The global drone market: main development trends

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Abstract

Research background: Many countries of the world announced increasing the use of drones for civil and military purposes. An important feature of the drone market is that it is an "ecosystem"", which includes software developers, integrators, component manufacturers, etc. By 2025, the capacity of the global unmanned aerial vehicle market will grow by 3 times.
Purpose of the article: The aim of the study is to identify current trends in the development of the global market of unmanned aerial vehicles for commercial use.
Methods: A significant part of the necessary statistical data is closed for public access, due to the fact that most of the UAVs produced are part of the military-industrial complex or "dual-use" goods. Only 23.6% of all UAVs produced can be classified as civilian or commercial products. Market development trends using economic statistic methods were determined based on the data of the reports “The Unmanned Aerial Vehicles in International Trade and their Regulation”, Drone Industry Insights, the analytical agency Mordor Intelligence, “Global Drone Regulations Database”.
Findings & Value added: The USA, China and France are the leaders in the production of commercial and consumer drones. The rating of drone manufacturers is led by: DJI (China), SenseFly / Parrot SA (France), Yuneec (China), 3D Robotics (USA). The largest purchases are made by the USA, China, Russia, Great Britain, Australia, France, Saudi Arabia, India and South Korea. Significant growth in the use of drones is expected in medicine, logistics and delivery.

Keywords: *drone; unmanned aerial vehicle; UAVs; trends; prospects*

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1 Introduction

The production of unmanned aerial vehicles, commonly known as drones, is one of the fastest growing and dynamically developing sectors of the world industry, equally attractive for both government and commercial investments. A significant part of the developed and developing countries of the world have already formed the necessary institutional and legal framework, as well as announced national programs aimed at increasing the share of the drone usage for civil and military purposes. In turn, already large commercial corporations such as Google and Amazon are showing an extraordinary interest in buying promising start-ups associated with the industry. Unmanned aerial vehicles sales are expectedly steadily growing every year. According to the reports of Drone Industry Insights in 2018 the market volume amounted to $14.1 billion with the prospect of threefold growth by 2024 (Droneii,2020). Commercial deployments of drones are growing exponentially, ranging from cargo and taxi services to agriculture, disaster relief, risk assessment and monitoring of critical infrastructures (Perreault and Behdinan, 2021).

The investment attractiveness of the drone market is due to several reasons. First of all, it should be noted that there are many ways to use this technology. The most common areas include:

- Survey, geodesy and cartography. The most popular way to use drones is to use them as a mobile camera that captures objects from the air. Have its applications in filming, industrial exploration and geoinformatics.
- Transportation and logistics. The use of drones as a means of delivering goods, raw materials, etc., which reduces logistics costs, increases the speed of delivery and makes it safer. E-commerce corporations show particular attention to this technology. Large companies such as Amazon and Google are currently testing deliveries using unmanned drones, intending to use these drones on the market (Khan et al., 2021).
- Use of drones for pollination and crop control in agro-industry. Drones can be used to provide customized information suitable for decision-making (Na et al., 2021).
- Military operations and law enforcement including reconnaissance, warfare, delivery of military cargo up to 1 ton.
- Use of drones in archaeology and mining for geo-prospecting and excavation in highly hazardous areas.
- Medicine with systems of emergency notification and epidemiological control.
- Using drones in entertainment industry as a kind of "toy" and other forms of recreation.
- Conducting journalistic investigations, filming reports, journalistic "espionage" by mass media.

In addition, the attractiveness of the industry is determined by its prospects. The drone market is largely at the stage of origin and many niches are still not occupied. Research shows that consumers are ready to deliver food by drones, which opens up good prospects for the development of the food and tourism industry (Choe et al., 2021).

The goal of the study was to identify trends in the development of the global market for unmanned aerial vehicles - drones.

2 Methods

In studying the structure of world demand and supply of unmanned aerial vehicles, the researcher faces several methodological problems. In the first place, a large part of the necessary statistics is closed to general access, due to the fact that most of the unmanned aerial vehicles produced are part of the military-industrial complex or dual-use goods. According to Cerna (2016), only 23.6% of all UAVs produced can be classified as civil or commercial products. The remaining drones belong to the military sphere (35%) and dual-

use products (29%), which make this part of the market inaccessible to an ordinary researcher due to secrecy protocols and many strict regulations related to the import and export of military unmanned aerial vehicles. That is why the main object of the study in the article will be the commercial sector, statistics on which are relatively accessible.

The second obstacle to analysis is the great variety of drone species and designs, even within the same class of application. Unmanned aerial vehicles cannot be classified as standardized products, and their production itself is a global production chain that allows for a variety of component and software configurations, which makes it difficult to analyze some market factors, in particular prices.

It is important to take into account that the drone market is an ecosystem. It includes software developers, integrators, component manufacturers, etc. The overall ecosystem scheme of the drone market includes suppliers of raw materials, production of components, drone manufacturers, service companies and drone providers, end users. The block of "component manufacturers" in turn can also be divided into a kind of ecosystem. To date, only a few leading companies, in particular DJI and MMC, are capable of fully designing and producing major industrial chains, including aircraft, power supply, flight control, video transmission and ground control. That is why almost any unmanned aerial vehicle is a set of components from different manufacturers: metal parts, laser rangefinders, software, batteries, cameras and fasteners, motors, electronics.

3 Results and Discussion

The analysis of secondary data of the Drone Industry Insights report, materials of the analytical agency Mordor Intelligence, Global Drone Regulations Database allowed the authors to determine the following trends in the development of the global drone market.

The production of unmanned aerial vehicles is one of the most technologically advanced and knowledge-intensive industries. There are three main types of drone construction: quadcopters (as well as octocopters, hexacopters, etc.), rotorcraft and fixed-wing vehicles. Quadrocopters are most widespread due to their low cost and flight stability (which is necessary for filming - one of the main areas of civilian use of drones). Each of these types of design has its own advantages and disadvantages, however, there are several problems that are characteristic of each design and the solution of which seems to be a priority for drone developers. Unmanned aerial vehicles suffer from the fundamental problem of any consumer electronics that is the inefficiency of energy sources and storage. The most common lithium-ion batteries today have almost reached the limit of their efficiency, which makes manufacturers look towards new approaches. That is why systems based on graphene, hydrogen and an air-jet engine are gaining popularity.

As the demand for Unmanned Aircraft Systems (UAS) operations increases, UAS Traffic Flow Management (UTFM) initiatives are needed to mitigate congestion, and to ensure safety and efficiency (Chin et al., 2021). It should be noted that drones can be used by individuals to transport prohibited goods or as weapons, thereby posing a threat to security. Therefore, there is a request for the development of technologies for tracking the movement of the drone and its neutralization, if necessary (Kumar and Agrawal, 2021). Improvements in autonomy and software reliability are the most promising research areas for increasing the usefulness and acceptance of UAS in the public safety domain (Stampa et al., 2021).

An important growth factor is not only technological know-how, but also a general reduction in production costs (thanks to economies of scale and the proliferation of standardized platforms with chipsets), as well as a decrease in the complexity of device management. In this vein, the case of the Chinese company DJI is interesting, the first to introduce on the market an affordable and undemanding product to the pilot, which ensures

it to conquer a dominating 72% of the entire world market of sales of consumer and commercial drones in all price categories.

In geographical terms, the largest share in the total production of commercial and consumer drones, according to the Drone Industry Insights report, is occupied by the United States due to the fact that it was there that UAVs first began to be used. In 2018, the market for the production and sale of UAVs, their support, software development and components reached $4.5 billion in North America (32%), in Asia - $4.4 billion (31%), in Europe - $4 billion (28%). It is worth noting that both each region and inside them can be distinguished by a certain specialization. The main manufacturers of both unmanned aerial vehicles and their components are China, France and, to a lesser extent, America, while the software and service development industry is developed in Europe. The world's leading manufacturers of civilian drones are companies from three countries of the world: DJI (China), SenseFly/Parrot SA (France), Yuneec (China), 3D Robotics (USA). Other manufacturers of expensive unmanned aerial vehicles (Ehang, Walkera, Squadrone System, Xiro, Yuneec) and budget drones (Cheerson, Syma, Hubsan, Blade, Hobbico, JJRC) are actively competing with them. It is worth noting that a number of leading manufacturers of unmanned aerial vehicles for military use (AeroVironment, BAE Systems, Elbit, Israel Aerospace Industries, Lockheed Martin) also gained their share in the civilian market segment by launching the production of unmanned aerial vehicles for commercial use. The geopolitical factor significantly affects the financial position of drone manufacturing companies. Military action or terrorist attacks with the use of drones negatively affects the stock price, in particular, of American companies (Bevilacqua et al., 2021). Unmanned aerial vehicles firms remove technology transfer barriers in the general business, humanitarian, and the entertainment sectors (Mendoza et al., 2021).

Asia's share is projected to reach 42.6% by 2025, driven by China and India's growing demand for unmanned aerial vehicles for both commercial and research use. According to the China unmanned aerial vehicles Association, Chinese drone exports reached 884,000 in 2017, up 47.2% year-on-year, with export destinations in Hong Kong, North America and the European Union. According to Research and Markets, significant market growth predicted by 2025 at the technological level will be provided by the optimization of sensors and control systems - in particular, all kinds of autopilots and collision avoidance systems, which will allow from 100,000 to several million drones to be simultaneously in the air. Equally important are the issues of increasing the carrying capacity, which will ensure the development of one of the most promising areas of use of drones - logistics.

Country drone markets are divided among the largest American, Chinese and French manufacturers; in particular, DJI, Parrot and 3DR. The evaluation of existing providers is based on the Drone Industry Insights rating, which is an integral indicator, including market share, capitalization, sales volume and public field representation of the company. Drone provider rating is shown in Figure 1.

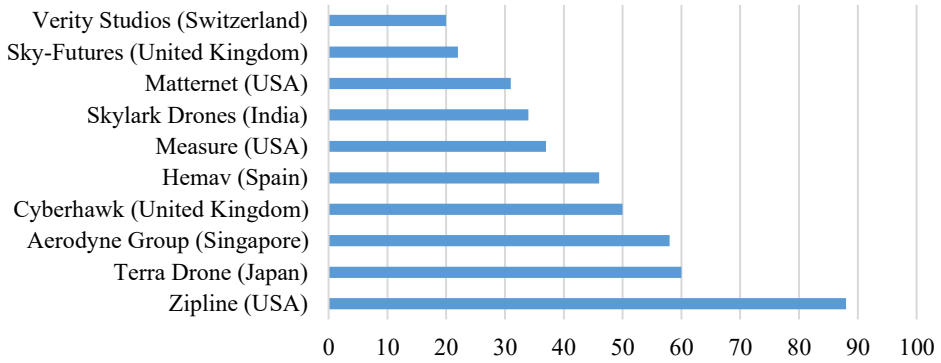

Figure 1. DRONEII drone providers ranking.

Source: Schroth (2019)

Some of the largest providers are located in the UK, India, Spain and Switzerland. Many companies are beginning to reorient themselves to the unmanned aerial vehicles application services market, the so-called "drone providers", focused on different application scenarios. In this regard, the market for renting drones and their maintenance is actively developing.

There is a trend towards integration and absorption. Strategic cooperation is being established between device manufacturers and software companies. Each industry requires more and more customized solutions, so many vendors change their standard configuration to meet the specific requirements of the industry.

The greatest demand for unmanned aerial vehicles is shown by companies and government agencies of the USA (31%), China (9%), Russia (8%), Great Britain (6%), Australia, France, Saudi Arabia, India and South Korea. Drone sales by country are shown in Figure 2.

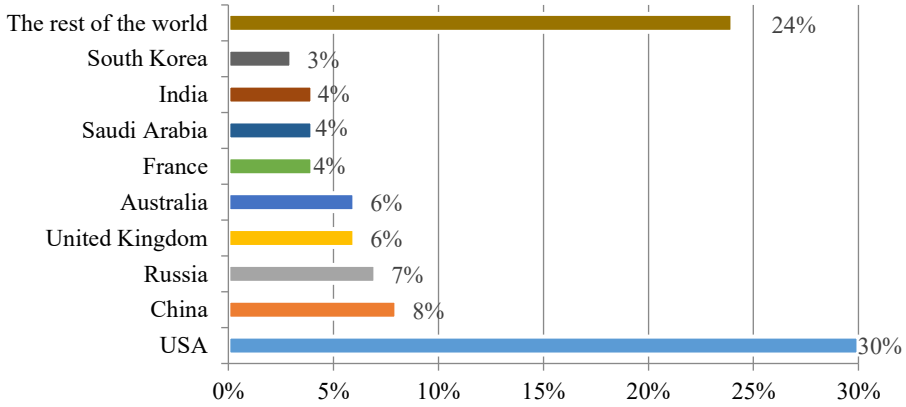

Figure 2. Geographic structure of world drone sales, 2019.

Source: Schroth (2019)

The largest share in the total use of drones belongs to the spheres of photography, the media, the agro-industry and the fuel industry. The most promising in terms of demand growth and application are “unconventional” areas of unmanned aerial vehicles application, such as mining, real estate and insurance.

The institutional infrastructure of the global drone market is being formed. On the one hand, it is required to ensure the safety of unmanned aerial vehicles integration into the national airspace, and on the other hand, not to strangle the promising industry with excessive control. The Global Drone Regulations Database provides an overview of the unmanned aerial vehicles regulations around the world. In the United States, no special licensing is required to import or manufacture non-military drones, and flying a drone does not require a pilot's license. The population of different countries of the world is concerned about possible abuse in matters of invasion of privacy. Often, it is covert filming from drones that becomes the main means of intrusion into the privacy of politicians, celebrities and other public figures, which leads both to calls for additional airspace regulation and the emergence of a whole new market for anti-drones countermeasures. Wang et al. (2021) focus on minimizing risks of harm and protecting privacy, mapping drones and the distinction of humanitarian from military use, toward the ethics of cargo drones carrying healthcare supplies and samples.

The cost of professional-quality commercial drones is constantly on the rise. A third of commercial drones sold in 2018 were worth over $2,000. This is a higher price than a year earlier. What's more, according to NPD, more than half of drone sales come from specialized unmanned aerial vehicles over $500. Since 2017, sales of this particular segment ($500-999) have grown by 33%. Even in the most mature areas of the market, new niches are emerging. Buyers are willing to pay more for drones with better camera quality for video shooting. Sales of such devices are doubling every year (Scott, 2018). From 2012 to 2018, according to TopTal, venture capitalists (Accel, Bessemer Venture Partners, Felicis Ventures, First Round, NEA, and Social Capital.) have invested more than $1.5 billion in drone launch companies. Investments are obviously concentrated primarily in the leading countries of the industry - the United States, Israel and China. In 2018, deals were made to finance 122 start-ups with an investment of over $506 million. Investors are most interested in companies working on bottlenecks in the current ecosystem, in particular, stand-alone solutions and analytical software. The IT-affiliated funds Google Ventures, Intel Capital and Qualcomm Ventures are showing the greatest investment interest, which confirms our thesis on the further consolidation of the market around IT conglomerates.

A temporary factor is the global pandemic, which sharply raised the issue of excluding people from production and supply chains, which further spurred investor interest in the industry. It can be predicted that in the current situation there will be a significant increase in the use of drones in medicine (emergency delivery, control of self-isolation and mask mode), as well as logistics and delivery, provided by such retail giants as Amazon and 7eleven (Castellano, 2019).

4 Conclusion

The drone market, due to its obvious science intensity and importance to national security issues, is under the influence of several constant factors. Drone technologies are at the forefront of scientific and technological progress, and therefore the latest developments and scientific achievements have a positive effect on the market situation, contributing to both the expansion of the scope of the product and its overall reduction in price. At the moment, the main efforts are aimed at improving batteries and navigation systems, which could subsequently open up a practically new era of commercial and recreational use of drones.

An important issue is state regulation of the sphere, which is still unresolved in a significant part of states. There is a general trend towards standardization and liberalization of unmanned aerial vehicles legislation in view of the increasingly obvious economic benefits of their implementation.

Experts from various consulting agencies and industry organizations (PwC, J'Son & Partners, DRONEII, etc.) give various assessments of the prospects for the development of the industry. The projected growth in market size by 2025 ranges from $20 billion to $45 billion. However, regardless of the details, all analysts agree that the market situation is favourable and call the drone market one of the most promising science-intensive markets. At the moment, the largest niches are investments in integrated companies, companies developing platforms for working with data, and air taxi. The latter receive investment from the automotive industry players looking for areas of diversification.

In this vein, it is logical to see a forecast of further growth in both production and demand. Drones will become increasingly accessible. Thanks to the integration and strategic cooperation of various manufacturers, the component base will be more and more modified, and further competition will take place already on the field of software and service provided. These trends are confirmed by more and more frequent news about the purchases of Google, Facebook and Amazon of various start-ups related to drone technologies, as well as vertical integration processes conducted by Chinese manufacturers, in particular, DJI. Probably, at the end of the growth phase, the global market will be more consolidated, being divided among several IT conglomerates that somehow control almost the entire ecosystem of unmanned aerial vehicles.

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