**Czech University of Life Sciences Prague**

**Faculty of Economics and Management**

**Department of Management**

# Master's Thesis

## The future Urban Air Mobility in Ile de France with electric vertical take-off and landing and its social acceptance

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# CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

# DIPLOMA THESIS ASSIGNMENT

Valentin Santia-Andrews

Economics and Management

Thesis title

**The future Urban Air Mobility in Ile de France with electric vertical take-off and landing and its social acceptance**

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**Objectives of thesis**

This thesis aims to contribute to the understanding of the groundbreaking technology of electric vertical take-off and landing in the Urban Air Mobility, in the context of the fourth industrial and digital revolution of the 21st century. The aims are to identify the strengths and weaknesses of this new technology focusing on the Ile de France region in France. The author focuses only on passenger transportation with eVTOL. The main objective of the research is to study the social acceptance and people attitudes towards this emerging air transportation solution.

**Methodology**

This thesis contains two main parts – one theoretical and one practical.

The theoretical part is based largely on a review of current literature, from the origins of the concept to the future of the sector.

The practical part will focus first on analyzing public acceptance when introducing the concept of electric vertical take-off and landing in Ile de France before 2030 through a questionnaire survey. Then some descriptive analysis will be conducted to describe the relationships between answers from the survey. Finally, the author interviewed several experts to bring qualitative analysis to the research.

**The proposed extent of the thesis**

70-100 pages

**Keywords**

Urban Air Mobility, Electric Vertical Take-off and Landing, Aerial Mobility Solutions, Social Acceptance

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**Recommended information sources**


Airbus. (2019). An Assessment of Public Perception of Urban Air Mobility (UAM)

Autorité environnementale. (2023). Avis délibéré de l'Autorité environnementale sur l'aménagement d'un vertiport sur la Seine, quai d'Austerlitz à Paris (75)

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EASA. (2021). Study on the societal acceptance of Urban Air Mobility in Europe. May 19

McKinsey & Company. (2022). Perspectives on advanced air mobility

Uber. (2016). Fast-Forwarding to a Future of On-Demand Urban Air Transportation. October 27


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Prague on 28. 03. 2024

**Declaration**

I declare that I have worked on my master's thesis titled "The future Urban Air Mobility in Ile de France with electric vertical take-off and landing and its social acceptance" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on 29/03/2024 _____

**Acknowledgement**

I would like to thank Petr Procházka, Ph.D., for his support and help during my work on this thesis.

# The future Urban Air Mobility in Ile de France with electric vertical take-off and landing and its social acceptance


## Abstract

The aim of the thesis is to contribute to the understanding of the groundbreaking technology of electric vertical take-off and landing in the Urban Air Mobility, in the context of the fourth industrial and digital revolution of the 21st century. The aims are to identify the evolution of this modern technology and to study the potential integration into the IDF region. The author focuses only on electric vertical take-off and landing passenger transportation. The main objective of the research is to study the social acceptance and people attitudes towards this emerging air transportation solution. Based on the given results, it will provide suggestions and recommendations to maximise people acceptance. In the master's thesis, the author tests a series of hypotheses related to the social acceptance of electric vertical take-off and landing. It seeks to shed brighter light on differences in attitudes caused by people's characteristics, such as gender, age and gross monthly income. About methodology, the findings mainly come from quantitative methods. Methodologically, the study primarily employs quantitative methods, utilizing data collected from a Google Forms survey administered to 263 individuals, with SPSS software used for hypothesis testing. Additionally, qualitative interviews with experts were conducted to supplement the findings. After conducting the analysis, it turns out that the findings are somewhat similar to other relevant reports and surveys published by authorities and key players in the sector, where they conclude that demographic features, habits and culture are significant factors creating differences in the way French people accept or not electric vertical take-off and landing. Based on the global results, some recommendations are provided, which aim at increasing the understanding and foster social acceptance of eVTOL.



**Keywords:** Urban Air Mobility, Electric Vertical Take-off and Landing, Aerial Mobility Solutions, Social Acceptance

# Budoucí městská letecká mobilita v Ile de France s elektrickým kolmým startem a přistáním a její společenské přijetí


## Abstrakt

Cílem práce je přispět k pochopení průlomové technologie elektrického vertikálního vzletu a přistání v rámci městské letecké mobility v kontextu čtvrté průmyslové a digitální revoluce 21. století. Cílem je identifikovat vývoj této nové technologie a prozkoumat její potenciální integraci do regionu IDF. Autor se zaměřuje pouze na elektrickou osobní dopravu s vertikálním vzletem a přistáním. Hlavním cílem výzkumu je studovat společenskou akceptaci a postoje lidí k tomuto novému řešení letecké dopravy. Na základě daných výsledků poskytne návrhy a doporučení k maximálnímu přijetí ze strany lidí. V magisterské práci autor ověřuje řadu hypotéz týkajících se společenské akceptace elektrického vertikálního vzletu a přistání. Snaží se osvětlit rozdíly v postojích způsobené charakteristikami lidí, jako je pohlaví, věk a hrubý měsíční příjem. Co se týče metodologie, zjištění pocházejí především z kvantitativních metod. Z metodologického hlediska studie využívá především kvantitativní metody s využitím údajů získaných z dotazníku Google Forms, který byl zadán 263 osobám, přičemž k testování hypotéz byl použit software SPSS. Kromě toho byly pro doplnění zjištění provedeny kvalitativní rozhovory s odborníky.
Po provedení analýzy se ukázalo, že zjištění jsou do jisté míry podobná jiným relevantním zprávám a průzkumům zveřejněným orgány a klíčovými hráči v tomto odvětví, které dospěly k závěru, že demografické rysy, zvyky a kultura jsou významnými faktory vytvářejícími rozdíly ve způsobu, jakým Francouzi přijímají nebo nepřijímají elektrický vertikální vzlet a přistání. Na základě celkových výsledků jsou uvedena některá doporučení, jejichž cílem je zvýšit pochopení a podpořit společenské přijetí eVTOL.



**Klíčová slova:** Městská letecká mobilita, elektrický vertikální vzlet a přistání, řešení letecké mobility, společenská přijatelnost

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| | |
|---|---|
| **SPSS** | Software Package for Social Sciences |
| **EVTOL** | Electric vertical take-off and landing aircraft |
| **EASA** | European Union Aviation Safety Agency |
| **DGAC** | Direction Générale de l'Aviation Civile |

| | |
|---|---|
| **DSNA** | Direction des services de la Navigation aérienne |
| **ENAC** | École Nationale de l'Aviation Civile |
| **UAM** | Urban Air Mobility |
| **AAM** | Advanced Air Mobility |
| **IATA** | International Air Transport Association |
| **ATM** | Air Traffic Management |
| **UTM** | Unmanned Traffic Management |
| **EU** | European Union |
| **ECA** | European Court of Auditors |
| **IDF** | Ile de France |
| **GDP** | Gross Domestic Product |
| **WHO** | World Health Organization |

# 1. Introduction

At the International Paris Air Show in 2023, Volocopter, the pioneer of UAM and Groupe ADP, alongside the French Civil Aviation Authority and Paris region, stressed that Paris will be the first European city – and likely the first city in the world – to offer eVTOL services in time for the 2024 Olympic and Paralympic Games. The services will be available to the public as an addition to the existing public transportation system of Paris Region.

Congestion and pollution are pressing concerns in European cities, as highlighted in reports like the TomTom Traffic Index 2020 and the Air quality in Europe 2020 report by the European Environment Agency. As urbanization accelerates and population densities rise, cities face profound challenges in managing transportation systems that are both efficient and sustainable. In the Île-de-France region, encompassing the vibrant metropolis of Paris and its surrounding areas, these challenges are particularly acute. Congestion, pollution, and the strain on existing transportation infrastructure underscore the urgent need for innovative mobility solutions that can navigate the complexities of urban environments while minimizing environmental impact.

One such solution that holds considerable promise is UAM featuring eVTOL aircraft. As the next frontier in transportation technology, eVTOLs offer the potential to revolutionize urban mobility by providing fast, efficient, and environmentally friendly aerial transportation. By bypassing ground congestion and utilizing vertical take-off and landing capabilities, eVTOLs have the capacity to transform the way people and goods move within and between urban centres.

However, the successful implementation of eVTOL-based UAM systems hinges not only on technological advancements but also on the acceptance and integration of these innovations within society. The social acceptance of eVTOL technology, influenced by factors such as safety, noise pollution, public perception, and regulatory frameworks, will ultimately determine its viability as a mainstream mode of transportation in Île-de-France.

This thesis seeks to explore the future of UAM in Île-de-France with a specific focus on eVTOL aircraft and their social acceptance. By examining the technological landscape, regulatory environment, and societal attitudes towards eVTOLs, this research aims to provide insights into the opportunities and challenges associated with integrating this transformative technology into

the region's urban landscape. The first step consists in measuring citizens' willingness to accept this new mode of transport and collating their possible concerns and expectations, for instance related to safety, security, privacy and environmental impact.

Through interdisciplinary analysis, questionnaire and qualitative interviews, this study endeavours to inform policy decisions, urban planning strategies, and industry initiatives aimed at realizing the full potential of eVTOL in Île-de-France.

# 2. Objectives and Methodology

## 2.1 Objectives

This thesis aims to contribute to the understanding of the groundbreaking technology of electric vertical take-off and landing in the UAM, in the context of the fourth industrial and digital revolution of the 21st century. The aims are to identify the strengths and weaknesses of this innovative technology focusing on the IDF region in France. The author focuses only on passenger transportation with eVTOL. The main objective of the research is to study the social acceptance and people attitudes towards this emerging air transportation solution.

One of the main ideas is to know how, why and to what extent eVTOL impact people behaviour as well as social acceptance.

The research objective could be presented as:

- Assessing the importance of social acceptance towards innovative technology such as eVTOL
- Understanding which factors are influencing social acceptance.
- Helping to raise awareness of this promising future of mobility, which requires the public's views to be considered.

## 2.2 Methodology

To respond to the objectives of the thesis in the best manner possible, it has been decided to proceed as follows: use quantitative and qualitative analysis. To correctly evaluate the perceived social acceptance of French people towards eVTOL, a questionnaire has been designed and disseminated to get the most accurate and representative answers from the population. The questionnaire presented several types of questions: yes/no/I do not know, yes/no/I am not sure, multiple choice, and Linkert scale. Once the answers collected through Google Forms, a list of hypotheses has been created to analyse the responses. The hypotheses include different type of factors to extend as much as possible this emerging topic.
After the survey, to extract more qualitative information, the author also conducts a series of semi-structured interviews with four people representing different stakeholders – aviation authorities, airport operators, corporate lawyer and air traffic management expert.

Below, the author presents the list of 19 hypotheses:

| N° | Hypotheses |
|---|---|
| 1 | Gender and potential use of eVTOL in the coming decade |
| 2 | Age and potential use of eVTOL in the coming decade |
| 3 | Age and prior knowledge of eVTOL |
| 4 | Prior knowledge of eVTOL and gross monthly income |
| 5 | The frequency of using mobility services technologies and the potential use of an eVTOL in the coming decade |
| 6 | Frequency of taking the plane and prior knowledge of eVTOL |
| 7 | Frequency of taking the plane and the potential use of an eVTOL in the coming decade |
| 8 | Age and global perception of running eVTOL before 2030 |
| 9 | Gross monthly income and the global perception of running eVTOL before 2030 |
| 10 | Gross monthly income and the potential use of an eVTOL in the coming decade. |
| 11 | Gross monthly income and the likelihood of using an eVTOL with 25-50% higher prices than road taxi |
| 12 | Gross monthly income and the likelihood of using an eVTOL with similar prices than road taxi |
| 13 | Age and assessment of eVTOL environmental impact by ecological label |
| 14 | Gross monthly income and assessment of eVTOL environmental impact by an ecological label |
| 15 | Knowledge of eVTOL and assessment of eVTOL environmental impact by ecological label |
| 16 | Education level and knowledge of eVTOL |
| 17 | Education level and potential use of eVTOL in the coming decade |
| 18 | Concerns about eVTOL and assessment of environmental impact of eVTOL by ecological logo. |
| 19 | Global perception of running eVTOL by 2030 and Education level |

Source: own processing

The diversity of hypotheses can be explained by the fact that the topic is very new, getting as much feedback as possible. To correctly analyse the data collected and confirm or deny the hypotheses, a statistical analysis using the SPSS software has been done. Considering the nature of the data, Chi-square tests has been used. Formulas for Chi-square tests are presented below, according to Berger & Casella (2021). The author considers the level of significance equal to 5% as a basis for the hypothesis testing.

Chi-square test (1)

$$X^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

# 3. Literature Review

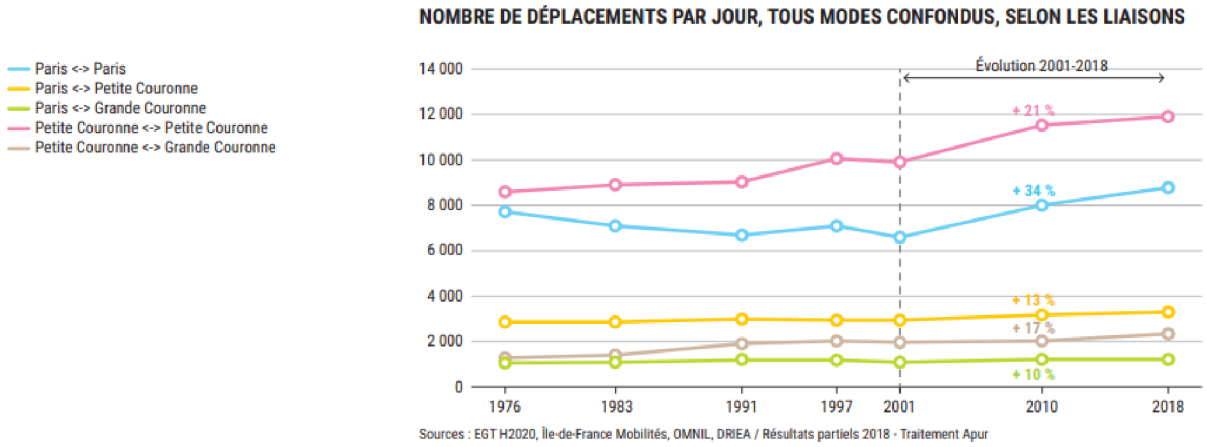
## 3.1 The mobility in Ile de France

### 3.1.1 Evolution of the mobility from 1980s to up 2030

Individual mobility in the Paris region has been increasing since the early 1990s, initially driven by the increase in the number of journeys made by car, followed by an increase in walking and, finally public transport since the 2000s.

Since 1976, the number of journeys made by the people of IDF has risen steadily, reaching almost 43 million daily journeys by all modes of transport in 2018, representing more than 180 million kilometres travelled every day. In 40 years, the number of journeys made has risen considerably, from just over 30.3 million daily journeys in 1976 to over 42.7 million in 2018. While this meteoric rise in the number of journeys is primarily due to the growth in the population of the Paris region (9.9 million inhabitants in 1975 and 12.2 million in 2018), it is also due to an increase in individual mobility since the 1990s, reflecting a more profound change in our lifestyles and the way we live the city.

Figure 1: number of daily journeys, all transport options, by routes in IDF.




Source: APUR, June 2021

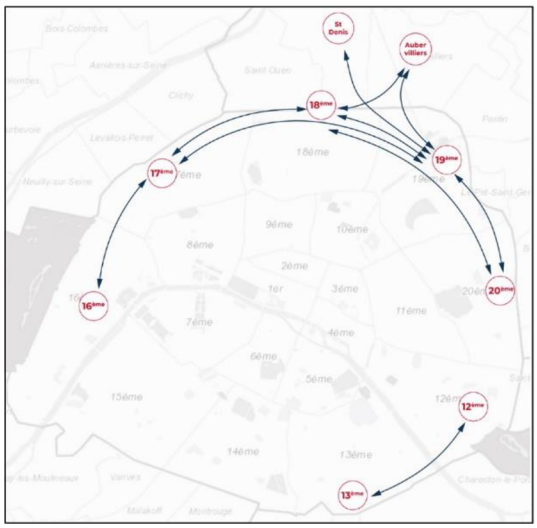
We can see that travels increase in all areas of the region, although more marked for journeys within the Petite Couronne and Paris. The number of journeys made within Paris rose by 34%, mainly because of a significant increase in journeys made on foot between 2001 and 2018.

In 2018, walking is the main mode of transport in Île-de-France, especially for short and local journeys, which are strongly represented within Paris and inner suburbs. With around 17.2 million journeys every day, walking option represents around 40% of the total number of journeys. Paris is the area where the number of journeys on foot rose the most between 2001 and 2018. Moreover, the car still accounts for more than a third of regional journeys and public transport for 22%. According to the National Institute of Statistics and Economic Studies in France, the modal shift is mainly focusing on public transport (metro, bus, tram, RER), because of changes in the network and the nature of jobs. There have also been significant developments in green mobility, especially in Paris.

Mobility of people in IDF between 2001 and 2010 started from 3.50 to 3.88 journeys per person per day. The individual mobility of the region's residents therefore showed an upward trend. Despite a decline in car use that began in 1997, and thanks to an increase in walking and public transport, individual mobility continued to grow until 2010, and is stagnating until 2018. The decline in car use began in Paris the 90s in Paris, spreading to the inner suburbs in the early 2000s, while car use seems to be levelling off in the Grande Couronne.
At the end of the 1990s, the car was the dominant mode of transport, accounting for more than 45% of all journeys made in Île-de-France, but its use has gradually declined since then, particularly in the heart of Paris. This reduction in car use is particularly seen in the Greater Paris metropolitan area, where car journeys fell by 12% between 2010 and 2018. In 2018, the number of journeys made by car in connection with the Greater Paris metropolitan area (within the metropolitan area or in connection with Paris or the inner suburbs) fell from 7.7 million to 5.9 million cars.

In the 2020s, a quarter of all journeys interacting with Paris come from Seine-Saint-Denis, followed by Hauts-de-Seine. One of the largest flows, including all origins-destinations (at the level of communes and arrondissements for Paris), are between the 16th and 17th arrondissements of Paris, between the 18th and 20th arrondissements, and between the 18th and 19th arrondissements.

Figure 2:Most important automobile flux on the ring road in Paris.




Source: Ville de Paris Direction de la Voirie et des Déplacements, 2020

While the proportion of journeys made by car is falling across all IDF, the number of journeys made by all modes in same area is increasing. The reduction in number of car journeys is therefore not linked to a drop in mobility, but rather to a change in travel practices involving a modal shift from the car to other modes. With a decrease by 31% over the period 2001-2015, the decline in car travel is having a major impact on road traffic in Paris. However, this overall slowdown does not mean the end of congestion and its many negative externalities: more than 300 km of cumulative traffic jams are still recorded on average at peak periods on the motorways and roads in IDF. The decline in household car ownership over the last 20 years in IDF begins in Paris, then extended to the inner suburb. The average number of vehicles per household fell from 0.52 in 1990 to 0.39 in 2017, thereby returning its historical level of 1975.

Figure 3: Evolution of car ownership by area of residence.

**ÉVOLUTION DU TAUX DE MOTORISATION SELON LA ZONE DE RÉSIDENCE**

| | 1975 | 1982 | 1990 | 1999 | 2007 | 2017 |
|---|---|---|---|---|---|---|
| Paris | 0,4 | 0,51 | 0,52 | 0,5 | 0,47 | 0,39 |
| Petite Couronne | 0,64 | 0,76 | 0,83 | 0,87 | 0,85 | 0,81 |
| Grande Couronne | 0,73 | 0,98 | 1,1 | 1,17 | 1,19 | 1,19 |
| MGP | 0,52 | 0,66 | 0,71 | 0,73 | 0,71 | 0,66 |
| Île-de-France | 0,6 | 0,76 | 0,83 | 0,9 | 0,9 | 0,87 |

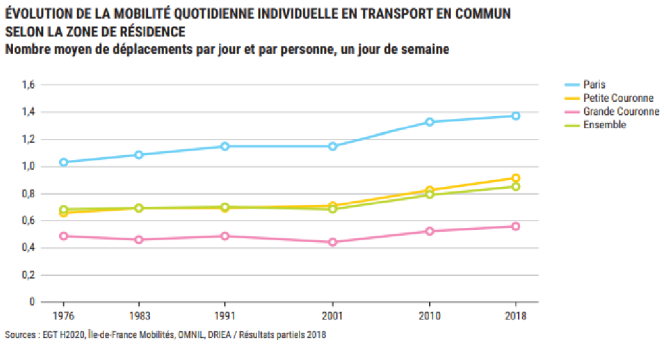
Source : Insee, recensements

Source: APUR, June 2021

In summary, the use of car is evolving over the decades, especially in Paris. This increase in the use of public transport is encouraged by the fall in car use, the increase in public transport

services and extension of the area served and changing behaviour. The growing number of mobility services and their improvements have led to greater use of public transport. With more than 1,500 bus routes, 14 metro lines, 9 tramway lines and 13 train and RER lines, the Paris public transport network is one of the largest public transport networks in the world. Across the Île-de-France region, daily public transport has grown steadily since 1976, rising from around 6 million daily journeys to more than 9.4 million in 2018, representing around 22% of the total number of daily journeys. The area of Paris shown the greatest number of journeys per day and per person since 2010.

Figure 4: Evolution in individual daily mobility by public transport by area of residence.




Source: APUR, June 2021

With extremely high mobility (8.8 million journeys within Paris in 2018) and mainly short distances (72% of journeys are less than 2 kilometres, and 92% less than 5 kilometres), Paris is an area for shared mobility and self-service, with different fleets: cars, bikes, scooters.
Vélib' and Autolib', true pioneers of shared mobility in Paris have paved the way for a new dimension to personal travel: use without ownership, and service with a direct route rather than a loop (back to the starting station). These two major innovations have revolutionized practices of city dwellers.

**Mobility distances**

The potential for modal shift in IDF is promising, given the short range of daily journeys. According to the 2020 Global Transport Study (EGT), almost 75% of journeys in the Paris Region are less than 5km long, and the average distance travelled is 4.7 km, up slightly on 2010 (4.4 km). As far as home-to-work journeys are concerned, 40% of working people in Île-de-

France travel short distances to work: 12% less than 1 km, 16% between 1 and 3 km and 12% between 3 and 5 km.

In a report from Paris authority, 4.41 km is the average distance of taxi journey in 2020 in IDF, with more than half journeys located in Paris (52.6%). For instance, these data follow similar ones found in the 2020 Global Transport Study.

Figure 5: Characteristics of taxi journeys in Paris.


Source: Syndicat professionnel des centraux radio de taxis de paris et de la région Parisienne, 2020

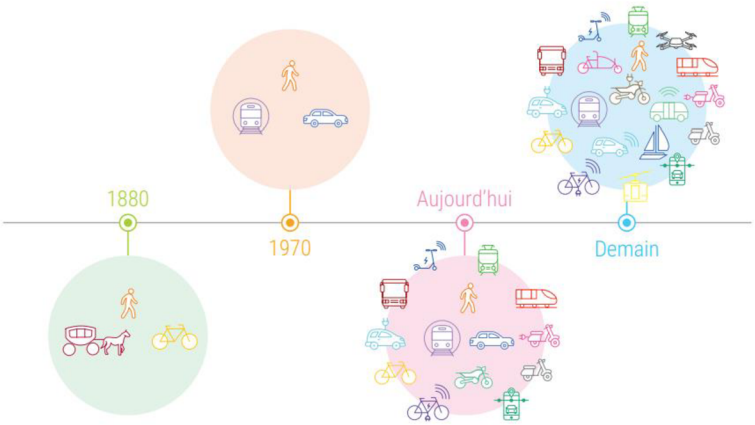
**The speed**

According to Paris Roads and Transportation Department, speed of cars between 7am and 9pm in Paris has been decreasing between 2002 and 2021. Average traffic speed fall by 6% from 2021 to 2020. Therefore, the speed in the heart of Paris is gradually decreasing. After analysing the evolution between 1980s and 2020s, the mobility industry is looking toward the future. According to OMNIL, the modal shift is mainly in favour of public transport (metro, bus, tram, RER), whose modal share of work-related journeys has risen sharply over the last decade. The range of mobility services is expanding both quantitatively and quality. The development of multiple and multimodal solutions is increasing the possibilities for getting various places, increasing at the same time the number of people who have access to them. It is no longer just the development of mobility services which supporting mobility development, but also the diversification of solutions and optimizing uses.

This transport diversification is driven by digital technology and mobile applications for and journey planners. The arrival of these new players and services are more competitive, flexible and tailored to users' needs and expectations. Inter-modality is encouraged, especially in the

vicinity of stations and public transport stations, making it possible to switch from one mode of transport to another within the same journey.

Figure 6: Timeframe from single mode of transport to diversified and sustainable mobility.




Source: APUR, June 2021

Current innovations are designed to optimize the use of motorized modes and the space for this type of offer. There are no plans to completely travel without the car, which still is a necessary means of transport, depending on specific situations. However, the space taken up by this mode of travel should tend to shrink. Cars take up over half of public space in Paris when it accounts for only 4% of journeys in Paris and 20% of journeys between Paris and suburbs. The current trend is to rebalance, in line with changes in usage and authorities' aims. The development of the public transport will continue with the Grand Paris metro of Greater Paris, but also with the numerous tramway projects. A total of 169 stations will be brought into service between 2021 and 2030, including 70 metro stations, 90 tramway 5 cable car stations and 4 new RER/Transilien stations.

By 2030, one of the main goals is 98% of people living in IDF will have access to a station within less than 2 km away. The aim is to provide an attractive offer for all residents, by developing the geographical network and improving access to these services. With the quick spread of teleworking and infrastructure improvements in favour of walking, cycling and micromobility, people are focusing on close mobility, which is compatible with their desire for quality of life and reducing environmental impact of travel.

In IDF, a planned ban on combustion-powered cars encourages people not buying new cars. Thus, people will have to find new mobility solutions. For instance, eVTOL solution is an

opportunity for people to still travel all around IDF. Local authorities have set up a low-emission zone to ban most polluting cars in all IDF, and Paris is mostly concerned.

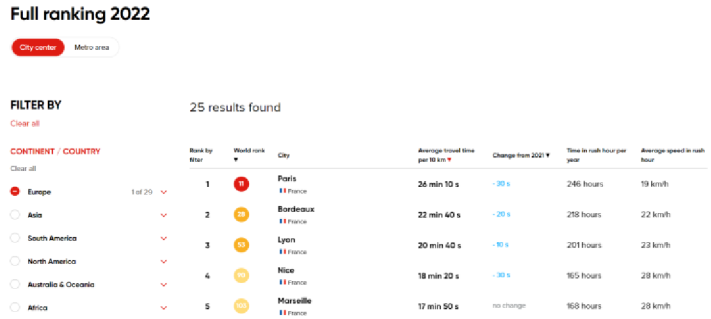
### 3.1.2 Negative externalities of traffic congestion

First, the main factors that are contributing to traffic congestion are: economic expansion, demographic changes and urbanization, transportation disruption, e-commerce and on-demand delivery, underinvestment in infrastructure and mixed effectiveness of policies and programs.
In IDF, some other factors affect and strengthen traffic congestion: the synchronization of working hours, the spatial concentration of employment, the reduction in the cost of car use, the city as a place of working and for leisure, the imbalance between supply and demand on the roads.

**Time of travel**

Time journey in IDF is one of the biggest challenges of people daily.
According to a report in 2010 by "Syndicat des transports d'Îlede-France (Stif)" and "la direction régionale et interdépartementale de l'Équipement et de l'Aménagement (DRIEA)", commuting distances between home and work are quite long in the Paris region. On average, working people spend 1 hour 24 minutes each day travelling directly between their place of residence and their place of work (round trip). It's 14 minutes longer than the French national average.
Besides, the average time to drive 10km in 2022 in Paris was 26 minutes and 10 seconds (11 world rank), according to the TomTom Traffic Index. The yearly cost of driving in Paris during rush hour in terms of time spent driving was 246 hours, including 109 hours due to congestion. People in Paris spent almost half of their driving time in congestion (44%).

Figure 7: 5 top French cities most congested rank per average travel time per 10 km in 2022.




Source: TomTom Traffic Index, 2022

**Road traffic noise**

Road traffic noise is also one of the biggest issues facing by residents and commuters.

According to the Île-de-France noise observatory, 11% of Parisians, or 231,000 people, would be exposed above the regulatory threshold of 68 dB(A) Lden during the day, and 5.2% or 109,150 people, would be above the threshold of 62 dB(A) at night in 2015.

More recently in 2021, according to a report by Bruitparif, the total cost of noise pollution in Île-de-France is set at 42.6 billion euros per year, depicting 29% of the national figure. The assessment carried out establishes that the costs incurred by transport noise in Île-de-France represent €26 billion per year, then 62% of the regional share.

Figure 8: Evolution of noise in IDF between 2012 and 2021


Source: Bruitparif, 2022

The year 2021 confirms the downward trend in road traffic noise seen since 2012, despite the successive lockdowns in 2020 because of Covid pandemic. New road developments, the lowering of the speed limit to 30km/h, less emissive vehicle engines and the development of new modes of transport are helping to reduce noise levels in the region.

**Quality of air**

According to the TomTom Traffic Index in 2022, based on a 10-km drive in the city centre of Paris with petrol engine, 1092kg of carbon emissions are emitted included 313kg due to congestion. For instance, almost 30% of carbon emissions are only due to congestion.

Overall, air quality continues to improve, as it has been for the past two decades: nitrogen dioxide and particulate matter levels continue to decrease. Nevertheless, this progress must be sustained considering current regulations: 40,000 residents of the Île-de-France region are still

breathing air holding concentrations of nitrogen dioxide that exceed the French and European regulatory limit value.

In 2022, the 12 million inhabitants of the Île-de-France region were exposed to air with concentrations of particulate matter and low-level ozone exceeding the thresholds recommended by the WHO, and 11.5 million inhabitants of the region for nitrogen dioxide (NO2). As a result, the ORS-Île-de-France (Île de France Regional Health Observatory) and Airparif have estimated that 7,900 premature deaths could be avoided each year in the area if pollutant concentrations fell below the levels recommended by the WHO.

Figure 9: 2022 Annual review of nitrogen dioxide pollution in IDF.


Source: Airparif, 2022

In 2021, the highest NO2 concentrations were recorded in the vicinity of the main roads: they were highest on the right bank of the Seine and on the peripheral boulevard. In 2021, exceedances of the annual limit value (40 µg/m3) will concern 20,000 Parisians, a slight reduction from 2019.

Between 2011 and 2021, NO2 levels near road traffic have fallen by over 45%, and average annual background NO2 concentrations have dropped by around 35%. This downward trend will continue in 2021, although 5040 premature deaths in Paris and nearly 7,920 in IDF were recorded between 2017 and 2019. Thanks to the continuing downward trend in chronic pollution levels, the exposed population is clearly down in 2019. However, NO2 concentrations are still problematic in Paris, with recurrent exceedances of limit values. For fine particulate matter, limit values are very occasionally exceeded on certain stretches of major roads, and measured concentrations still exceed quality aims.

**Socio-Economic damage**

According to the TomTom Traffic Index, the yearly fuel cost of a 10-km drive in the city centre of Paris with petrol engine is 836 EUR money spent, included 239 EUR due to congestion (almost 30% of total cost).

According to AirPArif, air quality is a major health and environmental issue. In France, the cost of air pollution is estimated at 70 to 100 billion euros per year by the Senate's Commission of Inquiry (report submitted in 2015). Health authorities estimate its health impact at 48,000 premature deaths a year, representing to 9% of mortality in France and a loss of life expectancy at age 30 that can exceed 2 years.

These health impacts have socio-economic costs. They cut short lives, increase medical expenses, reduce productivity through lost working days, etc.

**Low vehicle occupancy in Paris**

On average, vehicles using the ring road are very lightly occupied, with 82% of them moving only the driver. This proportion is even higher if we distinguish different trip purposes according to a report by 6t-bureau de recherche in 2021. As an example, the proportion of vehicles for commuting journeys with only one person is 91%.

Occupancy by car can be translated into average occupancy rates. Therefore, the report shows 1.1 persons per vehicle for commuting and 1.47 for leisure, shopping and accompanying. According to the 2010 Etude global transports report, the occupancy rate for commuting was also 1.1, and 1.28 for all purposes combined. So, the figures are therefore quite similar.

Moreover, most journeys reported (80% for all types of users) do not involve any constraints in terms of luggage or people to be transported. Thus, the rate of occupancy can increase if it is well optimized.

Figure 10: Average vehicle occupancy by trip purpose in Paris.

| | Taux d'occupation moyen |
|---|---|
| Trajet domicile/travail | 1.1 |
| Déplacement en lien avec l'activité professionnelle hors trajet domicile-travail | 1.23 |
| Loisirs, achats, accompagnement | 1.47 |
| **Tous motifs confondus** | **1.24** |

Source: 6t-bureau de recherche, 2021

## 3.2 Cost of urban congestion

When urban congestion management is not managed or missing, traffic congestion leads to a reduction in overall urban mobility for users. People are then facing different costs. According to a report by the ECA in 2020, the societal cost of road congestion in EU per year is around 270 billion euros. In heavily congested areas, traffic fluidity could generate productivity gains of up to 30%. Study has shown, however, that increasing road capacity in urban areas often leads to increased traffic and congestion, so the solution remains in other strategies such as the multi-modal approach. In many European cities, air quality is poor, and exceedances of the limit values designed to protect human health, set out in the Ambient Air Quality Directive, are frequent. As 96% of EU citizens living in urban areas are exposed to levels of air pollutants considered by the WHO to be harmful to health. In 2013, the European Commission estimated the total health cost of air pollution at several hundred billion euros per year.

According to a study from INRIX and Centre for Economics and Business Research, Parisian households who travel by private car will experience a 51% increase in congestion-related costs between 2013 and 2030. The impact of traffic jams will cost 4,123 euros per Parisian, compared with a cost of 2,883 euros in 2013. This staggering cost is due to several factors: the increase in the number of vehicles on the road (due to falling cost of vehicle ownership), strong demand for car travel, a rising standard of living driven by higher GDP per capita (Paris is set to record a 42% increase in GDP per capita), and population growth (increase by 7%, from 64 million in 2013 to 72 million in 2030).

The calculation of the cost of traffic congestion is tough to define, as traffic has a significant impact on many aspects, some of which, like the impact on health and the environment, are almost impossible to calculate precisely, but an estimation is possible. According to Matteo Satta, smart city consultant and expert, employers pay car users for the extra time they waste in their cars and try to work out just how much this can cost for each individual car. Because this time is paid at the minimum wage, the cost for the Île-de-France region would be over 49 million per day, over 10 billion per year and around 2,200 euros per year per car. This cost, which is greatly underestimated (the average wage is well above the minimum wage, affects almost 75% of households in the Paris region, but increases for households (24% of the total)

that own at least 2 cars. For instance, multimodal habits would not only be good for the environment and public health, but also for people's wallets.

## 3.3The Future Urban Air Mobility in IDF with eVTOL

### 3.3.1 Definitions of UAM and eVTOL

“Advanced Air Mobility” and “Urban Air Mobility” terms are in absence, yet, of agreed standard definitions. For instance, AMM and UAM are both in common use to speak about this new sector.

According to the National Aeronautics and Space Administration (NASA) in the United States of America, “the vision of AAM is that of a safe, accessible, automated, and affordable air transportation system for passengers and cargo capable of serving previously hard-to-reach urban and rural locations”. Thus, the term AAM covers passenger and cargo transport as well as other aerial missions in urban, regional, and in interregional geographies.

However, the term UAM is usually used when speaking about cities and densely populated environments and is therefore more easily understood by the public. According to the EASA, UAM is “a new safe, secure, and more sustainable air transportation system for passengers and cargo in urban environments, enabled by innovative technologies and integrated into multimodal transportation systems. The transportation is performed by electric aircraft taking off and landing vertically, remotely piloted or with a pilot on board.” Moreover, an eVTOL is an aircraft that uses electrical power to hover, take off and land vertically, according to Siemens. These vehicles are aircraft optimized for electrical propulsion powered by banks of batteries. The near-term goal of many eVTOL companies is to develop vertical take-off and landing vehicles which can provide quick and accessible short-range transportation for both people and cargo at a price comparable to current ground transportation. In the emerging market for UAM, an air taxi eVTOL has to be greener, safer, faster, quieter and more efficient than a helicopter or traditional automobile taxi.

### 3.3.2 Emergence of Urban Air Mobility and eVTOL concepts

According to EASA, the number of people living in urban areas will increase by around 3% every decade. In the 2019 Annual Review of IATA, due to an expected increase in air transport traffic by 5% every year and a doubling of air transport passenger numbers to 8.2 billion by 2037, significant challenges are posed to the aviation industry. Indeed, transport in urban areas is likely to become even more difficult than it is today.

When it comes to urban mobility issues, one of the thorniest of which is road congestion. Indeed, traffic congestion has gone up globally over the past decades. Cities are working on optimizing their road network performance, and around 75% of the cities included in the TomTom Traffic Index report had either increased or stable congestion levels between 2017 and 2018.

In Europe, according to a report by the ECA in 2020, "sustainable urban mobility is both one of the main challenges facing cities in the EU and a matter of concern for a large number of EU citizens". Urban mobility is an issue that concerns any EU citizens who are concerned about journey times and the cost of travel. Driven by the growing society's concern for the environment, advancements in green technology, changing urban landscapes, and a growing need for more efficient transportation options, Advanced Air Mobility has appeared as a disruptive concept in the aviation industry. Thus, eVTOL have appeared as a potential solution to traffic congestion especially in urban areas.

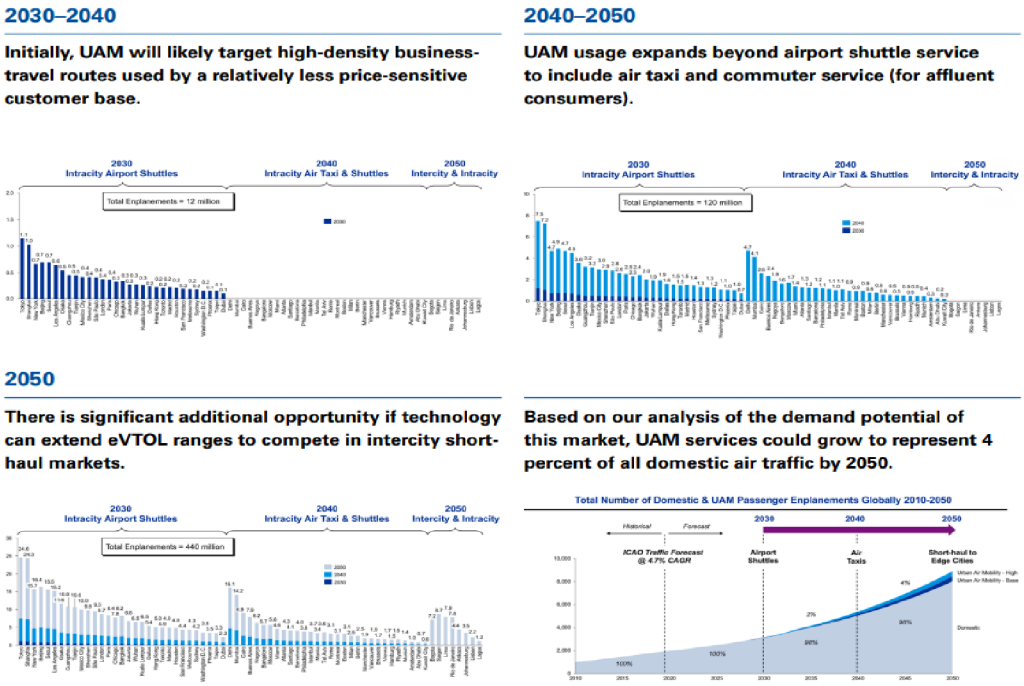
In summary, UAM is not a new concept. Urban helicopter transport options are available worldwide for decades. What's new are emerging aviation paired with digital technologies – battery improvements and distributed electric propulsion, eVTOL aircraft, advanced autonomy and ride-hailing platforms. All these modern technologies will make the urban aviation of the 21$^{st}$ century competitive with other premium transportation options.

### 3.3.3 eVTOL Market dynamics and development trends

Main question from stakeholders in the sector is not whether UAM will appear as a feasible ride-sharing option for a part of urban population. Rather, the question who plan to take part in UAM market is when. According to KPMG in Ireland, UAM can capture 4% of global domestic air traffic in 2050, accounting for 12 million passenger enplanements per year globally as soon

as the 2030s, rising to more than 400 million by 2050. The evolution of UAM growth is projected by decade (see below picture). Between 2030 and 2040, UAM will likely target high-density business travel routes used by a relatively less price-sensitive customer base. From 2040 to 2050, UAM usage expands beyond airport shuttle service to include air taxi and commuter services. Then, from 2050, opportunities are more significant if technology can extend eVTOL ranges to compete in intercity short-haul markets.

Figure 11: Charts illustrating the evolution of UAM growth by decade.



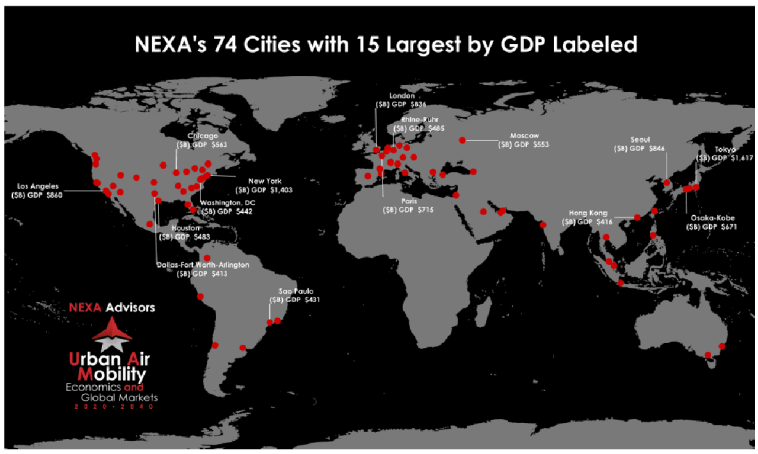

Source: KPMG Ireland, 2019

Regarding autonomous or piloted air taxis, the evolution that could happen is: first, the pilot is in the aircraft. Then, the pilot is no longer in the aircraft but on the ground, remotely operated (one pilot per aircraft). And then, over time, this ratio goes down.

The anticipated flight durations for eVTOL operations are significantly shorter compared to conventional commercial airline flights, averaging approximately 18 minutes. Moreover, eVTOL aircraft are designed to accommodate fewer passengers, typically ranging from one to six individuals, in addition to a pilot. In terms of fleet size, eVTOL operators are projected to maintain larger fleets compared to traditional commercial airlines. The scale of operations is expected to be substantially greater for eVTOL operators, with approximately 20,000 flights per day, representing an order of magnitude increase compared to the largest commercial

airlines, which typically operate around 2,200 flights per day. Many countries have prioritized AAM as strategic and critical to their aerospace industries due to its potential economic impact and national security implications. For example, the Vertical Flight Society (VFS), which is dedicated to advancing vertical flight technology and its practical applications, reports that there are currently over 200 commercial eVTOL projects in progress worldwide. These projects encompass a wide variety of configurations and applications, highlighting the diverse nature of eVTOL development efforts globally. In 2019, VFS and Nexa Advisors, an aerospace advisory and investment firm, have forecasted 74 metropolitan areas likely to run UAM operations between 2020 and 2040.

Figure 12: Worldwide metropolitan areas with high likelihood of using UAM services.




Source: Nexa Advisors,

Depending on aircraft technology, operations, economics and market size, Urban air transportation could take many forms. The National Aeronautics and Space Administration identified 36 potential UAM markets across 16 market categories. One of the main potential markets are: airport shuttle, air taxi, and air ambulance.

Figure 13:By 2050, UAM could fully emerge in 70 large cities globally.


Source: KPMG, 2019

According to a report by McKinsey & Company in 2022, niche markets will spring up around the world, driven by local champions using mostly existing infrastructure and current regulatory frameworks, targeting passengers who value their time but cannot quite afford a full helicopter charter. The report estimates the global opportunity will be hundreds of billions of dollars a year, when this UAM market reaches scale and its full potential.

On other hand, according to the EASA, commercial flights in UE cities are expected to start around 2025 with delivery of goods by drones or transport of passengers by piloted aircraft. In 2030, EASA estimates a market worth €4.2 billion in Europe, with 90,000 jobs created. Around 31% of global UAM market is expected to be in Europe in 2030.

To sum up, in the framework of the UAM, the air taxi segment is expected to dominate the eVTOL market share, due to the growing interest in on-demand air transportation services.

## 3.4Conditions and challenges for eVTOL operations

Many key factors should be considered for the success of UAM. Safety and security, infrastructure network, air traffic management, affordability, public acceptance, regulatory frameworks, are main conditions for eVTOL operations.
Flying taxi market will require radical changes, such as automotive-scale manufacturing, pilotless flying, a total rethink of air traffic control, cost-effective physical and charging infrastructure, and high vehicle-utilization levels. eVTOL manufactures, authorities, and all stakeholders involved in the development of this technology are then facing many challenges.

### 3.4.1 Team from stakeholders

First, team effort from stakeholders is a key factor of success to help personal air mobility market take off. Potential industry stakeholders include regulators, start-ups, traditional airplane and automobile manufacturers, cloud-based technology players, electric-vehicle (EV) charging networks, private-equity companies, venture capitalists, financing entities, commercial real-estate developers, civil architecture firms, and insurance companies, to name only a few will work hand-in-hand to the same goal. All players need to invest in understanding the potential structure of the ecosystem. And beyond innovative technologies and brick-and-mortar investments, this idea will require collaboration across many industries - that are not used to working together - to create an ecosystem capable of launching a successful flying taxi industry that the everyday commuter is comfortable making a part of their mobility ecosystem.

### 3.4.2 Infrastructure and Integration into existing transport network

The size of eVTOLs and the fact that they are usually battery-powered and run on electricity means that aircraft need to land often, not only for onboarding passengers, but also for recharging. As eVTOLs will be mainly flying in or around urban areas, the aircraft needs to be accommodated in such a way that it does not take up too much space and has to be connected to current network.
The ability to access vertiports quickly and efficiently will make or break the time-saving value proposition of eVTOL. Thus, integration into the broader mobility ecosystem will be crucial. Airports are likely to be at the centre of the AAM revolution, at least in the beginning. Their

prominence will result partly from the fact that more than two-thirds of the 25 largest UAM companies have stated that airports are among their initial target markets.

Infrastructure must support both peak flight needs and off-peak parking needs, which leads to a dilemma: infrastructure networks will be larger than needed to support "average" use, or else operators must spend money to shuttle empty vehicles between parking and active sites. As UAM is becoming a reality, airport operators need to assess the opportunity and integrate it into their planning. Owners and operators begin planning for this emerging transport mode today, given the long timelines for building infrastructure and for making other necessary changes.

EASA published in 2022 the world's first guidance for the design of vertiports, the ground infrastructure needed for the safe operation of UAM services such as air taxis in locations across Europe, including in urban areas. Depending on the urban environment and on the performance of certain VTOL-capable aircraft, omnidirectional trajectories to vertiports will be also possible. Such approaches can more easily take account of environmental and noise restrictions and are more suitable for an urban environment than conventional heliport operations, which are constrained in the approaches that can be safely applied.

### 3.4.3 Aircraft technology and its technical features

Distributed electric propulsion will be the key enabling technology for UAM success. First, it removes the single point failure of the main rotor of a helicopter and increases the safety of the vehicle by design. Second, by placing strategically the propulsion system around the vehicle, complex aerodynamics flow features can be harnessed to increase the lift and reduce the drag. Finally, by having lower rotor tip speed and less loaded blades, the noise can be drastically reduced.

An eVTOL will generate noise. To be accepted by a community and be certified, its noise footprint will have to blend in the city background noise. This type of vehicle will be by design quieter than a helicopter since distributed electric propulsion has significant advantages with respect of noise. However, the city background noise is not that high compared to a conventional helicopter so these new vehicles will have to be incredibly quiet. Therefore, broadband noise, interactional noise will have to be taken in consideration early in the design phase to be sure, the vehicle will be designed around one goal: blend into the city background noise.

### 3.4.4 eVTOL noise emission challenge

eVTOL noise emission challenge refers to the issue of noise generated by these aircraft during operation, especially during take-off, landing, and low-altitude flight. eVTOL will introduce entirely new sources of noise to the population. They will bring unconventional sound signatures that will not resemble those of conventional aircraft and will operate over urban communities not usually exposed to aircraft noise.

According to the deliberate opinion of the Environmental Authority on the development of a vertiport on the Seine quai Austerlitz in Paris, noise level analysis conducted for the interior of the INM premises concludes that activities inside the building will not be affected by those of the vertiport. However, it is considered that particular vigilance is required for INM's terraces and corridors, with an average noise level average sound level over the day (6 a.m.-6 p.m.) would reach 67 dB(A), generating a ZBC and therefore a high annoyance zone, and a maximum sound level for e-VTOL of 83 dB(A).

Furthermore, the report states that, up to a distance of 55 m, the acoustic contribution of the e-VTOL, calculated on the ground, is between 60 and 65 dB(A) shows that the sound level may even exceed 65 dB(A).

Figure 14: Impact of noise pollution in the framework of the experimentation in Paris in 2024

*Figure 7 : Impact sonore maximal au passage (LAmax), au sol, du VC-2X en phase de survol sur une portion du périphérique -source : dossier*

Source: RAPPORT ENQUÊTE_02_02_24 enquête publique vertiport JO.

The report notes that, it would be advisable to assess the acoustic by taking into account the effects of the low-emission zone from 2025, the reduction in speeds within the dense urban zone with most roads limited to limited to 30 km/h, the trend towards electrification of vehicle engines, etc. All these factors background noise in the area, and they are gradually decreasing to no longer contribute to masking e-VTOL noise pollution.

### 3.4.5 Pilots challenge

These aircrafts will eventually fly autonomously, but that could take a decade or more because of technology issues, regulatory concerns, and the need to gain public acceptance. Until autonomous flight of hundreds or thousands of vehicles above cities across the globe becomes a reality, the industry must recruit, train, and deploy thousands of pilots.

To address the challenge of recruiting, training, and certifying UAM pilots during the early years of UAM, the industry will require collaboration across a range of stakeholders, including vehicle manufacturers, technology players, operators, regulators, and flight schools.

In the meantime, pilots will help the public recognize the value proposition for UAM. Before taking flight, however, they must gain experience with this new mode of transport and help compile data about it. Pilots must also understand broader operational issues and help build confidence in the industry's safety and reliability among regulators and the public.

Pilots are one of the most significant drivers of value and cost for the AAM sector, accounting for an estimated 15 to 25 percent of total value. One way to reduce costs, once regulation and technology allow for it, is to move the pilot from the vehicle to a control centre on the ground in 1:1 pilot-to-vehicle operations. This will begin to shift the value chain from pilots to vehicle control centres, and it will allow mobility providers to earn revenues from an additional passenger seat. In the long term, the 1:1 operation ratio may go down to a 1:5 pilot-to vehicle operation ratio or even more, depending on regulatory developments.

Regarding the customer-experience challenge, a pilot's presence in a small capsule without a separate flight deck will surely affect the customer's experience of the ride and perceptions of its safety— potentially both positively and negatively—much as experiences with taxi or rideshare drivers do today. In turn, the pilot's presence will influence the willingness of consumers to embrace a new mode of transport.

### 3.4.6 Air traffic management

ATM is one of the many operations that enables air mobility and has its own specific tasks and responsibilities. It comprises three main services: air traffic control, air traffic flow management and airspace management. According to Antoine Martin, program director for new ATM services at DSNA of DGAC, depending on safety and capacity criteria, "we'll need to look at the most suitable VTOL traffic management system, and certainly develop innovative tools in this area." In terms of flight paths, the VTOLs will be aligned with the main routes established for helicopters. Helicopter trajectories have been designed to respect a certain number of public safety and environmental constraints. He states that "We have more or less the same requirements for VTOLs in terms of trajectories and strategic airspace organization". Unlike commercial air travel, UAM passengers won't book months in advance. For that reason, operators need to be far more agile and responsive to short-term changes in demand. For instance, the concept of U-space emerged to support commercial operations with drones, especially those entailing greater complexity and automation. This is the European system being developed to manage drone traffic. U-space is a set of specific services and procedures designed to ensure safe and efficient access to airspace for many drones, and which are based on prominent levels of digitalization and automation.

According to Javier Calvo Torrijos and Isidro José Porras - aeronautical engineers and consultants from ALG - segregating the airspace is a key enabler for the integration of small Unmanned Aerial Systems (UAS), eVTOLs vehicles, and conventional aircraft. Indeed, "segregating the airspace by altitude will allow certain ATM and UTM systems to utilize more flexible airspace regulations and communication protocols, especially in non-critical areas".

### 3.4.7 Regulatory frameworks

UAM in Europe is subject to regulatory oversight by various aviation authorities and regulatory bodies at both national and UE levels. Fundamental pillars should be regulated when introducing UAM: airworthiness, airspace integration, vertiports, safety management, environmental protection, etc.

As one of the world's leading aviation authorities, the EASA ensures that the safety and sustainability needs of Europe's citizens are met, not only in Europe, but internationally too. EASA is the highest competent authority in EU in terms of aviation. It has started creating the

UAM regulatory framework, building notably on the results of 2021 UAM study on societal acceptance. Some building blocks have already been achieved:

- On airworthiness, EASA has been the first in the world to publish in July 2019 a Special Condition to authorize small VTOL aircraft operations, in 2020 for Light Unmanned Aircraft Systems operating in medium risk situations, and in 2021 Guidelines on the design verification of UAS operating in the specific category.
- On operations and pilot licensing, in early 2019 it has launched preparatory activities that will lead to rules for the pilots/remote pilots of these vehicles, their operators and for the infrastructure.
- On airspace integration, EASA has prepared a worlds-first U-Space/UTM regulatory package.

At national level, in France, the DGAC is to guarantee the safety and security of air transport by placing sustainable development at the heart of its actions. It deals with all aspects of civil aviation: safety, air traffic control, sustainable development, economic regulation, support for aircraft construction, general aviation and aeronautical training. DGAC is itself attached to the French Ministry of Transport. At European level, the DSAC is heavily involved in regulatory development projects, as part of the work program described in the European Plan for Aviation Safety (EPAS), which is updated every year.

However, according to a report by the ECA in 2020, urban mobility is managed at local level, and there are no EU regulations or directives on the subject, in line with the principle of subsidiarity. For instance, local, national, and European authorities should work together to align shared challenges and standardize regulations. According to Olivier Jouans, in charge of the eVTOL mission at the French Civil Aviation Authority in 2021, “they don't have enough insight to have an identical regulatory framework for all machines. They expect to have general rules in the coming five or six years. In the meantime, they must be careful not to sclerotize current developments.”

The DGAC aims to have the same level of safety as on today's airliners. As states Olivier Jouans, “We're learning as systems progress, but whatever the type of VTOL, it will have the same level of passenger safety as an Airbus”. Indeed, A prominent level of safety will be a prerequisite for their acceptability, and this will require further work on certification. These

machines will also have to demonstrate the progress expected in terms of cost, ease of use, ecological impact and noise pollution compared with current helicopters.

From eVTOL manufacturers point of view, the main challenge that could delay the arrival of UAM is not technological, but regulatory. Laws will have to be rewritten to allow these new aircraft to fly. Competent authorities need to rethink air corridors and create certification programs. One of the biggest challenges is the obstacle of massification of eVTOL while maintaining a quality that is unequal in the industry and transport. Regulators must certify not only eVTOL aircraft but also new batteries, electric motors, distributed propulsion systems, and features of autonomous flight. Without getting certified, aircraft will not be able to access routes where most people travel.

Besides, a report from McKinsey & Company about perspectives on advanced air mobility states that regulators might basically consider focusing on five actions. First, develop new aircraft certification standards; second, take steps to enable the integration of the new UAM system with traditional air traffic control networks; third, enable test-flight programs; fourth, create standards and certification for autonomous flight; and, finally, provide incentives and subsidies for personal air mobility.
To sum up, regulatory framework is evolving rapidly with many authorities at both national and international levels working together to establish upcoming standards. Overall goal for main stakeholders of UAM ecosystem is to combining safety and innovation.

### 3.4.8 Affordability

Another risk for UAM is the affordability of the services for a large part of society. If the services are only available to more affluent individuals but the disadvantages (like noise) are borne by everyone, this could hamper the acceptance of UAM within society. eVTOL aircraft are expected to be more affordable than helicopters with similar levels of safety and significantly lower acquisition costs. According to Robin Riedel, certified commercial airline pilot, “we’re expecting that the price will be around $2.25 per passenger mile. Over the medium or long term—with higher-capacity autonomous aircraft and lower cost infrastructure—the price will be comparable to high-speed trains or other ground-based transportation.” Overall, for large-scale customer adoption and the mass market, trip costs must ultimately compete with ground travel. That means the cost of a trip must decline by more than 90 percent compared

with the estimated $4 to $6 in direct operating cost per seat-mile that helicopter travel costs today. Once the industry attains the above enablers, it can achieve the lower costs that can allow mass adoption.

### 3.4.9 Public acceptance

The growing number of publications regarding AAM repeatedly cite the public acceptance as one of the challenges for UAM.

One of the primary factors influencing public acceptance is safety. eVTOL technology represents a significant departure from traditional modes of transportation, and potential passengers may harbour concerns about the safety of flying in these aircraft, especially considering that they are autonomous or semi-autonomous. Addressing these safety concerns through rigorous testing, certification, and public education is essential to gaining public trust and acceptance.

About noise and environmental impact, eVTOL aircraft have the potential to significantly impact noise levels in urban areas, particularly during take-off and landing. Concerns about noise pollution and its effects on quality of life can lead to resistance from communities living near eVTOL infrastructure.

Public acceptance of eVTOL operations may also hinge on the perceived affordability and accessibility of these services. If eVTOL flights are perceived as exclusive or prohibitively expensive, there may be resistance from segments of the population who feel marginalized or excluded. Ensuring that eVTOL services are accessible to diverse socio-economic groups and pricing them competitively with existing transportation options can help promote broader public acceptance.

The regulatory and legal frameworks governing eVTOL operations will significantly influence public acceptance. Clear regulations addressing safety, privacy, airspace management, and liability are essential for instilling confidence in both passengers and communities affected by eVTOL operations. Lack of regulatory clarity or inconsistencies in enforcement could undermine public trust and hinder widespread acceptance of eVTOL technology.

Cultural attitudes towards technology, innovation, and risk-taking vary across different regions and demographics. Public acceptance of eVTOL operations will depend, in part, on how these technologies align with societal values and norms. Engaging with communities through

outreach programs, public forums, and stakeholder consultations can help bridge cultural divides and foster mutual understanding.
Finally, public acceptance of eVTOL operations will be contingent on the perceived benefits they offer to society. These benefits may include reduced traffic congestion, shorter travel times, improved connectivity, and environmental sustainability. Demonstrating tangible benefits through pilot programs, case studies, and real-world applications can sway public opinion and build support for eVTOL initiatives.

According to a public inquiry which ran from November 6 to December 8, 2023 in France in the framework of the Olympics Games experimentation, the reasons given in the contributions against the flying cab project were mainly related to noise pollution (the French Fashion Institute, which is very close to the vertiport, fears that its students and teachers will be inconvenienced), the denunciation of an energy-hungry mode of transport that contradicts sobriety policies, and the risk of pollution.

In summary, public acceptance is both a condition and a challenge of eVTOL operations and development in the coming years.

# 4. Practical Part

## 4.1 Concept

Given the framework of the thesis – to realize a study on the social acceptance of EVTOL il IDF by 2030 – the chosen method was to create and disseminate a survey. Google forms have been used to create the questionnaire and observe the results. The questionnaire was exclusively disseminated among French people living in various places in France. It was essential to consider only French respondents to evaluate the social acceptance of upcoming eVTOL technology in the scope of IDF region. At the most, the respondent had to answer 22 questions. The survey followed different paths of questions according to the answers given at some questions. The stake with such a method, is to have specific questions to get specific answers and results without appearing too intrusive at the risk that the respondent may be on guard and not really reveal his true feelings. For instance, the length of the question explains it. The survey has been sent through different platforms: by LinkedIn, Messenger, WhatsApp, and email. Within 6 weeks, 263 responses have been collected. Even though the population might not be important enough to be representative, the questionnaire's answers can still be used – with an awareness of limits – as gender parity is almost perfectly respected, and age is well balanced between people less than 25 years old and more than 60 years old. Besides, professional situation, gross monthly income and education level are wide and well-balanced meaning that the sample is quite representative. The full transcript of the questionnaire is available in the appendix, in which questions alongside choice of answers are specified.

Moreover, after conducting such a survey, hypotheses were made to confirm or deny the current social acceptance of eVTOL in IDF. As a result, the author of the thesis has made 19 hypotheses to test through a statistical analysis. For the practical part of the hypotheses' analysis, SPSS software has been used and based on the type of data involved in the hypothesis, one main statistical test has been used: Chi-square. On top of that, some analyses have been conducted directly from the Google Forms to give additional insight.

For extracting more qualitative data, the author also conducted a series of structured interviews with different stakeholders involved in the topic:

- Innovation Program Manager from French Civil Aviation Authority within the Ministry of Ecological Transition

- Deputy Director, Paris-Le Bourget Airport and General Aviation Airfields from Groupe ADP
- Corporate lawyer
- Air traffic management expert

## 4.2Hypotheses

In addition to culture, demographic variables, such as age, gender, and income, also significantly impact consumer attitudes toward new aircraft technologies. Hypotheses have been conducted with different dependent and independent variables to cover as much as possible the topic and understand relationships between multiple factors. Demographic variables shape individuals' preferences, priorities, and expectations regarding air travel and can significantly affect their willingness to embrace innovative transportation options like eVTOL aircraft.

The first hypothesis that was evaluated in the practical part was related to two variables: gender and potential use of eVTOL in the coming decade. The purpose is to know whether the likelihood of using an eVTOL in the coming decade is related to gender. A recent report from the University Aviation Association on *Consumer Willingness to Fly on Advanced Air Mobility (AAM) Electric Vertical Take-off and Landing (eVTOL) Aircraft*, shows significant differences between genders, with males having a higher average willingness to fly with eVTOL. Thus, the author tends to think that gender is influencing the likelihood of using an eVTOL in the coming decade in France.

The second hypothesis is relatively the same as the first one except that age is considered instead of gender. So, is Age and willingness to use eVTOL in the coming decade are related or not? The author tries to find out if the use of cutting-edge technologies such as eVTOL can be related or not to age. Author thinks that younger people (less than 25 years) are more likely to use eVTOL than elderly ones (more than 60 years old).

The third hypothesis is about age and prior knowledge of eVTOL before answering the survey. The aim of this hypothesis is to determine whether there is a relationship between an individual's age and their awareness or knowledge of existing eVTOL technology when they

answer to the survey. Either young people or elderly people have already heard about eVTOL before answering the survey? The authors want to assess these two variables because he thinks that younger generations tend to exhibit higher acceptance of new aircraft technologies due to their affinity for innovation and eagerness to explore new experiences.

The fourth hypothesis is about prior knowledge of eVTOL and gross monthly income. The aim is to know if gross monthly income is linked to prior knowledge of eVTOL. Author thinks that people with higher gross monthly income have more likelihood of knowing eVTOL technology.

The fifth hypothesis is about the frequency of using mobility services technologies such as car sharing and Uber and the potential use of an eVTOL in the coming decade. The aim is to understand how existing usage patterns of modern transportation services might influence the adoption of future air mobility solutions like eVTOL. Author guess that respondents using current mobility services technologies would use eVTOL more in the coming decade than people not using mobility services technologies.

The sixth hypothesis is about the frequency of taking the plane per year and prior knowledge of eVTOL. Author seeks to know if high frequency of taking the plane can be linked to prior knowledge of eVTOL. Author supposes that taking the plane many times a year can increase the knowledge of eVTOL.

The seventh hypothesis deals about the frequency of taking the plane per year and the potential use of an eVTOL in the coming decade by the respondent. The objective is to understand if taking the plane has an impact on the willingness to use an eVTOL in the coming years. The author thinks that a high frequency of taking the plane will increase the willingness of using an eVTOL and vice versa, a current low frequency of taking the plane will not make people using an eVTOL later.

The eighth hypothesis is about age and global perception of running eVTOL before 2030 in IDF. Author would like to know if different category of age is linked to general perception of upcoming eVTOL by 2030.

The nineth hypothesis is about gross monthly income and the global perception of running eVTOL before 2030. The aim is to understand whether there is a relationship between income levels and perceptions about the introduction of eVTOL as new urban transportation mode.

The tenth hypothesis is about gross monthly income and the potential use of an eVTOL in the coming decade. This hypothesis aims to explore whether individuals' income levels influence their willingness to adopt and use eVTOLs as a transportation option in the future. It seeks to determine if there are differences in the intention to use eVTOLs among different income groups.

The eleventh hypothesis is dedicated to gross monthly income influences the likelihood of using an eVTOL with 25-50% higher prices than road taxi. This hypothesis aims to investigate whether individuals' income levels affect their willingness to use eVTOLs when the price is higher compared to conventional road taxis. It seeks to understand if there are differences in the acceptance of eVTOLs among different income groups when considering price sensitivity.

The twelfth hypothesis is again about gross monthly income and the likelihood of using an eVTOL with similar prices than road taxi. The aim is to determine whether there is a relationship between income levels and the propensity of individuals to opt for eVTOL when prices are comparable to traditional road taxis. It seeks to understand if income plays a role in the adoption of eVTOL technology under conditions of price parity with traditional taxi services.

The thirteenth hypothesis is about age and assessment of eVTOL environmental impact by ecological label. This hypothesis seeks to investigate whether different age groups have varying perceptions of the environmental impact of eVTOLs when provided with information through an ecological label. It aims to understand if age influences individuals' attitudes toward the environmental sustainability of eVTOL technology.

The fourteenth is about gross monthly income and assessment of eVTOL environmental impact by an ecological label. This hypothesis aims to investigate whether respondents with different income levels have varying perceptions of the environmental impact of eVTOL when provided

with information through an ecological label. It seeks to understand if income influences individuals' attitudes towards the assessment of eVTOL impact on environment.

The fifteenth hypothesis is about prior knowledge of eVTOL and assessment of eVTOL environmental impact by ecological label. This hypothesis aims to investigate whether individuals who are more knowledgeable about eVTOL technology have different perceptions of its environmental impact compared to those who are less knowledgeable, when provided with information through an ecological label. It seeks to understand if prior knowledge about eVTOL influences individuals' attitudes toward the environmental sustainability of the technology by a label.

The sixteenth hypothesis is about education level and prior knowledge of eVTOL. This hypothesis seeks to explore whether respondents with higher levels of education are more likely to be aware of eVTOL technology and vice versa. It aims to investigate if education plays a role in shaping individuals' awareness of emerging transportation technologies like eVTOL.

The seventeenth hypothesis is about education level and potential use of eVTOL in the coming decade. This hypothesis seeks to investigate whether individuals with distinct levels of education have varying attitudes toward adopting eVTOL technology in the future. It aims to explore if education level influences individuals' likelihood of considering or being open to using eVTOL as a mode of transportation in the next decade.

The eighteenth hypothesis is about several concerns about eVTOL, and the second variable is about assessment of environmental impact of eVTOL by ecological logo. This hypothesis aims to explore whether individuals who express more concerns about eVTOL technology are more likely to perceive its environmental impact differently when presented with an ecological logo. It seeks to determine if concerns about eVTOL influence individuals' interpretation of its environmental friendliness, as indicated by their response to the ecological logo.

The nineteenth hypothesis is about global perception of running eVTOL by 2030 and education level. This hypothesis aims to explore whether respondents with distinct levels of education hold different opinions about the introduction of eVTOL by 2030 in IDF. It seeks to determine

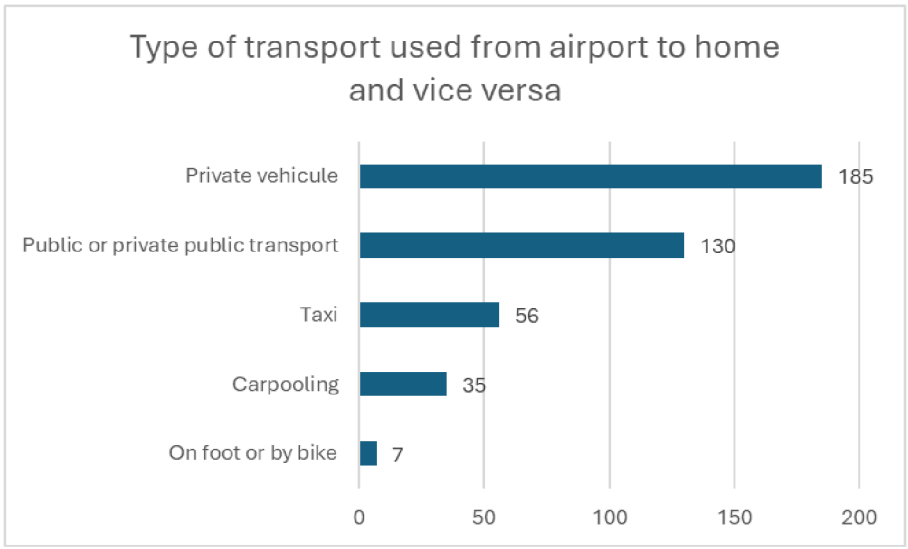
if education level influences individuals' perceptions of the potential benefits or drawbacks of implementing eVTOL technology in the near future.

## 4.3First results and analysis

Note that some results were not submitted to statistical analysis, however some analysis can be deducted from Google Forms results.

According to the questionnaire from Google Forms, private vehicles reign supreme as the preferred mode of transport, with a staggering 70% of respondents opting for this option. Whether it's the convenience of having a vehicle readily available, the flexibility to depart on one's schedule, or the comfort of traveling in a familiar environment, private cars offer a sense of control and autonomy that resonates with many travellers.
However, public or private public transport also garners significant traction, with approximately 50% of respondents opting for this mode of transportation. From airport shuttles and buses to trains and metro services, public transport offers an economical and environmentally friendly alternative to private vehicles. With dedicated airport routes, frequent schedules, and sometimes even dedicated lanes, public transport provides a reliable and hassle-free option for travellers looking to navigate the journey from the airport to home and back again.

Figure 15: bar chart of type of transport used from airport to home and vice versa.

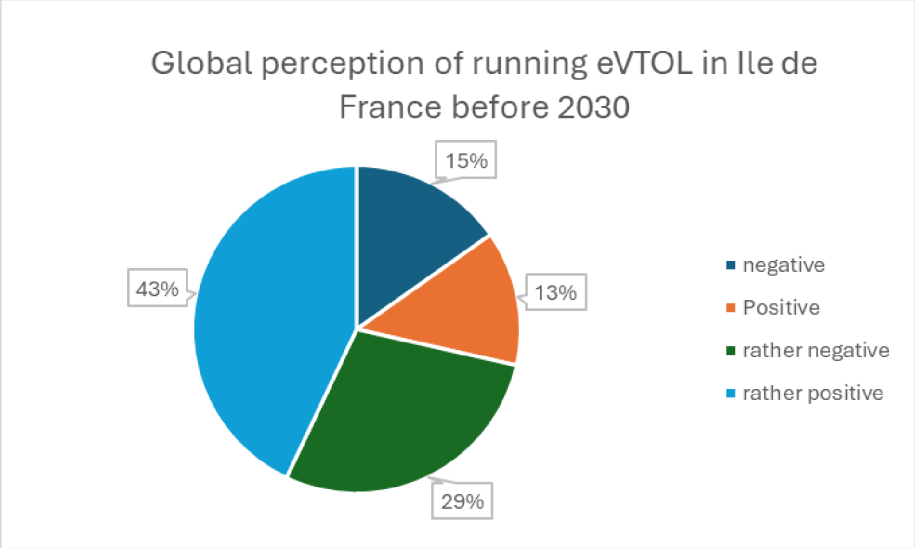



Source: own processing from the questionnaire on Google Forms

The figure X below illustrates the question: what is your global perception of running eVTOL in IDF before 2030? We can see that 43% people are rather positive and 13% positive towards eVTOL (so 56% in total positive). This trend is correlated with the results from EASA UAM

social acceptance survey in which they found that 83% people in total having a positive attitude towards UAM.

Figure 16: pie chart of global perception of running eVTOL in IDF before 2030




Source: own processing from the questionnaire on Google Forms

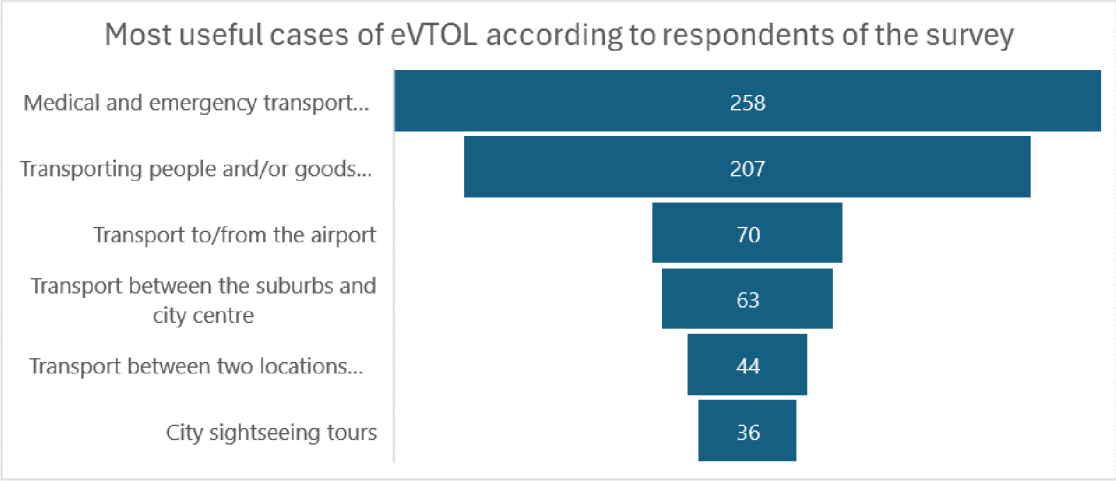
The figure 17 illustrates the most useful cases of eVTOL according to respondents. Respondents were able to choose one or more answers. The bar chart highlights several key use cases where eVTOL is perceived as useful.

Medical and Emergency Transport is seen as the most crucial application of eVTOL aircraft according to 258 respondents. Almost all respondents (98%) agree to rank Medical and Emergency Transport as the most useful use case. The ability of eVTOLs to swiftly transport casualties, medical personnel, and vital organs in emergency situations offers a lifeline for critical healthcare needs. Their speed, agility, and ability to bypass ground obstacles make them invaluable in providing timely medical assistance, especially in situations where every minute counts. In the EASA UAM social acceptance survey, emergency use cases are considered most useful by respondents too with 41% opting for transport of injured person to hospital.

Then, transporting people and/or goods in times of crisis or natural disaster is the second most useful use case with 207 answers representing 78% of answers. Whether it's delivering supplies to disaster-stricken areas, evacuating individuals from danger zones, or facilitating search and rescue operations, eVTOLs offer a rapid and flexible response mechanism. Their ability to access remote or inaccessible locations makes them invaluable assets in emergency management and disaster relief efforts.

Besides, respondents also recognize the potential of eVTOLs in streamlining airport transportation. 70 answers are concerning the transport to/from airport. Compared to the two first ones, 70 answers are slightly lower, meaning this use case is not addressing big expectations. Moreover, in the EASA UAM social acceptance survey, few people also consider shuttle service to airport as the top use cases.

Figure 17: bar chart of most useful cases of eVTOL.



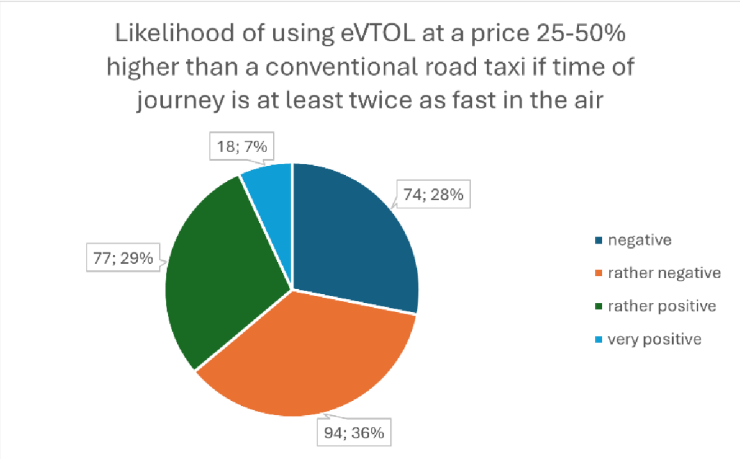

Source: own processing from the questionnaire on Google Forms

The figure 18 illustrates all the respondents' answers about their willingness to try out an air taxi at a price 25-50% higher than road taxi if time of the journey is at least twice as fast in the air. We can from the questionnaire that 36% of people are either rather positive or very positive towards using eVTOL with higher prices. Nevertheless, we can observe that 64% of respondents are unlikely to use eVTOL with higher prices even tough time journey is cut by two.

In EASA UAM social acceptance survey, 50% of respondents in Paris said they are positive, and the other half are negative for using eVTOL at a price 25-50% higher than road taxi.

As a result, the price is a key factor of success for using eVTOL and increased prices of this service compared to traditional taxi would not incite people to change their habits.

Figure 18: pie chart of likelihood of using eVTOL at a price 25-50% higher than road taxi if time of the journey is at least twice as fast in the air.




Source: own processing from the questionnaire on Google Forms

The figure 19 illustrates now the likelihood of using eVTOL with similar prices than road taxi if time of the journey is at least twice as fast in the air.

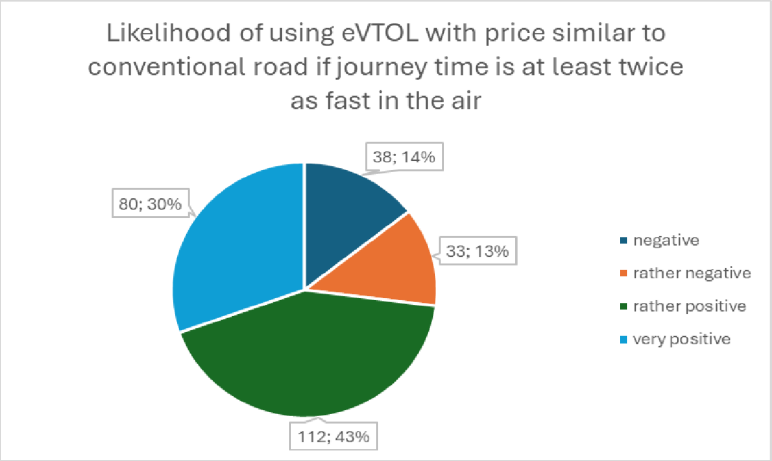
We can see now that 73% of respondents are either very positive or rather positive to use eVTOL with similar prices than road taxi if time of the journey is at least twice as fast in the air. For instance, price is an essential aspect to consider for most people.

Only 14% of respondents would not consider using eVTOL with similar prices than road taxi.

We have seen in the previous pie chart that 64% of respondents are unlikely to use eVTOL with higher prices even tough time journey is cut by two.

For instance, we can deduce that price affects considerably the likelihood of using eVTOL.

Figure 19: pie chart of likelihood of using eVTOL with similar prices than road taxi if time of the journey is at least twice as fast in the air.




Source: own processing from the questionnaire on Google Forms

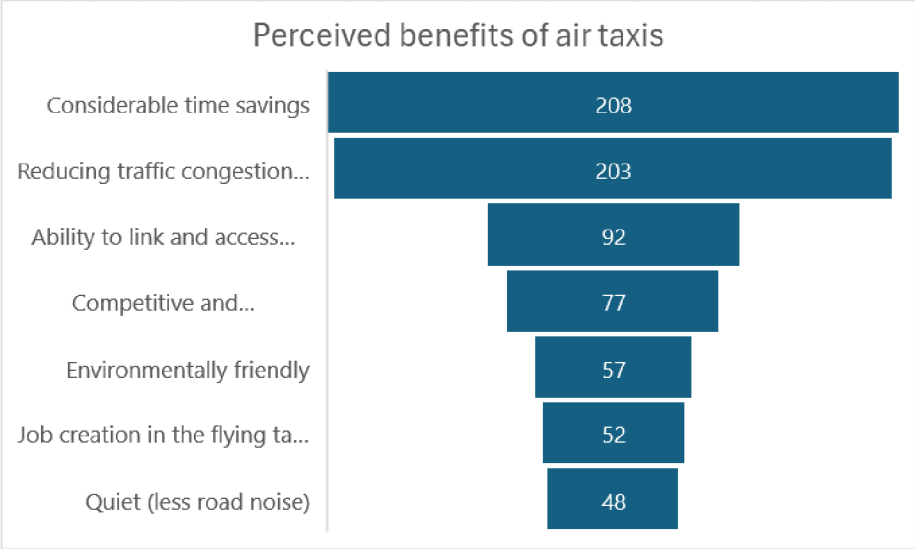
The figure 20 illustrates the perceived benefits of eVTOL from respondents of the survey. Foremost among these perceived benefits is the remarkable time savings that air taxis offer. Approximately 80% of respondents rank this as the primary advantage. Unlike traditional ground-based transportation, air taxis transcend the limitations imposed by traffic congestion and infrastructure bottlenecks. By soaring above the gridlock, they promise swift point-to-point travel, drastically reducing commute times.

Around 80% of respondents ranked "Reducing traffic congestion and relieving congestion on the roads" as the second-best benefit of eVTOL. With urban roads increasingly saturated, the prospect of introducing aerial corridors for transportation holds immense appeal.

Furthermore, air taxis offer a gateway to previously inaccessible or remote locations, a benefit recognized by 35% of respondents. Traditional modes of transportation often struggle to reach remote areas due to geographical barriers or inadequate infrastructure.

In EASA UAM social acceptance survey, the three top benefits are in order: reduction of traffic jams (59%), time saving for passenger (48%), access to remote areas (37%). Thus, we see that the top three benefits of eVTOL is same between these two surveys and the ranking too.

Figure 20: bar chart of advantages of eVTOL according to respondents of the questionnaire.



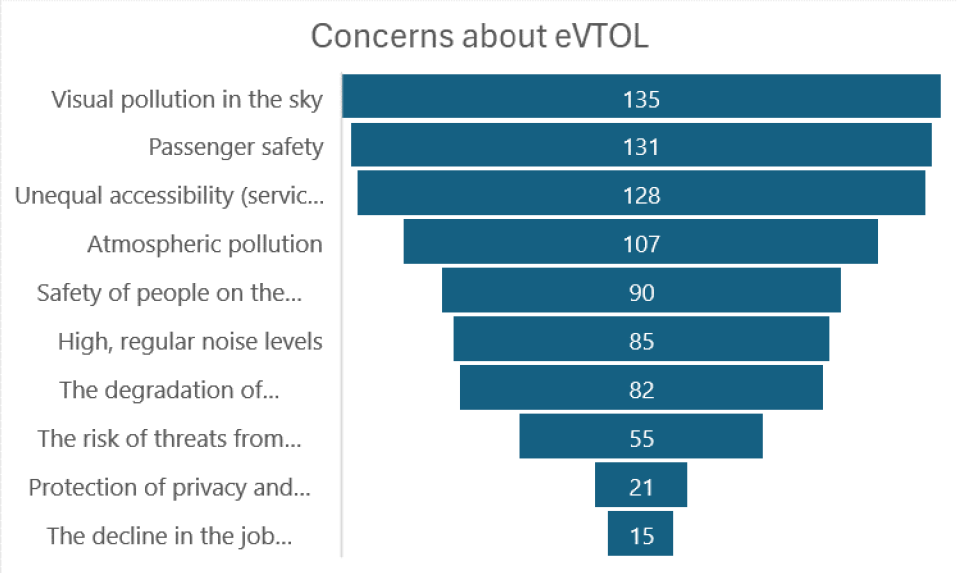

Source: own processing from the questionnaire on Google Forms

The figure 21 illustrates concerns about eVTOL from the questionnaire on Google Forms. We can then observe the top three most concerns: visual pollution in the sky, passenger safety and unequal access to this service reserved for the richest.

In the EASA UAM social acceptance survey, affordability is seen as the largest concern among the selected concerns presented to participants in different cities. Indeed, 82% of people are agree that air taxis are too expensive and only for rich. Regarding Paris in France, 14% of the respondents in this area say that affordability is one of their concerns.

To sum up, we can say that affordability and accessibility to air taxi is seen as one the largest concern.

Figure 21: bar chart of concerns about eVTOL.




Source: own processing from the questionnaire on Google Forms

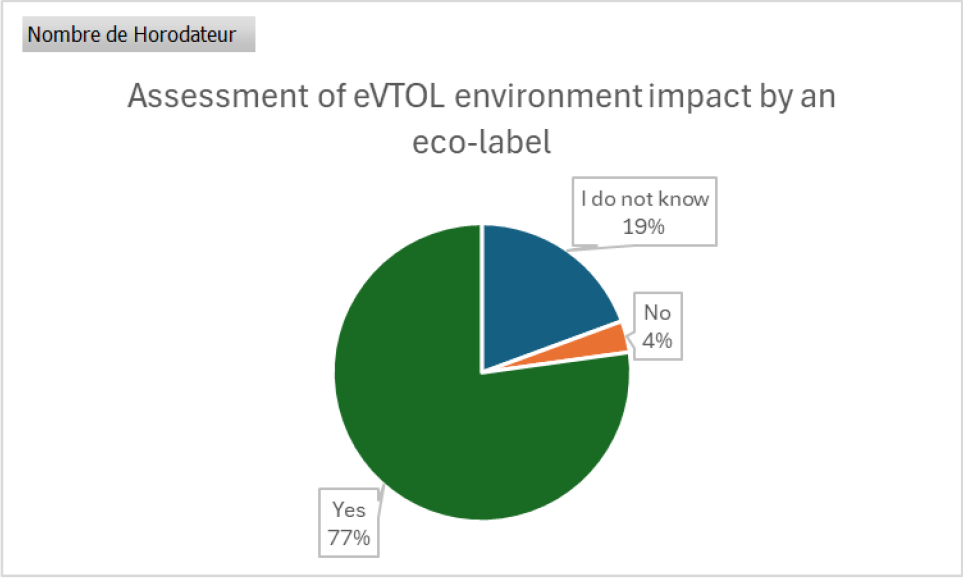
The figure 22 illustrates the assessment of eVTOL environment impact by an eco-label. From the questionnaire, we see that more than 3 quarters of respondents (77%) agree to evaluate the impact of eVTOL on the environment by setting up an eco-label. Only 4% disagree and almost 20% say they do not know.

In the EASA UAM social acceptance survey, 69% respondents are in favour of introducing an eco-label for commercial eVTOL. 27% say they do not know and only 4% disagree. Thus, we see that the three figures are correlated between these two surveys. These figures can be explained by the culture of acceptability towards ecolabel. According to the European Commission, France is the third country in EU with the most ecolabel licences awarded with a share of 15%, compared to 15% in Germany and 18% in Italy.

Finally, we can highlight one of the comments made in the interview of Thierry ALLAIN, Innovation Program Manager at the French Civil Aviation Authority. Indeed, he thinks that

before creating such an eco-label, it's important to remember that this is initially an experimentation in Paris, with limited duration, which is not intended to continue. “I don't think we're at a stage where we can award an eco-label”. Besides, “when we talk about eco-labels, we need to be clear about what we're talking about and what component is included: impact on biodiversity, noise pollution, emissions, etc”. Nevertheless, he states that “If, after the trial, the eVTOL service become permanent, it would be worth considering an eco-label”. For instance, at the experimentation stage, he is slightly against most of respondents of the survey but if eVTOL become a new mode of transport over the long-term, it is worth creating an eco-label. In summary, the precision of the timeline and the use case of the eco-label determine the correlation of opinions.

Figure 22: pie chart of assessment of eVTOL environment impact by an eco-label.



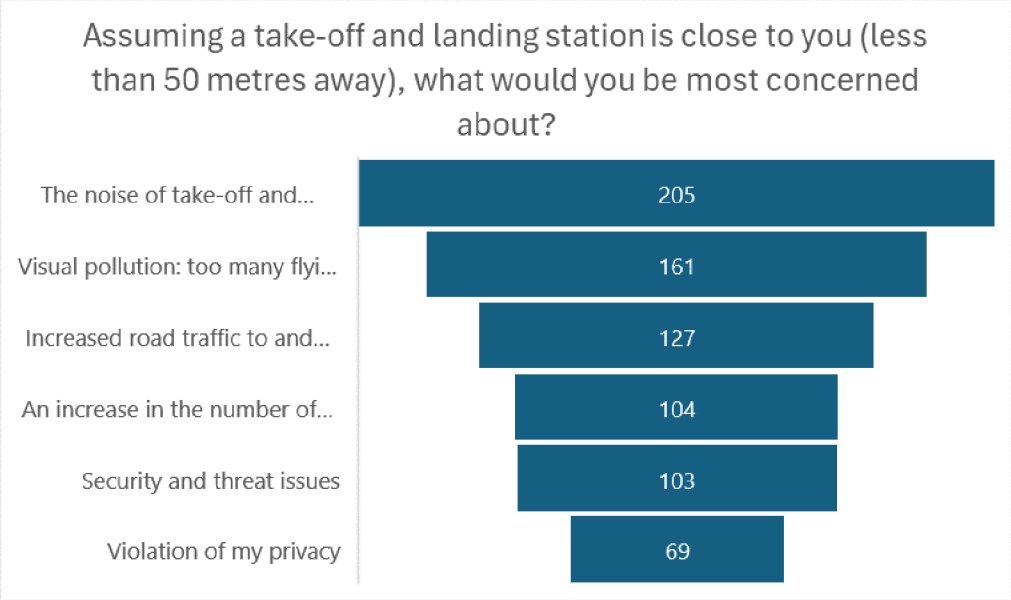

Source: own processing from the questionnaire on Google Forms

The figure 23 depicts various concerns related to vertiports, particularly when respondents are situated less than 50 meters from one. Among these concerns, noise pollution stemming from take-off and landing activities emerges as the most prominent issue. Remarkably, over 75% of respondents in the questionnaire identified noise pollution as their primary concern. This finding resonates with the results of the EASA UAM social acceptance survey, where participants also ranked noise from take-off and landing as their foremost concern. Consequently, it becomes evident that noise pollution holds substantial significance in the context of vertiport implementation, necessitating careful consideration of public opinion.

Furthermore, the questionnaire respondents identified visual pollution as the second most significant concern. Approximately 60% of respondents expressed agreement with visual pollution being a major issue concerning eVTOL operations. This indicates that the proliferation of eVTOL aircraft taking off and landing could potentially compromise the aesthetics of the surrounding environment. As such, mitigating visual pollution becomes imperative in ensuring the acceptability and integration of eVTOL infrastructure into urban landscapes. In the EASA UAM social acceptance survey, visual pollution is ranked as the third most concerns regarding vertiport.

Nevertheless, safety as seen as the second most concern in the EASA UAM social acceptance survey, is ranked as the fifth in the author's questionnaire. The explanation of this figure can be explained as security and threat issues are in the same answer. Respondents might be confused or would have liked to choose between safety and security. Thus, it would have been better to separate the security to the safety. In the EASA UAM social acceptance survey, safety and security are separately and evokes two different meanings.

Figure 23: bar chart of concerns about vertiport.




Source: own processing from the questionnaire on Google Forms

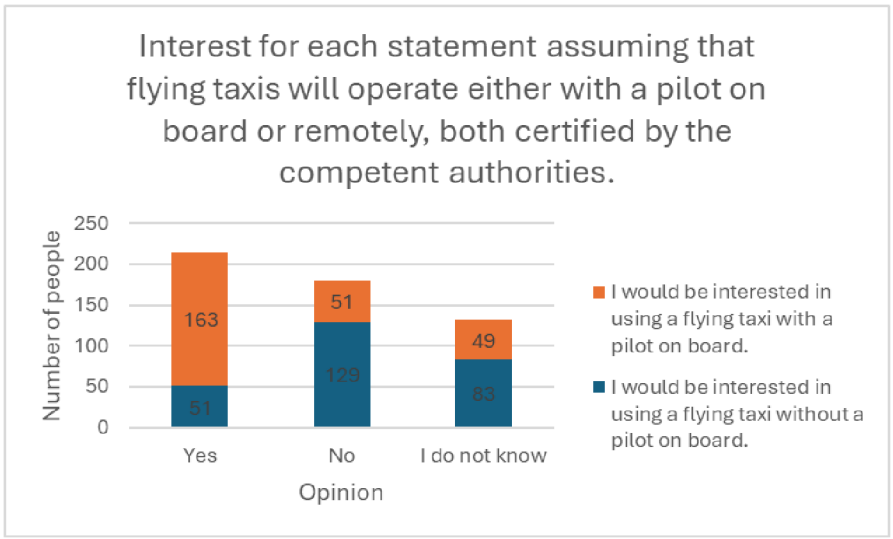
The figure 24 illustrates the interest to use an eVTOL with or without pilot onboard.

This breakdown suggests a significant degree of scepticism or apprehension towards the idea of flying taxis without a pilot on board. With only 51 respondents (19%) expressing interest in this concept, it indicates that a sizable portion of the surveyed population harbours concerns

regarding the safety, reliability, and trustworthiness of autonomous aerial vehicles. Factors such as perceived risk, technical feasibility, and regulatory oversight may influence individuals' reluctance to embrace fully autonomous flying taxis. Almost 50% of respondents say no and seems not be interested in using eVTOL without pilot onboard. In the EASA UAM social acceptance survey, 61% of respondents would not be interested in trying out an unmanned air taxi. We can see then a correlation between these two surveys regarding the level of comfort with unmanned eVTOL.

In contrast, most respondents - 163 individuals (62%) - express interest in utilizing flying taxis with a pilot on board. This suggests a higher level of comfort and confidence in the traditional piloted model of aviation, where human expertise and intervention are perceived as essential safeguards against potential risks or malfunctions. The preference for piloted flying taxis underscores the importance of human oversight and control in instilling trust and assuring passengers of their safety and security during aerial transportation. In the EASA UAM social acceptance survey, 68% of respondents would be interested in trying out a manned air taxi. We can see a strong correlation between these two surveys regarding the level of comfort with manned eVTOL.

Figure 24: bar chart of interest to use an eVTOL with or without pilot onboard.




Source: own processing from the questionnaire on Google Forms

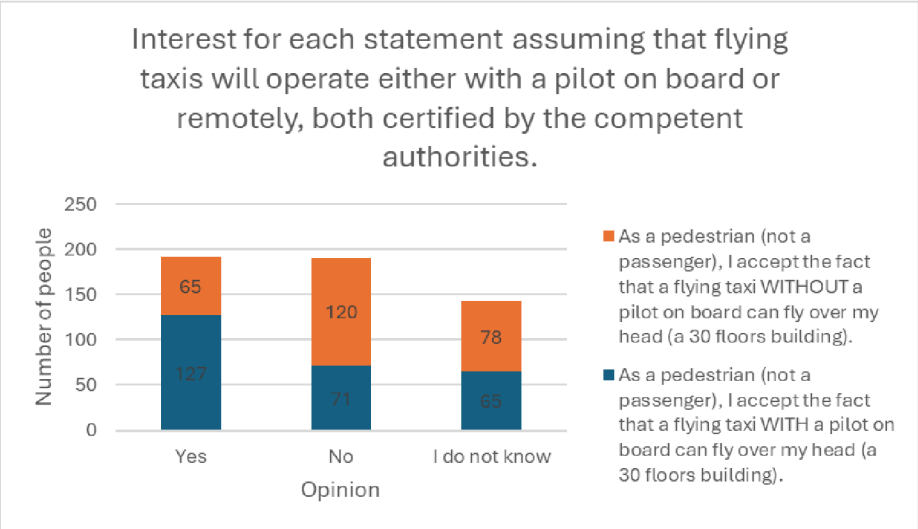
The figure 25 illustrates acceptability as a pedestrian the fact an eVTOL with or without pilot onboard fly above the respondent's head.

The acceptance of an eVTOL aircraft flying overhead, both with and without a pilot on board, is a crucial aspect of integrating these innovative aerial vehicles into urban environments. Understanding pedestrians' attitudes towards this emerging mode of transportation is essential for ensuring public safety, confidence, and social acceptance. Let's delve into the perspectives revealed by the questionnaire on Google Forms.

The chart indicates a moderate level of acceptance among pedestrians for eVTOL aircraft with a pilot on board flying over their heads. With 127 respondents (48%) expressing willingness, it suggests a degree of comfort and trust in the presence of human oversight and control. However, the 71 individuals who answered negatively and the 65 who remained undecided underscore concerns regarding safety, noise, privacy, and especially the uncertainty towards this new technology. In the EASA UAM social acceptance survey, 64% of respondents accept as a pedestrian, the fact that manned air taxis could fly above their head. We can see a correlation between these two surveys.

In contrast, acceptance levels drop significantly when considering eVTOLs without a pilot on board. With only 65 respondents (25%) expressing acceptance, and 120 individuals (45%) rejecting the idea, it highlights apprehension towards fully autonomous aerial vehicles. Concerns over safety, reliability, technical failures, and the potential consequences of accidents or malfunctions are likely contributing factors to the reluctance observed among pedestrians. 78 remains undecided meaning that the uncertainty towards the development of this technology is high and it is very difficult to assess its externalities.

Figure 25: bar chart of acceptability as a pedestrian the fact an eVTOL with or without pilot onboard fly above the respondent's head.




Source: own processing from the questionnaire on Google Forms

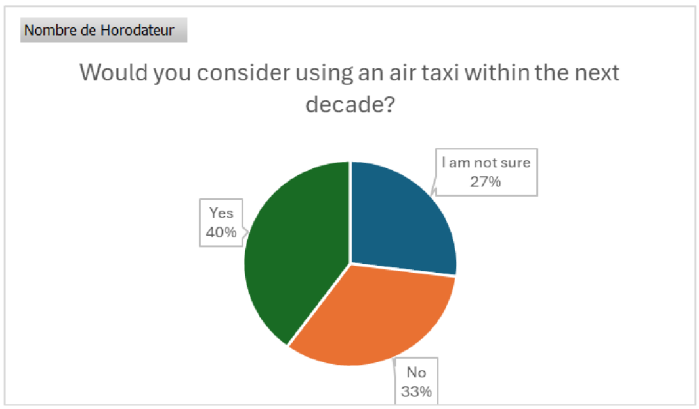
The figure 26 illustrates the likelihood to try out air taxis within the next decade. This question was asked at the end of the questionnaire to know the latest feeling of the respondent after completing the survey. This question is the key point for all stakeholders involved in the eVTOL industry because the public opinion is the most important.

Among the respondents, 105 (40%) express openness to the idea of using an air taxi within the next decade. This affirmative stance signals a willingness to embrace innovative aerial mobility solutions and reflects optimism about the potential benefits that air taxis could offer. Factors such as time savings, convenience and reduction of traffic jams likely contribute to this positive outlook. These individuals see air taxis as a promising addition to urban transportation networks, offering a novel and efficient mode of travel that aligns with their evolving lifestyle and mobility needs. On the other hand, 87 (33%) respondents' express reluctance or opposition to the idea of using an air taxi in the coming decade. This indicates a degree of scepticism, apprehension, or reservation towards this mode of transportation. Concerns regarding safety, cost, environmental impact, and regulatory uncertainties may influence their decision to air taxi usage. These individuals may prefer to stick with familiar ground-based transportation options or perceive air taxis as impractical or inaccessible for their needs.

A sizeable portion of respondents, numbering 71 (27%), remain uncertain or undecided about using an air taxi within the next decade. This ambivalence underscores the complexity and novelty of the concept of air taxis, leaving room for further development, education, and evidence. These individuals may be open to considering air taxis under certain conditions or as more information becomes available regarding their safety, affordability, and reliability.

In summary, the responses to the question reveal a diverse range of perspectives and attitudes towards the adoption of air taxis in the next decade.

Figure 26: pie chart of likelihood to try out air taxis within the next decade.




Source: own processing from the questionnaire on Google Forms

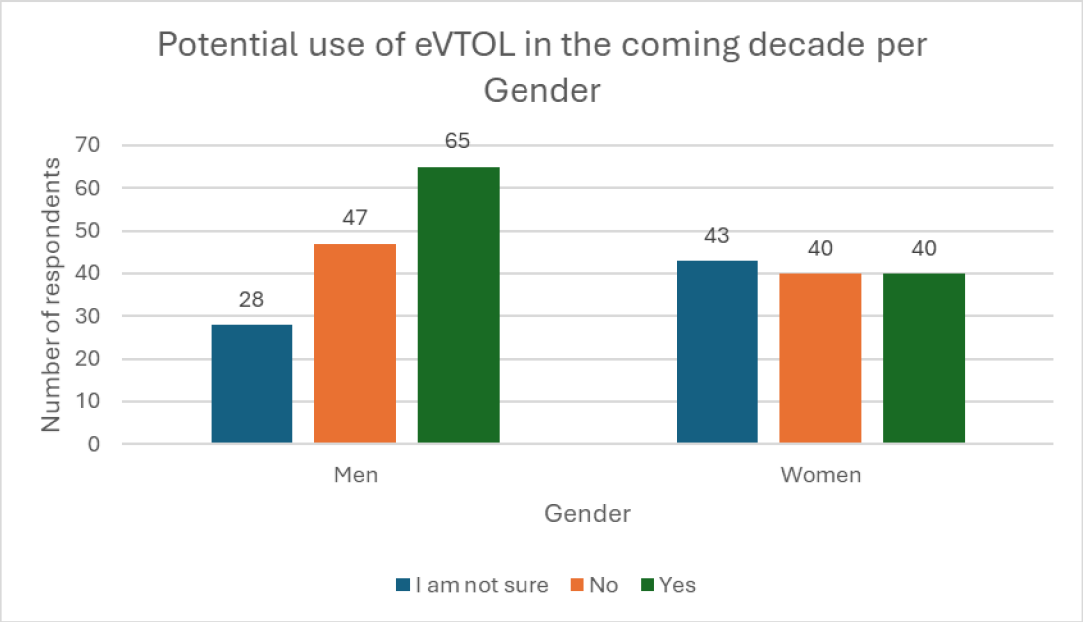
## 4.4Testing

Before processing the hypothesis testing and showing the results of each hypothesis tested, it was wise to suggest that the author had recorded some of the answers (Likert scale ones) into a scale from 1 to 6, where 1 shows the lowest level of response to 6, which indicated the highest level of response.

The author started with the first hypothesis, where Gender and potential use of eVTOL in the coming decade were analysed.

**Hypothesis 1: Gender and potential use of eVTOL in the coming decade**

Figure 27: bar chart for the first hypothesis.




Source: own processing from the questionnaire on Google Forms

Based on the bar chart from figure 27 for the first hypothesis, which involved two variables – Gender and potential use of eVTOL in the coming decade, it is wise to say that the overwhelming share of men likely to use eVTOL in the coming decade is more important than women. Women gender did not seem to be a factor that created significant differences in tendencies. Author assumed that gender is influencing the potential use of eVTOL in the coming decade.

However, before drawing any insights, it was fundamental to test the hypothesis first. For the test of this hypothesis, the author used SPSS software and used the Chi-square testing procedure

needed for two categorical variables. In Table 1, the author shows the output according to which the test was done.

Table 1: bar chart for the first hypothesis.

**Last but not least, would you consider using an air taxi within the next decade? * What is your gender? Crosstabulation**

| | | | What is your gender? Women | Men | Total |
|---|---|---|---|---|---|
| Last but not least, would you consider using an air taxi within the next decade? | I do not know | Count | 43 | 28 | 71 |
| | | Expected Count | 33,2 | 37,8 | 71,0 |
| | | % within What is your gender? | 35,0% | 20,0% | 27,0% |
| | | Standardized Residual | 1,7 | -1,6 | |
| | No | Count | 40 | 47 | 87 |
| | | Expected Count | 40,7 | 46,3 | 87,0 |
| | | % within What is your gender? | 32,5% | 33,6% | 33,1% |
| | | Standardized Residual | -,1 | ,1 | |
| | Yes | Count | 40 | 65 | 105 |
| | | Expected Count | 49,1 | 55,9 | 105,0 |
| | | % within What is your gender? | 32,5% | 46,4% | 39,9% |
| | | Standardized Residual | -1,3 | 1,2 | |
| Total | | Count | 123 | 140 | 263 |
| | | Expected Count | 123,0 | 140,0 | 263,0 |
| | | % within What is your gender? | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 8,622[a] | 2 | ,013 |
| Likelihood Ratio | 8,667 | 2 | ,013 |
| Linear-by-Linear Association | 8,331 | 1 | ,004 |
| N of Valid Cases | 263 | | |

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 33,21.

Source: own processing

H0: Gender and potential use of eVTOL in the coming decade are not related.

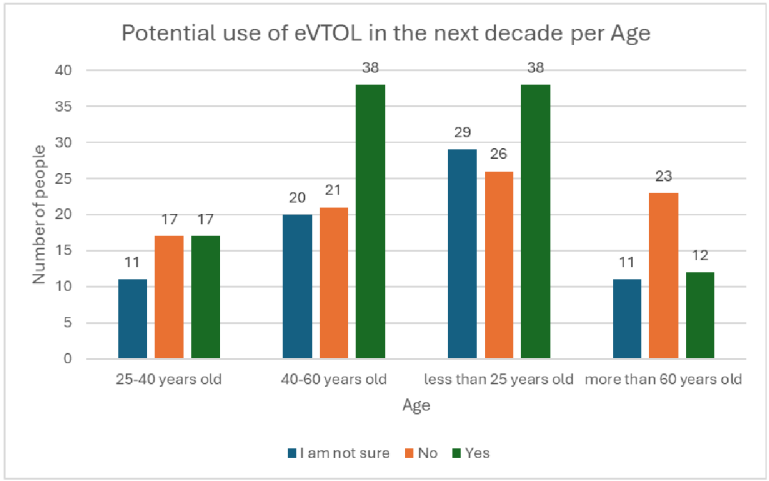
H1: Gender and potential use of eVTOL in the coming decade are related.

P-value = 0.013 < 0.05 so we reject H0 and accept H1

Then, we can assume that Gender and potential use of eVTOL in the coming decade are related and it make sense related to the bar chart of the first hypothesis underlining the number of yes for men.

**Hypothesis2: Age and potential use of eVTOL in the coming decade**

Figure 28:bar chart for the second hypothesis.




Source: own processing from the questionnaire on Google Forms

Table 2:output from SPSS for the second hypothesis

**Last but not least, would you consider using an air taxi within the next decade? * How old are you? Crosstabulation**

| | | | How old are you? | | | | |
|---|---|---|---|---|---|---|---|
| | | | 25-40 years | 40-60 years | less than 25 years | more than 60 years | Total |
| Last but not least, would you consider using an air taxi within the next decade? | I do not know | Count | 11 | 20 | 29 | 11 | 71 |
| | | Expected Count | 12,1 | 21,3 | 25,1 | 12,4 | 71,0 |
| | | % within How old are you? | 24,4% | 25,3% | 31,2% | 23,9% | 27,0% |
| | | Standardized Residual | -,3 | -,3 | ,8 | -,4 | |
| | No | Count | 17 | 21 | 26 | 23 | 87 |
| | | Expected Count | 14,9 | 26,1 | 30,8 | 15,2 | 87,0 |
| | | % within How old are you? | 37,8% | 26,6% | 28,0% | 50,0% | 33,1% |
| | | Standardized Residual | ,5 | -1,0 | -,9 | 2,0 | |
| | Yes | Count | 17 | 38 | 38 | 12 | 105 |
| | | Expected Count | 18,0 | 31,5 | 37,1 | 18,4 | 105,0 |
| | | % within How old are you? | 37,8% | 48,1% | 40,9% | 26,1% | 39,9% |
| | | Standardized Residual | -,2 | 1,2 | ,1 | -1,5 | |
| Total | | Count | 45 | 79 | 93 | 46 | 263 |
| | | Expected Count | 45,0 | 79,0 | 93,0 | 46,0 | 263,0 |
| | | % within How old are you? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 10,586[a] | 6 | ,102 |
| Likelihood Ratio | 10,355 | 6 | ,110 |
| Linear-by-Linear Association | 1,059 | 1 | ,304 |
| N of Valid Cases | 263 | | |

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 12,15.

Source: own processing

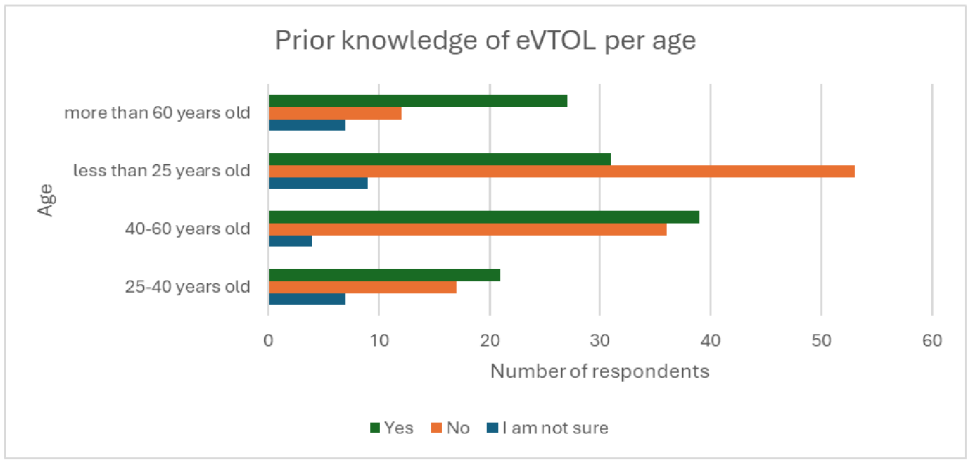
H0: Age and potential use of eVTOL in the coming decade are not related.

H1: Age and potential use of eVTOL in the coming decade are related.

P-value = 0.102 > 0.05, so we cannot reject H0, then we can assume that Age and potential use of eVTOL in the coming decade are not related.

**Hypothesis 3: Age and prior knowledge of eVTOL**

Figure 29: bar chart for the third hypothesis.




Source: own processing from the questionnaire on Google Forms

We can see from the bar chart that the percentage of people less than 25 years old who have not heard about eVTOL is higher than for people more than 60 years old. As the author collected more responses from people less than 25 years old than people more than 60 years old, these results should be nuanced. Indeed, the results might change if the number of answers from each age category would be similar. To go deeper into the research, the author did a test on SPSS to deny or validate previous insight.

Table 3:output from SPSS for the third hypothesis

**Have you ever heard of electric aircraft with vertical take-off and landing (eVTOL)? * How old are you? Crosstabulation**

| | | | How old are you? | | | | |
|---|---|---|---|---|---|---|---|
| | | | 25-40 years | 40-60 years | less than 25 years | more than 60 years | Total |
| Have you ever heard of electric aircraft with vertical take-off and landing (eVTOL)? | I am not sure | Count | 7 | 4 | 9 | 7 | 27 |
| | | Expected Count | 4,6 | 8,1 | 9,5 | 4,7 | 27,0 |
| | | % within How old are you? | 15,6% | 5,1% | 9,7% | 15,2% | 10,3% |
| | | Standardized Residual | 1,1 | -1,4 | -,2 | 1,0 | |
| | No | Count | 17 | 36 | 53 | 12 | 118 |
| | | Expected Count | 20,2 | 35,4 | 41,7 | 20,6 | 118,0 |
| | | % within How old are you? | 37,8% | 45,6% | 57,0% | 26,1% | 44,9% |
| | | Standardized Residual | -,7 | ,1 | 1,7 | -1,9 | |
| | Yes | Count | 21 | 39 | 31 | 27 | 118 |
| | | Expected Count | 20,2 | 35,4 | 41,7 | 20,6 | 118,0 |
| | | % within How old are you? | 46,7% | 49,4% | 33,3% | 58,7% | 44,9% |
| | | Standardized Residual | ,2 | ,6 | -1,7 | 1,4 | |
| Total | | Count | 45 | 79 | 93 | 46 | 263 |
| | | Expected Count | 45,0 | 79,0 | 93,0 | 46,0 | 263,0 |
| | | % within How old are you? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 16,721[a] | 6 | ,010 |
| Likelihood Ratio | 17,411 | 6 | ,008 |
| Linear-by-Linear Association | ,002 | 1 | ,966 |
| N of Valid Cases | 263 | | |

a. 2 cells (16,7%) have expected count less than 5. The minimum expected count is 4,62.

Source: own processing

H0: Age and knowledge of eVTOL are not related.

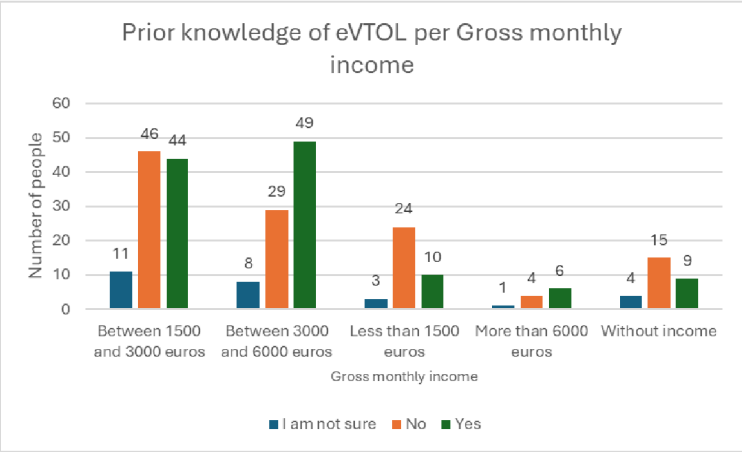
H1: Age and knowledge of eVTOL are related.

P-value = 0.010 < 0.05: we reject H0 and H1 is validated

So, we can assume that age and knowledge of eVTOL are related. The variable age influences the knowledge of eVTOL or not before completing the survey.

**Hypothesis 4: Prior knowledge of eVTOL and gross monthly income.**

Figure 30:bar chart for the fourth hypothesis.




Source: own processing from the questionnaire on Google Forms

Table 4:output from SPSS for the fourth hypothesis

**Have you ever heard of electric aircraft with vertical take-off and landing (eVTOL)? * In what bracket do you estimate your gross monthly income? Crosstabulation**

| | | | In what bracket do you estimate your gross monthly income? | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Between 1500 and 3000 euros | Between 3000 and 6000 euros | Less than 1500 euros | More than 6000 euros | Without income | Total |
| Have you ever heard of electric aircraft with vertical take-off and landing (eVTOL)? | I am not sure | Count | 11 | 8 | 3 | 1 | 4 | 27 |
| | | Expected Count | 10,4 | 8,8 | 3,8 | 1,1 | 2,9 | 27,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 10,9% | 9,3% | 8,1% | 9,1% | 14,3% | 10,3% |
| | | Standardized Residual | ,2 | -,3 | -,4 | -,1 | ,7 | |
| | No | Count | 46 | 29 | 24 | 4 | 15 | 118 |
| | | Expected Count | 45,3 | 38,6 | 16,6 | 4,9 | 12,6 | 118,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 45,5% | 33,7% | 64,9% | 36,4% | 53,6% | 44,9% |
| | | Standardized Residual | ,1 | -1,5 | 1,8 | -,4 | ,7 | |
| | Yes | Count | 44 | 49 | 10 | 6 | 9 | 118 |
| | | Expected Count | 45,3 | 38,6 | 16,6 | 4,9 | 12,6 | 118,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 43,6% | 57,0% | 27,0% | 54,5% | 32,1% | 44,9% |
| | | Standardized Residual | -,2 | 1,7 | -1,6 | ,5 | -1,0 | |
| Total | | Count | 101 | 86 | 37 | 11 | 28 | 263 |
| | | Expected Count | 101,0 | 86,0 | 37,0 | 11,0 | 28,0 | 263,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 13,793[a] | 8 | ,087 |
| Likelihood Ratio | 13,881 | 8 | ,085 |
| Linear-by-Linear Association | 1,303 | 1 | ,254 |
| N of Valid Cases | 263 | | |

a. 5 cells (33,3%) have expected count less than 5. The minimum expected count is 1,13.

Source: own processing

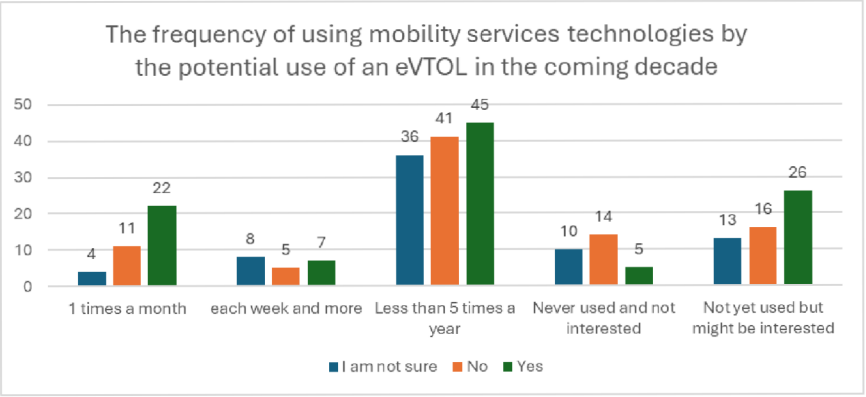
H0: Knowledge of eVTOL and gross monthly income are not related.

H1: Knowledge of eVTOL and gross monthly income are related.

P-value = 0.087 > 0.05: H0 cannot be rejected then we can assume that Knowledge of eVTOL and gross monthly income are not related.

**Hypothesis 5: The frequency of using mobility services technologies and the potential use of an eVTOL in the coming decade.**

Figure 31:bar chart for the fifth hypothesis.




Source: own processing from the questionnaire on Google Forms

Table 5:output from SPSS for the fifth hypothesis:

**Last but not least, would you consider using an air taxi within the next decade? * How often do you use new mobility technologies such as car sharing (Blablacar...) and taxi services via a mobile application (Uber, Bolt...)? Crosstabulation**

| | | | How often do you use new mobility technologies such as car sharing (Blablacar...) and taxi services via a mobile application (Uber, Bolt...)? | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 times a month | Each week or more | Never used and not interested | Less than 5 times a year | Not yet used but might be interested | Total |
| Last but not least, would you consider using an air taxi within the next decade? | I do not know | Count | 4 | 8 | 10 | 36 | 13 | 71 |
| | | Expected Count | 10,0 | 5,4 | 7,8 | 32,9 | 14,8 | 71,0 |
| | | % within How often do you use new mobility technologies such as car sharing (Blablacar...) and taxi services via a mobile application (Uber, Bolt...)? | 10,8% | 40,0% | 34,5% | 29,5% | 23,6% | 27,0% |
| | | Standardized Residual | -1,9 | 1,1 | ,8 | ,5 | -,5 | |
| | No | Count | 11 | 5 | 14 | 41 | 16 | 87 |
| | | Expected Count | 12,2 | 6,6 | 9,6 | 40,4 | 18,2 | 87,0 |
| | | % within How often do you use new mobility technologies such as car sharing (Blablacar...) and taxi services via a mobile application (Uber, Bolt...)? | 29,7% | 25,0% | 48,3% | 33,6% | 29,1% | 33,1% |
| | | Standardized Residual | -,4 | -,6 | 1,4 | ,1 | -,5 | |
| | Yes | Count | 22 | 7 | 5 | 45 | 26 | 105 |
| | | Expected Count | 14,8 | 8,0 | 11,6 | 48,7 | 22,0 | 105,0 |
| | | % within How often do you use new mobility technologies such as car sharing (Blablacar...) and taxi services via a mobile application (Uber, Bolt...)? | 59,5% | 35,0% | 17,2% | 36,9% | 47,3% | 39,9% |
| | | Standardized Residual | 1,9 | -,3 | -1,9 | -,5 | ,9 | |
| Total | | Count | 37 | 20 | 29 | 122 | 55 | 263 |
| | | Expected Count | 37,0 | 20,0 | 29,0 | 122,0 | 55,0 | 263,0 |
| | | % within How often do you use new mobility technologies such as car sharing (Blablacar...) and taxi services via a mobile application (Uber, Bolt...)? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 17,202[a] | 8 | ,028 |
| Likelihood Ratio | 18,381 | 8 | ,019 |
| Linear-by-Linear Association | 1,110 | 1 | ,292 |
| N of Valid Cases | 263 | | |

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 5,40.

Source: own processing

H0: Frequency of using mobility services technologies and potential use of an eVTOL in the coming decade are not related.

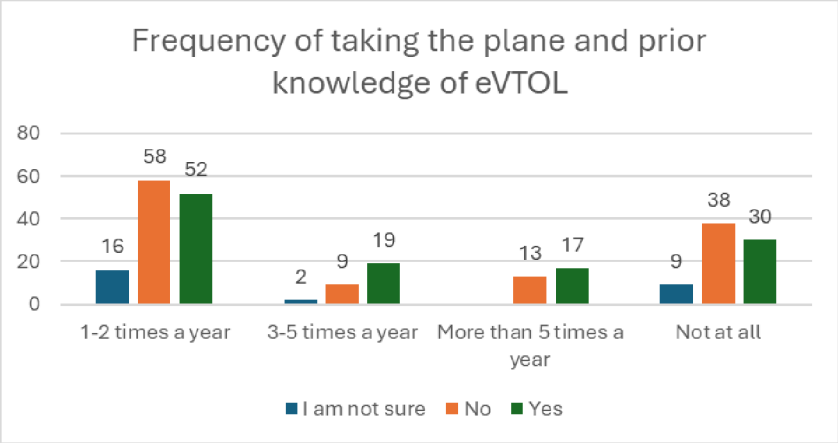
H1: Frequency of using mobility services technologies and potential use of an eVTOL in the coming decade are related.

P-value = 0.028 < 0.05: we reject H0 and H1 is validated

Then we can assume that frequency of using mobility services technologies and potential use of an eVTOL in the coming decade are related. People using less than 5 times a year and 1 time a month are more likely to use an eVTOL in coming years as they already use mobility services technologies such as Bolt or Uber.

**Hypothesis 6: Frequency of taking the plane and prior knowledge of eVTOL.**

Figure 32:bar chart of the frequency of taking the plane and the knowledge of eVTOL.




Source: own processing from the questionnaire on Google Forms

Table 6:output from SPSS for the sixth hypothesis

**Have you ever heard of electric aircraft with vertical take-off and landing (eVTOL)? * In the course of a normal year, how many times do you fly for personal or professional reasons? Crosstabulation**

| | | | In the course of a normal year, how many times do you fly for personal or professional reasons? | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1-2 times a year | 3-5 times a year | Not at all | More than 5 times a year | Total |
| Have you ever heard of electric aircraft with vertical take-off and landing (eVTOL)? | I am not sure | Count | 16 | 2 | 9 | 0 | 27 |
| | | Expected Count | 12,9 | 3,1 | 7,9 | 3,1 | 27,0 |
| | | % within In the course of a normal year, how many times do you fly for personal or professional reasons? | 12,7% | 6,7% | 11,7% | 0,0% | 10,3% |
| | | Standardized Residual | ,9 | -,6 | ,4 | -1,8 | |
| | No | Count | 58 | 9 | 38 | 13 | 118 |
| | | Expected Count | 56,5 | 13,5 | 34,6 | 13,5 | 118,0 |
| | | % within In the course of a normal year, how many times do you fly for personal or professional reasons? | 46,0% | 30,0% | 49,4% | 43,3% | 44,9% |
| | | Standardized Residual | ,2 | -1,2 | ,6 | -,1 | |
| | Yes | Count | 52 | 19 | 30 | 17 | 118 |
| | | Expected Count | 56,5 | 13,5 | 34,6 | 13,5 | 118,0 |
| | | % within In the course of a normal year, how many times do you fly for personal or professional reasons? | 41,3% | 63,3% | 39,0% | 56,7% | 44,9% |
| | | Standardized Residual | -,6 | 1,5 | -,8 | 1,0 | |
| Total | | Count | 126 | 30 | 77 | 30 | 263 |
| | | Expected Count | 126,0 | 30,0 | 77,0 | 30,0 | 263,0 |
| | | % within In the course of a normal year, how many times do you fly for personal or professional reasons? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 10,386[a] | 6 | ,109 |
| Likelihood Ratio | 13,353 | 6 | ,038 |
| Linear-by-Linear Association | 1,652 | 1 | ,199 |
| N of Valid Cases | 263 | | |

a. 2 cells (16,7%) have expected count less than 5. The minimum expected count is 3,08.

Source: own processing

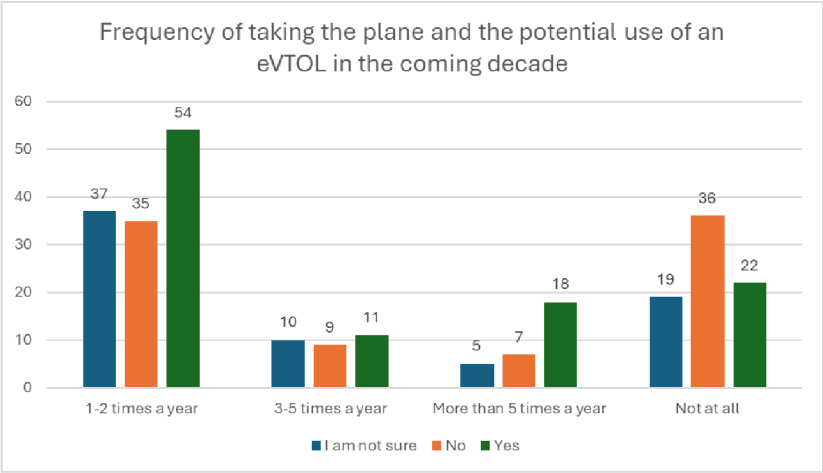
H0: Frequency of taking the plane and knowledge of eVTOL are not related.

H1: Frequency of taking the plane and knowledge of eVTOL are related.

P-value = 0.109 > 0.05: H0 cannot be rejected then we can assume that the frequency of taking the plane and the knowledge of eVTOL are not related.

**Hypothesis 7: Frequency of taking the plane and the potential use of an eVTOL in the coming decade**

Figure 33:bar chart of the frequency of taking the plane and the potential use of an eVTOL in the coming decade.




Source: own processing from the questionnaire on Google Forms

From the bar chart regarding the relation between the frequency of taking the plane and the potential use of an eVTOL in the coming decade, we can see that respondents taking the plane 1-2 times a year are more likely to use an eVTOL within the decade (54 yes compared to 35 No and many do not know). Besides, within the range of respondents taking plane more than 5 times a year, we see that most of them (18, 60%) are willing to use eVTOL in the coming years. Let's emphasise also the fact that most respondents who do not take at all the plane are not willing to use an eVTOL (36 people saying No against 22) in the coming years. To sum up, these three tendancies confirmed author' hypothesis. Le'ts now make a statistical test to approve or deny previous results.

Table 7:output from SPSS for the seventh hypothesis

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 14,283[a] | 6 | ,027 |
| Likelihood Ratio | 13,966 | 6 | ,030 |
| Linear-by-Linear Association | ,530 | 1 | ,467 |
| N of Valid Cases | 263 | | |

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 8,10.

**In the course of a normal year, how many times do you fly for personal or professional reasons? * Last but not least, would you consider using an air taxi within the next decade? Crosstabulation**

| | | | Last but not least, would you consider using an air taxi within the next decade? | | | |
|---|---|---|---|---|---|---|
| | | | I do not know | No | Yes | Total |
| In the course of a normal year, how many times do you fly for personal or professional reasons? | 1-2 times a year | Count | 37 | 35 | 54 | 126 |
| | | Expected Count | 34,0 | 41,7 | 50,3 | 126,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 52,1% | 40,2% | 51,4% | 47,9% |
| | | Standardized Residual | ,5 | -1,0 | ,5 | |
| | 3-5 times a year | Count | 10 | 9 | 11 | 30 |
| | | Expected Count | 8,1 | 9,9 | 12,0 | 30,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 14,1% | 10,3% | 10,5% | 11,4% |
| | | Standardized Residual | ,7 | -,3 | -,3 | |
| | Not at all | Count | 19 | 36 | 22 | 77 |
| | | Expected Count | 20,8 | 25,5 | 30,7 | 77,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 26,8% | 41,4% | 21,0% | 29,3% |
| | | Standardized Residual | -,4 | 2,1 | -1,6 | |
| | More than 5 times a year | Count | 5 | 7 | 18 | 30 |
| | | Expected Count | 8,1 | 9,9 | 12,0 | 30,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 7,0% | 8,0% | 17,1% | 11,4% |
| | | Standardized Residual | -1,1 | -,9 | 1,7 | |
| Total | | Count | 71 | 87 | 105 | 263 |
| | | Expected Count | 71,0 | 87,0 | 105,0 | 263,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 100,0% | 100,0% | 100,0% | 100,0% |

Source: own processing

H0: Frequency of taking the plane and the use of an eVTOL in the coming decade are not related.

H1: Frequency of taking the plane and the use of an eVTOL in the coming decade are related.

P-value = 0.027 < 0.05: we reject H0 and H1 is validated

Then we can assume that frequency of taking the plane and the use of an eVTOL in the coming decade are related. Many reasons can explain this correlation. Individuals who frequently take planes may already have a familiarity with air travel and may be more inclined to consider alternative forms of aviation, such as eVTOLs once they become available. Their existing comfort with air travel could make them more open to embracing new aerial transportation options. As such, the adoption of eVTOLs could represent a natural extension of their air travel habits, providing seamless connectivity between airports and final destinations. Besides, frequent air travellers are often individuals who prioritize efficiency and convenience in their transportation choices. As such, they may be particularly receptive to the potential time-saving benefits offered by eVTOLs, which have the capability to bypass ground congestion and provide rapid point-to-point travel within urban environments. Individuals who are accustomed to air travel may make them early adopters or enthusiasts for new developments in this industry.

**Hypothesis 8: Age and global perception of running eVTOL before 2030.**

Table 8: output from SPSS for the eighth hypothesis.

**How old are you? * What would be your overall perception if flying taxis were introduced in the Ile-de-France region by 2030? Crosstabulation**

| | | | What would be your overall perception if flying taxis were introduced in the Ile-de-France region by 2030? | | | | |
|---|---|---|---|---|---|---|---|
| | | | Negative | Rather negative | Rather positive | Positive | Total |
| How old are you? | 25-40 years | Count | 8 | 14 | 19 | 4 | 45 |
| | | Expected Count | 6,8 | 12,8 | 19,3 | 6,0 | 45,0 |
| | | % within What would be your overall perception if flying taxis were introduced in the Ile-de-France region by 2030? | 20,0% | 18,7% | 16,8% | 11,4% | 17,1% |
| | | Standardized Residual | ,4 | ,3 | -,1 | -,8 | |
| | 40-60 years | Count | 9 | 16 | 44 | 10 | 79 |
| | | Expected Count | 12,0 | 22,5 | 33,9 | 10,5 | 79,0 |
| | | % within What would be your overall perception if flying taxis were introduced in the Ile-de-France region by 2030? | 22,5% | 21,3% | 38,9% | 28,6% | 30,0% |
| | | Standardized Residual | -,9 | -1,4 | 1,7 | -,2 | |
| | less than 25 years | Count | 16 | 33 | 30 | 14 | 93 |
| | | Expected Count | 14,1 | 26,5 | 40,0 | 12,4 | 93,0 |
| | | % within What would be your overall perception if flying taxis were introduced in the Ile-de-France region by 2030? | 40,0% | 44,0% | 26,5% | 40,0% | 35,4% |
| | | Standardized Residual | ,5 | 1,3 | -1,6 | ,5 | |
| | more than 60 years | Count | 7 | 12 | 20 | 7 | 46 |
| | | Expected Count | 7,0 | 13,1 | 19,8 | 6,1 | 46,0 |
| | | % within What would be your overall perception if flying taxis were introduced in the Ile-de-France region by 2030? | 17,5% | 16,0% | 17,7% | 20,0% | 17,5% |
| | | Standardized Residual | ,0 | -,3 | ,1 | ,4 | |
| Total | | Count | 40 | 75 | 113 | 35 | 263 |
| | | Expected Count | 40,0 | 75,0 | 113,0 | 35,0 | 263,0 |
| | | % within What would be your overall perception if flying taxis were introduced in the Ile-de-France region by 2030? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 11,366[a] | 9 | ,251 |
| Likelihood Ratio | 11,572 | 9 | ,239 |
| Linear-by-Linear Association | ,004 | 1 | ,951 |
| N of Valid Cases | 263 | | |

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 5,99.

Source: own processing

H0: Age and global perception of running eVTOL before 2030 are not related.

H1: Age and global perception of running eVTOL before 2030 are related.

P-value = 0.251 > 0.05: we cannot reject H0, then we can assume that Age and global perception of running eVTOL before 2030 are not related.

**Hypothesis 9: Gross monthly income and the global perception of running eVTOL before 2030.**

Table 9: output from SPSS for the ninth hypothesis.

**Crosstab**

| | | | In what bracket do you estimate your gross monthly income? | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Between 1500 and 3000 euros | Between 3000 and 6000 euros | Less than 1500 euros | More than 6000 euros | Without income | Total |
| What would be your overall perception if flying taxis were introduced in the Ile-de-France region by 2030? | Negative | Count | 17 | 10 | 5 | 2 | 6 | 40 |
| | | Expected Count | 15,4 | 13,1 | 5,6 | 1,7 | 4,3 | 40,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 16,8% | 11,6% | 13,5% | 18,2% | 21,4% | 15,2% |
| | | Standardized Residual | ,4 | -,9 | -,3 | ,3 | ,8 | |
| | Rather negative | Count | 30 | 22 | 14 | 0 | 9 | 75 |
| | | Expected Count | 28,8 | 24,5 | 10,6 | 3,1 | 8,0 | 75,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 29,7% | 25,6% | 37,8% | 0,0% | 32,1% | 28,5% |
| | | Standardized Residual | ,2 | -,5 | 1,1 | -1,8 | ,4 | |
| | Rather positive | Count | 46 | 40 | 12 | 7 | 8 | 113 |
| | | Expected Count | 43,4 | 37,0 | 15,9 | 4,7 | 12,0 | 113,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 45,5% | 46,5% | 32,4% | 63,6% | 28,6% | 43,0% |
| | | Standardized Residual | ,4 | ,5 | -1,0 | 1,0 | -1,2 | |
| | Positive | Count | 8 | 14 | 6 | 2 | 5 | 35 |
| | | Expected Count | 13,4 | 11,4 | 4,8 | 1,5 | 3,7 | 35,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 7,9% | 16,3% | 16,2% | 18,2% | 17,9% | 13,3% |
| | | Standardized Residual | -1,5 | ,8 | ,5 | ,4 | ,7 | |
| Total | | Count | 101 | 86 | 37 | 11 | 28 | 263 |
| | | Expected Count | 101,0 | 86,0 | 37,0 | 11,0 | 28,0 | 263,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 13,896[a] | 12 | ,307 |
| Likelihood Ratio | 17,288 | 12 | ,139 |
| Linear-by-Linear Association | ,076 | 1 | ,783 |
| N of Valid Cases | 263 | | |

a. 7 cells (35,0%) have expected count less than 5. The minimum expected count is 1,46.

Source: own processing

H0: Gross monthly income and global perception of running eVTOL before 2030 are not related.

H1: Gross monthly income and global perception of running eVTOL before 2030 are related.

P-value = 0.307 > 0.05: we cannot reject H0, then we assume that Gross monthly income and global perception of running eVTOL before 2030 are not related.

**Hypothesis 10: Gross monthly income and the potential use of an eVTOL in the coming decade.**

Table 10: output from SPSS for the tenth hypothesis.

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 9,981[a] | 8 | ,266 |
| Likelihood Ratio | 10,319 | 8 | ,243 |
| Linear-by-Linear Association | ,024 | 1 | ,878 |
| N of Valid Cases | 263 | | |

a. 3 cells (20,0%) have expected count less than 5. The minimum expected count is 2,97.

**Last but not least, would you consider using an air taxi within the next decade? * In what bracket do you estimate your gross monthly income? Crosstabulation**

| | | | In what bracket do you estimate your gross monthly income? | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Between 1500 and 3000 euros | Between 3000 and 6000 euros | Less than 1500 euros | More than 6000 euros | Without income | Total |
| Last but not least, would you consider using an air taxi within the next decade? | I do not know | Count | 29 | 20 | 11 | 1 | 10 | 71 |
| | | Expected Count | 27,3 | 23,2 | 10,0 | 3,0 | 7,6 | 71,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 28,7% | 23,3% | 29,7% | 9,1% | 35,7% | 27,0% |
| | | Standardized Residual | ,3 | -,7 | ,3 | -1,1 | ,9 | |
| | No | Count | 39 | 26 | 9 | 3 | 10 | 87 |
| | | Expected Count | 33,4 | 28,4 | 12,2 | 3,6 | 9,3 | 87,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 38,6% | 30,2% | 24,3% | 27,3% | 35,7% | 33,1% |
| | | Standardized Residual | 1,0 | -,5 | -,9 | -,3 | ,2 | |
| | Yes | Count | 33 | 40 | 17 | 7 | 8 | 105 |
| | | Expected Count | 40,3 | 34,3 | 14,8 | 4,4 | 11,2 | 105,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 32,7% | 46,5% | 45,9% | 63,6% | 28,6% | 39,9% |
| | | Standardized Residual | -1,2 | 1,0 | ,6 | 1,2 | -1,0 | |
| Total | | Count | 101 | 86 | 37 | 11 | 28 | 263 |
| | | Expected Count | 101,0 | 86,0 | 37,0 | 11,0 | 28,0 | 263,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

Source: own processing

H0: Gross monthly income and the potential use of an eVTOL in the coming decade are not related.

H1: Gross monthly income and the potential use of an eVTOL in the coming decade are related.

P-value = 0.266 > 0.05: we cannot reject H0, then we can assume that Gross monthly income and the potential use of an eVTOL in the coming decade are not related.

**Hypothesis 11: Gross monthly income influences the likelihood of using an eVTOL with 25-50% higher prices than road taxi.**

Table 11: output from SPSS for the eleventh hypothesis.

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 14,313[a] | 12 | ,281 |
| Likelihood Ratio | 14,668 | 12 | ,260 |
| Linear-by-Linear Association | ,014 | 1 | ,906 |
| N of Valid Cases | 263 | | |

a. 6 cells (30,0%) have expected count less than 5. The minimum expected count is ,75.

**If journey times are at least twice as fast in the air, how likely would you be to use a flying taxi at a price 25-50% higher than a conventional road taxi? * In what bracket do you estimate your gross monthly income? Crosstabulation**

| | | | In what bracket do you estimate your gross monthly income? | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Between 1500 and 3000 euros | Between 3000 and 6000 euros | Less than 1500 euros | More than 6000 euros | Without income | Total |
| If journey times are at least twice as fast in the air, how likely would you be to use a flying taxi at a price 25-50% higher than a conventional road taxi? | Negative | Count | 32 | 18 | 10 | 3 | 11 | 74 |
| | | Expected Count | 28,4 | 24,2 | 10,4 | 3,1 | 7,9 | 74,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 31,7% | 20,9% | 27,0% | 27,3% | 39,3% | 28,1% |
| | | Standardized Residual | ,7 | -1,3 | -,1 | -,1 | 1,1 | |
| | Rather negative | Count | 40 | 30 | 12 | 2 | 10 | 94 |
| | | Expected Count | 36,1 | 30,7 | 13,2 | 3,9 | 10,0 | 94,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 39,6% | 34,9% | 32,4% | 18,2% | 35,7% | 35,7% |
| | | Standardized Residual | ,6 | -,1 | -,3 | -1,0 | ,0 | |
| | Rather positive | Count | 25 | 28 | 12 | 6 | 6 | 77 |
| | | Expected Count | 29,6 | 25,2 | 10,8 | 3,2 | 8,2 | 77,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 24,8% | 32,6% | 32,4% | 54,5% | 21,4% | 29,3% |
| | | Standardized Residual | -,8 | ,6 | ,4 | 1,5 | -,8 | |
| | Positive | Count | 4 | 10 | 3 | 0 | 1 | 18 |
| | | Expected Count | 6,9 | 5,9 | 2,5 | ,8 | 1,9 | 18,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 4,0% | 11,6% | 8,1% | 0,0% | 3,6% | 6,8% |
| | | Standardized Residual | -1,1 | 1,7 | ,3 | -,9 | -,7 | |
| Total | | Count | 101 | 86 | 37 | 11 | 28 | 263 |
| | | Expected Count | 101,0 | 86,0 | 37,0 | 11,0 | 28,0 | 263,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

Source: own processing

H0: Gross monthly income and the likelihood of using an eVTOL with 25-50% higher prices than road taxi are not related.

H1: Gross monthly income and the likelihood of using an eVTOL with 25-50% higher prices than road taxi are related.

P-value = 0.281 > 0.05: we cannot reject H0, then we assume that Gross monthly income and the likelihood of using an eVTOL with 25-50% higher prices than road taxi are not related.

**Hypothesis 12: Gross monthly income and the likelihood of using an eVTOL with similar prices than road taxi.**

Table 12: output from SPSS for the twelfth hypothesis.

**Now let's assume that the price is similar between a conventional road taxi and a flying taxi, and that the journey time is at least twice as fast in the air, how likely would you be to use a flying taxi rather than a conventional road taxi? * In what bracket do you estimate your gross monthly income? Crosstabulation**

| | | | In what bracket do you estimate your gross monthly income? | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Between 1500 and 3000 euros | Between 3000 and 6000 euros | Less than 1500 euros | More than 6000 euros | Without income | Total |
| Now let's assume that the price is similar between a conventional road taxi and a flying taxi, and that the journey time is at least twice as fast in the air, how likely would you be to use a flying taxi rather than a conventional road taxi? | Negative | Count | 18 | 8 | 6 | 1 | 5 | 38 |
| | | Expected Count | 14,6 | 12,4 | 5,3 | 1,6 | 4,0 | 38,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 17,8% | 9,3% | 16,2% | 9,1% | 17,9% | 14,4% |
| | | Standardized Residual | ,9 | -1,3 | ,3 | -,5 | ,5 | |
| | Rather negative | Count | 15 | 11 | 3 | 2 | 2 | 33 |
| | | Expected Count | 12,7 | 10,8 | 4,6 | 1,4 | 3,5 | 33,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 14,9% | 12,8% | 8,1% | 18,2% | 7,1% | 12,5% |
| | | Standardized Residual | ,7 | ,1 | -,8 | ,5 | -,8 | |
| | Rather positive | Count | 45 | 36 | 15 | 3 | 13 | 112 |
| | | Expected Count | 43,0 | 36,6 | 15,8 | 4,7 | 11,9 | 112,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 44,6% | 41,9% | 40,5% | 27,3% | 46,4% | 42,6% |
| | | Standardized Residual | ,3 | -,1 | -,2 | -,8 | ,3 | |
| | Positive | Count | 23 | 31 | 13 | 5 | 8 | 80 |
| | | Expected Count | 30,7 | 26,2 | 11,3 | 3,3 | 8,5 | 80,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 22,8% | 36,0% | 35,1% | 45,5% | 28,6% | 30,4% |
| | | Standardized Residual | -1,4 | ,9 | ,5 | ,9 | -,2 | |
| Total | | Count | 101 | 86 | 37 | 11 | 28 | 263 |
| | | Expected Count | 101,0 | 86,0 | 37,0 | 11,0 | 28,0 | 263,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 9,636[a] | 12 | ,648 |
| Likelihood Ratio | 10,073 | 12 | ,610 |
| Linear-by-Linear Association | ,997 | 1 | ,318 |
| N of Valid Cases | 263 | | |

a. 7 cells (35,0%) have expected count less than 5. The minimum expected count is 1,38.

Source: own processing

H0: Gross monthly income and the likelihood of using an eVTOL with similar prices than road taxi are not related.

H1: Gross monthly income and the likelihood of using an eVTOL with similar prices than road taxi are related.

P-value = 0.678 > 0.05: we cannot reject H0, then we can assume that Gross monthly income and the likelihood of using an eVTOL with similar prices than road taxi are not related.

**Hypothesis 13: Age and assessment of eVTOL environmental impact by ecological label.**

Table 13: output from SPSS for the thirteenth hypothesis.

**Should the environmental impact of flying taxis be assessed by the authorities and made public, for example by means of an eco-label such as the one below? * How old are you? Crosstabulation**

| | | | How old are you? | | | | |
|---|---|---|---|---|---|---|---|
| | | | 25-40 years | 40-60 years | less than 25 years | more than 60 years | Total |
| Should the environmental impact of flying taxis be assessed by the authorities and made public, for example by means of an eco-label such as the one below? | I do not know | Count | 6 | 13 | 19 | 13 | 51 |
| | | Expected Count | 8,7 | 15,3 | 18,0 | 8,9 | 51,0 |
| | | % within How old are you? | 13,3% | 16,5% | 20,4% | 28,3% | 19,4% |
| | | Standardized Residual | -,9 | -,6 | ,2 | 1,4 | |
| | No | Count | 1 | 1 | 5 | 2 | 9 |
| | | Expected Count | 1,5 | 2,7 | 3,2 | 1,6 | 9,0 |
| | | % within How old are you? | 2,2% | 1,3% | 5,4% | 4,3% | 3,4% |
| | | Standardized Residual | -,4 | -1,0 | 1,0 | ,3 | |
| | Yes | Count | 38 | 65 | 69 | 31 | 203 |
| | | Expected Count | 34,7 | 61,0 | 71,8 | 35,5 | 203,0 |
| | | % within How old are you? | 84,4% | 82,3% | 74,2% | 67,4% | 77,2% |
| | | Standardized Residual | ,6 | ,5 | -,3 | -,8 | |
| Total | | Count | 45 | 79 | 93 | 46 | 263 |
| | | Expected Count | 45,0 | 79,0 | 93,0 | 46,0 | 263,0 |
| | | % within How old are you? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 6,789[a] | 6 | ,341 |
| Likelihood Ratio | 6,899 | 6 | ,330 |
| Linear-by-Linear Association | 4,615 | 1 | ,032 |
| N of Valid Cases | 263 | | |

a. 4 cells (33,3%) have expected count less than 5. The minimum expected count is 1,54.

Source: own processing

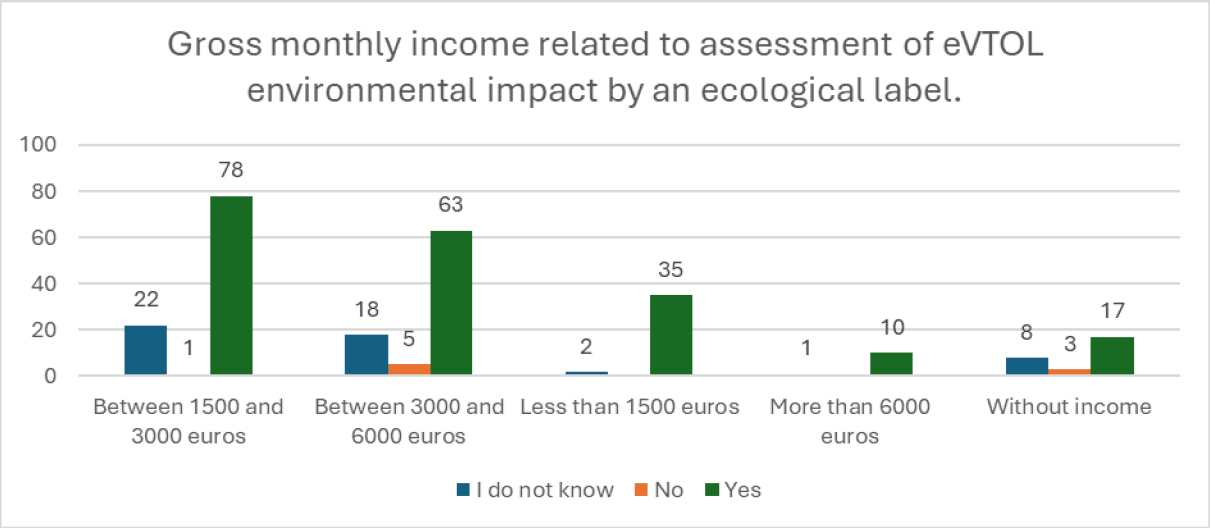
H0: Age and assessment of eVTOL environmental impact by ecological label are not related.

H1: Age and assessment of eVTOL environmental impact by ecological label are related.

P-value = 0.341> 0.05, so we cannot reject H0, then we can assume that Age and assessment of eVTOL environmental impact by ecological label are not related.

**Hypothesis 14: Gross monthly income and assessment of eVTOL environmental impact by an ecological label.**

Figure 34: bar chart of the Gross monthly income and assessment of eVTOL environmental impact by an ecological label.




Source: own processing from the questionnaire on Google Forms

As a result from this bar chart, whether the respondent's income, most people agree to set up an eco-label for assessing the environmental impact of eVTOL.

Table 14: output from SPSS for the fourteenth hypothesis.

**Should the environmental impact of flying taxis be assessed by the authorities and made public, for example by means of an eco-label such as the one below? * In what bracket do you estimate your gross monthly income? Crosstabulation**

| | | | In what bracket do you estimate your gross monthly income? | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Between 1500 and 3000 euros | Between 3000 and 6000 euros | Less than 1500 euros | More than 6000 euros | Without income | Total |
| Should the environmental impact of flying taxis be assessed by the authorities and made public, for example by means of an eco-label such as the one below? | I do not know | Count | 22 | 18 | 2 | 1 | 8 | 51 |
| | | Expected Count | 19,6 | 16,7 | 7,2 | 2,1 | 5,4 | 51,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 21,8% | 20,9% | 5,4% | 9,1% | 28,6% | 19,4% |
| | | Standardized Residual | ,5 | ,3 | -1,9 | -,8 | 1,1 | |
| | No | Count | 1 | 5 | 0 | 0 | 3 | 9 |
| | | Expected Count | 3,5 | 2,9 | 1,3 | ,4 | 1,0 | 9,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 1,0% | 5,8% | 0,0% | 0,0% | 10,7% | 3,4% |
| | | Standardized Residual | -1,3 | 1,2 | -1,1 | -,6 | 2,1 | |
| | Yes | Count | 78 | 63 | 35 | 10 | 17 | 203 |
| | | Expected Count | 78,0 | 66,4 | 28,6 | 8,5 | 21,6 | 203,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 77,2% | 73,3% | 94,6% | 90,9% | 60,7% | 77,2% |
| | | Standardized Residual | ,0 | -,4 | 1,2 | ,5 | -1,0 | |
| Total | | Count | 101 | 86 | 37 | 11 | 28 | 263 |
| | | Expected Count | 101,0 | 86,0 | 37,0 | 11,0 | 28,0 | 263,0 |
| | | % within In what bracket do you estimate your gross monthly income? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 18,008[a] | 8 | ,021 |
| Likelihood Ratio | 19,954 | 8 | ,011 |
| Linear-by-Linear Association | ,019 | 1 | ,890 |
| N of Valid Cases | 263 | | |

a. 6 cells (40,0%) have expected count less than 5. The minimum expected count is ,38.

Source: own processing

H0: Gross monthly income and assessment of eVTOL environmental impact by ecological label are not related.

H1: Gross monthly income and assessment of eVTOL environmental impact by ecological label are related.

P-value = 0.021 < 0.05, then we can reject H0 and accept H1

So, we can assume that Gross monthly income and assessment of eVTOL environmental impact by ecological label are related.

**Hypothesis 15: Knowledge of eVTOL and assessment of eVTOL environmental impact by ecological label.**

Table 15: output from SPSS for the fifteenth hypothesis.

**Have you ever heard of electric aircraft with vertical take-off and landing (eVTOL)? * Should the environmental impact of flying taxis be assessed by the authorities and made public, for example by means of an eco-label such as the one below? Crosstabulation**

| | | | Should the environmental impact of flying taxis be assessed by the authorities and made public, for example by means of an eco-label such as the one below? | | | |
|---|---|---|---|---|---|---|
| | | | I do not know | No | Yes | Total |
| Have you ever heard of electric aircraft with vertical take-off and landing (eVTOL)? | I am not sure | Count | 7 | 0 | 20 | 27 |
| | | Expected Count | 5,2 | ,9 | 20,8 | 27,0 |
| | | % within Should the environmental impact of flying taxis be assessed by the authorities and made public, for example by means of an eco-label such as the one below? | 13,7% | 0,0% | 9,9% | 10,3% |
| | | Standardized Residual | ,8 | -1,0 | -,2 | |
| | No | Count | 21 | 4 | 93 | 118 |
| | | Expected Count | 22,9 | 4,0 | 91,1 | 118,0 |
| | | % within Should the environmental impact of flying taxis be assessed by the authorities and made public, for example by means of an eco-label such as the one below? | 41,2% | 44,4% | 45,8% | 44,9% |
| | | Standardized Residual | -,4 | ,0 | ,2 | |
| | Yes | Count | 23 | 5 | 90 | 118 |
| | | Expected Count | 22,9 | 4,0 | 91,1 | 118,0 |
| | | % within Should the environmental impact of flying taxis be assessed by the authorities and made public, for example by means of an eco-label such as the one below? | 45,1% | 55,6% | 44,3% | 44,9% |
| | | Standardized Residual | ,0 | ,5 | -,1 | |
| Total | | Count | 51 | 9 | 203 | 263 |
| | | Expected Count | 51,0 | 9,0 | 203,0 | 263,0 |
| | | % within Should the environmental impact of flying taxis be assessed by the authorities and made public, for example by means of an eco-label such as the one below? | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 1,991[a] | 4 | ,737 |
| Likelihood Ratio | 2,845 | 4 | ,584 |
| Linear-by-Linear Association | ,027 | 1 | ,868 |
| N of Valid Cases | 263 | | |

a. 3 cells (33,3%) have expected count less than 5. The minimum expected count is ,92.

Source: own processing

H0: Knowledge of eVTOL and assessment of eVTOL environmental impact by ecological label are not related.

H1: Knowledge of eVTOL and assessment of eVTOL environmental impact by ecological label are related.

P-value = 0.737 > 0.05 so H0 cannot be rejected, then we assume that Knowledge of eVTOL and assessment of eVTOL environmental impact by ecological label are not related.

## Hypothesis 16: Education level and knowledge of eVTOL

Table 16: output from SPSS for the sixteenth hypothesis.

**Have you ever heard of electric aircraft with vertical take-off and landing (eVTOL)? * What is the last level of education you obtained/are currently studying? Crosstabulation**

| | | | What is the last level of education you obtained/are currently studying? | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Bac (general, pro and technical) | Bac+2 | Bac+3 | Bac+5 | Bac+5 and more | Brevet des collèges | CAP/BEP (other technical diploma) | Without diploma | Total |
| Have you ever heard of electric aircraft with vertical take-off and landing (eVTOL)? | I am not sure | Count | 3 | 7 | 3 | 7 | 5 | 1 | 1 | 0 | 27 |
| | | Expected Count | 2,7 | 4,0 | 5,1 | 9,1 | 3,7 | ,6 | 1,6 | ,1 | 27,0 |
| | | % within What is the last level of education you obtained/are currently studying? | 11,5% | 17,9% | 6,0% | 7,9% | 13,9% | 16,7% | 6,3% | 0,0% | 10,3% |
| | | Standardized Residual | ,2 | 1,5 | -,9 | -,7 | ,7 | ,5 | -,5 | -,3 | |
| | No | Count | 11 | 14 | 29 | 44 | 14 | 3 | 3 | 0 | 118 |
| | | Expected Count | 11,7 | 17,5 | 22,4 | 39,9 | 16,2 | 2,7 | 7,2 | ,4 | 118,0 |
| | | % within What is the last level of education you obtained/are currently studying? | 42,3% | 35,9% | 58,0% | 49,4% | 38,9% | 50,0% | 18,8% | 0,0% | 44,9% |
| | | Standardized Residual | -,2 | -,8 | 1,4 | ,6 | -,5 | ,2 | -1,6 | -,7 | |
| | Yes | Count | 12 | 18 | 18 | 38 | 17 | 2 | 12 | 1 | 118 |
| | | Expected Count | 11,7 | 17,5 | 22,4 | 39,9 | 16,2 | 2,7 | 7,2 | ,4 | 118,0 |
| | | % within What is the last level of education you obtained/are currently studying? | 46,2% | 46,2% | 36,0% | 42,7% | 47,2% | 33,3% | 75,0% | 100,0% | 44,9% |
| | | Standardized Residual | ,1 | ,1 | -,9 | -,3 | ,2 | -,4 | 1,8 | ,8 | |
| Total | | Count | 26 | 39 | 50 | 89 | 36 | 6 | 16 | 1 | 263 |
| | | Expected Count | 26,0 | 39,0 | 50,0 | 89,0 | 36,0 | 6,0 | 16,0 | 1,0 | 263,0 |
| | | % within What is the last level of education you obtained/are currently studying? | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 16,131[a] | 14 | ,305 |
| Likelihood Ratio | 16,359 | 14 | ,292 |
| Linear-by-Linear Association | 2,096 | 1 | ,148 |
| N of Valid Cases | 263 | | |

a. 10 cells (41,7%) have expected count less than 5. The minimum expected count is ,10.

Source: own processing

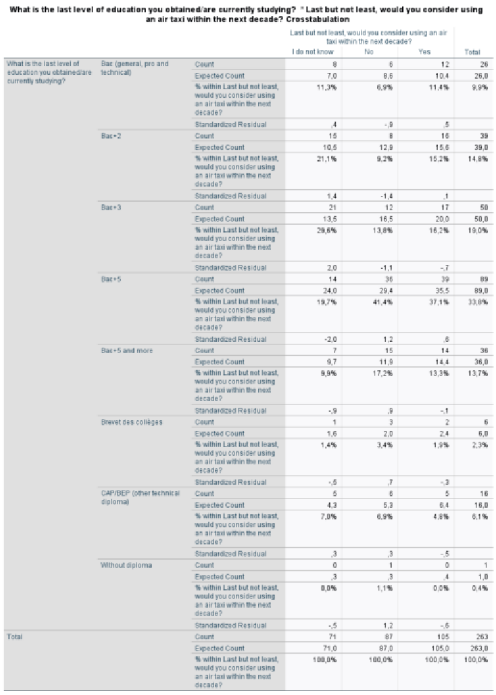
H0: Education level and knowledge of eVTOL are not related.

H1: Education level and knowledge of eVTOL are related.

P-value = 0.305 > 0.05, so we cannot reject H0, then we can assume that Education level and knowledge of eVTOL are not related.

**Hypothesis 17: Education level and potential use of eVTOL in the coming decade**

Table 17: output from SPSS for the seventeenth hypothesis.



What is the last level of education you obtained/are currently studying? * Last but not least, would you consider using an air taxi within the next decade? Crosstabulation

| | | | Last but not least, would you consider using an air taxi within the next decade? | | | |
|---|---|---|---|---|---|---|
| | | | I do not know | No | Yes | Total |
| What is the last level of education you obtained/are currently studying? | Bac (general, pro and technical) | Count | 9 | 5 | 12 | 26 |
| | | Expected Count | 7,0 | 9,5 | 10,4 | 26,9 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 11,3% | 6,9% | 11,4% | 9,9% |
| | | Standardized Residual | ,4 | -1,5 | ,5 | |
| | Bac+2 | Count | 15 | 8 | 16 | 39 |
| | | Expected Count | 10,5 | 12,9 | 15,6 | 39,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 21,1% | 9,2% | 15,2% | 14,8% |
| | | Standardized Residual | 1,4 | -1,4 | ,1 | |
| | Bac+3 | Count | 21 | 12 | 17 | 50 |
| | | Expected Count | 13,5 | 16,5 | 20,0 | 50,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 29,6% | 13,8% | 16,2% | 19,0% |
| | | Standardized Residual | 2,0 | -1,1 | -,7 | |
| | Bac+5 | Count | 14 | 36 | 39 | 89 |
| | | Expected Count | 24,0 | 29,4 | 35,5 | 89,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 19,7% | 41,4% | 37,1% | 33,8% |
| | | Standardized Residual | -2,0 | 1,2 | ,8 | |
| | Bac+5 and more | Count | 7 | 15 | 14 | 36 |
| | | Expected Count | 9,7 | 11,9 | 14,4 | 36,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 9,9% | 17,2% | 13,3% | 13,7% |
| | | Standardized Residual | -,9 | ,9 | -,1 | |
| | Brevet des collèges | Count | 1 | 3 | 2 | 6 |
| | | Expected Count | 1,6 | 2,0 | 2,4 | 6,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 1,4% | 3,4% | 1,9% | 2,3% |
| | | Standardized Residual | -,5 | ,7 | -,3 | |
| | CAP/BEP (other technical diploma) | Count | 5 | 6 | 5 | 16 |
| | | Expected Count | 4,3 | 5,3 | 6,4 | 16,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 7,0% | 6,9% | 4,8% | 6,1% |
| | | Standardized Residual | ,3 | ,3 | -,5 | |
| | Without diploma | Count | 0 | 1 | 0 | 1 |
| | | Expected Count | ,3 | ,3 | ,4 | 1,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 0,0% | 1,1% | 0,0% | 0,4% |
| | | Standardized Residual | -,5 | 1,2 | -,6 | |
| Total | | Count | 71 | 87 | 105 | 263 |
| | | Expected Count | 71,0 | 87,0 | 105,0 | 263,0 |
| | | % within Last but not least, would you consider using an air taxi within the next decade? | 100,0% | 100,0% | 100,0% | 100,0% |

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 21,709[a] | 14 | ,085 |
| Likelihood Ratio | 22,236 | 14 | ,074 |
| Linear-by-Linear Association | ,399 | 1 | ,528 |
| N of Valid Cases | 263 | | |

a. 7 cells (29,2%) have expected count less than 5. The minimum expected count is ,27.

Source: own processing

H0: Education level and potential use of eVTOL in the coming decade are not related.

H1: Education level and potential use of eVTOL in the coming decade are related.

P-value = 0.085 > 0.05 so we cannot reject H0, then we can assume that Education level and potential use of eVTOL in the coming decade are not related.

**Hypothesis 18: Concerns about eVTOL and assessment of environmental impact of eVTOL by eco-label.**

Table 18: output from SPSS for the eighteenth hypothesis.

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 227,292[a] | 230 | ,538 |
| Likelihood Ratio | 174,887 | 230 | ,997 |
| Linear-by-Linear Association | ,164 | 1 | ,685 |
| N of Valid Cases | 263 | | |

a. 341 cells (98,0%) have expected count less than 5. The minimum expected count is ,03.

Source: own processing

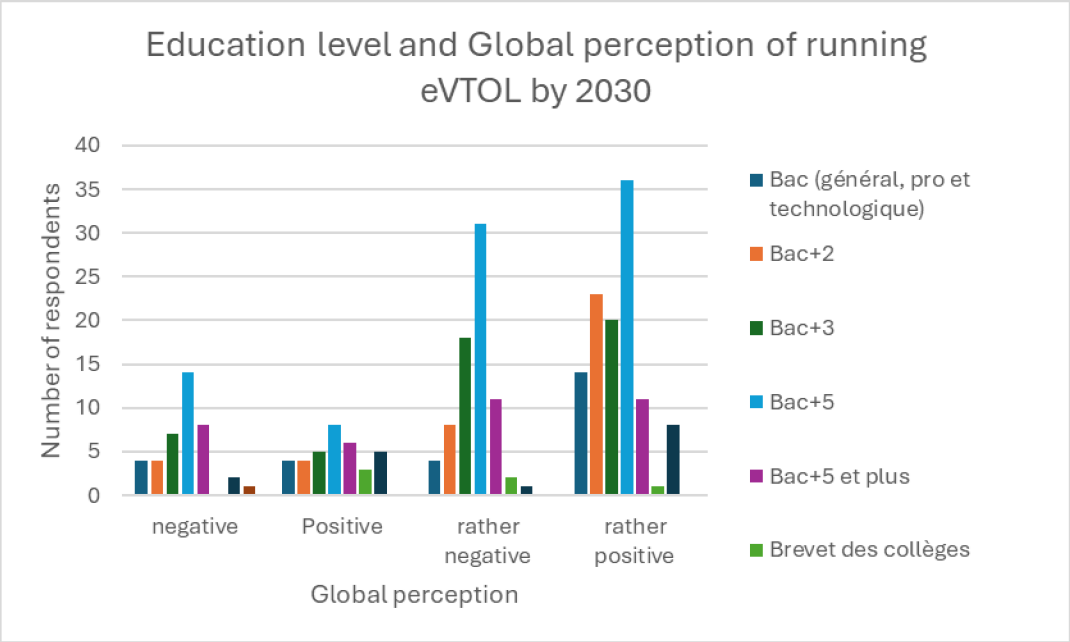
H0: Concerns about eVTOL and assessment of environmental impact of eVTOL by ecological logo are not related.

H1: Concerns about eVTOL and assessment of environmental impact of eVTOL by ecological logo are related.

P-value = 0.538 > 0.05, then we cannot reject H0, so we can assume that Concerns about eVTOL and assessment of environmental impact of eVTOL by ecological logo are not related.

**Hypothesis 19: Global perception of running eVTOL by 2030 and Education level**

Figure 35: bar chart of the Global perception of running eVTOL by 2030 and Education level.




Source: own processing from the questionnaire on Google Forms

Table 19: output from SPSS for the nineteenth hypothesis.

**Chi-Square Tests**

| | Value | df | Asymptotic Significance (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 33,958[a] | 21 | ,037 |
| Likelihood Ratio | 31,296 | 21 | ,069 |
| Linear-by-Linear Association | ,000 | 1 | ,987 |
| N of Valid Cases | 263 | | |

a. 14 cells (43,8%) have expected count less than 5. The minimum expected count is ,13.

Source: own processing

H0: Global perception of running eVTOL by 2030 and Education level are not related.

H1: Global perception of running eVTOL by 2030 and Education level are related.

P-value = 0.037 < 0.05 so we can reject H0 and validate H1, meaning that Global perception of running eVTOL by 2030 and Education level are related.

## 4.5Interviews and analysis

Table 20: on overview of semi-structured interview with Mr. Evgheni OJEVAN, Corporate lawyer, expert on legal and regulatory regime in France and Europe for passenger and freight transport companies occupying public urban airspace.

| N° | Question | Answser |
|---|---|---|
| 1 | How is the legal and regulatory framework designed to remain flexible in the face of rapidly evolving technology and business models in urban air mobility? | The legal and regulatory framework is constantly adapting to the development of eVTOL technology |
| 2 | Who do you think is the most appropriate and legitimate authorities to ensure the safety of urban air mobility? Should a new body be created? | DGAC should be involved in the authorisation and validation of infrastructure, the air corridor, etc. Then the local authorities should manage the continuity of operations |
| 3 | Wouldn't a single set of rules governing the operation and coexistence of different types of transport affect the overall safety of urban air travel? | It is imperative to move away from the specific technology of eVTOLs and create multi-purpose standards and regulations. |
| 4 | The protection of privacy and the collection of personal data is one of the least important concerns of the respondents to my survey (7.8% replied). How can this dimension be taken into account in the legal and regulatory framework for urban air mobility? | I consider the results to be consistent, based on the distinction between two categories of people involved in eVTOL-related data collection: customer-passengers and third parties, i.e. people who could be impacted by the use of eVTOLs without being directly involved. |
| 5 | There is currently a lack of experimentation in urban airspace. Why is this? Is it mainly a regulatory problem? | In my opinion, the lack of experimentation in urban airspace is not primarily due to regulatory problems. Rather, it's a problem linked to the use and usefulness of this technology. The fundamental question is whether we really need this type of transport. |
| 6 | Should the French authorities have the final say on European regulations, or vice versa, concerning the MAU? | No, the French authorities should not have final decision-making power over the European bodies and vice versa. There are few disparities between national and supranational authorities. The European framework draws heavily on the legal and regulatory frameworks of each country, and vice versa. |
| 7 | With regard to my subject, would you have any recommendations for studying the legal and regulatory aspects in greater depth? Any books or videos? | Ask yourself general questions about the subject and the usefulness of this technology today. Do we really need it? |

Source: own processing

To sum up, Mr. Evgheni Ojevan ‘s statement confirmed the literature review about the regulator concerned by this technology. The French Civil Aviation Authority is the highest national authority allowing certification of eVTOL on the French territory. It also allows air traffic

management and infrastructure. Nevertheless, local authorities as the region and department must monitor daily operations.

Moreover, he also validates some results from the survey. As an example, he agrees that protection of privacy and collection of personal data is one of the least important concerns of people. In the questionnaire, the author finds out that only 8% of respondents are concerned about it. Evgheni states that people are already used to give some personal data to current public transport network or taxi service apps, for instance they would not be more concerned with eVTOL than today.

Table 21: on overview of semi-structured interview with Mr. Thierry ALLAIN, Innovation Program Manager Airship and VTOL focal point at French Civil Aviation Authority (Ministry of Ecological Transition)

| N° | Question | Answser |
|---|---|---|
| 1 | In your opinion, should the DGAC be the only French regulator to certify eVTOLs, or should a new body be created? | EASA is the European authority responsible for the technical certification of eVTOLs. It is not the DGAC in France that certifies them. However, the DGAC certifies all French operators and all French airlines for passenger transport. |
| 2 | According to some, the possibility of using urban airspace lies in the design of a single set of rules governing the operation and coexistence of different types of transport. Are you for or against this? | It's complicated at the moment to determine a single set of regulations. When it comes to regulations, the interrelationship between land transport players is not very clear, precise or obvious. We don't know who really has jurisdiction. Today, we're only at the beginning. Up to now, the regulations have made no mention of air traffic in urban areas at local level. This is the first time we've had to supervise and deal with urban air mobility. |
| 3 | According to 77% of respondents to my survey, the environmental impact of flying taxis should be assessed by the authorities and made public, for example by means of an eco-label. Is it your responsibility or that of another agency such as the Environmental Authority to monitor these regulations? | Before creating such an eco-label, it's important to remember that this is initially an experiment, of limited duration, which is not intended to continue. I don't think we're at a stage where we can award an eco-label. If, after the trial, the eVTOL service is to become permanent, it would be worth considering an eco-label. |
| 4 | How and on what criteria does France influence its representation on the EASA? | France represents its interests at the EASA through a number of working groups and discussions in which French representatives are numerous |
| 5 | Do you take on work-study students from business schools at the DGAC? | recruitment rules are specific, and integration is mainly by competitive examination |
| 6 | Do you have any recommendations or advice for my thesis? | to get in touch with the Paris airports operator and the manufacturers to find out their vision and specific approach to the eVTOL market |

Source: own processing

To sum up, Thierry thinks that it is currently complicated to determine a single set of regulations. Because “we're only at the beginning “, the regulations have made no mention of air traffic in urban areas at local level, “this is the first time we've had to supervise and deal

with UAM". Compared to Evgheni OJEVAN, Thierry thinks right now that it is extremely complicated to assume one single regulation would be the solution.

Thierry also gives his opinion on the assessment of environmental impact of flying taxis by an eco-label. He says that "I don't think we're at a stage where we can award an eco-label". Nevertheless, he states that "If, after the trial, the eVTOL service become permanent, it would be worth considering an eco-label".

Thiery gave some recommendations to the author such as getting in touch with ADP Group, key player in the eVTOL ecosystem. As the author had already thought of contacting them, this advice came to reality with an Interview with the Deputy Director of Paris-Le Bourget Airport and General Aviation Airfields at ADP Group.

Table 22: on overview of semi-structured interview with Mr. Olivier DELATTE, Deputy Director of Paris-Le Bourget Airport and General Aviation Airfields at ADP Group

| N° | Question | Answser |
|---|---|---|
| 1 | Can you tell me about the emergence of the eVTOL project within the ADP Group, future changes, necessary adaptations, etc.? | To integrate eVTOL into airport infrastructures, it is crucial to define the costs of batteries, the components of charges and to establish common standards to ensure a smooth transition to this new era of air mobility. |
| 2 | How does the ADP Group perceive the usefulness of eVTOL in urban mobility? | We see the benefits of eVTOL in the infrastructure it requires, since the ADP Group is an infrastructure manager and operator. |
| 3 | What criteria are used to select eVTOL operators wishing to operate from your group's airports? | Experience in the operator's sector<br>- The maturity of the partner's project<br>- The question of timing, in order to be in phase at the same moment to create a partnership<br>- The relationship between risk management and risk culture<br>- Alignment of objectives and challenges to be met |
| 4 | What do you see as the 2 main challenges in adapting existing infrastructure to accommodate eVTOL operations? | The ADP Group must ensure the safety of eVTOL operations by equipping airports with appropriate air traffic management systems and implementing robust safety procedures, while effectively managing energy-related infrastructure, including exploring the challenges associated with using electricity and hydrogen as energy sources for eVTOLs. |
| 5 | What measures does the ADP Group plan to take to promote social acceptance and public engagement with eVTOLs? | Today, very few people have actually seen an eVTOL fly, but many have seen videos, which are sometimes fake. Few people have actually seen an eVTOL fly, but most already have an opinion on the subject. The aim, therefore, is to continue with the experiment and increase the number of flights so that the general public can learn more and more about flying an eVTOL. |
| 6 | A last word ? | Yes, where is the focus? Who is concerned?<br>eVTOL is a disruptive innovation that is constantly evolving and does not concern everyone. The important thing is to know who is affected and what the Group's operational difficulties are. |

Source: own processing

To sum up, we have seen in the literature review and through the questionnaire, that the usefulness of eVTOL is the most important for public acceptance. From the ADP Group point of view, the usefulness of eVTOL is the infrastructure needed to operate, since the ADP Group own and manage airport infrastructure. As Olivier said, "We want to know how eVTOL will impact on our work tools and their management".

According to Olivier, the main challenges for ADP Group regarding eVTOL infrastructure are the security and energy management. Security of operations at airport is the most critical point to monitor. “In aviation, they are two rules: security and security.” About energy management, it is a topic to consider carefully as sobriety is required today and the energy used for one eVTOL is being criticized as very energy intensive. These two challenges are like literature ones because security and energy are key success factors when talking about innovation in aviation sector.

Moreover, to promote social acceptance and public engagement towards eVTOL, he thinks that eVTOL ecosystem has “to continue with the experiment and increase the number of flights”, thus the public can learn more and more about eVTOL and accept it or not.

Table 23: on overview of semi-structured interview with Mr. Julien Lavandier, currently PhD at ENAC: on aircraft trajectory planning and reducing the workload of controllers.

| | | |
|---|---|---|
| 1 | Could trials in urban areas advance the development of eVTOLs? | Simulations are widely used to anticipate the performance and constraints of eVTOL systems, but real experiments are essential to adjust and validate the models. Optimisation involves operations research, where precise knowledge of stakeholder parameters enables effective and realistic modelling. |
| 2 | What are the biggest challenges facing urban air traffic regulators? | The main challenges for urban air traffic regulators include regulation and trajectory safety. The question of whether traffic will be managed by existing controllers or a new player arises, while the safety of trajectories requires the definition of emergency landing zones and the taking into account of meteorological conditions, particularly wind, in the optimisation of trajectories. Since eVTOLs are not drones, I think that a new player will be needed to regulate urban air traffic. |
| 3 | In your opinion, can vertiports be used as emergency landing zones? | Yes, technically this is possible, but it can lead to conflicts on trajectories and therefore on air traffic management. Uncertainty over the take-off time of an eVTOL (one of the causes may be passenger delays) has a direct impact on overall air traffic management. Conflicting trajectories is therefore a major challenge for air traffic controllers, to ensure optimum navigation while maintaining safety. |
| 4 | In your opinion, is the idea of separating airspace a key factor in the integration of eVTOL? | From ENAC Alumni report, they recommend (page 7) that restrictions should be imposed below 1000ft: "In a recent white paper, Embraer suggests that Urban Airspace Service Providers (UASP) should provide UATM in the lower airspace (below 1,000 ft. AGL) where appropriate", which is at least the minimum altitude for conventional aircraft to fly over built-up areas. So the idea would be to separate eVTOLS from conventional aircraft. |

Source: own processing

To sum up some part of the interview, Julien said that the biggest challenges facing urban air traffic regulators are knowing who is competent to regulate and trajectory safety. About regulation, he states that “I think that a new player will be needed to regulate urban air traffic.” Based on ENAC Alumni report on airspace management, Julien thinks that eVTOL must be separated from conventional aircraft. This point of view is confirmed by other experts mentioned in the literature review such as Javier Calvo Torrijos and Isidro José Porras -

aeronautical engineers and consultants from ALG. Segregating the airspace is a key enabler for the integration of eVTOLs vehicles. Indeed, “segregating the airspace by altitude will allow certain ATM and UTM systems to utilize more flexible airspace regulations and communication protocols, especially in non-critical areas”.

# 5. Results and discussion

## 5.1Summary and discussion

After the testing of 19 hypotheses, it turns out that some assumptions were verified, others were denied, and new assumptions can be made from the results. The following table summarizes the results of the hypotheses testing.

Table 24: Summary and results of the hypotheses

| N° | Hypotheses | Results |
|---|---|---|
| 1 | Gender and potential use of eVTOL in the coming decade | Variables related |
| 2 | Age and potential use of eVTOL in the coming decade | Not related |
| 3 | Age and prior knowledge of eVTOL | Variables related |
| 4 | Prior knowledge of eVTOL and gross monthly income | Not related |
| 5 | The frequency of using mobility services technologies and the potential use of an eVTOL in the coming decade | Variables related |
| 6 | Frequency of taking the plane and prior knowledge of eVTOL | Not related |
| 7 | Frequency of taking the plane and the potential use of an eVTOL in the coming decade | Variables related |
| 8 | Age and global perception of running eVTOL before 2030 | Not related |
| 9 | Gross monthly income and the global perception of running eVTOL before 2030 | Not related |
| 10 | Gross monthly income and the potential use of an eVTOL in the coming decade. | Not related |
| 11 | Gross monthly income and the likelihood of using an eVTOL with 25-50% higher prices than road taxi | Not related |
| 12 | Gross monthly income and the likelihood of using an eVTOL with similar prices than road taxi | Not related |
| 13 | Age and assessment of eVTOL environmental impact by ecological label | Not related |
| 14 | Gross monthly income and assessment of eVTOL environmental impact by an ecological label | Variables related |
| 15 | Knowledge of eVTOL and assessment of eVTOL environmental impact by ecological label | Not related |
| 16 | Education level and knowledge of eVTOL | Not related |
| 17 | Education level and potential use of eVTOL in the coming decade | Not related |
| 18 | Concerns about eVTOL and assessment of environmental impact of eVTOL by ecological logo. | Not related |
| 19 | Global perception of running eVTOL by 2030 and Education level | Variables related |

Source: own processing

The author will gradually assess each hypothesis which had not been rejected but also some hypothesis which had been rejected when it's worth it. He will compare his results with the findings of other sources while he will also quickly reflect on other hypotheses.

Starting first with the hypothesis that gender is influencing the likelihood of using an eVTOL in the coming decade. Initially, a bar chart made from data collected by the questionnaire suggests that men are more likely to use eVTOL, though the influence of gender needs testing. For instance, the author has used SPSS software and the Chi-square test confirming a meaningful relationship between gender and potential use of eVTOL in the coming decade (p-value = 0.013 < 0.05). This result is aligning with other studies suggesting that men tend to be more open to innovative technologies and exhibit higher acceptance levels compared to women (Winter et al., 2020). We can conclude that the results from the author analysis are relevant and correlated to other studies regarding people willingness to fly on eVTOL. Additionally, further research exploring the underlying reasons for these gender differences would provide valuable insights for developing targeted interventions and promoting inclusive eVTOL adoption.

The second hypothesis examines the relationship between age and the willingness to use eVTOL in the coming decade, hypothesizing that younger individuals are more likely to adopt this technology compared to older people. The author believes that people aged under 25 would use eVTOL more than people aged 60 and over. However, the statistical analysis using SPSS software assumes that age is not significantly related to the potential use of eVTOL. With a p-value of 0.102, which is greater than the significance level of 0.05, the null hypothesis cannot be rejected, suggesting that age does not influence the willingness to use eVTOL in the coming decade. To confirm author's results, the University Aviation Association's report identifies a weak negative correlation between age and the willingness to try out eVTOL. Despite the hypothesis results, the weak negative correlation identified in external research indicates the need for further investigation into the relationship between age and eVTOL adoption. Additional studies, including qualitative research and surveys targeting different age groups, can provide deeper insights into the factors influencing adoption preferences among various demographics.

Let's discuss about the third hypothesis between age and prior knowledge of eVTOL before completing the survey. The bar chart done from the data collected in the questionnaire, indicates

that a higher percentage of individuals under 25 years old are unaware of eVTOL compared to those over 60 years old. However, it's essential to note that there were more responses from individuals under 25, potentially skewing the results. Despite this, statistical analysis from SPSS software with Chi-square test, confirms a significant relationship between age and eVTOL awareness, suggesting that younger generations are more likely to know eVTOL technology before completing the survey. While younger individuals exhibit higher awareness of eVTOL, there's a weak negative correlation between age and willingness to try out eVTOL. This contradicts the hypothesis that younger generations would show greater acceptance of new aircraft technologies due to their affinity for innovation. Given the observed age disparity in eVTOL awareness, additional research should be conducted to have a better sample of the population.

The fifth hypothesis explores the relationship between the frequency of using mobility services technologies (e.g., car sharing, Uber) and the potential use of eVTOL in the coming decade. It aims to investigate whether individuals who frequently utilize modern transportation services are more inclined to adopt future air mobility solutions like eVTOL. The statistical analysis using SPSS software indicates a significant relationship between the frequency of using mobility services technologies and the potential use of eVTOL in the coming decade. With a p-value of 0.028, which is less than the significance level of 0.05, the null hypothesis is rejected, indicating that frequency of using mobility services technologies is related to the potential use of eVTOL in the coming decade. The analysis from the questionnaire reveals that individuals who use mobility services technologies less than 5 times a year and 1 time a month are more likely to consider using eVTOL in the coming years. This finding suggests that existing usage patterns of modern transportation services may influence the adoption of eVTOL, with frequent users of such services showing greater interest in eVTOL technology.

Trust in technology has been shown to be a central theme in customer acceptance and willingness to use it. Trust plays a crucial role in determining people's readiness to use innovative forms of transport, and this is influenced by factors such as risk perception. To contextualise, French people has a weak relation with risk perception and risk management. This risk perception is linked to French culture, states Olivier DELATTE in the interview with the author. “In France, it’s cultural, French people see the risk as negative and do not want to engage, innovate or try to manage it”, quotes Olivier.

The seventh hypothesis explores the relationship between the frequency of air travel and the potential use of eVTOLs in the coming decade. The hypothesis suggests that individuals who frequently travel by plane may be more willing to adopt eVTOL technology, while those with infrequent air travel experiences may exhibit lower willingness. The bar chart illustrates clear trends that align with the hypothesis. Respondents who take the plane 1-2 times a year or more than 5 times a year show a higher inclination towards using eVTOLs in the coming decade compared to those who do not take the plane at all. This observation supports the idea that familiarity with air travel influences the willingness to adopt eVTOL technology. The statistical analysis using SPSS confirms the hypothesis, with a p-value of 0.027, indicating a significant relationship between the frequency of taking the plane and the potential use of eVTOLs. This statistical validation strengthens the credibility of the observed trends and provides quantitative evidence for the hypothesis.

The fourteenth hypothesis explores the relationship between respondents' gross monthly income and their assessment of the environmental impact of eVTOLs by an ecological label. The hypothesis suggests that individuals with different income levels may perceive the environmental impact of eVTOLs differently based on their socioeconomic status. The bar chart illustrates that regardless of income level, most respondents agree with the idea of using an ecological label to assess the environmental impact of eVTOLs. This figure suggests a general cultural acceptance of eco-friendly initiatives, as France has a strong culture of environmental awareness and acceptance of eco-friendly practices. This context may influence respondents' attitudes towards eVTOL environmental impact assessment, regardless of income level. To confirm or deny, the author has proceeded to a statistical analysis from SPSS software, and the test supports the hypothesis with P-value = 0.021 < 0.05, indicating a significant relationship between gross monthly income and the assessment of eVTOL environmental impact by an ecological label.

The analysis of the nineteenth hypothesis indicates a significant relationship between education level and the global perception of running eVTOL by 2030. This finding suggests that individuals with distinct levels of education hold varying opinions about the introduction of eVTOL technology in IDF. Based on the Chi-square test on SPSS, the author finds a P-value lower than 0.05 so we can reject H0 and validate H1, meaning that Global perception of running eVTOL by 2030 and Education level are related. Moreover, related studies by Biehle (2022),

Garrow et al. (2021), Koumoustidi et al. (2022), Postorino & Sarné (2020), and Winter et al. (2020) highlight the importance of educational attainment and household income level in shaping consumer attitudes towards emerging transportation technologies. These studies suggest that respondents from high-income households are more welcoming towards new aircraft technologies like eVTOLs, potentially due to perceptions of luxury associated with them. However, it is noteworthy that other studies such as the one from the University Aviation Association, did not find significant differences among groupings of education levels regarding acceptance of eVTOL technology. For instance, while education level may play a role in shaping attitudes towards eVTOLs in some contexts, its impact may vary depending on other socioeconomic factors and regional considerations.

## 5.2Recommendations

Based on the findings of this research, several recommendations for future study surfaced. The first recommendation would be to broaden the scope and the methods of test. Replicating the study with a more extensive and more diverse sample in France is crucial. This could be accomplished by sample expansion in IDF region to get feedback from people living in the same area. Replicating the study to multiple countries is also crucial to provide insights into cultural variations in eVTOL acceptance. Repeating the study after the 2024 Olympic Games in Paris is valuable, as an experiment is planned to test eVTOL electric aircraft. Assessing "live" experiences will capture the influence of real-world scenarios and address potential discrepancies between hypothetical and actual perceptions.

The second recommendation suggests improving data collection methods by implementing enhanced user profiling and including more detailed questions focusing on eVTOL-specific aspects. This entails gathering additional information about respondents' demographics, travel patterns, and attitudes towards technology to gain insights into different user segments and their unique considerations. Furthermore, conducting further research on preferred services, aircraft features, and safety concerns associated with specific eVTOL designs could identify critical factors influencing acceptance and resistance.

As for the third recommendation, the author emphasizes the importance of investigating the impact of cost on willingness to fly through an eVTOL. Evaluating price sensitivity is crucial

for developing effective pricing strategies and assessing the affordability of eVTOL services across diverse user segments. Understanding how cost influences consumer decisions will help tailor pricing models to meet the needs and preferences of the public.

# 6. Conclusion

In conclusion, this thesis represents one of the pioneering attempts to gauge societal acceptance of UAM in France, particularly in the context of IDF. The emergence of new transportation modes is a rare occurrence, and their adoption is intricately linked to several factors such as technological maturity and public perceptions of associated risks and benefits. As this study was conducted at an early stage, it was challenging to predict the exact timing of UAM deployment and anticipate potential societal implications accurately.

At the time of the study, French citizens held diverse perceptions of UAM, ranging from viewing it as "science fiction" to an "exciting new concept." However, these attitudes were shaped by theoretical understanding rather than actual experiences, as UAM operations were yet to be implemented. Nevertheless, the overall image of UAM concepts and operations was positive among respondents, reflecting a general openness to solutions that enhance urban life and promote the common good.

While the study revealed a promising outlook for UAM acceptance, it underscored the importance of addressing certain prerequisites. Citizens' acceptance of UAM is contingent upon fulfilling key guarantees and conditions to ensure safety, security, and environmental protection. Additionally, efforts must be made to mitigate potential disturbances caused by UAM operations to ensure equitable outcomes for all residents.

Moving forward, it is imperative for UAM stakeholders, particularly regulatory authorities, to capitalize on this initial positive sentiment and take proactive measures to meet citizens' expectations. This entails conducting further studies, demonstrations, and early implementation projects to bridge the gap between theoretical perceptions and real-world experiences. Additionally, recommendations for future research include expanding the study's scope by diversifying the sample and replicating it in multiple countries to capture cultural variations in UAM acceptance.

Moreover, enhancing data collection methods by incorporating detailed questions on eVTOL-specific factors and implementing user profiling techniques will provide deeper insights into different user segments and their preferences. Furthermore, investigating the influence of cost

on willingness to use eVTOL services is crucial for developing effective pricing strategies and ensuring affordability across diverse socioeconomic groups.

In essence, while the study offers promising insights into societal acceptance of UAM in France, it underscores the need for continued research and proactive measures to address challenges and capitalize on opportunities as UAM evolves in the coming years.

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# 8. Appendix

## Appendix 1: Calculation of traffic congestion in IDF

Calculation according to Matteo Satta, smart city consultant and expert
Cost per day = SMIC per hour*(40min/60) *(n. of vehicles per day in Île-de-France)
Calculation of vehicles per day in Île-de-France = N. trips/1.46. The source of trip numbers is the "Enquête globale transports" (EGT 2010-STIF-OMNIL-DRIEA) conducted between 2009 and 2011. It was managed by STIF in partnership with DRIEA as part of Omnil. A total of 18,000 households (almost 43,000 people) responded to a detailed questionnaire on their travel habits.
Working days net of vacations (216 days/year).
Total number of cars in Ile-de-France, see note 2 for source.
1885 euros net/month in Ile-de-France (Source: http://www.salairemoyen.com/sources.php)

## Appendix 2: List of questions asked in the questionnaire.

Note that questions have been translated from French to English.
1) What is your gender?
- Female
- Male
- Other

2) How old are you?
- less than 25 years old
- 25-40 years old
- 40-60 years old
- over 60 years old

3) What is your professional situation?
- Farmer
- Craftsman
- Shopkeeper
- Company director
- Liberal profession
- Executive or higher intellectual profession
- Intermediate profession
- Clerical worker
- Manual worker
- Retired
- Jobseeker
- Homemaker
- Student
- Other

4) What would you estimate your gross monthly income to be?
- Less than 1500 euros
- Between 1500 and 3000 euros
- Between 3000 and 6000 euros
- More than 6000 euros
- No income

5) What is the highest level of education you have completed or are in the process of completing?
- No diploma
- Brevet des collèges
- CAP/BEP (other technical diplomas)
- Bac (general, vocational and technological)
- Bac+2
- Bac+3
- Bac+5
- Bac+5 or more

6) Have you ever heard of electric vertical take-off and landing aircraft (ADAV or eVTOL for those knowledgeable)?
- Yes
- No
- I am not sure

7) How often do you use new mobility technologies such as car sharing (Blablacar...) and taxi services via a mobile application (Uber, Bolt...)?
- Never used and not interested
- Not yet used but potentially interested
- Less than 5 times a year
- Once a month
- Every week or more

8) In the course of a normal year, how many times do you fly for personal or professional reasons?
- Not at all
- 1-2 times a year
- 3-5 times a year
- More than 5 times a year

9) When you fly, how do you get to the airport from home and vice versa? Please select all the options that correspond to your habits.
- On foot or by bike
- Private car
- Taxi

- Car pool
- Public or private transport

10) What would be your overall perception if flying taxis were introduced in IDF by 2030?
- Negative
- Rather negative
- Rather positive
- Positive

11) Which of the following uses of flying taxis would you find most useful? Please select 3 answers.
- Medical and emergency transport (injured people, doctors, vital organs, etc.)
- Transport of people and/or goods in times of crisis or natural disaster
- Transport to/from the airport
- Transport between the suburbs and the city centre
- Transport between two locations within a city
- Sightseeing in a city

12) If transport time is at least twice as fast in the air, how likely would you be to use a flying taxi at a price 25-50% higher than a conventional road taxi?
- Negative
- Rather negative
- Rather positive
- Positive

13) Now let's assume that the price is similar between a conventional road taxi and a flying taxi, and that the journey time is at least twice as fast in the air, how likely would you be to use a flying taxi rather than a conventional road taxi?
- Negative
- Rather negative
- Rather positive
- Positive

14) In your opinion, what are the advantages of flying taxis? Please select 3 answers.
- Considerable time saving
- Reduces traffic jams and congestion on the roads
- Ability to connect and access more remote locations
- Job creation in the flying taxi industry
- Silent (less road noise)
- Competitive and advantageous transport time/price ratio
- Environmentally friendly

15) What would concern you most about flying taxis? Please select 3 answers.
- High and regular noise levels
- Passenger safety
- Safety of people on the ground

- Visual pollution in the sky
- Unequal accessibility (service too expensive and reserved for the most privileged)
- Air pollution
- Degradation of biodiversity
- Decline in the job market, particularly for taxi drivers
- The risk of threats from criminal organisations or hackers
- Protection of privacy and personal data

16) Should the environmental impact of flying taxis be assessed by the authorities and made public, for example by means of an eco-label such as the one below?
- Yes
- I do not know
- No

17) Assuming that a take-off and landing station is close to you (less than 50 metres away), what would you be most concerned about? Select a maximum of 3 choices.
- The noise of take-off and landing
- The increased flow of people walking around the station
- Increased road traffic to and from the station
- Visual pollution: too many flying taxis in my field of vision
- Security problems and threats
- Violation of my privacy

Flying taxis will operate either with a pilot on board or remotely. Assuming that both options are certified by the competent authorities, please indicate your interest in each statement.
18) I would be interested in using a flying taxi WITH a pilot on board
- Yes
- I do not know
- No

19) I would be interested in using a flying taxi WITHOUT a pilot on board
- Yes
- I do not know
- No

20) As a pedestrian (not a passenger), I accept the fact that the flying taxi WITH pilot on board can fly over my head (30-storey building).
- Yes
- I do not know
- No

21) As a pedestrian (not a passenger), I accept that a flying taxi WITHOUT a pilot on board can fly over my head (30-storey building).
- Yes
- I do not know
- No

22) Last but not least, would you consider using an air taxi within the next decade?
- Yes
- I do not know
- No