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PROSPECTS FOR THE DESIGN AND DEVELOPMENT OF DRONES IN ARMENIA

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A B S T R A C T

This research aims to analyze the current state and prospects of Armenia' drones or Unmanned Aerial Vehicles (hereinafter UAV) industry, identifying ke challenges and proposing actionable strategies for enhancement, concentratin on domestic and international regulatory impacts.
It examines regulatory and operational challenges in Armenia's UAV industry including stringent import regulations, limited production capabilities, and lack of standardized procedures. The paper also explores UAV applications i the agriculture and defense sectors.
The study adopts a mixed-methods approach, combining reviews of existing UA regulations with qualitative interviews of key stakeholders and case studies fro countries with advanced UAV industries to identify best practices. Despit challenges, Armenia's UAV sector has significant growth potential. The industr can contribute to national economic and security goals by integratin international standards and leveraging technological advancements. Th research offers strategic recommendations for sustainable development..

1. INTRODUCTION

The high-technology industry is experiencing rapid growth on a global scale, and Armenia is no exception. This trend is especially vital for countries such as Armenia, which has restricted natural resources and requires technological advancement to improve their economic conditions. In response, the Republic of Armenia (henceforth RA) has implemented a development strategy centered on technology. A pivotal aspect of this strategy pertains to the drone industry, often known as UAV (Mohsan et al. 2022). While drones were first developed primarily for military purposes, their utility has broadened significantly to include recreational, hobbyist, professional, commercial, and military purposes (Tepylo, Straubinger & Laliberte 2023). This study focuses on the present remote-control systems and investigates the challenges faced in the production, application, and modernization of UAVs. It seeks to identify ways to improve these systems to ensure their ongoing advancement. The focus is on pinpointing the primary obstacles and suggesting development strategies for Armenia's drone industry. At present, Armenia's remote-control system is undergoing reforms and advancements, with the government acknowledging the significance of UAV technology in both military and civilian domains and investing in its development (Calcara et al. 2022).

2. THE ROLE AND SIGNIFICANCE OF HIGH TECHNOLOGIES IN THE RA ECONOMY

2.1. Determining the main directions of the high-tech sector and developing a development strategy

In the course of identifying challenges in the field of high technology (IT), developing policies for the further development of the field, and conducting research and analysis in the field of IT, there is always a need to collect

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data and information from companies in the latter. According to the Republic of Armenia (hereinafter referred to as RA) Government's decision N1553 of December 10, 2015, the RA Ministry of High-tech Industry (hereafter HTI) is the authorized state management body that collects the indicators of the RA information technology sector and maintains the administrative register. Companies operating in the IT sector must submit reports to the RA Ministry of HTI electronically through the information system of the administrative register of the IT sector.

The high-tech sector with its related sectors is a complex and multi-functional system, which makes it difficult to get complete information about the sector. According to the information system of the administrative register of the IT sector, the number of organizations in this sector in 2018 made up about 1000 companies. The turnover of the sector was about 115 billion AMD or 242 million US dollars. The number of people employed in the field is around 15,000 specialists.

The best assessment of RA's position in the international arena can be obtained by analyzing the indicators of the Global Innovation Index (GII), which is evaluated based on 7 main factors with their sub-factors. The development strategy of the high-tech sector defines 2020-2025. The goals chosen for and the main directions to achieve them. The plan of the RA government, adopted by the decision of the RA government of February 8, 2019 N 65-A, was the basis for developing the development strategy of the high-tech sector.

When talking about the high-tech sector, as a rule, a question arises as to what we mean by high-tech. There are different approaches to defining high technology, and it is difficult to find a common definition that will satisfy all parties. The Ministry of HTI of the RA determines the list of IT sector technologies, which specifies the main directions.

A summary SWOT analysis of the high-tech sector was made based on the conducted research and available indicators are presented in Table 1.

Table 1. A summary SWOT analysis of the high-tech sector was made based on the conducted research and available indicators.

Strengths	**Weaknesses**
Availability of talent, high level of fundamental knowledge	The absence of tech educational institutions with international high-ranking, modern educational programs
The presence of international tech companies	A small number of students studying in engineering fields
Diaspora presence	A small market for domestic consumption
Communication and Internet access throughout the country	Insufficient volumes and conditions of office infrastructure
Established and developing high-tech sector, presence of technological culture and institutions	Insufficient presence of large venture funds, international business accelerators
Simplicity of business registration and preferential tax system for start-ups, free entry and exit of capital	Low level of international recognition as a tech country
Access to international markets	Difficulty in obtaining the right to work for foreign professionals
Education, safety, high quality of food, favorable living conditions	Insufficient level of digitization of state services
A high participation rate of women in tech	Lack of a favorable legal environment for the development of startups on intellectual property and joint stock companies
Opportunities	**Threats**
Increase in domestic consumption of local products in the defense sector	brain drain
Application of high-tech products in the domestic market in all sectors.	Possible threat of war
Targeted use of diaspora opportunities	High level of concentration
Development unconstrained by natural resources and logistical constraints	Lack of funds
Proportional technological development in regions	The presence of international organizations dominating the world
Increasing involvement of women in the industry	Dependence on communication infrastructure
Development of digital infrastructures	
Scaling up educational programs of private companies	
High demand for high-tech professionals	
Ability to inflow talents	

2.2. The goals of the development of the RA military industry and the role and importance of UAV in it in 2020-2025

2.2.1. General Provisions

1. The strategy for the development of the military-industrial complex of the RA RADFR is developed based on the plan of the Government of the RA, taking into account the main directions of the national security policy and defense policy of the RA: ensuring the necessary capabilities of the Armed Forces of the RA, the economic and technological development of the country, as well as also the deepening of international cooperation of the RA in the field of military industry (Ortiz-Villajos, & Martos-Gómez 2023).

2. This strategy defines the goals, principles, priority directions, and main tasks of the development of the RA military industry, as well as the mechanisms of their implementation and the expected results (Surkov, Moroz & M Romaniuk 2020).
3. One of the primary problems facing Armenia in the field of defense is the development of the capabilities of the armed forces and their acquisition of modern weapons, military equipment, and logistical means, with a combination of the best samples of domestic and foreign production. The development of the domestic military-industrial complex is aimed at providing the primary needs of the Armed Forces with several types of weapons and military equipment, reducing dependence on imports, as well as promoting technological progress, and increasing the export potential of high-tech military-industrial products and services (Bove, Rivera & Ruffa 2020).

2.2.2. The nature of modern warfare

Technical and technological progress, the revolution in military affairs, and the introduction of new types of weapons have led to a change in the forms and methods of armed struggle, and therefore also like war (Liao (2020).
Features of "New Generation" wars are:
1) A significant part of tasks is performed by forces and means operating in the aerospace domain, operations requiring direct contact with the enemy give way to long-range operations Gady (2023).
2) Operational-strategic and operational means are used to attack the objects of tactical significance that cannot be protected from them
3) Hitting vitally important objects in the entire depth of the territories of the parties (Monge & Vidal 2021).
4) The concepts of the traditional front and rear, as well as the emphasized front line, are blurred.
5) Wide use of special operations forces and landing forces (Merrigan et al. 2020).
6) The capabilities of modern weapons significantly reduce the differences between day and night warfare (Lavazza & Farina 2023).
7) The advantage of offensive means over defensive ones increases, making it impractical to repel aggression using only the latter (Gagnon, Quansah& McNicoll 2022).
8) The presence of modern means of exploration and attack dramatically increases the vulnerability of accumulated large forces and assets (Ahmad et al. 2023).
9) Improvement of troop management systems, increasing the efficiency of small combat units increases the expediency and efficiency of conducting decentralized (network) operations (Kovalenko et al. 2023).
10) The use of self-organizing swarms of drones of various sizes and purposes and autonomous systems significantly changes the nature of warfare (Lehto & Hutchinson 2020).

2.2.3. The strategic directions of the development of the RA

The production capacity of the RA is:
1) The expansion of metal processing centers and the machine park processing precision parts
2) Creation of production of radio-electronic devices, equipment, and assembly of parts
3) Creation of the production of explosives and fuel alloys, as well as mastering the technologies of composite materials
4) Assimilation of high, scientific, and competitive technologies, and organization of new developments and productions

3. STUDY OF DOMESTIC AND INTERNATIONAL EXPERIENCE OF STATE REGULATION OF UAV

3.1. Analysis of UAV and remote-control Legislation

Within the framework of this scientific work, researches carried out by several companies were studied. According to Mondaq1, a platform providing English content, the unmanned aircraft system (henceforth UAS) in 2021. The main highlights of the rules are:

- AIU has been classified as aircraft, rotary, and hybrid, further classified as remote-controlled aircraft, model remote-controlled aircraft, and autonomous UAS.
- UAVs are classified as nano, micro, small, medium, and large UAVs based on their maximum weight, including their payload, from <250 grams to 150 kilograms. Nano UA can be classified in the next higher category if it exceeds the flight speed and altitude performance parameters.
- Individuals and companies are mandated to receive approval from the Directorate General of Civil Aviation (DGCA) in order to import, manufacture, trade, own, or operate drones.
- No permission. No Take-off legislation is adopted for all AIs except the nano category.
- Micro and small UAVs are not allowed to fly above 60m and 120m respectively.
- All IAS except the nano category must be equipped with a Global Navigation Satellite System, Autonomous Flight Termination System, or Return to Home option, geo-fencing capability, and flight controller, among others.
- IAF is prohibited from flying over strategic and sensitive locations, including near airports, defense airfields, border zones, military installations/facilities, and areas designated as strategic locations/vital facilities by the Ministry of Interior.
- Nano, micro, and small UAS operations are limited to line of sight and are prohibited from delivering goods.
- Delivery of goods permitted by medium and large UAS.

- R&D organizations (including start-ups and any accredited and recognized institution of higher education in India) are allowed to conduct R&D only after obtaining permission from the DGCA.

3.2. Evaluation of the international experience of UAV and remote-control sector regulation

From quarantine and social distancing to mass disinfection and medical supply assistance, drones have been a key component in the coronavirus outbreak. Nowadays, regulations are being adjusted to facilitate expedited approvals for promising applications. While the long-term effects of these changes remain uncertain, it is clear that the pandemic has highlighted the societal benefits of drones. The pandemic has promoted the potential of drones for society.

According to a study by students at Wageningen University (located in the Netherlands) the global demand for food has led to the rapid introduction of Information Communication Technology (ICT) innovations in agriculture; One such innovation is drone technology. Drones are used in precision agriculture, including aerial observations, sensing, and spraying pesticides; Regulations on the use of drones are necessary because drones can breach privacy rules, data protection rights, and public peace. Nonetheless, a significant number of African countries have either stringent regulations in place or no applicable regulations that detail the steps required to obtain a drone license. In this study, the students present their findings based on research that examines current drone regulations in sub-Saharan Africa and the results of a systematic literature review (SLR = Statutory Liquidity Ratio) and a research study through which they interviewed relevant stakeholders to understand the challenges posed by regulation of the effective use of drones for agriculture. The results show that the regulations contain about 40-85 percent of the International Civil Aviation Organization (ICAO) Manual on Remotely Piloted Aircraft Systems (RPAS). In addition, while the SLR focused on drone technology, safety, ethics, and regulatory barriers, respondents focused on the need for the skill and awareness of the responsible authorities to implement the regulations, and the need for stability and a participatory process in defining them. For crop health imaging, integrated GIS mapping, and reducing the need to physically walk the field, drones can play an important role in decision-making and management, helping to increase yields and reduce costs. This will increase the efficiency and productivity of some management activities. In addition, drones can be used to monitor restricted areas and track illegal activities, forest fires, and other natural disasters. Drones are also attracting youth to engage in agricultural service businesses, thereby creating employment opportunities and improving farmers' income. Despite the obvious benefits, drone flights have raised public concerns about security and privacy issues. Drones have emerged as a new type of aerial object that could potentially endanger other airspace users, along with businesses and individuals on the ground. Consequently, a rising number of countries are establishing regulations designed to mitigate the security and privacy risks associated with drones for people and their property. Based on the ICAO, drones are classified into two functional categories:

- Fixed wings
- Rotor (rotating wings)

Fixed-wing drones generate lift during movement, enabling them to maintain speed in the air, while the rotor has high maneuverability and can hover and rotate with the flight controller. Both have specific advantages and disadvantages related to weight, stability, speed, flight duration, and handling.

Regulation of civil airspace in Africa is the responsibility of the National Civil Aviation Authorities (NCAA), which oversee both the development and adoption of regulations. The responsibilities of the NCAA include:

• Inspection of air and ground equipment that may affect flight safety.
• Pilot licensing.
• Issuance of flight permits.
• Setting standards for drone operations and minimum requirements for the operation of different classes of drones based on flight mass and size.

In this section, the researchers present the processes followed in the SLR process and the survey study conducted. Documents on drone regulations were obtained from the following two online sources (database). These sources provide information on whether or not drone regulation is in place in a given country, and either contain a regulatory document or a link to it. The survey study highlights current barriers to drone policy development, implementation, and maintenance. They are discussed below: The results of the SLR presented five main challenges to the effective application of UAVs for agriculture. This is a logical solution to how regulations for the use of UAVs can be created. First, regulations should include relevant aspects that are specific to the countries concerned. Second, regulations must be developed with the potential uses and concerns of the general public in mind. Third, regulations must be implemented and enforced to ensure that unspecified uses are checked. Fourth, the procurement process and the process of importing drones should be formalized. Finally, the safe use of drones must be guaranteed. It is important to ensure that the drones cannot be armed and that their airspace is restricted.

4. INFLUENCE OF UAV ON ECONOMY, INDUSTRY

4.1. Application of UAV Abroad in Armenia

Drones have been in use by defense organizations and tech-savvy individuals for a significant amount of time. As drones become increasingly available, many of the most hazardous and financially rewarding jobs in the commercial sector have been designed to utilize drones for transportation purposes. Use cases for secure, cost-

effective solutions range from data collection to delivery. And as autonomous and collision avoidance technologies improve, so will the ability of drones to perform more complex tasks. The emerging global market for business services using drones is valued at more than $127 billion, according to PwC. As an increasing number of corporations seek to capitalize on these commercial prospects, there has been a significant rise in investment in drone technology. Typically, a drone is defined as a UAV that utilizes a variety of technologies, such as computer vision, artificial intelligence (AI), and object avoidance systems. It is important to note that drones can also encompass land and maritime vehicles that function autonomously. In the following sections, we will explore the extensive applications of drones by companies across various industries for commercial purposes. (Drones, 2020; Insider Intelligence, 2021).

4.1.1. Emergency response, Humanitarian aid, and disaster relief

The innovations in camera technology have significantly shaped the development of drones. Drones that utilize thermal imaging cameras have provided emergency teams with an optimal solution for detecting victims who are hard to see without assistance. In 2017, Land Rover joined forces with the Austrian Red Cross to design a specialized operations vehicle that features a thermal imaging drone mounted on its roof. This vehicle incorporates an integrated landing system, allowing the drone to land safely on the vehicle during transit. Dubbed Project Hero, this special Land Rover Discovery hopes to save lives by speeding up response times. In 2019, DJI, a leading drone manufacturer, launched a program focused on emergency response, which provides first responders with access to certain drones and accessories alongside technical support and assistance. To this point, DJI has formed partnerships with the fire departments of Los Angeles and Menlo Park, as well as the Alameda County Sheriff's Office. Startup companies and universities are also designing systems for search and rescue. Flyability specializes in collision-tolerant drones that are tailored for operation in restricted environments with limited visibility, which are commonly encountered by emergency response teams. Hence, drones have shown great effectiveness during natural disasters. After hurricanes and earthquakes, they have been deployed to evaluate damage, locate individuals in need, and distribute humanitarian assistance. And under certain circumstances, they help prevent disasters altogether. Drones were essential in 2017 for the regional reconstruction affected by Hurricane Harvey, as they helped assess flood damage and contributed to search and rescue efforts. Furthermore, surveillance drones equipped with thermal imaging technology are actively used to monitor and fight wildfires by identifying atypical temperature variations in forested regions. This allows teams to pinpoint areas most susceptible to wildfires or identify fires just minutes after they start.

There is a growing demand for this category of technology. In 2019, the Department of Defense made a formal request for drones that could be utilized in natural disaster scenarios to deliver food and water to impacted regions.

4.1.2. Conservation

The global health of wildlife is profoundly threatened by the dual challenges of poaching and climate change. The World Wildlife Fund reports that thousands of species face extinction annually. In response to this alarming trend, conservationists are implementing creative strategies to safeguard and examine our ecosystems. Drones, in combination with geospatial imagery, are increasingly utilized to observe and monitor animal populations.

4.1.3. Healthcare

The advancements in contemporary medicine have greatly contributed to the prevention of illnesses by increasing the life expectancy, and the improvement of living standards. Despite this progress, numerous rural communities around the world continue to encounter a shortage of adequate healthcare services. While medical supplies can be delivered by traditional means, some circumstances require rapid access to drugs, blood, and medical technology, which drones can satisfy. In 2018, North Carolina's WakeMed Health & Hospital partnered with the state's Department of Transportation on a pilot program to test the feasibility of using drones to deliver medical packages between hospital campuses. After a series of successful trials, WakeMed partnered with California-based drone manufacturer Matternet and later UPS to further develop hospital drone delivery efforts. Zipline International is a well-funded venture-backed specializing in medical delivery. Having raised a total of $237 million in disclosed funding, the company operates drone services to deliver medical supplies to rural locations across Africa. Flirtey is another startup in the delivery space looking to transport drugs.

4.1.4. Agriculture

Farmers worldwide are continuously exploring methods to reduce expenses and increase their production. The incorporation of drones in agriculture enables personnel to gather essential data, automate monotonous tasks, and improve overall efficiency. A prominent instance is Raptor Maps, an agricultural analytics company that utilizes drone technology to assist farmers in precisely forecasting their crop yields. Additionally, drones are making substantial advancements in crop cultivation, a process that is frequently repetitive and labor-intensive, demanding meticulous attention to detail. To tackle this issue, Case IH has engineered an autonomous tractor, while Abundant Robotics is working on a self-assembly solution for agricultural products. The energy-intensive nature of seed planting is another challenge, but companies like DroneSeed, which raised $5.1 million from Social Capital in 2017, are striving to alleviate this burden by employing drones for seed distribution. Furthermore, research has demonstrated the use of drones

in the pollination of flowers. This approach may one day be useful in compensating for declining bee populations.

4.1.5. Weather forecast

Scientists are using new forms of hardware and software to collect data to help study the climate and better predict future changes in global weather systems. Today, most data is collected using stationary structures or recorded with two-dimensional imaging solutions. Drones, however, offer a versatile option that can physically track weather patterns as they develop. In conjunction with drones, UAVs are transforming the data collection methodology. Saildrone has launched an autonomous sailing vessel particularly engineered to collect oceanic and atmospheric data from the sea's surface. The pilot initiative for Saildrone, executed in partnership with the University of Washington's Atmospheric Sciences department, is presently active off the West Coast. As part of the research, the company's 6 drones independently gather data offshore. The researchers involved in the project anticipate that the information gathered by the drones will contribute to enhancing the precision of weather forecasts.

4.1.6. Maritime

On one hand, successfully navigating the oceans and harbors demands considerable expertise and a large labor force, with estimates suggesting that around 1.65 million personnel are currently engaged on international merchant ships. On the other hand, with increased innovation in ocean data and autonomy, unmanned maritime vehicles may become the standard for maritime transportation. Rolls-Royce has already completed a series of tests with remote control of unmanned ships. Ship inspection is also an important part of the industry. While Rolls-Royce plans to use smaller drones to inspect ships above the surface, startup Orobotix has designed an underwater drone to be used to inspect hulls from below. Drones are already being used in countries such as the Netherlands, Denmark, and Norway to track down ships that commit emissions violations. Unmanned vehicles can travel miles away from a port to detect emissions and identify violators.

4.1.7. Waste Management

Recycling and biodegradation have improved global waste management. However, innovations in waste collection are still emerging, including drones that have helped clean up the oceans. RanMarine operates a Roomba-like unmanned marine vehicle used to collect waste in ports and harbors, while RedZone Robotics focuses on robots used to maintain wastewater management systems.

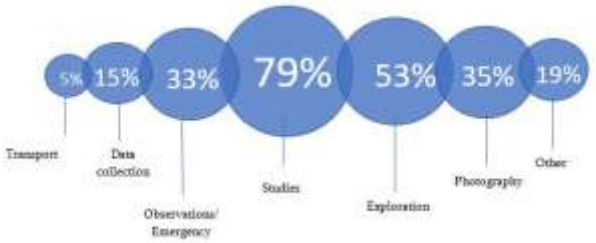
4.1.8. Energy

Even though there has been an increment in the appropriation of elective vitality, fossil powers remain a vital source for the world. The assessment of framework related with oil and gas production, processing, and transportation may be an imperative component of the industry, frequently required to guarantee compliance with administrative benchmarks. The utilize of rambles empowers the larger part of these reviews to be performed remotely and securely. Sky-Futures offers ramble arrangements for oil and gas assessments, which are utilized by a few of the biggest oil organizations all-inclusive to screen seaward wells. The company was acquired by Scottish maintenance company ICR in 2019. SkyX Systems uses drones to assess pipelines, and Cyberhawk Innovations offers solutions for both fossil fuel and alternative energy providers. Another area where drones have shown promise is in the creation of new energy production sites. Drones that survey areas and gather topographical details can be used by oil and gas companies to find new drilling sites, or they can be used by solar companies to design new array configurations. Other industries that use drones are as follows:
Construction design, Infrastructure development, Insurance, Real estate, City Plans, Airlines, Internet and Telecommunications, Live broadcast/demonstration, in the field of sports and tourism, Hollywood / Filmmaking, advertising and marketing, retail, Production and Property Management, Fitness, food services, Media, space, security, etc.

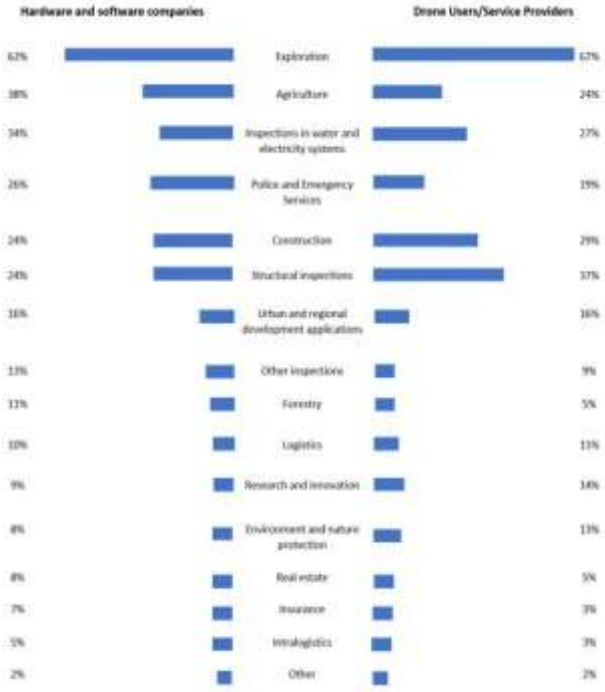
4.2. The development of the effectiveness of the use of UAVs and the development prospects

As doctor Argam Artashyan, former PhD Candidate of ASUE, states in his article, regarding the international market of UAVs: Currently, high technologies are considered one of the fastest developing directions both in the world and in the RA. It is especially important for countries that do not have enough natural resources and need to develop the economy in a technological direction. Armenia is among such countries and it is no coincidence that the Armenian government adopted the direction of technological development. As for commercial UAV production, it is closely related to the hardware, software, and service delivery industries. Their application fields include agriculture, real estate market, power generation, etc. It is divided geographically into the following regions: North America, Europe, Asia, the Middle East and Africa, and South Africa. Undoubtedly, our keenest interest lies in the progress occurring in the European region, given our obligation to follow the guidelines set forth by the European Aviation Safety Administration (EASA). Additionally, all European countries take into account the legislative change packages proposed by this organization. The European Market of UAVs. Rotary-wing UAVs account for 65% of the European commercial UAV market. At present, organizations producing UAVs mostly produce such models. These have the potential to be applied in different fields and for different purposes. But the most popular field is photography. The use of UAVs for this purpose accounts for 35% of the European market. However, this raises the issue of personal data privacy. That is why the use of UAVs is strictly controlled in many European countries. Droneii's latest report indicates how UAVs are currently being used in Europe (Figures 1 and 2). However, this figure will change

shortly. Due to the development of the field and new technologies, UAVs will also begin to be used in other fields.

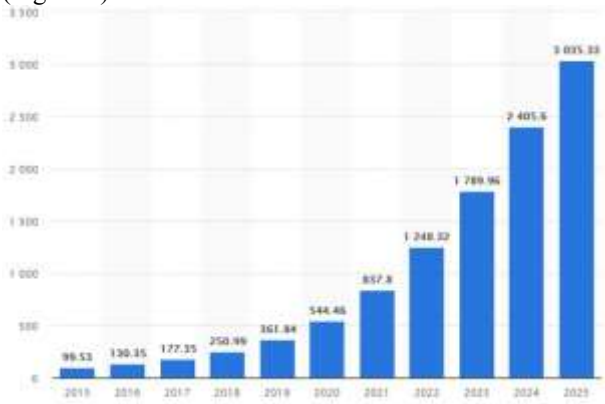


Figures 1. UAS deployment in Europe



Figures 2. Trends in the development of UAV applications

This, in turn, will increase the income of organizations engaged in the production and use of UAVs. According to some forecasts, this growth will have a similar image (Figure 3).



Figures 3. Forecast of the growth of the income of the organizations due to the development of the sector (revenue in millions of dollars)

However, there is a problem that affects not only the European market but the entire UAV industry. Since UAVs have multiple applications, it seems to be difficult to regulate the field in a way that is beneficial to everyone. These difficulties are also due to the parametric properties of UAVs (size, weight, engine power, controllable distance, etc.). Therefore, when regulating the field, the interests of all parties must be considered: the market, the government, the military, research institutions, and society. Figure 4 presents the global UAV market forecasts for the indicated sectors.

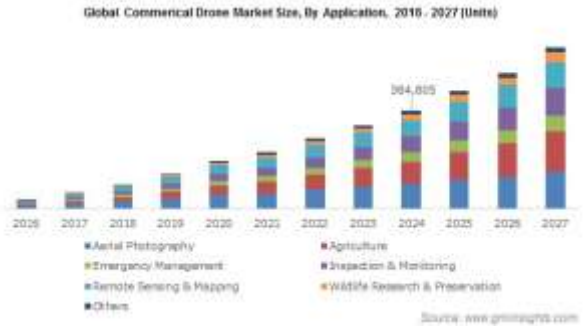


Figure 4. Forecast of the use of UAVs until 2027

In this regard, it is important to understand the situation in our region and our country. In the RA, as well as in our neighboring states, there is a production of UAVs. As can be assumed, they are exclusively of military significance. Armenian UAVs are produced in the Artsakh Republic. In addition, many foreign organizations invest in local manufacturing companies. In particular, Danish companies engaged in the production of UAVs are making large-scale investments. Nevertheless, due to the specifics of the sector, statistical data are missing. As for their civil applications, since there are no laws restricting their use, no structures for their registration, and no regulations for granting permits, clear data cannot be obtained. Nonetheless, it should be noted that due to global developments, the availability of UAVs, the production of UAVs, and other factors, it can be assumed that shortly, RA will also have a clear policy for the use of UAVs.

The first Kamikaze UAVs of Armenian production is now in the test phase and may be used shortly. KBX company representative Armen Vardanyan talked about this within the framework of the ArmHiTec 2018 international exhibition in NEWS.am. According to him, the device was designed about 7 years ago, but no one was interested in it, and one month after April 2016, the escalation was tested for the first time. He noted that there are more complex Kamikaze models, but their design is unique. "It was designed and manufactured in Armenia," explained Vardanyan. In addition to Kamikaze, the company also presented several other models of UAVs at the international exhibition (Armhitec, 2021). Furthermore, some fund was raised for the construction of Armenia's first drone airport.

The Karen Vardanyan Educational Foundation informs that sufficient funds have been collected for the

construction of the first drone airport in Armenia in the village of Lernapat. A fundraiser announced earlier this month raised a total of $117,582. The foundation says that "this entire fundraising process was a good example of public cooperation." It shared photos of the project, which is expected to be completed shortly. There will be regular updates on the progress of the construction (Ghazanchyan, 2021).

5. UATE ANNOUNCED THE LAUNCH OF "ROOTS IN THE AIR" PROGRAM

On 19-01-2021, a press conference was held at the office of the Union of Advanced Technology Enterprises (UATE) regarding their projects, in particular, the expected expansion of "Armat" laboratories. The speakers at the press conference were Raffi Kassarjyan, the Executive Director of the National Association of Trade Unions, Sedrak Vardanyan, the head of the "Armat" project, and Vahan Vardanyan, the nephew of the founder of the "Armat" project, Karen Vardanyan, as a representative of the Vardanyan family. During the press conference, the Armath Airborne UAV educational workshop program was launched. The latter is a development direction of the project of "Armat" engineering laboratories. It is carried out in accordance with the methodology developed by the company "Instigate Robotics" (Figure 5).

Figure 5. UATE Announced the Launch of "Roots in the Air" Program

The goal of the project is to establish UAV educational workshops in all 65 cities of Armenia (including Artsakh), the admission of which will be open to both the residents of the given community and young girls and boys from neighboring communities. To achieve this goal, UATE started fundraising for the "Armat in the Air" initiative, as a result of which the goal is to establish 25 UAV workshops in 2021, and 40 in 2022. The target amount is 422 million AMD, of which 52 million AMD have already been collected in recent months. "The first steps of the UAV in this field were the UAV competitions organized in 2013 and 2016. And in the days of the Armenian-Azerbaijani war of 2020, on October 15, the family of Karen Vardanyan, the founder of "Armat" laboratories, started the "ATS re-equipment" initiative, in which about 600 families participated. At the same time, the group leaders of "Armath" community also made a significant contribution to that cause with their own funds. As a result, they planned to install the labs with this fundraising. The workshops will be held for boys and girls aged 15-18. Young people will obtain theoretical knowledge of the operation of UAVs, and learn the features of their design and manufacture, software, technical maintenance, and management.

6. UAV EDUCATIONAL WORKSHOP PROGRAM 2021

The project is part of the Root Engineering Laboratories initiative by the Association of Advanced Technology Enterprises, using a methodology developed by Instigate Robotics.

6.1. Objective for Senior Students (15-18 years old)

Educate students on UAV operation, design, manufacturing, software, technical service, and management.

6.2. Skills Development

Teach multi-sector applications of UAVs, including computer programming, management, and technical maintenance.

6.3. Aviation Engineering Interest and Application of Knowledge

- Enable students to apply their knowledge in service, existing companies, or startups.
- Structure includes selecting team leaders, training based on Instigate Robotics' materials, and certification.

6.4. UAVs in Armenia

- Between the years 2016 and 2020 marked a notable rise in prominence, especially in the context of the Artsakh war.
- The global drone market is projected to expand at an annual rate of 13.8%, ultimately reaching a value of $42.8 billion by the year 2025.
- Drone EduLab, a collaboration between "Startup Armenia," "Respo," and DJI, offers an 8-month course for youth (13-17) in programming UAVs and robots using Python and AI, culminating in the creation of their UAVs.

6.5. Green Week Event (2021)

- Tested UAVs for precision agriculture, utilizing DJI drones for efficient work.
- Students at the Agrarian University of Armenia gain hands-on experience with UAVs for plant protection and mapping.

6.6. EU Green Agriculture Initiative in Armenia

- Aimed at inclusive development in northern regions (Tavush, Shirak, Lori) and supports all farmers in Armenia.
- Aragil startup, funded by ACBA Federation, joined Impact Hub for mentorship and received an agricultural UAV for experimental work.

7. NDVI (NORMALIZED DIFFERENCE VEGETATION INDEX)

The use of vegetation indices like NDVI with satellite images for monitoring agricultural lands and predicting crop yields is increasingly popular. NDVI tracks plant biomass development by measuring red light absorption and near-infrared reflection by green leaves. This index varies through the plant's growth stages, increasing during initial growth, stabilizing at flowering, and decreasing at maturity. The Aragil team calculated NDVI for the Arzakan community in the Kotayk region, leading to cooperation with AKBA FEDERATION. This partnership enhances testing and product development, potentially establishing a business to provide valuable services to farmers. On June 16, experimental research using UAVs for agricultural tasks commenced.

$$NDVI = \frac{NIR - Red}{NIR + Red}$$

Equation 1. NDVI formula

where:
NIR – light reflected in the near-infrared spectrum
RED – light reflected in the red range of the spectrum

8. RESULTS AND DISCUSSIONS

It is recommended to use UAVs in the fields of service and delivery of goods, to put out the fire in case of emergencies, and technological universities of Armenia consider this field as a priority in their faculties. For example, to implement student exchange programs between foreign and Armenian universities, thanks to which students will apply their knowledge for the benefit of Armenia. Moreover, young Armenian farmers should be taught how to use drones to enhance the efficiency of their crops, saving time and money. In addition, Armenian meteorologists are encouraged to consider the benefits of drones applicable to weather forecasting (storm tracking and forecasting hurricanes and tornadoes).

9. CONCLUSIONS

Drones are rapidly evolving from their original military use to a wide range of civilian applications, necessitating clear sector regulation. Innovations in microelectronics, particularly in accelerometer and gyroscope data, have enabled significant advances in drone stability and movement via GPS. The development of drones' data collection and processing capabilities continues to progress swiftly, while physical movement technology is evolving more gradually. Future advancements may include using photovoltaic cells for continuous flight and integrating AI to enhance obstacle avoidance. In many European and Western countries, this field is regulated by various laws and regulations. In RA, it still requires deeper studies. This thesis underscores the transformative potential of UAV technology in Armenia, highlighting its significant implications for economic and industrial growth. By addressing regulatory, strategic, and practical challenges, Armenia can foster a robust drone industry that leverages both military and civilian applications. The research concludes with recommendations for enhancing the development and application of UAV technology, ensuring sustainable growth and integration into Armenia's technological landscape.

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