban air taxi, business aircraft, and large commercial aircraft. Aviation has the strong demand among various types of aerial vehicles in agriculture. There are several types of revenue generation from aviation service: aircraft rental for the period of tillage; provision of comprehensive chemical protection services; equipment leasing; repair and maintenance of farmers' own equipment; organization of aerial monitoring of crops. The main factors that make it possible to transport livestock over long distances are: settings of the aircraft environmental control system (ECS), animal physiology, the environment at the airport and on the route, possibility of ground service.

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