



Sustainable Aviation

Discovering the achievability of electrification in the
aviation industry



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“Electrifying Horizons: Unveiling the Price Tag of Sustainable Options across European Flights – An exploration of the Willingness to Pay for Electric Short-Haul Flights”

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ABSTRACT

This research investigates the willingness of customers to pay for electric flights. Although commercial electric flights are still in their early stages, they show promising solutions to reduce the emissions resulting from aviation, which is still a significant part of total emissions nowadays. A survey is used as an analysis to discover which factors significantly impact the willingness of customers to pay for electric aviation within Europe. The analysis is split into four different hypotheses to narrow down the analysis and discover some specific factors. The analysis results indicate that environmental awareness and education are significant factors that influence the willingness to pay. The relationship, however, between these factors is negative, which implies that people who are more educated and environmentally conscious are less inclined to pay less for sustainable-friendly flights. An explanation for this might be that they value non-monetary contributions more or have a scepticism about monetary contributions. Besides that, government policies also play an important role in shaping customers' willingness to pay; however, this relationship is less significant. Therefore, there is a need for government policies to be in line with customers' expectations and behaviours, which must be considered when developing new policies.

Keywords: *Sustainable aviation, Electrification, Willingness to pay, Environmental awareness*

PREFACE

This thesis marks the end of my educational journey at Erasmus University Rotterdam. Over the past six months, I have explored sustainability practices within the aviation industry, driven by a desire to better understand the customers' views and opinions on sustainability in the industry.

I would like to extend my deepest gratitude to my supervisor, Floris de Haan, for his support and guidance over the past few months. I am also thankful for my second assessor, Dr. Giuliano Mingardo, for his valuable feedback and the time he took to read and assess this paper. I also want to thank my family and friends, who have supported me through my four years of studies.

I hope that this thesis will contribute to a better understanding of the sustainability challenges in the aviation industry and serve as a source of inspiration for future research in this area.

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LIST OF ABBREVIATIONS

Abbreviation	Definition
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
ETS	Emissions Trading System
EU	European Union
FAA	Federal Aviation Administration
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IEA	International Energy Agency
SAF	Sustainable Aviation Fuel
WTP	Willingness to Pay

1. INTRODUCTION

1.1 RESEARCH TOPIC

Aviation provides the only rapid global transportation network, making it critical for both international travel and business. In 2019, airlines carried more than 4.5 billion passengers, and their revenue passenger kilometres – the total distance flown by all passengers – amounted to around 8.7 trillion. By facilitating the globalization of production and expanding access to other markets, it aids nations in their contributions to the world economy. In 2019, around 61 million metric tonnes of cargo were transported via air (Gill, 2020), and therefore, global trade is facilitated by air travel.

Aviation plays a crucial role in shaping the global economy and societal environment. It facilitates trade, tourism, and connectivity, fosters economic growth, creates jobs, raises living standards and provides a lifeline for remote communities. With 11.3 million direct jobs and a global employment support of 87.7 million, aviation is a significant employer. Global GDP is enabled by aviation at \$3.5 trillion (Dodd, n.d.).

Aviation accounted for 2.5% of the world's energy-related CO₂ emissions in 2022, with its growth in the last few decades outpacing that of rail, road, or shipping. Following the Covid-19 pandemic, demand for international travel has recovered, and as a result, aircraft emissions in 2022 reached 80% of the level prior to the pandemic (International Energy Agency, 2024). The number of passengers making use of commercial aircraft (international and domestic) increased by about 70% in 2022, reaching 75% of pre-pandemic levels in 2022. This trend can be observed in figure 1-1, which shows the global total commercial air passenger traffic between 2019 and 2022. After a year of slower recovery of international aviation, compared to domestic aviation, the primary driver was an increase in activity in international aviation, with a gain of more than 150% (International Energy Agency, 2024).

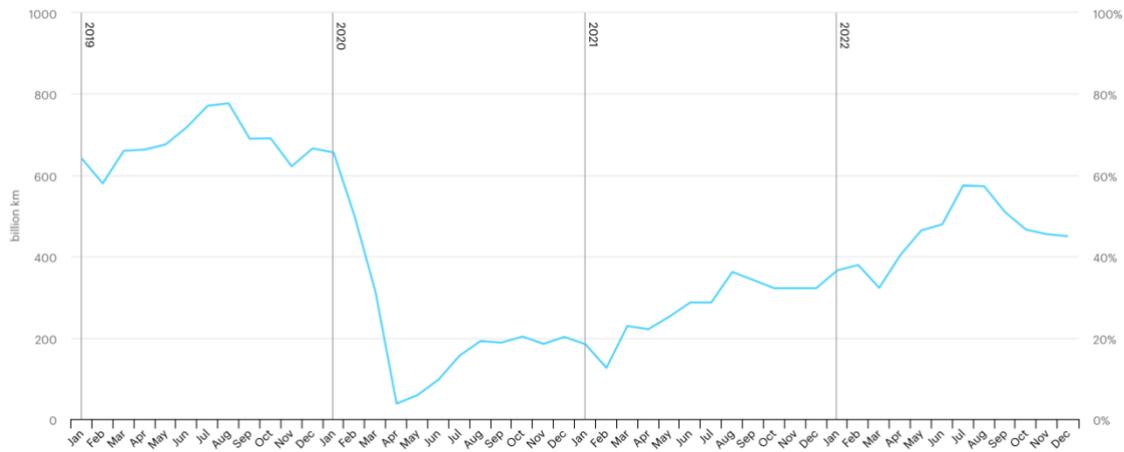


Figure 1-1: Global total commercial air passenger traffic between 2019 and 2022 (International Energy Agency, 2024).

When compared to other transport options like road or rail, aviation is a more efficient method of long-distance transportation in many locations. Although flights longer than 1500 kilometres account for over 80% of aviation emissions, for certain routes there is no alternative to travel other than by air. Reducing emissions while maintaining the advantages of an expanding air transportation industry therefore remains a challenge (Gill, 2020).

More than 17% of airline emissions come from short-haul flights of less than 1000 kilometres. As a result, new technologies, such as electric flights and flights operated on sustainable aviation fuels, are being explored. According to estimates, electrification may be used to power all flights under 4000 kilometres, which account for over half of all CO₂ emissions from aviation (Ellerbeck, 2022).

1.2 RESEARCH OBJECTIVES

The concept of electric flights is a very recent but relevant topic for research. In the last few years, sustainability in the aviation industry has been an important topic for researchers. Most studies focus on the implementation of electric flights as well as their benefits and challenges. Current research, however, lacks customers' views and opinions about this topic.

The aim of this study is, therefore, to better understand the factors that drive customers' willingness to pay for the development of electric flights. To guide this research, the following research question was developed:

*“How does the evolving environmental awareness and the increasing prevalence of **short-haul electric flights** influence and shape customers' **willingness to pay** for air travel within the **European market?**”*

The answer to this research question is attempted to be obtained through quantitative research, supported by a questionnaire. The following sub-questions serve as guidance to obtain a valid answer to the research question.

- What potential barriers or concerns do customers have regarding the adoption of electric flights, and how do these impact their willingness to pay?
- What are the main reasons for passengers to choose electric flights?
- What role do government policies and incentives play in shaping customers' willingness to pay and their attitude towards electric flights?

1.3 RELEVANCE

Concerns about the environment have focused on aviation, which accounts for 4% of annual climate change impacts and 2% of global carbon dioxide emissions (Verde, 2024). Several previous studies have shown the potential that electric flights can have on the environment. However, previous studies lack knowledge about how customers are facing these new technologies. Therefore, this research aims to expand the knowledge that is readily available about the adoption of electric flights by including the customers' side of the story. The study focuses on the willingness to pay for environmentally friendly flights, more specifically electric flights. This is a pressing topic in the industry since there is an urgent need and importance to lower the emissions. As the aviation industry seeks more environmentally friendly options, this research provides insightful information about the opportunities and trade-offs of flying electric aircraft.

On the other hand, this topic is relevant to providing insights and recommendations to companies in the aviation industry. Airlines, for example, can get insights into how to implement these new technologies into their pricing strategies.

1.4 THESIS OUTLINE

This research is organized as follows; first, in section two, a literature review is presented, focusing on sustainability in aviation, the challenges and opportunities of electric aircraft, the environmental awareness in air travel, and the willingness to pay for sustainable friendly modes of transportation. This section is concluded by defining the scope for further research. Next, in section three, the conceptual framework is presented, focusing on four hypotheses that will be used for the research itself. In section four, the methodology is presented, including the descriptive statistics of the survey. In section five, the results of the survey are presented, divided into the four hypotheses. Section six encompasses the discussion of the results, including limitations and recommendations for future research. Finally, in section seven, a conclusion of this research is provided.

2. LITERATURE REVIEW

The aviation industry is crucial for global connectivity and economic development. However, it faces significant pressure to reduce its environmental impact. This literature review examines efforts to mitigate carbon emissions, the potential of electric aviation, and the role of public perception in promoting sustainability.

Despite some progress, reducing absolute emissions remains challenging, particularly considering rising passenger numbers. The Covid-19 pandemic temporarily lowered emissions, highlighting the potential of sustainable aviation fuels, though long-term solutions are needed as travel rebounds. Electrification offers a promising path to reducing emissions and noise, but technical and infrastructural challenges remain. Initiatives like Norway's plan to electrify short-haul flights by 2040 exemplify the sector's potential and hurdles (Tom et al., 2021). Public awareness and willingness to pay for sustainable aviation are crucial. Movements like flight shame and consumer attitudes towards higher costs for green options play a key role in driving change.

2.1 SUSTAINABILITY IN AVIATION

Chiambaretto et al. (2021) highlight the significance of assessing the evolution of the aviation industry alongside its environmental impact, particularly concerning carbon emissions. The International Energy Agency (IEA) and the World Bank have provided data indicating a significant rise in air travel between 2000 and 2018, with a 153% increase in aircraft passengers and a 28.5% increase in aviation-related carbon emissions. Despite efforts by various airlines to reduce their carbon emissions per passenger, few have managed to decrease their absolute carbon emissions. For example, from 2005 to 2018, the Air France-KLM group achieved a nearly 20% increase in passenger volume while reducing their absolute carbon emissions by 7% (Chiambaretto et al., 2021).

The global expansion of the aviation sector is particularly notable in countries with vast geographical areas and inadequate transport infrastructure, such as the USA, Russia, and China. In these regions, air travel is the most practical means of transportation due to the high costs

associated with building extensive road or rail networks. Large-scale passenger and cargo movements are more efficiently managed by railroads, which offer dedicated routes costing millions of dollars per kilometre. Roads, while more flexible, are limited by the capacity of individual vehicles. In contrast, regions like the Middle East face unique challenges in developing resilient infrastructure due to environmental conditions such as shifting sands, making aviation a thriving industry (Yusaf et al., 2022).

2.1.1 THE EFFECTS OF AVIATION ON THE ENVIRONMENT

The aviation industry is poised for significant growth, with the International Air Transport Association (IATA) projecting 8.2 billion air travellers over the next twenty years (Rice et al., 2020). The Federal Aviation Administration (FAA) oversees more than 16 million flights annually, highlighting the extensive reach and usage of air travel. To accommodate the increasing number of passengers, the industry needs to expand its fleet and potentially build larger airports. This expansion poses a considerable environmental challenge, as increased production and operation of aircraft could lead to a sharp rise in pollution. Currently, the aviation sector accounts for 2-3% of global carbon emissions, a figure that could escalate significantly. By 2050, aircraft alone are expected to contribute over 43 gigatons of emissions, and the fuel consumption necessary to meet this demand is projected to triple. A single 9–10-hour flight on an average commercial aircraft like the Boeing 747 uses approximately 36 000 gallons of gasoline, producing around 24 kilograms of CO₂ per mile (Rice et al., 2020).

Elhmoud and Kutty (2021) emphasize that, despite these challenges, the aviation sector has made strides in reducing its carbon footprint, achieving a 50% reduction compared to the late 1990s. This progress is largely attributed to advancements in technology, including zero-emission engine designs and sustainable fuel alternatives. These innovations are critical for mitigating the sector's impact on climate change and aligning with Sustainable Development Goal 13, which focuses on climate action. However, balancing the economic benefits of air travel with its environmental impact remains a significant challenge. Addressing sustainability in aviation requires careful consideration of both CO₂ and non-CO₂ related impacts. Walker et al. (2020) also highlight climate change as one of the most pressing issues of the current time, necessitating lifestyle changes and industry-wide regulatory reforms to mitigate its effects. Given the essential role of aviation in global transportation and commerce, it is imperative that the

industry grow in a socially and environmentally sustainable manner. Despite the temporary reduction in aviation emissions due to the Covid-19 pandemic, emissions are expected to rebound. By 2025, CO₂ emissions are predicted to exceed their pre-pandemic levels, reflecting a resumption of demand for air travel (International Energy Agency, 2024).

Valean and Ky (2022) delve into the broader environmental impact of aviation, examining noise pollution, air quality, and climate change. They argue that these factors are critical for policymakers to consider when making decisions about the industry's future. Noise pollution from aircraft affects millions of people in Europe, particularly those living near airports, leading to health issues such as heart disease, sleep disturbances, and learning disabilities for children. While aircraft noise impacts fewer people than road or rail noise, it is considered more disturbing. In terms of air quality, aviation contributes to the emission of pollutants such as particulate matter (PM), nitrogen oxides (NO_x), and ground-level ozone (O₃), which are particularly harmful in urban areas. Although aviation's contribution to global CO₂ emissions is about 2.5% annually, these emissions have grown significantly in recent years, with nearly half of the total emissions since 1940 occurring after 2000. This trend can be observed in figure 2-1 below.

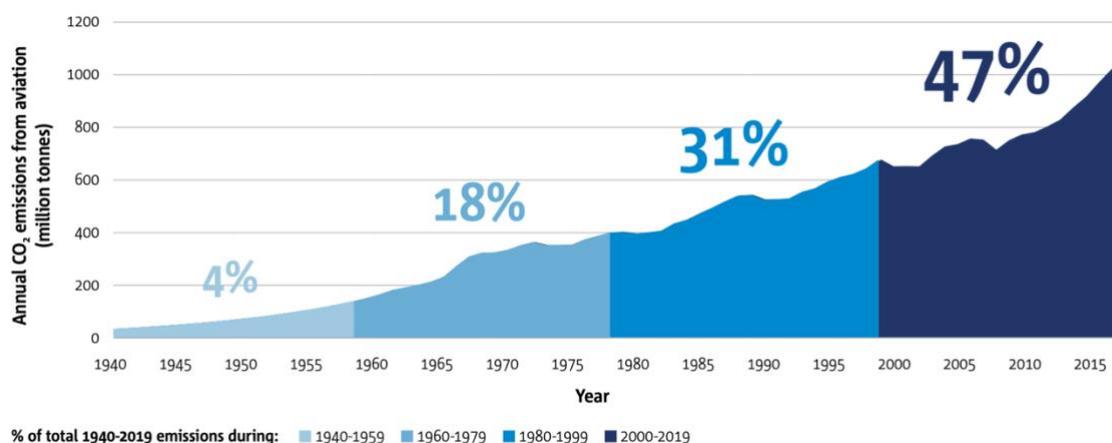


Figure 2-1: Annual global CO₂ emissions from aviation (1940 – 2020) with % of total cumulative emissions broken down into 20-year periods (Valean and Ky, 2022).

Domone (2018) expands on the adverse effects of aviation emissions, noting that pollutants such as ozone (O₃), fine particulate matter (PM_{2.5}), and nitrogen oxides (NO_x) from increased aircraft operations worsen local air quality around airports. These emissions pose serious public health risks, necessitating stringent measures to mitigate their impact. Additionally, noise pollution remains a concern for residents near airports, despite advancements in aircraft design aimed at reducing noise levels.

Hizarci and Arifoglu (2023) proposed sustainable aviation fuels (SAFs) as a promising solution for reducing aviation's environmental impact. SAFs, derived from biological or waste materials, can potentially reduce emissions by up to 80% compared to conventional kerosene. They can be blended with regular jet fuel without necessitating modifications to aircraft fuelling systems. However, the production of SAFs presents challenges, such as the potential impact on food supply due to the use of oilseeds and corn grains. Despite these challenges, SAFs are beneficial for lowering emissions that harm human health and the environment. The current higher cost of SAFs, driven by limited production scale, is expected to decrease with more investment. Thus, while SAFs hold promise for reducing CO₂ emissions, their full potential requires careful consideration and thorough evaluation from production to application in the aviation industry. Yusaf et al. (2022) address the broader issue of air pollution from aviation. Although aviation accounts for only 2-3% of global carbon emissions compared to 11% from road transportation, it draws significant attention due to the broader impact of jet engine contrails. The rising number of aircraft operations in both commercial and defence sectors has led to increased pollution levels, which have been studied in various settings, including urban and regional areas, airports, and through different technological lenses. Research has focused on the emissions of carbon and nitrogen oxides from aircraft engines, highlighting the direct correlation between increased passenger transport and operational waste. The aviation industry contributes to global pollution not only through emissions but also by using disposable items like meal trays, cups, and cutlery, which, while reducing aircraft weight, contribute to overall pollution.

2.1.2 THE EFFECTS OF COVID-19 ON AVIATION EMISSIONS

The Covid-19 pandemic had a profound impact on global aviation, leading to unprecedented reductions in flights and passenger load factors through 2020. Grewe et al. (2021) highlighted that in April 2020, the number of available seat kilometres (ASK) dropped by 94% compared to the previous year. The ICAO projected that, despite some recovery, the annual decline in available seat kilometres for 2020 would range between 45% and 63%, assuming some level of industry expansion during the year. Zeydan and Zeydan (2023) elaborated on the broader context of how health crises impact travel and tourism. For instance, the SARS outbreak in 2003 caused a significant drop in passenger volumes by 57% to 77% at affected airports, and the Swine Flu pandemic in 2009 led to a 4-8% reduction in aircraft passengers between March and May.

Similarly, the recent Covid-19 pandemic resulted in an 85.3% year-over-year decrease in revenue passenger kilometres (RPK) on international routes from January to December 2020. This decline was primarily due to various pandemic control measures such as travel restrictions, lockdowns, border closures, and quarantine requirements. While these measures were necessary for public health, they severely disrupted tourism, which accounts for 5% of global carbon emissions, with air travel contributing to 40%. Before the pandemic, aviation emissions were on an upward trajectory, with forecasts predicting that emissions would double by 2050 (Zeydan and Zeydan, 2023). The pandemic-induced lockdowns led to a substantial decrease in transportation-related emissions. During the first lockdown in 2020, mobility was reduced by 90%, resulting in a 30% decrease in environmental pollution. Specifically, the early restrictions in April 2020 led to a 75% reduction in aviation activity and a corresponding 60% decrease in CO₂ emissions.

In 2022, aviation-related CO₂ emissions will have risen to 80% of their pre-pandemic levels (International Energy Agency, 2024). This trend can be observed in figure 2-2, which shows the CO₂ emissions of international aviation over the years. Due to the Covid-19 pandemic, there is a sudden drop in emissions as of 2020. However, the graph is starting to rise again, and is likely to reach or even surpass pre-pandemic levels.

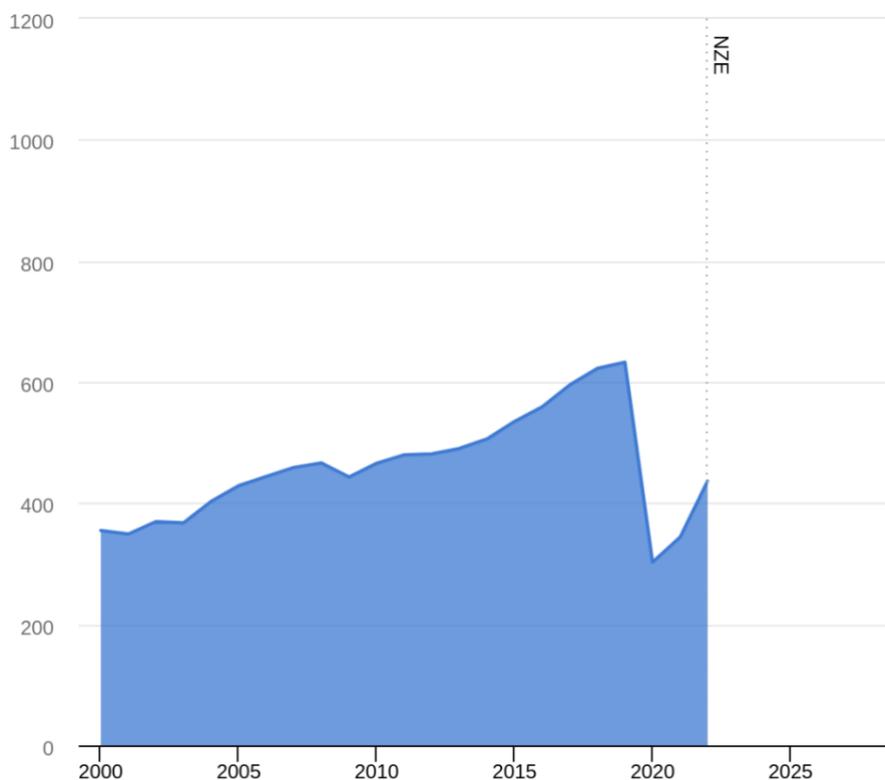


Figure 2-2: CO₂ emissions in international aviation between 2000 and 2022 (International Energy Agency, 2024).

Gill (2020) argues that, besides having an impact on the number of flights and emissions, the Covid-19 pandemic also has a great impact on the labour market and economic activity. Therefore, governments must make sure that air transport receives the proper levels of support and assistance so that, once the pandemic is under control, aviation's benefits can quickly return and reach the level of jobs and economic activity that aviation provided. Due to the impact on aviation-related jobs, there may be a temporary loss of up to 46 million jobs (52% decline). After the government wage support schemes conclude, 4.8 million jobs (43%) may be lost within the industry (at airports, airlines, air traffic control, and the manufacturers of aircraft, engines, and components). The actual number of jobs lost could be severe, depending on the company. To retain employees during difficult periods, companies can and frequently do take short-term losses, cut wages, and reduce dividend payments. This would reduce the number of jobs lost relative to those that are at risk due to muted business activity (Gill, 2020).

On the other hand, the impact on economic activity supported by air transport is likely to be high – a 51.5% reduction compared with the pre-covid era, or a \$1.8 trillion decline in supported GDP (Gill, 2020). This is due to both a delayed recovery that affects the tourism industry's catalytic effects and a decline in investment by airports, airlines, and other industry participants. The construction of new runways or terminals will be put on hold, mainly because of prudent financial management and partially because fewer people will be using the planned extensions soon. However, the side effects will also be seen when personnel in the aviation industry who have accepted salary cutbacks cut back on spending until the economy stabilizes.

2.2 ELECTRIFICATION IN AVIATION

An electric airplane is an aircraft powered by electric motors mostly supplied by batteries (Han et al., 2019). Because of its comparatively large capacity, an electric airplane with a fully charged battery can travel approximately 500 kilometres, providing the bare minimum of services to roughly 120 passengers, and it can therefore be used on short-haul routes. Electric aircraft can be especially useful in the airline markets of North America and Europe, where their local route and international route services are prevalent, given their geographical and environmental qualities. The tourism sector and the transportation sector are gradually becoming dependent on the airline industry's electric transformation. Han et al. (2019) argue that, making the switch to electricity will be crucial for the aviation sector to succeed considering the high cost of

gasoline. Another issue that could gradually limit fossil fuel usage is the pollution that high carbon emissions cause to the environment. Because electric aircraft are less polluting and have lower air fares, the rise of electric aircraft may therefore create a shift in consumer preferences.

Electric aviation has the potential to significantly reduce the environmental impact of air travel. Domone (2018) noted that aviation accounts for approximately 3% of the EU's total greenhouse gas emissions and over 2% globally. With the current pace of technological advancements, CO₂ emissions from airplanes are projected to increase substantially, driven by rising demand for air travel in emerging markets like China, India, Africa, and South America. The shift to electric aircraft could mitigate this trend by enabling the use of renewable energy sources for recharging batteries, although care must be taken to avoid merely relocating emissions if non-sustainable power sources are used (Domone, 2018).

Schwab et al. (2021) estimated that commercial aviation currently emits 186 million metric tons of CO₂ annually, a figure expected to rise to 209 million metric tons by 2050. Sustainable aviation fuels, derived from biomass sources, are one alternative being explored to decarbonize the sector. Another option would be aircraft electrification. Han et al. (2019) argue that the technologies supporting an electric aircraft, such as battery and engine technology, are advancing rapidly. Additionally, it is anticipated to significantly reduce the airline industry's negative environmental effects. The airline industry's contribution to air pollution can be reduced by substituting conventional flights with zero-emission electric aircraft. With the application of electric aircraft, cabin noise can be decreased by about 50%. Additionally, using electric aircraft can save up to 90% of the fuel used on traditional flights. In its electric transition, the aircraft industry is tracking the automotive sector closely and rapidly.

The electrification of aviation systems has seen significant advancements in recent years, driven by the need for more energy-efficient and environmentally friendly aircraft. According to Tom et al. (2021), this revolution in aviation technology promises modern architectural designs and reduced emissions, making electric airplanes an attractive proposition for the future of air travel. The journey towards electrifying aviation began in the 1960s, with a steady shift from mechanical to more electric auxiliary systems, which are lighter and more efficient (Bauen, 2020). Since the 1970s, electric propulsion systems have been developed primarily for leisure and demonstration purposes. However, these systems hold potential benefits such as noise reduction and decreased fuel consumption, although technical challenges, particularly in battery energy and power density, remain significant hurdles.

A distinction can be made between different types of electric aircraft. On the one hand, hybrid electric aircraft combine an electric motor and a turbofan in either series or parallel configurations, utilizing an electric battery to provide power. This setup allows for reduced overall energy consumption and emissions during the flight. The electric motor can operate alongside the turbofan during high-thrust phases and independently during low-thrust phases like cruising, thereby improving fuel efficiency and enabling smaller turbo engines (Tom et al., 2021). On the other hand, full-electric aircraft rely solely on battery power for propulsion, offering significant advantages such as high energy efficiency, noise reduction, and zero onboard emissions. Norway's commitment to making all short-haul flights electric by 2040 exemplifies the growing interest in this technology (Tom et al., 2021). However, the limited energy density of current batteries poses a major constraint, necessitating advancements in battery technology, motor and airframe design, power electronics, and thermal management systems. Additional challenges include ensuring battery safety, efficient charging infrastructure, and integrating power systems.

2.2.1 OPPORTUNITIES

Electric aviation offers several promising opportunities. Schwab et al. (2021) highlighted potential cost reductions, with Ampaire¹ estimating a 90% reduction in fuel costs and a 50% reduction in maintenance costs for their 15-passenger electric aircraft. This could make currently unprofitable routes viable again. The regional travel market, with distances under 500 kilometres, is particularly well-suited for electric hybrid aircraft due to the economic viability and battery capacity constraints. Additionally, electric aircraft can significantly reduce emissions, with short-haul flights offering the greatest potential for improvement. Numerous significant airlines have also started to encourage the advancement of electric aircraft technology. For example, EasyJet, a British airline, started a collaboration with Wright Electric, a US based company, to introduce an electric aircraft to the industry.

Noise reduction is another key benefit, with studies suggesting that electric propulsion could lower aircraft noise by up to 85% and improve fuel efficiency by 40% (Schwab et al., 2021). Increased accessibility to remote areas, reduced traffic at major airports, and potential

¹ Ampaire is a US based company focusing on the production of hybrid-electric airplanes (<https://www.ampaire.com/>).

economic development through new market openings and enhanced pilot training operations are further advantages of electric aviation.

2.2.2 CHALLENGES

Despite the opportunities discussed above, significant challenges remain with the introduction of electric aircraft. The introduction of electric planes is not as easy and straightforward as electric road vehicles. Hizarci and Arifoglu (2023) discussed the complexities introduced by the electrification of aircraft, particularly in power storage and infrastructure requirements. The need for high power supply, reliable and safe energy storage, and the integration of numerous systems and components are major obstacles. The specific energy density of batteries is currently insufficient to match that of traditional aviation fuel, leading to concerns about the viability of commercial fully electric aircraft in the future. Additionally, lengthy battery charging times and the necessity for charging stations at airports pose logistical challenges. Electrifying traditional aircraft components increases efficiency and reduces weight, and also adds complexity to the powertrain system (Hizarci and Arifoglu, 2023).

Han et al. (2019) argue that customers cannot easily select electric aircraft due to issues with battery explosion risk, lengthy charging times, low temperature performance, and battery life. To put it another way, even if it is anticipated that more passengers will opt to fly in electric aircraft due to the lower costs and lower carbon emissions, further research should be done to address to the remaining issues and promote their use.

In summary, the electrification of aviation presents both significant opportunities and formidable challenges. While hybrid and fully electric aircraft offer potential benefits in terms of cost, noise, and emissions reductions, the technological and logistical hurdles must be addressed to realize their full potential. Continued advancements in battery technology, power system integration, and infrastructure development are crucial for the future of sustainable electric aviation.

2.2.3 CARBON OFFSETTING INITIATIVES

In accordance with the Net Zero Emissions Scenario, the aviation sector requires a multifaceted approach to reduce its growing emissions to below 1000 million metric tonnes of CO₂ by 2030. This involves advancing technology, managing demand, and promoting SAF. The development of alternatives to jet kerosene, such as electricity- or hydrogen-powered aircraft, alongside investments in pre-commercial and low-emission SAFs, should be prioritized for policy and fiscal support (International Energy Agency, 2024).

Climate change and global warming are significant sustainability challenges for the energy-intensive aviation industry. Governments, regulators, commercial airlines, and industry organizations are actively engaged in efforts to reduce fuel use and develop low-carbon fuels. Efforts to reduce the aviation industry's carbon footprint have been collaborative, involving multiple stakeholders. Organizations such as the International Civil Aviation Organization (ICAO) and the European Union (EU) have introduced significant legislative measures. The ICAO has introduced CORSIA – an initiative aimed at offsetting and reducing CO₂ emissions from international aviation (Walker et al., 2020). The ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), implemented in 2016, and the EU's integration of air transport activities into its Emissions Trading System (ETS) in 2012 have both exerted financial pressure on airlines to cut their carbon emissions. These measures require airlines to maintain carbon-neutral growth, forcing them to purchase carbon credits from other airlines if they exceed their emissions limits. However, it is important to note that these initiatives primarily aim at maintaining carbon neutrality rather than directly reducing absolute carbon emissions.

In 2017, air travel accounted for approximately 859 million metric tons (MMT) of CO₂ emissions, or around 2% of global human-induced CO₂ emissions. The IATA projected a near-doubling of aviation activity by 2035, reaching 7.2 billion passenger journeys, indicating significant long-term growth in aviation activity despite the Covid-19 pandemic (Prussi et al., 2021). The ICAO has implemented policies to mitigate aviation's environmental impact, such as the global CO₂ norm effective in 2020, which mandates a 2% annual improvement in fuel efficiency. CORSIA, adopted in 2016, requires airlines to offset CO₂ emissions above 2019 levels, allowing for carbon-neutral growth in 2020. The scheme encourages the use of SAFs, which must meet specific sustainability criteria and are assessed using a life-cycle assessment method approved by the ICAO (Prussi et al., 2021).

The European Commission’s Sustainability and Smart Mobility Strategy, launched in 2020, aims to increase the use of SAFs in aviation to enhance sustainability without compromising competitiveness. The ReFuel EU Aviation proposal supports the EU aviation market by mandating a growing share of SAFs, with targets of 5% of SAF by 2030 and 63% by 2050 (Bauen et al., 2022). This will require approximately 2.3 million metric tonnes of SAF by 2030 and 28.6 million metric tonnes by 2050. The strategy also includes a sub-mandate for synthetic aviation fuels, rising from 0.7% in 2030 to 28% in 2050 (Bauen et al., 2022).

Figure 2-3 exhibits a roadmap established by Sustainable Aviation (2024). This outlines the plan to reach net zero carbon emissions by 2050, boosting aviation by 78% while cutting the carbon dioxide output from around 39 million metric tonnes to zero. This can be accomplished by increasing the efficiency of aircraft and engines, using sustainable aviation fuels, optimizing operations and airspace, using reliable carbon offsets, and investing in cutting-edge carbon removal technologies to handle residue.

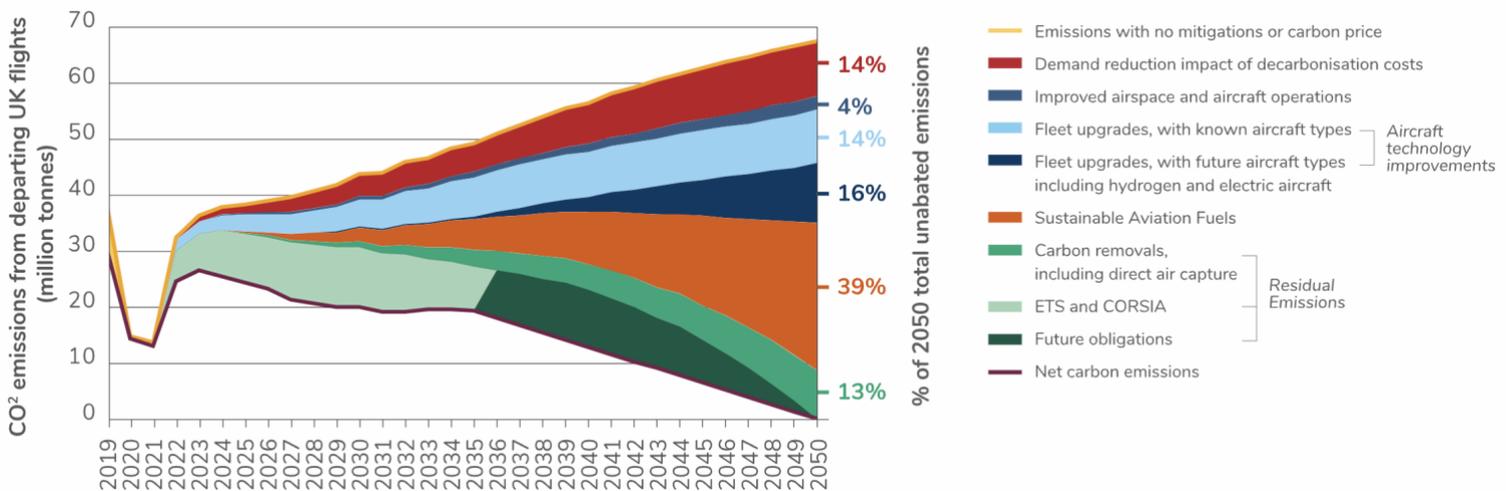


Figure 2-3: Sustainable Aviation Carbon Road-Map: A Path to Net Zero (Sustainable Aviation, 2024).

2.3 ENVIRONMENTAL AWARENESS ON AIR TRAVEL

Aviation's rapid growth increasingly conflicts with societal goals to limit climate change and mitigate issues such as air pollution, noise, and the expansion of infrastructure. Gössling et al. (2019) argue that while the aviation industry often highlights its contributions to GDP growth and job creation, this growth trajectory undermines several United Nations Sustainable Development Goals and the Paris Agreement's climate targets. The ICAO projects that emissions from aviation could increase by a factor of 3 to 4 between 2010 and 2040 if current trends continue. Given these projections, it is unrealistic to rely solely on market-based solutions, technological advancements, or the aviation industry's strategies to resolve the escalating environmental impact.

Individuals travel for various reasons, including business, leisure, and visiting friends and family, with air travel accounting for 57% of all international arrivals (Gössling et al., 2019). To justify extensive use of air travel, aviation organizations generate two main discourses. First, flying has become a societal norm, affecting a significant portion of the global population. This narrative is bolstered by the large number of passengers worldwide, although it often obscures the fact that frequent flyers predominantly belong to the wealthiest social groups in developed nations. The second discourse posits that all air travel is legitimate, socially acceptable, and ethically justified due to the personal and economic benefits it generates.

Frequent flying has sparked public concern over its environmental impacts, leading to the emergence of "flygskam", or flight shame, particularly in Europe. Chiambaretto et al. (2021) note that this movement began in Scandinavian countries and has since spread, driven by social media and widespread media coverage. Advocates argue that reducing air travel can significantly lower carbon emissions and combat global warming. The phenomenon of flight shame has led several European governments to implement additional tariffs and ban certain short domestic flights to curb the aviation sector's environmental footprint. The movement underscores the necessity for airlines and airports to understand and address the environmental concerns fuelling flight shame, as they face increasing pressure to reduce their environmental impact. Flight shame is closely tied to the understanding that aviation is a major source of carbon emissions. The movement assumes that reducing flights will have a substantial positive impact on lowering carbon emissions and mitigating global warming. Despite efforts by the aviation sector to minimize its environmental impact, the concept of flight shame has gained traction,

suggesting that many flights are unnecessary and could be replaced with alternatives like video conferences (for business travellers), or less carbon-intensive modes of transportation (such as train or car) (Chiambaretto et al., 2021).

2.4 WILLINGNESS TO PAY

Willingness to pay (WTP) refers to the maximum price that a customer is willing to pay for a product or service (Stobierski, 2020). In this case, it is the maximum price that a customer is willing to pay for their flight to be electric, and therefore contributing positively to the environment. The transition to sustainable aviation and achieving net-zero carbon targets necessitate not only legislative frameworks, operational improvements, and technical breakthroughs, but also significant public engagement and WTP.

Due to the lack of research about the willingness to pay for electric flights, research about sustainable aviation fuel is consulted for comparison. Xu et al. (2022) highlight that the cost of SAF is substantially higher than that of conventional fossil jet fuels. Therefore, airlines may need to increase ticket prices to offset these costs. Understanding the public's knowledge and WTP for the environmental benefits of SAF is crucial for the broader social acceptance of this innovation. If the public remains unaware or unwilling to pay, the market introduction of SAF could falter. The potential benefits of SAF, such as reduced emissions and fossil fuel independence, must be communicated effectively to ensure public support. Conversely, the potential drawbacks, including competition for food supplies, health risks, and environmental impact, must also be addressed transparently. Public awareness and attitudes towards new technologies like SAF and electrification are pivotal in determining their success. While awareness alone does not guarantee adoption, it plays a significant role in influencing innovation outcomes. Several studies have demonstrated that people are willing to pay more for environmentally friendly implementations in aviation. However, most research has focused on airport infrastructure rather than SAF usage. Studies specifically investigating factors that influence willingness to pay for new technologies in aviation are scarce, highlighting a gap in the literature that must be addressed (Xu et al., 2022).

Rice et al. (2020) suggest that the public's increasing awareness of the environmental impacts of greenhouse gases has fostered a growing acceptance of sustainable practices in aviation. Numerous studies indicate that consumers are willing to pay a premium for green initiatives in the aviation sector. However, these studies often do not quantify the extra amount people are willing to pay in relation to the specific percentage of greenhouse gas emissions reduced. For example, a study conducted in 2018 found that people were more willing to pay for the construction of green airports than conventional ones, expressing positive emotional responses towards these green facilities. A Swiss study highlighted that approximately 20% of passengers are willing to pay extra for environmentally friendly services in aviation. This finding underscores the importance of considering passenger attitudes and personal traits when implementing sustainable practices. Factors such as gender, perceived value, and emotions significantly influence consumer preferences for green products in aviation. Rice et al. (2020) found that passengers support the use of biofuels to reduce carbon emissions and are willing to pay an additional 13% for such initiatives. Emotions played a crucial role in determining WTP, indicating that affective responses to sustainability initiatives are vital.

According to Han et al. (2019), the key factors determining the success of electric airplanes are changing consumer attitudes and safety concerns, as both concepts are closely linked to consumers' readiness to accept this new airline product. The process of commercializing electric aircraft requires a shift in passenger attitudes, safety certification, and technological advancements. Unquestionably, airline companies must thus actively address these crucial triggers as well as other significant factors that influence consumers' readiness or willingness to adopt electric aircraft. This will ultimately guarantee the successful entry of electric flights into the increasingly competitive airline market and bring long-term success to the airline companies that are leading the way in the electric transition.

2.4.1 THE CASE OF ELECTRIC BUSES

Due to a lack of research about the willingness to pay for electric flights, a comparison is made to existing research about the willingness to pay for other modes of electric transportation. Son et al. (2022) have studied the willingness to pay for public electric buses in Nepal. Green energy vehicles, such as electric buses, are receiving more attention as a result of the sharp rise in traditional gasoline and diesel cars in emerging nations. Nepal's fast population growth over the

previous years has resulted in issues with habitual designation and environmental pollution. Improving the transportation environment to reduce greenhouse gas emissions is one of Nepal's main concerns. In Nepal, about 90% of people and cargo are transported by road. The number of registered vehicles in Nepal has increased rapidly, and this trend is expected to continue due to the country's growing urbanization, better roads, and rising incomes. It has been suggested that using clean energy vehicles, such as electric vehicles, will help address the problems brought on by traditional gas and diesel-fuelled automobiles. Since public transit can have a higher impact by reducing the number of cars on the road, publications have concentrated on examining electric buses. The direct advantages of switching from diesel-powered CNG buses to electric buses could include lower operating expenses for the vehicles and an improvement in comfort of use because of less noise and fuel odour. Environmental cost reduction, economic effects on related industries, and urban quality effects are some of the indirect advantages of the deployment of electric buses (Son et al., 2022).

The results of the study by Son et al. (2022) indicate that people would prefer the introduction of electric buses, and they have determined that they would be willing to pay 758.6 NPR (€ 5.25) as a special purpose tax for the benefits of using electric buses. Besides this, the study also found that 78% of the respondents mentioned they would be willing to pay for electric buses since they "are likely to be helpful to the environment". Because introducing electric buses in the city is "not a personal priority", and "electric buses do not seem worth much", the remaining 22% of respondents are not willing to pay for electric buses (Son et al., 2022).

2.5 SCOPE OF RESEARCH

Based on the literature presented above, there is room for more specific research regarding this topic. Currently, there is no readily available research about the willingness to pay for electric flights specifically. There are, however, recent studies that focus on electric trains or buses, and these can be used as a source of inspiration for this piece of research.

The proposed research aims to investigate how evolving environmental awareness and the increasing prevalence of short-haul electric flights influence customers' willingness to pay for environmentally friendly air travel within the European market.

3. CONCEPTUAL FRAMEWORK

This section of the paper will provide the conceptual framework for the research, and based on this, four hypotheses are formulated. Based on the literature review in the previous section, four hypotheses have been formulated to investigate and answer the proposed research question. The research question formulated earlier is as follows:

“How does the evolving environmental awareness and the increasing prevalence of short-haul electric flights influence and shape customers’ willingness to pay for air travel within the European market?”

Based on this research question, a conceptual framework has been developed, which is visualized in figure 3-1.

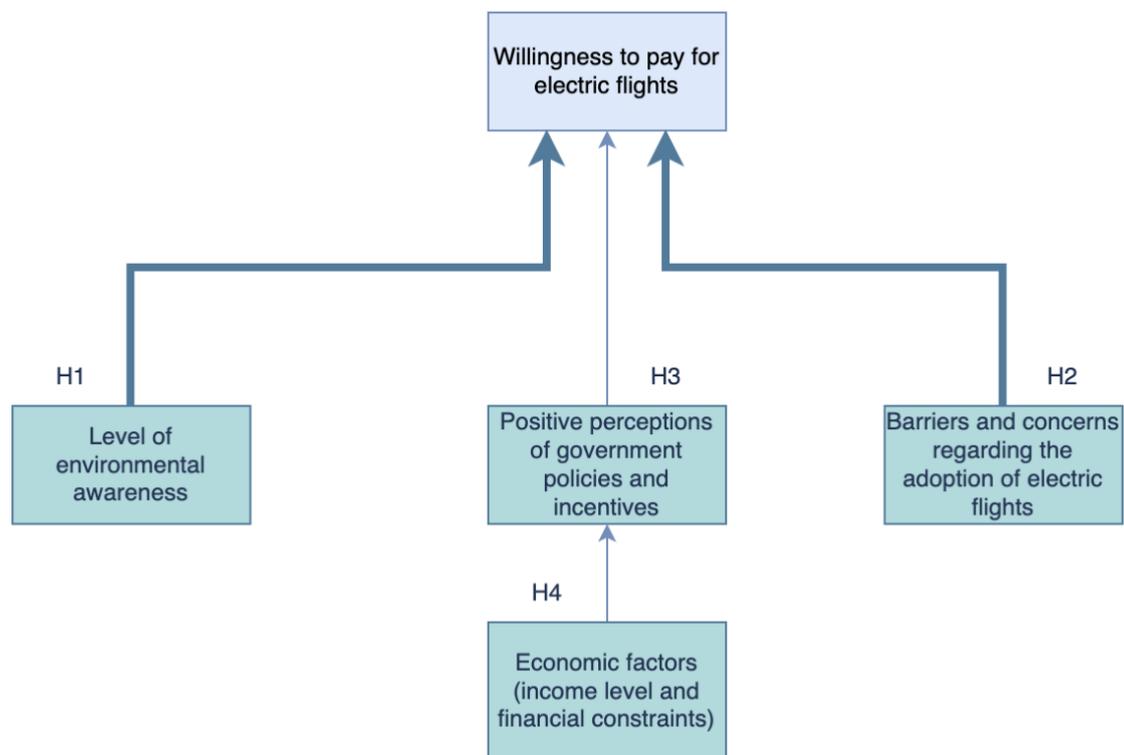


Figure 3-1: Conceptual framework of the different variables.

The diagram shows the relationships between the different hypotheses on the dependent variable, the willingness to pay for electric flights. The thicker arrows show an expected strong relationship between the different variables, while the small arrows show an expected moderate relationship. The arrows' strengths are based on the rationale that environmental awareness and barriers have a more immediate and direct influence on willingness to pay, whereas perceptions of government policies and economic factors have a more indirect, although significant, effect.

Arrows from level of environmental awareness, barriers, and concerns point to willingness to pay, which show direct influences between the variables. An arrow from positive perceptions of government policies and incentives to willingness to pay indicates that positive perceptions can enhance willingness to adopt and pay for electric flights. Finally, economic factors influence positive perceptions of government policies and incentives, which in turn affect willingness to pay for electric flights.

3.1 HYPOTHESIS 1

Gössling et al. (2019) point out that environmental awareness is increasingly influencing travel behaviours, such as the emergence of “flight shame”. This awareness motivates consumers to choose options that align with their environmental values, such as paying a premium for electric flights that reduce carbon emissions. Chiambaretto et al. (2021) also highlight the influence of environmental consciousness on travel decisions, reinforcing the idea that more aware customers are willing to invest in sustainable options. This leads to the first hypothesis, which suggests that customers who are more aware of environmental issues are likely to value the environmental benefits of electric flights more than those who are less aware.

[H1] Customers with higher levels of environmental awareness will exhibit a greater willingness to pay for electric flights compared to those with lower levels of awareness.

3.2 HYPOTHESIS 2

Han et al. (2019) and Hizarci and Arifoglu (2023) discuss the technological and logistical challenges of electric aviation, such as battery limitations and charging infrastructure. These barriers can lead to consumer scepticism, reducing their willingness to pay for electric flights. Addressing these concerns through technological advancements and effective communication can help to mitigate their impact on customer willingness to pay. The second hypothesis therefore posits that potential barriers and concerns, such as safety issues, limited range, and higher costs of electric flights, will influence customers' willingness to pay.

[H2] Barriers and concerns regarding the adoption of electric flights have a significant impact on customers' willingness to pay.

3.3 HYPOTHESIS 3

Government initiatives like the ICAO's CORSIA and the EU's Emissions Trading System, as noted by Chiambaretto et al. (2021), create a regulatory environment that encourages sustainable aviation practices. Positive perceptions of these policies can enhance consumer confidence in electric aviation, making them more likely to support and pay for electric flights. The third hypothesis suggests that when customers perceive government policies and incentives as supportive of electric aviation, they are more likely to be willing to pay for electric flights.

[H3] Positive perceptions of government policies and incentives promoting electric aviation positively correlate with customers' willingness to pay for electric flights.

3.4 HYPOTHESIS 4

Schwab et al. (2021) and Xu et al. (2022) highlight the higher costs associated with sustainable aviation fuels and electric aircraft. Higher-income individuals are generally less constrained by price and more capable of prioritizing environmental benefits in their purchasing decisions,

thereby showing a greater willingness to pay for electric flights. The final hypothesis examines how economic factors influence the willingness to pay for electric flights, suggesting that individuals with higher incomes are more likely to afford and be willing to pay a premium for environmentally friendly travel options.

[H4] Economic factors, such as income level and financial constraints, play a role in shaping customers' willingness to pay for electric flights, with higher-income individuals exhibiting a greater willingness to pay.

4. METHODOLOGY

This part will give an overview of the methodology used in this research. First, the research approach will be explained, followed by the design of the survey. After this, it is explained how the data has been collected.

4.1 RESEARCH APPROACH

This study aims to investigate the willingness to pay for electric flights in the European market, considering customers' growing environmental awareness and the development of short-haul electric flights. The study employs a quantitative approach, utilizing an online questionnaire to collect data. The study employs a cross-sectional survey design to gather quantitative data on customers' WTP for electric flights. A cross-sectional study analyses data from a population at a single point in time (Wang & Cheng, 2020). The survey is designed to capture a snapshot of current attitudes, preferences, and factors influencing WTP at a specific point in time. This specific design was chosen for its efficiency in gathering a large amount of data from a diverse, European population, allowing for the identification of trends and relationships.

4.2 SURVEY DESIGN

The survey is structured into four main parts to gather data on transportation preferences, customer attitudes, willingness to pay, and demographic information. Each part is carefully designed to address specific aspects of the research question and subsequent sub-question, ensuring that the collected data can provide insights into customers' willingness to pay for electric flights within the European aviation market. The survey questions and designs can be found in Appendix 1.

The first section of the survey aims to understand the respondents' current transportation habits and their environmental considerations when choosing a certain mode of transportation. Besides that, this part also aims to understand the customers' current level of awareness of electric flights, and their main purpose of travel (business or tourism). The second part of the survey assesses customers' preferences and attitudes towards different transportation options for specific routes. In this part, two scenarios are presented, which attempt to discover which modes of transportation customers are most likely to use. Figures 4-1 and 4-2 below depict the two scenarios. The duration and prices of the two scenarios are estimated using different websites of airlines, train booking websites, and information about tolls in the different countries.

Amsterdam - Paris

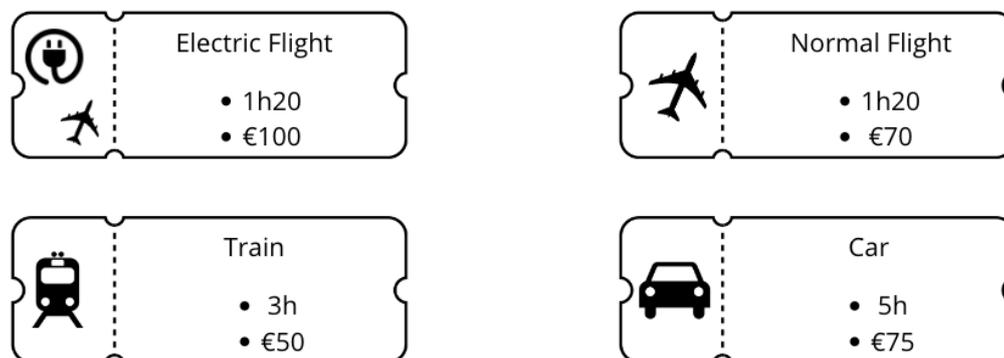


Figure 4-1: Scenario 1 Survey

Amsterdam - Barcelona

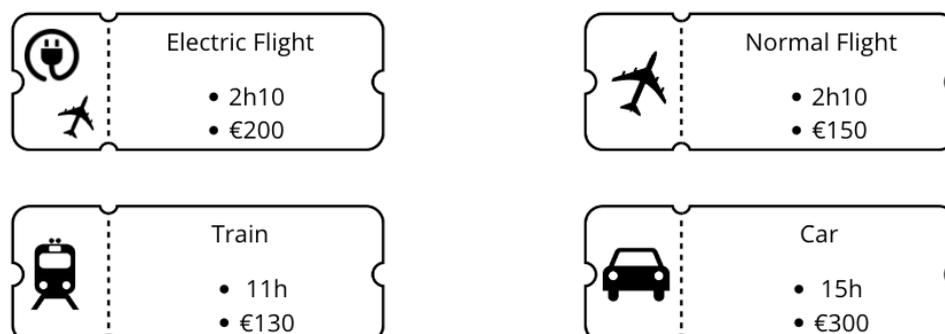


Figure 4-2: Scenario 2 Survey

The third part of the survey explores how much extra customers are willing to pay for electric flights, and which factors influence their WTP. The questions are developed in such a way that, on the one hand, the premium that customers are willing to pay for the environmental benefits of electric flights is determined. On the other hand, the key factors that drive their willingness to pay are identified in the specific questions. Finally, in this part, the customers' view on the impact of government interventions is assessed. In the final part, demographic data about the respondents is collected to understand their background and facilitate further analysis. This demographic information includes age, gender, country of residence, employment status, highest level of education, annual income, and frequency of air travel.

4.3 DATA COLLECTION

The survey is conducted online using the online platform, Qualtrics. Before the survey was distributed, some pre-tests had been done. The survey has first been completed by family members and friends to ensure clarity, relevance and reliability of the questions. After implementing feedback, the survey is distributed through online channels such as Facebook, Instagram, and WhatsApp to obtain randomized results. The target population for this study includes adult (18+) air travellers within the European market who have flown at least once in the past year. The survey is randomly distributed to ensure a representation of the population across different demographic groups, such as age, gender, income level, and travel frequency. Participants have been made aware that the questionnaire is fully anonymous and that the results are being kept confidential and are only used for this study's purposes.

4.4 DATA ANALYSIS

Before the survey was distributed, it was first tested by 3 family members to make sure everything was clear and easy to understand for people who have no knowledge about this topic. After changing some of the sentence structures to ensure clarity, the survey was ready to be sent out.

Before the analysis was conducted, the obtained data was being prepared. The survey was conducted using the online program Qualtrics, and responses were collected in the period April – May. After collecting the responses, the obtained data was transferred to SPSS for further analysis. The survey was distributed,

resulting in 181 responses. There were, however, some not finished and incomplete results, which were removed from the dataset. After removing all unnecessary observations, the dataset included 123 data points that were usable. Next, it was assured that all variables were in the correct numeric format to simplify further analysis. Variables that were not in the correct categorical format were transformed into numerical variables. Finally, the names of the necessary variables were adjusted to simplify calculations later.

In the next section, the analytical results of the survey are presented. First, some descriptive statistics of the survey participants are displayed to show how the test population is composed. Afterwards, an analysis is done for each of the four hypotheses presented earlier.

5. RESULTS

Before the results of the analysis are discussed, some descriptive statistics will be displayed below. The aim of these descriptive statistics is to better understand the target group of the survey and, and therefore, the composition of people that are being observed.

5.1 DESCRIPTIVE STATISTICS

Figure 5-1 shows the age distribution among the survey participants. The survey reveals that the largest age groups are between 18 – 25 and 41 – 60. This is interesting to note, as nowadays, younger people, and especially students, are more concerned with the environment than older people. The fact that there is quite an equal split between the age groups can lead to more reliable overall results.

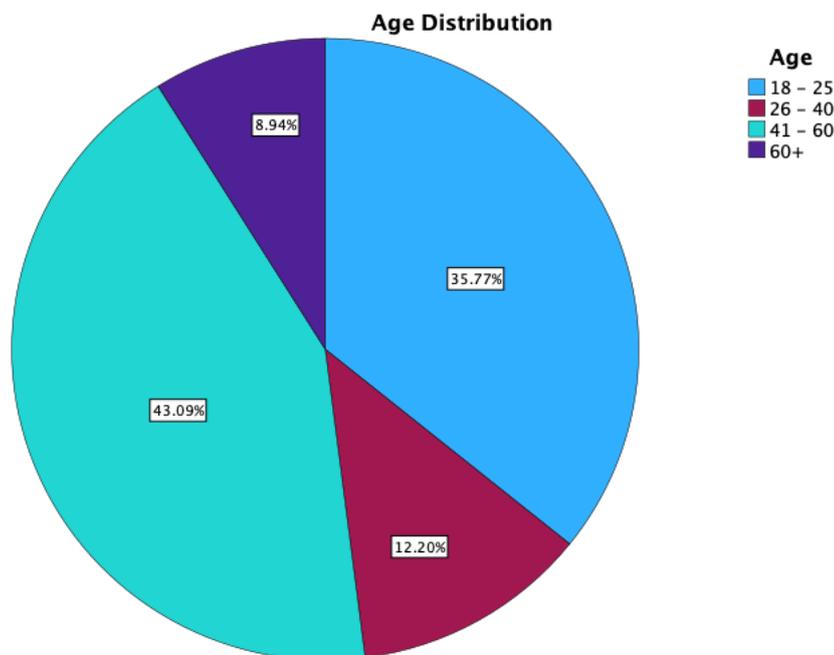


Figure 5-1: Age Distribution among the Survey Participants

Figure 5-2 illustrates the gender demographics among the survey participants. The chart highlights a higher proportion of female participants than male participants. This unequal gender distribution may lead to biased results, as the opinions of males and females may differ regarding this topic. There are different possible reasons for this biased distribution. It could be that, for instance, females visit the channels via which the survey was distributed more often than males. Females have been more inclined to respond to the survey due to personal interests than males. This biased distribution is kept in mind when discussing the analytical results of the survey.

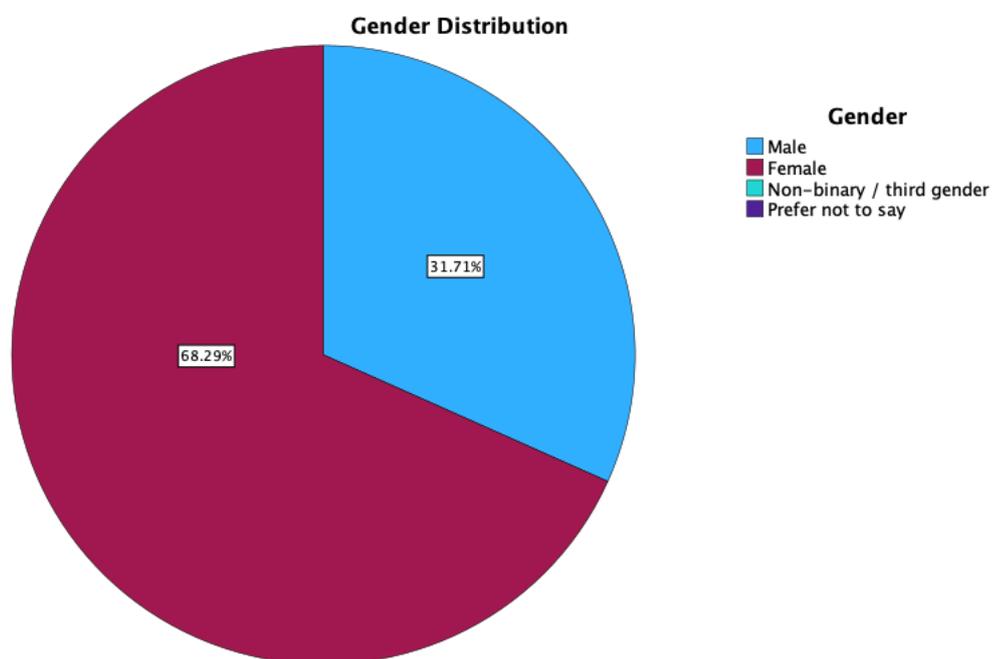


Figure 5-2: Gender Distribution among the Survey Participants

Figure 5-3 illustrates which countries the survey participants are from. As can be seen, the majority of participants live in Belgium, with only a smaller percentage residing in other countries. This is because the social network is primarily based in Belgium. The survey was distributed through other countries; however, the response rate was lower than expected there. This could potentially cause the results to be slightly biased and must be taken into account when analysing the results. Participants in the category 'other' live in Switzerland, Greece, North Macedonia, and Ireland.

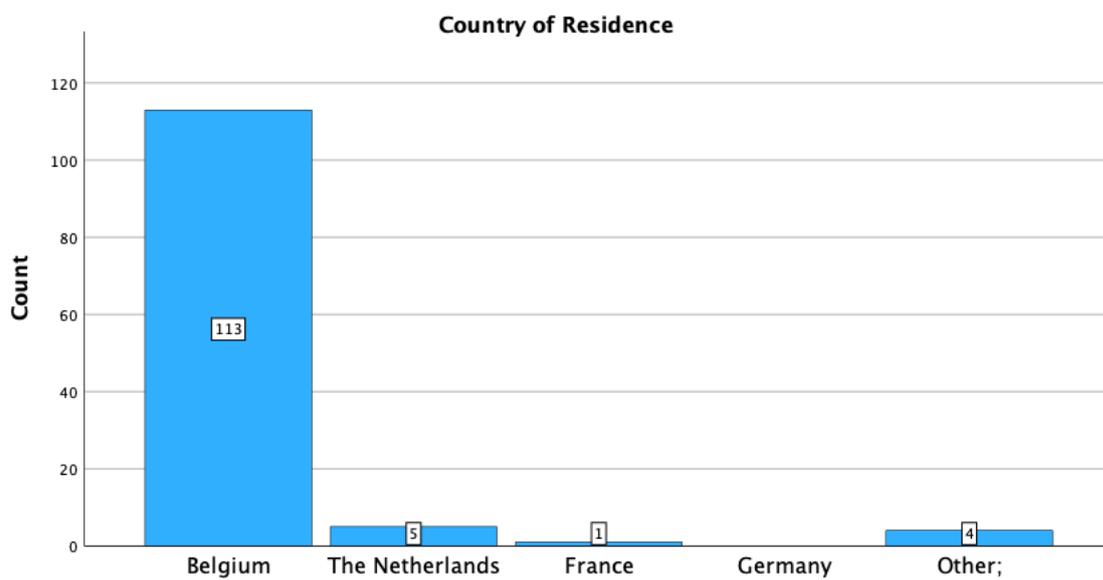


Figure 5-3: Residential Countries of the Survey Participants

Figure 5-4 displays the amount that participants travel by plane each year, without Covid restrictions. Most respondents (44%) travel 0 – 2 times per year by plane (return trip), and only a small part of the survey participants (9%) travel more than 6 times per year by plane. This last group consists mainly of business travellers, as was indicated by some people in the survey. There are sufficient participants to represent each category of yearly air travel, which means that the results should not be biased in this case.

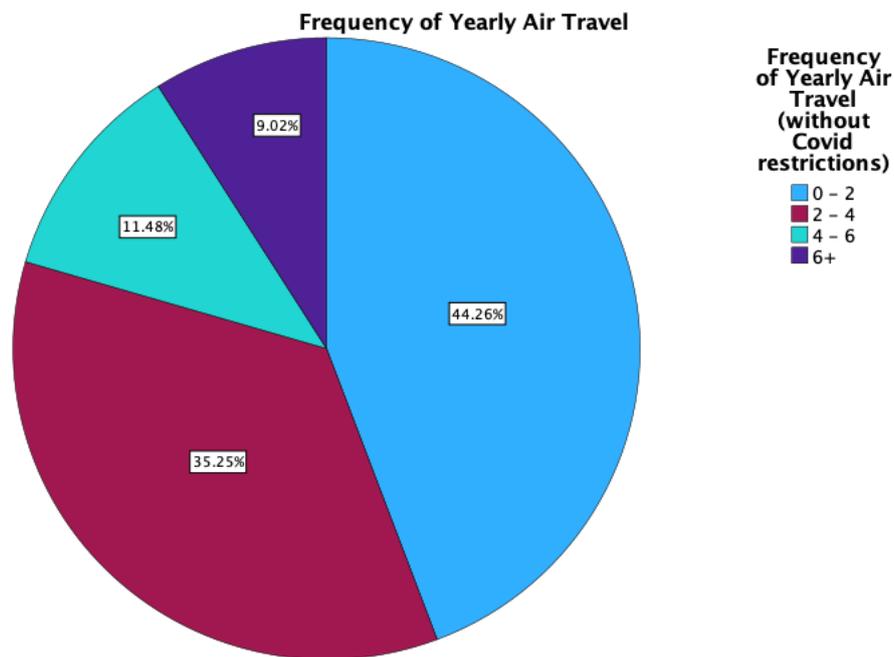


Figure 5-4: Frequency of Yearly Air Travel (without Covid restrictions) among the Survey Participants

Finally, figure 5-5 shows the employment distribution of the survey participants. The largest parts of employment consist of students and full-time employees. This ensures that there are participants with different income levels, as full-time employees have a greater income than students, and that the results will be more reliable in this respect. Participants that have another employment status indicated in the survey that they are self-employed, which explains the category 'other'.

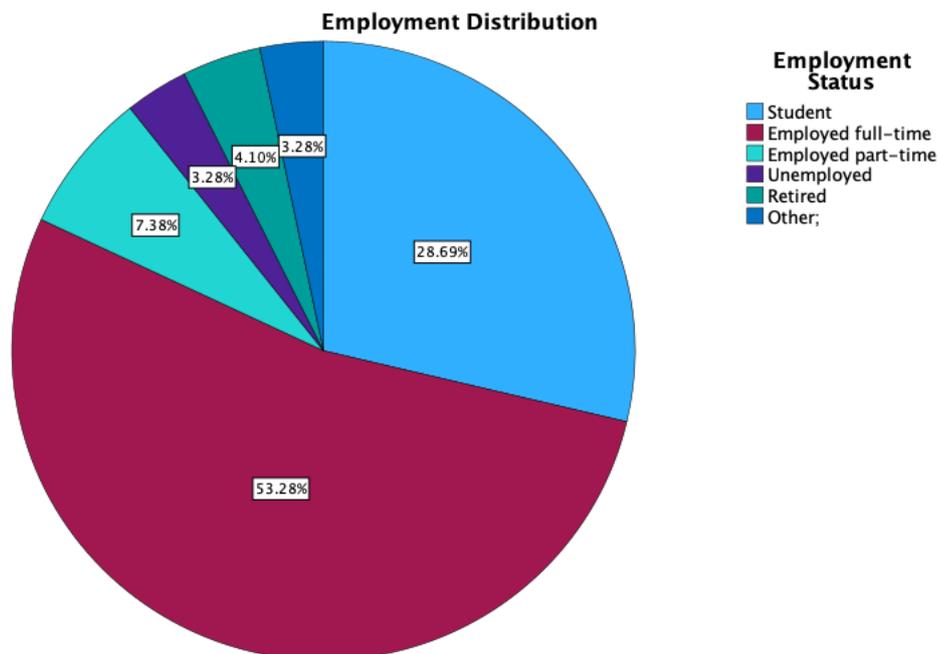


Figure 5-5: Employment Distribution among the Survey Participants

5.2 HYPOTHESIS TESTING

Four hypotheses were formulated earlier to simplify the further analysis. In this section, a regression analysis is done for each of these hypotheses. Each hypothesis aims to understand a certain part that could have an influence on the willingness of customers to pay for electric flights. For each separate hypothesis, a formula has been established to simplify the regression analysis. In each formula, 3 control variables were included to reduce omitted variable bias, which occurs when the model leaves out certain relevant variables. Including relevant control variables can improve the model's overall fit of the model by explaining more of the dependent variable's variance.

It was chosen to include the control variables age, income, education, and yearly air travel (for the last hypothesis only). The choice of including these specific variables is to help to account for the influence of other factors that may affect the dependent variable. First, older individuals may have different perceptions of the implementation of electric flights, which can therefore influence their willingness to pay. Similarly, higher-educated individuals may have a higher environmental awareness, and therefore may be willing to pay more for green transportation options. Individuals with higher incomes might be willing to pay more for environmentally friendly travel options. Finally, individuals who travel more per year via air than those who travel less per air, might be willing to pay more for sustainable travel options, as they make more use of them.

5.2.1 METHOD AND ASSUMPTIONS

To discover the effect of different factors on the willingness to pay for electric flights, four OLS regression analyses are used. The objective of the OLS algorithm is to determine the coefficient values, or the parameters, of the linear regression model that minimize the sum of the squared residuals. The residuals are the differences between the dependent variable's actual values and its anticipated values considering the independent factors (Sahu, 2023). An OLS regression is chosen because it is easy to implement and interpret as the coefficients indicate the magnitude and direction of the relationship between each of the independent variables and the dependent variable. Besides that, the assumptions for an OLS regression are all reasonable in this case (linearity, independence, homoscedacity, and normality of residuals).

The variables that are used for the analysis all come from a specific question in the survey. The dependent variable, willingness to pay, comes from question 7 of the survey, which asks participants how much they are willing to pay extra for a flight from Amsterdam to Barcelona, considering that the flight is electric. The variable environmental awareness comes from question 2, where it is asked how often participants consider environmental awareness when choosing a transportation option. The variable about the different factors and concerns regarding electric flights comes from question 9, where it is asked for each factor to rank them in terms of importance. The variable government policies come from question 10, where it is asked whether government incentives and policies play a role in choosing for electric flights. The variable income is derived from question 16, in which participants are asked about their yearly income. The control variables all come from the subsequent demographic questions at the end of the survey.

5.2.2 HYPOTHESIS 1

[H1] Customers with higher levels of environmental awareness will exhibit a greater willingness to pay for electric flights compared to those with lower levels of awareness.

The first hypothesis that was established relates to the effect of higher levels of environmental awareness on willingness to pay. The dependent variable in this case is the willingness to pay (WTP) for electric flights, while the independent variable is the level of environmental awareness (EA). The control variables included are age, education, and income. This information is summarized in formula 5-1 below. In this first model, a positive relationship between an individual's level of environmental awareness and their willingness to pay is expected, as more environmentally conscious people are likely to pay more for environmentally friendly travel options than people who are less environmentally conscious.

$$WTP_i = \beta_0 + \beta_1 EA_i + \beta_2 age_i + \beta_3 euc_i + \beta_4 inc_i + \varepsilon_i$$

Formula 5-1: Effect of the level of environmental awareness on Willingness to Pay

Where;

- WTP_i = willingness to pay for individual i
- β_0 = intercept
- β_1 = coefficient representing the effect of environmental awareness on WTP
- EA_i = level of environmental awareness for individual i
- $\beta_2 age_i$ = control variable (age)
- $\beta_3 educ_i$ = control variable (level of education)
- $\beta_4 inc_i$ = control variable (income level)
- ε_i = error term for individual

	<i>Dependent variable:</i>
	Willingness to Pay
Environmental Awareness	- 0.450** (0.186)
Age	0.083 (0.191)
Education	- 0.316** (0.157)
Income	- 0.040 (0.109)
Constant	4.402*** (0.688)
R	0.305
R square	0.093
Observations	123

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 5-1: Hypothesis 1 – OLS Regression results

The results of the first hypothesis are shown in table 5-1. The results table includes the coefficients for the independent variable and control variables, the standard errors in parentheses, and the significance of the coefficients. Besides this, the table also includes the R, R square, and number of observations included in the model. The low VIF values in the model show a lack of multicollinearity, which therefore ensures that the estimates of the regression are reliable and can be interpreted correctly.

The coefficient of environmental awareness is -0.450 , meaning that it is negatively correlated with willingness to pay. For every unit increase in environmental awareness, WTP decreases by 0.450 units. This effect is statistically significant at the 5% significance level, and the small standard error related to this coefficient indicates a relatively precise estimate. The coefficient of age is 0.083 but does not have a statistically significant association with WTP. This means that changes in the variable age do not significantly change the WTP. In comparison to the coefficient value, the larger standard error of 0.191 indicates a less precise estimate, which is also in line with the insignificance of the coefficient. The coefficient of education is -0.316 , meaning that for every unit increase in education, WTP decreases by 0.316 units. This effect is statistically significant at the 5% significance level. The small standard error indicates again a relatively precise estimate. Finally, the coefficient of income is -0.040 , which is not statistically significant, and this means that income does not have a great impact on WTP in this model. The larger standard error indicates again a less precise estimate.

The coefficient of the constant is 4.402 , which represents the predicted value of WTP when all other variables are zero. This coefficient is statistically significant at the 1% significance level. The R square value of 0.093 indicates that around 9.3% of the variance in WTP is explained by the independent variables in the model. This value is relatively low, indicating that there might be other important factors that influence WTP.

Based on this model, environmental awareness and education levels are significant indicators of willingness to pay, both of which have a negative correlation with WTP. This implies that people who are more educated and environmentally conscious are less inclined to pay less for sustainable friendly flights. An explanation for this might be that they value non-monetary contributions more or have a scepticism about monetary contributions.

The negative and significant coefficient of environmental awareness contradicts the first hypothesis. The data implies that, rather than showing a positive correlation between

environmental awareness and willingness to pay, there is a negative correlation between environmental awareness and willingness to pay. Therefore, the hypothesis (H1) is **rejected**.

5.2.3 HYPOTHESIS 2

[H2] Barriers and concerns regarding the adoption of electric flights have a significant impact on customers' willingness to pay.

The second hypothesis relates to the different barriers and concerns regarding the implementation of electric flights that could have an influence on the willingness to pay for these flights. The different factors that are being examined are environmental considerations, pricing, safety, convenience and the influence of government initiatives. This relationship is shown in formula 5-2, where the dependent variable is again the willingness to pay for electric flights, and the independent variables are the different factors that could potentially impact the willingness to pay. The control variables included for this hypothesis are education, income, and age.

$$WTP_i = \beta_0 + \beta_1 BC_{1i} + \beta_2 BC_{2i} + \beta_3 BC_{3i} + \beta_4 BC_{4i} + \beta_5 BC_{5i} + \beta_6 age_i + \beta_7 educ_i + \beta_8 inc_i + \varepsilon_i$$

Formula 5-2: Effect of different barriers and concerns regarding the adoption of electric flights on Willingness to Pay

Where;

- WTP_i = willingness to pay for individual i
- β_0 = intercept
- $\beta_1, \beta_2, \beta_3, \beta_4$ & β_5 = coefficient representing the effect of different barriers and concerns regarding the adoption of electric flights on WTP
- BC_{1i} = concerns about environmental considerations regarding the adoption of electric flights for individual i
- BC_{2i} = concerns about pricing regarding the adoption of electric flights for individual i
- BC_{3i} = safety concerns regarding the adoption of electric flights for individual i
- BC_{4i} = concerns about safety regarding the adoption of electric flights for individual i

- BC_{4i} = influence of government initiatives regarding the adoption of electric flights for individual i
- $\beta_6 age_i$ = control variable (age)
- $\beta_7 educ_i$ = control variable (level of education)
- $\beta_8 inc_i$ = control variable (income level)
- ε_i = error term for individual i

	<i>Dependent variable:</i>
	Willingness to Pay
BC2 – Price	- 0.230 (0.173)
BC3 – Safety	- 0.024 (0.162)
BC4 – Convenience	- 0.273 (0.179)
BC5 – Government incentives	- 0.766*** (0.200)
Age	0.250 (0.188)
Education	- 0.255* (0.149)
Income	- 0.055 (0.105)
Constant	7.713*** (1.567)
R	0.439
R square	0.193
Observations	123

Note: *p<0.1; **p<0.05; ***p<0.01

Note: BC1 – Environmental considerations has been excluded from the model due to multicollinearity

Table 5-2: Hypothesis 2 – OLS Regression results

Table 5-2 shows the results of the second hypothesis. For this model again, the low VIF values in the model show a lack of multicollinearity, and therefore ensures that the estimates of the regression are reliable and can be interpreted correctly.

The variable BC1 - environmental considerations has been excluded from the model due to multicollinearity issues. This means that this factor was highly correlated with other variables, and therefore it has been excluded from the model to prevent biased results. All the coefficients of the different factors that might influence the willingness to pay for electric flights (price, safety, convenience, and government incentives) are negative. Of all these factors, only BC5 - government incentives is statistically significant at the 1% significance level. The larger standard error of 0.200 in comparison to the coefficient value indicates a less precise estimate, which is also in line with the insignificance of the coefficient. This means that price, safety, and convenience are all statistically insignificant, and changes in these variables will not significantly change the willingness to pay. The coefficient of education is -0.255 , meaning for each unit increase in education, WTP decreases by 0.255 units. This effect is statistically significant at the 10% significance level. The other control variables, age and income, are statistically insignificant, so changes in these variables will not significantly change WTP.

The coefficient of the constant is 7.713, which represents the predicted value of WTP when all other variables are zero. This coefficient is statistically significant at the 1% significance level. The R square of 0.193 indicates that around 19.3% of the variance in willingness to pay is explained by the model. This suggests a modest explanatory power, and there might be other factors influencing WTP.

The data indicate that price, safety, and convenience do not significantly influence willingness to pay, indicating that these factors do not have a particular impact. Government incentives, however, have a significantly negative effect, suggesting that this factor does have a major impact on willingness to pay. Besides that, education levels also have a significant, yet negative, effect on the willingness to pay for electric flights. Given this information, the hypothesis (H2) is **rejected**. Although there is a barrier that significantly impacts WTP, there are more factors that do not have a significant effect on the WTP, and therefore the hypothesis is rejected.

5.2.4 HYPOTHESIS 3

[H3] Positive perceptions of government policies and incentives promoting electric aviation positively correlate with customers' willingness to pay for electric flights.

The third hypothesis relates to the influence of government policies and incentives on the willingness to pay for electric flights. Policies from the government like the CORSIA or EU ETS may offer incentives for customers to choose sustainable travel options. Governments may also offer tax benefits for customers who choose to travel sustainably. Therefore, a positive relationship is expected between government policies and incentives that promote electric aviation, and the willingness to pay for these electric flights. The independent variable in this model is the effect of government policies, and the control variables included are again age, education, and income. This information is all summarized in formula 5-3.

$$WTP_i = \beta_0 + \beta_1 GP_i + \beta_2 age_i + \beta_3 educ_i + \beta_4 inc_i + \varepsilon_i$$

Formula 5-3: Effect of government policies on Willingness to Pay

Where;

- WTP_i = willingness to pay for individual i
- β_0 = intercept
- β_1 = coefficient representing the effect of government policies on WTP
- GP_i = perceptions of government policies for individual i
- $\beta_2 age_i$ = control variable (age)
- $\beta_3 educ_i$ = control variable (level of education)
- $\beta_4 inc_i$ = control variable (income level)
- ε_i = error term for individual i

	<i>Dependent variable:</i>
	Willingness to Pay
Government policies	0.201 (0.158)
Age	0.236 (0.190)
Education	- 0.263* (0.152)
Income	- 0.069 (0.110)
Constant	2.387*** (0.694)
R	0.223
R square	0.050
Observations	123

Note:

*p<0.1; **p<0.05; ***p<0.01

Table 5-3: Hypothesis 3 – OLS Regression results

Table 5-3 displays the results of the third hypothesis. For this model again, the VIF values in the model were low, and showed a lack of multicollinearity. Therefore, it is ensured that the estimates of the regression are reliable and can be interpreted correctly.

The coefficient for government policies is 0.201. This suggests that, for every unit increase in government policies, willingness to pay increases by 0.201 units and yet shows a positive relationship. However, this coefficient is not statistically significant at any significance level. The coefficient of age is 0.236, suggesting a positive yet insignificant relationship. The coefficient of education is – 0.263, suggesting that for each additional unit of education, willingness to pay decreases by 0.263. This effect is statistically significant at the 10% significance level. This suggests that more educated people are willing to pay less for electric flights. Income has a coefficient of – 0.069, suggesting a negative and insignificant relationship with willingness to pay.

The coefficient of the constant is 2.837, which indicates the baseline level of willingness to pay when all other variables are equal to zero. This coefficient is statistically significant at the 1% significance level. The R square of 0.050 indicates that around 5% of the variance in WTP is explained by the model. This value is quite low and suggests that there might be other factors influencing WTP that are currently not included in the model.

The data shows a positive relationship between government policies and the willingness to pay, as was expected. However, this relationship is not statistically significant, and therefore the hypothesis (H3) is **rejected**.

5.2.5 HYPOTHESIS 4

[H4] Economic factors, such as income level and financial constraints, play a role in shaping customers' willingness to pay for electric flights, with higher income individuals exhibiting a greater willingness to pay.

The fourth hypothesis revolves around the effects of economic factors on the willingness to pay for electric flights. It is expected that, in this case, people with higher incomes are willing to devote more of their income into sustainable travel options, as these people are also likely to travel more because they have a greater income. For this model, income is the independent variable, as this variable has been measured through the demographic information of the survey. The control variables are age, education, and yearly air travel. The last one is included in this model to make sure there are still three control variables.

$$WTP_i = \beta_0 + \beta_1 inc_i + \beta_2 age_i + \beta_3 educ_i + \beta_4 YAT_i + \varepsilon_i$$

Formula 5-4: Effect of income on Willingness to Pay

Where;

- WTP_i = willingness to pay for individual i
- β_0 = intercept

- β_1 = coefficient representing the effect of economic factors (income) on WTP
- inc_i = level of income for individual i
- $\beta_2 age_i$ = control variable (age)
- $\beta_3 educ_i$ = control variable (level of education)
- $\beta_4 YAT_i$ = control variable (yearly air travel)
- ε_i = error term for individual i

	<i>Dependent variable:</i>
	Willingness to Pay
Income	- 0.079 (0.110)
Age	0.220 (0.189)
Education	- 0.305* (0.155)
Yearly air travel	0.181 (0.184)
Constant	2.791*** (0.554)
R	0.219
R square	0.048
Observations	123

Note: *p<0.1; **p<0.05; ***p<0.01

Table 5-4: Hypothesis 4 – OLS Regression results

Table 5-4 shows the results of the final hypothesis. For this model again, the VIF values in the model were low, and showed a lack of multicollinearity. Therefore, it is ensured that the estimates of the regression are reliable and can be interpreted correctly.

The coefficient of the independent variable, income, is – 0.079. This means that for every unit increase in income, the willingness to pay decreases by 0.079 units. This relationship is,

however, not statistically significant at any significance level. Age has a positive coefficient of 0.220, which indicates a positive effect on WTP. However, this effect is not statistically significant. The coefficient of education of -0.305 shows a negative relationship with willingness to pay. However, this effect is statistically significant at the 10% significance level. This suggests, like in the previous models, that a higher education is associated with a lower willingness to pay. Finally, the coefficient of yearly air travel shows a positive relationship between the amount people travel by air per year and their willingness to pay for electric flights. However, this relationship is not statistically significant.

The coefficient of the constant is 2.791, which indicates the baseline level of WTP when all other variables are equal to zero. This coefficient is statistically significant at the 1% significance level. The R square of 0.048 indicates that only 4.8% of the variance in WTP is explained by the variables in the model. This suggests that there are other factors that explain WTP that are currently not included in the model.

The coefficient for the independent variable, income, is negative and insignificant, and therefore contradicts the original hypothesis that higher-income individuals are willing to pay more for sustainable travel options. Therefore, this hypothesis (H4) is **rejected**.

6. DISCUSSION

6.1 RESEARCH QUESTION

The primary research question that was addressed in this paper is:

“How does the evolving environmental awareness and the increasing prevalence of short-haul electric flights influence and shape customers’ willingness to pay for air travel within the European market?”

To answer this research question, four hypotheses were formed to facilitate the further analysis. For each of these four hypotheses, an OLS regression has been done with data that resulted from an online survey. The results of the hypotheses are summarized in table 6-1.

<i>Hypothesis</i>	<i>Result</i>
Customers with a higher environmental awareness do not exhibit a greater willingness to pay for electric flights	1 – Rejected
Most of the barriers and concerns regarding the adoption of electric flights do not have a significant impact on the willingness to pay	2 – Rejected
Positive perceptions of government policies and incentives do not correlate positively with customers’ willingness to pay	3 – Rejected
Economic factors do not play a significant role in shaping customers’ willingness to pay for electric flights	4 – Rejected

Table 6-1: Hypotheses results

Hypothesis 1

The regression analysis results show that there is a negative relationship between WTP and environmental consciousness. WTP decreases by 0.450 units for every unit increase in environmental awareness, a result that is statistically significant at the 5% level. This result is contrary to the stated hypothesis, which indicates that a greater willingness to pay for electric

flights is not correlated with a higher environmental awareness. One argument for this is that people who care more about the environment might value non-financial contributions more or might be sceptical of the effects of financial contributions. Furthermore, those with higher levels of education, who also showed a negative correlation with WTP, may favour other environmentally friendly modes of transportation over electric flights.

The limitations of this hypothesis are, among others, that the measurement of environmental consciousness may vary between individuals based on their perceptions and values. This can lead to biased results. Next, the scope of environmental consciousness may be overgeneralized. Therefore, it could be oversimplified to treat environmental consciousness as a single, cohesive concept given the variety of related motivations and behaviours.

Hypothesis 2

From the factors that were considered (price, safety, convenience, and government incentives), only government incentives had a significant negative impact on WTP, with a coefficient of -0.766 . This implies that concerns about incentives from the government have drastically reduced WTP. Price, safety, and convenience were among the other characteristics that did not show any statistical significance. This suggests that the WTP of customers for electric flights is not greatly impacted by these different constraints. For the government incentives, there may be a belief that these are ineffective or poorly distributed, which may raise questions about how well they will work to cut prices or raise the standards of electric flights. On the other hand, the other factors, such as safety and convenience may be viewed as less important and are therefore not significant. WTP may not be greatly impacted by these factors since they might already be viewed as acceptable by the public. Alternatively, the survey sample might have a high trust in the safety and convenience of new technologies, which might explain the insignificance.

The limitations of this hypothesis may include that there might be other factors that influence WTP that are not included in the model, for example, environmental awareness, technological familiarity, or personal attitudes. Another limitation is that the results may be influenced by current events, media coverage, or recent experiences with government policies, which may influence the negative relationship between government incentives and WTP.

Hypothesis 3

The findings of this regression show a positive, although not significant correlation between WTP and government incentives. The latter had a coefficient of 0.201, which may indicate a positive influence, but this cannot be said with certainty due to the lack of statistical significance. This lack of significance can be due to several reasons. First, people may view government policies and incentives with suspicion or distrust. Therefore, people might not include them in their factors that influence the WTP. Next, the electric aviation market is still in its early stages and potential customers might have a wait-and-see approach. Government incentives may not have much of an impact until electric flights become more widely adopted and their advantages are proven. Finally, people simply may not be aware of the government incentives, and therefore are not a main factor in WTP.

There are, however, also some limitations related to this hypothesis. First, the sample size may be too small to detect any statistically significant effects of government incentives on WTP. Next, the observed correlation may be undermined by a high degree of variability in the replies regarding WTP or perceptions of government incentives. Variations in personal preferences, experiences, or awareness levels may arise from this variety. Finally, it is plausible that the respondents' perceptions of government incentives may have a limited effect on their willingness to pay for electric flights. This can be the result of insufficient incentives or a lack of faith in government activities.

Interesting to note is that, while in hypothesis two, government incentives had a significant negative impact on willingness to pay, in hypothesis three, there was a positive yet insignificant correlation between the two variables.

Hypothesis 4

With a value of -0.069 , the data did not demonstrate a statistically significant link between income and WTP. This implies that WTP for electric flights is not greatly impacted by income levels. This outcome can occur for a variety of reasons. First, high-income individuals might not find electric flights to offer enough extra value over traditional flights. Should the advantages of electric flights (such as reduced emissions, reduced noise levels, and innovation) prove to be insufficiently attractive, they may be unwilling to pay a higher price. Next, income may not have as much of an impact on WTP as environmental awareness and personal values do. Regardless of income, people who place a higher priority on sustainability and environmental protection may

be willing to pay more. Finally, people with higher incomes might not be as aware of variations in airline prices. They might value other considerations – like comfort, convenience, and flight duration – over the type of aircraft.

There are some limitations regarding this hypothesis. First, any potential association between income and WTP may be obscured if there is insufficient variance in the sample's income levels (for example, if most respondents fall in the same income category). Next, like the other hypotheses, the relatively small sample size might lead to non-significant results. Finally, personal values, travel patterns, and environmental awareness are a few examples of factors that may have a greater impact on WTP than income alone.

One consistent finding in all four regression models is the significant negative effect of education on consumers' willingness to pay for electric flights. Education was found to be a significant factor impacting WTP in each regression model. Higher levels of education are linked to a lower willingness to pay for electric flights, as seen by the consistently negative coefficient for education. This surprising result implies that those with higher levels of education could be less likely to spend additional money on electric flights. The consistency and dependability of this result was confirmed by the statistical significance of the variable education in each model.

There are different possible interpretations for this consistent negative relationship. First, people with more education may be more sceptical and capable of critical thought. They might evaluate the technological viability and environmental advantages critically, which would make them reluctant to spend heavily in such an advance. Second, people with higher education may have a more sophisticated understanding of how to allocate their spending and budget. They might consider electric flights to be an unnecessary investment considering other available options, or they may prioritize funding for other environmentally friendly projects.

6.2 IMPLICATIONS

The research' findings have several implications for policymakers, the airline industry itself, and environmental advocates. First, education has a big impact on how eager consumers are to pay for electric flights. Higher education levels are correlated with a lower willingness to pay, indicating that those with higher levels of education may be less convinced of the effectiveness of financial contributions to environmental sustainability. This emphasizes the need for

improved methods of teaching and communication on the advantages and efficacy of electric flights.

Second, higher environmental awareness was found to inversely correlate with WTP, contradicting the original hypothesis. This implies that those who care about the environment might choose alternative sustainable behaviours over paying more for electric flights. To appeal to this group, airlines and policymakers may need to investigate alternate incentives or incorporate electric flights within a larger sustainability framework.

Finally, the significant negative effect that government incentives have on the willingness to pay suggests that the current policies may not be working or may even discourage consumers from paying extra for electric flights. This emphasizes how crucial it is to review and possibly restructure government regulations to better meet the needs of the public and promote environmentally friendly transport options.

6.3 LIMITATIONS AND RECOMMENDATIONS

This research has faced some limitations, which could be avoided in future research regarding this topic. First, most of the survey respondents were from Belgium, and there were more women than men among the respondents. The results might be slightly biased because of this demographic skew, and their applicability to the larger European market may be limited. Next, because the data is self-reported, biases such as social desirability bias could be introduced, leading participants to overestimate their willingness to pay for environmentally friendly solutions.

Based on these limitations, there are some recommendations that could help these results become more reliable. First, to improve the generalizability of the results, more representative and diverse samples from different European nations should be included in future research. Next, qualitative research methods, such as interviews, could offer a more in-depth understanding of the factors influencing consumers' willingness to pay for electric flights as well as the obstacles they face. Finally, to fully capture the complexity of factors impacting WTP, future research should include a wider variety of variables, such as specific travel habits and comprehensive environmental attitudes.

Future research might build on this study's findings to better understand and promote the adoption of sustainable travel options in the European market by addressing these limitations and following the recommendations.

7. CONCLUSION

This research aims to understand what factors are shaping customers' willingness to pay for electric flights. Although the development of commercial electric flights is still in its early stages, it is interesting to understand the customers' behaviour in choosing more sustainable travel options. The findings of this research provide significant information about what drives consumers' willingness to pay for electric flights. Higher environmental awareness and education levels were found to negatively correlate with WTP, defying the initial hypothesis and indicating that people with these traits might prioritize other sustainable practices or be sceptical about the effectiveness of monetary contributions towards environmental sustainability.

The significant impact of government incentives on WTP also highlights a complex relationship. While policies are important for encouraging environmentally friendly aviation, they may need to be restructured to effectively persuade passengers to choose electric flights. This emphasizes the need for policies that not only encourage sustainable decisions but also effectively convey their advantages and fit the views and values of the public. These findings highlight the significance of designing incentives that reflect the opinions of customers and clearly illustrate the advantages of electric aviation for policymakers. The results suggest that simply introducing incentives may not be sufficient, but these policies must also be perceived as effective and worthwhile by the public.

Understanding these factors can help the airline industry create pricing and marketing tactics that appeal more to the informed and environmentally sensitive sectors of the market. Additionally, by highlighting a comprehensive strategy for lowering carbon footprints, incorporating electric planes within a larger sustainability framework may appeal to people with strong environmental consciousness.

In conclusion, even though electric aviation is a promising step towards sustainable travel, consumers' willingness to pay for this innovative solution depends on several variables, such as education, environmental consciousness, and government policies. It will be essential to address these issues through focused communication, efficient regulations, and comprehensive sustainability plans to build public support and advance the use of electric flights. Future research should continue to explore these relationships and examine additional variables that could further clarify the complexities of consumer behaviour in the context of sustainable aviation.

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9. APPENDIX

APPENDIX 1: SURVEY DESIGN

Start of Block: Default Question Block

Q1 Which modes of transportation do you frequently use for intra-continental transportation (within Europe)?

- 1 Car (1)
 - 2 Train (2)
 - 3 Bus (3)
 - 4 Airplane (4)
 - 5 Electric airplane (5)
 - 6 Other, please specify (6) _____
-

Q2 On a scale of 1 to 5, how often do you consider environmental impact when choosing a mode of transportation (1 being never, 5 being always)?

1 5

Environmental impact ()	
-------------------------	--------------------------------------------------------------------------------------

Q3 To what extent are you aware of the existence and development of electric flights for (intracontinental) travel?

- Not aware at all (1)
 - Somewhat aware (2)
 - Very aware (3)
-

Q4 For which purpose do you travel most?

- Tourism (1)
- Business (2)
- Other, please specify (3) _____

End of Block: Default Question Block

Start of Block: Block 1

Q5 Imagine you are travelling from Amsterdam to Paris (around 400km), with following prices and durations for different modes of transportation:

	Duration	Price
Electric Flight	1h20	€100
Normal Flight	1h20	€70
Train	3h	€50
Car	5h	€75 (fuel, tolls...)

To what extent do you agree with following statements?

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I am more likely to take the electric flight for this distance (1)	•	•	•	•	•
I am more likely to take the normal flight for this distance (2)	•	•	•	•	•
I would not fly for this distance and would rather take the train or car (3)	•	•	•	•	•

Q6 Imagine you are travelling from Amsterdam to Barcelona (around 1500km), with following prices and durations for different modes of transportation:

Duration	Price	
Electric Flight	2h10	€200
Normal Flight	2h10	€150
Train	11h	€130
Car	15h	€300 (fuel, tolls...)

To what extent do you agree with following statements?

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I am more likely to take the electric flight for this distance (1)	•	•	•	•	•
I am more likely to take the normal flight for this distance (2)	•	•	•	•	•
I would not fly for this distance and would rather take the train or car (3)	•	•	•	•	•

End of Block: Block 1

Start of Block: Block 2

Q7 Imagine you are flying from Amsterdam to Barcelona, and the ticket price is €150 (one way). How much extra are you willing to pay for an electric flight, considering that it reduces the carbon emissions of flying?

- €30 extra (1)
 - €60 extra (2)
 - €90 extra (3)
 - €150 extra (4)
 - I would not pay extra just because it is an electric flight (5)
-

Q8 Considering your willingness to pay for electric flights, please rank the following factors in order of importance (please drag your preferred choice to the top)

- _____ Environmental considerations (1)
 - _____ Price (2)
 - _____ Safety (3)
 - _____ Convenience (4)
 - _____ Government incentives (subsidies or tax benefits) (5)
-

Q9 To what extent do you agree with following statements?

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
"I am concerned about the safety of electric flights" (1)	•	•	•	•	•
"I worry about the reliability and performance of electric aircrafts" (2)	•	•	•	•	•
"The limited availability of charging infrastructure for electric flights concerns me" (3)	•	•	•	•	•
"I am unsure about the overall environmental impact of electric flights" (4)	•	•	•	•	•
"The cost of tickets for electric flights is a major concern for me" (5)	•	•	•	•	•
"I have concerns about the range of distance electric flights can cover" (6)	•	•	•	•	•
"I am uncertain about the comfort and amenities provided on electric flights" (7)	•	•	•	•	•

Q10 To what extent do you believe government policies and incentives (such as subsidies, tax benefits, or regulatory support) influence your attitude towards and willingness to pay for electric flights?

- Not at all influential (1)
- Slightly influential (2)
- Moderately influential (3)
- Very influential (4)
- Extremely influential (5)

End of Block: Block 2

Start of Block: Block 3

Q11 How old are you?

- 18 - 25 (1)
- 26 - 40 (2)
- 41 - 60 (3)
- 60+ (4)

Q12 What is your gender?

- Male (1)
 - Female (2)
 - Non-binary / third gender (3)
 - Prefer not to say (4)
-

Q13 What is your country of residence?

- Belgium (1)
- The Netherlands (2)
- France (3)
- Germany (4)
- Other; (5) _____

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Q14 What is your employment status?

- Student (1)
 - Employed full-time (2)
 - Employed part-time (3)
 - Unemployed (4)
 - Retired (5)
 - Other; (6) _____
-

Q15 What is your highest level of education?

- High school degree (1)
 - Professional bachelor degree ("Hoge School") (2)
 - Academic bachelor degree (University) (3)
 - Master degree (4)
 - PHD (5)
-

Q16 What is your annual income? (Gross Salary)

- Less than €20 000 (1)
 - Between €20 000 and €40 000 (2)
 - Between €40 000 and €60 000 (3)
 - Between €60 000 and €80 000 (4)
 - More than €80 000 (5)
 - Prefer not to say (6)
-

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Q17 In a normal year (without Covid restrictions), how often do you usually travel abroad by plane for a return trip?

- 0 - 2 (1)
 - 2 - 4 (2)
 - 4 - 6 (3)
 - 6+ (4)
-

Q18 Do you have any suggestions or comments regarding this research?

End of Block: Block 3
