INSTITUTO
UNIVERSITÁRIO
DE LISBOA

Acceptance and Intention to use Drone Delivery Services in the city of Lisbon

Jonathan Alonso Villanueva Alvarez

Master in International Management

Supervisor:

Dr. Sofia Kalakou, Assistant Professor, Department of Accounting, Marketing and Management,

Iscte Business School

November, 2020

BUSINESS
SCHOOL

Department of Marketing, Strategy and Operations

Acceptance and Intention to use Drone Delivery Services in the city of Lisbon

Jonathan Alonso Villanueva Alvarez

Master in International Management

Supervisor:

Dr. Sofia Kalakou, Assistant Professor, Department of Accounting, Marketing and Management,

Iscte Business School

November, 2020

iscte INSTITUTO UNIVERSITÁRIO DE LISBOA	**Acceptance and intention to use drone delivery services in the city of Lisbon**	Jonathan Villanueva

Acknowledgements

It would be impossible to achieve this stage of my life without the contribution of many people to whom I would like to express my gratitude:

To my parents, for all the support, incentive and unconditional love. To Karen, who has always encouraged me to follow my dreams and accomplish my goals. Both forgive the lack of availability and time that was not spent with you.

To Professor Sofia Kalakou, my thesis supervisor, I thank you for all the support, guidance and availability which was a valuable contribution to this journey.

To all friends and family, for their support received over the years.

Resumo

O rápido crescimento do e-commerce e da entrega de encomendas tornou as entregas ”last-mile” menos eficientes ao longo dos anos. As empresas procuram continuamente encontrar soluções para o problema do “last-mile”, onde a necessidade de reduzir os custos vai ao encontro da satisfação do cliente. Nesse contexto, o serviço de entrega de encomendas por drones surge como um projeto de tecnologia inovador para solucioná-lo. Embora a sua utilização esteja a expandir-se na Europa, a sua sensibilização e aceitação em Portugal têm de ser dirigidas para planear as entregas de drones na logística urbana.

Este trabalho analisa a aceitação e intenção de utilização dos serviços de entrega por drones por parte dos consumidores da cidade de Lisboa. A pesquisa baseia-se em dados primários recolhidos por inquérito online respondido por 300 pessoas residentes em Lisboa, entre portugueses e estrangeiros com idades compreendidas entre os 18 e mais de 65 anos. São avaliados aspetos como o impacto dos benefícios e preocupações percebidas sobre a atitude e intenção de uso, assim como o nível de consciência e variáveis como género, carta de condução e área de residência.

Os resultados do estudo mostram que a atitude em relação à entrega por drone tem impacto na intenção de usá-lo, dependendo de como as pessoas percecionam os benefícios e as preocupações.

Do ponto de vista da gestão, este estudo serve como fonte de informação para empresas que planeiam implementar serviços de entrega por drones, pois contém informações valiosas sobre os fatores de aceitação dos consumidores.

Palavras-chave: Entrega por drone, aceitação do consumidor, attitude, intenção de uso.

Classificação JEL: L9 (Industry Studies: Transportation and Utilities), M19 (Business Administration, Other), O30 (Innovation, Other).

Abstract

The rapid growth of e-commerce and parcel delivery has made last mile deliveries less efficient over the years. Companies are aware of that and continuously try to find solutions for the last mile problem, where the need to lower the costs meets the customer satisfaction. In this context, drone delivery service appears as an innovative technology design to solve these problems. Even though its use is expanding in Europe, its awareness and acceptance in Portugal need to be addressed to plan drone deliveries in urban logistics.

This work examines the acceptance and intention to use drone delivery services by consumers in the city of Lisbon. The research is based on primary data collected by a web survey answered by 314 people living in Lisbon, within Portuguese and foreigners aged between 18 to over 65 years old. Aspects like the impact of perceived benefits and concerns on attitude and intention to use are evaluated, as well as the level of awareness and the impact of variables like gender, owning a driving license and area of residency.

The results of the study show that the attitude towards drone delivery has an impact on the intention to use it, depending on how people perceive the benefits and concerns.

From a managerial perspective, this study serves as information sources for companies planning to invest or implement drone delivery services, as it contains valuable information regarding the factors for consumers' acceptance.

Key words: Drone delivery, consumer acceptance, attitude, intention to use

JEL Classification System: L9 (Industry Studies: Transportation and Utilities), M19 (Business Administration, Other), O30 (Innovation, Other)

Table of Contents

List of figures

List of tables

List of Annexes

CHAPTER 1

Introduction

Technology moves alongside with the future and ever since the Unmanned Aircraft Vehicles (UAVs) - commonly known as drones - were introduced in our lives, people have begun to think about their multiple ways of use. From children toys up to helpful resources for today's business world, the presence of drones is becoming more and more natural to daily live. These UAVs are seen covering big sport events giving amazing visual perspectives or acting as security cameras for monitoring restricted places, even in emergency situations looking for people in rescue missions, reaching places that are difficult to get.

Special interest comes as well from the area of logistics, as UAVs could be employed for last mile deliveries, which are considered as the final leg of the supply network, involving the transportation of packages from the retailer's last contact point with the cargo to the final point of consumption (Halldórsson & Wehner, 2020; Baldi et al., 2019). Nevertheless, due to the ongoing consumption patterns and evolution of e-commerce, the parcel delivery market is expected to grow in the next years, which will represent a challenge for logistics companies and for the distribution of urban space (Mordor Intelligence, 2020). Consequently, a term known as the "*last mile problem"* has appeared.

For example, imagine tracking your online purchase and seeing it as "*out for delivery*"; unfortunately, in most cases you won't be certain when your product will arrive. The reason behind this is the multiple stops the package has to make before reaching you, making last mile inefficient. In last mile logistics, couriers have to choose among transportation companies with different costs and service quality, which becomes then a tactical problem.

Many authors have tried to come with solutions for the last mile problem, by first trying to define the real problem: whether this is a packing problem (Baldi et al., 2019), a vehicle routing and scheduling problem (Boysen et al., 2018), a broadband connectivity issue (Majumbar, 2019), energy efficiency (Halldórsson & Wehner, 2020) or pollution problem (European Commission, 2011). The common ground comes when considering the last mile problem as a conflict of objectives: on one side minimizing the cost and on the other side maximizing the quality of service.

The use of drones as a delivery service could become the strategic and tactical solution needed to fix the last mile problem as not only they can fly over ground obstacles because they are not limited by the traffic and road infrastructure, but they can also deliver packages to a specific place in an accurately predicted delivery time and have been recognized as one of the new innovative technologies for delivery services (Lee et al., 2016; Mohamed et al., 2020). Currently, some companies are already applying this technology over some cities and many firms are considering to acquire it in the near future. Even though drones appeared as the new technology for deliveries which can function without human intervention, few

studies have been conducted on customers' attitudes regarding this type of service and their intention to use it.

One more reason to study this topic is because there has been a considerable increase in CO2 emissions from the road transport industry (Meng et al., 2017). In this context, drone delivery does not only represent a high-tech device for transportation of goods but an eco-friendly vehicle which can be considered as an aid in the fight to reduce pollution.

This dissertation will analyze the future acceptance and intention to use drone delivery services in the city of Lisbon to determine which aspects might influence consumer's decision to adopt this technology. Within this analysis, this research will measure the level of awareness and perception regarding drones and drone delivery. Furthermore, it will investigate consumers' preferences and expectations towards this service.

In the next pages, this thesis will review what research has been conducted over the years on the topic, prepare a field study and analyze the results to collaborate with future research and provide relevant conclusions for companies preparing to offer drone delivery services in the near future.

1.1 Objective, research question and methodology

Drone delivery services are still in its growing stage, even though some companies are implementing this service, they are still gathering information, doing studies and developing improvements. In order to contribute to this endeavor, the main objective of this study is to understand the general perception and intention to use drone delivery services in the city of Lisbon, assuming that this new type of delivery service will soon be introduced. Therefore, the objectives of this study are as follow:

- Determine whether there is a positive or negative perception of drone delivery service.
- Understand the characteristics that consumers would appreciate the most.
- Understand the factors affecting the intention to use drone delivery services in the future.

For this purpose, the following research questions need to be answered:

i. Are the citizens aware of the existence of drone delivery service?
ii. How do future consumers perceive drone delivery service?
iii. What products would consumers be willing to accept by drone delivery and how much would they be willing to pay for it?
iv. What are the barriers that would keep people from using drone delivery service?
v. Do people intend to use drone delivery services in the future?

Methodology

In order to answer these questions and achieve the objectives, a theoretical framework will be designed, where the information from the literature review will be analyzed, summarize and converted into variables to develop hypotheses that will be tested in the methodology. The chosen methodology for the study is a quantitative research through an online questionnaire for people living in Lisbon. Therefore, measurable data will be obtained and the hypotheses will be tested. The reasons explaining this choice of methodology and its advantages will be further explained in the chapters ahead.

1.2 Thesis Structure

There are seven chapters within this dissertation. The first chapter includes the introduction, objective and research question. Chapter two points out the literature review supporting the objective of the study. The third chapter determines the methodological framework necessary for the research method and explains the most suitable tool. Chapter four outlines the data analysis and describe the sample, the results and discussion will be revealed in the fifth chapter, where the data will be analyzed and the findings will be shown. Finally, chapter six will include the overall conclusions regarding the research topic along with some recommendations based on the findings of the study.

CHAPTER 2

Literature review

Drones have been operating in our world for more than a decade. In order to have a further understanding of the aspects necessary to answer the research questions, it is important to review what has been done over the years regarding drones and their many applications. This chapter will start explaining all that is needed to know regarding the technology and different uses of drones. After that, it will focus on the application called "drone delivery" where it will point out the benefits and concerns of this new type of delivery and what some companies have done in recent years. Moreover, it will analyze the variables that explain consumer's preferences and beliefs related to risks and awareness. In the last part, the implications for logistics will be review showing the current situation, revealing how companies are able to provide this service and what to expect in the near future.

2.1 Drone Technology

When it comes to the drone's architecture, generally they are composed of an unmanned aircraft which is basically the autonomous body of the drone, a ground control station where people can control or monitor the drones while they are flying, and the communication data-link to provide drones with a wireless information flow to send and receive signals, for example, using satellite communications (Yaacoub et al., 2020).

Drones can enter new places, collect and analyze data in real time, doing live-stream videos and capturing images. These features are now available for citizens, making them very appealing for a wide range of uses. Kellermann et al. (2020) pointed out that *"drones combine three key principles of technological modernity – data processing, autonomy and boundless mobility"*. From these facts, we can expect drones to cause a revolution in many industries in the next years.

Though there are different types of drones depending on their technical characteristics and design, the details of 9th generation drones in a letter from Amazon to the FAA (Federal Aviation Administration) specified drones as a type of unmanned aerial vehicles weighting less than 25 kilos and being able to carry around 2,2 kilos. They could fly around 30 minutes at speeds of up to 80 kilometers per hour, delivering packages within a radio of 16 kilometers from a drone station (Welch, 2015). In fact, at a speed of 80 km/h, this radius can be done in 12 minutes. Drones can be autonomous or semi-autonomous and they fly using propellers and/or rotors with batteries as their source of energy (Watkins et al., 2019).

Aside from the functionality and technical information on drones, it is also important to point out some of the features that are part of the drone's flying system, since they fly autonomously. Thanks to their crash avoidance system, they can fly around obstacles or detect objects flying in the same space. Another special

feature for different drone applications is the ability to develop a route considering their surroundings and strategies already planted by its network (Yaacoub et al., 2020).

According to Watkins et al. (2020), first appearances of drones were not kindly welcome since they were first used for military, but that concern will fade over the years through the development of multiple civilian applications. However, with these new applications, new concerns will come to people's mind, which will be discussed further ahead in this paper.

2.2. Drone Applications

Whether people call them UAVs, drones or flying little robots, it is a fact that they have been around for more than two decades, but the last few years have been key for global awareness, since different applications have been implemented in different industries, such as the delivery industry, specifically food delivery (Hwang et al., 2019b). However, there are many more possible applications that are to be expected in the near future.

Due to the worldwide conditions such as population growth, limited resources and areas for development, energy efficiency, economic issues and environmental sustainability, there has been a continuous interest in the development of smart cities. In order to cope with that interest, it will be necessary to use advanced Information and Communication Technologies (Mohamed et al., 2020). In this context, UAVs can become an essential part of these cities, being drone delivery one of its many applications.

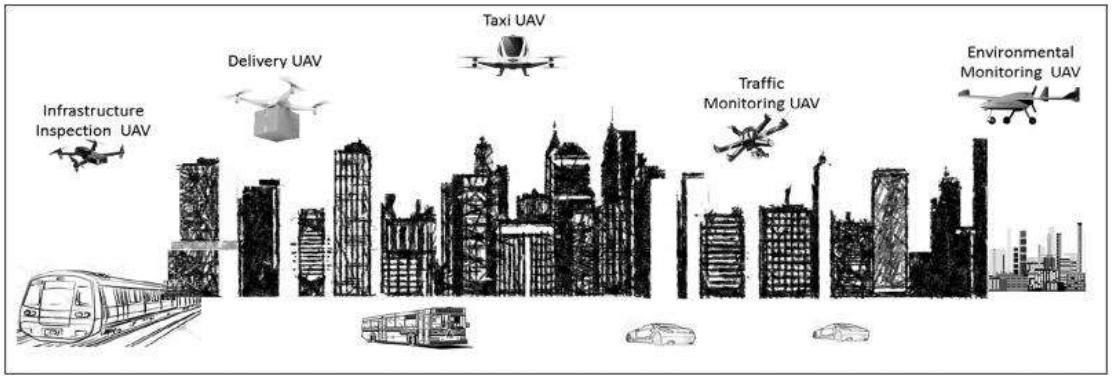

Figure 2.1. UAV applications in smart cities
Source: N. Mohamed et al./UAVs Research (2020)

The graphic above (figure 2.1) shows how drones could be used in future smart cities (e.g. traffic and crowd management, smart transportation), these features offer many advantages when using them for these technological cities. Smart cities are a combination of people, technology and creativity in order to make a city more sustainable and efficient, all of this can be achieved thanks to the Internet of Things (IoT)

solutions. It is a fact that the world population will increase in the next three decades, which is why these new city concepts will become a necessity to control the different aspects of the society.

There are already many applications for drones that are currently in use, the reality is that drone technology improves every year and new innovative applications have been increasing. A study done by Aydin B. (2019) showed some of the current and future applications related to drones, table 1 show the data collected from scientific literature, mass media and related sources. Some of the future applications included very interesting uses such as supplying connectivity and disease spread control.

Table 2.1. Summary of some current UAV applications

Industry/Sector	**Drone Application**	**Impact**
Sports	Recording sports events	Provides a different angle
	Broadcast live games	Provides another perspective
Agriculture	Crop monitoring	Fast surveillance
	Reforestation	Planting trees
	Pesticide spraying	Fast and accurate
Logistics	Parcel delivery	Speed and precision
	Passenger transportation	Efficiency
Public safety	Search and rescue	Improves aid
	Track suspected criminal or terrorist	Gather information
	Control illegal immigration	Improves surveillance
	Control drug trafficking	Improves surveillance
	Highway and bridge surveillance	Improves surveillance
Wildlife protection	Surveying wild animal ecosystems	Better monitoring
Mass media	Enhance news coverage	Provides different angles
	Film and entertainment	Multiple uses
Research	Data gathering	Speed
	Archeological surveys	Takes care of the objects
Military	Military operations	Provides aid

As seen in the table above (table 2.1), not only commercial use but also different sectors can take advantage from the benefits of drones. For example, border control has improved thanks to the surveillance application of drones and search and rescue operations have become more accurate by using drones to assist them in treating the people in need (Yaacoub et al., 2020).

One of the newest applications is the “air taxis” which are drones used for transporting passengers from one point to another. These passenger drones will potentially establish a new era in aviation where people will be able to travel in low level airspace (Kellermann et al., 2020). Even though the use of drones as surveillance devices is already known in many industries, their application as passenger transportation

is very recent, which means there is still a long way to go before they could be widespread as a mean of transport.

Regarding all the potential applications of drones, this study will focus on parcel delivery-also referred as "drone delivery service"- and will analyze the different aspects necessary for achieving the study's objective.

2.3 Drone delivery service

Some firms have decided to deliver their products by using drones. This process consists on the drone setting off from a station carrying the package and flying at a certain altitude. Once the drone has reached the residence, it either lands or drops off the package to a place that has been prepared. After the delivery is finished, the drone goes back to the station (Soffronoff et al., 2016).

According to Kim (2020), it is not important for consumers which vehicle is used to deliver their products; however, if drone delivery becomes massive, it will be the customers instead of the shippers who will decide on the type of transportation used for their purchases, which is why it's important to study the potential consumer's preferences regarding this service.

In a recent study, Kellermann et al. (2020) talked about the possibility of drone delivery changing behavioral patterns if this technology is acquired by many companies. In this scenario, consumers are satisfied almost immediately through instant delivery since drone delivery is fast and precise, making them happy but also more eager to buy, causing excessive or compulsive consumption; in consequence, their levels of debt might increase which could cause an impact on their personal finance.

From the business perspective, drone delivery competitors would be the traditional parcel delivery services such as trucks and motorbikes, even though these two modes focus on different segments, they could be drone competitors depending on which type of products they carry and how much time the consumer is willing to wait. Actually, one of the future consequences of using drone delivery would be the reduction of ground traffic. However, because of this technology's limitations, the only way to achieve less ground traffic is by placing a large fleet of autonomous drones. For example, in order to switch 70% of ground deliveries to drone deliveries in the city of Paris, it would require around 180.000 drone flights per hour (Doole et al., 2018).

It seems that for online food delivery, drones could easily be implemented for delivery seeing as not only these type of online consumers are quite familiar with technological devices but they also are used to acquired new suppliers whenever they feel unsatisfied with their current provider; in this case, service quality can highly affect consumer satisfaction (Yusra et al., 2019).

2.4 Benefits and concerns

There are many advantages when it comes to drone delivery, such as speed, flexibility, ease of delivery, among others. Because of its many benefits, drone delivery could be considered as a promising solution to the last mile problem addressed previously. In this section this study will review the most relevant benefits and concerns of this type of delivery service.

2.4.1 Speed and precision:

Drones can deliver products precisely and quickly. The main advantage of doing delivery by drones is their speed (Lee et al., 2016) because they can fly in a straight line without traffic or obstacles. They can fly over very difficult terrains (like mountains, forests, etc.) with ease and in many cases take a shorter route, since they are not restricted to the infrastructure of the regular means of transportation (rail lines, highways, etc.). For online consumers, speed is indeed an important factor which they are very sensitive; therefore, delays in the delivery time will affect consumer's loyalty levels (Rao et al., 2011).

When it comes to reaching a single point, it is known that drones can go very close to specific targets, these characteristics grant them higher levels of accuracy and better targeted actions (Mohamed et al., 2020). In fact, this advantage of speed suits the delivery of food because the main focus of food delivery is to keep it warm and in good condition, a faster delivery such as drone delivery would fulfill those requirements (Park et al., 2018).

Regarding the delivery service part, a recent study concluded that drones are at their best at delivering a few packages at a time; however, trucks seemed to be better when it comes to deliver large quantities to more populated areas (Goodchild & Toy, 2018). According to Goodchild (2018), "a drone can't really compete with a very full truck making 100 deliveries in a fairly small pace. The farther apart those customers are, the less room for consolidation, the more competitive a drone can be".

2.4.2 Environmental impacts

In the logistics process, goods are shipped from factories, stocked in warehouses and finally trucked to destination, all of this comes with an environmental cost. In the transport industry, the more fuel a vehicle uses the more CO2 emissions it produces. To face this, drones have been addressed as a clean way to do quick deliveries, since they have lower environmental impacts than other delivery methods. According to a study published by Stolaroff et al. (2018), small drones have a lower environmental impact than diesel trucks, the ones powered by natural gas, electric ones and other ground-based delivery methods. In another study, Goodchild and Toy (2018) ran some simulations where they compared carbon dioxide emissions between drones and trucks. They concluded that drones were in fact more environmental friendly than trucks.

Unfortunately, in most cases drone delivery is paired with trucks, meaning that they will travel in the roof of a vehicle until they reach a point where drones can fly straight to the location the truck can't go. However, they do have the potential to reduce pollution and contribute to having a positive environmental impact in the near future. Chiang et al. (2019) did some simulations in their research, following the structure where drones and trucks work together to make a delivery. In their results, they concluded that by using UAVs in the last mile delivery, the amount of CO2 emissions normally produced only by trucks could be reduce by twenty percent, on average.

In a different scenario for delivery, Park et al. (2018) did a simulation in Korea between the regular motorbike delivery and drone delivery in order to determine the potential positive impact to the environment when using drones, they even considered additional factors such as electric motorbikes and how electricity is produced. After calculating the electricity consumption and different damages to the nature (i.e., ozone layer destruction, acidification), they concluded that the environmental impact of drones was 1/12 of motorbikes, meaning that drone delivery is more friendly to the environment than motorbike delivery.

The area of living also plays a role in this part, since they also concluded that the environmental impact of doing drone delivery was more positive in rural areas than in urban areas, due to longer delivery distance and fewer population density. Also, when compared to electric motorcycles, they found out that drones were more environmentally friendly because they require less electricity per one kilometer.

There is also a different opinion regarding this issue; Kellermann et al. (2020) believe that drones would not be such an energy efficient option because they would need to use renewable energy (i.e., using solar panels on drones), their batteries would need to last much longer and be recycled, meaning that there is a long way to go before we can affirm that drones are much more friendly to the environment that other means.

To sum it up, although unmanned aerial vehicles consume no fuel, producing less impact on the environment; it is important to analyze their full life cycle in order to fully understand how environment friendly they truly are.

2.4.3 Driver's safety and dynamism

When it comes to the functional advantages of drone food delivery services, one of them is how consumers can pre-order food while they are on the move outside. For example, in Japan, there are drone food delivery services for golf courses. While playing golf, customers can order food with their smartphones and select the location where they want to receive it (Hwang et al., 2019a), making drone delivery very dynamic.

There is an interesting number of companies investing in this type of service, and they have been increasing in recent years, specially food service companies, due to all the benefits that would come from delivering their products by drones, such as speed, cost saving and even reducing the loss of life. According

to Hwang et at (2019a), around 1500 people are injured and 30 people are killed every year while delivering food in Korea; even more, 50% of these people are under the age of 29.

This situation happens around the world. In general, 57% of traffic accidents are caused by human error which is why the European Commission has been taken strong efforts to prevent delivery transport accidents (Galkin et al., 2019); therefore, drone delivery service presents an effective way of dealing with road transport accidents.

In addition to driver's safety, there is the promise of a reduction in the ground traffic because there would be less vehicles in the roads, which is also one of the expectations from this new technology. In an early report published by the logistics company DHL, they mentioned that "UAVs could provide major relief for inner cities, taking traffic off the roads and into the skies" (DHL, 2014).

2.4.4 Autonomous operation

Drones designed for delivery purposes will have to be operated by computers. Making drones fully autonomous is expected to reduce the risks related to human operation, such as fatigue from overwork, response time and others. Currently, while a fully autonomous drone is still not a reality due to some constraints regarding technology, there are computers able to make custom-designed flights which have been successfully tested (Watkins et al., 2019).

Enabling autonomy in drones will allow to do multi-drone operations, also known as swarming. In short, making drones autonomous means that they could sense close objects in their surroundings and process the information gathered in order to react accordingly; at the same time, update the information within the proper timeframe. While that is still far down the road, there are institutions like the Federal Aviation Administration (FAA) in the U.S. that have been constantly supervising drone technology, especially when it comes to the autonomous part, since there have been some accidents in the past involving drone crashing near people. However, the last couple of years have improved relationship between the FAA and drone delivery companies, granting them permission to operate.

2.4.5 Payload size

When it comes to loading capacity, it is a fact that trucks have the advantage over drones, which have their own limitations (Wang & Sheu, 2019). A truck is able to take on heavier goods and travel longer distances; in addition, charging stations are far less common than gas stations. In their study, Wang stated: "Without trucks, drones cannot undertake all the possible deliveries themselves. Delivering with both trucks and drones then becomes an efficient way that can make the best use of their advantages".

A delivery drone has its limits, some of them can carry up to 5 kgs and fly a distance of 50 km. In terms of speed some can go as fast as 65 km per hour and have a flight altitude of 30 to 120 m (Lee et al.,

2016). However, drone technology is also improving to make them lighter, faster and more efficient. Although this issue may be seen as a problem, Joerss et al. (2016) considered that even taking into account the weight limit of what a drone can carry, more than 70% of all domestic package deliveries can be done by drones.

The biggest constraint in relation with payload is the battery duration. Since drones are powered by batteries (energy), the more they lift or the further they want to go, the more energy they will need to produce the propeller thrust necessary to counter the force of gravity. They won't be able to carry more than five or six kilos unless there is a major breakthrough in technology for batteries.

2.4.6 Wireless communication

The possibility of having an advanced smart delivery service could not be real without a reliable wireless communication system that works providing a link between all the different parts involved in the operation. System such as Wi-Fi, GSM, WiMAX and satellite links are what make drones communicate at all levels (Mohamed et al., 2020). This network allows drones to fly autonomously, thanks to their different sensors and links between air and ground devices and stations.

In the future, it is expected for this intelligence system to influence drone delivery in the way that each drone would be able to decide by its own which parcel to deliver based on the many factors surrounding the operation (distance, battery, weight, route, etc.) or in other words, autonomous navigation. Nevertheless, there are some circumstances that could be a major concern regarding these systems. For example, having the stations overload due to populated areas or big sport events where there is a high number of net users or even natural disasters damaging the equipment, these potential threats need to be analyzed in order to develop a contingency plan. For now, drone communications are still in development and far from affecting people's daily routine.

2.4.7 Safety

Clearly safety is one of the main concerns about drone delivery service. During the performance, drones will fly among the city infrastructure like buildings, roads, etc. In some cases, drones could fly very close to people, this is why it is needed to include high safety requirements (Mohamed et al., 2020). Moreover, drones could be used for smuggling drugs or they could be hacked for malicious purposes, such as information/data breach or terrorist attacks (e.g., using a drone to drop a bomb in a specific location). In that aspect, it would be fair to say that the potential use of drones for criminal purposes could be higher than using them as police aid (Kellermann et al., 2020). Nonetheless, there are certain solutions for these type of threats; for starters, drones would have to be registered in order to identify them. Another solution is setting up restricted areas (geofencing) and if necessary, installing drone defense systems.

Although these aspects have improved over the years by some companies making drone delivery very reliable, most governments are still discussing issues like proximity, speed, altitude among some other factors for assuring the safety of this service. These concerns along with security and privacy issues will be reviewed and discussed further ahead in the section regarding variables that influence public acceptance.

2.4.8 Privacy

Another concern regarding this type of service is regarding the potential invasion of privacy. Drones are equipped with data collection devices such as sensors and cameras which leads to think that some people (residents) may complain against drones collecting data around the space where they live. According to Watkins et al. (2019) the action of entering the urban territory (towns, cities, etc.), in addition with the ability to take pictures or film videos and then disappear from sight could cause a justifiable concern in the citizens.

This concern becomes even more crucial in countries with well-established drone operation laws. In United Kingdom, citizens are protected by a "Data Protection Act" that includes different issues regarding privacy (Mohamed et al., 2020). For example, in 2018 there was a case of a drone flying outside the window of a bedroom, which was reported and classified as privacy breach. Another example is in Australia, where there is a separation requirement of 30 m between drones and public. In countries like these, some actions are considered illegal and could be prosecutable (Watkins et al., 2019).

This issue along with the safety mentioned before have to be part of the regulations necessary to develop a guideline to ensure the proper use of drones.

2.4.9 Cost

At first, decreasing shipping costs was the reason to develop drone delivery because there were countries that because of their high labor costs and large land areas, made shipping costs to be high. Since then, drone delivery has been a cost-effective option in rural environments which consist of low population density and limited accessibility by road (Park et al, 2018).

The advantage of using drones for the delivery process is the potential reduction of number of trucks, since part (or probably all) of the service will be done by drones. For a company, this represents an important reduction in their fixed costs. In fact, in their study, Chiang et al. (2019) found a reduction of more than twenty-five percent when using drones by developing a vehicle-UAV green routing model. By applying the use of drones, not only did they manage to reduce fixed costs (less number of vehicles required) but they were also able to reduce variable cost such as the money expended on fuel (gas/diesel).

Another example is from Chang Y. and Lee H. (2018), who showed that when drones are use with trucks for delivery purposes, it becomes efficient. They developed some simulations where they defined

cluster delivery locations in areas within drones' delivery range, found an optimal route and established a center depot. One of their findings was that the operating cost of drones is lower than trucks, from a cost perspective.

In terms of numbers, Keeney (2015) indicates that "It is estimated that the cost to deliver a parcel under five pounds within ten miles could be as low as $1 with drones, compared to almost $13 with UPS ground or $8 FedEx ground". The cost of a drone goes around $ 4000 (including software), which compared to the cost of a truck is considerably lower. In addition, there are costs like maintenance, drone stations, research and development and others, but the trend is that the prices will decrease due to economies of scale just as the same process with other types of technological tools, while on the other side, delivery prices increase on less busy days.

In spite of all the possible additional costs, there is much to gain from drone delivery, which is why well-known companies like Amazon or Google have been investing in this technology. Simulations are proving to generate a cost advantage when doing drone delivery and currently there are commercial drones flying in some countries for delivering purposes, which will be reviewed further ahead in this thesis.

2.5 Public acceptance

Watkins et al. (2019) said: "In democratic societies, it is the greater public sentiment towards a technology that will ultimately determine the governance of the sector". This statement means that if a new technology is expected and accepted by the majority of the population, it will put some pressure over the government in order to have it.

In another study which took place in Switzerland, Klauser and Pedrozo (2017) concluded that the public perception of the use of drones depended on what kind of use and where would it take place. For example, in their results, people supported the use of drones for military and police, but were more reluctant for commercial applications or hobbies due to privacy issues.

We can state that people's acceptance for any emerging technology will depend on how much they know about it, how they perceive it and how would they use it. According to Aydin B. (2019), analyzing these three pillars can help us to develop better strategies for people to adopt new technologies. Therefore, in this section the knowledge, perception and practice will be further explained in order to get a better understanding of the situation.

2.5.1 Knowledge

There is a lack of information on how much people know about drones. In a study done by Reddy L. B., and DeLaurentis D. (2016) in the U.S. it was concluded that the way general public learned about drones was mostly through movies and mainstream news media; on the other side, stakeholders would learn from

personal experience and trade literature. The following list shows the sources of information for general public:

- Mainstream news media.
- Movies or television series.
- Trade literature (scientific journals, aviation magazines, textbooks, formal reports, etc.).
- Fiction novels.
- Personal experience (classroom, workshop, etc).
- Others.

There is also the awareness issue, in spite of the many applications related to drone technology, there is not much information on how much people know about it. In the study done by Aydin B. (2019), the level of awareness was analyzed through different uses for drones. As a result, the research showed that people were highly aware with drones being used for military purposes and search and rescue operations, they were also highly aware of some of the commercial uses such as recording sports events. On the other hand, they were not entirely aware (50%) of food delivery applications and have very little knowledge of the possible future applications like passenger transportation or disease spread detection.

2.5.2 Perception

Regarding drone delivery service, from the consumer's perception, it has benefits and risks. While it can improve the service in terms of speed, security and cost and at the same time be a more environmental friendly option, consumers worry about its potential military and criminal use such as invasion of privacy or attempt to damage a person's integrity (Yoo et al., 2018).

Despite the excitement by the evolution of technology and its impact in logistics, the social impact in people's mind are not the same. According to a survey done in the US with a sample of 1400 people, only 44% liked the idea while 34% disliked it (Soffronoff et al., 2016). A distributor of press releases in New York called PR Newswire (2020) stated that when it comes to drone delivery, more than 35% of e-commerce customers will be willing to buy an item knowing that it will be delivered by a drone. In the UK, another survey found that 51% people also were in favor of drone delivery (Royal Aeronautical Society, 2018).

These studies show that there is a group of consumers that are not ready to adopt or accept this new technology because they perceive risks instead of the benefits, which is why more research like this one should be done to investigate further about the characteristics of these consumers and what variables or attributes influence people's decision regarding adoption and resistance to it.

2.5.2.1 Risks and beliefs:

On the other hand, when it comes to beliefs, the people associated the risks of drone delivery with the potential damage the package could suffer from drone malfunction; in the case of violation of privacy, people associated it with drones making the delivery to a wrong address, trespassing private property; in the case of safety they related it with the potential use to hurt other or transport illicit drugs, in addition, the sound pollution that would come from it (Soffronoff et al., 2016). In that research, they found that the people's acceptance on drone delivery varied by age, sex, education, location and whether they were e-commerce frequent customers or not.

Xun Zhu (2019), a communication scientist from the University of North Dakota, managed to do a segmentation of the public's risk beliefs about drone delivery and identified profiles based on that by using data from a survey done by the U.S. Postal Service Office of Inspector General in 2016, the sample included 1475 people between the age of 18 up to 75 years old. This study claims that the obstacles regarding the drone delivery system will be social and legal, since some people may focus on safety risks and others on privacy risks.

He called "the immediate" to the biggest group (47%), which were concerned about things directly related to the service like the package or property damage due to malfunction, steal of packages or simply goods being delivered to a wrong address and finally, delivery drones being damaged by people. However, they were not worried about privacy invasion and illegal use of drones.

A second group was called "the lateral" (3%) which were the opposite of the immediate. They would worry more about issues relevant but not directly linked to the service. For example, the lateral group were concern about illegal activities being done by drones and perpetrating people's privacy but they were not concern about packages being damaged because of drones' malfunction.

Xun Zhu called the third group "the comprehensive" (17%) because their concern regarding drone delivery was more a probability rather than a fact. Besides, they were the only group concerning about this type of service making the sky less pleasant.

The last group (33%) labeled as "the indifferent" had a lack of invested concerns about drone delivery, but accounted for a third of the urban residents in the sample. It is important to note that the perceive risks such as performance malfunction and privacy risks expressed negatively to attitude towards drone delivery. In other words, consumers who believe that a drone might hurt them or violate their privacy have less intention to use drone delivery service, this finding is consistent with previous risk studies (Lee, 2009; Robinson, 2017; Vijayasaranthy, 2004).

All these facts and studies related to the public's risk beliefs lead to think that the success of drone delivery technology will depend on the public support. In order to gain acceptance, it is important to understand the complexity of the people's beliefs when it comes to new technology.

2.5.2.2 Perceived innovation:

Innovation is an important part when speaking about new technologies. In their study, Hwang et al. (2019b) proposed that perceived innovativeness positively affects attitude toward using drone food delivery services, meaning that consumers who like to experience new innovative technologies have a higher intention to use this type of service.

In addition, Hwang et al. (2019b) also found that gender had an influence in the likelihood to adopt a new technology. The findings of the study showed that when it came to drone food delivery, the females were more interested in adopting this service and say positive things about it than the male population. Another aspect that plays an important role is age, young consumers perceive high levels of innovativeness making them more likely to use drone food delivery services.

The term MCI (Motivated Consumer Innovativeness) was used by Hwang et al. (2019a) as a combination between internal and external factors and the consumer's tendency to have preferences over some products/services. They found out that MCI had a direct influence on behavioral intentions, meaning that if consumers perceive high levels of MCI, they would be more likely to use drone food delivery services. In addition, when they perceive that this service offers excitement and stimulation, there would be a positive attitude towards using it. On the contrary, if there is not enough information, there would be a time and performance risk perceived by the consumers since they would need to spend time learning how to use drone food delivery services.

Another theory used in understanding why consumers decide to adopt innovative technology is called "Diffusion of Innovation" (DOI). This theory is often used in communication and information systems research and focused on how customers' perception that an innovative product/service is far superior than the traditional one might persuade their decisions in choosing the innovative product/service (Yoo et al., 2018).

2.5.2.3 Area of residence:

There is another aspect which is important to understand about people's attitude and preferences towards drone delivery; according to Yoo et al. (2018) the area of residence affects the attitude related to drone delivery. Consumers in the rural areas are more likely to use environmentally friendly technologies; on the other hand, consumers in the urban areas are as equally concerned about the environment but less supportive of activities related to it.

High population density, tall buildings and houses close to each other are characteristics of urban areas (Ratcliffe et al., 2016). In general, urban residents live in apartments and a drone drops parcels on a designated point near the apartment, therefore these consumers are less sensitive to private exposure.

Meanwhile, rural residents who live in detached houses are more concerned to privacy issues since a drone may drop the parcel to an inner space or yard of their houses.

2.5.2.4 Noise perception:

By definition, noise is considered as an unwanted sound. In the case of drones, sound comes from vibrations and aero-acoustic interactions; however, the sound decreases by 6dB every time it doubles the distance in a free-field area (Watkins et al., 2019).

Although the presence of a drone or group of drones together may produce a level of annoyance, according to Watkins et al. (2019) it will probably be perceived different depending on people's order. For example, if the person is waiting for a much-awaited medical product, the noise will be perceived as an announcement of this awaited item reaching its destination, meaning that it will cause a feeling of excitement or relief. In conclusion, it can be said that perception of the noise is subjective.

In order to further clarification, it is important to point out that drone noise and perception of it are still new areas of research; in fact, the same concept can be applied to other industries. If we analyze the car industry, regarding soundscape we will find people expressing a desire for a quiet car but we will see the oppose scenario when people are looking for a sportive car and expect some acoustic load when accelerating.

An additional idea regarding noise is that if silent electric cars pose a safety concern for people walking on the streets, then it could also be said that entirely silent drones would also pose different risks in similar ways.

2.5.3 Practice

As shown before, there is a vast number of applications for drones and different companies currently using them. In this section, this research will briefly remark some of the main companies which are currently in the drone delivery business and comment on their projects. From big companies like Google or Amazon to small entrepreneurs like Airbus who has found a niche for their deliveries. These companies are the proof of what's being done and what's to come in the next few years.

2.5.3.1 Companies over the world:

Currently, the use of drones is related to agriculture (spraying products on the fields), construction (as in aerial-mounted photographic equipment), television and military. Less common applications are related to delivery of lightweight freight such as drugs, these products are transported for limited distances where road access is limited. Companies like Amazon, Walmart, UPS and Royal Mail are investing in the development of a drone delivery service (Watkins et al., 2019).

The expectation of people for having drone delivery service has increased due to the cases of success in countries like Japan, Korea, New Zealand and others, where drone food delivery testing was done (Hwang et al., 2019a). Within these cases in the industry we can find, for example in Korea, Yogiyo successfully completed a series of tests using drones for its food deliveries (Hwang et al., 2019a).

A well-known company like Amazon has a program for drone delivery within a radius of 10 miles called Amazon Prime Air, companies like Intel and Disney are replacing aerial fireworks with drones; furthermore, Zomato acquired a company called TechEagle in order to start with the food delivery by air (Hassija et al., 2020). There are a few more successful cases such as the firms below:

- **Zipline:** This company has been making drone deliveries of life-saving medical supplies since 2016 by making a partnership with the government of Rwanda. They started carrying blood, plasma and platelets from a depot they made to the different medical facilities (TechCrunch, 2020). Later they expanded to Ghana and currently after being approved by the FAA they will be allowed to make deliveries of medical supplies and protective equipment to hospitals in North Carolina, US (BBC, 2020).
- **Uber Eats:** Being one of the biggest companies in the food delivery industry, they created a division for drone delivery called "Uber Elevate" where a drone can carry a meal for two people. They announced that they were planning to start delivering food by drones in the year 2021 (Forbes, 2018). So far, they have been making many successful tests where they deliver food from McDonald's near San Diego State University (NBC, 2019).
- **Airbus:** With the help of doing a partnership with Wilhelmsen Ships Services (a worldwide company dedicated to maritime logistics) they created the Skyways drone for delivering parts and supplies from shore-to-ship, in the country of Singapore (Airbus, 2019). These UAVs carry the goods from the pier and do autonomous flights to the vessels, a trip of around 2 km in ten minutes. Airbus is planning to start tests in urban areas, having done a partnership with the National University of Singapore (Newatlas, 2019).
- **Google:** After many years of trials, Project "Wing" of Google started doing drone deliveries to the community of Canberra in Australia. These drones deliver small parcels which are lowered into the client's yard using a string (BBC, 2019). Currently they are also working in the city of Logan (Australia), Helsinki in Finland and Virginia in the U.S. after getting certification from the FAA (Digital Trends, 2020).
- **DHL:** The "Parcelcopter" created by this German company is able to make fast deliveries of vital medical supplies (like blood and laboratory samples) to hospitals in an island in Lake Victoria, Tanzania. This parcelcopter is able to flight 60 km in 40 minutes, a trip that would

take more than six hours by road due to the difficult terrain, saving many lives of people needing urgent medicines for snake's venom, among other things (DHL, 2018).

One of its best features is that this UAV needs little infrastructure since it can take off and land vertically. Lately in 2019 DHL joint forces with drone company EHang to operate their last-mile delivery drones in urban areas of China (Air Cargo News, 2019).

- **UPS:** In 2019 they were given permission by the FAA to deliver medical packages after one year of test flights of health care supplies (blood samples, tissues, etc.) in North Carolina, U.S (NY Times, 2019). In April 2020, they partnered with DroneUp and due to the coronavirus pandemic, multiple deliveries were done in a short period of time, almost every 3 minutes (Dronelife, 2020).
- **Flytrex:** In Iceland, Flytrex provides service for customers to deliver food using drones without having to visit an actual store (New York Post, 2017). After their successful debut in 2017, the next year they partnered with drone company EASE Drones and started operations in a golf course in North Dakota, US (UAS, 2020).
- **Flirtey:** Perhaps this company is the most representative of drone delivery due to its operations and alliances. They started in 2016 in the US doing deliveries from store to home after a partnership with 7-eleven. In Australia, a partnership with Zookal (a textbook rental company) made possible the delivery of textbook by drones within 2 km radius. Flirtey also delivered medical supplies to a free clinic in Virginia (Welch, 2015). In addition, they were also known by their partnership with Domino's in New Zealand where they did pizza deliveries ("Domicopter"). Currently in 2019 they have developed a new drone called "Eagle" with the goal of making ten minute deliveries from restaurants to customers (Avionics, 2019).

As seen above, many companies are investing money and resources in the implementation of drone delivery, hoping to increase the level of public acceptance by proving the importance of a fast, accurate and good delivery. In addition, some researchers like Wang et al. (2016) proposed that making drones more sensitive to society could raise the level of acceptance; in other words, they would have to be approachable and easily identifiable. There is also the idea of opening a public debate on how to properly use drones in the airspace (Kellermann et al., 2020), though this approach would require the participation of citizens, government and all the stakeholders in order to reach common understanding.

2.6 Logistics implications: an overview

The prospect of replacing the gasoline/diesel requirements of a delivery vehicle with a battery-powered drone can provide multiple benefits in costs and productivity. In terms of food delivery, it is automatic, the path that the drones follow is designated by a computer so the risk associated with air traffic or accidents is

very low (Hwang et al., 2019a). In addition, in order to develop multi drone operation, the drone must have an autonomous or semi-autonomous system, which would reduce risks that are caused by human operator performance (Watkins et al., 2019).

2.6.1 The Vehicle Routing Problem with Drones (VRPD):

In this type of documents, the literature addresses the routing of vehicles for delivering goods as routing problems (RP). The RP includes characteristics like pickup and delivery, trip simulations, depots, interval of times in which each delivery is done, among others.

Unfortunately, the main problem with drone delivery is regarding its loading capacity and flying range, which is why it's necessary for the drone to work together with a truck in order to be more efficient (Wang & J.B. Sheu, 2019). This way, a drone would do its delivery while the truck performs its route.

One possible solution for this problem is establishing full-time hubs for drone delivery services, in which drones can deliver goods by a parachute airdrop and launching the drone from a stationary truck. By doing this, the trucks would be able to carry drones besides their regular deliveries and pick them up at their designated hubs.

In their article, Wang and J.B. Sheu express the problem between using trucks and drones:

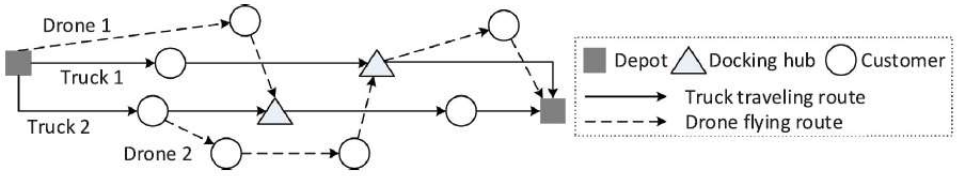

Figure 2.2. An example of the VRPD

Source: Z. Wang and J.-B. Sheu/Transportation Research (2019)

According to the graph (figure 2.2), a drone can do many flights and landings and be associated with a different truck each time. At the same time, a truck can receive and launch at different times and locations. This integrated routing is referred as the VRPD (Vehicle Routing Problem with Drones).

It is important to point out how relevant speed issues can be. The speed of UAVs in relation to the trucks influence the way the deliveries are done since a certain level of synchronization is required, because the drone will have to wait for the truck after the delivery is performed and there is a limited amount of time the drone can wait, therefore is another issue related to the VRPD.

2.6.2 Landing and docking hubs:

It is important to point out that only a docking hub or a depot can receive a landing drone. The reason for that is due to the special conditions that are needed for the drone to land, exchange information and set it up to the next delivery (Hern, 2014).

In their study, Wang and J.B. Sheu ran some tests using truck-drone delivery and found that this service can not only reduce the logistics cost but provide better service for customers regarding time of delivery.

Another study supported by Hanshin University Research Grant was done by Y.S. Chang and H.J. Lee (2018) in which they developed a model and performed 30 exercises with 30 delivery locations, confirming not only that delivery by drone is more effective, but also that the operating cost is also lower than trucks.

A drone may travel with a truck, take off from its stop to serve customers, and land at a service hub to travel with another truck as long as the flying range and loading capacity limitations are satisfied. Routing trucks and drones in an integrated manner is what makes the VRPD.

2.6.3 Flight time and battery duration:

One of the issues to be concerned about is related to the flight time, since the battery that powers them have low endurance, which is around 10-60 minutes depending on the payload (Watkins et al., 2019), this situation also restricts drone delivery service in distance and/or height.

According to Hassija et al. (2020), there are several works on how to extent the drone flight time by recharging methods; however, they are based on predictive analysis which is probabilistic or sensor data which is highly expensive. A distributed framework for drone charging is needed, one that is effective and accurate. In their study, they proposed a network of charging stations where drone could be charged depending on mileage, criticality of the charge requirement, price and other parameters that could lead them to the best suitable charging station, in their model, they also considered how to maximize the station's revenue by an appropriate scheduling of charging drones.

Currently, smart energy management have become an important subject to improve. Different researchers are doing simulations on how to increase battery duration and improve charging efficiency for drones. In other words, not only the focus is for the drone flight to last longer, but also for the battery charging time to be shorter. For example, in the case of swarms of drones, they are developing an algorithm that can make a drone with a higher priority be recharged instead of one with a lower priority.

2.6.4 Government regulations:

Regulatory institutions could be a limitation for this service in the future, there are different opinions on how this type of drones should be regulated and which institutions would be entitled to regulate them (West et al., 2019). Furthermore, Watkins et al. (2019) stated that the limitations of drones are related to regulatory

restrictions directly connected to public's acceptance and integration, battery endurance, strong weather conditions which limits the effectiveness of the sensors, obstacles such as buildings.

The situation is a little different in countries like UK, Austria and US which are more developed. In there, a certificate recognized by the Federal Aviation Administration must be acquired by the company or person doing operation with remotely piloted vehicles, which of course, includes drones (Watkins et al., 2019). Furthermore, it is important to inform that since 2015, the situation in the U.S. for companies willing to use drones for commercial purposes is that they must fulfill the following requirements (Welch, 2015):

- Submit an application for the Federal Aviation Administration (FAA) where they basically indicate the drone's specifications and ask for permission to operate.
- Drone operators must get a pilot's license and pass a medical exam.
- Permission to fly for each operation must be requested 2 days in advance.
- Flights are limited to less than 35 mph and below 300 feet.

The FAA mission is to ensure an efficient and safe aerospace, which is why it has been working with some of the companies below for supervision, control and improvement of the drone technology. In fact, there is a Code of Conduct created by the Unmanned Vehicle Systems International, which is the association that represents the drone industry in the United States. It is also important to mention that the GPS system in the drones does not allow them to enter restricted areas (Park et al., 2018).

Following the previous information, these are examples of some of the restrictions that were done by governments across Europe, USA and Australia regarding the operation of drones:

- They cannot operate near people who are not associated with the operation.
- There is a limit on how heavy a drone can be (2-25 kgs aprox.).
- There is a limit on how high a drone can fly (120 m aprox.).
- A pilot can only operate one drone at a time.
- Drones without pilots are, by default, not allowed.

These are just some of the regulations that can be found in some countries. There are also 16 countries where the commercial use of drones is not permitted or the regulations are so strict that it is practically impossible to follow. In places like Korea, drones are permitted as long as they do not leave your sight and in 27 countries drones can fly out of sight following some measures or adopting government approval like in the US (Park et al., 2018).

2.6.5 Price

Even though there is not much information about pricing of drone delivery, it is an important factor since the price of a product/service has an important influence in the consumer's decision to buy. The way that consumers perceive price has a meaning and it also gives information about a product/service (Kotler &

Keller, 2016). In fact, when it comes to last mile delivery for online retailers, the delivery part is a factor that determine consumer's loyalty and shipping fees directly affects the order and size of the purchases (Lewis, 2006).

2.6.6 The key to success:

As seen before, there are many factors influencing drone delivery service; regarding the logistics process for this service to become successful, a recent study done by Raj, A. and Sah, B. (2019) showed three main aspects that need to be worked on and improved:

a) Technological development: drone must reach a point where they are considered fully safe and not prone to errors.
b) Government regulations: to make sure that drone delivery comply with the law and there are no legal or political issues regarding their performance.
c) Skilled workforce: there different aspects related to drone logistics need to be handle by an expertise group. We are referring to aspects such as routing, obstacle avoidance and others.

Final Remarks

The objective is to measure the level of public acceptance towards drone delivery service, in order to achieve that, it is necessary to answer the sub-questions that were mentioned in the first pages of this research. The following is the criteria to match the literature review in order to achieve the objectives:

In the following table (table 2.2), the aspects of drone delivery service seen in the literature review are shown:

Table 2.2. Drone delivery aspects considered for public acceptance in the existing literature

Drone delivery aspect	Study	Methodology	Drone delivery variable(s) in focus	Effects on public acceptance
Public awareness	Aydin (2019).	Online survey 153 participants - Pareto analysis. Mann-Whitney. ANOVA. Independent t-test	Commercial, public safety, hobby, scientific applications	Affect public acceptance.
	Reddy and DeLaurentis (2016)	Empirical study - opinion survey 535 participants. Multinomial logit model.	Risks, applications, environment and benefits	Have strong impact on perception of drones

Benefits of drone delivery	Joerss et al. (2016)	Empirical study – survey 4,700 participants	Delivery speed	Increase consumer satisfaction|
	Mohamed et al. (2020)	Empirical study – literature review and discussion	Drone accuracy and targeted actions	Enhance productivity and efficiency
	Lee et al. (2016)	Empirical study – literature review and discussion	Ability to reach difficult places	Increase consumer satisfaction
	Stolaroff et al. (2018)	Simulations truck and drone delivery	Environmental impact	Positive attitude to adopt
	Joerss et al. (2016)	Empirical study – survey 4,700 participants	Environmental impact	Positive attitude to adopt
	Goodchild and Toy (2018)	Simulations trucks and UAVs CO2 emissions	Environmental impact	Positive attitude to adopt
	Chiang et al. (2019)	Simulations drones CO2 emissions and cost	Environmental impact	Positive attitude to adopt
	Park et al. (2018)	Simulations UAV and electric motorbikes, energy consumption	Environmental impact	Positive attitude to adopt
Concerns about drone delivery	Soffronoff et al. (2016)	Empirical study – online survey 1,465 participants. Traditional statistics tests	Invasion of privacy	Decrease level of trust in drone technology
	Watkins et al. (2019)	Empirical study – literature review	Invasion of privacy	Cause negative attitude
	Zhu (2019)	Empirical study – national survey 474 participants. Confirmatory factor analysis. Correlations. Covariate analysis.	Malfunction	Cause negative attitude

	Watkins et al. (2019)	Empirical study – literature review	Drone noise	Differs depending on necessity
	Yoo et al. (2018)	Empirical study – national survey 296 respondents. Factor analysis. Multiple regression analysis. Correlations.	Criminal and illegal use	Negatively affect public acceptance
	Zhu (2019)	Empirical study – uses national survey 474 participants. Confirmatory factor analysis. Correlations. Covariate analysis.	Criminal and illegal use	Negatively affect public acceptance
Preferences towards the service	Kotler and Keller (2016)	Book	Price perception	Affect intention to use
	Lewis (2006)	Empirical analysis. Covariate. Correlations. Elasticity.	Customer adquisition Shipping fee and prices	Influence order incidence and expenditure

CHAPTER 3

Methodological framework

In this chapter, the research framework will be pointed out with the conceptual model developed to answer the research questions. Then, the methodology for the study will be explained and finally, the survey designed will be described.

3.1 Research Framework

A theoretical framework was developed including some hypotheses to answer the research questions within the scope of the city of Lisbon. For this, the final remarks on the literature review was considered. Following this idea, it is necessary to identify how much people know about this new technology, how they perceive its advantages and disadvantages and what determines their intention to use it in the future.

This research's goal is to understand the attitude of people towards drone delivery and what kind of impact would it have on the adoption of this delivery service. Furthermore, the present study also plans to understand the e-commerce behavior and preferences of future consumers. This way, the researcher will be able to develop a user's profile for drone delivery service.

In order to obtain results conclusive enough for the research questions, 7 hypotheses were developed as a guideline for the study.

Consumer awareness

In the literature review, it is shown that there is a lack of knowledge and awareness regarding most drone applications (including drone delivery). In general, people are not that familiar with drones other than military and surveillance applications, which is why it is important to measure this in the research. In other words, how much do people know about drone delivery and if this factor will affect their attitude and adoption of technology. The following hypothesis was created:

H1: Awareness about drone delivery services has a positive impact on the intention to use drone delivery services.

Perception of benefits

This topic will analyze the level of agreement of people regarding the expected benefits of drone delivery service and which attributes they would value more. Regarding the factors that have an impact in the future adoption of the technology, it is important to analyze each variable within the perception of benefits and their relationship with attitude towards drone delivery. As seen in the literature review, analyzing the perceived benefits is an important part to determine the level of acceptance towards a new technology, therefore the following hypothesis was created:

H2: Perceived benefits of drone delivery services has an impact on the attitude towards drone delivery services.

Perception of concerns

This part is in line with the previous hypothesis, this topic will reveal the level of agreement of people about the potential concerns of drone delivery and which one could be considered as barriers for adoption. Following the concept of perception, the variables for perception of concerns also needs to be analyzed. A hypothesis was created:

H3: Perceived concerns of drone delivery services have a negative impact on the attitude towards drone delivery services.

Attitude and intention to use

The intention to use a technology is influenced by the attitude towards that technology (Davis et al., 1989), which in this case, attitude is considered to be determined by how much the people know about it, what kind of use and where it would be used (Klauser & Pedrozo, 2017; Aydin, 2019), in other words, the knowledge, perception and practice related to this new technology. The "intentions" of a person is bound to be more consistent when a person considers the ups and downs of a certain behavior or attitude (Bagozzi, 1981). For this, the following hypothesis was created:

H4: Attitude towards drone delivery services has an impact on the intention to use drone delivery services.

The following hypotheses (H5, H6 and H7) were created to complement the information above. Since people who drive a vehicle tend to be more sensitive to the road congestion problems, it is necessary to investigate whether they are more receptive of the benefits regarding drone delivery. Thus, the following hypothesis was elaborated:

H5: Perceived benefits have a positive impact on people with driving license.

In some cases, gender has an influence when adopting a new technology (Hwang et al., 2019b), with that in mind, the researcher developed H6 in order to find out if the level of awareness is different between males and females perception:

H6: Gender has an impact on the level of awareness.

As seen in the literature review, the area of residency could play a role when it comes to privacy issues, which is why it is important to investigate if the concerns are perceived differently depending on the location where people live. Therefore, the following hypothesis was created:

H7: Area of residency has an impact on perceived concerns.

A conceptual model was developed including the factor that affect attitude towards drone delivery, which influence intention to adopt this new technology. The variables considered are awareness, perception of benefits and perception of concerns (figure 3.1).

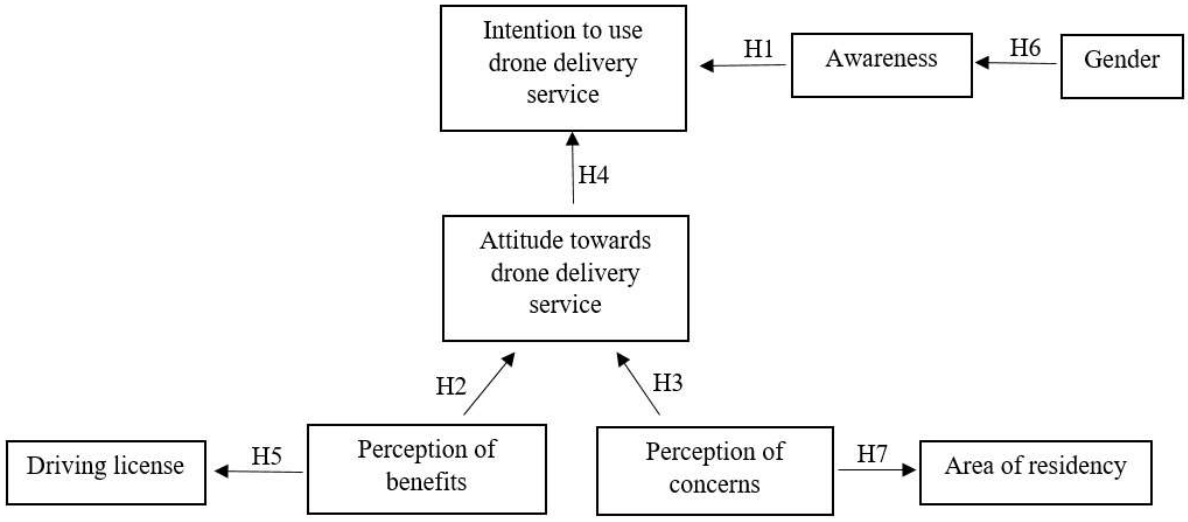

Figure 3.1. Conceptual model

3.2 Methodology

This study follows a quantitative descriptive research design, meaning that the acquired data will be measurable like numbers and statistics, which translates into a survey to explore the people's view on drone delivery service. The study is using a descriptive approach, which according to Myers and Rothman (1995) is used to understand from the respondents, their attitude about a phenomenon in question. This type of method is based on statistical information, using objective variables and developing hypotheses to be tested. These variables are analyzed with questionnaires in order to find out the existence of relationship among them. As a mean to measure the results in an objective way, these quantitative research use hypotheses as the base, which are to be validated or rejected (Wainer, 2017).

The instrument chosen for the methodology was a web survey. The reasons for choosing this method was due to its many advantages such as it does not require the presence of the researcher to collect the responses, it is faster and cheaper than phone or presence surveys (Malhotra & Birks, 2006). In addition, it is more environmentally friendly because it involves less or none printing and the non-presence of the interviewer gives it no bias. However, there are a few downsides about using this method; for example, a person answering the questionnaire can easily quit before finishing it.

Even though there are limitations for this type of survey, it is considerable cheaper than normal methods; furthermore, nowadays most people have access to the internet and it is fast to reach a large quantity of respondents in a short period of time.

For each analysis of the variables, a normality test was done to determine whether parametric or non-parametric method was appropriate to use. In order to validate the hypothesis mentioned before, different tests were done for the analysis of the data: ANOVA, t-test, Kruskal-Wallis, Mann-Whitney, PCA, reliability, factor analysis and correlations (Yin, 2003).

Reliability and validity

Heale and Twycross (2015) said that "Validity is defined as the extent to which a concept is accurately measured in a quantitative study", meaning that this survey must be able to fully measure the level of acceptance regarding drone delivery service. The conceptual model will ensure the validity of the survey, giving accuracy for the questionnaire to measure what it is supposed to measure. In the case of reliability, it refers to how consistent the tool for research is (Heale & Twycross, 2015). In order to make sure that the survey was reliable enough, it was tested before launching it.

3.3 Survey design

Variable scales

During the development of the survey, different types of variables were used; in consequence, there were different types of scales.

The survey includes a few nominal variables like gender, academic background, employment status and one dichotomous questions (Yes/No). In addition, there are some ordinal variables such as age, income, among others; however, the majority were scale variables which were non-comparative with itemized scoring represented as 5 categories Likert type because they are more appropriate for measuring attitudes and opinions (Malhotra & Birks, 2006), in concordance with this study's objectives.

For the questions that required the respondent to rate their opinion regarding a sentence, the following scale was used:

1	2	3	4	5
Strongly Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly Agree

Figure 3.2. Likert Scale

Questionnaire Structure

The aim of the questionnaire is to gathered information related to general perception and intention to use drone delivery service. In order to do that, the questions will be aiming to find out about the awareness that

consumers have of drone delivery, their perception concerning this new type of delivery and their future preferences towards it.

After doing a pre-test, the final web survey is structured into 4 parts and it can be found in Annex A. There was a total of 19 questions, all of them mandatory. Moreover, the questions were divided in 4 pages, each related to a different topic(s), giving more order and focus to the respondent answering the questions.

The first part called "E-commerce behavior" includes the respondent's frequency and habit regarding online purchases. Since the people using drone delivery service are people who buy online, these questions serve as filters for determining the real potential customers for this service. In addition, it also measures their satisfaction with current e-commerce deliveries by using a Likert Scale of 1-5, where "1" means very dissatisfied and "5" means very satisfied. Then, it measures the level of awareness regarding drone delivery by using a Likert Scale of 1-5, where "1" means strongly disagree and "5" means strongly agree.

The second part asks about consumer perception using the same Likert Scale 1-5 from the previous question. This covers aspects related to the benefits and concerns about drone delivery. These questions also work for raising awareness since there might be features or characteristics of drones that people are not familiar with, which may help them deciding on their answers.

Part three of the questionnaire contains questions regarding the preferences and expectations future consumers might have towards it. In this section, the participants are asked about what type of products would they be willing to receive by drone delivery and how much would they pay extra for it. Furthermore, they are asked a few questions in the previous Likert Scale 1-5 concerning their intention to adopt or try this service.

Finally, the fourth part includes the demographics of the participants, according to the advice of Kothari (2004) to leave these type of questions for the end. Following the same author's idea, the questionnaire was made short and simple in order to make it successful.

The following table (table 3.1) shows the statements that were used in the survey to measure the constructs from the research framework:

Table 3.1. Constructs and Items

Construct		Item
Awareness	**A1**	I am aware that drones can be used for delivering small products.
	A2	My first reaction when hearing about drone delivery service is positive
	A3	I am familiar with how a drone works
	A4	I am familiar with the use of drones in the area I live.
	A5	I am aware that drones have more applications other than military use
	A6	I have used a drone before.

	A7	I am aware that some big firms like Amazon, Google and Uber have started implementing drone delivery service in some countries.
Perception of benefits	**B1**	I can have my products delivered faster than any other means of
	B2	I can have my products delivered precisely at my exact location.
	B3	Drones can reach places where road transport can't reach.
	B4	Drone delivery will reduce road congestion.
	B5	Drone delivery is more environmentally friendly than traditional delivery methods.
	B6	Drone deliveries will be beneficial for people living in remote
Perception of concerns	**C1**	I feel concerned about drones trespassing my property.
	C2	Drone delivery will lead to a loss of privacy for me.
	C3	Drone delivery might not be used in a way that respects my privacy.
	C4	I think the drone might break during the service.
	C5	I am worried about the possibility of the package being damaged while it is transported.
	C6	I am worried about the possibility of the package being violated or stolen by others.
	C7	I am worried that drones will be very noisy.
	C8	I am worried that drones will reduce the view to the sky and the environment.
	C9	I'm worried that drones can hurt people.
	C10	I'm worried that drones could be used for illicit business.
Attitude towards drone	**D1**	I feel motivated to try a new technology as a drone delivery.
	D2	I believe drone delivery service will have a positive impact on the logistics industry.
	D3	I think drone delivery services will increase soon.
	D4	Drone delivery service is (will be) enjoyable.
	D5	I think that using drone delivery is a good idea.
	D6	I think drone delivery service will fail and won't be accepted in the future
	D7	I don't feel safe having drones delivering my products.
Intention to use	**E1**	I think drone delivery is an innovative technology and I feel excited to try it.
	E2	I would use drone delivery to receive my order.
	E3	Using drone delivery to receive some products is something I would use.
	E4	I could see myself using drone delivery service to receive my package.
	E5	I intend to use drone delivery service in the future immediately when they will be available.
	E6	I intend to use drone delivery services in the future but after they are available and tested for some time in the market.
	E7	I (will) have the knowledge necessary to use drone delivery services.

CHAPTER 4

Data analysis

In this chapter, the analysis of the data will be explained. This will include topic such as the data collection process and the sample description.

4.1 Sample composition

4.1.1 Data collection process

The data collection for this research was primary and it was done through a quantitative web-based survey. The questionnaire was conducted using the online platform Google Forms during a total of 19 days, starting from August 08 to August 26.

In order to confirm the reliability of the survey, improve the quality and find any possible errors like wording or content (Cooper & Schindler, 2013), a pilot survey was tested with 30 random participants. After getting the results and feedback from the participants, a few adjustments were made. The final version of the survey had a Cronbach's alpha above 0,7 per group of variables, which is recommended for exploratory research (Nunnally, 1978).

The survey was promoted mainly through social media (Facebook and Linkedin), email and the questionnaire's link was also sent to personal contacts of the researcher which resemble the target. Moreover, personal contacts were asked to re-sent the link to more people within the target in order to increase the quantity of respondents.

The secondary data included information about drone applications, functionality, perception and which companies are currently investing and developing this technology. This information was presented in the literature review and it was retrieved from different sources like reports, journals, books and scientific articles. Since this topic is relatively new, there are not many scientific sources.

4.1.2 Sample description

The study was done for the city of Lisbon but it was not restricted to Portuguese only because foreigners make up around 9,3% of Lisbon's total inhabitants (INE). The target population in this research are adults living in the city of Lisbon between the ages of 18-54 years old because according to an article published in Eurostat (2020), the users of e-commerce within the European Union between 2009-2019 belonged to the age group mentioned. Moreover, young people and people with high education make the largest number of internet users (European Commission, 2019).

A non-probabilistic sampling was chosen taking into consideration the time and resources available; besides, it was considered appropriate for the collection of information over the internet in a fast way. In this technique, the elements to be included in the sample can be chosen arbitrarily or consciously by the

person doing the research (Malhotra & Birks, 2006). Because of this, the selection of elements was done as convenience and snowball sampling. The sample obtained was representative, therefore it can be generalized to the population.

The total amount of respondents was 318, some of the answers had inconsistencies which is why they were removed; in addition, some of the respondents did not fit into the target profile, therefore they were also disregarded, leaving a final sample size of 303 participants.

Within the characteristics of the sample, it was based on some general aspects as age and gender but also other specific aspects like driving license and number of cars available in the household. These aspects were considered in order to contribute to the study with all the relevant information. From the sample, 48% were female and 51,6% were male, which is very similar to the population of Portugal. The majority of respondents came within the age group 25-44 years old and 69,4% of the respondents were currently fully-employed. The results are as shown in table 4.1.

Table 4.1. Description for respondents' demographics

Demographics		**Number of respondents**	**Percentage**
Age	18-24	29	9,6%
	25-34	145	47,9%
	35-44	61	20,1%
	45-54	41	13,5%
	55-65	22	7,3%
	65+	5	1,7%
Gender	Male	146	48,2%
	Female	157	51,8%
Education	Primary/secondary	0	0%
	High school	4	1,3%
	Technical school	38	12,5%
	Bachelor's degree	142	46,9%
	Master's degree	111	36,6%
	PhD	8	2,6%
Employment	Fully-employed	210	69,3%
	Part-time employed	11	3,6%
	Student	29	9,6%
	Retired	11	3,6%
	Currently unemployed	18	5,9%
	On lay-off	7	2,3%
	Other	17	5,6%
Monthly income	Less than 500 €	22	7,3%
	501-1000 €	62	20,5%
	1001-1500 €	85	28,1%

	1501-3000 €	86	28,4%
	3001-5000 €	38	12,5%
	More than 5000 €	10	3,3%
House building	House	107	35,3%
	Apartment	197	64,7%
Area of residency	City center	114	37,6%
	Urban environment	156	51,5%
	Suburban environment	28	9,2%
	Rural environment	5	1,7%
Driving license	Yes	225	74,3%
	No	78	25,7%
Cars available	0	71	23,4%
	1	130	42,9%
	2	65	21,5%
	More than 2	37	12,2%
	Total respondents	303	100,0%

Regarding educational level, 86% of the respondents have a high level of education which represents the majority; in addition, 69% are fully employed and have a monthly income of more than 1000 €. This means that the majority of respondents are people with consumer buying power and able to understand the functionality of drone delivery service.

Another aspect to consider about the sample is that 51,6% of the respondent live in the urban environment and 37,5% live in the city center. In addition, 64,8% of them live in apartments and the majority of respondents have at least one car available in their household. These details will be important when analyzing the behavior of the respondents according to the results presented in the next chapter.

CHAPTER 5

Results and discussion

Once the data was collected from the web survey (Annex A), it was downloaded in an Excel version, all the answers were revised and checked for completion and consistency. The variables were classified in nominal, ordinal or scale according to their characteristics. For every variable, the phrases were converted into numbers; for example, the ordinal Likert scale was coded into a numeric scale by assigning numbers from 1 to 5. After coding the excel file, it was ready to be exported to SPSS 27 (Statistical Package for the Social Science) which was the program used to perform the cross tabulations. After analyzing the results, conclusion will be drawn.

As seen in table 5.1, there was zero excluded cases from the respondents for all categories, meaning that all the questions were answered and the questionnaires completed.

Table 5.1. Case processing summary

	Cases	**Percentage**
Valid	303	100%
Excluded	0	0%
Total	303	100%

Descriptive statistics of the statements related to awareness are shown in table 5.2, where the highest means belonged to A5 (I am aware that drones have more applications other than military use) and A2 (My first reaction when hearing about drone delivery service is positive) compared to the other groups of statements, these statements have also the lower standard deviations, meaning that the values in that set are closer to the mean. On the other hand, the lowest mean belongs to A6 (I have used a drone before) with the highest std. deviation, reflecting a large amount of variation in that group.

Table 5.2. Descriptive statistics of awareness

Awareness - Statements	**Mean**	**Median**	**Std. Dev**	**Min**	**Max**
A1. I am aware that drones can be used for delivering services.	3,95	4,00	1,002	1	5
A2. My first reaction when hearing about drone delivery service is positive.	4,03	4,00	0,853	1	5
A3. I am familiar with how a drone works.	3,55	4,00	1,078	1	5
A4. I am familiar with the use of drones in the area I live.	2,75	3,00	1,217	1	5

A5. I am aware that drones have more applications other than military use.	4,13	4,00	0,980	1	5
A6. I have used a drone before.	2,35	2,00	1,427	1	5
A7. I am aware that some big firms like Amazon, Google and Uber have started implementing drone delivery service in some countries	3,65	4,00	1,262	1	5

Note. Std. Dev = Standard deviation

Following the analysis, table 5.3 shows the descriptive statistics of the expected benefits. As seen, all the statements have a high mean (above 4,0), which shows a high level of agreement to these facts, given that the maximum value is 5. Most of these statements have a low standard deviation below 1,0 except from B4 (Drone delivery will reduce road congestion) with value of 1,144 which shows the variation in that group of data is higher compared to the other groups of statements.

Table 5.3. Descriptive statistics of expected benefits

Benefits - Statements	Mean	Median	Std. Dev	Min	Max
B1. I can have my products delivered faster than any other means of transport.	4,06	4,00	0,869	1	5
B2. I can have my products delivered precisely at my exact location.	4,21	4,00	0,876	1	5
B3. Drones can reach places where road transport can't reach.	4,43	5,00	0,764	1	5
B4. Drone delivery will reduce road congestion.	4,11	4,00	1,144	1	5
B5. Drone delivery is more environmentally friendly than traditional delivery methods.	4,20	4,00	0,935	1	5
B6. Drone deliveries will be beneficial for people living in remote regions.	4,31	5,00	0,855	1	5

Note. Std. Dev = Standard deviation

Table 5.4 shows the descriptive statistics for the statements regarding concerns. All the statements have a low mean and a standard deviation above 1,0, which represents a large variation in that data set. The concern C10 (I'm worried that drones could be used for illicit business) showed the smallest mean, while C8 (I'm worried that drones will reduce the view to the sky and the environment) showed the largest std. deviation, which show that the data is disperse over a wider range of values.

Table 5.4. Descriptive statistics of perceived concerns

Concerns - Statements	Mean	Median	Std. Dev	Min	Max
C1. I feel concerned about drones trespassing my property.	2,67	3,00	1,200	1	5
C2. Drone delivery will lead to a loss of privacy for me.	2,77	3,00	1,135	1	5
C3. Drone delivery might not be used in a way that respects my privacy.	2,66	3,00	1,080	1	5
C4. I think the drone might break during the service.	2,85	3,00	1,037	1	5
C5. I am worried about the possibility of the package being damaged while it is transported.	2,88	3,00	1,109	1	5
C6. I am worried about the possibility of the package being violated or stolen by others.	2,63	2,00	1,172	1	5
C7. I am worried that drones will be very noisy.	3,38	3,00	1,118	1	5
C8. I am worried that drones will reduce the view to the sky and the environment.	3,34	3,00	1,255	1	5
C9. I'm worried that drones can hurt people.	3,12	3,00	1,217	1	5
C10. I'm worried that drones could be used for illicit business.	2,18	2,00	1,037	1	5

Note. Std. Dev = Standard deviation

The information from the descriptive statistics of the attitudes towards drone delivery services (table 5.5) presents the same median value for all the groups; however, there is a high mean above 4,0 for the statements D1 (I feel motivated to try a new technology as a drone delivery), D2 (I believe drone delivery service will have a positive impact on the logistics industry) and D5 (I think that using drone delivery is a good idea), these groups of statements also present the lowest standard deviation, which show that the data within those groups is not very disperse, on the contrary, is very close to the mean which makes it reliable.

Table 5.5. Descriptive statistics of the attitudes

Attitude - Statements	Mean	Median	Std. Dev	Min	Max
D1. I feel motivated to try a new technology as a drone delivery.	4,14	4,00	0,850	1	5
D2. I believe drone delivery service will have a positive impact on the logistics industry.	4,19	4,00	0,765	2	5
D3. I think drone delivery services will increase soon.	3,62	4,00	0,989	1	5
D4. Drone delivery service is (will be) enjoyable.	3,96	4,00	0,829	1	5
D5. I think that using drone delivery is a good idea.	4,17	4,00	0,817	1	5

D6. I think drone delivery service will fail and won't be accepted in the future.	3,55	4,00	1,164	1	5
D7. I don't feel safe having drones delivering my products.	3,50	4,00	1,088	1	5

Note. Std. Dev = Standard deviation

In table 5.6, the same analysis for the intention to use drone delivery services can be seen. In general, all the statements have a high mean and low standard deviation. However, the statement E5 (I intend to use drone delivery service in the future immediately when they will be available) showed the lowest mean and the highest std. deviation (1,033) for this variable, meaning that from these group of statements, E5 has the highest spread among that data set.

Table 5.6. Descriptive statistics of the intention to use

Intention to use - Statements	Mean	Median	Std. Dev	Min	Max
E1. I think drone delivery is an innovative technology and I feel excited to try it.	4,17	4,00	0,820	1	5
E2. I would use drone delivery to receive my order.	4,09	4,00	0,792	1	5
E3. Using drone delivery to receive some products is something I would use.	4,10	4,00	0,784	1	5
E4. I could see myself using drone delivery service to receive my package.	4,05	4,00	0,817	1	5
E5. I intend to use drone delivery service in the future immediately when they will be available.	3,68	4,00	1,033	1	5
E6. I intend to use drone delivery services in the future but after they are available and tested for some time in the market.	3,99	4,00	0,906	1	5
E7. I (will) have the knowledge necessary to use drone delivery services.	3,79	4,00	0,944	1	5

Note. Std. Dev = Standard deviation

Reliability Statistics

In order to show that the group of statements are valid all together, table 5.7 shows the reliability analysis made for each segment analyzed and tested. Cronbach's alpha was higher than 0,75 for each category, making the results very reliable.

Table 5.7. Reliability statistics

Segment analyzed	Number of items	Cronbach's Alpha
Awareness of drone delivery	7	0,765
Perception of benefits	6	0,838
Perception of concerns	10	0,879
Attitude towards drone delivery	7	0,772
Intention to use	7	0,881

5.1 Consumers' habits

Before continuing with the results, it is important to understand who are the people that answered the questionnaire since it will give an idea of their profile, whether they are used to buying online and what are their preferences.

The first part of the questionnaire asks about the e-commerce behavior of the respondents; as seen in figure 5.1, 39% of the participants buy products online between 1-3 times per month, and 27% make online purchases at least once a week; in addition, 13% of the respondents answered "less than once a week", meaning that in total, 79% of the sample are regular e-commerce users. Fortunately for the survey, the majority of respondents were people who are used to purchasing products online to be delivered at a specific address, these respondents are the people who will be potential customers for drone delivery services and can answer accordingly to previous e-commerce experience.

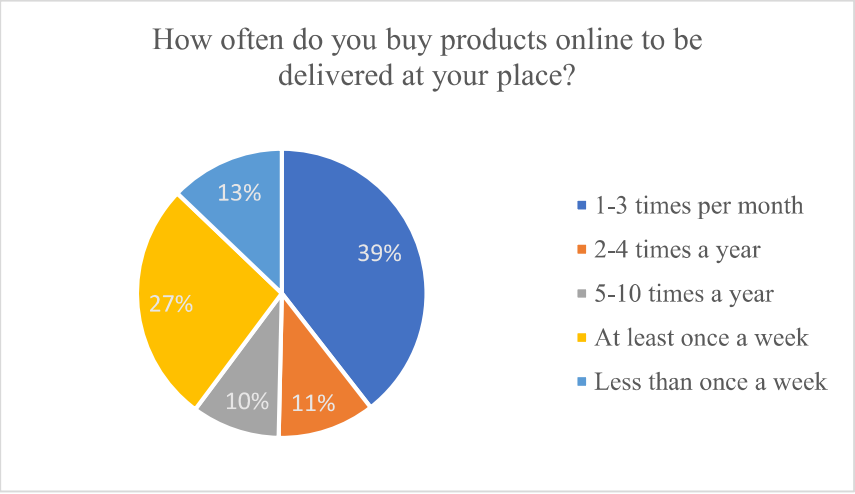

Figure 5.1. E-commerce behavior

Furthermore, when it comes to which products are usually bought online, the majority of respondents answered "food" and "clothes/shoes" as the main online purchases, while the least item for online purchase

was “valuable goods” (e.g., jewelry) and books, which can be found in figure 5.2. The reason behind this could be either the customers don’t have the intention to use delivery services for these products or that there is an issue with the current delivery service related to time, cost or service quality. This gives an idea of the possible market for drone delivery, since there is a great amount of food deliveries going in Lisbon.

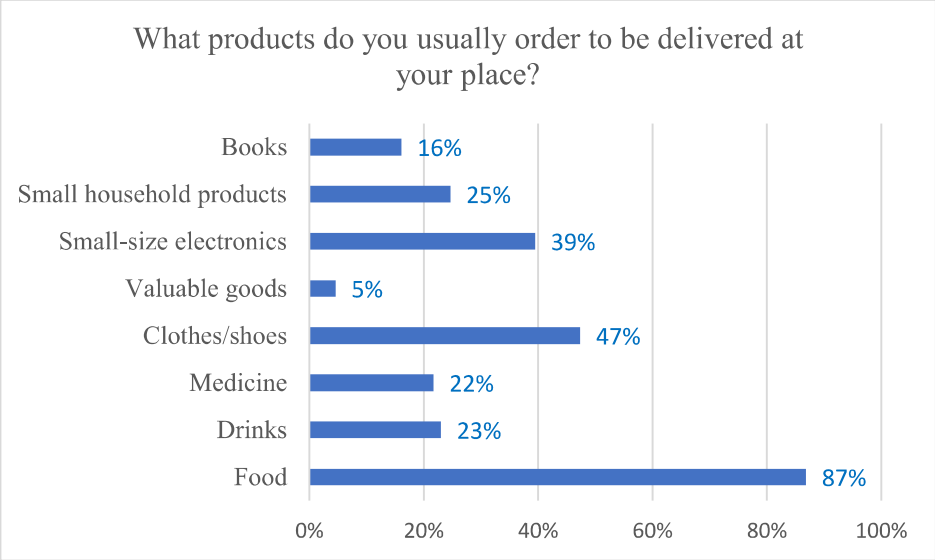

Figure 5.2. Frequent online ordered products

To complement the information above, figure 5.3 shows the current level of satisfaction regarding the delivery part of the online purchases of consumers living in Lisbon for the criteria of time to deliver the order, price paid for delivery and condition in which the order arrives. Regarding time and condition of the products, there is a high percentage of satisfied consumers, meaning that the distances are covered within the expected time and the products are being delivered in an acceptable condition. However, regarding the concept of price, there is an interesting 33% of respondents who are neutral and 21% who are dissatisfied with how much they are paying. This could represent an opportunity in which the strengths of drone delivery service could be used to take advantage of the consumers’ dissatisfaction.

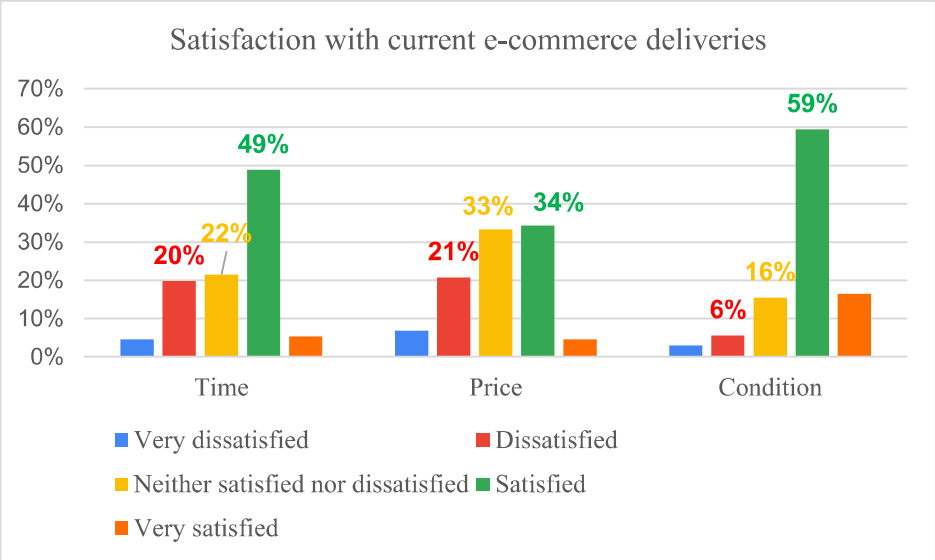

Figure 5.3. Current level of satisfaction

5.2 Impacts on attitude and intention to use

In order to measure the statistical association between two random variables, it is necessary to use the Pearson Correlation test, which gives information related to the magnitude of the correlation and the direction of the relationship (Rodgers & Nicewander, 1988). The correlation coefficient can vary between -1 to 1. In this study, it is necessary to determine whether the quantitative variables have a certain pattern or relationship so as to achieve the validation of the hypotheses.

Different authors have classified the correlation coefficient as small, moderate and strong. According to Cohen (1988), a value between 0 and lower than 0,3 can be classified as a low correlation, values above 0,3 and below 0,5 are considered as a moderate correlation and values equal or above 0,5 are classified as a strong correlation. If the value is negative, the relationship between the two variables are inversely proportional.

As shown in table 5.8 below, there is a positive and significant correlation between the level of awareness and the intention to use drone delivery services. This means that the more aware a person is about drones and drone delivery, the more willing they are to use the service, especially for the variable A1 (I am aware that drones can be used for delivering small products) and A2 (My first reaction when hearing about drone delivery service is positive).

Table 5.8. Impact of awareness on intention to use

Intention to use / Awareness	A1	A2	A3	A4	A5	A6	A7
E1	0,413**	0,420**	0,150**	0,034	0,203**	0,127*	0,266**
E2	0,373**	0,477**	0,204**	0,048	0,245**	0,121*	0,314**
E3	0,402**	0,446**	0,195**	0,010	0,267**	0,116*	0,277**
E4	0,379**	0,464**	0,197**	0,058	0,253**	0,134*	0,276**
E5	0,142*	0,295**	0,096	0,003	0,025	0,063	0,142*
E6	0,164**	0,223**	0,150**	0,053	0,187**	0,135*	0,270**
E7	0,284**	0,270**	0,199**	0,258**	0,334**	0,193**	0,251**
**. Correlation is significant at the 0,01 level (2-tailed). *. Correlation is significant at the 0,05 level (2-tailed).							

Note. Constructs' names can be found in table 3.1.

The hypothesis 1 tests whether awareness has an impact on the intention to use. According to table 12, there is a small and moderate correlation which is statistically significant; therefore, H1 is validated.

The same situation can be seen for the impact of the perceived benefits on the attitude towards drone delivery services (table 5.9); in other words, whenever the people think about the potential benefits of having their products delivered by a drone, they are more likely to have a positive attitude towards it. The hypothesis 2 analyzed if the perceived benefits of drone delivery service have an impact on the attitude towards it; in conclusion with the results, H2 is validated.

Table 5.9. Impact of expected benefits on the attitude

Attitude / Benefits	B1	B2	B3	B4	B5	B6
D1	0,451**	0,406**	0,223**	0,138*	0,428**	0,287**
D2	0,382**	0,375**	0,277**	0,165**	0,451**	0,258**
D3	0,214**	0,283**	0,123*	0,271**	0,197**	0,180**
D4	0,417**	0,367**	0,294**	0,078	0,395**	0,223**
D5	0,476**	0,458**	0,366**	0,100	0,457**	0,263**
D6	0,280**	0,221**	0,281**	-0,048	0,200**	0,173**
D7	0,296*	0,259**	0,254**	-0,038	0,257**	0,175**

**. Correlation is significant at the 0,01 level (2-tailed).
*. Correlation is significant at the 0,05 level (2-tailed).

Note. Constructs' names can be found in table 3.1.

A Pearson correlation was also done to investigate the impact of the potential concerns on the attitude towards drone delivery services (table 5.10). The results indicate a very weak positive correlation and also weak negative correlation. In the case of C10 (I'm worried that drones could be used for illicit business), there are negative values for all the variables related to attitude, meaning that the higher the people perceive this concern, the less likely they are to have a positive attitude towards drone delivery services; however, the effect is very small, therefore is not considerable for the validation of the hypothesis, meaning that H3 is rejected.

Table 5.10. Impact of potential concerns on the attitude

Concern / Attitude	D1	D2	D3	D4	D5	D6	D7
C1	0,145*	0,140*	-0,047	0,080	0,160**	0,194**	0,150**
C2	0,201**	0,172**	-0,007	0,114*	0,157**	0,199**	0,127*
C3	0,135*	0,159**	-0,097	0,174**	0,180**	0,203**	0,153**
C4	0,088	0,174**	-0,034	0,143**	0,172**	0,300**	0,176**
C5	0,161**	0,269**	0,001	0,265**	0,308**	0,313**	0,260**
C6	0,062	0,120*	0,014	0,220**	0,193**	0,191**	0,172**
C7	0,192**	0,159**	0,054	0,201**	0,199**	0,390**	0,312**
C8	0,235**	0,270**	-0,047	0,212**	0,297**	0,369**	0,288**
C9	0,173**	0,158**	-0,068	0,142**	0,156**	0,273**	0,174**
C10	-0,014	-0,027	-0,019	-0,042	-0,081	-0,100	-0,092
**. Correlation is significant at the 0,01 level (2-tailed).							
*. Correlation is significant at the 0,05 level (2-tailed).							

Note. Constructs' names can be found in table 3.1.

Regarding the impact of the attitude towards drone delivery on the intention to use it showed in table 5.11, there is a strong positive association between these two constructs. This means that the more positive the attitude of the people is, the more they would be willing to use this service. It is important to outline that among the variables related to attitude, there is a couple of negative results and small correlations for the variable that express negative attitude such as D6 (I think drone delivery will fail and won't be accepted

in the future) and D7 (I don't feel safe having drones delivering my products). In those scenarios, it is seen that for the negative values the higher the unacceptance or concern about drones, the lower their intention to use would be. In conclusion, H4 is validated.

Table 5.11. Impact of attitude on intention to use

Intention to use / Attitude	D1	D2	D3	D4	D5	D6	D7
E1	0,750**	0,739**	0,428**	0,629**	0,696**	0,160**	0,201**
E2	0,753**	0,670**	0,350**	0,676**	0,732**	0,124*	0,242**
E3	0,778**	0,695**	0,337**	0,597**	0,685**	0,126*	0,250**
E4	0,725**	0,664**	0,391**	0,595**	0,687**	0,168**	0,265**
E5	0,545**	0,489**	0,407**	0,550**	0,491**	-0,082	0,014
E6	0,388**	0,374**	0,186**	0,374**	0,431**	0,054	0,023
E7	0,372**	0,277**	0,373**	0,433**	0,401**	-0,036	0,011

**. Correlation is significant at the 0,01 level (2-tailed).
*. Correlation is significant at the 0,05 level (2-tailed).

Note. Constructs' names can be found in table 3.1.

5.3 Independent samples tests

To be able to determine whether there were any differences within the impact of expected benefits on people with driving license and people without it, an independent sample t-test was done (Annex B). For most of the aspects, the t-test was used since the Levene test was not statistically significant indicating that there were differences among the variances. For the aspects that the null hypothesis of Levene test was rejected, the result of the non-equal variances was applied. The results showed that there was no statistical difference between the 2 groups, meaning that whether people own a driving license or not, they will have similar perception of the benefits of drone delivery service, therefore H5 is rejected.

It was also needed to prove if the gender had an impact on the awareness, which is why the independent t-test was also done (Annex B). Since almost all the sig. were lower than 0,05, H6 was validated, therefore it can be conclude that there is a statistical difference between the gender and level of awareness, meaning that the knowledge people have on drones is different from male and female. According to the statistics, men have a higher level of awareness than women.

In order to investigate whether the area of residency had an impact over the perceived concerns of drone delivery, the Kruskal-Wallis non-parametric test was done (Annex C) because this variable did not

follow a normal distribution. Kruskal-Wallis is an alternative test to one-way ANOVA which is used to compare three or more groups of sample data (Ruxton & Beauchamp, 2008). The results showed that there is a statistical difference between the variables area of residency and the perceived concerns, which means that at least one of the groups among the variable area of residency follows a different distribution. In this case, this group is from people living in the urban environment with city center (Annex C), therefore H7 is validated.

Compared Means

In order to give more information concerning hypotheses 5, 6 and 7. It was necessary to compare the descriptive statistics between the variables representing the hypothesis. Therefore, table 5.12 shows the comparison between some representative statements regarding the benefits of drones in relation with owning a driving license. As seen, in the first part, there is very little difference between the means and standard deviation of the people with driving license and the people without it related to the benefit that drone delivery will reduce road congestion. In the second part, it can be seen that regarding the environmentally friendly benefit of drone delivery, the medians of both groups are identical and the means and std. deviation are also very similar. This provides the study with further evidence that in relation with the benefits of drone delivery service, the perception of people with driving license is not that different from people without driving license, confirming that H5 is rejected.

Table 5.12. Descriptive statistics between benefits and driving license

Drone delivery will reduce road congestion						
Driving license	**Mean**	**N**	**Std. Deviation**	**Median**	**Minimum**	**Maximum**
Yes	4,06	225	1,179	4,00	1	5
No	4,24	78	1,034	5,00	1	5
Total	4,11	303	1,144	4,00	1	5

Drone delivery is more environmentally friendly than traditional delivery methods						
Driving license	**Mean**	**N**	**Std. Deviation**	**Median**	**Minimum**	**Maximum**
Yes	4,20	225	0,927	4,00	1	5
No	4,18	78	0,964	4,00	1	5
Total	4,20	303	0,935	4,00	1	5

Note. Std. deviation = standard deviation

In the case of gender and awareness, the table 5.13 below shows the comparison between the statements more representative of awareness and the male and female groups. In the first part, although the medians

are identical, the mean scores are different, where the male group is more aware of drones being used for delivering small products compared to the female group. In the second part, the mean of the male group is also considerably higher than the female group, not only the mean is higher but the standard deviation is also lower, this means that the scores given by the male group are closer to the mean of that group compared to the distribution of the cases around the mean in the female group. This evidence adds to validate hypothesis 6 since gender has an impact on the level of awareness.

Table 5.13. Descriptive statistics between awareness and gender

I am aware that drones can be used for delivering small products						
Gender	**Mean**	**N**	**Std. Deviation**	**Median**	**Minimum**	**Maximum**
Male	4,08	146	1,000	4,00	1	5
Female	3,83	157	0,993	4,00	1	5
Total	3,95	303	1,002	4,00	1	5

I am aware that drones have more applications other than military uses						
Gender	**Mean**	**N**	**Std. Deviation**	**Median**	**Minimum**	**Maximum**
Male	4,36	146	0,804	5,00	2	5
Female	3,91	157	1,076	4,00	1	5
Total	4,13	303	0,980	4,00	1	5

Note. Std. deviation = standard deviation

In relation to the variables concerns and area of residency, the comparison was done in table 5.14, the mean of the city center group is higher than the other 2 groups; however, the mean scores of the groups urban, suburban and rural environment are not very different from each other in relation with the concern of the package possibly being damaged while it is transported. In the second part, the mean and median for the city center respondents is also higher compared to the other groups in relation with the concern of drones possibly hurting people. This information can be considered as evidence to support the validation of hypothesis 7 saying that the area of residency has an impact on the perceived concerns regarding drone delivery service.

Table 5.14. Descriptive statistics between concerns and area of residency

I am worried about the possibility of the package being damaged while it is transported						
Residency	**Mean**	**N**	**Std. Deviation**	**Median**	**Minimum**	**Maximum**
City center	3,05	114	1,166	3,00	1	5

Urban environment	2,76	156	0,997	3,00	1	5
Suburban/Rural environment	2,85	33	1,349	3,00	1	5
Total	2,88	303	1,109	3,00	1	5

I'm worried that drones can hurt people						
Residency	**Mean**	**N**	**Std. Deviation**	**Median**	**Minimum**	**Maximum**
City center	3,40	114	1,134	3,50	1	5
Urban environment	2,91	156	1,236	3,00	1	5
Suburban/Rural environment	3,09	33	1,234	3,00	1	5
Total	3,12	303	1,217	3,00	1	5

Note. Std. deviation = standard deviation

5.4 Factor Analysis

Having the high values of alpha Cronbach for all the concepts tested (awareness, perception of benefits, perception of concerns, preferences, attitude and intention to use), a factor analysis was done to determine if all the statements of a group contributed to the explanation of the concept; in other words, to see if they represent all together one factor or if there is any other underlying factor within the statements. Factor analysis is used to identify these hidden variables, that demonstrate the correlation patterns in a group of variables. It divides all the statements into different factors and weights them according to which factor the statement is more relevant to (Sutadian et al, 2016).

The Kaiser-Meyer-Olkin (KMO) Test is a statistic measure used to determine how adequate the data is for factor analysis. Values higher than 0,7 are considered as appropriate. Table 5.16 below shows the values obtain for all the concept tested.

Table 5.16. Kaiser-Meyer-Olkin (KMO) Test

Segment analyzed	Number of items	KMO measure
Awareness of drone delivery	7	0,773
Perception of benefits	6	0,858
Perception of concerns	10	0,846
Attitude towards drone delivery	7	0,780
Intention to use	7	0,907

Note. KMO = Kaiser-Meyer-Olkin

Awareness

A factor analysis with varimax rotation was used. Varimax rotation converts the existing factors into factors easier to interpret (Forina et al., 2005). As seen below (table 5.17), the test showed 2 components for the variables used for awareness, these components can be classified as: Functionality (Component 1) and Personal experience (Component 2). From the table, there is no value for item A3 (I am familiar with how a drone works), which means that it is a statement which does not contribute; therefore, it can be excluded if the survey is done again by other researcher in the future.

Table 5.17. Rotated Component Matrix for Awareness

Item	Component 1	Component 2
A1. I am aware that drones can be used for delivering services.	0,823	
A2. My first reaction when hearing about drone delivery service is positive.	0,717	
A3. I am familiar with how a drone works.		
A4. I am familiar with the use of drones in the area I live.		0,811
A5. I am aware that drones have more applications other than military use.	0,768	
A6. I have used a drone before.		0,785
A7. I am aware that some big firms like Amazon, Google and Uber have started implementing drone delivery service in some countries	0,646	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 3 iterations.		

After removing the variable A3 and running the test again for awareness, it shows the following result:

Table 5.18. New Rotated Component Matrix for Awareness

Item	Functionality	Personal experience
A1. I am aware that drones can be used for delivering services.	0,841	
A2. My first reaction when hearing about drone delivery service is positive.	0,734	
A4. I am familiar with the use of drones in the area I live.		0,820
A5. I am aware that drones have more applications other than military use.	0,761	
A6. I have used a drone before.		0,817

A7. I am aware that some big firms like Amazon, Google and Uber have started implementing drone delivery service in some countries	0,654	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 3 iterations.		

Perceived benefits

On the contrary, the factor analysis done for the benefits (table 5.19) resulted in only one component, meaning that the variables are measuring exactly what they state. However, the item B4 (Drone delivery will reduce road congestion) did not show any value, which means that for future studies, this statement can be discarded since it doesn't add value for the research.

Table 5.19. Component Matrix for expected benefits

Item	Component 1
B1. I can have my products delivered faster than any other means of transport.	0,807
B2. I can have my products delivered precisely at my exact location.	0,832
B3. Drones can reach places where road transport can't reach.	0,817
B4. Drone delivery will reduce road congestion.	
B5. Drone delivery is more environmentally friendly than traditional delivery methods.	0,771
B6. Drone deliveries will be beneficial for people living in remote regions.	0,802
Extraction Method: Principal Component Analysis 1 component extracted	

After removing the variable B4, the factor analysis is run again, showing the following table below:

Table 5.20. New Component Matrix for expected benefits

Item	Benefits
B1. I can have my products delivered faster than any other means of transport.	0,822
B2. I can have my products delivered precisely at my exact location.	0,850
B3. Drones can reach places where road transport can't reach.	0,825
B5. Drone delivery is more environmentally friendly than traditional delivery methods.	0,767
B6. Drone deliveries will be beneficial for people living in remote regions.	0,801
Extraction Method: Principal Component Analysis	

1 component extracted

Perceived concerns

In the case of potential concerns, 2 components were found (table 5.21). One can be classified as Illegal use (Component 1) and the other as Malfunction (Component 2). The same situation as the tables before can be seen, 3 statements do not contribute to the study which can be remove in the future. These item are as follow: C7 (I am worried that drones will be very noisy), C8(I am worried that drones will reduce the view to the sky and the environment) and C9 (I am worried that drones can hurt people).

Table 5.21. Rotated Component Matrix for potential concerns

Item	Component 1	Component 2
C1. I feel concerned about drones trespassing my property.	0,794	
C2. Drone delivery will lead to a loss of privacy for me.	0,867	
C3. Drone delivery might not be used in a way that respects my privacy.	0,767	
C4. I think the drone might break during the service.		0,635
C5. I am worried about the possibility of the package being damaged while it is transported.		0,842
C6. I am worried about the possibility of the package being violated or stolen by others.		0,829
C7. I am worried that drones will be very noisy.		
C8. I am worried that drones will reduce the view to the sky and the environment.		
C9. I'm worried that drones can hurt people.		
C10. I'm worried that drones could be used for illicit business.	0,621	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 3 iterations.		

After removing the variables C7, C8, C9 and running the test again, the table below shows the new results:

Table 5.22. New Rotated Component Matrix for potential concerns

Item	Illegal use	Malfunction
C1. I feel concerned about drones trespassing my property.	0,817	
C2. Drone delivery will lead to a loss of privacy for me.	0,891	

C3. Drone delivery might not be used in a way that respects my privacy.	0,793	
C4. I think the drone might break during the service.		0,653
C5. I am worried about the possibility of the package being damaged while it is transported.		0,871
C6. I am worried about the possibility of the package being violated or stolen by others.		0,872
C10. I'm worried that drones could be used for illicit business.	0,618	
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 3 iterations.		

Attitude

The factor analysis test was also done for the construct of attitude towards drone delivery (table 5.23), where the results showed 2 components: Positive attitudes (Component 1) and Negative attitudes (Component 2). There was no statement with a value lower than 0,6, which means that all of them are contributing to the construct of attitude towards drone delivery service.

Table 5.23. Rotated Component Matrix for attitude towards drone delivery service

Item	Positive att.	Negative att.
D1. I feel motivated to try a new technology as a drone delivery.	0,781	
D2. I believe drone delivery service will have a positive impact on the logistics industry.	0,828	
D3. I think drone delivery services will increase soon.	0,650	
D4. Drone delivery service is (will be) enjoyable.	0,853	
D5. I think that using drone delivery is a good idea.	0,874	
D6. I think drone delivery service will fail and won't be accepted in the future.		0,886
D7. I don't feel safe having drones delivering my products.		0,865
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. a. Rotation converged in 3 iterations.		

Intention to use

Regarding the intention to use, the results showed only one component extracted, proving that the statements all together measure the intention to use drone delivery service. Nevertheless, there was no value for items E6 (I intend to use drone delivery services in the future but after they are available and tested for some time in the market) and E7 (I have the knowledge necessary to use drone delivery services), which

means that these statements can be excluded if the questionnaire is done again for another study, because they don't contribute to the study.

Table 5.24. Component Matrix for intention to use

Item	Component 1
E1. I think drone delivery is an innovative technology and I feel excited to try it.	0,856
E2. I would use drone delivery to receive my order.	0,922
E3. Using drone delivery to receive some products is something I would use.	0,914
E4. I could see myself using drone delivery service to receive my package.	0,907
E5. I intend to use drone delivery service in the future immediately when they will be available.	0,715
E6. I intend to use drone delivery services in the future but after they are available and tested for some time in the market.	
E7. I (will) have the knowledge necessary to use drone delivery services.	
Extraction Method: Principal Component Analysis 1 component extracted	

After removing the variables E6 and E7, the factor analysis is run again. The new results can be seen in the table below:

Table 5.25. New Component Matrix for intention to use

Item	Intention to use
E1. I think drone delivery is an innovative technology and I feel excited to try it.	0,868
E2. I would use drone delivery to receive my order.	0,933
E3. Using drone delivery to receive some products is something I would use.	0,923
E4. I could see myself using drone delivery service to receive my package.	0,917
E5. I intend to use drone delivery service in the future immediately when they will be available.	0,742
Extraction Method: Principal Component Analysis 1 component extracted	

Regarding the previous Kaiser-Meyer-Olkin (KMO) test, it was needed to run it again to make sure that the data is adequate for the study. As the values were higher than 0,7, the results are acceptable.

Table 5.26. New Kaiser-Meyer-Olkin (KMO) Test

Segment analyzed	Number of items	KMO measure
Awareness of drone delivery	6	0,737
Perception of benefits	5	0,845
Perception of concerns	7	0,802
Attitude towards drone delivery	7	0,780
Intention to use	5	0,888

Note. KMO = Kaiser-Meyer-Olkin

Linear Regression

After doing the factor analysis, removing the statements that were not contributing to the study and establishing the components of those variables, a simple linear regression was done to determine whether each of these variables could predict the intention to use drone delivery services. In this case, intention to use was chosen as the dependent variable, while all the others (awareness, perception of benefits, concerns and attitude) as independent. The correlations done previously between the variables will determine the quality of the linear regression (Prion & Haerling, 2020).

All the results were put together in table 30, where it can be seen that the independent variables that were included in the final model were attitude (positive attitude component) and awareness (functionality component). The rest of independent variables were not considered as they did not contribute to the model.

The Adjusted R Square is a percentage of the variance in the dependent variable (intention to use) explained by the independent or predictor variable, which can be read as the higher this value is, then the better the intention to use can be explained by the independent variables mentioned. As seen in table 5.27, the results show that 74,3% of all of the variability in intention to use can be explained by the positive attitude and the level of awareness about the functionality of drone delivery services. In order to make sure that the data is relatively normal and not a cause for concern, the Durbin-Watson is a statistic value from the regression analysis used to measure the autocorrelation. It is important to have a Durbin-Watson value within 1,5-2,5 since values that are lower than 1 or higher than 3 would be considered as cause for concern (Field, 2009). For this analysis, table 30 shows that the model has a Durbin-Watson value of 2,018 which is within expectations.

Table 5.27. Model summary of the linear regression

Model Summary[c]										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin - Watson
					R Square	F Change	df 1	df2	Sig. F Change	

					Change					
1	0,853[a]	0,728	0,727	0,52262450	0,728	804,675	1	301	0,000	
2	0,863[b]	0,744	0,743	0,50726670	0,017	19,502	1	300	0,000	2,018

a. Predictors: (Constant), Attitude_Positive attitude
b. Predictors: (Constant), Attitude_Positive attitude, Awareness_Functionality
c. Dependent Variable: Intention to use

Note. df = degree of freedom

In table 5.28, the ANOVA for the independent variables was collected to confirm that the significance is lower than 0,05, making them statistically significant. This ANOVA table shows that the linear regression model used fits the data very well; in other words, the linear regression model can predict the intention to use (dependent variable) significantly well.

Table 5.28. ANOVA table of the linear regression

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	219,786	1	219,786	804,675	0,000[b]
	Residual	82,214	301	0,273		
	Total	302,000	302			
2	Regression	224,804	2	112,402	436,819	0,000[c]
	Residual	77,196	300	0,257		
	Total	302,000	302			

a. Dependent Variable: Intention to use
b. Predictors: (Constant), Attitude_Positive attitude
c. Predictors: (Constant), Attitude_Positive attitude, Awareness_Functionality

Note. df = degree of freedom

From the analysis, it can be seen how the intention to use drone delivery services is influenced by the positive attitude towards drone delivery services and the level of awareness about the functionality of it.

5.5 Barriers of adoption and main advantages

Table 5.29 shows the potential concerns that the respondents agreed more. As seen in the table below, 70% of the people are worried that drones could be used for illicit business (e.g., transporting illegal drugs, recording unauthorized areas, etc.). In addition, 51,5% of the respondents are worried about the possibility of the packages being violated or stolen by others. In both cases, they could be interpreted as the reasons why people wouldn't be willing to adopt this technology, making them the main barriers of adoption.

Table 5.29. Main concerns of drone delivery service

Concerns	Somewhat agree	Strongly agree	Total %
I'm worried that drones could be used for illicit business.	42,6%	27,4%	70,0%
I'm worried about the possibility of the package being violated or stolen by others.	34,3%	17,2%	51,5%

On the contrary, the table 5.30 below shows the expected benefits which people agreed more with. In this case, 91,1% of the respondents acknowledge the fact that drones can reach places where road transport can't reach, like places above the ground, islands and even ships in the ocean. Following that concept, 84,2% of the respondents agreed with the fact that drone deliveries will be beneficial for people living in remote regions, where it is hard for regular means of transport to go. This information presents the benefits that people noticed more and are benefits that companies could exploit in order to reach a bigger audience.

Table 5.30. Main benefits of drone delivery service

Benefits	Somewhat agree	Strongly agree	Total %
Drones can reach places where road transport can't reach.	35,3%	55,8%	91,1%
Drone deliveries will be beneficial for people living in remote regions.	33,0%	51,2%	84,2%

5.6 Consumer preferences

As seen in the figure below, the main products that the respondents were more willing to receive by drone delivery were medicine, food and books in that order. According to the literature review, there are some drones in charge of delivering medicine to some regions, because of the fast time and precise delivery, which is why it's understandable that medicine came out as first in this question. On the other hand, the least favorite product was the category of valuable goods. The reason behind this is directly related to the value of the good that the drone is transporting.

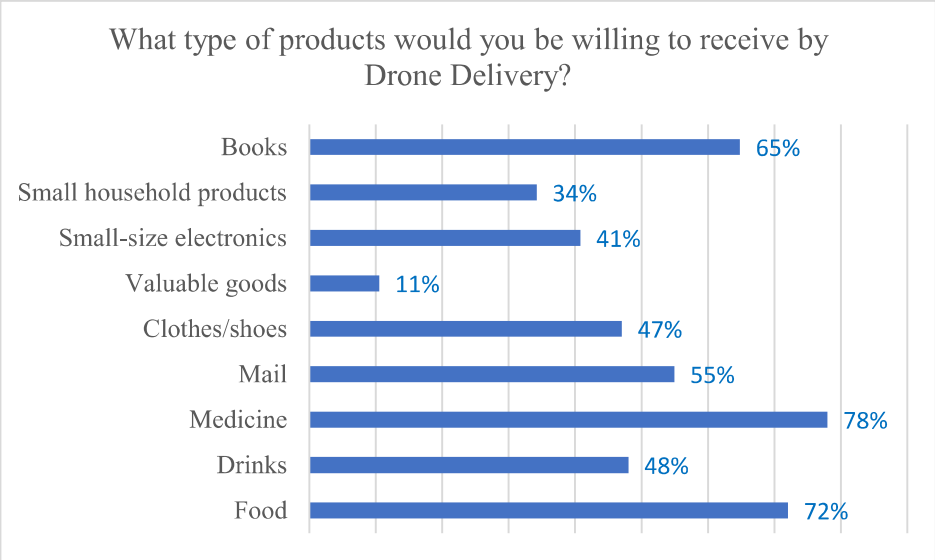

Figure 5.4. Preferences towards drone delivery products

There was also a question related to price range, in which the results showed that for most products, potential consumers would be willing to pay from 0,50 – 3,00 € for the delivery cost (figure 5.5). According to the literature review, the price for drone delivery in most cases was very cheap (around $1 for short distances) which means that there is a wide gap for this service to be implemented and to compete with other delivery services.

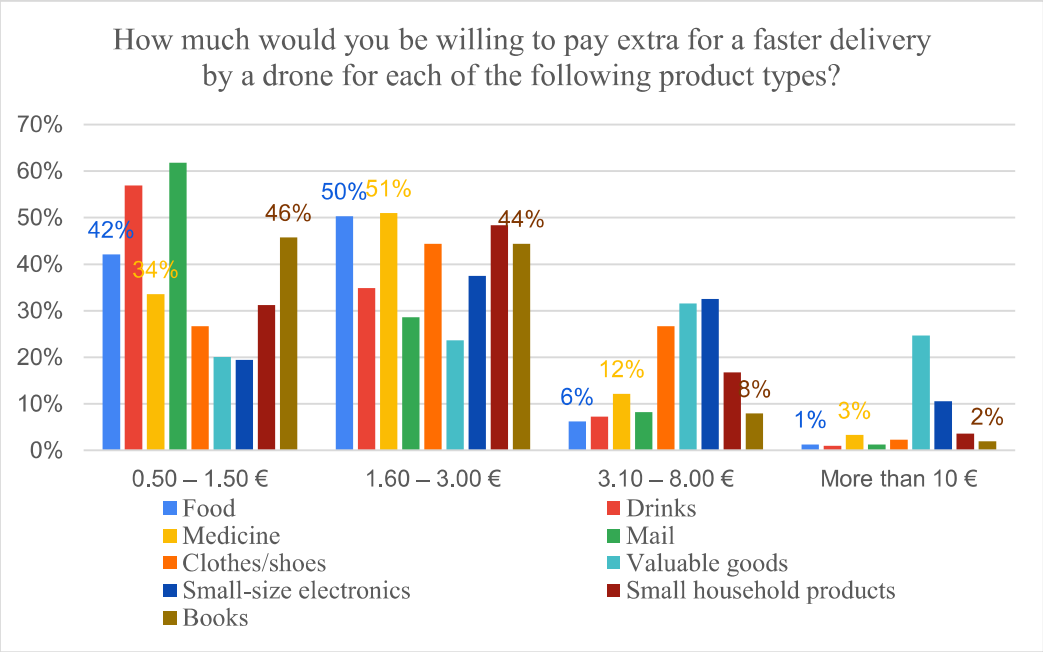

Figure 5.5. Preferred price range

In figure 5.6, people were asked about their expectation when it comes to availability of drone delivery services, it's interest to see that 35% of the respondents believe that this technology will be available in the next 3-5 years and 33% of respondents think that it will be available in the short term (1-3 years). In general, the majority of respondents expect for drone delivery service to be present in their city within the next 5 years, which leaves enough room for improvement related to the technology and development of regulations by the government.

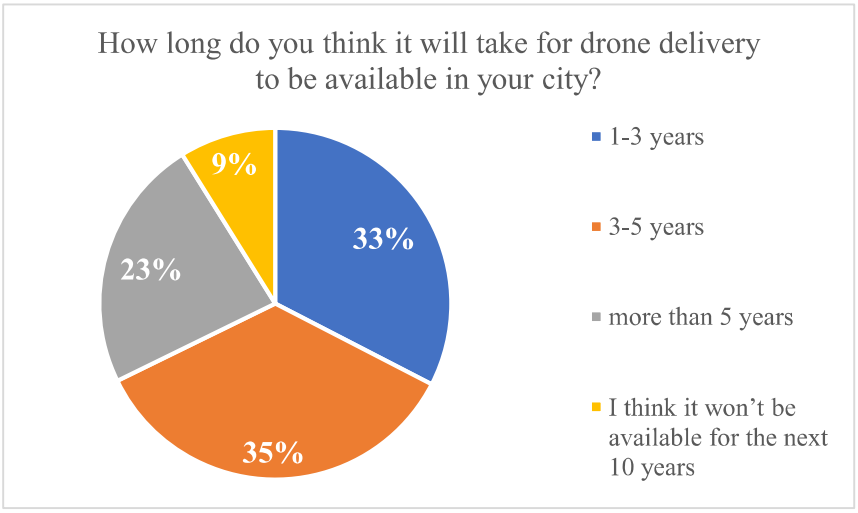

Figure 5.6. General public expectations

Table 5.31 below summarizes the results of the hypotheses and the tests done to each of them:

Table 5.31. Summary of hypothesis tests results

Hypothesis	Test	Conclusion
H1: Awareness about drone delivery services has a positive impact on the intention to use drone delivery services.	Correlations	Validated
H2: Perceived benefits of drone delivery services have an impact on the attitude towards drone delivery services.	Correlations	Validated
H3: Perceived concerns of drone delivery services have a negative impact on the attitude towards drone delivery services.	Correlations	Rejected
H4: Attitude towards drone delivery services has an impact on the intention to use drone delivery services.	Correlations	Validated
H5: Perceived benefits have a positive impact on people with driving license.	Independent t-test. Mann-Whitney U test	Rejected
H6: Gender has an impact on the level of awareness.	Independent t-test	Validated
H7: Area of residency has an impact on the perceived concerns.	Independent t-test. Mann-Whitney U test	Validated

CHAPTER 6
Conclusions

This chapter presents the main conclusions that were obtained from the study; it also points out the limitations of the research and give some recommendations for future studies regarding drone delivery services.

6.1 Main conclusions

The research framework of this study intended to assess the acceptance and the intention to use drone delivery services in the city of Lisbon. To reach that, it was needed to test the impact of factors such as perception of benefits and perception of concerns, on the attitude towards drone delivery service. Other aspects such as awareness of drone delivery and socioeconomic aspects (e.g., gender and driving license owners) were also tested to find out statistically significant differences.

To complement this information, the current e-commerce behavior and the future consumer preferences was also researched in order to develop a future user's profile. The conclusions will follow this structure.

The evidence analyzed in the literature review pointed out that the lack of awareness and knowledge influences the intention to use this service, because people would not understand how drone delivery service works, which would become a barrier. The correlations in this research showed that the more aware individuals are about drone delivery service, the higher their intention to use it would be; furthermore, men have a higher level of awareness than women. For companies offering drone delivery services in the future, this could translate into a call to raise awareness by communicating better the benefits of using drone delivery to future consumers, such as with marketing campaigns and advertisement. By having more information, there will be a positive intention to use this service.

The results of the study proved that the perception of drone delivery is a factor that affects the acceptance of this technology and the intention to use it. There is a positive perception of drone delivery in Lisbon, mainly because of its ability to reach difficult places and the potential to help people in remote regions to receive their orders. Since most people live in apartments, this will represent a challenge for companies offering this service because of the issues that comes with the dropping of packages, research and development areas of these companies will have to work on this. However, there is still an interesting amount of potential customers living in houses, where dropping packages becomes easier for the drones.

Even though the results proved that currently the concerns don't have an impact on the intention to use drone delivery services, these potential risks that come with it could become barriers for adoption if left unattended, as they represent possible threats to the safety of the people and the merchandise. In particularly, the potential use of drones for illegal activities as well as the possibility of the packages being

damaged or stolen by others could prevent consumers from using drone delivery services. These concerns need to be revised by Portuguese regulatory institutions in charge of being the policy makers for innovative technologies in order to properly develop drone regulations and guidelines regarding the legal and correct use of drones. One way to handle this situation is by following models already made by other countries where drone delivery service and other drone applications are being implemented and accepted by the general public.

Proposing participatory approaches could be a great aid in the public acceptance of drone delivery service. This way, through debates and public consultations in these times where this new technology will most likely be available in the short term, the citizens together with the government could reach a common understanding of what would be the most appropriate, legal and beneficial use of urban space in the future.

An important topic from the results are the consumer preferences regarding this service. 72% of the people would rather choose food delivery as the main source for drone delivery since it can be done in a regular basis and it is faster than any other mean of delivery; however, the product most accepted by consumers for drone delivery is medicine with 78% of acceptance, which represents an interesting opportunity for the health industry because in general, medicines do not have a heavy weight. At least 50% of future consumers are willing to pay extra up to 3,00 € for this type of delivery for food and medicine, while 46% of them are willing to pay up to 1,50 € for delivery of medicine. Logistics companies could take into consideration these statistics when they develop their costs structure and fix delivery prices. In addition, these people purchase products online around 1-3 times per month. This information could be used as a possible niche market for companies offering drone delivery services in the future.

This thesis considered drone delivery as a potential solution for the last mile problem, delivering the right item to the right place at the right time. Seeing as this technology would be accepted and used in the future, it represents a great opportunity for companies that are thinking about implementing this delivery service. Drones are enabling improved delivery systems by providing faster response times, reduced transportation costs and reaching underserved regions, which in addition to its ecological impact, will aid e-commerce companies in increasing the efficiency of their inventory management and last mile delivery network.

Finally, it was proved that the attitude towards drone delivery service has a strong impact on the intention to use it, which is why it is important to stress the need for e-commerce companies to communicate better the benefits of using drone delivery, especially those benefits who are not highly perceived such as the environmentally friendly advantage. In terms of technology, innovation and organization, drone delivery service is a system that offers a new level of quality for e-commerce traders and their distribution channels.

6.2 Limitations

Within the limitations of a research paper, this study identifies two:

First, there is not enough research done on public acceptance of drone delivery services. Since drone delivery service is still a new technology available only to some countries, there are not many sources of information about acceptance, attitude and intention to use by citizens. Therefore, it is not certain whether there are deeper factors influencing the acceptance such as culture, religion or any other belief.

Second, even though the survey was pre-tested and afterwards some questions were improved and rephrase, there are still some questions to improve or include. On one hand, although they make sense and have contributed to the results of the study, the development of some questions were not precise used for some of the tests that would be carried out. For instance, more questions regarding knowledge and awareness should have been added in order to better complement the findings of the literature review.

6.3 Recommendations

For future research, it is recommended to apply the same study but with a mixed approach methodology and use two types of methodologies, qualitative approach and quantitative approach, in different research phases and combine the results in order to improve accuracy. The qualitative approach could be a focus group with logistics experts in Portugal and then the survey with the regular population.

If the future researcher would like to use the same questionnaire, it is recommended to remove some of the statements from the constructs awareness, perceived benefits, perceived concerns and intention to use as it was shown in the results of the factor analysis, because some of those statements do not contribute to the study.

Bibliographical references

Airbus. (2019, March 15). Airbus' Skyways drone trials world's first shore-to-ship deliveries. https://www.airbus.com/newsroom/press-releases/en/2019/03/airbus-skyways-drone-trials-worlds-first-shoretoship-deliveries.html

Air Cargo News. (2019, May 21). DHL express collaborates with Ehang on last-mile drone delivery. https://www.aircargonews.net/sectors/express/dhl-express-collaborates-with-ehang-on-last-mile-drone-delivery/

Aydin, B. (2019). Public acceptance of drones: Knowledge, attitudes, and practice. *Technology in Society, 59*, Article 101180. https://doi.org/10.1016/j.techsoc.2019.101180

Bagozzi, R. (1981). Attitudes, intentions and behavior: A test of some key hypotheses. *Journal of Personality and Social Psychology, 41*(4), 607-627. https://doi.org/10.1037/0022-3514.41.4.607

Bandoim, L. (2018, October 23). Uber plans to launch food-delivery drones. *Forbes*. https://www.forbes.com/sites/lanabandoim/2018/10/23/uber-plans-to-launch-food-delivery-drones/#59da6530e147

Baldi, M. M., Manerba, D., Perboli, G., & Tadei, R. (2019). A generalized bin packing problem for parcel delivery in last-mile logistics. *European Journal of Operational Research, 274*(3), 990-999. https://doi.org/10.1016/j.ejor.2018.10.056

BBC. (2019, April 10). Google wing launches first home delivery drone service. https://www.bbc.com/news/technology-47880288

BBC. (2020, May 27). Zipline drones deliver supplies and ppe to US hospitals. https://www.bbc.com/news/technology-52819648

Boysen, N., Schwerdfeger, S., & Weidinger, F. (2018). Scheduling last-mile deliveries with truck-based autonomous robots. *European Journal of Operational Research, 271*(3), 1085-1099. https://doi.org/10.1016/j.ejor.2018.05.058

Bright, J. (2020, May 27). Zipline begins US medical delivery with drone program honed in Africa. *TechCrunch*. https://techcrunch.com/2020/05/26/zipline-begins-us-medical-delivery-with-uav-program-honed-in-africa/?guccounter=1

Chang, Y., S., & Lee H., J. (2018). Optimal delivery routing with wider drone-delivery areas along a shorter truck-route. *Expert Systems with Applications, 104*, 307-317. https://doi.org/10.1016/j.eswa.2018.03.032

Chiang, W. C., Li, Y., Shang, J., & Urban, T. (2019). Impact of drone delivery on sustainability and cost: Realizing the UAV potential through vehicle routing optimization. *Applied Energy, 242*, 1164-1175. https://doi.org/10.1016/j.apenergy.2019.03.117

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences (2nd ed.)*. Lawrence Erlbaum Associates, Publishers.

Cooper, D., & Schindler, P. (2013). *Business Research Methods (12th ed.)*. McGraw-Hill.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 903-1028. https://doi.org/10.1287/mnsc.35.8.982

DHL. (2014). Unmanned aerial vehicle in logistics. A DHL perspective on implications and use cases for the logistics industry. https://www.dhl.com/content/dam/downloads/g0/about_us/logistics_insights/DHL_TrendReport_UAV.pdf

DHL. (2018, April 10). Rapid response from the air: Medicines successfully delivered using a parcel drone in East Africa. https://www.dhl.com/global-en/home/press/press-archive/2018/rapid-response-from-the-air-medicines-successfully-delivered-using-a-parcel-drone-in-east-africa.html

Doole, M., Ellerbroek, J., & Hoekstra, J. M. (2018, December 3-7). *Drone delivery: Urban airspace traffic density estimation* [Conference paper]. 8th SESAR Innovation Days, Salzburg, Austria. http://resolver.tudelft.nl/uuid:f33c73a1-683f-4f9d-a04a-55254dd4aebf

Dormehl, L. (2020, January 27). When it comes to delivery drones, Google's wing is miles above the competition. *Digital Trends*. https://www.digitaltrends.com/cool-tech/google-wing-drone-deliveries/

European Commission. (2019). *Use of internet services. Digital economy and society index report 2019*. https://ec.europa.eu/digital-single-market/en/use-internet

Field, A. P. (2009). *Discovering statistics using SPSS: and sex and drugs and rock'n' roll (3rd Edition)*. Sage.

Forina, M., Armanino, C., Lanteri, S., & Leardi, R. (2005). Methods of varimax rotation in factor analysis with applications in clinical and food chemistry. *Journal of Chemometrics, 3*(S1): 115-125. https://doi.org/10.1002/cem.1180030504

Galkin, A., Davidich, N., Filina, L., & Davidich, Y. (2019). Improving the safety of urban freight deliveries by organization of the transportation process considering driver's state. *Transportation Research Procedia, 39*, 54-63. https://doi.org/10.1016/j.trpro.2019.06.007

Garcia, S. E. (2019, October 2). F.A.A. allows U.P.S. to deliver medical packages using drones. *The New York Times*. https://www.nytimes.com/2019/10/02/us/UPS-drone-deliveries.html

Garret-Glasser, B. (2019, December 19). Flirtey trials drone delivery at industrial center in Nevada. *Avionics*. https://www.aviationtoday.com/2019/12/19/flirtey-trials-drone-delivery-industrial-center-nevada/

Goodchild, A., & Toy, J. (2018). Delivery by drone: An evaluation of unmanned aerial vehicle technology in reducing CO2 emissions in the delivery service industry. *Transportation Research Part D: Transport and Environment, 61*(A), 58-67. https://doi.org/10.1016/j.trd.2017.02.017

Halldórsson, A., & Wehner, J. (2020). Last-mile logistics fulfilment: A framework for energy efficiency. *Research in Transportation Business & Management*, Article 100481. https://doi.org/10.1016/j.rtbm.2020.100481

Hassija, V., Saxena, V., & Chamola, V. (2020). Scheduling drone charging for multi-drone network based on consensus time-stamp and game theory. *Computer Communications, 149*, 51-61. https://doi.org/10.1016/j.comcom.2019.09.021

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative research. *Evidence-Based Nursing, 18*(3), 66-67. https://doi.org/10.1136/eb-2015-102129

Hern, A. (2014, September 25). DHL launches first commercial drone "Parcelcopter" delivery service. *The Guardian*. https://www.theguardian.com/technology/2014/sep/25/german-dhl-launches-first-commercial-drone-delivery-service

Hwang, J., Kim, H., & Kim, W. (2019a). Investigating motivated consumer innovativeness in the context of drone food delivery services. *Journal of Hospitality and Tourism Management, 38*, 102-110. https://doi.org/10.1016/j.jhtm.2019.01.004

Hwang, J., Lee, J. S., & Kim, H. (2019b). Perceived innovativeness of drone food delivery services and its impact on attitude and behavioral intentions: The moderating role of gender and age. *International Journal of Hospitality Management, 81*, 94-103. https://doi.org/10.1016/j.ijhm.2019.03.002

Joerss, M., Schröder, J., Neuhaus, F., Klink, C., & Mann, F. (2016, September). Parcel delivery: The future of last mile. *McKinsey & Company*. https://www.mckinsey.com/~/media/mckinsey/industries/travel%20transport%20and%20logistics/our%20insights/how%20customer%20demands%20are%20reshaping%20last%20mile%20delivery/parcel_delivery_the_future_of_last_mile.ashx

Keeney, T. (2015, May 5). How can Amazon charge $1 for drone delivery? *ARK Invest*. https://ark-invest.com/research/drone-delivery-amazon

Kellermann, R., Biehle, T., & Fischer, L. (2020). Drones for parcel and passenger transportation: A literature review. *Transportation Research Interdisciplinary Perspectives, 4*, Article 100088. https://doi.org/10.1016/j.trip.2019.100088

Kim, S. H. (2020). Choice model based analysis of consumer preference for drone delivery service. *Journal of Air Transport Management, 84*, Article 101785. https://doi.org/10.1016/j.jairtraman.2020.101785

Klauser F., & Pedrozo S. (2017). Big data from the sky: popular perceptions of private drones in Switzerland. *Geographica Helvetica, 72*(2), 231-239. https://doi.org/10.5194/gh-72-231-2017

Kothari, C. (2004). *Research methodology. Methods and techniques*. New Age International (P) Limited, Publishers.

Kotler, P., & Keller, K. L. 2016. *Marketing Management. 15ed*. Pearson Prentice Hall.

Lavars, N**.** (2019, March 18). Airbus drones deliver first packages to ship offshore. *New Atlas*. https://newatlas.com/airbus-drones-skyways-cargo-ships/58893/

Lee, M. –C. (2009). Factors influencing the adoption of internet banking: An integration of TAM and TPB with perceived risk and perceived benefit. *Electronic Commerce Research and Applications, 8*(3), 130-141. https://doi.org/10.1016/j.elerap.2008.11.006

Lee, H. L., Chen, Y., Gillai, B., & Rammohan, S. (2016). *Technological disruption and innovation in last-mile delivery* [White paper]. Stanford Graduate School of Business. https://www.gsb.stanford.edu/faculty-research/publications/technological-disruption-innovation-last-mile-delivery

Lewis, M. (2006). The effect of shipping fees on customer acquisition, customer retention, and purchase quantities. *Journal of Retailing, 82*(1), 13-23. https://doi.org/10.1016/j.jretai.2005.11.005

Majumbar, A. (2019). Chapter 3 - Last-mile problem revisited with potential solution for broadband connectivity. *Optical Wireless Communications for Broadband Global Internet Connectivity*, 39-53. https://doi.org/10.1016/B978-0-12-813365-1.00003-5

Malhotra, N., & Birks, D. 2006. *Marketing research – An applied approach*. Pearson Education.

McNabb, M. (2020, April 21). UPS drone delivery: DroneUp flies to prove the case for coronavirus response. *Dronelife*. https://dronelife.com/2020/04/21/ups-drone-delivery-droneup-partners-fly-to-prove-the-case-for-coronavirus-response/

Meng, F., Liu, G., Yang, Z., Casazza, M., Cui, S., & Ulgiati, S. (2017). Energy efficiency or urban transportation system in Xiamen, China. An integrated approach. *Applied Energy, 186* (2), 234-248. https://doi.org/10.1016/j.apenergy.2016.02.055

Mohamed, N., Al-Jaroodi, J., Jawhar, I., Idries, A., & Mohammed, F. (2020). Unmanned aerial vehicles applications in future smart cities. *Technological Forecasting and Social Change, 153*, Article 119293. https://doi.org/10.1016/j.techfore.2018.05.004

Mordor Intelligence. (2020). E-Commerce packaging market. Growth, trends and forecast (2020-2025). https://www.mordorintelligence.com/industry-reports/e-commerce-packaging-market

Myers, J., & Rothman, L. (1995). Chapter 12 - Field experiments to study regulation of fluctuating populations. *Population Dynamics*, 229-250. https://doi.org/10.1016/B978-012159270-7/50013-0

*NBC San Diego***.** (2019, October 30). Uber Eats says food delivery by drone is coming to San Diego next summer. https://www.nbcsandiego.com/news/local/uber-eats-drones-san-diego-next-year-food-delivery/2060802/#:~:text=Uber%20Eats%20announced%20this%20week,for%20deliveries%20in%20summer%202020

New York Post. (2017, August 24). Drone food delivery service is off the ground in Iceland. Last accessed on April 2020. https://nypost.com/2017/08/24/drone-food-delivery-service-is-off-the-ground-in-iceland/

Nunnally, J. C. 1978. *Psychometric Methods. 2nd Edition*. McGraw-Hill.

Park, J., Kim, S., & Suh, K. (2018). A comparative analysis of the environmental benefits of drone-based delivery services in urban and rural areas. *Sustainability, 10*(3), 888. https://doi.org/10.3390/su10030888

PR Newswire. (2020, January 21). Drone delivery data: 36% of online shoppers are more likely to purchase an item delivered by drone. https://www.prnewswire.com/news-releases/drone-delivery-data-36-of-online-shoppers-are-more-likely-to-purchase-an-item-delivered-by-drone-300989686.html

Prion, S. K., & Haerling, K. A. (2020). Making sense of methods and measurements: Simple linear regression. *Clinical Simulation in Nursing, 48*(C), 94-95. https://doi.org/10.1016/j.ecns.2020.07.004

Raj, A., & Sah, B. (2019). Analyzing critical success factors for implementation of drones in the logistics sector using grey-DEMATEL based approach. *Computer & Industrial Engineering, 138*, Article 106118. https://doi.org/10.1016/j.cie.2019.106118

Rao, S., Griffis, S. E., & Goldsby, T. J. (2011). Failure to deliver? Linking online order fulfillment glitches with future purchase behavior. *Journal of Operations Management, 29*(7-8), 692-703. https://doi.org/10.1016/j.jom.2011.04.001

Ratcliffe, M., Burd, C., Holder, K., & Fields, A. (2016). *Defining Rural at the U.S. Census Bureau (ACSGEO-1)*. United States Census Bureau. https://www.census.gov/library/publications/2016/acs/acsgeo-1.html

Reddy, L. B., and DeLaurentis, D. (2016). Opinion survey to reduce uncertainty in public and stakeholder perception of unmanned aircraft. *Transportation Research Record: Journal of the Transportation Research Board, 2600*(1), 80-93. https://doi.org/10.3141/2600-09

Robinson, C. (2017). Disclosure of personal data in e-commerce: A cross-national comparison of Estonia and the United States. *Telematics and Informatics, 34*(2), 569-582. https://doi.org/10.1016/j.tele.2016.09.006

Rodgers, J. L., & Nicewander, W. A. (1988). Thirteen ways to look at the correlation coefficient. *The American Statistician, 42*(1), 59-66. https://doi.org/10.2307/2685263

Ruxton, G. D., & Beauchamp, G. (2008). Some suggestions about appropriate use of the Kruskal-Wallis test. *Animal Behaviour, 76*(3), 1083-1087. https://doi.org/10.1016/j.anbehav.2008.04.011

Savanta ComRes. (2018, May 30). Royal Aeronautical Society - Drones polling. https://comresglobal.com/polls/royal-aeronautical-society-drones-polling/

Soffronoff, J., Piscioneri, P. Weaver, A. (2016). *Public perception of drone delivery in the United States* (RARC-WP-17-001) [White paper]. United States Postal Service Office of Inspector General. https://www.uspsoig.gov/document/public-perception-drone-delivery-united-states

Stolaroff, J., Samaras, C., O'Neill, E., Lubers, A., Mitchell, A., & Ceperly, D. (2018). Energy use and life cycle greenhouse gas emissions of drones for commercial package delivery. *Nature Communications, 9*, Article 409. https://doi.org/10.1038/s41467-017-02411-5

Sutadian, A. D., Muttil, N., Yilmaz, A. G., & Perera, B. J. C. (2016). Development of river quality indices-a review. *Environmental Monitoring and Assessment, 188*, 58. https://doi.org/10.1007/s10661-015-5050-0

Vijayasarathy, L. R. (2004). Predicting consumer intentions to use online shopping: the case for an augmented technology acceptance model. *Information & Management, 41*(6), 747-762. https://doi.org/10.1016/j.im.2003.08.011

Wainer, Jacques. 2017. *Métodos de pesquisa quantitative e qualitative para a Ciência da Computação*. UNICAMP.

Wang, Z., & Sheu, J. B. (2019). Vehicle routing problem with drones. *Transportation Research Part B: Methodological, 122*, 350-364. https://doi.org/10.1016/j.trb.2019.03.005

Wang, Y., Xia, H., Yao, Y., & Huang, Y. (2016). Flying eyes and hidden controllers: a qualitative study of people's privacy perceptions of civilian drones in the US. *Proceedings on Privacy Enhancing Technologies, 2016*(3), 172-190. https://doi.org/10.1515/popets-2016-0022

Watkins, S., Burry, J., Mohamed, A., Marino, M., Prudden, S., Fisher, A., Kloet, N., Jakobi, T., & Clothier, R. (2019). Ten questions concerning the use of drones in urban environments. *Building and Environment, 167*, Article 106458. https://doi.org/10.1016/j.buildenv.2019.106458

Welch, A. (2015). *A cost-benefit analysis of Amazon Prime Air* [Undergraduate honor thesis, University of Tennessee at Chattanooga]. UTC Scholar. https://scholar.utc.edu/honors-theses/47/

West, J. P., Klofstad, C. A., Uscinski, J. E., & Connolly, J. M. (2019). Citizen support for domestic drone use and regulation. *American Politics Research, 47*(1), 119-151. https://doi.org/10.1177/1532673X18782208

Wiggers, K. (2020, May 1). Flytrex launches drone delivery service in North Dakota. *UAS Magazine*. http://www.uasmagazine.com/articles/2158/flytrex-launches-drone-delivery-service-in-north-dakota

Yaacoub, J.-P., Noura, H., Salman, O., & Chehab, A. (2020). Security analysis of drone systems: Attacks, limitations, and recommendations. *Internet of Things, 11*, Article 100218. https://doi.org/10.1016/j.iot.2020.100218

Yin, R. K. 2003. *Case study research: Designs and methods (3rd Ed.)*. Sage Publications.

Yoo, W., Yu, E., & Jung, J. (2018). Drone delivery: Factors affecting the public's attitude and intention to adopt. *Telematics and Informatics, 35*(6), 1687-1700. https://doi.org/10.1016/j.tele.2018.04.014

Yusra, Y., & Agus, A. (2019). The influence of online food delivery service quality on customer satisfaction and customer loyalty: The role of personal innovativeness. *Journal of Environmental Treatment Techniques, 8*(1), 6-12. https://www.researchgate.net/publication/339551642_The_Influence_of_Online_Food_Delivery_Service_Quality_on_Customer_Satisfaction_and_Customer_Loyalty_The_Role_of_Personal_Innovativeness

Zhu, X. (2019). Segmenting the public's risk beliefs about drone delivery: A belief system approach. *Telematics and Informatics, 40*, 27-40. https://doi.org/10.1016/j.tele.2019.05.007

Annexes

Annex A – Questionnaire

Drone Delivery Service Acceptance Study

Welcome!

Thank you for participating in my survey designed for my Master Thesis in International Management on e-commerce deliveries by drones. It will not take you more than 8 minutes to fill in this survey and your reply is anonymous and confidential.

If you have any questions about the research or this survey, feel free to contact me:jvano@iscte-iul.pt.

If you are doing the survey from your smartphone, I recommend to use it horizontally.

By clicking next on this survey you are confirming that you have read and understood the information above and have given consent for your anonymized data to be used by the researcher.

Thank you for your collaboration!

Researcher information:

Name: Jonathan Villanueva Alvarez

Institution: ISCTE Business School

E-commerce behaviour

1. How often do you buy products online to be delivered at your place or any other address?
    - Never
    - Less than once a week
    - At least once a week
    - 1-3 times per month
    - 5 – 10 times a year
    - 2 – 4 times a year

2. What products do you usually order to be delivered at your place or any other address? (You can choose more than one option)
    - Food (e.g., pizza, burger)
    - Drinks (e.g., beer, coffee)
    - Medicine
    - Clothes/shoes
    - Valuable goods (jewelry, etc)
    - Small-sized electronics
    - Small household products
    - Books
3. How satisfied are you with the following aspects of your current e-commerce deliveries?

	Very dissatisfied	*Dissatisfied*	*Neither satisfied nor dissatisfied*	*Satisfied*	*Very satisfied*

Amount of time it takes to receive my order.					
Price paid extra for the home delivery.					
Condition in which the order arrives (good or damaged).					

4. Please indicate how much you agree with the following statements:

	Strongly disagree	*Somewhat disagree*	*Neither agree nor disagree*	*Somewhat agree*	*Strongly agree*
I am aware that drones can be used for delivering small products.					
My first reaction when hearing about drone delivery service is positive.					
I am familiar with how a drone works.					
I am familiar with the use of drones in the area I live.					
I am aware that drones have more applications other than military uses.					
I have used a drone before.					
I am aware that some big firms like Amazon, Google and Uber have started implementing drone delivery service in some countries.					

PAGE 3

Consumer perception

5. Please consider that it is possible to receive by drones your e-commerce deliveries at the place that you want. Indicate how much you agree with the following statements on drone delivery services:

	Strongly disagree	*Somewhat disagree*	*Neither agree nor disagree*	*Somewhat agree*	*Strongly agree*
I can have my products delivered faster than any other means of transport.					
I can have my products delivered precisely at my exact location.					
Drones can reach places where road transport can't reach.					
Drone delivery will reduce road congestion.					

Drone delivery is more environmentally friendly than traditional delivery methods.					
Drone deliveries will be beneficial for people living in remote regions.					
I feel concerned about drones trespassing my property.					
Drone delivery will lead to a loss of privacy for me.					
Drone delivery might not be used in a way that respects my privacy.					
I think the drone might brake during the delivery service.					
I am worried about the possibility of the package being damaged while it is transported.					
I am worried about the possibility of the package being violated or stolen by others.					
I am worried that drones will be very noisy.					
I am worried that drones will reduce the view to the sky and the environment.					
I'm worried that drones can hurt people.					
I'm worried that drones could be used for illicit business.					

PAGE 4

Preferences and expectations

6. Please answer accordingly: "It is easy for me to reach a place that sells…"

	Strongly disagree	*Somewhat disagree*	*Neither agree nor disagree*	*Somewhat agree*	*Strongly agree*
Groceries					
Medicines					
Personal and house products					
Electronics					
Books					

7. What type of products would you be willing to receive by Drone Delivery? (you may choose more than one option):

- Food (e.g., pizza, burger)
- Drinks (e.g., beer, coffee)
- Medicine
- Mail (e.g., correspondence, documents)
- Clothes/shoes
- Valuable goods (jewelry, etc)
- Small-sized electronics
- Small household products
- Books

8. How much would you be willing to pay extra for a faster delivery by a drone for each of the following product types?

	0.50 – 1.50 €	1.60 – 3.00 €	3.10 – 8.00 €	More than 10 €
Food (e.g., pizza, burger)				
Drinks (e.g., beer, coffee)				
Medicine				
Mail (e.g., correspondence, documents)				
Clothes / Shoes				
Valuable goods (jewelry, etc)				
Small-sized electronics				
Small household products				
Books				

9. As mentioned before, well-known companies are already implementing Drone Delivery Service in some countries. How long do you think it will take for it to be available in your city?
   - 1-3 years
   - 3-5 years
   - More than 5 years
   - I think it won't be available for the next 10 years

10. How much do you agree with the following statements on the use of drone delivery services:

	Strongly Disagree	Somewhat Disagree	Neither agree nor disagree	Somewhat Agree	Strongly Agree
I feel motivated to try a new technology as a drone delivery.					
I believe drone delivery service will have a positive impact on the delivery industry.					

I think drone delivery is an innovative technology and I feel excited to try it.					
I would use drone delivery to receive my order.					
Using drone delivery to receive some products is something I would use.					
I could see myself using drone delivery to receive my package					
I intend to use drone delivery services in the future immediately when they will be available.					
I intend to use drone delivery services in the future but after they are available and tested for some time in the market.					
I (will) have the knowledge necessary to use drone delivery services.					
I think drone delivery services will increase soon.					
Drone delivery service is (will be) enjoyable.					
I think that using drone delivery is a good idea.					
I think drone delivery service will fail and won't be accepted in the future.					
I don't feel safe having drones delivering my products.					

PAGE 5

Socioeconomic information

11. What is your age group?
    - 18 – 24
    - 25 – 34
    - 35 – 44
    - 45 – 54
    - 55 – 65
    - Over 65
12. What is your gender?
    - Male
    - Female
    - Other
13. What is your educational background (including ongoing education)?
    - Primary or secondary school
    - High school

- Technical school
- Bachelor's degree (or equivalent)
- Master's degree (or equivalent)
- PhD

14. What is your current employment situation?
    - Fully-employed
    - Part-time employed
    - Student
    - Retired
    - Currently unemployed
    - On lay-off
    - Other
15. Please indicate an approximation of your monthly net income:
    - Less than 500 €
    - 501 – 1000 €
    - 1001 – 1500 €
    - 1501 – 3000 €
    - 3001 – 5000 €
    - More than 5000 €
16. Do you live in a house or apartment?
    - House
    - Apartment
17. How would you describe the area you live in?
    - City center
    - Urban environment
    - Suburban environment
    - Rural environment
18. Do you have a driving license?
    - Yes
    - No
19. How many cars do you have available in your household?
    - 0
    - 1
    - 2
    - More than 2

Annex B – Independent t-test

T-test – Expected benefits and driving license

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
I can have my products delivered faster than any other means of transport	Equal variances assumed	4,692	0,031	0,812	301	0,417	0,093	0,114	-0,132	0,318
	Equal variances not assumed			0,719	110,647	0,474	0,093	0,129	-0,163	0,349
I can have my products delivered precisely at my exact location	Equal variances assumed	0,012	0,911	1,384	301	0,167	0,159	0,115	-0,067	0,385
	Equal variances not assumed			1,317	123,262	0,190	0,159	0,121	-0,080	0,398
Drones can reach places where road transport can't reach	Equal variances assumed	5,860	0,016	2,378	301	0,018	0,237	0,100	0,041	0,433
	Equal variances not assumed			2,036	106,094	0,044	0,237	0,116	0,006	0,468
Drone delivery will	Equal variances	1,667	0,198	-1,207	301	0,228	-0,181	0,150	-0,477	0,114

reduce road congestion	assumed									
	Equal variances not assumed			-1,286	151,374	0,200	-0,181	0,141	-0,460	0,097
Drone delivery is more environmentally friendly than traditional delivery methods	Equal variances assumed	0,040	0,841	0,203	301	0,839	0,025	0,123	-0,217	0,267
	Equal variances not assumed			0,199	129,780	0,843	0,025	0,125	-0,223	0,273
Drone deliveries will be beneficial for people living in remote regions	Equal variances assumed	0,476	0,491	0,798	301	0,425	0,090	0,112	-0,132	0,311
	Equal variances not assumed			0,740	118,458	0,461	0,090	0,121	-0,150	0,330

Non-parametric test

Hypothesis Test Summary			
Null Hypothesis	Test	Sig.[a,b]	Decision
The distribution of 5.Benefits_I can have my products delivered faster than any other means of transport is the same across categories of 18. Driving license.	Independent-Samples Mann-Whitney U Test	0,905	Retain the null hypothesis.
The distribution of 5.Benefits_Drones can reach places where road transport can't reach is the same across categories of 18. Driving license.	Independent-Samples Mann-Whitney U Test	0,074	Retain the null hypothesis.
a. The significance level is ,050.			
b. Asymptotic significance is displayed.			

T-test – Awareness and Gender

Independent Samples Test

Levene's Test for Equality of Variances	t-test for Equality of Means

		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
I am aware that drones can be used for delivering small products.	Equal variances assumed	0,316	0,574	2,164	301	0,031	0,248	0,115	0,022	0,473
	Equal variances not assumed			2,163	299,068	0,031	0,248	0,115	0,022	0,473
My first reaction when hearing about drone delivery service is positive.	Equal variances assumed	0,594	0,442	2,052	301	0,041	0,200	0,098	0,008	0,392
	Equal variances not assumed			2,055	300,591	0,041	0,200	0,097	0,008	0,392
I am familiar with how a drone works.	Equal variances assumed	6,944	0,009	5,112	301	0,000	0,609	0,119	0,374	0,843
	Equal variances not assumed			5,132	300,668	0,000	0,609	0,119	0,375	0,842
I am familiar with the use of drones in the area I live.	Equal variances assumed	17,021	0,000	0,481	301	0,631	0,067	0,140	-0,208	0,343
	Equal variances not assumed			0,477	273,451	0,634	0,067	0,141	-0,211	0,346
I am aware that drones	Equal variances	5,970	0,015	4,118	301	0,000	0,452	0,110	0,236	0,668

have more applications other than military uses.	assumed									
	Equal variances not assumed			4,161	287,878	0,000	0,452	0,109	0,238	0,666
I have used a drone before.	Equal variances assumed	24,672	0,000	3,997	301	0,000	0,640	0,160	0,325	0,955
	Equal variances not assumed			3,97	279,409	0,000	0,640	0,161	0,322	0,957
I am aware that some big firms like Amazon, Google and Uber are doing drone delivery.	Equal variances assumed	1,628	0,203	2,960	301	0,003	0,424	0,143	0,142	0,706
	Equal variances not assumed			2,967	300,999	0,003	0,424	0,143	0,143	0,705

Non-parametric test

Hypothesis Test Summary			
Null Hypothesis	Test	Sig.[a,b]	Decision
The distribution of 4. Awareness_I am familiar with how a drone works is the same across categories of 12. Gender.	Independent-Samples Mann-Whitney U Test	0,000	Reject the null hypothesis.
The distribution of 4. Awareness_I am familiar with the use of drones in the area I live is the same across categories of 12. Gender.	Independent-Samples Mann-Whitney U Test	0,719	Retain the null hypothesis.
The distribution of 4. Awareness_I am aware that drones have more applications other than military uses is the same across categories of 12. Gender.	Independent-Samples Mann-Whitney U Test	0,000	Reject the null hypothesis.
The distribution of 4. Awareness_I have used a drone before is the same across categories of 12. Gender.	Independent-Samples Mann-Whitney U Test	0,000	Reject the null hypothesis.
a. The significance level is ,050.			
b. Asymptotic significance is displayed.			

Annex C – Non-parametric test

Perceived concerns and Area of living

Hypothesis Test Summary			
Null Hypothesis	Test	Sig.[a,b]	Decision
The distribution of 5.Concerns_I feel concerned about drones trespassing my property is the same across categories of 17. Area you live in.	Independent-Samples Kruskal-Wallis Test	0,009	Reject the null hypothesis.
The distribution of 5.Concerns_Drone delivery will lead to a loss of privacy for me is the same across categories of 17. Area you live in.	Independent-Samples Kruskal-Wallis Test	0,643	Retain the null hypothesis.
The distribution of 5.Concerns_Drone delivery might not be used in a way that respects my privacy is the same across categories of 17. Area you live in.	Independent-Samples Kruskal-Wallis Test	0,038	Reject the null hypothesis.
The distribution of 5.Concerns_I think the drone might brake during the delivery service is the same across categories of 17. Area you live in.	Independent-Samples Kruskal-Wallis Test	0,003	Reject the null hypothesis.
The distribution of 5.Concerns_I am worried about the possibility of the package being damaged while it is transported is the same across categories of 17. Area you live in.	Independent-Samples Kruskal-Wallis Test	0,019	Reject the null hypothesis.
The distribution of 5.Concerns_I am worried about the possibility of the package being violated or stolen by others is the same across categories of 17. Area you live in.	Independent-Samples Kruskal-Wallis Test	0,056	Retain the null hypothesis.
The distribution of 5.Concerns_I am worried that drones will be very noisy is the same across categories of 17. Area you live in.	Independent-Samples Kruskal-Wallis Test	0,006	Reject the null hypothesis.
The distribution of 5.Concerns_I am worried that drones will reduce the view to the sky and the environment is the same across categories of 17. Area you live in.	Independent-Samples Kruskal-Wallis Test	0,003	Reject the null hypothesis.
The distribution of 5.Concerns_I'm worried that drones can hurt people is the same across categories of 17. Area you live in.	Independent-Samples Kruskal-Wallis Test	0,004	Reject the null hypothesis.
The distribution of 5.Concerns_I'm worried that drones could be used for illicit business is the same across categories of 17. Area you live in.	Independent-Samples Kruskal-Wallis Test	0,232	Retain the null hypothesis.
a. The significance level is ,050.			
b. Asymptotic significance is displayed.			

Pairwise Comparisons of 17. Area you live in					
Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
Rural environment-Urban environment	18,362	38,664	0,475	0,635	1,000

Rural environment-Suburban environment	40,268	41,317	0,975	0,330	1,000
Rural environment-City center	52,693	38,884	1,355	0,175	1,000
Urban environment-Suburban environment	-21,906	17,467	-1,254	0,210	1,000
Urban environment-City center	34,331	10,486	3,274	0,001	0,006
Suburban environment-City center	12,425	17,949	0,692	0,489	1,000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same.
Asymptotic significances (2-sided tests) are displayed. The significance level is ,050.
a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

Annex D – Questions from survey and their relationship with the literature review

QUESTION	OBJECTIVE	STUDY	REFERENCE
How often do you buy products online to be delivered at your place or any other address?	Filter Respondents	Soffronoff et al. (2016) Empirical study	In this research, they found that the people's acceptance on drone delivery varied by age, sex, education, location and whether they were e-commerce frequent customers or not
What products do you usually order to be delivered at your place or any other address?			
Please rate your current delivery services for the following:	Investigate about customer satisfaction with current delivery services	Yusra and Agus (2019) Empirical study	Service quality has a positive influence on customer satisfaction. Consumers of online food delivery tend to easily change provider if they feel unsatisfied.
- Amount of time they take to deliver your order.			
- Price you pay per delivery.			
- Condition in which your order arrives (good or damaged).		Zeithaml et al. (2006) Book	Price, product quality and perceived service quality are components of customer satisfaction
Please indicate how much you agree with the following statements: - I am aware that drones can be used for delivering small products. - My first reaction when hearing about drone delivery service is positive. - I am familiar with how a drone works. - I am aware that drones have more applications other than military use. - I have used a drone before. - I am aware that some big firms like Amazon, Google and Uber have started implementing drone delivery service in some countries.	Measure the level of awareness regarding drones and drone delivery	Aydin (2019) Empirical study	Public awareness of drone applications. "People know less tan what they think they know". There is a lack of knowledge regarding drone applications. Public knowledge on the applications of drones might affect the acceptance of the technology.
Indicate how much you agree with the following statements:	Measure the level of	Joerss et al. (2016) Empirical study	

- I can have my products delivered faster than any other means of transport	perception and raise awareness	Lee et al. (2016) Empirical study	Some people prefer not to buy products online due to the long delivery times The main advantage of doing delivery by drones is their speed.
- I can have my products delivered precisely at my exact location.		Mohamed et al. (2020) Empirical study	When it comes to reaching a single point, it is known that drones can go very close to specific targets, these characteristics grant them higher levels of accuracy and better targeted actions
- Drones can reach places where road transport can't reach.		Lee et al. (2016) Empirical study	Drones are not restricted to the infrastructure of the regular means of transportation.
- Drone delivery will reduce road congestion.		DHL (2014) Empirical study	UAVs could provide major relief for inner cities, taking traffic off the roads and into the skies.
- Drone delivery is more environmentally friendly than traditional delivery methods.		Stolaroff et al. (2018) Simulations Joerss et al. (2016) Empirical study Goodchild and Toy (2018) Simulations Chiang et al. (2019) Simulations Park et al. (2018) Simulations	Small drones have a lower environmental impact than diesel trucks. Drones are more environmentally friendly than traditional ways of delivery. Drones can reduce CO2 emissions. Drones are more environmentally friendly than electric motorbikes.
- Drone deliveries will be beneficial for people living in remote regions.			

- I feel concerned about drones trespassing my property. - Drone delivery might not be used in a way that respects my privacy.		Soffronoff et al. (2016) Empirical study Watkins et al. (2019) Empirical study	People concerned about drones making the delivery to a wrong address, trespassing private property. Entering the urban territory with the ability to take pictures or film videos and then disappear from sight could cause a justifiable concern in the citizens.
- I think the drone might brake during the delivery service.		Zhu (2019) Empirical study	People were concerned about things directly related to the service like the package or property damage due to malfunction.
- I am worried that drones will be very noisy. - I am worried that drones will reduce the view to the sky and the environment.		Zhu (2019) Empirical study Watkins et al. (2019) Empirical study	There is a group concerning about this type of service making the sky less pleasant. Drone's noise will probably be perceived different depending on how much the product is expected.
- I am worried about the possibility of the package being damaged while it is transported. - I am worried about the possibility of the package being violated or stolen by others.		Zhu (2019) Empirical study	People were concerned about things directly related to the service like the package or property damage due to malfunction, steal of packages.
- I'm worried that drones can hurt people.		Yoo et al. (2018) Empirical study	Consumers worry about its potential criminal use such as attempt to damage a person's integrity.
- I'm worried that drones could be used for illicit business.		Zhu (2019) Empirical study	Some people were concern about illegal activities being done by drones.
What type of products would you be willing to receive by Drone Delivery?	Investigate consumer's preferences	Hwang et al. (2019a) Empirical study	A combination between internal and external factors and the consumer's tendency to have preferences over some products/services

		Joerss et al. (2016) Empirical study	Fast delivery is most relevant for groceries and medication
How much would you be willing to pay for quicker deliveries by drone?		Kotler and Keller (2016) Book Lewis (2006) Empirical study	Price perception greatly affects a consumer's decision to purchase a product. Shipping fees directly affects the order and size of the purchases.
Please indicate the extent of your agreement or disagreement with:		Hwang et al. (2019) Empirical study	Consumers who like to experience new technologies have higher intention to use this type of service.
- I feel motivated to try a new technology as a drone delivery.			
- I believe drone delivery service will have a positive impact in the delivery industry.			
- I don't feel safe having drones delivering my products. - I think drone delivery service will fail and won't be accepted in the future.		Yoo et al. (2018) Empirical study	Consumers worry about its potential military and criminal use such as invasion of privacy or attempt to damage a person's integrity.
- I think drone delivery is an innovative technology and I feel excited to try it. - I would use drone delivery to receive my order. - Using drone delivery to receive some products is something I would use. - I could see myself using drone delivery to receive my package - I intend to use drone delivery services in the future immediately when they will be available. - I intend to use drone delivery services in the future but after they are available and tested for some time in the market.	Measure the level of perception and raise awareness	Hwang et al. (2019) Empirical study Yoo et al. (2018) Empirical study	Perceived innovativeness positively affects attitude toward using drone food delivery services. An innovative product/service is far superior than the traditional one might persuade their decisions in choosing the innovative product/service.

- I think drone delivery services will increase soon.			
- I (will) have the knowledge necessary to use drone delivery services.		Hwang et al. (2019) Empirical study	If there is not enough information, there would be a time and performance risk perceived by the consumers since they would need to spend time learning how to use drone food delivery services.
- Drone delivery service is (will be) enjoyable.		Hwang et al. (2019) Empirical study	Perceived innovativeness positively affects attitude toward using drone food delivery services.
What is your age?	Demographics questions (Filter)	Hwang et al. (2019) Empirical study	Young consumers perceive high levels of innovativeness making them more likely to use drone food delivery services
What is your gender?		Hwang et al. (2019) Empirical study	The females were more interested in adopting this service and say positive things about it than the male population.
Do you live in a house or apartment?		Yoo et al. (2018) Empirical study	The area of residence affects the attitude related to drone delivery.
How would you describe the area you live in?			

Annex E – Linear regression

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-2,909E-17	0,030		0,000	1,000		
	Attitude_Positive attitude	0,853	0,030	0,853	28,367	0,000	1,000	1,000
2	(Constant)	3,485E-17	0,029		0,000	1,000		
	Attitude_Positive attitude	0,795	0,032	0,795	24,839	0,000	0,832	1,203
	Awareness_Functionality	0,141	0,032	0,141	4,416	0,000	0,832	1,203
a. Dependent Variable: Intention to use								

Residuals Statistics[a]					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-2,8123403	1,4666433	0,0000000	0,86277726	303
Residual	-1,42758191	1,87927663	0,00000000	0,50558422	303
Std. Predicted Value	-3,260	1,700	0,000	1,000	303
Std. Residual	-2,814	3,705	0,000	0,997	303
a. Dependent Variable: Intention to use					