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UNMANNED AERIAL VEHICLE MARKET CONDITIONS AND IT'S PRACTICAL USE IN THE AGRICULTURAL SECTOR OF THE ECONOMY

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Abstract. *The purpose* of the article is to assess the current state of the unmanned aerial vehicles market in the world, to review the classifications of unmanned aerial vehicles by type of construction, size, purpose, range, and to forecast trends in the development of their use in various fields of activity. Based on the analysis of the use of modern technologies for the production and transportation of goods, the author proposes to investigate the logistical possibilities of using unmanned aerial vehicles (hereinafter – UAVs) as delivery vehicles, including their technical and technological capabilities in the analysis. Based on the study of the drone market, taking into account the existing limitations and prospects for the development of the UAV market, the authors of the article aim to develop technological recommendations to ensure promptness in time, efficiency in terms of cost of delivery of the required goods. The logistics component of the study involves building consistent chains of interaction between market participants of this service in time, delivery method and payment sequence, depending on the stage and status of delivery of goods. The study also aims to develop recommendations to improve the efficiency and safety of UAV delivery, and to generalize the advantages of delivering goods by drones over similar consumer actions by purchasing them themselves in a retail network or on the manufacturer's field using their own vehicles. It is also necessary to evaluate the advantages and disadvantages of delivering food products using UAVs in terms of their safety during transportation and to identify areas for further research and development to improve the safety and reliability of UAVs. *Methodology.* The study uses a monographic method of researching scientific knowledge based on analysis and synthesis. The use of traditional economic methods of systemic and comparative analysis made it possible to structure the objects of research according to their existing characteristics. The review of scientific publications, technical reports, patents and other sources of information allowed the authors of the article, as economists, to draw certain technical conclusions on UAVs, and on the basis of their basic conclusions, to draw conclusions regarding the safety, reliability and efficiency of using drones to provide food services to consumers. *Research results.* The authors propose the scientific idea of further studying the technical, technological, socio-economic components of the use of drones for further experiments and development of improved new approaches to such services. Thus, the use of a systematic, comprehensive methodological approach will allow us to obtain a comprehensive picture of the effectiveness and safety of UAVs for food delivery. *Practical implications.* The use of UAVs in the delivery of food and agricultural products has the potential to significantly change the logistics industry by providing fast, reliable and environmentally friendly solutions for the delivery of goods. *Value/originality.* Based on the study, the authors formulate conclusions and recommendations that may also be useful in developing programs and measures to counter climate challenges and aimed at sustainable development of the agro-industrial complex of Ukraine in peacetime.

Keywords: market conditions, market, logistics, food supply, UAVs, drones, value chains, agricultural companies.

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1. Introduction

Today, many agricultural producers of various technological levels use unmanned aerial vehicles (hereinafter referred to as UAVs) or, in the more common usage of the term, "drones" to optimize certain production processes in agricultural production. Ukrainian agricultural business uses drones, in particular, for important tasks, including monitoring the condition of fields, collecting data on harvests, chemical treatment of plants to combat pests and diseases, diagnosing the efficient use of transport infrastructure, etc. At the same time, for the purposes of sustainable development in peacetime, the civilian use of UAVs raises a set of issues of reformatting such services with an emphasis on food consumers and providing them with separate, time-efficient and cost-effective services.

Unmanned aerial vehicles are a new technological challenge of recent decades for traditional aircraft traditionally associated with airplanes and their human control. The value and cost of human life is an extraordinary achievement of mankind and is placed by the global society at the pinnacle of civilizational development. Traditional civilian military operations in the past could not do without human-piloted aircraft. Over time, due to certain human miscalculations, deliberate harm to air carriers by their enemies, and in times of war, enemy actions, this resulted in significant mortality among aircraft crews. The long-standing plan of mankind to solve this problem was eventually realized first in the United States, and then, over time, in other countries of the world, where the production of unmanned aerial vehicles with remote navigation control began. In a short time, UAVs went from passive aerospace, then military surveillance and participation in military operations to civilian delivery of goods that were safely and reliably received by the intended recipient, wherever they were. The longer the range and the ability to handle larger and heavier loads, the more productive these aircraft can be. Since drones cannot operate in congested and difficult areas, they must be absolutely safe. To ensure the safety of the transportation service, they need to include redundancy at several levels to avoid harm to people, property, or loss of valuable cargo. To this end, redundant systems such as engines, GPS for navigation, vision systems, and other sensors for flight and flight termination need to be powered in advance.

2. Scientific Generalizations

New global climatic, military-political, financial and economic challenges are increasingly drawing humanity's attention to the problems of food security. According to many Ukrainian scholars, the importance of food security lies in the guarantee by countries and their governments of food supply mainly through their own national agricultural production, since food consumption is basic in the general range of human needs and underlies the formation of a high level of quality of life.

For example, the articles by Kvasha S., Vakulenko V. (2023) and Vyshnivska B. (2024) state that "At the present stage, food security is a priority area of domestic policy and international relations of the state, as defined by the UN Sustainable Development Goals by 2030, which have been adopted by most UN member states, including Ukraine. In view of this, it is important to emphasize that at the present stage, an essential component of state policy is to ensure the proper development of the agricultural market".

Unmanned aerial vehicles will have a new and likely significant impact on ensuring the physical and economic accessibility of food security by optimizing the value chains of technological stages from agricultural production, monitoring and delivery of food.

UAVs provide fast delivery of food to remote or hard-to-reach areas, which is critical during emergencies or in conditions of insufficient infrastructure. Rapid delivery can reduce the loss of food, especially perishable food.

A number of foreign researchers have studied this current scientific and practical topic, in particular Amel Kosovac, Muharem Šabić, Ermin Muharemović, Edvin Šimić (2022) in their publication "Shipment delivery challenges using unmanned aerial vehicles" point out that the main advantage of drones in urban areas is the independence from road infrastructure and fast delivery, but several challenges need to be addressed for this type of delivery to be competitive with other modes.

Other researchers Benarbia Taha, Kyamakya Kyandoghere (2021) recognize that "to stay competitive and meet the increased demand, businesses began to look for innovative autonomous delivery options for the last mile, such as autonomous unmanned aerial vehicles/drones, which are a promising alternative for the logistics industry. Following the success of drones in surveillance and remote sensing, drone delivery systems have begun to emerge as a new solution to reduce delivery costs and delivery time".

Tadić Snežana, Kovač Milovan, Cokorilo Olja (2021) also recognize the relevance of using drones in social projects. Thus, in their study, they point out the need and feasibility of popularizing drone delivery: "With the rise of city logistics (CL) problems in the last three decades, various methods, approaches, solutions, and initiatives were analyzed and proposed for making logistics in urban areas more sustainable".

The introduction of UAVs into logistics processes requires significant investment. The high upfront costs of purchasing drones, developing the infrastructure to maintain them, and training personnel can be a barrier for many companies. In addition, the need to insure drones and the cargo they carry can increase operating costs. The cost-effectiveness of using UAVs also depends on the volume of transportation and the optimization of logistics processes.

With the development of science, technology, and social progress, drones will play an increasingly important role in logistics in the future. First of all, drones can effectively improve logistics efficiency. Their ability to operate at different altitudes and speeds, as well as to carry different cargoes, allows them to mitigate problems associated with urban traffic congestion and facilitate the transportation of goods to remote locations in the regions. (Chen, 2020)

The future of drone logistics promises great opportunities, but there are many unresolved issues that need attention. Drones can face many challenges to get started and these challenges can be expected and unexpected as well (Ncube Melisa, Kaabi Sultan, Altamimi Hadeel, 2021).

National legislation in certain countries regarding regulation, safety, environmental, technical, and economic issues pose serious barriers to the full implementation of UAVs in logistics processes. To overcome these barriers, it is necessary to work together with government agencies, the private sector, and academic institutions to find optimal solutions and ensure the successful development of this technology in the future.

In addition to speed and cost of delivery, environmental and social sustainability are increasingly important factors in logistics by drones, especially in urban areas (Tadić, Radovanović, Krstić, Veljović, 2023).

As the growing experience of civilian use of UAVs in previous years, and especially now, shows, drones have a realistic claim to redistribute transportation and logistics chains. More and more of the world's population is getting the opportunity to have transportation services using drones. Simplification of many important human communications, as well as cheaper deliveries on time and to the right place are the most important advantages of using drones in the social and everyday life of the world's population (Chen, 2020).

These compelling arguments are important to the entire population of any country, regardless of where they live. they can take inventory in a warehouse, transport goods by air, and even offer surveillance of the transportation of heavy machinery or materials within and outside of industry. Some companies have begun testing the use of drones to distribute products to the end user.

3. Classification of UAVs by use

Currently, there are several types of drones, which are classified according to different characteristics, such as the type of construction, purpose, size, and flight range. They can be divided into the following main categories:

1. According to the type of construction. Multi-rotor drones are the most common in terms of sales and their multifunctional use. They have several rotors, top four that are called quadcopters. They have long been dominant in procurement for personal social and industrial needs, well suited for stable flight and performing various tasks such as aerial photography. The second common type is fixed-wing drones, that is, drones that are similar in miniature to conventional aircraft. They can cover long distances at high speed and are often used for monitoring and reconnaissance. Vertical take-off and landing (VTOL) drones are extremely versatile in their needs. They are characterized by a technological combination of the capabilities of multi-rotor and fixed-wing drones, because they can take off and land vertically, and then go into horizontal flight.

2. By appointment. This segment, as in previous years, is dominated by drones of family or personal consumption. These drones are designed for visual surveillance and filming for the most advanced users and amateurs. They are usually small and affordable, have a limited range, and are easy to use. The second most popular use is commercial and industrial drones. For the most part, their use is business-related, that is, it is the delivery of personal goods to consumers, the cultivation of crops in agricultural production, the monitoring of infrastructure, in particular the state of energy and transport infrastructure. These drones are also widespread in specific and difficult conditions, as they are used to perform specialized tasks in industry, such as inspection of hard-to-reach objects, including water space, multi-store buildings, mountain cartography. Military drones have been particularly developed as the third type for their intended purpose, in particular under Russian aggression against Ukraine. Their successful use depends on the skill of military operators, installed software, frequency of movement and individual military tasks. Most of them are single-action drones, because the principle of their military use is one drone – one target. They are used for reconnaissance, surveillance, and actively even for attacking and destroying targets. They have a high level of autonomy and can operate in dangerous environments.

3. By size. This feature of classification is very important, since it characterizes the intention of manufacturers for use and compliance and accessibility with the needs of individuals and legal entities.

This classification is started by the smallest ones – these are microdrones. They are designed as meager products that can fit in the palm of a person's hand. Sometimes their use is of a specific espionage or cinematic nature. The second group, small drones, typically with a size of up to 50 cm diagonally. They are the subject of consolation for families, including adults and children, because their use for aerial photography in sports, at festive events is extremely effective. The next, third group, unites medium-sized drones with a wingspan of up to 2 meters. Traditionally, these aircraft are used for commercial and industrial purposes, and during the war also in the tasks of destroying military equipment. And at the end of this classification, a group of large drones that can have a wingspan of up to several meters. They have a universal civilian, scientific and military purpose. For them, the presence of runways, satellite support of flight navigation systems is a separate requirement. They also have the option of returning to their base of deployment.

4. By flight range. Depending on the power plant, i.e. its battery or liquid-fuel type, drones can also be divided into three groups. Firstly, these are short-haul drones with a flight duration of up to 30 minutes. Secondly, medium-haul drones with a stay time in the air of up to several hours. And thirdly, it is a UAV with a long flight time of several days.

So, each currently existing type of UAV created by the manufacturer with a specific purpose and the use of modern polycarbonate materials, designed to perform specific and specific tasks, has its own unique characteristics and maintenance.

An important area of civilian use of UAVs is to meet the growing needs of citizens in a variety of services for fast, addressed, affordable delivery of goods. As the authors' own experience shows, drones are an effective alternative for road transfer of food delivery, even from a nearby network. Drivers do not always have the opportunity to get up from the table, get into their own car to buy a cake, coffee, pizza or sushi in a supermarket, which is necessary and unforeseen before. In this case, the organization of courier delivery of products by drones from a commercial establishment to the consumer's table is an extremely interesting scientific and practical goal. In our opinion, a pre-planned need and timely delivery of freshly grown vegetables from the field to the consumer is a future goal for housewives. To plan such deliveries to a consumer in a small town or city, it is necessary to provide for several logical, interdependent stages, which must first be carefully planned and executed.

It is clear that the provision of such services should be provided by a specialized enterprise, the owner of the UAV as unmanned vehicles for the delivery of goods or the provision of services. After receiving an application for the delivery of goods by drone, the operator must take several sequential steps of his own actions, while providing certain guarantees in payment both for the goods to their owner and for the promptly provided service to their own enterprise. Below is a detailed plan for this process in peacetime: First, the operator must make a selection and have one or more drones pre-tested and prepared for flight. It is important to choose the right type of drones, namely, you should choose exactly those commercial drones that meet the sufficient payload capacity and range of a certain flight. For long-distance flights, these can be multicopters or VTOL drones that are capable of covering long distances. For such transportation, drones must be equipped in a certain way. In particular, drones should be equipped with containers or special holders for transporting products and other functions, such as sensors to monitor transportation conditions according to temperature, humidity, wind, etc. calls. A significant advantage of drones for such transportation should be their autonomy. They must be able to fly autonomously, with the ability to change their route in case of obstacles or dangerous conditions. Secondly, route planning by the operator is a key factor in the successful delivery of goods. To determine the optimal route, the operator must thoroughly know the geography of the territory. First, it is necessary to determine the most direct and safe route from the trading enterprise or field of the agricultural producer to the consumer. It is worth considering the terrain, the presence of areas with limited access, weather conditions and other factors. When planning the direction of flight, it is worth determining areas for the safe take-off and landing of drones both in the field and in the city. They must be convenient for consumer access and safe for surrounding objects.

Thirdly, it is the infrastructural support of the flight and the formation of a route for the use of base stations. If necessary, they should be equipped in areas of signal availability from the station, for example, in the field and at the destination of the cargo. With a certain arrangement, they can also be used for maintenance – for example, charging. Infrastructure support should also be thought of as a communication network. In this case, we envisage ensuring stable communication between the drones and the control center for flight monitoring and data transmission.

Fourthly, the organization of logistics is the next important issue of air delivery of goods. After all, when working with food products, it is necessary to provide for the packaging of products in advance. If, for example, vegetables are harvested directly in the field, then immediately sorted accordingly, then

the next step should be packaging in the appropriate containers for direct delivery to the consumer using an unmanned vehicle. The shape of the container, as well as manual or automatic packaging, are designed to reliably ensure the safety of products during the flight. The operator sends drones along a predetermined route with constant real-time monitoring to ensure safety and timely delivery.

Fifthly, the delivery of products should take place with a clear definition of the coordinates of the destination with visual support of movement. Landing at the destination implies that the buyer must have the appropriate territory or a specially equipped high-rise platform. The operator must land the drone in the designated landing zones. These can also be special stations in the form of take-off/landing sites. At the same time, the products ordered by the buyer can be transferred to the consumer both automatically and manually. It is assumed that after the completion of the transport operation, feedback occurs – the consumer informs about the success of the delivery of products and compliance with the ordered condition.

The constant operation of UAVs as vehicles for the supply of food to consumers provides for their mandatory post-flight visual or maintenance service.

The list of tasks for checking the condition of drones first includes assessing the condition of the battery and, if necessary, charging it. Drones are charged at base stations to prepare for the next flights. Regular maintenance of drones is carried out to ensure their reliability and safety. During the review process, the effectiveness of the deliveries performed is analyzed, problem points are identified and improvements are implemented.

In addition to the above sequential actions for the use of drones, there are also separate and specific additional requirements for the use of UAVs, which should be taken into account. We are talking about licensing and compliance with flight rules in the area. All flights must comply with local legal requirements and safety regulations. Another important caveat in the use of drones for the delivery of products is insurance of drones and cargo in case of accidents. When flying, it is also necessary to take into account environmental aspects. Taking into account environmental standards in terms of temperature and sound noise should obviously provide for the implementation of measures to minimize the impact on the environment. Such a detailed approach will allow you to effectively organize courier delivery by drones, ensuring fast, safe and reliable delivery of products from the field to the consumer in the city.

The analysis carried out by the authors testifies, for a long period of time, not only experiments with the delivery of goods by drones, but also a full-fledged transition to such a supply practice. According to the study, the global drone logistics market size in 2021 was around USD 8.25 billion, and it is projected to grow to around USD 53 billion by 2028, at a compound annual growth rate (CAGR) of about 20.75% between 2022 and 2028. Different countries differ in the pace of development of this new logistics and transport traffic. Thus, in the United States, applied experiments and testing on the delivery of goods using unmanned aerial vehicles (UAVs) have mostly ended. The U.S. government, for its part, is also actively working to regulate the use of drones for commercial delivery and airspace security. Several companies, such as Amazon Prime Air, Alphabet's Wing (a division of Google), UPS, and FedEx, are actively exploring the possibility of using drones to quickly and efficiently deliver goods to different regions of the country. For example, Amazon Prime Air, which is a project of Amazon, is testing a drone delivery system that aims to ensure that goods are delivered to customers within 30 minutes of ordering. They are testing a variety of drone models and developing new technologies for automated and secure delivery. Amazon Prime Air's goal is to ensure that items are delivered to customers quickly and efficiently within a short time of placing an order. Amazon drones can fly up to 11 km from a warehouse and deliver parcels weighing up to 2.3 kg within half an hour after a customer places an order. Drone delivery is attractive not only at high speed, but also at a lower cost. It is assumed that the drone will descend into the client's backyard and drop the package from a safe height before flying further (Figure 1).

Alphabet's Wing, which is a separate division of Google and specializes in the development of unmanned aerial vehicle technologies and delivery programs, is also active in this environment of using drones. Alphabet's Wing's projects are actively developing, and the company has launched food delivery programs, cooperates with stores, restaurants and other partners to implement consumer food delivery programs for individual customers.

A separate area of services that is important for civil society is implemented with the help of drones by UPS. It has already tested and uses drones to deliver medicines and other goods in certain regions. UPS actively uses unmanned aerial vehicles (UAVs) to deliver products, especially as part of experimental programs and specialized services. The basic and key areas of their work are related to the delivery of medical supplies. In particular, UPS has partnered with Matternet to deliver medical specimens between hospitals and laboratories. In addition to delivering medical samples, UPS also uses drones to transport medicines and other medical supplies to hard-to-reach or remote locations where traditional delivery

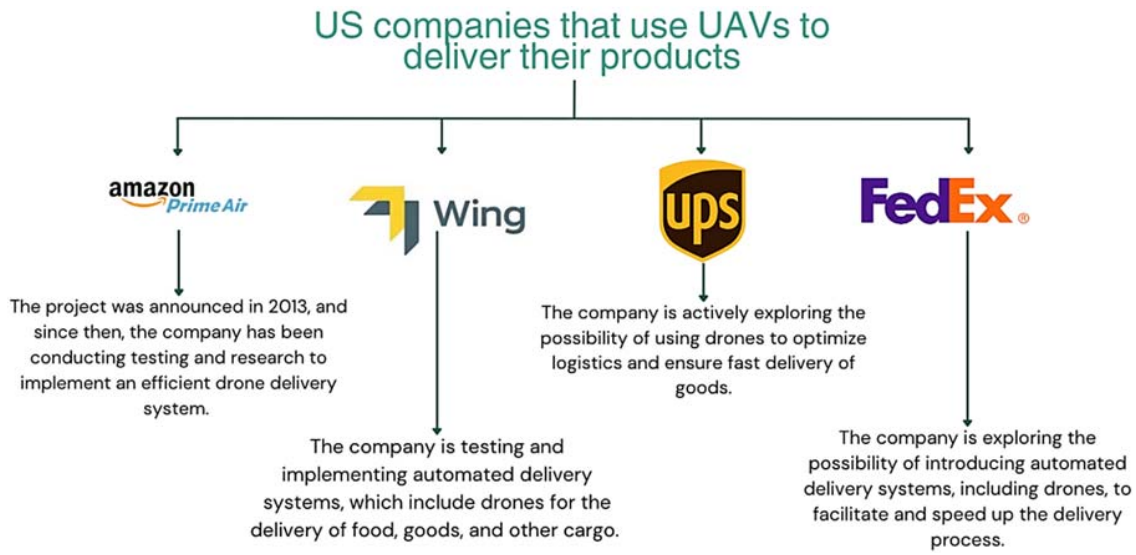

Figure 1. UAVs in the delivery of products

Source: systematized by the authors

methods may be too slow or complicated. This service is provided through the UPS Flight Forward program. In 2019, UPS received Part 135 certification from the U.S. Federal Aviation Administration (FAA), which allowed them to launch commercial services using drones. UPS also uses drones for internal logistics in its large warehouses and logistics centers. Drones can quickly transport small packages or documents between different parts of the warehouse, streamlining internal processes. UPS is actively researching and implementing UAV technology in an effort to make its logistics more efficient, faster, and more environmentally friendly.

Another major global company has quickly joined the use of drones, and this is FedEx. FedEx is also actively researching and using unmanned aerial vehicles (UAVs) to deliver products. A key aspect of FedEx's use of drones in recent years has been cooperation with industry technology partners. So, one of the significant partners for them is cooperation with Wing (a division of Alphabet). Real examples of the use of drones in this cooperation were pilot projects in Virginia, where five years ago, in 2019, FedEx together with Wing launched a pilot project in Christiansburg, Virginia. As part of this project, drones delivered goods from local Walgreens stores and pharmacies to customers. Among the priorities of these deliveries, the focus is on medicines. This, like UPS, has become somewhat widespread in the work of FedEx logistics for its own warehouses and sorting centers.

4. The Practice of Using UAVs in Agricultural Production

Like large industrial, information and transport corporations in the United States, large agricultural corporations are no less actively working on the implementation of UAVs in their activities. These companies work to develop and implement innovative drone delivery programs that aim to improve the efficiency, convenience, and speed of delivery of goods to their own agricultural customers. The activities of these corporations differ significantly in terms of industry but are partially similar in almost the entire list of services for the use of drones. There is no doubt that the key difference between the use of drones is their main purpose – high-quality monitoring of the state of crops and analysis of the state of crops using special video cameras (Table 1).

Thus, some of the largest agricultural concerns in the world, Cargill, Syngenta Monsanto, Archer Daniels Midland and others, mainly use drones to monitor crops, identify problems with plants during the growing season and analyze soil quality. These companies use drones as part of their strategies in the national logistics of the countries where their own products are supplied to monitor the performance of the supplied hybrids, search for best production practices in agriculture.

Unmanned systems and technologies in agricultural logistics are promising tools that can significantly facilitate and improve the processes of constant and urgent transportation of goods, in particular plant protection products during peak periods of the spread of pests and diseases. In Ukraine, in previous, pre-war times and now, chemical treatment of agricultural plants with herbicides has already become widespread. This work is carried out by several newly created companies and the demand for such an effective and relatively cheap cultivation service is growing annually.

Ukraine, with its large agricultural land, has every opportunity to intensify the provision of services

Table 1
Agricultural companies that actively use drones for logistics

Company Name	Use of drones
Cargill	One of the largest agricultural concerns in the world, Cargill uses drones to monitor crops, identify plant problems and analyze soil quality
syngenta	This company is engaged in the development and production of seeds and protective products for crops. Syngenta Uses Drones to Monitor Plants and Assess Pesticide Impact on Cultivation
MONSANTO	As a leading agrochemical company, Monsanto also uses drones to monitor field health, analyze yields, and develop new plant hybrids
ADM	Archer Daniels Midland – one of the world's largest suppliers of cereals and food products. The company uses drones to assess the condition of grain warehouses, monitor supplies and logistics
JOHN DEERE	A well-known manufacturer of agricultural machinery, John Deere, develops and implements drones for remote field monitoring and analysis of production processes

Source: systematized by the authors

and profitably use drones for the delivery of various agricultural products.

In agriculture, where there is often a need for fast and efficient delivery over long distances or to hard-to-reach places, the use of UAVs should become an important tool for optimizing transport logistics and generally increasing the productivity and efficiency of agricultural production.

Examples of the use of drones in the delivery of agricultural products (Figure 2).

These examples demonstrate the variety of possibilities for using drones in the delivery of agricultural products, which contributes to the mobility of effective decision-making in the process of production, processing and marketing of food products. In general, increasing the profitability of agribusiness, especially in such a difficult period as now.

Along with the above arguments about the advantages of using drones, we also note certain

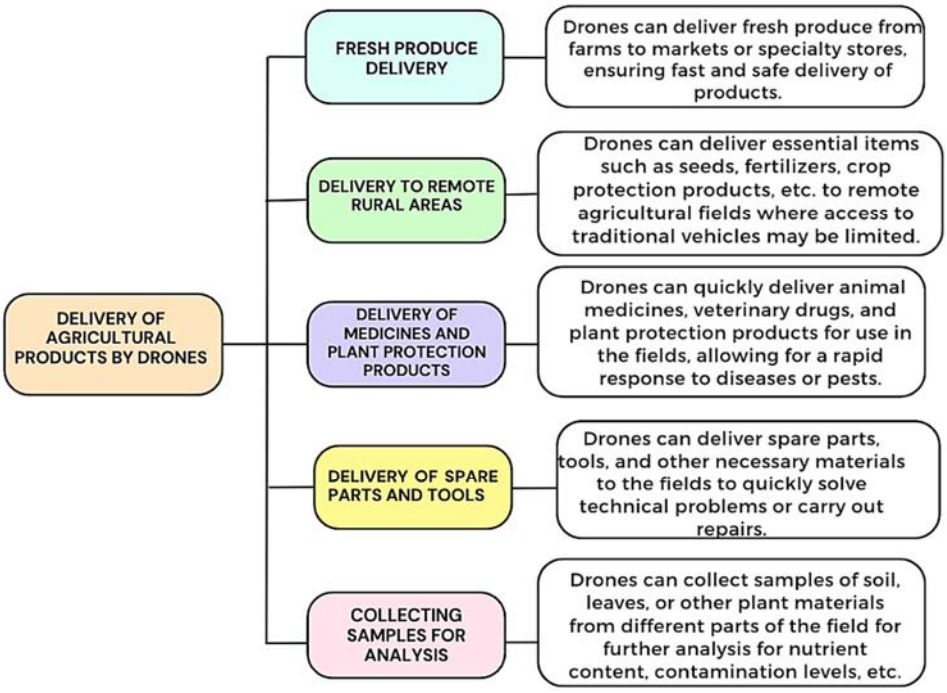

Figure 2. Options for the delivery of agricultural products by drones

Source: developed by the authors

challenges regarding their use. Drone delivery has its drawbacks, which are important to consider when evaluating its effectiveness and use (Table 2).

So, in general, there are grounds to assert the successful world experience of using drones as unmanned vehicles in various sectors of the economies of countries. Delivery of goods by drones has a competitive potential to be now and become an effective way of communication between sellers and buyers in the future. It is important for each of the sectors of the national economies to take into account the potential advantages and possible disadvantages when developing and implementing programs for the delivery of UAV goods.

At the same time, it should also be expected that, from a moral and ethical point of view, the large-scale use of drones will eventually lead to a significant restriction in communication outside of working hours. Also, we should expect another communicative negative – the now widespread traditions of family and personal car trips for consumer goods and holding certain parties with relatives, relatives and friends during purchases will decrease over time (Ncube, Kaabi, Altamimi, 2021).

Experience shows that in some ways, the unique results of the use of drones in the war of the Russian Federation against Ukraine are also associated with the extraordinary training of UAV operators in organizing and performing the most complex point operations. The training of drone operators is a constant purposeful work of educational institutions, individual trainings. Taking care of people's health – through urgent deliveries of medical supplies and medical supplies using drones is extremely important to reduce delivery time and ensure a quick response to customer needs.

5. Conclusions

It is important to recognize that the widespread use of drones for agricultural and food supply purposes as unmanned vehicles is a highly efficient logistics tool. They do not change the rules of the game in the traditional sense and do not completely replace existing methods. Instead, they streamline workflows, complementing and empowering the agricultural sector. The introduction of unmanned aerial vehicles in agriculture is gradual. This was partly due to the conservatism of traditional farming methods that were passed down from generation to generation. But it's also due to regulatory constraints, such as those restricting operations under the author's interest of this publication in exploring and submitting to the public the possibilities provided by drones for potentially food-based line-of-sight (BVLOS) populations, which have limited scalability.

Overall, despite some challenges, the outlook for the agricultural drone market remains positive. The sector is on a growth trajectory with significant potential for future expansion. This growth is underpinned by a growing awareness of the unique benefits of using drones in agriculture. With changing regulations and advances in technology, drones will play an increasingly important role in improving agricultural efficiency and productivity. It can also take advantage of these technologies to optimize its traffic flows and ensure greater efficiency in logistics processes. Potential applications of unmanned systems in transport logistics in Ukraine. However, for the successful implementation of this approach in Ukraine already in peacetime, it is necessary to resolve the issue of regulating the use of drones in the airspace, ensuring the safety and targeting of delivery and other organizational, economic and technical aspects.

Table 2

Advantages and disadvantages of using drones in agricultural logistics

Advantages	Disadvantages
Speed: Drones are able to deliver goods much faster, especially in hard-to-reach places where conventional transport cannot reach quickly.	**Limited lifting capacity**: Most drones have limited lifting capacity, which limits the volume and type of goods that can be delivered.
Efficiency in hard-to-reach locations: Drones can easily deliver goods in areas with difficult terrain or in remote locations where other means of transportation cannot reach.	**Limited range:** Drones can typically fly limited distances, which limits their effectiveness in delivering over long distances.
Cost-effective: In some cases, drone delivery costs can be lower because there is no need to pay people to drive the transport.	**Dependence on weather conditions:** Weather conditions, such as high winds, rain, or fog, can limit the ability to use drones for delivery.
Eco-friendly: Drones run on electricity or alternative fuel sources, making them environmentally friendly means of delivery.	**Security:** There are questions about airspace security and the possibility of conflicts with manned aircraft and other UAVs.
Flexibility: Drones can be programmed for automatic delivery, allowing for regular routes without the need for a human to be in control.	**Limited battery capacity:** Most drones run on batteries, which limits their flight duration and the distance they can fly without recharging.

Source: developed by the authors

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