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MASTER’S THESIS

DRONE OPERATOR FOR BUSINESSES

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APPROVAL PAGE



DECLARATION

I hereby declare that this master's thesis titled as "Drone Operator for Businesses" has been written by myself in accordance with the academic rules and ethical conduct. I also declare that all materials benefited in this thesis consist of the mentioned resources in the reference list. I verify all these with my honor.

26/04/2021

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ABSTRACT
Master's Thesis
Drone Operator for Businesses
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The traces of drone technology, one of the most important developments of the 21st century, actually dates back hundreds of years. Today, many individuals, institutions, and businesses use drones for different purposes. Drones, whose use has become widespread in recent years, have also begun entering businesses' inventories at an increasing rate. Businesses need more than digitalization to gain an advantage in today's competitive environment. In businesses where drone usage has begun in their activities, the need for drone operators is also increasing day by day. Drones are used, and drone operators are employed in many areas such as agriculture, photography, media, and military. The integration of drones and drone operators in businesses has attributed many responsibilities to recruiters regarding drone operators' employment criteria.

The purpose of this study is to give a point of view towards drone operators, potential drone operators, and employment phases for businesses that are already using or have the potential to use drones. Drone use and drone operator employment in enterprises are examined at the business level by conducting in-depth interviews with experts working as drone operators in different sectors to achieve this goal. Data from in-depth interviews are subjected to content analysis. The data is analyzed by examining under codes and themes. Inferences have been made about the use of drones and the qualifications that drone operators should possess.

This study presents that drone usage for businesses and the employment of drone operators provide advantages in terms of time, cost, and quality factors

in a competitive environment. These factors and their advantages create new business opportunities by increasing drone activities in businesses. Businesses need to employ qualified drone operators. Qualified drone operators' employment criteria are eye and muscular health, attitude and behavior, aviation-related interests, aviation know-how and analytical skills, training and technical information, and adaptation to different working conditions.

Keywords: Drone, Drone Operator Qualifications, Businesses



ÖZET
Yüksek Lisans Tezi
İşletmeler İçin Drone Operatörlüğü
Gizem TURCAN

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21. yüzyılın en önemli gelişmelerinden olan drone teknolojilerinin izleri aslında yüzyıllar öncesinden beri gözlenmektedir. Günümüzde birçok kişi, kurum ve işletme farklı amaçlarla drone'ları kullanmaktadır. Kullanımı yaygınlaşan drone'lar, işletmelerin de envanterlerine hızla girmeye başlamışlardır. İşletmeler rekabet ortamında avantaj elde etmek için iş faaliyetlerinde dijitalleşmeden daha fazlasına ihtiyaç duymaktadır. Faaliyetlerinde drone kullanmaya başlayan işletmelerde drone operatörü ihtiyacı da gün geçtikçe artmaktadır. Tarımdan fotoğrafçılığa, medyadan askeri alanlara kadar birçok alanda drone kullanılmakta ve drone operatörü istihdamı gerçekleşmektedir. Drone ve drone operatörlerinin işletmelere entegrasyonu, işe alımcılara kriterlerin belirlenmesi, drone operatörlerine ve drone operatörü adaylarına da sahip olmaları gereken nitelikler konusunda birçok sorumluluk atfetmiştir.

Bu çalışmanın amacı, drone kullanan ve kullanma potansiyeli olan işletmeler için, uzmanların drone operatörlerinden beklentilerini tespit etmek ve drone operatörlerine, drone operatörü adaylarına ve işe alım süreçlerine yönelik bir istihdam bakış açısı oluşturmaktır. Bu amaca ulaşırken farklı sektörlerde drone operatörü olarak çalışan uzmanlarla yapılan derinlemesine röportajlar ile işletmelerde drone kullanımı ve drone operatörü istihdamı işletme düzeyinde incelenmiştir. Derinlemesine röportajlardan elde edilen veriler içerik analizine tabi tutulmuştur. Veriler, kodlar ve temalar altında incelenerek analiz edilmiştir.

Drone kullanımı ve drone operatörlerinin sahip olmaları gereken nitelikler hakkında çıkarımlarda bulunulmuştur.

Bu çalışma göstermiştir ki, işletmelerde drone kullanımı ve drone operatörü istihdamı, rekabet ortamında zaman, maliyet ve kalite faktörleri açısından birçok avantaj sağlamaktadır. Bu faktörler ve sağladığı avantajlar, işletmelerdeki drone kullanım faaliyetlerini artırarak yeni iş fırsatları yaratmaktadır. İşletmelerin nitelikli drone operatörleri çalıştırması gerekir. Nitelikli drone operatörlerinin sahip olması gereken nitelikler, göz ve kas sağlığı, tutum ve davranışlar, havacılık ilgisi, temel havacılık bilgileri, analitik beceriler, eğitim ve teknik bilgi ve farklı koşullara uyumdur.

Anahtar Kelimeler: Drone, Drone Operatörü Nitelikleri, İşletmeler

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ABBREVIATIONS

AIS	Agricultural Information Systems
CAA	Civil Aviation Authority
CAAC	Civil Aviation Administration of China
CASA	Civil Aviation Safety Authority
DGCA	Directorate General of Civil Aviation
FAA	Federal Aviation Administration
GIS	Geographic Information Systems
GPS	Global Positioning System
GPU	Graphics Processing Unit
HCI	Human-Computer Interaction
HDI	Human-Drone Interaction
ICAO	International Civil Aviation Organization
MAV	Micro Air Vehicle
MIS	Management Information Systems/Meteorological Information Systems
M-RPAS	Military Remotely Piloted Aircraft Systems
UAV	Unmanned Aerial Vehicles
UAVSI	Unmanned Aerial Vehicle Systems Instruction
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft Systems
SUAS	Small Unmanned Aircraft System
UAS	Unmanned Aerial/Aircraft Systems

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INTRODUCTION

Drones are devices that are capable of flight. In recent years, they have become a technology that we are highly familiar with. Drone usage is becoming more accessible because of the wider usage of drones in different sectors recently. This advancement also led to the emergence of new employment fields such as drone operators. Drones need human support to fly. Supporters are the people who lead or operate them. Drone operators are a major contributor to drone use and businesses. Therefore, when businesses employ drone operators, they evaluate them according to multiple qualifications such as health, education, attitude, and adaptation to different conditions.

It is a known fact that significant leaps in the technological field arose from the new millennium's arrival. These developments were imagined as far back as the late 18th century. In several French painter Jean-Marc Cote's paintings, we can see telephones, cars, steamboats, flying vehicles, etc. Not all such developments were works of fiction. Great developments in science and technology had already existed in those years. To exemplify in 1907, the first helicopter; in 1910, the first seaplane; in 1932, the first amphibious bike and the first navigation device; in 1947, the first aircraft that exceeded the speed of sounds (Cleghom, 2017; Alfred, 2012; Alexander, 2016; Paur, 2009). Contrary to popular belief, unmanned aerial vehicles (UAVs) /drones technology was not developed as recently as it is believed. The first traces of drone usage can be dated back to 1849, when Austria attacked Venice with unmanned balloons (Holman, 2009). So, the first recorded instance of UAVs' was for military purposes as aerial attack vehicles. Though these unmanned balloons do not match all criteria to be drones, since they were used for a highly similar purpose, these can be counted as the first instance of drone use in warfare. Other instances of UAV usage in warfare can be traced back to the 1850s in Europe and the 1900s in the US. The next development came between the years 1915-1920, when the first pilotless aircraft was developed for usage in World War I. After that, in 1935, the British developed a radio-controlled aircraft to be used for training purposes. One of these, the Queen-Bee, is thought to be the origin of the term "drone". In World War II, the Germans developed the first cruise missiles, the Doodlebugs. In the 1950s, spy UAVs were developed by

the US. The next development in drone technology came in the Vietnam War. Here, special reconnaissance UAVs were used. Between the years 1980-1990, drone technology started to become more reliable and widespread. The Israel-US co-developed reconnaissance UAV in 1986 hastened these innovations. Between the years 1990-2010, military and civil drone technologies became more widespread and advanced. As of 2010, we are in the golden age of drones (Vyas, 2020). In recent years, besides their military and hobby uses, the demand for commercial drones has increased. Drone usage has become a primary component in certain sectors. Earlier drones were large and bulky, which was in accordance with their intended area of work. However, as drone usage became common, the size variation has also increased. Nowadays, drones can even fit in pockets because of the increase in their usage. They can be used as toys, cameras, data collectors, delivery devices, and even a transport vehicle. The user demographic of drones is growing larger by the day, so it is quite normal to see drones even in the hands of children or in small businesses.

According to world population statistics, by the end of 2019, our global population increased by 7,713,468,100 to a total of 8 billion (Worldometer, 2019). This in turn leads to an increase in job demand across the globe. With the development of new technologies, certain jobs are becoming obsolete due to automatization. However, new technological developments also lead to the emergence of new employment possibilities. So, what exactly are these “new opportunities”? The world is ever-changing, so while professions do not become completely obsolete, they are always changing by new technologies. The development that affects the current job market is digitalization. This digital transformation brought about change at the organizational level. Nearly all sectors have placed technology at the center of their processes. As daily life becomes more intertwined with technology, professions will follow suit, which we can already see from new professions such as solar and energy technicians, blockchain developers, robotics service technicians, commercial drone operators, remote health care engineers, nanotech engineers, and tech ethicists. These professions will become more widespread as technology becomes even more advanced and interactive. Besides these newly emerging professions, certain occupations have not emerged yet, but their road is being paved as we speak. These future occupations could range from cyborg designers, robotics to even brain implant specialists or body

part manufacturers. Here, one of these newly emerging professions, drone operator, will be investigated.

In broad terms, technology is the cumulative knowledge of machinery and devices and the methods used to collect, control, process, and transmit data. The Latin equivalent for technology is “Technologos”. The word “techne” means art, skill, or the way these are acquired, and “logos” means knowing, saying, or expression. Therefore, since humanity constantly evolves and changes, as they change, technology evolves with them. New technologies go through an adaptation phase. This phase involves the introduction of the product to the market and the general populous and/or organizations adopting the product to their routine. This adaptation process is also applicable for drones. New staff recruitments, changes in policies, organizational resistance, training, advantages, risks, and many other factors are part of this process. This study takes drone operator employment as a new process with different business parameters. When it comes to business qualifications, professionalism is one of the most sought out skills for potential employers.

There is a strong relationship between the Human-Computer Interaction discipline and Business/Management Information Systems. This relationship is a powerful factor in examining the integration of drones and operators into the business sphere. Drones are machines designed to work with computers, operating systems, and software, and they are managed manually. Although smart drones have started to enter the market, process management is impossible without human assistance. The “Drone Operator for Businesses” thesis, examined within the scope of the Human-Computer Interaction (HCI) discipline, is a guide that businesses and drone operator candidates can utilize.

In the current situation, drones are used in many sectors, but especially in the defense industry. Commercial and civil uses range from delivery, construction, agriculture, meteorology, search and rescue, and safety activities to photography and advertising. The drone usage areas and intensity of drone usage change from country to country. The reason for the difference in growth is that drone laws vary by country and by purpose. Besides, with the increase in demand for commercial drones, the need for qualified drone operators will also rise. Businesses that are employing drone operators ought to be selective. It would be false to assume that “Anyone who controls

or operates a drone is a drone operator”. As previously stated, businesses and/or organizations require professionalism. Regardless of their standing, recruiters will hire the applicants that are best suited for the firm they are representing. Business procedures should proceed smoothly, and the operators should provide the requirements.

Despite the increase in drone operators, the literature of drone technology is fairly new. Therefore sources and knowledge on drones sometimes lack the necessary background for safe assumptions to be made. There are few specific drone operator job requirements or job advertisements besides a handful posted by large corporations and military organizations. Prior to setting a thesis goal, several experts in the aviation industry were interviewed. These interviews highlight the various concepts and desire the experts had on the employment of drone operators. In conjunction with the interviews, this thesis aims to shed light on the “drone operator” issue and close the sector and the literature gap by defining drone operator qualifications in a clear and comprehensive manner. So, “What do businesses expect from drone operators?” is the research question of this thesis.

The purpose of this study is to determine the required qualifications for drone operators that desire employment in certain sectors and businesses. Within the scope of this thesis, the requirements for drone operators in enterprises are investigated. The studies *raison d’être* is creating a guide for individuals who aspire to work with drones. This study also aims to assist firms and professions in determining how to operate the employment phase of potential drone operators. Furthermore, it facilitates integration tools for businesses in which drone operating has not become commonplace yet. In this case, the thesis can give alternative perspectives for businesses that have recently started implementing drone technologies. Also, it helps individuals who aspire to be drone operators achieve this goal. In addition, the future of drone operators, drone activities in businesses, drone operator qualifications, working conditions, and drone operator training in universities are also touched upon. Drone operating is a specialty that will be the point of focus in the upcoming future. In the near future, drone operator training in universities is highly probable.

Information on drones, drone operators, and recruitment is given in a general framework in the study. The study is further built upon by interviews with experts in

the drone field. Initially, a research question that underlies the basis of the thesis is determined. This question addresses the main topic of the thesis and is divided into three sub-questions. The interviews surrounding the main topic were conducted with 20 experts. The questions asked to the interviewees were chosen within the framework of research questions. The interview hosted 23 questions, and all data obtained analyze in accordance with the qualitative analysis method. A purposeful qualitative sampling method was used to determine the interviewees. Due to the qualitative nature of the study, thematic content analysis was applied to the data gathered from interviewees. With the content analysis, certain data were tried to be standardized. As a result of standardization, findings and results were obtained. The findings and the results reached through the analysis shed light on the future of drone operating, and more importantly, on drone operators and businesses. The advantages and risks of using drones in businesses and the excess usage areas of drones in businesses are among the important findings of the thesis. The training levels expected from the drone operators vary according to their experience and self-development. Adapting different working conditions and specific qualities are also important findings of the thesis. In addition, one of the most mentioned issues by experts and the findings obtained is that it has become a necessity to provide drone training in universities. In addition to the literature gap, these findings contribute to the literature and similar projects as well.

Within the scope of the thesis, Chapter 1 focuses on the literature review that includes the theoretical information and applications about drones and drone operators for businesses. Chapter 2 provides information about drones and drone operators, drone usage in businesses, human-drone interaction, and drone information systems. Chapter 3 is about the general recruitment criteria of drone operators. Chapter 4 is the evaluation of drone operators for businesses. This section includes study, data analysis, and findings parts. This section is followed by the conclusion.

CHAPTER ONE

LITERATURE REVIEW

The literature review of this thesis covers topics and sub-topics related to the scope of the thesis. Terms about aerial vehicles, drone activities and applications in sectors, UAV regulations, drone operator qualifications, academic drone operator training, and organizational resistance of drone integration to businesses are among the topics reviewed in the literature. Organizational resistance is one of the most important issues when businesses have new technologies, so whether drone technologies integration causes organizational resistance has been searched. Terms about UAVs and drones are also complicated in literature and sectors. Therefore these terms are briefly included in the literature review. Besides, the regulations that aviation activities have to obey are reviewed because regulations are factors that greatly affect drone use and operator employment in businesses. There are many drone training courses in the world. However, most of these courses are not at an academic level. The thought, drone operator as a profession, requires to get an academic training. So, the universities that have academic drone education are briefly mentioned. The research is also done in accordance with the expected qualifications for employing drone operators in businesses.

Job adverts are posted for drone operators in the USA, Europe, Asia, and many countries worldwide where drone uses are allowed. However, the advertisements vary according to the respective sector. The activities each sector uses drones in vary. For this reason, organizations are looking for drone operators who can meet their needs. The qualifications required by drone operators for businesses in recruitment are not standardized. In the literature, there are many sources about the advantages and disadvantages of drone use, its contributions to businesses, organizational resistance to drone use, sectors that use drones, cost-benefit comparisons, regulations, and working conditions of drone operators. However, there are very few sources that directly address all the qualities expected from drone operators. In addition, there are some deficiencies in subjects such as the education levels of the operators, their ages, the importance of drone using licenses, and the selection criteria of companies providing drone services. There are some contradictions in the literature about calling

people using drones in businesses as "operator" or "pilot". With this study, these issues are clarified, and the literature's deficiencies are attempted to be mitigated.

1.1. TERMS ABOUT UNMANNED AERIAL VEHICLES / DRONES

There are many terms in aviation regarding unmanned aerial vehicles. These are drones, UAVs (Unmanned Aerial Vehicles), RPAs (Remotely Piloted Aircraft), UASs (Unmanned Aircraft Systems, sUASs (small Unmanned Aircraft System), and MAVs (Micro Air Vehicle) (Altigator, 2020; Herrick, 2017). These vehicles differ in weight, range, and durability. Also, depending on their field, military, commercial or civil, these terms change (Avitan, 2019; ICAO, 2020). However, the most widely known and up-to-date word is "drone". In French-speaking countries, the term drone is more widely used. In the military field, the terms UAV and UAS are used. UAS is a more comprehensive term compared to UAV. It encompasses all equipment and operation processes from its control center to its wireless data connection. RPA is mostly used by International Aviation Agencies (Avitan, 2019; ICAO, 2020). These abbreviations can be expanded in different ways. For example, the term UAV can be Unmanned Aerial Vehicle, Unmanned Air Vehicle, Unmanned Aircraft Vehicle, Unmanned Aerospace Vehicle, or Unmanned Autonomous Vehicle (Altigator, 2020; ICAO, 2020). Besides the mix-up, in unmanned aerial vehicles, terms drone pilot and operator are also used interchangeably (Vanderispaille, 2017). In the legislation of several countries, pilot and operator terms are present. Directorate General of Civil Aviation (DGCA) uses the term, pilot (UAVSI, 2019). In domestic and foreign job advertisements, the term operator is more widely used (Indeed, 2019; Seek, 2020). There is no clear distinction between these terms in the literature. However, the difference between the remote pilot and UAV/drone operators is that operators do far more than just manually operate the drone and are also the real or juridical people that command the process. When terms are used, the respective countries' drone legislation needs to be considered (Vanderispaille, 2017).

1.2. DRONE ACTIVITIES, APPLICATIONS AND ORGANIZATIONAL RESISTANCE

The use of drones in businesses is increasing day by day. Since 2016, the number of registered drones has also increased significantly (Chen, 2016). Now drones are becoming the primary means of activity for businesses. Drones are used in precision farming, search and rescue, security, firefighting, photography, surveillance, wildlife protection, media, infrastructure monitoring, oil field surveillance, logistics, delivery, military, etc. (Hazel & Aoude, 2015; Barnes, 2014). Amazon, a multinational technology company, announced in 2013 that Amazon Prime Air has started delivering light packages, via drones, to customers in less than 30 minutes. This application, which makes the customers curious, has been groundbreaking in the world by Amazon. Businesses that carry out their activities using drones provide a great advantage in the competitive environment (Gross, 2013). Countries such as Japan, Australia, and Canada are in the first place in the global competitive environment in agriculture and delivery practices (Miah, 2020). Businesses that really need drones in their business activities reduce their costs significantly and challenge their competitors by doing more work in less time (Coyne & Goodman, 2020). An example of this can be Chen's (2016) research about the company Flying-Cam aerial using drones instead of helicopters and, in turn, mitigating their costs. At the same time, with drone use, business processes that require observation are carried out faster and with less cost. In addition to the advantages and efficiency, there are also risks associated with drones regarding businesses, privacy, security problems, and environmental damage (Chen, 2016). While governments legalize the use of commercial drones, they also consider these risks (Ravich, 2013; Chen, 2016).

Organizational resistance is inevitable in enterprises. Innovation always brings opposition along with it. Throughout history, every new technology has brought with it physical (machines) and organizational changes. Resistance to this change has been shown by managers, staff, and customers (Bao, 2009). As famous names such as Karl Marx, Clarence Darrow and George Bernard Shaw said, "history repeats itself". Drones are new technologies, although they have a long history. So today, the same organizational resistance is also shown for drones. Technological, operational, and

managerial changes within the organization create an organizational resistance (Oreg, 2006). Drone technology is a major technological innovation for businesses. The use of drones in business processes can decrease the number of personnel, create a requirement for new training programs for personnel, and the recruitment of new personnel. Resistance to such change may occur within the organization (Rao et al., 2016). Organizational resistance, especially in technology, is the survival mechanism of the enterprise (Obeidli, 2018). The biggest challenges for UAVs are cultural and organizational resistance and prejudice. For example, according to Smith's (2014) study, drones in the US Air Force were seen as a self-serving technology. It is argued that many unmanned aerial vehicles disrupt manned platforms and that manned platforms are more suitable than unmanned aerial vehicles. Besides, unmanned aerial vehicles are controlled by autonomous intelligence, and little or no human control brings about resistance (Whittle, 2016). The use of larger UAVs, such as predators, in the army, requires more human participation than typical manned aircraft (Hoffman, Cullen & Hawley, 2016). Therefore, in some organizations, pilots resist taking on the role of UAV operators. The capacity to recruit, train and, retain the operator and related personnel is a critical element of an army's capacity to participate in high-paced operations with UAVs (Lubold, 2015).

1.3. UAVS / DRONE REGULATIONS

The vital status that drones have reached in the last ten years is undeniable. In various institutions and organizations, notably in military activities, drone usage has been integrated into their operations. Drones have come a long way in the commercial, civil and military fields with the assistance of technical and software developments and changes. Drone usage is rapidly increasing in the military, security, logistics, agriculture, mapping, and photography fields have created new business opportunities (Crutsinger et al., 2016:166; Everaerts, 2008; Holton et al., 2015). Many sectors have begun using drones commercially (Kuzma et al., 2016). With the increase in drone-using businesses, the need for drone operators has also arisen (Snead & Seibler, 2017). Though drones have been in use for a while now, job advertisements featuring drone operators/pilots only started rising in the last ten years (Hanssen, 2016). One of the

new and upcoming occupations, drone operating, will have several job qualifications (Taylor, 2020). When businesses hire potential drone operators, they set essential and desirable criteria that fit the respective job definition and business (Stopforth, 2017). Businesses expect the candidates to fit the criteria.

While talking about drone regulations, the relevant agencies in countries that set the regulations regarding commercial and civil drone operators must be mentioned. The US has the Federal Aviation Administration (FAA), Australia has the Civil Aviation Safety Authority (CASA), China has the Civil Aviation Administration of China (CAAC), and Turkey has the DGCA. Operators are required to get the relevant license and education for their respective UAV's weight classes. It is of the essence for drone operators to adhere to flight regulations. Individuals working under organizations are commercial drone operators (Luppacini & So, 2016). These operators are required to have the technical competencies laid out by the regulations and must have completed the necessary internship flight hours (Qi et al., 2018). UAVs have different flight qualifications depending on their weight, and operators are required to meet these qualifications (Mirot, 2013; Jones, 2017; UAVSI, 2019)

UAV driver's licenses in Turkey are classified according to the weight of the UAV (UAVSI, 2019: article 5). These are as follows:

UAV - 0: UAVs with a maximum takeoff weight of 500 g (including) - 4 kg.

UAV - 1: UAVs with a maximum takeoff weight of 4 kg (including) - 25 kg.

UAV - 2: UAVs with a maximum takeoff weight of 25 kg (including) - 150 kg.

UAV - 3: UAVs with a maximum takeoff weight of 150 kg (included) and more.

Working hours and working locations for drone operators can vary according to the regulations. Therefore, these individuals should not have any travel restrictions. More so, to work under certain organizations, institutions, or establishments, the individual should not have any international travel restrictions (Indeed, 2019).

According to the DGCA's instruction, UAV0 users must be at least 12 years old, and UAV1 users must be at least 15 years old, which means that a low-weight UAV/drone can be used from the age of 12. In the world, according to the FAA in the United States, individuals must be at least 13 years old. In the United Kingdom, according to the Civil Aviation Authority (CAA), they must be at least 16 years old

(Miah, 2020). However, many job advertisements' desired age is at least 18 (Indeed, 2019; Seek, 2020).

1.4. QUALIFICATIONS OF DRONE OPERATORS

Professional quality, physical and psychological health, education requirements, operation, and coordination experiences are the main components of a drone operator (Qi et al., 2018; Schreiber et al., 2002). Individuals who are eager to learn, who have the ability to think analytically, and are passionate about their work are more inclined to be drone operators. As a result of businesses starting to use drones in most of their work processes, drone operators must work in teams and under a heavier workload (Vente, 2017:54). Businesses expect potential operators to be cooperative and friendly with their coworkers (Baykar, 2020; Graupner, 2020).

One of the most important conditions sought in the employment of a drone operator is the health of the individual. A health report showing that the individuals, especially their eyes and muscles, are healthy is requested (Mirot, 2013). Chappelle et al. (2014)'s study on manned and unmanned aerial vehicle operators regarding neuroticism, extroversion, openness, agreeableness, and conscientiousness shows that pilots that are fit to work under pressure were able to handle high-stress situations more easily, that they were harder to frustrate and that they had high levels of self-esteem. For this reason, operators need to be psychologically healthy in order to perform higher and work more efficiently. More so, individuals should also be mentally trained (Qi et al., 2018).

When the most important studies about drone operator training in the literature are considered, a study by Schreiber et al. (2002) on seven separate groups of pilots consisting of formally trained and untrained people showed that people who received formal UAV flight training performed better. Therefore, education is of great importance to drone operator qualities (Mirot, 2013). Masters (2012) says that as drones began to be used by businesses and the government, operators began to be equivalent to aircraft pilots. Therefore, to become a qualified drone operator, two or four years of training in mechanical engineering, electrical and electronics engineering, or in the aerospace field is a factor considered by businesses in

recruitment (Masters, 2012). Individuals are expected to know aviation theory and aviation regulations (Qi et al., 2018). Operators must have basic aviation, electronic and mechanical knowledge. One of the qualities employers care about most is that the operators speak English. Many business components are in English from drone use to customer relations and contracts in large and overseas-linked firms. They should have a good understanding of English speaking, writing, and reading comprehension skills. (Baykar, 2020; FAA, 2020). In addition to language education, candidates might be required to know basic programming languages in accordance with the requirements of the job. Candidates should be able to relate drone technology with Information Systems. They must also master how data collected by drones is analyzed and how it is processed in the background (Bartholomew & Mayo, 2018; Moguel et al., 2018; Week, 2000).

In recent years, drone studies and software started becoming intertwined (Crutsinger et al., 2016:161). When it comes to drone operator employment and specifications, looking at the past 30 years' literature provides more effective and appropriate data for this topic because drone operators' recruitment criteria became more defined.

Though industries, companies, and governments are newly adapting to this profession, drone operating has existed for a while. However, there are many vacancy agreements in some countries such as the USA, UK, Germany, Netherlands, Israel, India, Singapore, Japan, China, Korea, Cape Town, Johannesburg, and Colombia (Indeed, 2019). In Turkey, the UAV venture began in 1990. However, the increase in field employment only started rising in recent years (Altunok, 2010). In this case, these vacancies' job requirements are considered to determine qualified drone operators' specifications in organizations.

1.5. ACADEMIC DRONE OPERATOR TRAINING

The idea of opening up the future of drone training as a course or department in universities has also been researched in literature. Academic drone training is a fairly common thought in current news. As a result of the research, it is argued that departments such as photography and agriculture industries, cartography, engineering, cinema, etc., should be given technical and theoretical drone training in addition to their courses (Hanssen, 2016; Zhao, 2020). In many cities in the USA and Europe, universities have programs granting drone bachelor's degrees (Akins, 2018; Wald, 2013). In addition to all this, Indiana State University, which is one of the most equipped universities in America that offers UAV undergraduate education, has a curriculum. This curriculum mostly includes basic aviation classes, mechanics of UAVs, computer systems classes, human factors of UAVs, payloads and sensors, data links for unmanned systems and, advanced aviation and unmanned systems classes, and so on.

Web-based distance education is quite common in today's world. With the Covid-19 pandemic, education has been moved to online platforms. Thus, it is possible to access many education, especially theoretical courses, from digital platforms. Although not at the undergraduate level, drone training can be taken from massive online open courses (MOOC) platforms such as Udemy and edX (Erdem, Turcan & Tekin, 2020).

CHAPTER TWO

DRONES, DRONE OPERATORS AND INFORMATION SYSTEMS

2.1. DRONES

UAVs have been first developed in 1916 by A.M. Low (Sale, 2013). The United States started working on drone technologies for World War I. They were used as targets for train anti-aircraft gunners in World War II (Wood, 2014:4). Drones are also UAVs. In fact, their history is earlier than that of UAVs (Havadrone, 2018). The first drones are unmanned balloons that had been used by Australians in 1849 (Holman, 2019). The acronym for the term “Dynamic Remotely Operated Navigated Equipment” is “drone”. (Ozols, 2015). Drones are flying platforms and are suitable to serve various purposes (Vergouw et al., 2016). Therefore, drones can be used in all fields in which UAVs are used, and both these terms are interchangeable unless the field of their usage is not specified (Jalali, 2017:6). The terms RPAS (Remotely Piloted Aircraft Systems) and UASs (Unmanned Aerial/Aircraft Systems) are also used when talking about drones (Sandbrook, 2015). For some authors, there are some distinctions between these terms, regarding the automation and transfer of the control mechanism from the pilot to the system (Boucher, 2015:1396).

Today, technological advancements emerge at an all-time high. As it is with all unmanned technological products, such as robots and unmanned aerial vehicles (UAVs), in the background of these devices there is the initial thought or the mind of a scientist (Jones, 2019). A UAV is the whole of the physical parts that provide the aircraft the ability to fly. Though these devices are called “unmanned”, in most instances, hundreds of people take part in the development process of UAVs (Everaerts, 2008).

Drones can be classified as commercial and individual, according to their intended use. There are some differences in commercial and civil drone use.

- **Commercial Drones**

Commercial drones are used in profit-making situations and businesses. In addition to making financial profit, using a drone in situations that benefit a project or business is also the use of commercial drones. For example, scanning areas with drones

to contribute to a land survey without the purpose of making money is considered as commercial drone use. For this reason, whether drones are commercial or not depends on their use and purpose. A person or institution who wants to use a commercial drone must have a certificate and license by completing the commercial UAV training organized by the aviation administration of the country where it is located (Uzialko, 2018; Turk Loydu, 2020). Commercial drones and licenses must be registered in the UAV registration systems of the Aviation General Directorates of the countries. People and institutions must be complied with commercial drone use conditions that stated in countries' aviation authority regulations such as CAA in the UK, FAA in the United States, DGCA in Tukey, and CAAC in China (UAVSI, 2019; FAA, 2020).

- **Individual Drones**

Individual drones are drones used without a commercial purpose. They are used for entertainment and hobby purposes. However, individual drones are also subject to the legal regulations of the countries. For example, individual drones should be registered with UAV Registration Systems just like commercial drones. Even for entertainment purposes, a flight permit must be obtained from the system before each flight. Flying drones in areas without a flight permit is forbidden (UAVSI, 2019; FAA, 2020; EASA, 2021).

2.2. DRONE USAGE IN BUSINESSES

Today, drones are used for hobbies, commercial aims and emergencies. Now, many industries and sectors prefer to use drones in their business processes commercially. This shows that technological developments in the drone field are vast. These marvelous developments affect the competitive environment of big industries, and, in some cases, even smaller enterprises (Crutsinger et al., 2016:161; Lidynia et al., 2017:317-329). The reasoning behind the constant mentioning of the future of drone industries is that drones are widely used in the public and private sectors and, also for professional services. It can be clearly seen in its literature as well. Drone use in the military, in agriculture, for inspection, in photography, in videography, in media and also, search and rescue missions have increased by a significant margin in recent years. This means that drone operators will have job opportunities in almost every

sector (de Miguel Molina & Santamarina Campos, 2018:39). Today, we are in an age of constant digitalization (Fogu, 2009). The organizations, which invest in drone technology in their business processes, have advantages in their sectional competition environment. Creating value for customers, offering alternative services that competitors lack, preventing imitation, and especially using instead of many things are determinant attributes (Aydoğan & Altuğ, 2006:100). Drones can be used in many different fields ranging from service to commerce and business (Austin, 2011; Kardasz et al., 2016). Commercial drone use can be exemplified as follows:

Aerial Photography and Videography: Photography is arguably the most well-known use of drones. In this field, drones are mostly preferred for some special events or personal hobbies. Drone cameras can be controlled easily. They can shoot from angles and distances that an individual with a camera cannot reach (MyDearDrone, 2019). Due to these reasons, drones are preferred for outdoor shooting.

Agriculture and Farming: In agriculture, many growers ranging from individual producers to large agriculture firms have begun to integrate drones into their business processes. Drones can do most, if not all, the work that farmers are capable of. However, it is more useful for companies that do large industrial jobs. Firms and farmers can bring down their cost of workers, electricity and water usage by implementing drones in their agricultural activities (MyDearDrone, 2019). In addition to this, the yield of their cultivation area also increases. Drone usage in the agricultural field ranges from spraying pesticides, scaring away crop-eating birds to observing the crops, managing irrigation and providing harvest counselling (Patel, 2016; RembleTech, 2017).

Construction: Drones are used in the civil engineering field and also in industrial and commercial projects. The construction firms use drones for, inspections, to monitor employees, to get an aerial image of the construction process and, also for surveying and security. Even the smaller drones can give extensive information about the state of the construction, thusly they have a significant impact on the construction process. Additionally, with gathered images by drones, three-dimensional (3D) models can be

done by architects. The firms that integrate drones in their business processes get ahead of curve and have an advantage compared to their competitors (MyDearDrone, 2019).

Delivery and Shipping: Drone delivery is a very significant issue in the drone fields' current agenda. Leading companies in the world such as Amazon, Domino's, Google and United Parcel Service (UPS) have attempted drone technology for their delivery services. With the development of Global Positioning System (GPS) technologies, firms have begun using drones for their shipping and transportation processes. However, there are some restriction and obstacles regarding the weight of the products, planning of the drone battery, GPS dependence, system control, Ground Handling Services, weather conditions, route planning, Federal Aviation Administration (FAA) regulations for commercial use of drones, reliable delivery and public safety. However, within these limitations, drones offer less cost and more practical delivery chance to related organizations (Bamburry, 2015:41).

Disinfection and Mask Control: With the occurrence of the Covid-19 pandemic at the end of 2019, there have been fundamental changes all over the world. With the increase of hygiene studies in both private and public areas, disinfection efforts to destroy and control the virus have begun. Now drones are also used for disinfection purposes (Bozkurt, 2020). Many large-scale areas, such as streets, alleys, parks and shopping centers, are able to be sprayed and disinfected with drones. At the same time, mask inspections of citizens are carried out with drones in open areas (Jayaprakash et al., 2020).

Drone Racing and Sports: Drone operators love partaking in racing activities. These activities give an opportunity for drone operators to display their skills in drone handling. Moreover, some companies and foundations organize drone fund-raising campaigns to finance an enterprise or a project (Bøg et al., 2012:19; Heitner, 2017).

Firefighting: Until recently, helicopters were used to assist in the duties of the fire department. However, the lives of the crew responsible for helitack, which stands for helicopter-delivered fire resources, are under constant risk due to the fires they have

to endure (Komjáthy et al., 2013:27). As previously stated, drones can be referred to as UAVs and thanks to certain features of drones, the danger in which the helitack operators find themselves is completely eliminated (Jalali, 2017:6). Also, drones can scan and display a larger area than any firefighter or any manned aerial vehicle can (Wu et al., 2017).

Mapping and Surveying: With the assistance of advanced automatic control and UAV systems, mapping and terrain analysis has also become much easier than ever before. These procedures, which require high precision and dynamism, are now able to be done in a shorter time span. The use of drones for field scanning and identification has enabled mapping businesses to take a step forward in the sector (Bozkurt, 2020; Everaerts, 2008).

Military, Defense and Armed Forces: The defense sector is the most common and well-known field in which drones are used. Most of the established applications of RPAS are for military purposes (m-RPAS) (Boucher, 2015:1394). Thus, the military applications are one of the main forces that drive the development of drone technology. However, drones are not as innocent as they may seem at first glance. They are used in counterterrorism, target identification and disturbing the target signal in the event of a conflict. They also can fly over perimeter defenses and controlled entry points (Dunn, 2016). It goes without saying that these types of drones used by the military are different from the drones that are used in civil manners. Though, big drones have much higher expenses and are expensive themselves they are highly suited for military and national security. When put into consideration, lighter and smaller drones can potentially bring down costs by increasing the production volume (Clarke, 2014:235). Some governments, police and military forces are already attempting to develop countermeasures against the threat small-drones possess (Dunn, 2016).

2.3. DRONE INFORMATION SYSTEMS

Information systems are computer-based automated systems that cover the process of collecting, analyzing, processing, distributing, and storing data. Information systems are used for organizational purposes. In enterprises, drones play a role in collecting targeted data. Drones are used by the government in different sectors such as agriculture, search and rescue, mapping, meteorology, oil and gas, construction, and by the military and police to ensure security (Özçatalbaş et al., 2004; Ajami, 2013; Fan et al., 2009; Goodchild, 2009; Soleimani Roozbahani et al., 2018; Zhai et al., 2009) . Hence why, drones are devices that are capable of collecting different types of data. Data obtained by drones is transferred to information systems for processing and use. So, drones provide data to different information systems. They have become part of the information systems of enterprises (San-Miguel-Ayanz et al., 2002; Ceruti, 2003). Some information systems that can use data obtained through drones include:

- Agricultural Information Systems (AIS)
- Construction Information Systems
- Delivery Information Systems
- Earthquake Information Management System
- Fire Information Systems
- Geographic Information Systems (GIS)
- Management Information Systems (MIS)
- Meteorological Information Systems (MIS)
- Military Information Systems

Businesses that want to further improve drone activities are starting to use all these information systems. Drone operators also play a major role in the use of drone information systems. They can take roles such as collecting data, transporting data to the analysis unit, analyzing data, and viewing data. At this point, businesses plan tasks by authorizing drone operators or people involved in drone operation.

2.4. HUMAN-DRONE INTERACTION

Humanity, technology and computers are interdependent, this dependence will exist as long as there are technological developments. All the interactions, between humanity and computers, can be named as human-computer interaction (HCI). HCI has four main components: user, task, tool, and context. In HCI studies, when users perform certain tasks with the tools or interface, the observation results obtained are evaluated together with the effects such as usability, habits and this data is used in the development of interactive systems (Acartürk & Çağıltay, n.d.). One of the newly emerging HCIs, drone usage, is a valid example. Thusly, a new study field "human-drone interaction" has begun (Funk, 2018:78).

Considering the today's technology, almost every 2D interfaces can be transformed to 3D by adding flying robots to them. The difference between traditional robots and drones lies in the drones' usefulness and are easier to operate. Human-drone interactions occur in four different manners. The first of them is direct position control. This usage does not require the use of sensors to analyze the surroundings. The second interaction manner is absolute position control. These interactions require some on-board processors to determine the location e.g. Compared to the first manner, this interaction is more complex, this is because drones move autonomously (Cheng et al., 2017:989). The third interaction type is relative position control. This control defines the relation between the drone user and the drone itself. Here, the user tells the drone the desired comments e.g. "Follow me for along this path." or "Stay put for eight minutes." drones should be able to relate to an object, a place or individual. The last interaction manner is task-oriented control of drones. In this control type, drones are assigned certain tasks. For example, constructing a wall using cubes. After the task is assigned the drone is supposed to build a wall (Funk, 2018:78). All these controlling functions of drones show that, drone usage is an example for the human-drone interaction.

Within the scope of human-drone interaction (HDI), for example, new drone shapes with a friendly appearance or new user interfaces that allow non-skilled pilots to use drones correctly without extensive training can be designed. According to the studies of Tezza and Andujar (2019), human-drone interaction can be examined in four

different dimensions as control modalities, human-drone communication, proxemics and use-cases. HDI can take several different forms.

- The pilot/operator can directly control the drone with a control interface to perform a task. For example, using a drone actively in agricultural spraying.

- The person can be a recipient who interacts with drone, not a drone user. For example, receiving a package from a delivery drone.

- Drones can act simultaneously and in the same environment with humans as social friends. For example, tracker drones flying simultaneously with runners in Wings for Life World Run.

- Autonomous UAVs require users to act as supervisors. For example, pre-programming drone behaviors such as flight mission and route, or supervising an autonomous flight simultaneously.

2.5. DRONE OPERATORS

Drones are designed as smart devices. In the military, there is a new software that makes automated drone control achievable. However, in other fields that drones are used in, the operator is required to use and control the drone. Recently, the number of individuals that use drones has exponentially increased. A big part of these individuals uses drones as a hobby. However, soon, we will have a new profession: "drone operator." Drone operating is a job in which an individual must, and hypothetically does, possess the technical and theoretical prowess on drones and drone control. Therefore, operating a drone requires professionalism. It is known that, the individuals that use drones are called as "drone operators". However, the drone user that organizations require and who have control over every step of the drone processes are called "drone operators". In today's world, individuals want to have hobbies and interests outside of their corporate identities. Financial hardships result in the search for new income opportunities. So, for individuals that see drone operating as a new source of income, this shift may cause them to choose a degree or course in the drone field (Hanssen, 2016:871).

While every drone operator is a drone user, every drone user cannot, and in some cases, should not become a drone operator. It goes without saying that, when in

high stress situations, calm nerves and professionalism is required to deal with the issue with minimal damage. This is one of the main distinctions between a normal drone user and a drone operator.

Professionalism in a field, first and foremost, is about the level of knowledge one possesses in that field. Professionalism cannot be defined by just being skilled or good at a field such as medicine, law etc. The definition of professionalism depends on the expansion of knowledge (Beaton, 2010:3). Knowledge on all bodies of a profession or a field is what the expected performance from a professional is. Professionalism is more about occupational control than consumer control management control in business (Freidson, 1999:118). The individual, who strives for professionalism in their respective field, should have specialized knowledge about their field. This field could be human resources, finance, information technologies, carpentry, cooking, teaching or using a device. Every profession has its own form of professionalism. To be a professional, the ins and outs of the business field need to be known. In 1853, professionalism was defined within the scope of divinity, medicine and law. Professionals need to know how to test and learn more about certain issues (Beaton, 2010:2). In cases of financial crises and technical problems, high stress situations in general, professionals are expected to and able to keep themselves level-headed. They also should organize the trainings and trainings about the field, have self-regulatory, be collegial, client-focused and ethical (Beaton, 2010:4)

Globally, there are many drone operator job advertisements. Businesses across the globe are in search for drone operators. The fields that are actively recruiting drone operators are mapping and surveying, agriculture, public health, drone delivery, government, environmental planning, ecology and environment, telecommunications, photography/videography, aircraft manufacturing and the military field (Indeed, 2019:1). Businesses generally require drone operators to be used in aerial photography, videography for advertisements or aerial surveillance. Drone operators satisfy the drone needs of companies. Most commercial organizations do not have full-time drone operators. They hire drone operators on a project basis (Conlin, 2019:3). However, the demand for drone operators is growing.

CHAPTER THREE

RECRUITMENT OF DRONE OPERATORS

3.1. RECRUITMENT

With the increasing need for drone operators, a number of processes related to the employment of drone operators have also occurred in enterprises (Fennelly & Perry, 2020). Drone operator employment also places new responsibilities on human resources during the recruitment phase. Drone users are very important for institutions and organizations in terms of data privacy and security. Therefore, businesses behave meticulously during the employment phase. Choosing people who can directly serve the needs of businesses is the first goal of businesses. However, while doing this, many factors such as health, education, attitude and behavior, experience are involved. Businesses have to consider all factors, adhering to their own interests and laws.

Drone use varies by type of drone. Operators must undergo a separate training process for each drone. The purposes drones serve also differ sector to sector (McNabb, 2019). It may be necessary to use different drones for different tasks or different tasks can be done with the same drone. Different processes such as image acquisition, temperature measurement, area determination, spraying, use as an offensive weapon in the military, lighting, etc. these all require separate forms of use.

Choosing the right drone operator for the respective job is the task of employers and human resources. Although human resources in around the world have not achieved a detailed drone operator recruitment process yet, more systematic recruitment processes will take place soon. Currently, the choice of drone operator in enterprises is usually made by professional drone operators and pilots. Some companies provide drone operator services to businesses (Murison, 2020). Although short-time operators were previously used, now larger drone service providers are building full-time operator teams to serve large corporate customers (McNabb, 2019). Day by day, drone use is spreading to new sectors. For this reason, the chances of finding work for licensed drone operators are also increasing. In the recruitment processes, candidates are expected to meet the required job description. A testing process begins for operators who meet these requirements (Perritt & Sprague, 2015).

Candidates are expected to complete and safely perform the tasks assigned. These tasks vary by sector. Some organizations, on the other hand, hire operators to train them in-house. They can therefore also accept inexperienced graduates (Indeed, 2019).

The human resources department determines the criteria for the drone operator position. However, the use of drones is frequently used in small businesses as well as large businesses. In enterprises that do not have a human resources department, the person or unit that performs the recruitment processes should identify these criteria and create a recruitment form. Recruitment processes such as application, preparation, interview, reference, health check, and employment are a roadmap for operators. From the day the job is posted, operators must have the qualifications expected by the business.

The drone industry contributes to both economic income and employment. The drone sector, which creates its own economy and positively affects the economies of the country, provides employment to many people and it is predicted that this employment will increase in the next 10 years (Yeşilay & Macit, 2020). Some numerical data regarding drone employment in the world are as follows:

- While 70.240 jobs were created in the USA between 2015 and 2017, this number is expected to increase by approximately 33.500 by 2025 (Jenkins & Vasigh, 2013: 5).

- In the European Union, it is predicted that 100.000 people will be directly employed and 100.000 people will be indirectly employed by 2035 (SESAR, 2016).

- In 2030, 628.000 people are expected to be employed in the UK (PwC UK., 2018).

- In India, which provides 50% of the employment from the agricultural sector, it is expected that employment in the field of agricultural drone use will increase.

- In Turkey, according to data from July 2020, the number of registered drone operator in DGCA is 293.907 (DGCA, 2020). It is thought that this number and employment will increase in the next 10 years (Yeşilay & Macit, 2020).

3.2. DRONE OPERATOR RECRUITMENT CRITERIA

There are criteria that businesses set for drone operators in recruitment. These criteria are mainly determined within the framework of Health, professionalism, technical and theoretical knowledge, education, experience and organizational harmony. These are qualifications that operators must possess or obtain before applying for jobs. These qualifications are classified as essential and desirable in many drone operators job adverts. Essential requirements are properties that are a must for operators (FAA, 2020). Desirable features, on the other hand, are features that give candidates an advantage, which they can use to perform better, and therefore are preferred by businesses (Indeed, 2019). At the same time, these features vary according to the hobby, commercial and government use (Wendorf, 2020). In addition to essential and desirable features, one of the most important issues focused on in hiring is working conditions. Operators are provided with information about the conditions under which they will need to work.

3.2.1. Essential Qualifications

Essential features cover the basic features that operators should have and the critical features that employers set in their respective businesses. In commercial and governmental organizations, these are characteristics put in place by employers and ones that operators, legally, must possess. Operators cannot fly drones without having one or more of these features (UAVSI, 2019; Indeed, 2019; Conlin, 2019; FAA, 2020). These requirements can basically be sorted as follows:

- Drone operator license
- Clean criminal record
- Medical certificate (physical, psychological and especially eye health)
- At least high school or associate degree
- Basic computer skills
- Knowledge of framing/photography
- Flight experiences
- Reading, understanding and writing in English

- Skilled at and adaptable to group or team-based projects
- Adaptable to different environment and weather conditions

3.2.2. Desirable Qualifications

Desirable qualifications usually cover the characteristics that candidates themselves have developed over time regarding drones. The knowledge and skills acquired by operators as a result of their experiences depend on their learned expertise and technical-theoretical training in specific sub-fields. These characteristics, which create prominence among candidates, differ by sector. But in general, the qualities employers want to see in operators are as follows:

- Bachelor's or post graduate degree in Aeronautics, Business, Engineering or similar disciplines
- Knowledge of DGCA Unmanned Aerial Vehicle Systems Instruction (UAVSI)
- Knowledge in image editing programs
- Required level of programming knowledge in drone related systems
- Strong attention to details and detecting errors
- Strong communication skills
- Sector-based knowledge on framing, mapping, artistic photography/videography, search and rescue, scanning, monitoring, etc.

CHAPTER FOUR

EVALUATION OF DRONE OPERATORS FOR BUSINESSES BY EXPERTS

4.1. STUDY

This study aims to determine the required qualifications of drone operators for businesses. The preferred data collection method is interviewing. The study is qualitative. Therefore, qualitative data was obtained from the interviews.

The drone field mostly depends and relies on practice. So, only literature-based responses are not expected. These interviews comprise of the experiences of experts and professionals from different sectors.

Interview questions include questions ranging from drone usage in sectors to employment of drone operators. The data are obtained as a result of interviews with experts selected by the purposive qualitative sampling method. The data collection process is about four months. The data obtained from interviews consist of long texts and personal opinions. The obtained data is unstructured, and the interviewees are flexible in answering the questions. For this reason, content analysis is used as a methodology in analyzing the data.

4.1.1. Objectives of the Study

The main objective of the study is to analyze what businesses expect from drone operators. In the study, qualifications that the drone operators should have, are determined regarding the enterprise and the employee. While determining these qualifications, three different research questions define the scope of the study.

The problem that led to the emergence of this study is that there is no set of general and clear criteria for drone operator employment in businesses. For this reason, a study has been presented that determines these qualifications to guide both businesses and drone operator candidates. In addition, various results were obtained by collecting data on drone use and drone operator employment in businesses within the scope of the main purpose and research questions.

Main Purpose:

- ❖ What do businesses expect from drone operators?

Research Questions (RQ):

- What are the expert opinions on drone use and drone operator employment in businesses?
- What are the drone activities and how are they conducted within the organizations?
- What are the qualifications that experts seek from drone operators?

4.1.2. Data Collection Method

Purposeful qualitative sampling method was used to choose individuals who could contribute and add their knowledge to the interview questions by providing useful information about drone operators for businesses. To widen the scope, professionals from both public and private sectors in media, agriculture, academy, arts, and safety were involved in the in-depth interviews. Interviewees' profiles are visual inspection specialists, freelance and commercial adversity, sales engineer and digital marketing specialist in agriculture, instructor pilots, aircraft technology lecturer in vocational school, professionals in the national defense and safety, and directors in media, photography, oil and gas industry.

Before the in-depth interviews were carried out, the study was designed. Open-ended interview questions were organized according to information gained from experts, related literature, and other online and published resources such as news articles, reports, etc.

Interviewees' observations were collected via in-depth interviews. Main analytical objectives describe variation, explaining relationships, individual experiences, and group norms through commercial drone operators' eyes. Responses were obtained via face-to-face interviews and online interview questionnaires via Google Forms. Face-to-face interviews were recorded for further analysis. 14 people were interviewed face-to-face. The length of face-to-face interviews varies between 27-94 minutes. The average interview duration is 52 minutes 35 seconds.

Interview questions consist of six sub-sections. The first section includes personal information of experts such as name, title, company name, and their drone operator status. The second section is an overview of drone operators and drone use in businesses. Future of drone operators, advantages, contributions and risks of integrating drones and drone operators into the businesses, organizational resistance and cost-benefit comparison is mentioned in this part of the interview. The third part is designed to determine the activities that use drones and drone activity intensity in businesses. The fourth part is on businesses in which drone activities are carried out with in-house resources. This section's questions include the number of drones and operators, testing period for drone operators before hiring, internal regulations, and evaluating the drone operator's performance. The fifth part is drone operating as a job. In this section, criteria for drone operators are mentioned. Also, drone training as a department or lecture in universities and the ambiguity between the terms operator and pilot is mentioned. The sixth part is comments and suggestions. Experts share their comments and suggestions about this study in this section. If we exclude the first and the last sections, three research questions and the remaining four subsections overlap with each other. The sections contain a total of 22 sub-questions. The answers to the sub-questions addressing 22 different sub-topics constitute the data of the study. According to the sections and questions (Q):

Section-1 (personal information of experts) includes demographic information about experts.

Section-2 (overview of drone operators) includes Q1-Q6.

Section-3 (drone activities) includes Q7-Q10.

Section-4 (in-house drones and operators) includes Q11-Q16.

Section-5 (drone operating as a profession) includes Q17-Q22.

Section-6 includes experts' comments and suggestions.

According to the research questions and interview questions:

Q1-Q6, Q18 and Q22 are designed to answer the RQ-1 (expert opinions on drone use and drone operator employment).

Q7-Q16 are designed to answer the RQ-2 (drone activities and how are they carried out within the organizations).

Q17, Q19, Q20 and Q21 are designed to answer the RQ-3 (qualifications that experts seek from the drone operators).

4.1.3. Data Sampling

Purposive/purposeful sampling method was used to determine the interviewees. For in-depth interviews, individuals specialized in drones and/or drone operators in businesses were reached. The main reasoning for choosing this sampling method is because accurate and in-depth research is aimed. Sectors/fields using drones were determined, and experts from these sectors were tried to be reached. Due to the nature of this sampling type, many different opinions and views are included in the study. With this, the analysis data has been enriched.

According to DGCA data, the number of UAV pilots registered to the system has approached 216 thousand. This number includes users operating commercial and individual flights. For this reason, pilots and operators independent of the enterprises are also registered in the system. UAV / drone users who work professionally in enterprises and are also registered to the DGCA system consist of the population of this study. Interviewees are from different sectors and have different titles. One of the interviewees uses drones for hobby shooting. Two of them use the drone for publicity and advertisement activities. Four of the 20 interviewees work in huge technology-driven national defense organizations. One of them has a media company operating in the field of cinema and advertising. Two of them are sales engineers and digital marketing specialists in a company operating in agriculture, specifically in spraying. Three of them are lecturers at the vocal school of aircraft technologies. One of them is a flight instructor in the piloting department of an aviation college. One of them is a bureau chief at a police force headquarter. One of them is a director of photography. One of them is a software developer in a public transportation organization. One interviewee is a project manager in the oil and gas industry. Two of them are working in the defense technology sector, and one of them is a professional drone photographer.

19 of the 20 interviewees are licensed drone operators, but one is a plane pilot with a verified license.

Two professional licensed drone users have not integrated drones into their business processes yet. Individuals answered questions taking into consideration various companies that use drones in their businesses, and also answered assuming that they themselves use drones in the appropriate business processes. The number of the interviewee and their sectors/fields are shown in Table 1.

Table 1: Number of Interviewee and Their Sectors/Fields

Sector / Field	Number of Interviewee
Agriculture	2
Aviation (Academy)	3
Aviation (Civil)	1
Defense Technology	2
Hobby	1
Media	1
National Defense	4
Oil and Gas	1
Photography	1
Publicity/Advertisement	2
Safety	1
Transportation	1

4.1.4. Limitations

The interviewees have different titles and work in different sectors. Drones are being used in many areas, but they are especially used in specific sectors such as national defense, media, photography, agriculture, and search and rescue. However, the number of professional drone operator in these fields is low. Therefore, a total of 62 drone operators from different sectors were reached out to. The researcher of this thesis, joined a UAV training course to have license to use UAVs. In total, 30 individuals participated in this course, where the UAV-1 license can be received. The interview questions were sent to these 30 people. In addition to 30 people, 32 more drone operators were determined to be interviewed. During the data-gathering phase, the interview questions, that were prepared via Google Forms, were shared with people

via Linked-In, e-mail and face-to-face interviews. Out of 62 people, only 20 people could respond. These 20 people are operating in the sectors/fields of agriculture, aviation (academy), aviation (civil), defense technology, hobby, media, national defense, oil and gas, photography, publicity and advertisement, safety and transportation.

Most of the responses (14) were obtained through face-to-face interviews. The interviews were in a conversational mood. For this reason, coding is applicable for specific questions and most of the answers are unstructured.

Drone use is common in national defense and safety. However, these types of special organizations operate confidentially and use private data. The staff in these organizations do not want to or are not able to share private information about their inventory and business processes because of certain organization policies. Therefore, contacting with these personnel and acquiring information regarding their drone activities was limited. Five interviewees from national defense shared relevant information based on their experiences in the field.

In addition to all the limitations, the Covid-19 Pandemic posed additional challenges. The pandemic caused a shift of paradigm for humanity. Individuals are required to avoid crowded and public areas to protect themselves. Being in quarantine is an obligation. Therefore, face-to-face interviews were not possible to conduct in this process. Most of the potential interviewees were unwilling to answer interview questions during the quarantine, though because of curfew implementation during the pandemic drone usage increased.

4.2. DATA ANALYSIS

For the qualitative interview analysis, a thematic content analysis was used. The 23 in-depth interview questions are located in Appendix 1. The first section has a demographic profile. In other sections, open-ended questions are used and, therefore, have unstructured responses. The quantitative data obtained from the interviews were evaluated using the frequency. The following steps have been applied for the qualitative responses in accordance with the thematic concept:

1. 14 audio files were listened separately. The recordings were manually converted into text files by the researcher. Replies received via e-mail and Google Forms were also added to these text files.
2. Text files were read three times to find the most repeated words. It also provided to control the mistakes and to get control overall semantic.
3. The most repetitive keywords and expressions in the texts were sorted out. These are determined as the codes of the analysis.
4. Codes expressing the same opinion were collected under common headings. These headings were determined as the themes of the codes.
5. Tables were created for codes and themes and semantic relationships between them were checked.
6. According to the frequencies of the codes and themes, the thoughts that experts mostly mentioned about the research questions and sub-questions were revealed.

These themes and codes are created for responses that have certain intensity in themselves. However, themes and codes were not created for the scattered responses.

14 interview recordings with a duration of 27-94 minutes were converted from audio files to text files manually. The data in the text files is read three, four or more times depending on the complexity of the data. The most emphasized expressions have been sorted out. Keywords and expression which have the same meaning were evaluated together. These keywords represented the codes. Codes were extracted and certain keywords were highlighted from the responses. They were used as predictive features and determining factors in order to extract meaningful inferences. In accordance with the thematic concept, the codes expressing the same idea were collected under certain themes. All themes were read and analyzed multiple times to be certain whether the experts have similar ideas with each other or not. The themes bring the data to the results. However, long conversations caused the data to be unstructured. Therefore, coding could not be done for each question. Due to the code and theme generation was applicable to certain questions, the remaining questions were evaluated statistically by extracting related data from interviewees' responses. Then, the three research questions that determine the scope of the study were reviewed to control data compatibility with the corresponding themes. For instance, two themes

were revealed from the answers to a question that measures whether an organizational resistance will arise as a result of integrating drones into businesses. These themes are "resistance" and "acceptance". The details of the themes are created by the codes. The codes of the resistance theme are "fear of job loss", "fear of learning new technologies" and "lack of education". Acceptance theme's codes are "eagerness to learn", "curiosity" and "make it easy" (Table 5). Keywords (codes) obtained from interviews were accepted as 1 for analysis, even if repeated more than 1 times.

Drone use and drone operator employment in businesses are related to each other. That is why, the questions regarding drone use in businesses assist the drone operator employment. This qualitative study addressed the following three major research questions and their sub-topics. Each sub-topic corresponds to an interview question.

The research questions and sub-topics are:

- 1- What are the expert opinions on drone use and drone operator employment in businesses?
 - a- Future of drones and drone operators
 - b- Advantages and contributions
 - c- Risks
 - d- Organizational resistance
 - e- Cost-benefit comparison
 - f- Drone training departments or lectures for universities in the future
 - g- Drone operator vs drone pilot
- 2- What are the drone activities and how are they conducted within the organizations?
 - a- Activities using drone
 - b- Drone activity intensity
 - c- Number of drones
 - d- Number of drone operators
 - e- Managing drones according to number of drones and operators
 - f- Testing period before recruitment
 - g- Internal regulations
 - h- Internal or external drone use

- i- Drone services from other companies
- j- Evaluating the performance of drone operator
- 3- What are the qualifications that experts seek from drone operators?
 - a- Ages and education levels of drone operators
 - b- License
 - c- Working conditions of drone operators
 - d- Qualifications of drone operators

Because of the qualitative nature of the study, open-ended questions were preferred. Open-ended question types allowed the interviewees to say express themselves freely. An expert could support more than one opinion. Some of the interviewees that have speech errors in the audio recordings and typographical errors in the written interviews were corrected. At the same time, the gestures and facial expressions of the interviewees were also observed during the interview. Because the data is composed of experts' answers, the answers were expressed without any personal commentary. The data obtained from the experts was analyzed in the following sub-titles.

4.2.1. General Perspective of Drone Usage and Drone Operator Employment in Businesses

In this section, the answers of the six questions mentioned in the first part of the interview were examined. Respectively, experts' views on future of drone operators, advantages of drones and operators, risks of them, organizational resistance, cost-benefit comparison of integrating drones to the businesses, drone training department for universities and pilot-operator terms comparison are included.

a- Future of Drones and Drone Operators

The question, "What do the experts think about the future of drones and drone operators?" is answered under this title. What will happen in the near future has been viewed through the eyes of experts.

The themes created from the answers given by experts to make inferences about the future of drone use and drone operator employment in businesses are "drone" and "drone operator". The codes of the "drone" theme: "intensity of use", "diversity of usage area", "drone swarms" and "government investments for drone industry". Codes for the "drone operator" theme: "new job opportunities" and "government support for operators". The frequencies of the themes and codes are shown in Table 2.

Table 2: Future of Drones and Drone Operators

Themes	Codes	Number of Interviewee	Total
Drone	<i>Intensity of Use</i>	5	17
	<i>Diversity of Usage Area</i>	6	
	<i>Drone Swarms</i>	3	
	<i>Government Investments for Drone Industry</i>	3	
Drone Operator	<i>New Job Opportunities</i>	9	12
	<i>Government Support for Operators</i>	3	

Looking at the table above, the most supported thoughts are about the future of drones. However, experts say that future of drone operators are also affected in directly proportional to this at the same level. Although experts talk about the future of drone and drone operators, they evaluate this issue keeping also in mind the past of drone technologies. According to many of the experts involved in the study, though drones have a long history they are a fairly new employment area for enterprises. By overcoming societal resistance to new technologies, drone technologies have reached an important place in today's society. As a result of the insufficient and unsystematic trainings and courses, stubborn financial structuring and restrictions in the country, the integration process in Turkish enterprises was delayed. This new profession is evolving at a rapid pace, therefore it should be followed closely by organizations and applied to business processes as fast as possible. If organizations manage to integrate

drone usage into their businesses, drone operating will be a sought after profession. Drone usage in the last three years has increased. With the coming of industry 4.0 and the digitalization process, drone usage in companies will become commonplace. These drones must be operated by professional drone operators. Hence, the need for drone operators is increasing.

The views of 11 interviewees who talked about the intensity of use and diversity of usage area are as follows: Drones are used in varying areas ranging from the defense industry to the agricultural sector. The defense industry is the sector in which UAVs usage initially began in. Today, it still is one of the most progressive sectors regarding drone use and technology. In coming years drone technology in the defense industry will become even more widespread. Countries that do not currently use drones will be at a strong disadvantage. Drone use in search and rescue activities will also increase. Depending in which direction sectors decide to move towards, drone technologies will also follow suit. Different drones are required for different tasks. As the capabilities of drones expand, drone operator requirements and drone usage businesses will also increase. In addition to drone operators, there are also individuals who take roles such as information processors, observers and evaluators in the background. These also differ from industry to industry as analysts, video editors, drone operation managers and so on. Different sectors and positions require different abilities. Therefore, as nine of the experts say, the drone operator profession has also opened up new professions and new employment opportunities. Drone technology is highly useful, as long as it is used by countries in good faith and is used for the betterment of humanity. However, malicious uses such as terror attacks can have bad consequences for humanity and may create mistrust towards drone technology.

Three of the experts from the national defense mentioned drone swarms. Interviewee-5 says: *"In the near future, drone swarms will be used more in the defense activities."* and explains:

"UAV swarms are a group of smart UAVs with set routes and goals. They also have the ability to fly collectively. The UAV swarms are assigned tasks via software. Accompanied by a master drone, the movement and tasks of other drones are also adjusted. The master drone is also backed up. So should damage occur to the master drone, one of the other drones becomes the master drone..."

Experts consider that many businesses are financially inadequate and therefore, lack the funds to employ drones and drone operators. Government investments are

complementary investments. Therefore, it is inevitable for the government to invest in drone technologies, and training and employment of drone operators. Governments and large businesses should increase their investment in drone technology. Also, the cost of drone use for some business processes is lower than previously used equipment. Therefore, drone technology will be one of the biggest advantages of the aviation field globally. In the future, it will form the basis for fast and safe transportation.

b- Advantages of Drones and Accordingly Drone Operators for Businesses and Contributions to Business Processes

The advantages drones offer for businesses are undeniable, however, certain parts of society and some organizations still resist this technology. In fact, these advantages form the basis of drone use (Washington, 2018; Yoo et al., 2018) and drone operator employment. These advantages make drone use attractive. Businesses that want to acquire drones have to employ drone operators. Under this title experts' experiences and opinions on the advantages of drones and drone operators, and contributions to business processes are collected under this title. Experts that talked about the advantages of the drone and the operator, put into consideration the sectors and positions they are working in.

Interviewee-20 operating in the field of agriculture says: *“...It provides making detailed observation and getting aerial data in very large agricultural lands. They present an opportunity to demonstrate topography of land via 3D imagery... In agricultural spraying, drones allow less spraying depending on the daily analysis reports of the data obtained.”*

According to the expert in the oil and gas sector, occupational health safety and prior problem detection are essential for the oil and gas industry. In drilling areas where transportation and geography are unfavorable, working conditions and equipment can be controlled remotely. Measures are taken before problems occur, labor is preserved, and projects are completed without any problems. The expert also refers to the construction industry due to the similarity of the workplaces: *“...It ensures that construction and workers are tracked without using manpower and creating security gap... It is also safer with drones to identify the objectionable situations in*

the construction, evaluate the workers' performance and report the progress of the construction.”

Interviewee-18 from safety field says: *“Helicopters cause great damage in the event of an accident and their risk is high. For this reason, it is safer to use drone instead of helicopters... It also allows hour-long and high-cost works that are conducting by ships, planes and helicopters to do faster and lower-cost.”*

Six interviewees that are business owner or are in managerial positions mentioned the advantages of drone use in business interests: “Making money is the primary reason for companies to exist. Therefore, low cost is one of the most important factors in making money. At first, drone costs may be too high for small businesses. However, in the long run, drones provide profit for the business by amortizing these costs. If a business needs a drone, they must buy a drone. Otherwise, it can lead to extra costs. Costs can also be mitigated by reducing the number of staff. The human factor creates many problems that can be avoided by digitalization such as psychology, social environment and diseases. This also reduces the efficiency of the work done. Businesses can take advantage of drones by making the right decisions.”

Experts emphasized three factors in this regard: time, cost and quality. These factors are determined as themes for advantages of drone use and drone operators and their contributions. For the analysis, various codes were assigned to interview data. The theme “time” includes some codes such as ‘speed’, ‘saving time’, ‘less time’. The theme “cost” consists of the codes ‘low cost’, ‘cost reduction’, ‘profit’, ‘less personnel’. For the theme “quality”, the codes are ‘safety’, ‘efficiency’, and ‘easier processes’. Table 3 indicates the distribution of coded advantages by interviewees and sectors.

Table 3: Advantages of Drone Use and Employing Operators

Advantages		Number of Interviewee	Sectors	Total
Themes	Codes			
Time	<i>Speed</i>	9	Media, Publicity, Safety, Agriculture, Aviation	18
	<i>Saving Time</i>	9	Publicity, Aviation, Oil and Gas, Safety	
Cost	<i>Low Cost</i>	6	National Defense, Publicity, Aviation, Transportation	16
	<i>Cost Reduction</i>	5	Publicity, Agriculture, Transportation, Oil and Gas	
	<i>Profit</i>	3	Agriculture, Aviation, Transportation	
	<i>Less Personnel</i>	2	National Defense, Safety, Defense Technology	
Quality	<i>Safety</i>	3	National Defense, Safety, Aviation, Defense Technology	15
	<i>Efficiency</i>	7	National Defense, Safety, Aviation, Publicity, Oil and Gas	
	<i>Easier Processes</i>	5	Safety, Publicity, Agriculture, Media	

For experts, the most important factor is time. Especially for experts working in the national defense, media, advertising, safety, agriculture, aviation and oil and gas fields, the use of drones allows processes to run faster and, in turn, saves time.

One of the main issues of the business, cost, is ranked as second most important by experts. According to the majority's answers, the most important issue is low cost. This idea is followed by cost reduction. For experts, the involvement of drones will reduce current costs of operating business. Experts think that the increase in business profits is also one of the most important benefits of drone use. It is important for businesses to have drones if they aim to operate more efficiently while at the same

time requiring less personnel. For this reason, working with less staff can lead to an increase in profit. According to experts, drones assist the business in getting detailed images from distances that are too far to be seen by the naked eye and that require costly elements such as helicopters and more personnel. Moreover, this is less costly and less time consuming. An example of this, interviewee-8 who is the owner of a media company says: *“Images taken from the air by cranes or helicopters in the past can be obtained more easily and quickly with drones now. Today, almost all news channels and production companies have drones. It contributes them to work on cost control of businesses.”*

Experts have also addressed the issue of quality. This section’s header, quality, includes safety, efficiency and easier execution of business processes. For experts, the most important advantage achieved with drone use is efficiency. Not only doing tasks faster and with less personnel than normal is more profitable, but it also saves on time. That is why drone use in businesses is efficient. Interviewee-12 says: *“...It also provides the most efficient use of time, which is very precious and irreversible for businesses and employees. In the future, fewer personnel will work more efficiently.”*

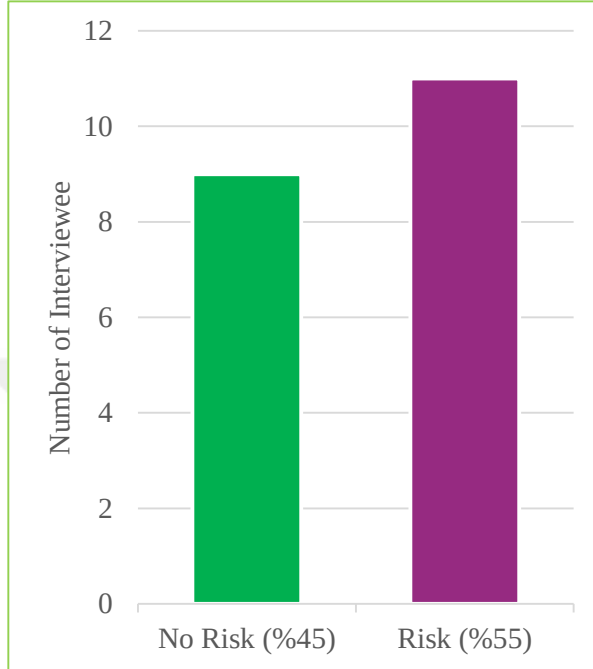
It is followed by easier execution of business processes. Easier completion of existing business processes in the safety, advertising, agriculture and media sectors saves time and lessens costs. Both their motivation and the quality of the work increase when staff start to carry out complex business processes more easily than usual. At the same time, doing more work with less staff increases efficiency. Also many business processes in these areas will be carried out unmanned and more safely with drone use. All these factors increase the quality.

c- Risks of Drone Use in Business Processes and the Employment of Drone Operators for Businesses

In a similar fashion to any new technology, drone technology brings with itself not only advantages but also risks. Risk-taking is inevitable for businesses that want to make a profit (March & Saphira, 1987). Do businesses prefer to use drone despite the potential risks it carries? How do they deal with these potential risks? Under this

title, the risks that drone use and drone operators may pose are mentioned. Figure 1 shows the risk distribution of drone use according to the number of interviewee.

Figure 1: Risk Distribution of Drone Use According to the Number of Interviewee



Nine of the experts argue that there are no risks in drone use or drone operator employment in businesses. 11 of them emphasize that there are inevitable risks in integrating drones and operators into businesses, as it is with every new technology.

55% of experts think that using drones in businesses is risky. 45% of them argue that using drones does not pose any risk for businesses. According to the 11 experts, although drone use is not considered a risky situation for businesses, there are some risks that are predicted and experienced by experts. These risks are shown in Table 4.

Table 4: Risks of Drone Use in Business Processes

Risks	Number of Expert
Terrorist Attacks (Espionage and Assassination)	4
Malicious Use (Untrustworthiness)	3
Loss of Time and Income (Due to Bad Weather Conditions)	2
Maintenance-Free Drone Use (Negligence)	1
Environmental Damage Caused by the User (Lack of Knowledge)	3

According to four of experts, the biggest risk of drones are potential terrorist attacks. The possibility of espionage or assassination plans should not be ignored. Drones have become convenient weaponry for terrorist organizations. Since these attack drones cannot be operated from long distances, they have prompted institutions to buy anti-drones. As three interviewees said, drone operators with malicious intentions can do illegal work for individuals or institutions. Employed drone operators must be trustworthy. They should care about the security and privacy of their business data. Not everyone who has a drone license should be hired. The individual's references and commitment to the business should be the most important criteria.

In sectors that are accustomed to conducting business processes with drones, such as meteorology, the first option in most processes is to send a drone to the region. However, should the weather conditions be unfavorable, tasks might be disrupted and might even be put on hold. The majority of problems that arise during drone use can be attributed to the drone user. The chance of software errors occurring is rare. User errors might be caused from lack of knowledge and/or education. Lack of knowledge always carries a risk. It is essential to know when and where a drone can and cannot fly. In some cases, these mistakes can even cost humans or animals their lives.

Failure to perform required drone maintenance in accordance with the regulation carries with it several risks. Permanent damage may occur in the drone in

the event of an accident. Accidents carry with them responsibilities that differ according to the location and fall type of the drone.

Some experts expressed that the use of drones does not possess any risk. Instead of dealing with the outcome of accidents, the occurrence of them can be prevented. If they are selected properly, employed drone operators do not pose a risk. People who are well trained and have the required license can use a drone with a minimal error margin. However, maintenance should not be postponed because postponing it carries with it increased risk of malfunctions or repair requiring situations.

An expert with 20 years of experience in the national defense says:

“What first seems like a risk might actually be an advantage. For example, a high number of drone operators in an enterprise is a disadvantage in terms of personnel expenses... It is more advantageous to work together with several individuals with each controlling a single aspect of the process, these aspects are flying the drone, taking the image as desired, processing the image, payload managing, etc.”

With the increase in drone use job security has also increased. This has led to a fall in operational risks. Even if these risks still persist, the financial repercussions they carry are lowered. Figure 1 shows the risk distribution of drone use according to the number of interviewees.

d- Organizational Resistance

In this section, the opinions of the experts about whether any organizational resistance will be in drone use or not are mentioned. Four of the experts say that they have encountered or may have encountered an organizational resistance in the process of incorporating the drone into their businesses. One of the experts from national defense says, *"If businesses do not educate themselves on how to build, fly, maintain, and/ or program, they can face with organizational resistance for drone"*. Another expert who supports this idea says that he foresees that they should use drone technology years ago and would take the business to higher levels. However, senior executives in the institution have opposed this technology. He says that *"It was difficult to convince the management because they do not want to disrupt the current order and do not have the belief that drone technology will improve. Now, almost all works are being done with drones"*.

Employers and employees, who do not know the value of the drone, tend to resist. Many businesses are still not professionals in this field. Sometimes businesses observe the market to reduce this resistance. Businesses that want new devices to be satisfactory for their businesses wait other businesses to buy and use this technology in advance. In this way, they take measures against negative situations.

Personnel reduction is also part of organizational resistance. Sometimes, reducing personnel allows to reduce costs and make profit. In the past, people were afraid of losing jobs when new machines came to the factories. The same applies to drones. Reluctance, fear of learning, and inability to understand create resistance. However, when this resistance breaks, businesses will always go further. This resistance will leave its place to curiosity and desire for learning. In addition to that, new working areas will emerge for the people who are laid off. According to the some experts, the resistance can be overcome in a short time or there is no resistance for drone use.

One interviewee said, “...*This new technology had made them curious and their willingness to learn has increased. Because using drone provides great convenience for both personnel and business. If there is no job loss that can occur by using drone in an institution, the staff will not resist.*” Another interviewee said that “*Even if there was a job loss, it was the management's decision and there would be no resistance.*”

The themes are determined as “resistance” and “acceptance”. The theme resistance consists of the codes ‘fear of job loss’, ‘fear of learning new technologies’ and ‘lack of education’. The theme acceptance includes the codes ‘eagerness to learn’, ‘curiosity’ and ‘make it easy’. Table 5 indicates distribution of experts’ opinions on resistance and acceptance with their reasons (codes).

Table 5: Organizational Resistance and Acceptance of Drone Use

Themes	Codes	Number of Interviewee	Total
Resistance	<i>Fear of Job Loss</i>	4	11
	<i>Fear of Learning New Technologies</i>	2	
	<i>Lack of Education</i>	5	
Acceptance (No Resistance)	<i>Eagerness to Learn</i>	4	15
	<i>Curiosity</i>	3	
	<i>Make It Easy (Making Things Better and Easier)</i>	8	

According to experts, the acceptance of drone technology is greater than the resistance to drone technology. The most important reason for experts, staff and customers to accept this technology is that things can be carried out more easily and quickly. This factor is supported by the answer given by eight experts. It is followed by a desire to learn new technology and curiosity. Experts, who experience and observe organizational resistance, consider lack of education as the most important reason for this situation. This factor is followed by job loss and fear of learning new technologies.

e- Cost-Benefit Comparison of Drone Use and Drone Operator Employment in Businesses

According to the economic theory, a rational individual makes decisions on the basis of a comparison of benefits and costs (Brent, 2006). The same can be said for the businesses. Considering investment to the drone technology, businesses have to do cost-benefit analysis. The purpose of cost-benefit analysis is to see whether it is worth the expense for new technology decided to invest (Drèze & Stern, 1987). Benefits and costs are expressed in monetary terms and they are proportioned to each other. It is eligible to invest if the benefits are greater than the costs (Karayılmazlar & İşler, 2019). The drone integration into the business directly affects the drone operators. In this

section, experts are asked to evaluate the use of drone in businesses in terms of cost-benefit. Most of the interviewees agree about cost-benefit index of drone use in businesses is high and they express it as follows.

Interviewee-4 says: *“The cost-benefit ratio in using drone is more satisfactory than old business processes and devices... If drone usage provides a decrease in the number of personnel and devices, it may decrease personnel and device expenses. In this way, the profit increases.”* Then he adds that, the benefits supported the cost. The cost-benefit index varies depending on the sector and the work done. It is very efficient in defense and security areas. In addition, when the companies that serve customers use this technology correctly, they provide to increase the demand and accordingly the profit for him.

The expert who is working for the oil and gas industry says:

“In terms of time savings and work safety, drones are worth to use. Reach to difficult-to-reach places such as oil exploration, production and refinery facilities is difficult. However, when it is not possible to go to these regions in terms of job security and time saving, huge financial losses are experienced. Even if the cost of flying drone is high, the oil industry is strong enough to ignore these costs and prevent greater losses.”

The aviation industry is always an expensive industry. Drones can also look like costly devices. However, it provides profit to the business in the long term. For example, in national defense, drones can be used as a destruction devices and weapons can be loaded on them. They ensure that the works, which will cost more than 1-5 million dollars, are done at a price of 1/10. Likewise, fuel costs of a ship are around 300 thousand TL per hour. Using drone instead of ships in surveillance activities significantly reduces personnel, operating system and equipment costs.

Enterprises should have image inspection and processing, maintenance-repair, personnel and training infrastructure suitable for drone use. Drones with a capacity suitable for the infrastructure owned by the enterprise should be purchased. For example, drones with high camera quality are always more expensive. Editing and publishing programs suitable for the quality of the image obtained should be used. Otherwise, the quality of the work done will be under the expectation and cause unnecessary cost. Businesses should do a good feasibility study before they have this technology. They must make the right decisions to avoid unnecessary costs. Regarding this issue, the interviewee-8 from aviation field shares the following ideas: *“...Drones*

are good form of investment. Insufficient pilotage neglected use of the drone and holding the purchased drone without using it will damage the business. If the enterprise has more technical and personnel costs for drone use, the cost-benefit index is low as well.”

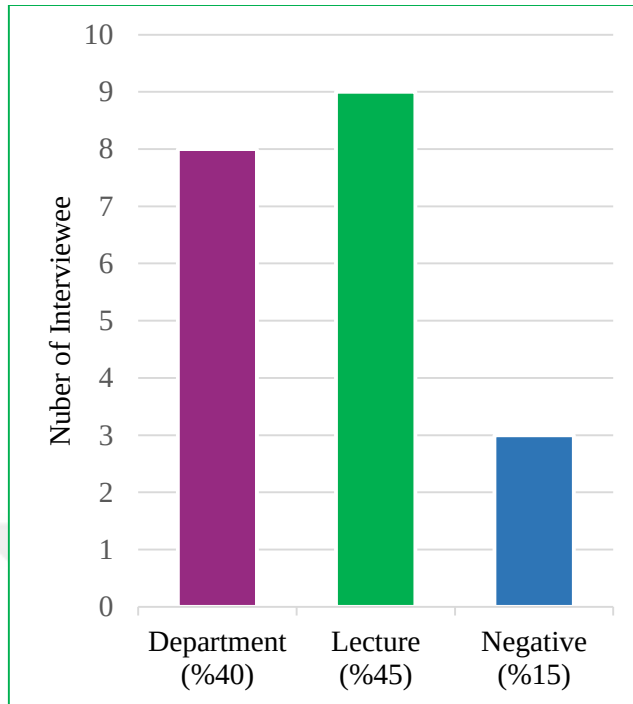
According to most of the experts, today, home production drones and cameras are less than imported drones. Therefore, their cost can be high for businesses. However, the financial burden varies depending on the sector and the operator using the drone. Accidents that may occur during the flight may cause extra costs. As a result of the factors such as the load carrying capacity, speed and fuel capacity of the drone are not suitable for the work done, the drones cannot reach the correct coordinate, they burn extra fuel and technical faults may occur. These also cause extra costs. Thus, drone and equipment production of domestic companies should be supported by the government.

f- Drone Training Departments or Lectures in Universities in The Future

Drone use has increased significantly in the last 20 years. From this time on, drone use will only grow even faster (Karaağaç, 2014). However, as the employment of drone operators increases, the need for drone operators in business sectors also increases. Especially generation Z, individuals born in the age of technology, are more prone to do drone operating as a profession (Amato-McCoy, 2017). In some states of the USA, UAV Systems undergraduate education is given at universities (Flynt, 2019). However, certified trainings are only accessible through aviation organizations. Therefore experts' views about opening drone operator classes or departments at universities was taken.

Eight of the interviewees support the opening of a drone related department in universities. However, nine of the interviewees think that it should be given as a lecture under the relevant departments of universities. Three of the experts explained that they did not support this idea for several reasons. Figure 2 presents the distribution of expert opinions.

Figure 2: Expert Opinions of Drone Training at Universities



15% of the interviewees are negative about opening classes or departments in universities to become a drone operator. One of the experts thinks that the drone operator employment is inadequate. He says, “*Training at national defense, safety and flight academies will be sufficient for now.*” Private sector companies still do not have enough capacity to employ drone operators. If the operator need increases in the private sector in the future, departments and classes can be opened. Other experts look at the issue from another perspective. There are too many restrictions on drone flights in the DGCA’s UAV Regulation. Procedures for obtaining permission for the flight, registering a drone and a pilot are very troublesome. Regions with flight permits consist of very limited areas. For this reason, people cannot develop themselves easily. In fields such as media, academia and transportation, sectors had to restrict drone use. Therefore, drone operator employment is also very low. These experts approach the opening of departments or courses in university negatively.

85% of the interviewees support the training of drone in universities. While 52% of these interviewees support that drone lectures should be given in the related departments, 48% support the opening of comprehensive departments in related faculties. Interviewees who support giving lectures in the field of drone think that

drone training should be given as a course under the aviation departments of universities with good administrative, academic and economic infrastructure. Practicing is the most important part of this training. Universities that have good financial opportunities can provide more drone and drone parts for students. This means also more opportunities for students to practice. Besides, it takes a long time to open departments related to faculties. Therefore, it is more appropriate to give as a lecture. In the University of Turkish Aeronautical Association, some lecturers mention about drone technologies in their related lessons. One of the interviewees, who is a lecturer at this university explains this situation as follows: *“We are explaining the basis of drones within the scope of the 2-year aircraft technologies department. Besides the lessons, we make flights with the drones that we have designed with the teams we have created from the students.”* According to some experts, besides aviation departments, drone lessons can be given to students as a sub-branch of different departments such as agriculture engineering, forest engineering, communication design, digital technologies, information technologies, photography and cinema-television.

The rest of the interviewees consist of experts who support the opening of drone/UAV departments in universities in order to have the title of drone operator and to acquire a profession. Experts predict that UAVs will become very common in the near future and the need for drone operators will increase. Sectors need qualified personnel in this field. For this reason, academic education is one of the most important elements of being a professional in a job. The opening of these departments in universities is an investment in the future. Considering the future, it will be a must to open the department according to some experts. An expert who is a lecturer at the university says: *“Depending on the weight of the device, drone operator trainings take between 3-10 months. These trainings are thought to be very fast and inefficient by experts. So, opening the departments will provide more detailed training. Theoretical and practical information should be given to students for 2-4 years.”*

In addition to this, another lecturer says: *“...Lessons and practices need to be constantly updated. At the same time, universities should have enough financial budget to provide the new drone technologies to the students. An education plan should be created by forecasting the next 50-60 years.”*

According to experts, the department to be opened should be based on aviation. Because people who do not have aviation culture and training are not good drone operator candidates. They should know about aviation laws and have technical know-how as much as airplane pilots. For this reason, departments should be opened under aviation, space sciences and engineering faculties. The number of lecturers to give the lectures in departments is very few. For this reason, this education can be given in higher quality and accurately in universities with a good aviation level. Drone operators are service providers. Thus, operators who will work to serve after graduation should be familiar with concepts such as specification, offer and contract. They should take documentation and related law lessons.

According to the interviewee who is a plane pilot, the curriculum of the departments to be opened should include core courses such as aviation laws, legal provisions, English language, drone mechanics, electronics, psychology, analytics and software. In addition to these, elective courses specific to the sectors in which students want to work can be given in the related faculties. For example, they should be able to take elective courses such as mapping, landscaping, agricultural spraying, data analysis, occupational health and safety, and fine arts.

One of the interviewees support this idea with a statement in field of the future of aviation of Mustafa Kemal Atatürk, who is the founder of the Republic of Turkey, and a great leader: "*The future is in the skies.*"

g- Drone Operator vs. Drone Pilot

In this section, a question that does not have a clear answer in the literature and in the media is mentioned. What should the drone users be called? In the DGCA UAV Systems Regulation, they are called as "pilot. In the world, there are many job advertisements aimed at RPA, UAV or drone users. These advertisements have many common qualifications in terms of expectations from the candidate, but there is an inconsistent issue: the words "operator" or "pilot" are used at the same time for drone, UAV and RPA users. Also, in the literature, they are used interchangeably. Since it is not clear which concept is definitely correct to call them professionally, the opinions of the experts on this subject were taken. Reasons for saying pilot or operator were

also examined. Table 6 shows that how many experts support the words “operator” and “pilot” for drone users.

Table 6: Reasons for Saying Operator and Pilot

	Operator (Number of Interviewee = 12)	Pilot (Number of Interviewee = 8)
Reasons	• Image Acquisition • Monitoring • Inspection • The person does not take off with the drone • Remotely Control • More Technical Concept • Flies Short Distances	• Flies the Drone • DGCA uses the word "pilot" • No differences from flying airplane • For long-time flights • Directs the Drone • Drone is a flying aircraft • Flies Long Distances

60% of the interviewees (12) prefer to call the employed drone users as operator, while 40% of them (8) use the word pilot. The reasons for these preferences of the interviewees are given below.

Experts who prefer the word pilot for drone users explain their reasoning as: these people fly an aircraft; therefore, they should be called pilots. They support that drones were devices that fly in the air like airplanes, and the person who uses it was called a pilot. Drones are also UAVs. So they may need to go on long-distance and long-time flights in national defense, safety and search and rescue areas and so on. Therefore, the word pilot meets this need better for them. According to these experts, drones are also a flying aircraft and the person directing the drone is the pilot. As another reason, drone users are referred to as "pilots" in the DGCA UAV Regulation.

According to experts who prefer the word operator for drone users, flying a drone is different from flying an airplane. The pilots who using the aircraft take off with the aircraft, but the drones are controlled remotely. Therefore, they should be called operators. Drones generally carry out image acquisition, monitoring, data acquisition and control activities. The person who uses the drone has to fulfill these tasks most of the time. The operator who both flies the drone and executes these tasks at the same time is an operator. In some cases, it is more correct to call people using

UAV a pilot. Because UAVs are large vehicles and are used for long-distance flights. However, drones are smaller devices and are used for shorter distances. Operators are people who know how to command drone activities. Drone users must be familiar with all kinds of technical information about the drone. They have to detect malfunctions and provide solutions, decide, route, think analytically and master each piece. So, drone flights are operation processes from start to finish. Therefore, the word pilot is insufficient for someone who can do so much work at the same time. The word operator, which is a more technical concept, should be used.

4.2.2. Drone Activities in Businesses and Conducting These Activities

In this section, drone activities and how they are conducted within the business are examined. The section includes drone activities in businesses, the intensity of activity, the number of drone and drone operators in the organizations, the testing period before employment, in-house regulations, criteria determined to receive drone service from companies and evaluating the drone operator performance.

a- Activities Using Drone in Businesses

In this section, interviewees share their ideas and experiences about activities using drones. It was mentioned which activities are suitable for drone use, and for which activities drone use is preferred. Table 7 shows various activities that drones are used for.

Table 7: Drone Activities According to the Experts' Sectors/Fields

Sectors/Fields	Activities
Agriculture	Plant Analysis, Spraying, Agriculture Land Survey for Investigating Land Usage.
Aviation (Academy)	Development Projects for Scientific and Technological Research Council of Turkey
Aviation (Civil)	Weather Control Before Flight
Defense Technology	Manufacturing
Hobby	Hobby Shooting
Media	Movie Shooting
National Defense	Evaluating Images for Safety, Defense and Attack in Air, Land and Sea, Reporting, Reconnaissance and Surveillance Missions, Annihilation of Targets
Oil and Gas	Trouble Shooting, Work Safety Control, Inventory Tracking, Support to Security Teams
Photography/Videography	Song Clips, Promotional Films, and Wedding Clips
Publicity/Advertisement	Shooting for Ads, Photo and Video Shoot for Tourism Sector
Safety	Search and Rescue, Traffic Control, Operations, Migrant Smuggling, Corpse and Lost Search
Transportation	Collecting Traffic and Mass Transport Data

The interviewees also explained in what other areas drones can be used. Responses include health, fire service, transportation, delivery, mapping, construction and architecture.

b- Drone Activity Intensity in Businesses

For this part, questions about drone activity intensity in organizations, experts are working in, were posed to experts. Two of the interviewees who are not using drones for their business processes answer this question by assuming they use drones for related business processes. According to the responses, eight out of 20 interviews chose weather conditions. The interviewees said that they have flown drones when weather was not rainy, windy or snowy. Table 8 shows the daily, weekly and monthly

flight times in each operators' work area. Some operators expressed their flight time qualitatively. People who consider the suitability of the weather are also mentioned.

Table 8: Drone Activity Intensity by Sectors/Fields

Working Areas	Drone Use Intensity
Agriculture	- Every Day (In Suitable Weather) - 4 Days a Week For 30-45 Minutes
Aviation (Academy)	- Once a Month (At Scientific Events) - Once in 3 Months (For Trainings) - Often (For Test Flights and Practice)
Aviation (Civil)	- Almost Every Day (For Checking Weather Before Flight)
Defense Technology	- Often
Hobby	- 2 Times a Week (When Permission Can Be Obtained from DGCA)
Media	- Every day (In Suitable Weather)
National Defense	- 9 Months a Year - Every Day
Oil and Gas	- Once a Week (For Security Support)
Photography	- Every Day in the Summer For 30-50 Minutes
Publicity/Advertisement	- 150 Hours a Year - 3 Times a Year
Safety	- At Least 4 Hours a Day (Often)
Transportation	- 2-3 Times a Week (In Suitable Weather)

Drone usage density data obtained from experts do not represent specific numerical ranges. For this reason, considering the density of use, the use of drones in national defense, media and agriculture fields is higher than other fields of use.

c- Number of Drones in Business

In this section, the number of drones in the companies where the experts work is laid out. This information is related to the number of drone operators who can work in the institution. The number of drones in businesses is in Table 9.

Table 9: Number of Drones in Businesses According to the Sectors/Fields

Sectors/Fields	Number of Drones
Agriculture	4-10
Aviation (Academy)	2-8
Aviation (Civil)	~2
Defense Technology	10-15
Hobby	4
Media	3
National Defense	20-40
Oil and Gas	~2
Photography	2
Publicity/Advertisement	1-3
Safety	7
Transportation	~10

Some interviewees have estimated the number of drones in their businesses due to company policies.

d- Number of Drone Operators in Business

The number of drone operators in the companies where the experts work is mentioned in this section. Experts say that the number of drone operators within the institution varies according to the work done and the type of drone used. The number of drone operators in the businesses are in Table 10.

Table 10: Number of Drone Operator in Business According to the Sectors/Fields

Sectors/Fields	Number of Drone Operators	Total Number of Employees
Agriculture	2-7	~250
Aviation (Academy)	4-5 (includes students)	18
Aviation (Civil)	2	~20
Defense Technology	30	~8.500
Hobby	1	1
Media	3-4	10
National Defense	10-80	~70.000
Oil and Gas	~3 (external)	~2.000
Photography	1	5
Publicity/Advertisement	1	~25
Safety	3	~9.000
Transportation	~10	~2.500

The distinction between the total number of employees in enterprises and the total number of drone operators vary. This distinction depends on how often organizations employ drones in their operations.

e- Drone Management According to Number of Drones and Operators

This section aims to find out how many drones and drone operators there are in businesses that deploy drone operators. “Can each operator use only one drone?” or “Can one operator use more than one drone?”.

According to the two experts, each drone needs separate operators. One of the experts uses drones in agricultural activities in the US. Their company has employed and can employ multiple drone operators. However, the other expert, which works for a police headquarter said that they did not have enough drone operators. So, in their organization, operators have to use more than one drone.

Four of the experts in organizations where the operators can or are required use multiple one drones say that all operators should know how to use each drone and regularly undergo training with all of them. However, in serious or demanding tasks,

the use of drones is limited to experienced personnel. Individuals should always strive for self-improvement. Employing separate personnel for each drone is also very costly.

According to one of the experts, separate teams of 2-3 operators are required for each drone. Because the people, who are responsible for the flight, images, deficiencies, software and, if necessary, the data collection, should be separated. By doing this, the quality of work increases and in-turn the businesses profit increases.

f- Testing Period Before Recruitment of Drone Operators

Flying drones or UAVs require practice, experience and theoretical information. When they are used for business processes, the main focus is to make a profit. Therefore, businesses care greatly about which candidate they recruit. In this section, the aim is to find out whether businesses follow a standardized process for the recruitment of drone operators.

50% of the interviewees said that they underwent a testing period prior to them being hired. In Turkey, four different drone / UAV license courses including UAV0, UAV1, UAV2 and UAV3 are taught by aerospace firms. To use drones or UAVs weighing between 500 g and 4 kg, the UAV0 license is enough. However, UAV0 only consists of theoretical training. It should also require practical training. Therefore, individuals, who will be hired with UAV0 license, need to have testing process. Putting the references of individuals into considerations, trials should be done with different types of drones. Those who cannot complete the process as expected should not be hired. This process can vary between 10-15 days for some businesses. This process can be task-based as well as time-specific. During the hiring process, people are expected to perform the assigned tasks via drones. The higher the task success rate the higher is their employment chances.

One of the most important factors is to work as a team and in harmony with each other. In the testing processes, the compatibility of the potential employees with the work environment and with their colleagues is also observed.

The other half of the interviewees said that they did not undergo a testing process. These businesses prefer people who have a license, meet the job description, and have experience and good references. In addition to these experienced personnel,

they employ them to train new recruits to ensure the continuity of the work. The trainees are also taught business culture. The trainees undergo trial flights that are carried out with drones in safe environments to ensure safety and to prevent any damage from occurring. Some businesses that do not provide in-house drone training, work in collaboration with various aviation companies for their employees. This training includes foreign language education. Those who complete the training must obtain their license and fill the minimum flight hours to legally fly a drone. Personnel currently trained in the enterprise will not have a problem during the adaptation to the work environment.

g- Internal Regulations

In Turkey, the DGCA is responsible for all operational drones and UAVs. A regulation (UAV Systems Instruction (2019)) is published and revised on a yearly basis. Individuals, institutions and organizations are obliged to comply with this regulations at every stage of drone flying procedures. For this section, the interviewees are asked whether there are any regulation in their company other than the DGCA legislation. Two of the interviewees who are working in defense industry answered this question, but they did not give details. 11 of the interviewee think that DGCA legislation is sufficient. The other nine say that there are additional regulations to the DGCA legislation in the businesses they work for. The issues that interviewees mentioned about extra regulations are as follows:

- Damage Directive
- More Frequent Maintenance and Repair than DGCA Regulations
- Frequent Flight Hour Inspections
- Hiring and Firing Procedures for Drone Operators

One of the interviewee says that DGCA legislation covers all of these articles. However, organizations that want to secure their drones, operators and businesses are setting more detailed directives. Interviewees prefer not to give detailed information about these internal regulations. Some businesses have previously received external drone services and are currently using their own resources.

h- Internal or External Drone Use in the Business

Some businesses receive external drone and drone operator services for their work with drones. Others perform their business processes with drones and operators within the structure of the organization. In this section, businesses that have received drone service from other firms and businesses using their own resources are identified. Some businesses have previously received external drone services and are currently using their own resources. In businesses where two interviewees work, drone is not yet used in business processes. 16 of the interviewees use their internal resources for drone activities. Three of the interviewees experienced external drone services.

i- Drone Services From Other Companies

For the previous part, the experts are asked whether they received the drone service from another firm for their business processes. In this section, it was asked how they chose the company which they received drone service from. Employees in the business where drone service is received from outside stated their opinions related their experiences. Those who did not receive, assumed that they received drone service from outside, and listed their selection criteria. As a result, all interviewees shared their opinions on this issue. The answers given state in three main themes: “experiences”, “tech” and “references”. The theme “experiences” contains the following codes: ‘drone operator’s experiences’ and ‘sectoral experiences’ The theme “references” includes the following codes: ‘reliability’, ‘previous works’ and ‘compliance with specifications’. The theme “tech” includes ‘technical specifications’ and ‘quality of drone components’. Table 11 shows the criteria for selecting the company to get drone service and the number of experts.

Table 11: Criteria for Selecting the Company to Get Drone Service

Themes	Codes	Number of Interviewee	Total
Experiences	<i>Drone Operators Experiences</i>	4	9
	<i>Firm's Sectoral Experiences</i>	5	
References	<i>Reliability</i>	5	12
	<i>Previous Works</i>	5	
	<i>Compliance With Specifications</i>	2	
Tech	<i>Technical Specifications</i>	5	8
	<i>Quality of Drone Components</i>	3	

The most important issue by experts is references. According to the experts, the company that will provide the service must be a known and reliable company in the drone field. If the drone fails during use, or if the operator assigned by the firm has to quit the job due to force majeure, the company must guarantee the business for these failures. Also the company that will provide the service should assign reliable and honest operators. An interviewee who has worked for a media consultancy firm in the past says: “*Their work is their reference. Skills such as framing, managing the drone, collecting data with the drone, and image processing play an important role in the completion of jobs in line with expectations...*”

The references are followed by the company's experience and technological infrastructure. The company's sectoral experiences such as knowing the industry, using the drone correctly and meeting expectations are one of the major factors in their selection. The drone operators the company provides to businesses are also expected to be experienced enough to minimize the error.

The interviewees say that about the code "tech", the features of the drone components specified in the technical specifications are considered by the business receiving the service. The quality of the drone components is decisive in choosing the

company from which they will receive service. Companies should have good technological infrastructure. They must have drones suitable for the tasks and drone operators who are able to use these drones. The devices' components and features used in the agreement process should be presented to the business within the scope of technical specifications.

An interviewee who owns a company that produces garden fences and promotes them with drones says: “...*There are also companies that offer advice and interventions for the business process they are involved in, other than carrying out the works as desired. These types of companies are leading in the order of preference due to their consultancy infrastructures...*”

In addition to these, some experts prefer companies that receive drone services are domestic and national companies. They support that it should be taken into consideration in terms of contributing to the country's economy.

j- Evaluating the Performance of Drone Operator

Personnel working in a business determine the quality of that business. If the staff do their job on time, with little cost and as desired, the quality of the work done and the profit of the enterprise will increase. Therefore, employee performance is always an issue to be considered. Personnel performance evaluation is a routine and necessary task for corporate companies. The performance of the staff is evaluated by the department manager. However, this assessment has certain criteria (Landy & Farr, 1980; Leonard, 2019). There are also some performance evaluation criteria for recruited drone operators. For this section, experts were asked how the performance of drone operators working in their businesses was evaluated. Themes are determined as “flight time”, “customer satisfaction”, “technical knowledge” and “organizational interests”. “flight time” codes are “valid” and “efficient”. “customer satisfaction” codes are “fulfill the given task” and “good communication skills”. The codes of “technical knowledge” are “knowledge of flight”, “quick decision making”, “problem solving skills” and “tolerating the accident probability”. The codes of “organizational interests” are “meeting the objectives”, “saving time” and “reducing the cost”. Table

12 shows the factors that affect the evaluation of the performance of drone operators in businesses.

Table 12: Performance Evaluation of Drone Operators

Themes	Codes	Number of Interviewee	Total
Flight Time	<i>Valid</i>	2	8
	<i>Efficient</i>	6	
Customer Satisfaction	<i>Fulfill the Given Task</i>	11	17
	<i>Good Communication Skills</i>	6	
Technical Knowledge	<i>Knowledge of Flight (landing and take-off, flight safety, air traffic contact, direction determination, sunlight control and meteorology)</i>	3	12
	<i>Quick Decision Making</i>	4	
	<i>Problem Solving Skills</i>	3	
	<i>Tolerating the Accident Probability</i>	2	
Organizational Interests	<i>Meeting the Objectives</i>	4	13
	<i>Saving Time</i>	4	
	<i>Reducing the Cost</i>	5	

According to the statements of 17 interviewees, customer satisfaction has an important role in evaluating the performance of the operators. Interviewee-5 says: “After the business process is completed in this way, the satisfaction of the customer or the manager plays a big role in evaluating the performance of the operators. It is always important to do the job diligently.” This theme, customer satisfaction, includes the codes fulfill the given task completely and good communication skills. More than half of the experts emphasize that the operators fulfill the given task completely and without accident. This also improves the quality of service provided to the customer.

Good communication skills of drone operators who have to get in touch with the customer are also high performance indicators.

Customer satisfaction theme is followed by organizational interests. 13 interviewees shared opinions about meeting the objectives, saving time and reducing the cost. Interviewee-7 says: *“The interests of a business are important for its continuity. Operators should work with these interests in mind and work efficiently in terms of time and cost.”* Additionally, the operator's framing knowledge and ability are also decisive in performance. According to an expert, images shot appropriate to demand always increase post-job satisfaction.

Technical knowledge is the third performance evaluation criterion supported by 11 interviewees. Quick decision making is supported by four interviewees. Knowledge of flight and problem solving skills follow this with support of three interviewees, and one of them supported the code, tolerating the accident probability. Operators are expected to have good knowledge of drone landing and takeoff, flight safety, air traffic contact, direction determination, sunlight control and meteorology, which vary by sector. Quick decision-making and problem-solving skills should be good according to the experts. Flight time is also an issue addressed by the interviewees. Valid and efficient flight time indicates the good drone operator performance according to eight of the experts.

Operators' analysis and detection capabilities also affect their performance in jobs that require analysis such as spraying in agriculture, weather forecasting, search and rescue, safety and national defense according to the experts from different sectors.

Apart from these, the performance evaluations in the enterprises, where five experts work, are made as a result of the surveys applied to the customers. Their feedback after the service they received is very important for managers and operator. Businesses should determine and set performance objectives for their employees. If the employees can meet the objectives, save time and reduce the cost of the business processes, their performance are evaluated as good and satisfied.

4.2.3. Qualifications of Drone Operators

This section includes the qualifications that businesses and experts expect from drone operators. Qualifications may vary from sector to sector. However, there are also common requirements for all institutions and organizations. These requirements can be mentioned as follows: the age and education levels of operators, having drone operator license, working conditions that operators have to adapt and the qualifications that operators should have.

- Ages and Education Levels of Drone Operators

What should be the ages and training levels of drone operators? Experts answered this question, considering both their own opinions and the ages and education levels of the drone operators working in their business.

The age ranges that experts consider appropriate for drone operator employment are in Table 13.

Table 13: Age Range of Drone Operators

Age Range	Number of Interviewee
<18	0
18-24	8
25-34	13
35-44	10
45-54	4
55>	1

According to 16 experts, operators experience is more important than their age. For example, if an 18 year old drone operator uses a better drone than an operator in the 30-40 age range, if they can interfere with problems, perform the desired tasks fully and have a better work history the 18 year old operator would have a higher chance of getting hired by organizations. From another perspective, they do not prefer a candidate who is younger in age, because he has just completed his education and has less industry experience.

Health is the condition that experts care about most when it comes to age. As a result of their experience, experts have found that people under the age of 40 are more energetic and willing. The most supported age range is 25-34.

The education levels that drone operators should have according to experts are in Table 14.

Table 14: Education Levels that Drone Operators Should Have

Education Levels (at least)	Number of Interviewee
High School Graduate	3
Associate's Degree	9
Bachelor's Degree	14
Master's Degree	1
PhD	Not Necessarily

According to most experts, drone operator candidates should have at least an associate degree or bachelor's degree. Experts also prefer that the departments that operators graduate from are aviation-related departments. Experts who said that they do not require university graduation expect operators to graduate from the relevant vocational high schools. Master's and doctoral degrees for specialists are not essential in recruitment. But experts say it will have a positive impact when it comes to choosing candidates.

- License

Having a drone license is a must for many businesses. Small businesses except the corporate firms (photo studios, agencies, real estate offices, small businesses doing their own promotion, hobbyists, production companies, etc.) do not make license obligatory. The point of view of experts on drone license is mentioned in this section.

Two of the 20 interviewees who worked in the defense technology industry employ drone operators to train themselves in their businesses. Therefore, there is no license obligation. However, the applicants must have a bachelor's degree for employment. Three people working in the fields of media, photography and cinema

prefer people who trained by the masters of the job rather than license and diploma. Self-trained individuals are also evaluated in this context. The other 15 interviewees say that drone license is a must. It is a crime to employ an unlicensed drone operator, especially in corporate companies. DGCA's UAV Systems Instruction (2019) does not allow to fly a drone without a license and to employ personnel. The license is mandatory for applications.

- Working Conditions of Drone Operators

Drone operators should apply for the job, by knowing the working conditions of the job they are applying for. Getting detailed answers to the question asked to determine the working conditions of the drone operators were expected. However, experts answered this question with general answers.

One of the most common answers to the question is that operators must be ready for flight at any time of the day. Operators can fly, as long as the weather conditions are suitable. In regions where the weather is changeable, they should follow every moment when the weather is good for the flight. They must be ready to work within the working hours and rest periods specified in the UAV Systems Instruction. In addition, they must fill in the daily, monthly and annual flight hours specified in the instructions. Depending on the size of the work, maximum flight times can sometimes be exceeded in some enterprises. However, they have a rest period after the flight at least 12 hours. Between both flights, there is a rest period as 1/3 of the previous flight. It is essential to comply with the rest periods for the eye, muscle and mental health of the operators.

Sometimes, drone operators can be sent to different mission areas to work. Therefore, they should be able to adapt quickly to different locations. They may also have to work with different people in different locations.

- Qualifications of Drone Operators

Applying for a position in small, medium and large organizations requires having many qualifications. Compliance with the needs of the job almost completely,

adapting to the organization and contributing to the business enables the people to be employed to work longer in the organization. The drone operator profession also has a job description and requirements as every job position has (Hanssen, 2016; Snead & Seibler, 2017). For this section, interviewees were asked what qualifications and requirements drone operators should have. The expectations of the experts from the drone operators to be employed in their enterprises are shown in Table 15. These expectations are also called “qualifications that drone operators should have” by experts. Qualifications are classified into categories. Experts also explained the requirements for some qualifications.



Table 15: Qualifications of Drone Operators

CATEGORIES	QUALIFICATIONS	REQUIREMENTS
Health	Have A Good Eyesight	Medical Report
	Have A Good Physical Health	
	Have Good Reflexes	Passing Physical Tests
	Be Mentally Strong	Psychological Report or Passing the Psychology Test
Attitude	Have a Nice Personality	Have Good Faith
		Be Reliable
		Be Conscientious
	Have Teamwork Skills	Have Leadership Training
		Work in Tandem with the Team
		Execute Operation
	Have Nice Relations	Have Strong Communication Skills
		Collaborative
Interests	Be Curious and Eager to Know Drones and Technology	Follow the Technological Developments About Drones Closely
		Be Able to Use Different Type of Drones
	Be Open to Self-Improvement	Can Be Supported by Certified Training
Aviation	Have Safe Flight Skills	Be Educated in Safe Flight
	Obeying The Aviation Regulations	Be Educated in Laws

Analytic Skills	Detect Errors and Problems	Propeller Loss, Fuel and Battery Shortage, Return to Home Conflict, Indoor Accidents, etc.
	Think Analytically	Have Analytical Thinking Ability
		Make Right Decisions in a Short Time
		Have Problem Solving Skills
	Think 3D	Passing 3D Simulation Tests Before Recruitment
Education and Know-How	Be Educated	Have at Least High School Education
		Have a Strong Education and Working Background
		Be Licensed
		Know Foreign Languages (English)
		Have Required Level Programming Knowledge
	Have Know-How (Technical Experiences)	Have Required Level Editing Programs Knowledge
		Have Knowledge of Framing and Photography
		Have Adequate Flight Experience (100-300 hours)
		Be Able to Disassemble and Reassemble Drone Parts
Adaptation to Changes	Adapt to Different Conditions	Adapt to Weather Changes
		Be Ready for Uncomfortable Travel and Accommodation Conditions
		Be Able to Work with Different People in Different Environments

The qualifications specified by the experts in the interview can be classified as essential and desired according to the sector and the job the drone is used for. This

classification is made by reference to drone operator job adverts in the US, in Europe, in developed Asian and in African countries.

People applying for jobs are expected to have no health problems that hinder drone use. They should not have any disease that impairs their physical health, especially their eyesight. Besides this, drone operators with good muscular and skeletal health have good reflexes. There may be situations where drone operators need to react rapidly or where they have to move the drone carefully. In addition, the drone operator's mental health should also be evaluated. Psychological problems regarding the operator's private life should not spill over into their professional life. Otherwise, it may cause conflicts of interest and might cause serious organizational problems. The requirements of the health status of the operators are health reports, physical and psychological tests. The reports they had and tests they have passed are evaluated during recruitment processes.

- Eyesight
- Physical Health
- Mental Health
- Good Reflexes

The characteristics of hired operators are very important. Good faith, trustworthiness and consistent behaviors are indicators of a decent working environment for both employers and employees. Managers always want to have confidence and believe in their employees. Malicious behaviors may cause employees to terminate their jobs. These behaviors may also tarnish the employee's references. Working conscientiously is also a must for drone operators. Employees who do their jobs meticulously and properly are always successful.

Candidates' social lives apart from their business life are also very important. More attention is paid to the criminal records and in-depth background check of candidates specifically working in the national defense, safety and defense technology. Committing a crime that harms society is a valid reason for individuals to not be employed. Businesses do not want to employ such individuals in their businesses. They must have an official document evidence from the prosecutor's office.

Drone operators are strongly related to teamwork. There may be businesses where tasks like giving direction, taking images, processing the received image data

analysis, evaluation, maintenance, payload control, and reporting are handled by different people. Therefore, employed drone operators should be willing and prone to teamwork. They should be able to deal with teammates and managers with professionalism and teamwork and should also be able to coordinate team-based tasks with them. In some large corporate companies, drone operators are expected to have leadership training. The ability to coordinate the team is among the qualifications required in drone operators. Working with people channels employees to communicate. According to their job responsibilities and definitions, individuals may have to be in a complex communication network (DiSalvo et al., 1976). In addition to having communication with their managers and teammates, drone operators may also have to meet with customers and make presentations in public areas. For this reason, communication skills should meet the needs of the institution.

- Have a Nice Personality
- Have Teamwork Skills
- Have Nice Relations
- Must Have a Clean Criminal Record

Drone technology is a developing and evolving quite rapidly. Every day, there are new developments in the drone field. The areas in which drones are used is also growing. It has the potential to spread its usage to nearly every facet of human existence. Because of this rapid expansion, new devices are regularly designed and produced. Drone operators should follow these technological developments closely and be able to use different types of drones. They should be able to make predictions about the use of drones for the future and be open to learning about these new functions. Drone operators who lack eagerness to learn and are closed to self-improvement will become obsolete in their work life. By educating their drone operators in-house, companies aim to achieve higher quality development and more seamless implementation.

- Be Curious and Eager to Learn About Drones and Technology
- Be Open to Self-Improvement

Flight safety is vital for an organization's operator and external environment. Safe flight means completing the flight without any harm to employees, equipment, any wild animals or devices in proximity of the drone. Safe flight also requires that

there are no legal violations. Adhering to the aviation regulations, fulfilling legal responsibilities also constitutes a legally safe flight. Operators need to be educated in safe flight skills and laws.

- Have Safe Flight Skills
- Obeying the Aviation Regulations

Although the safest flying paths are preferred, errors and accidents are within the realm of possibilities. The drone operators, who fully control the drone, can calculate the success and error margins before the drone even takes off. Preliminary error detection prevents larger problems from occurring. For example, operators should detect problems such as propeller loss, fuel and battery shortage, return to home conflict and indoor accidents. With this, operators prevent time loss and extensive costs as well. Businesses prefer operators who use their resources in the most efficient way.

Drone operators should be able to think analytically. It is very important to be able to make fast and accurate decisions during the flight. Operators should be capable enough to quickly find solutions to any problem. To find the source of the problem even under pressure and to put the problem through a cause-and-effect check requires analytical thinking. The problem should be identified and after that, the required implementation should be made to solve it. In addition to practical and analytical thinking, drone operators are expected to have the ability to think in 3D. Thinking in 3D in aviation is very important for aircraft or drone movements. 3D thinking is one of the basic requirements of aviation. Organizations can have 3D simulation tests for operators before recruitment.

- Detect Errors and Problems
- Think Analytically
- Think in 3D

Education is a must in every part of life. In places where there are educated people, business processes are always completed more systematically and efficiently. Educated people strive to create a fairer and more peaceful environment (Bhardwaj, 2016). In addition to all these, people should receive good education in the right institutions regarding the fields they want to specialize in. For this reason, businesses expect that the personnel they will employ have a training suitable for the position. According to the opinions of the interviewees, it is a desirable qualification to be

trained in aviation field. Apart from very large corporate companies, being a graduate is not an obligatory qualification to be employed as a drone operator. Studying at aviation vocational schools or undergraduate aviation training is a plus in job applications. After graduating from any department of undergraduate or associate degree, getting drone operator training from aviation companies providing training also contributes greatly to the resumes of applicants.

Having a license is also part of the training. Five of the interviewees employ drone operators to train in their organizations. Three of five interviewees are from academy and two of them are from aerospace industries. These two experts said they generally preferred newly graduated engineering students for training. However, for the remaining 15 interviewees, a UAV/drone license is a must for employment.

In addition to training, the experiences, job references and knowledge levels of prospective drone operators are also considered when recruiting. Therefore, applicants must have a strong resume. A powerful resume should include the ability to use visual editing programs, programming knowledge, flight know-how, and foreign language knowledge. Operators need to know basic level of programming language to dominated and understand the operations when it is necessary. Experts pay special attention to these issues when choosing the person, they will employ. Cameras, propellers, batteries, power cards and motors on the drone are usually imported. Some companies cooperate with foreign companies or provide drone services to foreign countries. Therefore, the foreign language knowledge of the operators, especially English, should be at an advanced level.

In addition to having this knowledge, operators should also have good photography knowledge. It is not easy to take images from the points that the eye cannot see live. For this reason, it is a very special qualifications to have a drone framing knowledge. Having all the know-how is directly proportional to the experience. Well-informed operators should have adequate flight experiences. This is also among the qualifications that should be included in their resumes. According to the experts, adequate flight experience should be 100-300 hours for each operator. Also as a technical skill, operators may have to disassemble and reassemble drone parts such as propeller, camera, and payload before the task or during the work.

Therefore, operators must definitely master the technical and mechanical structure of drones.

- Be Educated
- Have Know-How (Technical Experiences)

Working conditions vary a lot for drone operators. There are several determinants such as working hours, locations, air conditions, environmental factors etc. that affect the performance of the operator. For this reason, operators should be ready to work in different conditions. They might be required to travel regularly for their profession. In addition, weather conditions are also important in drone flights. Flying a drone in windy, rainy and snowy weather carries with it certain risks. During these weathers, drones should not takeoff unless absolutely necessary. However, the drone might have to be flown in defensive tasks, or weather conditions may suddenly get worse during an important mission. In such cases, operators should be able to cope with unfavorable weather conditions.

Operators may also have to work with different people. Relations with new workmates and customers should stay civil no matter the circumstances. Therefore, being able to adapt to different social environments and different conditions is one of the demands of businesses.

4.3. FINDINGS

The qualitative data obtained as a result of negotiations and talks with the experts are analyzed under main topics and sub-topics. In this section, the data are interpreted taking into consideration the answers of the experts. Findings obtained from the analyzed data are included in this section. These findings are grouped under three headings to answer the research questions.

4.3.1. Organizational Perspective

This section is the answer to the first research question. The findings obtained within the scope of drone use and drone operator employment in businesses are in this section. Under this title, the future of drone operators, advantages and risks, cost-benefit evaluation, organizational resistance, drone training in universities, and pilot-operator concept comparison are mentioned.

- **Future of Drone Operators**

Experts' views on the development of drones and operators differ. Some experts believe that the next 10 years will be very important in the development of drone technologies and the profession of drone operator. This technology, which has been developing rapidly in the last 20 years, will continue to develop at an even faster pace. The expansion of drone use into different sectors will also create new business opportunities for operators. The most emphasized issues by experts are that the usage areas of drones will increase and new business opportunities will emerge for drone operator candidates. But according to some experts, the pace of integrating drones into organizations is slow, except for national defense. Therefore, it may take time for new business opportunities for drone operators to develop. Taking both into considerations, the drone industry and its operators expect big developments in the field.

- **Advantages-Risks**

Given the themes and codes determined by the words that experts use most in their answers during interviews, the topic that experts focus most on is time. The use of drones in businesses allows work to be completed in less time and in a more efficient manner. Saving time also reduces costs. Cost reduction is one of the most effective methods of profit making. With the use of drones, it is possible to do more efficient and cost-effective work with less staff. That's how businesses make a profit. Quality is one of the most important elements that a business should have in a competitive environment. This quality constitutes of work safety, efficiency and easy execution of

business processes. All these are the most important elements that contribute to the overall quality management of an enterprise (Uryan, 2020). Supplying a business with a drone brings with it the employment of a drone operator. The advantages that drones offer to the business are provided directly by the drone operator. In addition to these advantages, there are disadvantages and risks. Apart from useful uses, drones can also be mostly used for terrorist attacks. This poses a major threat to both countries and businesses. States should encourage organizations to use anti-drones to deal with this problem in the national defense and safety areas. Besides that, goodwill and honesty are very important characteristics in drone use. Otherwise, there may be negative consequences for businesses. Bad weather conditions, accident possibilities, maintenance-repair errors are among the risks that can be encountered at any time. But with well-trained operators and well-planned flights, these risks should be tried to be minimized. In addition, legal regulations related to drones should be well known. Illegal situations that occur unwittingly cause big problems and risks for businesses.

Sometimes problems that are seen as risks can be turned into advantages. Drone use in businesses is generally aimed at reducing cost. But sometimes exceeding the budget which is seen as a financial risk for businesses can make a profit in the long run. For example, when tasks such as image retrieval, planning, and utility load control are performed by a single operator, various problems can occur. But with more personnel, higher quality flight operations can be performed. This, in turn, ensures profit in the long run.

- **Cost-Benefit Comparison**

When the process is handled professionally, supplying a drone to a business, and employing a drone operator is very advantageous in terms of benefit and cost. However, should inventory and staff be mismanaged it could lead to extra cost in businesses. Drones play a big role in reducing staff numbers. Great savings in time and budget are achieved. Business processes become easier, and security increases. Drones are low-cost for some businesses. But for small businesses, this cost can be excessive. In such enterprises, drones and operators must be provided according to the needs or drone and operator services should be outsourced. But although it may seem expensive

at first, the use of drones brings great benefits and profits to the business in the long run. Especially in expensive industries such as aviation, the use of drones is very advantageous in terms of benefit-cost. Therefore, investment should be made for drone and drone operators in all large, medium and small businesses. Most of the quality drone parts are imported in Turkey. Therefore, investment costs are high. However, in this way, the extra costs that may occur as a result of the failure of low-quality parts are avoided. Another issue that businesses should consider to provide more benefits is maintenance and repair. A large part of the investment in drones should be devoted to maintenance and repair activities. Drones whose maintenance is carried out regularly are less likely to malfunction and do not lead to unnecessary costs.

- **Organizational Resistance**

Job loss, fear of learning new technologies and lack of education are the biggest causes of this resistance. But there are also businesses that have no resistance to this technology, which are seamlessly accepted. In these businesses, managers, staff, and customers are aware that the business process can be done more easily and quickly with drones. At the same time, staff are willing and curious to learn about this technology. More so, in enterprises integration is more common than opposition. This data is very promising for the future. In the age of technology, we are in, resistance to drone technology is undesirable for businesses.

- **Drone Training in Universities**

In drone operator recruitment, candidates are expected to be trained in the drone field. Drone training around the world is usually provided in the form of certified programs. As a result of these trainings, candidates have a license to use a drone. However, given the technological requirements and advancements of the current century, drone training should be given as an undergraduate education program and/or a sub-course of a department in universities. In this way, a more detailed and equipped drone training can be provided to students. Faculties related to aviation, the aerospace industry or engineering are suitable for drone training departments. In addition, it is

also a highly future-proof sub-course option for departments such as agriculture, Fine Arts, oil and gas, construction, health and social services. Opening departments and adding courses to programs are big changes for universities. For this reason, drone training should be integrated into universities by following the need of the drone operator in the business world and preparing the foundation of these faculties and/or departments.

As more drone departments and courses open, the number of drone operators who want to work in different sectors will increase. Although there is currently no need for a large number of drone operators in businesses, this need will increase in the future. For this reason, the necessary steps for the training of future drone operators should be taken in advance. According to the DGCA's UAV instructions, drone flights are restricted for security purposes. This prevents operators from advancing further in the drone field. In addition, there is a resistance to drone technology in some universities and businesses, although there are some obstacles to the development of this line of business, drone operator should be considered as one of the professions of the future. States should provide universities with the necessary investment and platform.

According to experts, drone training in universities should include the following topics.

Basics

- Aviation Knowledge
- Aviation Law
- Physics of Drones
- Mechanics of Drones
- Electronics
- Information Technologies
- Software for Drones
- English
- Flight Practices

Electives

- Mapping
- Landscaping
- Agricultural Spraying
- Data Analysis
- Occupational Health and Safety
- Aerial Photography
- Oil and Gas
- Meteorology
- Etc. (They can be diversified.)

- **Drone Operator vs Drone Pilot**

There are many terms used in the aviation industry. The Pilot is one of these terms. According to the Cambridge Dictionary ("Pilot", n.d.), a pilot is the person who operates an aircraft. According to the DGCA, a pilot is the person who flies an aircraft personally or professionally and undertakes the management of the aircraft in these regulations, the word pilot is also used for people using drone / UAV. According to the International Civil Aviation Organization (ICAO) (2011) some definitions of unmanned aircraft systems are as follows:

Pilot: It is the individual who operates the controls and whose responsibility is to set the flight trajectory of an aircraft during flight.

Remote pilot: It is the individual who manipulates the flight controls of a remote-piloted aircraft during flight time.

Operator: An individual, an organization or an enterprise engaged in or offering to engage in aircraft operations.

Given these definitions and the opinions of the experts involved in the study, the distinction between pilot and operator can be easily made. Pilots are the individuals who operate the aircraft's flight and are the ones responsible for the trajectory and control of the aircraft throughout said flight. Remote pilot is a term used for individuals

who use remotely controlled air vehicles. The operator is the individual and/or organization that carries out the operations. According to experts who prefer the word Pilot, drones are also air vehicles, therefore, individuals who use air vehicles are called pilots. They also direct drones and fly long distances. In DGCA legislation, drone users are called "pilots" that is why they prefer this term. But more than half of experts think individuals who use drones should be called "operators." Because, unlike pilots, operators do image acquisition, monitoring and inspection. These experts say that pilots take off with air vehicles, while operators provide remote control. In addition to using the drone, operators must master all technical, mechanical and operational processes related to the drone. At the same time, drone users travel shorter distances than planes. That's why they prefer to call drone users "operators." In the United States, the word operator is often used in job ads published in areas such as national defense personnel, agriculture, construction, and photography. ICAO also frequently mentions the term operator in its reports.

It is essential to use legal and widely accepted terms in undergraduate education, recruitment, specifications and contracts. For this reason, DGCA's preferred term "pilot" is used. But the word "operator", which is also supported by experts and is used in many institutional and organizational events, job ads and technical issues, comes across as a broader and more professional term. So while there is no clear decision yet, the title of drone operator seems to be the term that will be used more often than the title of drone pilot.

4.3.2. Activities

This section is the answer to the second research question. The findings obtained within the scope of drone activities and the execution of the activities within the businesses are in this section. Under this heading, drone activities, drone activity intensity, number of drones and operators in businesses, pre-recruitment testing process, in-house regulations, in-house or out-of-business drone use and drone operator performance evaluation issues are mentioned.

- **Drone Activities**

For people who want to work as a drone operator, there are employment opportunities in many different positions and industries. Different industries use drones in different business processes. This brings along new learning areas for operators. Because simply using a drone is not enough to be an operator. Employed individuals must meet the requirements of the tasks in which they use drones. For example, in the agricultural sector, drones are used for spraying, plant analysis and the study of farmland use. The individual who will use the drone must at the minimum have information regarding plant spraying, plant species, plant diseases and field scanning. In addition to basic knowledge of photography and flight mechanics, people need to master industry and business-specific information. Table 7 shows the areas of drone use in the sectors where interviewees work. Business processes and in-business activities also vary by sector. Activities suitable for drone use also vary depending on the purpose served by the sector. Businesses also consider these activities while employing drone operators.

- **Drone Activity Intensity**

Business processes that take place using drones are increasing every day. Increasing the intensity of drone activity is good for the business, given that the profit of the business, the speed of business processes and the quality of business will increase. The intensity of drone use in an enterprise concerns the drone operator directly. More drone operators are needed in businesses that use drones more frequently. Operators must adhere to statutory flight and rest periods, no matter how busy the job is. Knowledge on the intensity of drone use in the areas they want to in work can be of assistance for future job applications. Table 8 shows the intensity of drone use by sector. According to Table 8, drone use in national defense, agriculture and media is more intense than other sectors and fields.

- **Number of Drones and Operators in Businesses**

The number of potential drones that businesses own is given in Table 9. In some organizations, drone numbers also determine operator numbers. But not every enterprise has as many operators as the number of drones. In some businesses, there are two drones per operator, while in some businesses, there are two operators per drone. While experts say that a separate operator is needed for each drone, in many organizations one drone is used by more than a single person. In defense organizations, the number of operators exceeds the number of drones. The reason for this is that they train operators according to the organizational culture. But as can be seen in Table 10, the number of drone operators is quite small and disproportionate compared to the total number of employees in those enterprises. Likewise, the number of drones used is inconsistent with the number of drone operators. This shows that sectors cannot accurately determine the needs of drones and its operators. In order to make the most of these advantages, the numbers must be determined accurately, done according to operation size and the work done. Otherwise, there may be negative consequences for businesses in terms of cost, time and quality.

- **Testing Period before Recruitment**

Before hiring drone operators, businesses expect potential operators to have the specified certificates and driver's licenses, and also the required training. However, in addition, some businesses have a testing process before hiring. During this process, the person's compliance with the business and teammates, performance in assigned tasks, and technical knowledge on drones is tested. Various test flights and missions are performed. Individuals who get through the process with fewer problems have higher employment potential. This process varies according to the expectations set by the enterprises. For example, a person who wants to work as a drone operator in the oil and gas industry is tested regarding their knowledge and expertise on Fault Detection, occupational safety checks, inventory tracking, and security support. The candidate is expected to successfully handle each business process. In comparison, the

person who wants to work as a photographer is tested in their knowledge in framing and image editing.

In some businesses, there is no testing process. They hire individuals that possess a UAV license, match the job description and have good references. Such organizations provide training to the personnel they hire in accordance with their needs. Another method is people who are taken in as interns. These people are also subjected to continuous training in the business.

- **Internal Regulations**

The DGCA UAV Regulation is a frequently updated regulation on UAV and drone use. Every business that uses drones must adhere to these regulations. But apart from this regulation, businesses also have intra-organizational regulations. These extra regulations are the reinforced and solidified forms of the articles that are already present in the DGCA legislation. Damage guidelines, frequency of drone maintenance and repair, flight and rest hours, and recruitment and removal procedures are carried out in a manner that businesses determine themselves. These are important applications in terms of the vision and mission of enterprises. Drone operators working in-house and departmental managers overseeing them must master and adhere to these rules.

- **Internal or External Drone Use in the Business**

Large organizations that invest in drone technology and employment, usually, have their own equipment and employees. In this way, they reduce costs and facilitate business processes. However, instead of buying drones and hiring internal operators, small-scale and budget enterprises can obtain these services from an external drone company. In this way, both extra costs are avoided and business processes are carried out with drones.

Businesses expect quality service. Therefore, several criteria are also taken into account when selecting the company to which this service will be entrusted to. Drones and operators also determine the quality of the service. The industry experience of the

company giving the service should be up to the mark, and the drone operators they employ should have a successful flight history. References of the company to be selected are very important. Their previous works should be investigated and evaluated. Companies and operators must be reliable. Adherence to the specification is one of the most important requirements in service purchases. The articles written in the technical specifications must be prepared professionally. Therefore, these should be considered in terms of the quality and reliability of the work. In addition, the components of the drones to be used must be robust and high quality. If any problems occur, the business acquiring the service should not be aggrieved.

- **Evaluating the Performance of Drone Operators**

Performance evaluation for businesses is important. For the quality and continuity of work, the performance of operators must be on par. Businesses make this performance assessment considering several criteria. The criteria that define quality drone operating enterprises are as follows:

- Ability to quickly understand the tasks that are requested from them
- Complete the given tasks thoroughly (efficiently complete the flight hours)
- Satisfaction of the manager and/or customer of the task performed
- Having good communication skills
- Have knowledge and experience in drone landing and takeoff, flight safety, air traffic contact, direction determination, sunlight control and meteorology
- Fast and accurate decision making
- Problem Solving
- Obtaining images suitable for analysis and evaluation
- Mastering the technical and mechanical properties of the drone
- Ability to adapt to different weather conditions when needed while using a Drone
- Staying levelheaded in high-risk situations

4.3.3. Qualifications of Drone Operators

This section is the answer to the third research question. Findings obtained within the scope of the qualifications that experts expect from drone operators are in this section. Under this heading, the age and education levels of the operators, drone license, working conditions that operators must adapt to and general qualifications are included.

- **Ages and Education Levels of Drone Operators**

Age must and is considered during the hiring process in most industries. For drone operators, factors affected by age, rather than the age itself, are considered. People aged 18-45 are more preferable because they usually have better eyesight and muscle health and because they have faster reflexes. In addition to health, it is very important that people are experienced. Therefore, individuals who are experienced, healthy, energetic and are willing to learn people are at an advantage during the employment process. Candidates under the age of 18 are not preferred by businesses, as people with experience and at least a high school degree are preferred. People over the age of 55 are more preferred for the planning and coordination phase rather than for drone operating.

Candidates are mostly expected to possess an associate or bachelor's degree. More so, candidates studying in the aviation field and/or those who know English are more advantageous. Master's or doctoral degrees are not required; however, they offer an advantage for candidates.

- **License**

In order to be employed in a corporate firm, individuals must meet all the requirements of the position they are applying for. In addition to the candidate's suitability, documents such as a health report, registration, Bachelor's degree, certificate and diploma are also required. Businesses must keep these documents in their databases. In jobs that require licenses and certificates employing undocumented personnel is highly illegal. Possessing the relevant drone operating license is highly

important for businesses employing drone operators. The DGCA'S UAV Systems directive also prohibits flying drones without a license and has criminal sanctions for those who do so. Although a license requirement is not required in non-corporate, small businesses and organizations that train operators, candidates for personnel who will work in different sectors must have a driver's license to use a drone.

- **Working Conditions of Drone Operators**

Businesses expect drone operator candidates to adapt to the following situations during the time they work together:

- Should be ready for, unplanned, emergency flights.
- Should be ready to fly in all conditions as long as the weather is suitable.
- Regions with volatile weather need to be constantly monitored even during suitable weather conditions.
- Should be ready to work during the working hours and rest periods specified in the UAV System Instruction
- Complete the daily, monthly, and annual flight hours specified in the instructions
- Should be able to adapt to different locations quickly and work with different individuals

- **Qualifications of Drone Operators**

The qualifications of the drone operators that will be employed can be listed under seven categories:

- Health
- Attitude
- Interests
- Aviation Knowledge
- Analytic Skills
- Education and Know-How
- Adaptation to Different Conditions

Drone operator candidates are expected to provide qualifications for each of these seven categories. These categories cover the qualifications. Qualifications can be split up as essential and desirable according to sectors and tasks by the employers. Essential features are abilities that candidates must have. Desirable features, however, are not required but are sought after by managers. These give an edge in the employment process. But it is not as mandatory as essential features. These characteristics can vary according to the requirements of the job, the ranking of the individual in the firm, and the level of institutionalism of the enterprises.



CONCLUSION

In today's world, drone and UAVs technologies exist, and have existed under different shapes and names for decades and are rapidly evolving every day. Today, organizations use drones in many areas, ranging from the defense industry to agriculture and transportation. This rapid introduction of drones to businesses has also led to the need for drone operators in different sectors. Although drones are unmanned aerial vehicles, it is still not possible for them to be completely autonomous. There is still a need for human factors in drone use. Drone operators are the main contributors to drone technologies. There are many reasons that businesses integrate drones into their business processes, such as gaining an advantage in the competitive environment, increasing profits, carrying out business processes faster, and lowering costs. This rapid integration of drones into businesses has created a need for drone operators in varying sectors. The drone operator profession, which has become a new business opportunity and source of income for people, has also brought with it new processes for managers, human resources, and universities.

This thesis has three main results that refer to the sub-questions of the thesis. Firstly, the expert opinions on drone use and drone operator employment in businesses show that time, cost, and quality management are the most important factors. Conducting business processes faster saves time on all business processes. So, the overall quality and pace at which business occurs and proceeds increase. Especially project-based businesses care about time-saving.

The cost factor is an advantage for businesses. Low costs, cost reduction, less personnel, and profit determine the cost for a business. Based on the findings, the use of drones in media, national defense, and agriculture lower overall costs. At the same time, drone usage in businesses reduces the amount of needed personnel. Hence, labor costs reduce. Low costs, cost reduction, and working with less personnel, increase business profits. In addition, the use of drones and drone operators in businesses are worthwhile factors in terms of cost and benefit.

The quality factor is also an advantage for businesses in terms of efficiency and ease of working processes. When staff starts to carry out complex business processes more easily than usual, their motivation and work's quality increase. At the same time,

facilitating work processes increases efficiency. Increasing efficiency enables businesses to grow. Regarding the competitive environment, businesses that use drones experience great advantages in time, cost and quality.

Secondly, drone activities and drone usage in businesses show that drone activity intensity is a determining parameter for businesses. The usage area of drones varies according to the sectors. For example, in an agricultural context, drones can be used for plant analysis, spraying, and land survey. In addition, drones are also used in search and rescue activities, traffic control, illegal migration detection, corpse, and lost search, collecting traffic and mass transport data, troubleshooting, work safety control, and inventory tracking. Drones are also used in the entertainment field in activities such as light shows.

As the usage areas of drones widen, the need for drone operators and operations also increases. Many businesses use drones in almost every work process, given that the weather conditions are favorable. It shows the need for continuously working operators as well as project-based works. Drone activity intensity and the wide variety of usage activities affect the drone operator needs of businesses. It brings new job opportunities for operators and operator candidates. Therefore, operators must have the qualifications in line with the sector and business requirements using drones. The variety and intensity of drone activities play a significant role in employment.

Thirdly, the qualifications that experts seek from drone operators are divided into seven categories. Together, the categories, health, attitude, interests, aviation knowledge, analytic skills, education and know-how, and adaptation to different conditions make up all the qualifications that a drone operator should possess. Businesses have essential and desirable expectations from operators. However, these expectations vary according to the sectors. Having a UAV license, a clean criminal record, good eyesight, and muscle health are essential. Besides, operators should have at least an associate degree and be upper-intermediate or advanced level in English reading, writing, understanding, and speaking. They need to have basic computer skills such as Microsoft Office, web and social media, troubleshooting, basic statistical analysis and database programs, a basic programming language, and job-specific computer skills. Besides, basic aviation knowledge like atmospheric physics, aerostatic and aerodynamics, airflow, flight controls, tail and propeller assemblies, fuel

and power systems, and aviation laws is required. Analytical thinking skills, making the right decision quickly, problem-solving skills, and good framing knowledge are also considered. Adequate flight experience depends on the operator's flight hours that change between 100 and 300 hours in total. Also, operators must master the technical and mechanical structure of drones. They have to know how to disassemble and reassemble drone parts such as propeller, camera, and payload before the task or during the work. Adaptability to different weather conditions and the lack of any travel restrictions are crucial for the operator to be employed. Their professional attitudes are also important, as good organizational and communicative skills and reliability are among the most sought out for qualifications.

Desirable qualifications provide an advantage to operators in the employment phase. For instance, having a bachelor's degree in Aeronautics, Business, Engineering, or similar disciplines, having experiences in remote control vehicles, and following technological developments about drone shows that the operator is interested in drone technology and is eager to learn and improve in this field. Operators should also be experienced in using image editing programs, have safe flight skills, have extensive control of environmental and technical details during the flight, and be able to detect problems, be mentally strong, and know, one of the necessary programming languages well. Operators should possess most, if not all, of these qualifications and should be open to improvement in UAV and drone technologies. The more abilities a drone operator possesses, the more employment fields and position opportunities.

Giving drone training or opening it as a department in universities will contribute to drone operators' development. In the near future, the state administration must strengthen fundamental aviation education and infrastructure and support such attempts. Businesses should be supported technically and financially in order to create new job opportunities for drone operator candidates. For businesses whose drone need is increasing, qualified personnel should be educated in universities with well-equipped training. Smart drones with smart, accurate sensors and self-monitoring have already started to take their place in the transportation, national defense, logistics, and commercial sectors.

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APPENDICES

Appendix 1: Interview Questions

Section 1: Demographic Features

- Name/Surname
- Title
- Company Name
- I am a Drone Operator or Not

Section 2: Overview of Drone Operator and Drone Use in Businesses

Question 1: What is your perspective on the present and future of the drone operator?

Question 2: What are the advantages of drone operators for businesses?

Question 3: What are the contributions of drone use to business processes?

Question 4: What are the risks (if any) in the inclusion of drone in business processes and the employment of drone operators for businesses?

Question 5: Does the inclusion of drone in the enterprise create organizational resistance (in terms of changes in the number of staff and organizational structure, etc.)? Please explain.

Question 6: Please evaluate the use of drone for businesses in terms of additional cost and benefit. (Device, system, personnel, etc.)

Section 3: Drone Use and Drone Operator Specific to Business Perspective

Question 7: Which business activities do you use drone for? / Do you know in which business activities drone is used?

Question 8: How intensive are your drone activities in your business? (daily, weekly or annual average usage periods)

Question 9: Do you perform your drone activities by outsourcing or by your own drones and drone operators?

// Respond this question, if drone activities are performed by outsourcing.

Question 10: According to which criteria is the company, that the drone service is taken from, selected?

Section 4: Conducting Drone Activities with In-House Resources

Question 11: How many drones are used in your company?

Question 12: Is the same operator managing all the drones? Do you need a separate operator for each drone? Please explain.

Question 13: How many drone operators are working in your company?

Question 14: Do you have any trial and orientation process for your new operators before hiring? How long does it take? Please explain.

Question 15: Is there any internal regulations for drone operators other than UAV/drone legislation in your country? Please explain.

Question 16: How do you evaluate the performance of drone operators?

Section 5: Drone Operator as a Job

Question 17: Which of the following is required to be employed as a drone operator?

Why? (You can mark multiple options.)

- A relevant undergraduate diploma
- A relevant certificate
- One's self-education without any formal training or training by people who know the job
- Other

Question 18: What do you think about the opening of the drone operator as a department in colleges or giving as a lecture?

Question 19: What should be the ideal ages and education levels of the operators?

Question 20: What features should drone operators have? (technical, software, operation, etc.)

Question 21: What are the working conditions of drone operators?

Question 22: Do you call drone users "pilot" or "operator"? Please specify the difference between pilot and operator.

Section 6: Comments & Suggestions