WHERE DOES THE RESPONSIBILITY LIE?

VOLUNTARY CARBON OFFSETTING IN THE AVIATION INDUSTRY – THE CONSUMERS' PERSPECTIVE

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ABSTRACT

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Abstract

Climate change poses a serious threat to societies as well as the natural environment. Currently there are suggestions to keep global warming below 1.5 degrees Celsius in order to avoid irreversible damage. Commercial aviation is an industry where different climate change mitigation tools are being suggested, and one of these tools is voluntary carbon offsetting (VCO). This thesis looks further into consumer behaviour and their perceptions regarding voluntary offsetting within the aviation industry. There are different VCO projects that consumers can choose to invest in these mainly focusing on reforestation, renewable energy projects and sustainable aviation fuel. By conducting a quantitative survey as well as looking into existing literature this research looks into whose responsibility do consumers see offsetting as, what the feasibility of voluntary offsetting is as a climate change mitigation tool as well as potential alternatives solutions to voluntary offsetting. The findings show that consumers are hesitant about offsetting their flight emissions either due to the lack of knowledge or due to their distrust towards voluntary offsetting. Participants did not see that they alone would be responsible for offsetting their emissions from flying and very few had offset their flights before, which could increase the importance of other mitigation efforts. However, should voluntary offsetting succeed as an emission reduction tool, there are indications that there is a need for regulations, transparency and overall, an increase of information around voluntary offsetting. Consumers as well as researchers have concerns regarding whether voluntary offsetting projects deliver on their promises, thus also indicating a need for more research on the long-term environmental impacts of voluntary offsetting projects.

Key words
Voluntary offsetting (VCO), VCM, aviation, consumer behaviour, sustainability, sustainable aviation fuel (SAF)

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Tiivistelmä

Ilmastonmuutos on suuri uhka yhteisöille sekä luonnollemme. Asiantuntijat ovat suositelleet rajaamaan ilmastonlämpenemistä 1,5 celsius asteeseen, jotta minimoisimme ja välttäisimme pysyvät muutokset ilmastoon. Ilmailualalla on ehdotettu useita mahdollisia ilmastonmuutoksen hillitsemiseen keskittyviä ratkaisuja, joista yksi on vapaaehtoisen päästökompensaation lisääminen. Tämä pro-gradu tutkielma tutkii kuluttajien käyttäytymistä ja näkemyksiä vapaaehtoista päästökompensaatiota kohtaan. Toteuttamalla kvantitatiivinen kysely kirjallisuuskatsauksen tuella pyritään saada selvyyttä siitä kenen vastuulla kuluttajat kokevat vapaaehtoisen päästökompensaation olevan sekä onko se mahdollinen tapa minimoida ilmailualan päästöjä. Löydökset viittaavat siihen, että kuluttajat eivät tiedä vapaaehtoisestä päästökompensoinnista tai eivät luota siihen. Tämän kritiikin myötä, tutkielma myös käsittelee mahdollisia korvaavia tapoja lieventää ilmastonmuutosta ilmailualalla. Kyselyn tulokset osoittavat, että vaikka ihmiset ovat huolestuneita ilmastonmuutoksesta, suurin osa ei ole kompensoinut lentojensa päästöjä ja eivät koe, että päästökompensaation pitäisi olla kuluttajien vastuulla. Tämä viittaa siihen, että muita toimia tarvitaan päästöjen pienentämiseen ja nämä toimet voivat olla kulutuksen vähentämistä, vastuullisen polttoaineen lisäämistä tai muiden innovaatioiden kehittäminen ilmailualalla. Kuluttajille sekä tutkijoilla on herännyt kritiikkiä vapaaehtoista päästökompensaatiota kohtaan minkä vuoksi lisätty sääntely ja läpinäkyvyys sen ympärillä näyttäisi olevan tarpeen. Lisää tutkimusta tulisi tehdä asian saralla ja selvittää vapaaehtoisen päästökompensoinnin pitkäaikaisia vaikutuksia luvattuihin asioihin. Näillä tavoilla on mahdollista varmistaa vapaaehtoisen päästökompensoinnin toimivuus ilmastonmuutoksen vaikutusten rajaamisessa mutta tällä hetkellä näyttää siltä, ettei kompensointi ole kuluttajien suosiossa.

Asiasanat
Vapaaehtoinen päästökompensaatio, ilmailuala, vastuullisuus, kuluttajien käyttäytyminen, ilmastonmuutos

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ABBREVIATIONS

CO_2	Carbon Dioxide
CORSIA	Carbon Offsetting Scheme for International Aviation
CM	Carbon Market
EU	European union
EU ETS	European Union Emission Trading Scheme
GHG	Greenhouse Gas Emissions
GWP	Global Warming Potential
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IPCC	Intergovernmental Panel on Climate Change
NO_x	Nitrous Oxides
NGO	Non-governmental Organization
SO_2	Sulphur Oxides
SAF	Sustainable Aviation Fuel
VCM	Voluntary Carbon Market
VCO	Voluntary Carbon Offset
RCM	Regulated Carbon Market
UNFCCC	United Nations Framework Convention on Climate Change
WTP	Willingness To Pay

1 INTRODUCTION

This thesis begins with providing an introduction on the research topic. Firstly, the background information on the connection between climate change and the aviation industry is provided. After which the voluntary carbon market and use of voluntary offsetting within the aviation industry is presented. This chapter presents the main research question as well as the two sub-questions related to the main question. Followed by this, the research boundaries are addressed after which the motivation behind this research topic is explained. Lastly, this first chapter presents the structure of this thesis in its entirety.

1.1 Background

Climate change is one of the key problems today that need to be tackled. The Intergovernmental Panel on Climate Change (IPCC) has highlighted that action needs to be taken against climate change and indicated that a global warming of 1.5°C should not be reached. In order to be able to remain under the 1.5°C global warming, all industries need to take actions in order to reduce their GWP. The Paris Agreement set a goal to limit global temperature increases to well below 2°C above pre-industrial levels, requiring comprehensive strategies to mitigate emissions from all industries (UNFCCC, 2015). Recent report by the IPCC indicate that there is more than a 50% possibility that the global temperature rise will either reach or surpass 1.5 degrees between the year 2021 and 2040, which is even sooner than previously expected (IPCC, 2023). The findings in the recent IPCC report highlight that in order to limit the temperature rise under 1.5 degrees will require more GHG emission reductions.

While there are many emissions which contribute towards global warming, carbon dioxide (CO_2) emissions have been identified as one of the main drivers of climate change. In 2017 the direct emissions cause by aviation accounted for 3.8% of total CO_2 emissions within the EU which means that if the aviation industry would be a country it would within the top 10 emitters (European Commission, n.d.-b). While air travel reduced significantly due to COVID-19, the International Civil Aviation organization (ICAO) found that the seat capacities and passenger quantities globally have reach around 80% of the pre-pandemic levels (n.d.). ICAO has suggested certain actions in order to reduce the emissions caused by that aviation industry such as operational improvements, the use of technological advancements as well as offsetting carbon emissions. As society grapples with the urgency to address climate change, the aviation industry faces pressure to reduce its environmental impact. Voluntary carbon offsetting has emerged as a strategy to some as it is meant to enable consumers to mitigate their own environmental consequences caused by air travel. While voluntary carbon offsetting has been introduced as a potential solution in the

fight against climate change, it is a controversial one. There have been concerns raised regarding the reliability, regulations, and the actual feasibility of offsetting.

The Kyoto Protocol in 1997 established mechanisms for the global compliance of carbon markets. Since then, the carbon markets (CM) and the voluntary carbon markets (VCM) have grown significantly, and it is predicted that they will keep growing. While these markets have grown, they are also heavily criticized, leaving consumers confused on the reliability of offsetting schemes. As voluntary offsetting has gained some prominence, it is crucial to understand the perspective of consumers, who play a pivotal role in determining the impact of voluntary offsetting and the role it plays. Existing literature on the topic of voluntary offsetting within the aviation industry focuses heavily on the willingness to pay and how the environmental knowledge of consumers impacts their offsetting habits.

There is a gap in current research regarding the distribution of the offsetting responsibility (Karhunmaa et al., 2023) as well as whether there are alternatives to voluntary offsetting since existing literature mainly focuses on the factors which affect the consumers' willingness to pay (Choi et al., 2018; Cordes et al., 2023; Ritchie et al., 2021; B. Zhang et al., 2022a). This research will aim to provide better understanding on how consumers view their responsibility regarding voluntary offsetting as well as their opinions regarding the sustainability of flying.

1.2 Research Questions

The focus of this research is placed on voluntary offsetting and the aviation industry. The main research question for this study is: *Who do consumers deem to be responsible for the environmental impacts of flying*.
In order to address the primary research question, the following sub-questions are also addressed:

1. *What is the viability of voluntary offsetting as a climate change mitigation tool and are there alternative tools?*
2. *Who is responsible for voluntary offsetting and aviation emissions?*

The research questions have been formulated in order to address the research gaps identified earlier. The first research gap is the distribution of responsibility for voluntary offsetting (Karhunmaa et al., 2023). This is addressed with the main research question "who do consumers deem to be responsible for the environmental impacts of flying" and the sub-question "who is responsible for voluntary offsetting and aviation emissions?". Additionally, existing research has identified that consumers do not trust voluntary offsetting (Gössling et al., 2009; Haug & Hassinggaard, 2022; Karhunmaa et al., 2023; B. Zhang et al., 2019). Because of this lack of trust, the sub-question "what is the viability of voluntary

offsetting as a climate change mitigation tool and are there alternative tools" is asked. When looking into the viability of voluntary offsetting it is important to understand the different variations of carbon offsetting, the challenges and benefits and the potential alternatives for voluntary offsetting. The objective of these questions is to provide further insight on the current status of voluntary offsetting as a climate change mitigation tool within the aviation industry and potential future trends regarding it. This research should provide some guidelines on where future research should focus on and the findings could be utilised when governments and organizations decide how to develop the regulations regarding offsetting as well as how they will utilise voluntary offsetting in their climate change mitigation plans based on the habits of consumers.

1.3 Research Boundaries

This research aims to look at the current status of voluntary offsetting as a climate change mitigation tool and what consumer perspectives are towards the mentioned tool. This is done by conducting a literature review to provide the theoretical framework and by conducting a survey directed towards consumers to verify existing information as well as provide new insights on the matter. The largest group of participants were under the age of 35, which allows to draw conclusions regarding the perspectives of young consumers. The theoretical framework focuses on voluntary offsetting within the aviation industry in order to narrow down the scope. Specifically, primary focus has been placed on the perspectives and feelings consumers have regarding the sustainability of the aviation industry and the use of voluntary offsetting.

1.4 Motivation for research

There are few factors which explain the motivation for this research. Firstly, there is a severe need to mitigate climate change in order to avoid long-lasting or even irreversible impacts (IPCC, 2022). The aviation industry is a carbon intensive industry which may have the potential to mitigate its emissions. Because of the negative environmental impacts caused by air travel, I wanted to look into the solutions which have been provided in order to address these issues. As voluntary offsetting has been presented as a potential and a vital tool in mitigating the emissions from air travel, I was curious what the public perception regarding it was. Furthermore, I wanted to know whether it could truly be a feasible tool in mitigating climate change or whether alternative solutions need to be considered. Having recognized the increasing focus on voluntary offsetting I wanted to research further the feasibility of it within the aviation industry.

Existing literature on the topic has seemed to mainly focus on the willingness to pay of consumers and which variables increase their willingness to pay for voluntary offsetting. However, I would like to focus on whether consumers felt responsible for the emissions of air travel in the first place and whether based on their habits, it could be a feasible option. I believe that this research would address questions which have not yet been answered and could further contribute to existing research.

1.5 Thesis Structure

This thesis is structured into six overall chapters. In the first chapter, background information about the aviation industry and voluntary offsetting is provided. The first chapter also introduces the research questions, research boundaries and the motivation for this thesis. The second chapter introduces the theoretical framework of voluntary offsetting by conducting a literature review. This chapter looks into the connection the aviation industry has to climate change and the different solutions which have been offered in order to address the negative climate impacts caused by it. The main focus is placed on voluntary offsetting and the consumer behaviour relating to it. The third chapter introduces the methodology used for this thesis. This includes the research design, data analysis methods, socio-demographics of the survey participants and the research ethics. This chapter also explains why a quantitative survey and the analysis methods chosen were used for this thesis. Chapter four introduces the findings of the survey conducted. The findings have been divided into sub chapters which look into consumer behaviour and perceptions related to voluntary offsetting, the responses related to climate change and other environmentally friendly habits participants may have. Chapter five contains the discussion where the potential implications of the findings and their correlations to existing literature are presented. The discussion focuses on the research questions and combines both the data gathered through primary as well as secondary data. This chapter also discusses the potential limitations of the research and provides recommendations for future research based on the findings made. Chapter six is the final chapter which summarizes the findings of the thesis and concludes the results.

2 THEORETICAL FRAMEWORK

This chapter includes the theoretical framework which relates to the aviation industry, voluntary offsetting and the consumer behaviour relating to the first two. The contents of this chapter have been formulated by conducting a literature review for which two primary databases have been used: Web of Science and Google Scholar. Literature was found by conducting a keyword search. When looking into voluntary offsetting the literature needed to include a connection between voluntary offsetting and how consumers perceived the topic. However, when providing more general background information, for example, relating to how aviation industry impacts climate change, the literature did not always relate to voluntary offsetting. The literature used dates between 2008 and 2023, with an emphasis being placed on more recent literature that has been published within the last 5 years.

This chapter begins by providing an overall look into the aviation industry and its impact on climate change. Following this, the emission reduction goals made within the EU as well as on a national level within Finland are introduced as they also guide the future requirements within the aviation industry. The regulations currently in place as well as those that are being planned regarding to carbon offsetting as well as voluntary offsetting are presented. Next the existing literature relating to voluntary offsetting is presented as is its use as a climate change mitigation tool. The most common carbon offsetting schemes are introduced in this chapter, as are the potential alternative solutions in terms of mitigating climate change related emissions within the aviation industry. This chapter also goes into the theoretical framework focusing on the consumer behaviour in terms of voluntary offsetting with the aviation industry.

2.1 Climate Change and the aviation industry

The Intergovernmental Panel on Climate Change (IPCC) report shows that greenhouse gas (GHG) emissions continue to rise and there are increasingly more perceived impacts occurring due to climate change (IPCC, 2022). The current actions against climate change are not sufficient to stop warming to reach 1.5°C, which has been thought to be a threshold that should not be exceeded (IPCC, 2022). GHG emissions, specifically carbon dioxide (CO_2) emissions, contribute significantly towards global warming (Warburg et al., 2021). The majority of climate impacts within aviation industry come from the use of fossil fuels in jet engines. According to Lee et al. (2021), "aircraft engines have burned more than 1 billion litres of fuel per day in the years 2016-2019". In addition to releasing CO_2 emissions, air travel also produces non-CO effects due to nitrogen oxides (NOx), vapour trails and cloud formation (Niklaß et al., 2020). Even though the CO_2

emissions are perhaps the most talked about emissions related to the aviation industry, approximately two-thirds of the impacts aviation has on the climate come from non- CO_2 effects (Brazzola et al., 2022). When nitrous oxide (NOx), sulfuric dioxide (SO_2), water vapor and particulate matters such as soot are emitted in high altitude it impacts the physical and chemical properties of the atmosphere (D. S. Lee et al., 2021). The IPCC (2018) has highlighted the important of achieving and sustaining "net-zero global anthropogenic CO_2 emissions and declining net non- CO_2 radiative forcing would halt anthropogenic global warming on multi-decadal time scales". This indicates that also the aviation industry needs to focus on their non-CO_2 effects, in addition to CO_2 emissions (D. S. Lee et al., 2021). One of the key solutions to mitigate climate change that were introduced in the IPCC AR6 report was to decarbonize aviation and shipping.

When measuring the impact flying has on the environment there are many variables that determine the actual impact a passenger has during the flight. The capacity of the flights and the class that has been travelled in impacts the number of emissions. Those traveling in business and first class have a higher footprint compared to those traveling in economy (Bofinger & Strand, 2013). Additionally, direct flights cause less emissions than stop-overs, thus when calculating your emissions for the travel each layover needs to be included (Baumeister, 2017). Baumeister also found modern aircrafts to be more fuel efficient than older models, thus the airline fleet plays a part in the emissions produced.

2.2 Emission reduction goals

2.2.1 Paris agreement

The Paris Agreement is a legally binding international treaty focusing on climate change. 196 Parties adopted the agreement at the United Nation's Climate Change Conference (COP21) in 2015. The goal of the Agreement is to hold odd the increase of global average temperature to "well below 2°C above pre-industrial levels" as well as "to limit the temperature increase to 1.5°C above pre-industrial levels" (UNFCC, n.d.). Under the Paris Agreement all parties are required to set national targets to reduce emissions and to report them regularly (UNFCC, n.d.). As stated by UNFCCC, commitments from countries to reduce their emissions are included in the Agreement and every five years each country needs to provide an updated national climate action plan. While the Paris Agreement is a major milestone regarding the fight against climate change, there have been indications that the current plans presented are not sufficient to reach the set goals (IPCC, 2023).

2.2.2 Carbon neutral by 2035

The European Union (EU) has set a goal to be climate-neutral by 2050 and as a member state of the EU, Finland is required to develop their own national long-term strategy focusing on how to reduce their greenhouse gas (GHG) emissions to meet their commitments stated by the Paris Agreement as well as the objectives set by the EU (European Commission, n.d.-a). Finland has set a goal to be carbon neutral by 2035 and after that Finland aims to become carbon negative (Ministry of the Environment, 2022). Every industry needs to contribute to the reduction of GHG emissions, thus also including the transportation industry which is where aviation falls under. Regarding aviation policies, the emissions caused by aviation within the EU are covered under the Emissions Trading System and the emissions caused by international aviation are adopted by ICAO (European Commission, n.d.-b). Within Finland there is only one national airline, Finnair, of which the government owns the majority of shares (Finnair, 2023). Since Finnair is mainly owned by the government, the policies set by the government of Finland, directly impact their investments.

2.3 Carbon offsetting policy & regulations

"Carbon offsets allow carbon to be reduced by compensating the excess emissions in one location through carbon reductions in another" (Bumpus & Liverman, 2008). Various carbon offsetting schemes have become increasingly more common since the first carbon offsetting project was implemented in 1989 by Applied Energy Services with an investment of 2 million USD towards reforestation in Guatemala (Galatowitsch, 2009). In 1992 the Kyoto Protocol defined the initial offsetting provisions under the Clean Development Mechanism (CDM), which entered into force in 2005. (UNFCCC, n.d.). The Kyoto Protocol allowed developed countries to offset their emissions by investing in environment-positive projects in developing countries (Bumpus & Liverman, 2008).

In 2016, the Carbon Offsetting and reduction Scheme for International Aviation (CORSIA) was adopted which requires airlines to purchase emission reductions to offset the emissions that have exceeded the target levels (IATA, 2022). In addition to the required offsets, voluntary offsetting of flights has emerged as a possibility for consumers. CORSIA has established mandatory schemes in order to achieve carbon neutrality which primarily relies on offsetting, however, questions have been raised regarding offsetting credits in terms of their "permanence and additionality" (Bergero et al., 2023).

In Finland there is no official policy or regulations that concern voluntary offsetting. Previously, voluntary offsetting was regulated under the Money Collection Act. The Money Collection Act was amended in 2021 to allow voluntary carbon offsetting services to be provided without a money collection

licence (Laine et al., 2021). As stated by the Ministry of the Environment in Finland, "the development of voluntary carbon markets in Finland are guided by EU regulation and international agreements". A study conducted by the Ministry of the Environment also showed that separate national solutions regarding voluntary offsetting could become outdated and thus should be avoided (Laine et al., 2021). The European Commission has proposed a certification of carbon removals which would aim to improve the "EU's capacity to quantify, monitor and verify carbon removals" (European Parliament, 2023).

While there is no official policy or regulation in Finland concerning the VCM, the Ministry of the Environment and the Ministry of Agriculture and Forestry published a guide on the good practices for VCM in February 2023 (Ministry of the Environment, n.d.). The published guide outlines the good practices for both producers and byers of carbon credits and was formulated based on EU regulations as well as international guidelines.

2.4 Voluntary carbon offsetting

Voluntary carbon offsetting has emerged as an option which allows consumers to purchase carbon credits that aim to offset their emission. Many airlines, as well as third-party offset providers, offer consumers the opportunity to purchase carbon offsets. These offsets are invested in projects that either remove or reduce an equivalent amount of carbon dioxide from the atmosphere (Gössling et al., 2007). There are two main categories of carbon markets: the regulated carbon market (RCM) and the voluntary carbon market (VCM) (Haug & Hassinggaard, 2022). The voluntary carbon market VCM allows governments, non-governmental organisations (NGOs), businesses and individuals to offset their emissions outside of the regulations financially (Liu et al., 2021). According to Warburg et al. carbon offsetting has increased in popularity since 2005 as the offsetting methods became more established (2021).

Since the VCM is not subject to the same regulations that the RCM is, it has been surrounded with controversy and uncertainty (Lange et al., 2017). In response to the negativity surrounding VCOs, certain standards and protocols were established to improve their credibility (Haug & Hassinggaard, 2022). While there have been efforts that aim to improve VCO schemes there are also questions regarding to what extent these schemes can reduce CO_2 from the atmosphere and if these projects would have occurred even without the VCO schemes (Lange et al., 2017).

While airlines are required under CORSIA to offset their emissions that exceed target levels, many airlines have begun to offer their customers the option for them to offset their flights under VCM. Often these are powered by a third-party operator operating within the carbon market. There are various different offsetting schemes which consumers can contribute to such as sustainable aviation fuel or climate projects. To summarize, voluntary offsetting offers

consumers the choice to compensate for the emissions associated with their air travel, theoretically contributing to a reduction in net emissions.

2.5 Carbon offsetting schemes

Offsetting activities can be grouped into four broad categories as identified by Ramseur. These four categories are "(1) biological sequestration (2) renewable energy projects); (3) energy efficiency and (4) reduction of non- CO_2 emissions" (Ramseur, 2009). Many carbon offsetting schemes are focused on increasing the carbon stored by trees, for example through planting trees as well as preserving forests. Another method is by replacing the fossil fuels used by developing renewable energy projects (Polonsky et al., 2011). Within the aviation industry a newer scheme has emerged along with the use of biofuels in place of jet fuels which have been referred to as sustainable aviation fuel (SAF). As an example, within Finnair's website their carbon offset service is powered by CHOOSE, a climate-tech company. Their offset service only accounts for CO_2 emissions as well as only the direct emissions. Once you have decided to offset your flight you can decide how much you would like to allocate towards SAF and how much you would allocate to climate projects that "reduce, capture, or avoid greenhouse gas emissions"(Finnair, n.d.). Currently Finnair has two climate projects, one of which is a mangrove reforestation project in Pakistan and the other is a forest protection project in Indonesia. There are debates occurring regarding how climate projects offset emissions and how they should be measured to ensure that the projects offset emissions.

While the standard of carbon offsetting has relied on various climate projects such as reforestation, another option has emerged with biofuel used for aviation, otherwise known as sustainable aviation fuel (SAF) (Capaz et al., 2021; Chao et al., 2019). SAF utilises biofuels instead of traditional jet fuel and while there are finding that indicate that it would produce less CO_2 emissions, the production of the biofuels used is not yet sufficient to replace jet fuel (Abrantes et al., 2021; Shahriar & Khanal, 2022). Barke et al. has recognized that SAF can potentially be a solution to reducing emissions within the aviation industry (2022). However, they also found that SAFs have significantly higher production costs, thus reducing the economic viability of SAFs as a primary fuel source. SAF focuses on the reduction of CO_2 emissions but does not take into account the non-CO_2 effects (David S. Lee et al., 2023). In order to increase the competitiveness of SAFs there are political measures needed that would allow a larger industrial scale production of SAFs (Barke et al., 2022).

2.6 Reliability & regulations of VCOs

There are many challenges with voluntary carbon offsetting as the reliability of many offsetting schemes have been called into question (Guix et al., 2022; Haug & Hassinggaard, 2022). One challenge is that while the reduction of CO_2 emissions plays an important part in climate change mitigation, also non- CO_2 effects should be considered. Brazzola et al. (2022) found that neutralizing the CO_2 emissions from aviation without reducing non- CO_2 effects lead to up to 0.4 degrees Celsius of additional warming. Highlighting the importance that while addressing the CO_2 emissions of aviation is important it needs to be combined with reducing also non- CO_2 effects. Becken & Mackey (2017) found that carbon offsetting "does not reduce atmospheric concentrations of CO_2 in the atmosphere". Which is why they state that carbon offsetting should not be the first response against climate change (Becken & Mackey, 2017). As there are many different types of climate projects offered through many providers it may be challenging to comprehend which of these projects can be trusted. Kreibich & Hermwille do raise the point that while there are criticisms concerning offsetting, should the risks be minimized through regulations and proper research, there may be a future for offsetting within sustainability (2021).

As mentioned before, CORSIA requires offsetting from airlines when they have exceeded target levels and have regulated these offsets. However, voluntary offsetting does not fall under CORSIA. At this moment the voluntary carbon market remains rather unregulated, even though there have been standards introduced to address the lack of regulations. Finland's Ministry of the Environment published their minimum criteria for good carbon offsetting (Ministry of the Environment, 2023). These include the following: additionality, solid accounting method, solid baseline, monitoring and reporting, permanence, independent verification, transparency, Do No Significant Harm principle, avoiding double counting and avoiding carbon leakage. The guidelines offered do outline any legislation which is applicable to voluntary offsetting within Finland. Before 2021 companies offering offsetting services were required to obtain a permit for fundraising. The fundraising legislation was adapted in 2021 to exclude offsetting actions, thus removing their need to receive obtain a fundraising permit (Laine et al., 2021). There is, however, a specification that this only excludes companies offering offsetting services that can be verified and quantifiable. After this legislative change, the consumer protection act no longer applies to the offsetting industry as it does not apply to the actions that have no commercial goals. This means that there is no authority supervising voluntary offsetting within Finland as they are awaiting for guidelines regarding the subject from the EU level (Laine et al., 2021; Ministry of the Environment, n.d.).

2.7 Consumer behaviour & voluntary offsetting

The global discourse on sustainability and climate change has reached unprecedented levels due to the level of urgency and its important. As scientific evidence on the urgency of climate change continues to increase, understanding the public perception and how it impacts their consumption habits becomes important. The public perception and the changes in consumption habits of individuals is a crucial factor of the success of climate change mitigation and the sustainable development efforts being made (Van de Ven et al., 2018; Whitmarsh et al., 2021). The rise of environmental awareness, amplified by scientific reports on climate change, has led to increased "flight guilt" among consumers. Individuals are becoming more conscious of the carbon footprint associated with air travel, influencing their decisions regarding frequency and necessity of flights (Gössling et al., 2018). This guilt, often fuelled by media coverage of climate-related events, contributes to a growing trend of eco-conscious consumerism. Additionally, the stigma associated with frequent flying, particularly for non-essential purposes, has prompted consumers to revaluate the societal acceptability of their flight consumption habits (Nicholls et al., 2020). Environmental awareness and social pressure and norms are influential factors in determining consumer choices, with potential consequences for the aviation industry.

Recently studies have emerged that look at the different behaviours consumers have regarding voluntary offsetting. Gössling et al. (2012) states that Psychological, economic, and sociodemographic variables may all play a role in shaping consumer attitudes and behaviours. The majority of these studies focus on the willingness consumers have to pay for offsetting services in hypothetical scenarios (Árnadóttir et al., 2021; Berger et al., 2022; Choi et al., 2018; Lu & Shon, 2012; B. Zhang et al., 2022b). There has also been discussions on whether voluntary offsetting would reduce the environmental guilt felt by travellers, thus encouraging them to travel more often (Árnadóttir et al., 2021; Bösehans et al., 2020; Kerner & Brudermann, 2021). Bösehans et al. (2020) study indicated that overall air travellers are supportive of carbon offsets, however, there was no evidence that integrated carbon offsets would reduce the guilt associated with flying or their likelihood of choosing said flights. However, it is important to note that in this study the offsets were integrated within their ticket price instead of purchased separately.

There are many factors which affect the consumers' purchase decision regarding aviation VCOs. These factors include the consumers' environmental values (Choi et al., 2016), their existing understanding regarding carbon offsetting (Lu & Wang, 2018) as well as the social norms (Ritchie et al., 2019). Haug & Hassinggaard (2022) explored the relationship that young Danish consumers have regarding carbon offsetting schemes. This study found that sustainability knowledge of consumers is tied to their willingness to contribute to aviation VCO schemes. It has also been found that the way VCOs are

communicated and marketed (Berger et al., 2022; Zhang et al., 2019a; Zhang et al., 2021) and the trustworthiness of aviation industry and airlines (Baumeister et al., 2022; Zhang et al., 2019a) can impact the behaviour of consumers' purchasing of VCOs. While others have found that sustainability knowledge affects whether consumers contribute towards voluntary offsetting, according to Berger et al. passengers are mostly unwilling to offset their flights even though they may be conscious about sustainability (2022). Theoretical models have also been used to explore the cognitive factors which impact the purchase behaviours of consumers regarding VCOs in the aviation industry (Ritchie et al., 2019; B. Zhang et al., 2022b).

Many consumers feel powerless against climate change as they feel that personal change does not impact enough (Árnadóttir et al., 2021; Jacobson et al., 2020). Consumers have felt that corporations and the political systems play the most important role in reducing CO_2 emissions of air travel (Jacobson et al., 2020). There have been findings that individuals need to experience the effects of climate change for them to change their behaviour as media information is not sufficient to promote change in behaviour (Árnadóttir et al., 2021). While some consumers show interest towards other more environmentally friendly means of traveling, they feel that there is a lack of options which prevents them to stop flying (Jacobson et al., 2020).

The study conducted by Ritchie et al. (2019) indicated that current social norms will begin to support offsetting flights more thus potentially starting a behavioural change in aviation consumers. Those that lack awareness or knowledge regarding environmental issues are less likely to experience guilt from traveling (Árnadóttir et al., 2021). This means that if awareness or knowledge is not increased, these travellers may not make any behavioural changes regarding their purchase decisions. According to Árnadóttir their study showed that even their most climate conscious interviewee was not willing to consider quitting air travel. Similar findings were made by Alcock et al. as their study found that while pro-environmental behaviour did not translate towards air travel (2017).

Karhunmaa et al. conducted a study in Finland in order to look into what role does voluntary offsetting mean to citizens and whether they trust the offsetting sector (2023). The study indicated that citizens have mixed feelings towards voluntary carbon offsetting, however it appeared that women, young adults and highly educated individuals were more likely to take part in VCOs (Karhunmaa et al., 2023). Even though certain citizens displayed a higher level of trust than some, the participants showed uncertainty towards voluntary offsetting. Existing literature shows that passengers who feel responsible or who feel a shared sense of responsibility with airlines for their CO_2 emissions are found to be more willing to pay for voluntary offsetting, whereas if passengers felt that the responsibility should be carried by airlines, passengers are less willing to pay for voluntary offsetting (Cordes et al., 2023).

2.8 Alternatives to voluntary offsetting

As previously mentioned, voluntary offsetting allows consumers to voluntarily reduce their carbon emissions by compensating the emissions in one location through carbon reductions in another (Bumpus & Liverman, 2008). There is still plenty of criticism around voluntary offsetting and carbon offsetting in general which has led some to suggest supplementary or substitutive methods. Becken & Mackey have stated that voluntary offsetting should not be the primary method utilised by consumers in order to tackle climate change (2017). Alternative strategies have been introduced and they should be looked into and analysed appropriately.

Instead of aiming to remove the caused emissions after they have happened, many consider that avoiding the emissions overall would be a preferable approach. There are actions which airlines can take and actions which consumers can take. Consumers have the possibility of reducing the amount they travel via air, choosing the most direct and sustainable route or choosing economy class to name a few options. Should consumers reduce their air travel significantly, this may lead to an overall reduction in flights and thus reducing the emissions caused by the aviation industry (Baumeister, 2020; Gössling et al., 2019). The availability and promotion of alternative, more sustainable transportation options, such as high-speed rail and electric vehicles, provide consumers with viable alternatives to air travel (Dällenbach, 2020). The convenience and accessibility of these options impact consumer choices, particularly for shorter-distance travel, leading to a potential shift in flight consumption patterns.

Airlines also have options regarding reducing their emissions outside of offsetting or offering offsetting services. Fuel efficiency is one of the mentioned methods which have the potential to reduce CO_2 emissions. By using sustainable aviation fuels (SAFs), improving the efficiency with aircraft designs and by modernizing their aircraft fleet airlines may be able to reduce their negative environmental impact. There have also been discussions revolving technological innovations within the aviation industry such as electric or hybrid aircrafts (Gnadt et al., 2019).

The first way to address emissions should be through reducing them (Sandberg, 2021) which could mean that consumers could reduce the amount they fly, they could reduce their emissions in other aspects of their life, or they could choose to fly with more sustainable airlines and in economy class as directly as possible (Gössling & Lyle, 2021). Consumption, and more specifically over consumption has been often identified as a driver for climate change due to increasing productions and increase in emissions in order to meet the demands (Jorgenson et al., 2019; Rosa et al., 2015).

The main issue consumers have regarding reducing flying is that other travel methods are not as fast, as affordable, or as convenient as flying is (Cocolas et al., 2020). The decisions consumers make depends on what they choose to be

the most important aspect, meaning that if consumers would choose the most environmentally friendly option, sustainability would need to be a priority over all other aspects (McDonald et al., 2015; Núñez Alfaro & Chankov, 2022).

3 DATA AND METHODOLOGY

This chapter focuses on the methodological choices that have been made for this thesis. Firstly, the research method used is in justified and described. Secondly, the data collection process and the socio-demographic data from the survey is introduced. Thirdly, the data analysis process is explained. And lastly, the research ethics concerning this thesis are discussed.

3.1 Research method

Research can be divided into qualitative and quantitative research. Quantitative research focuses on numerical data in aims to find patterns and averages (Wetcher-Hendricks, 2011). In order to choose the appropriate research design, the guidelines provided by Creswell and Creswell have been utilized. As stated by Creswell and Creswell (2018) quantitative approaches typically are used when variables are related to questions. Which is why this study utilises a quantitative approach as the aim was to gain new insight regarding the perception consumers have regarding voluntary offsetting within the aviation industry. While there is some existing data focusing on certain aspects of the research questions, there was no data found focusing on who consumers thought the responsibility of offsetting belonged to. The research design chosen was a survey for this study. Survey research has been defined as "the collection of information from a sample of individuals through their responses to question" (Check & Schutt, 2012). Creswell and Creswell state that survey designs help researchers answer three types of questions, one of which being "descriptive questions", the other being "questions about the relationships between variables" and the last being "questions about predictive relationships between variables over time" (2018). The questions of this survey are mainly descriptive as well as look at the relationships between variables, thus supporting a survey research design. This study's survey utilises both qualitative and quantitative research strategies as there are open questions as well as quantifiable data. However, primarily the data of the survey is quantitative.

3.2 Data collection

The survey was conducted using Typeform, which is a SaaS (software as a service) that specialises in online surveys. An online survey was chosen as is a cost-effective tool that allows immediate responses (Beauchemin et al., 2010) A total of 103 responses were collected through social media as well as the University of Jyväskylä's emailing list. The emailing list was used as the primary source for

participants as literature has found that student demographics along with employees are more likely to respond to surveys than other groups (Shih & Xitao, 2008). The social media platforms that the survey was shared on were LinkedIn as well as Instagram. The survey was shared on social media on a different date than on the university's emailing list, which may indicate the majority source of replies as there was an increase in responses when the survey was distributed through the emailing list. Responses for the survey were collected between May 4th and June 8th of 2023. The survey questions are presented in Appendix A. As seen in Appendix A. the questions presented to participants differ depending on their responses to certain questions. For example, if participants responded that they have not offset their flights before they were offered different follow-up questions to those who answered "yes". Additionally, whenever a participant has chosen an option titled "other", they are asked to elaborate on their answer. In order to verify the findings, the results are compared to existing similar studies to find possible correlations.

3.3 Data analysis & Research ethics

IBM SPSS Statistics version 26 was used to analyse data received from Typeform. This study uses a dew different data analysis methods starting with looking at the frequency distribution and cross tabulating the findings. The frequency distribution analysis is used for categorical variables as it allows to determine the variety in data, median and the average (mean) within the results (Wetcher-Hendricks, 2011). The results have been cross tabulated between each other to see response frequencies and whether there are certain trends between questions. A Pearson product-moment correlation or more commonly known as Pearson *r* has been chosen to identify potential links between the 10-point Likert-scale questions. The Pearson correlation measures the linear correlation between two data sets or variables (Denis, 2020). The correlation has values between -1 and +1. A negative value indicates that when one variable decreases the other variable increases. Whereas when the value is positive, both variables' values increase. Values of zero would indicate a lack of linear correlation (Denis, 2020). This will allow to see any potential connections there may be with the variables.

The survey's welcome page included a paragraph where the aim of the research was introduced as well as stating to participants that participating is completely anonymous and voluntary. This essentially, allows participants to decide whether they want to participate or not. Researcher bias is a potential problem that may occur which is why when there were pre-determined options provided to participants there was also an option titled "other" where they had the opportunity to provide an open answer. Additionally, researcher bias has been addressed by using a variety of sources within the literature review and utilising general keywords when searching for literature (Baldwin et al., 2022).

3.4 Socio-Demographic

The study included four background questions focusing on the socio-demographics of the participants. This section shows the four questions and the distribution of the responses. Table 1 indicated the age distribution of participants, and it showed that the majority of responders (64%) were between the age of 25-34. The second biggest age group was 18-24 which represented 20% of participants. When cross-tabulating age distribution with other variables, those between the ages of 18-34 have been grouped together and those over the age of 34 have been grouped together. Meaning that there was a total of 87 participants in those under 34 years old and 16 participants who were over the age of 34.

Table 1 Age distribution

Age group	N (Total 103)	Per cent (%)
18-24	21	20%
25-34	66	64%
35-44	8	8%
45-54	2	2%
55-64	6	6%

Table 2 shows the gender distribution of participants of which 64% are female. 35% of the participants were male and 2% of participants answered that they would rather not say. The survey also offered options for "non-binary" and "other", to which none of the participants chose these options. When gender is being compared to other variables, those who answered "I would rather not say" have been excluded due to the small sample from that answer category. However, when looking at all answer frequencies, all of the three groups from this answer are included in the results.

Table 2 Gender distribution

Gender	N (Total 103)	Per cent (%)
Female	66	64%
Male	35	34%
I would rather not say	2	2%

The highest achieved education level of participants is shown in table 3. For this question the different options were clarified by stating that the option "postgraduate" indicates a master's level education and above whereas "university/college" option refers to an Undergraduate level degree. 63% of participants stated that the highest education level that they have achieved is "university/college". 25% of participants had achieved a postgraduate level education. Then followed by 11% who had achieved a secondary school level of education and 1% who chose the option "I would rather not say". Most participants have achieved a higher education level as 11 of the 103 participants stated that so far, they have achieved a secondary school level of education. There may be participants that are attending a higher level of education but have not yet achieved it.

Table 3 Education level

Highest achieved education level	N (Total 103)	Per cent (%)
University/College	65	63%
Postgraduate	26	25%
Secondary school	11	11%
I would rather not say	1	1%

The final question which related to socio-demographic factors asked the employment status of participants is represented in table 4. 46% are employed full-time and 44% are students. 6% of participants work part-time, 3% are retired, 1% retired and 1 % chose the option "I would rather not say". Please note that the percentages have been rounded and may not total to 100% because of this. When compared to other results, this category it is only looked at employed individuals (part-time and full-time) and students. There was a total of 5 answers in the other three categories, which was too small of a sample to draw any conclusions on those demographics. Answers have been rounded to the closest full percentage, which is why the total will not equal to 100%. When comparing employment status to other research variables, the focus is placed on those who are employed both part-time and full-time and students as they were the biggest demographic group. There were few results from those who are retired and unemployed which is a too small sample size to draw conclusions from. Additionally, those who are retired, unemployed or did not want to disclose this were not able to be grouped into a larger group as they are too different statuses. It is important to note that for this question there was no possibility to choose multiple options so some of the participants may also be employed as well as students but have had to choose what they feel better describes their current employment status.

Table 4 Employment status

Employment status	N (Total 103)	Per cent (%)
Full-time	47	46%
Part-time	6	6%
Student	45	44%
Retired	3	3%
Unemployed	1	1%
I would rather not say	1	1%

4 FINDINGS

This chapter introduces the findings made by the survey conducted. The areas of focus have been divided into three sub-chapters starting with consumer behaviour and voluntary offsetting. This section looks at both the climate change related behaviour participants have and their aviation consumption habits. Furthermore, the offsetting habits of participants is introduced as well as their reasons behind offsetting habits. The following sub-chapter looks into whether participants felt that voluntary offsetting impacts climate change mitigation in either way. The final sub-chapter dives into who consumers feel to be responsible for emissions caused by air travel and who should be responsible for offsetting these emissions. Additionally, the potential findings related to alternative solutions to voluntary offsetting are introduced. The findings have been presented by providing response frequency tables, cross-tabulation tables, correlation matrixes and bar chart figures to assist with the visualization of the findings made.

4.1 Consumer behaviour & voluntary offsetting

The majority of the questions within the survey focused on consumer behaviour related to their voluntary offsetting habits. Some of these looked at the overall sustainability behaviour of participants and some focused on voluntary offsetting of flights. The first question of the survey asked participants to indicate their level of agreement to the statement "I feel worried about climate change". The scale for this question was 0-10, where 10 indicated that they fully agreed with the statement and 0 indicated that they do not agree with the statement. A clear majority (78%) answered an 8 or above level of agreement to the statement of which 35% agreed to the statement fully by choosing "10". 3% of participants chose option 0, which indicated that they did not agree to the statement, thus were not worried about climate change.

Participants were asked to indicate how often they fly on average and the results can be seen in table 5. Please note that the percentages have been rounded which may mean that they do not total to 100%. As seen in the figure 49% of participants fly a few times a year, 36% fly once a year or less, 9 % fly once every 2-3 months, 4% fly once a month and 3% fly 2-3 times a month. The only options which were not chosen was "never" and "once a week or more".

Table 5 Average flights flown

Flights taken on average	N (Total 103)	Per cent (%)
A few times a year	50	49%
Once a year or less	37	36%
Once every 2-3 months	9	9%
Once a month	4	4%
2-3 times a month	3	3%

Participants were asked whether they try to reduce their carbon footprint of their environmental impacts in other aspects of their lives. The objective was to understand whether there would be correlations between the action of consumers in their daily lives and their offsetting habits. 92% of participants said that they try to reduce their carbon footprint/environmental impact in other aspects of their lives whereas 6% do not try to do so and 2% did not know if they try. This question was cross-tabulate with the previous offsetting habits of participants which is demonstrated in table 6. The cross-tabulation showed that 18 of the 19 participants who had offset their emissions before also reduce their carbon footprint in other aspects of their lives. Only a total of 6 participants from the entire sample size said that they did not try to reduce their carbon footprint and two participants were not sure if they have tried to reduce their carbon footprint.

Table 6 Cross tabulation: offsetting and other climate actions

		Have you offset your flights before?			
		I don't know	No	Yes	Total
Do you try to reduce your carbon footprint/environmental impact in other aspects of your life?	I don't know	0	2	0	2
	No	0	5	1	6
	Yes	6	71	18	95
Total		6	78	19	103

One of the first questions of the survey asked whether participants had offset their flights before and 76% of participants answered "no". Meaning that a strong majority had not offset their flights before. 18% answered "yes, thus stating that they had offset their flights before and 6% were not sure if they had offset their flights before as they had chosen "I don't know". The majority (74%) of those who had offset their flights before do so occasionally, rarely or once or twice, whereas 26% do so on a regular basis. When asked why participants offset their

flights, they mentioned that they wanted to mitigate their environmental impact of flying and it made them feel less guilty. Participants also stated that it was affordable and convenient. Some participants did state however, that they were suspicious about offsetting, for example, due to the low prices.

The participants who have not offset their flights before were asked to explain the reasons why they had not done so previously. The most common answers were participants stating that they were not aware about offsetting and stating that it was too expensive. Both of these responses represented 37% of participants. 29% said that they did not see any benefits in offsetting. This question allowed for open answers as well and some of the participants mentioned that they did not trust airlines or offsetting in general feels like greenwashing. One participant mentioned that "the problem is shifted and not tackled at the roots when offsetting". As seen in figure 1, participants under the age of 35, were the largest demographic in each group, except in the reason "too difficult". Within this reason, the largest demographic group were female participants. Participants over the age of 35, were the smallest demographic group in each answer category, except in the too difficult category where the smallest demographic group were male participants.

Figure 1. Reasons for not offsetting flights

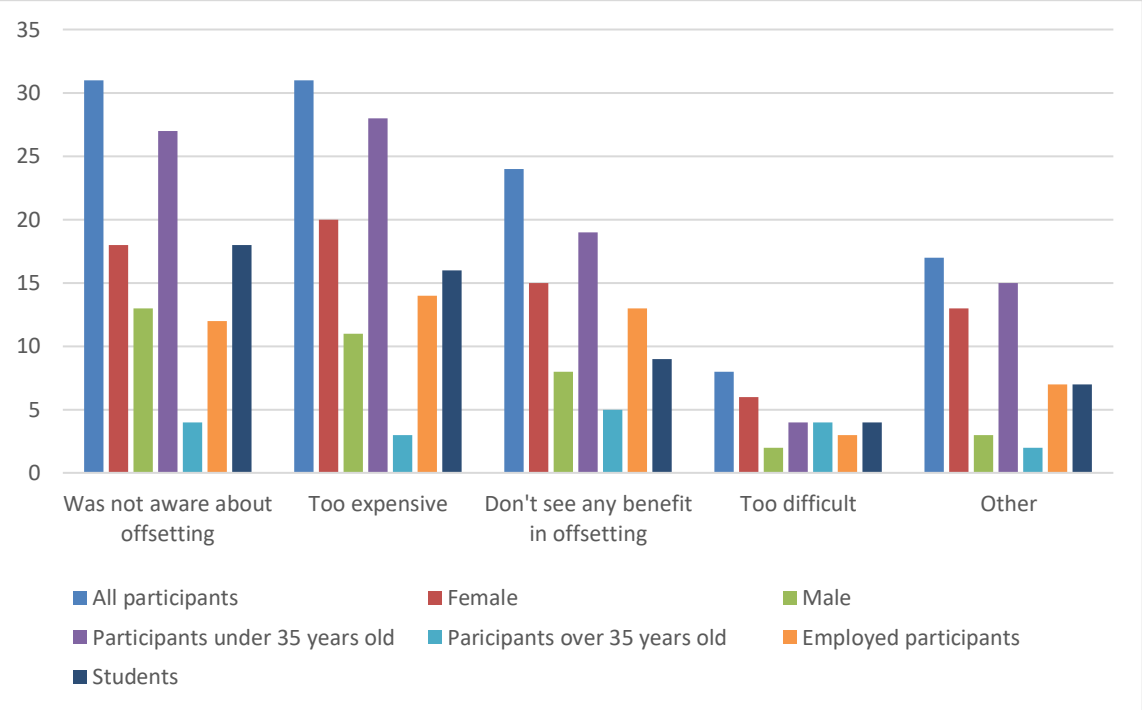


Table 7 represents the offsetting projects participants supported through offsetting. This question had the option to choose multiple choices which is why there are more responses than the 19 who had offset their flights before. Eight participants were not sure which offsetting project they had supported. Seven participants had supported climate projects, five had supported sustainable

aviation fuel projects, three had supported local community projects and renewable energy projects. Two participants chose the option "other", one of them stated that they had offset via compensate, which offsets on a variety of different projects. The other reply specified that they had supported forest conservation projects.

Table 7 Offsetting projects

Offsetting projects	N (Total 28)	Per cent (%)
I don't know	8	42%
Climate project (for example, reforestation)	7	37%
Sustainable aviation fuel (SAF)	5	26%
Local community projects	3	16%
Renewable energy projects	3	16%
Other	2	11%

In order to understand the perception consumers, have regarding voluntary offsetting they were asked to indicate their agreement to the statement "I believe that offsetting alone can impact positively on climate change mitigation". The average in this was 4.3 indicating that most leaned towards disagreeing with the statement. However, they were also asked whether they believed that offsetting does not affect climate change mitigation and the average was a 4.5 which also indicated disagreement. When asked if they believed that offsetting should be done together with other climate actions the agreement was higher at an average of 8.5 out of 10.

Table 8 depicts the cross-tabulation between whether participants had offset their flights before and if they may do so in the future. From the 19 participants who had offset their flights before, none said that they would not offset their flights in the future. 11 of those 19 participants said "yes" indicating a level of certainty that they will offset their flights also in the future. From those who had not offset their flights before or were not certain if they had previously offset their flights, only eight stated that they will not offset their flights in the future and the rest said that they "maybe" would offset or "yes" they will offset their flights in the future.

Table 8 Cross tabulation of offsetting history and future offsetting habits

		Have you offset your flights before?			
		I don't know	No	Yes	Total
Would/Will you offset your flights in the future?	Maybe	4	56	8	68
	No	0	8	0	8
	Yes	2	14	11	27
Total		6	78	19	103

Table 9 depicts how concerned females and males were about climate change and how it could correlate on their flight habits. As the average worry level about climate change was an 8.3, which was rounded down to 8. Those less concerned answered below an 8 and those more concerned answered over an 8 out of a possible 10. As seen from the cross tabulation there were both more male and female participants were more concerned than average compared to those less concerned about climate change. There were two participants for this survey who did not wish to disclose their gender and thus the sample size for this cross tabulation was 101 instead of the total 103. There were 29 women, who were less concerned than the average and 14 men less concerned than average about climate change compared to other participants. 37 women were more concerned than average, and 21 men were more concerned about climate change than the average.

Table 9 Cross tabulation of flight habits and how worried different genders are about climate change

		How often do you fly on average?					
		Once or less a year	A few times a year	Once every 2-3 months	Once a month	2-3 times a month	Total
	Women less concerned	7	15	3	2	2	29
	Women more concerned	16	18	1	2	0	37
	Men less concerned	6	7	0	0	1	14
	Men more concerned	7	10	4	0	0	21
Total		36	50	8	4	3	101

Table 10 shows the age groups of consumers and whether they have offset their flights before. Ages were grouped into those participants who were between the ages of 18-34 and those between the ages of 35-64. As seen from the table, the most participants who had offset their flights before were 18-34 years old, as they represented 18 out of the 19 participants who had offset their flights before. From those over the age of 35 only one participant had offset their flights before. Overall, the majority of the participants from this survey were consumers under the age of 35 who had not offset their flights before as they represented 61% of responses. There were 15 participants over the age of 35 who had not offset their flights in the past.

Table 10 Age and offsetting habits

		Frequency	Percent
Valid	Consumers who were not sure whether they had offset their flights before	6	5.8
	Consumers under the age of 35 who have offset their flights	18	17.5
	Consumers under the age of 35 who have not offset their flights	63	61.2
	Consumers over the age of 35 who have offset their flights	1	1.0
	Consumers over the age of 35 who have not offset their flights	15	14.6
	Total	103	100.0

4.2 Climate change and offsetting

There were three questions which focused on whether participants felt that voluntary offsetting impacted climate change. The first one asked if participants believed that offsetting alone could impact positively on climate change. An average level of agreement of 4.3 out of a possible 10 was shown. Each level of agreement got responses, and the frequencies per level of agreement ranged from 3 to 15. The most frequent levels of agreement were 0 and 4 which both received 15 responses each. The fewest responses were received in a level 10 of agreement, which received 3 responses out of the 103 participants. The next question asked whether participants believed that offsetting did not affect climate change mitigation. The average level of agreement was a 4.5 out of 10. Responses ranged from a 0 to 10, each level of agreement receiving at least 2 responses. The most frequent response was a 3, which received 14 responses and the fewest responses were in a level 9 of agreement, which received 2 responses.
Lastly, participants were asked if they believed that offsetting should be done together with other climate actions. The average level of agreement was an 8.5 out of 10. The lowest level of agreement was a 3 which received one response. And the highest level of agreement was a 10, which received 45 responses. Answers ranged from 3 to 10, each level of agreement in between received at least one response.

Participants were also asked to indicate their level of agreement to the statement "It is important to me that the flights I book are sustainable". The average level of agreement was 6.6 out of a possible 10. Answers to this question ranged from 0-10, each option receiving at least two responses. The most frequent answer was a level 8 of agreement, which received 29 responses. The most infrequent answer was a 0 out of 10, which received two answers.

A correlation matrix between the level of worry participants had towards climate change and their age was conducted which showed a negative correlation of a -0.053. Additionally, the different Likert scale questions have been analysed using the correlation matrix which is depicted in table 11. The correlation matrix will indicate whether certain answers correlate with others, either positively or negatively. The question "I feel worried about climate change positively correlated with the question "I believe that offsetting should be done together with other climate actions" with a correlation of 0.53. Worry about climate change also positively correlated with the question "How convenient is offsetting flights in your opinion". This had a correlation level of 0.27. Worry about climate change did not correlate significantly with other questions. The question "I believe that there are alternative solutions to voluntary offsetting" correlated negatives with the question "I believe that offsetting alone can impact positively on climate change mitigation" as it had a correlation of -0.26. The belief that offsetting alone can impact positively on climate change mitigation also correlated negatively with the question "I believe that offsetting does not affect climate change mitigation" with a correlation of -0.53. Additionally, there was a positive correlation found with the belief that offsetting alone can impact positively on climate change and how convenient offsetting flights was as the correlation was at a 0.22. The belief that offsetting does not affect climate change mitigation was found to positively correlate with the belief that offsetting should be done together with other climate actions at a 0.20 Pearson correlation. As specified at the bottom of the table when there is "**" marked the correlation is significant at a 0.01 level and when marked with "*", the correlation is significant at a level of 0.05.

Table 11 Correlation matrix between Likert-scale questions

		I feel worried about climate change	There are alternative solutions to voluntary offsetting	Offsetting alone can impact positively on climate change mitigation	Offsetting does *not *affect climate change mitigation	Offsetting should be done together with other climate actions	Convenience of offsetting flights?
I feel worried about climate change	Pearson Correlation	1.00	.12	.06	-.14	.53**	.27**
	Sig. (2-tailed)		.23	.57	.16	<.001	.01
	N	103.00	103.00	103.00	103.00	103.00	103.00
There are alternative solutions to voluntary offsetting	Pearson Correlation	.12	1.00	-.26**	.16	.01	.14
	Sig. (2-tailed)	.23		.01	.11	.94	.16
	N	103.00	103.00	103.00	103.00	103.00	103.00
Offsetting alone can impact positively on climate change mitigation	Pearson Correlation	.06	-.26**	1.00	-.53**	.19	.22*
	Sig. (2-tailed)	.57	.01		<.001	.06	.03
	N	103.00	103.00	103.00	103.00	103.00	103.00
Offsetting does *not *affect climate change mitigation	Pearson Correlation	-.14	.16	-.53**	1.00	-.29**	-.20*
	Sig. (2-tailed)	.16	.11	<.001		.00	.04
	N	103.00	103.00	103.00	103.00	103.00	103.00
Offsetting should be done together with other climate actions	Pearson Correlation	.53**	.01	.19	-.29**	1.00	.20*
	Sig. (2-tailed)	<.001	.94	.06	.00		.04
	N	103.00	103.00	103.00	103.00	103.00	103.00
Convenience of offsetting flights?	Pearson Correlation	.27**	.14	.22*	-.20*	.20*	1.00
	Sig. (2-tailed)	.01	.16	.03	.04	.04	
	N	103.00	103.00	103.00	103.00	103.00	103.00

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4.3 The responsibility and potential alternatives to offsetting

Participants were asked to indicate to which statement they agreed the most with of which the options were: 1. "I feel that carbon offsetting should be the airlines responsibility" 2. "I feel that both consumers and airlines should be responsible for offsetting their flights" and 3. "I feel that carbon offsetting flights should be the consumers responsibility". 50% answered that they felt that carbon offsetting flights should be the airlines responsibility, 48% stated that they felt both consumers and airlines should be responsible and 2% stated that they felt consumers should be responsible. As seen in table 12, the majority of the participants who had offset their flights before felt that offsetting flights should be both the consumers and the airlines responsibility. Additionally, 7 of those who had offset their flights before felt that offsetting should be solely the airlines' responsibility. There were two participants in the survey who felt that offsetting should be solely the consumers responsibility, these participants had not before offset their flights.

Table 12 Cross tabulation of offsetting responsibility & offsetting habits

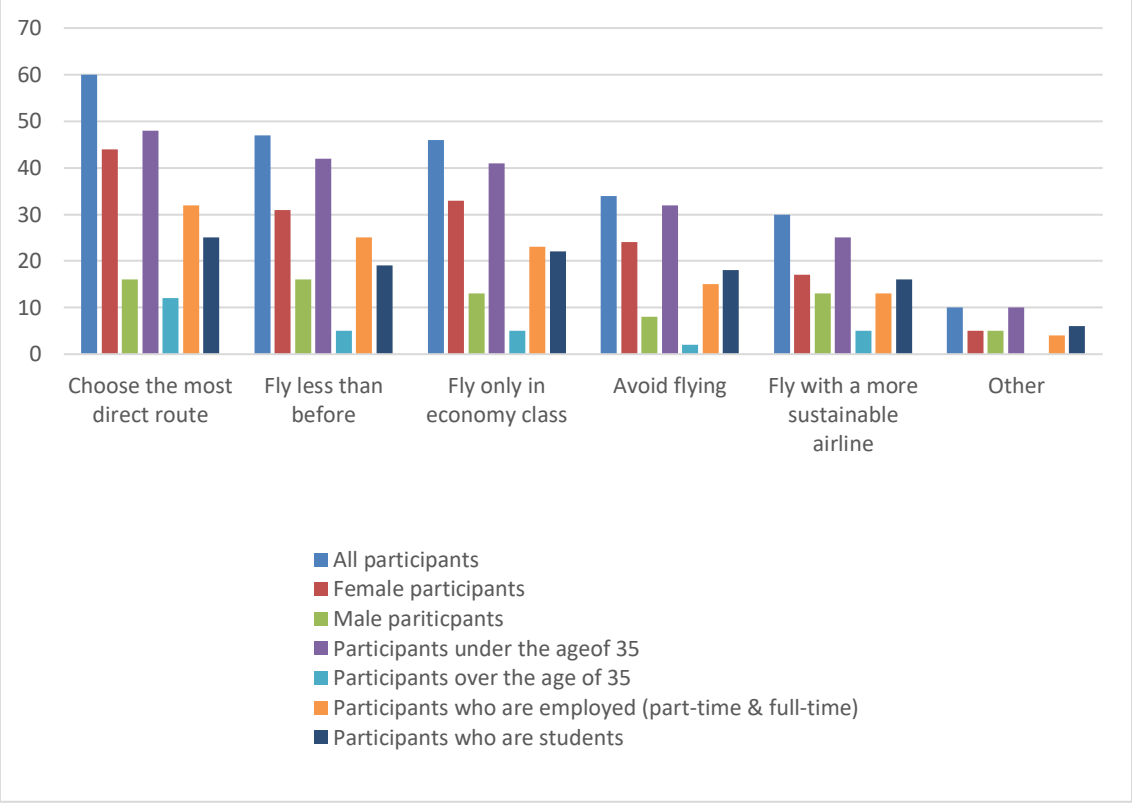
		Have you offset your flights before?			
		I don't know	No	Yes	Total
Which of the following statements do you agree the most with?		0	2	3	5
	I feel that both consumers and airlines should be responsible for offsetting their flights	5	33	9	47
	I feel that carbon offsetting flights should be the airlines responsibility	1	41	7	49
	I feel that carbon offsetting flights should be the consumers responsibility	0	2	0	2
Total		6	78	19	103

Figure 2 depicts the different actions different demographics have taken to reduce their emissions from air travel. This chart shows what actions females, males, those under 35 years old, those over 35 years old, participants who are students and the participants who are employed either part-time or full-time have taken to reduce their emissions from flying. Among all participants the most common action taken was choosing the most direct route possible, which 60 participants out of 103 (58%) stated that they do. The least frequent option was chosen by 30 participants (29%) which stated that they reduce their air travel emissions by flying with a more sustainable airline. There were 10 responses in the "other" category of which some participants clarified their reasons and some stated that they haven't taken any actions to reduce their emissions from flying

because they fly so rarely if at all. One participant stated that they select their destinations mindfully and try to avoid traveling long distances for short trips, and related to this another participant said that they aim to stay longer times in their travel destinations. Another participant stated that they reduced their emissions by also only traveling with hand luggage. Two of the participants mentioned that they have not reduced their emissions from flying and did not provide further reasoning or clarifications.

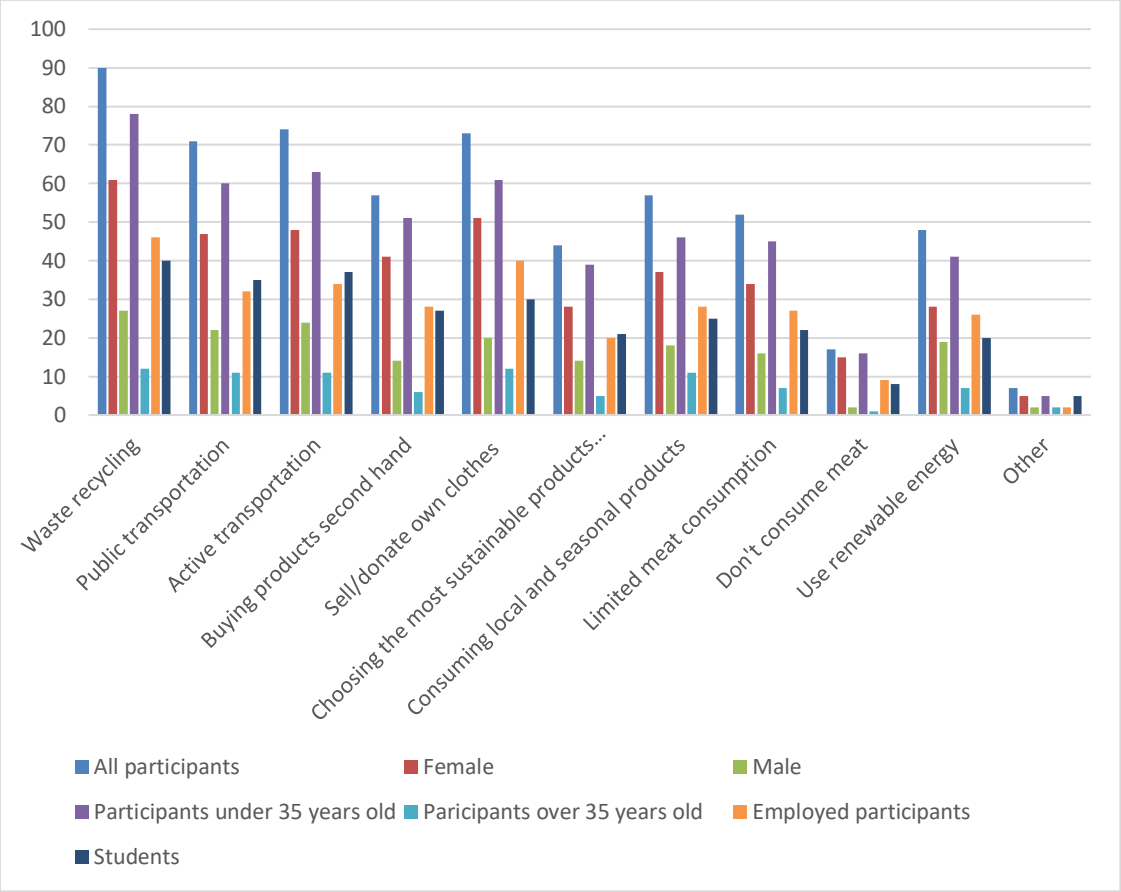
In all categories within figure 2, female participants were the most frequent demographic. And the least frequent demographic was the participants who were over 35 years old. This is also represented in the demographic questions as the majority of responders for the survey were females and under the age of 35. Among male participants, flying with a more sustainable airline was more common than avoiding flying. And with female participants choosing to fly only in economy class was more common than flying less than before. Among participants over the age of 35 flying with a more sustainable airline was more popular than avoiding flying. Other than those outliers, each demographic's most frequent choices went in the following order: choosing the most direct route, flying less than before, flying only in economy class, avoiding flying, and lastly flying with a more sustainable airline.

Figure 2. Bar chart of the other actions participants have taken to reduce their emissions from flying



As seen in figure 3, among all participants the most common way of reducing their carbon footprint in their lives was by recycling their waste. 90 participants out of the 103 (96%) said that they recycle their waste. The next most popular way was by using active transportation which represented 79% of participants and then followed by selling or donating their clothes after done using them (78%). Apart from the "other" category, the least common method was by not consuming meat at all, 17 participants (18%) in total stated that they did not eat meat. For each demographic group measured, the most common method was recycling their wastes and the least common was not eating meat. 7 participants also provided other answers in which the following methods were provided: driving a hybrid car, limiting consumption based on true need, influencing consumption habits of others, and studying sustainability. Participants over the age of 35 were the smallest demographic in each category, whereas the largest demographic in each category were participants under the age of 35.

Figure 3. Bar chart of the ways participants aim to reduce their carbon footprint in other aspects of their lives



Participants were asked to demonstrate their agreement to the statement "I believe that there are alternative solutions to voluntary offsetting". When asked

whether participant felt that there are alternative solutions to voluntary offsetting, the average response was 7.3 out of 10. 10 indicating that they fully agreed with the statement "I believe that there are alternative solutions to voluntary offsetting" and 0 indicating that they fully disagreed with the statement. The lowest agreement level indicated was a 3 out of 10 and the highest was a 10 out of 10 agreement level. The most frequent level of agreement was a 5, which represented "neither disagree nor agree" with the statement, which 33 (32%) participants chose. The second most frequent response was 10, which 25 (24%) participants chose. Other participants' answers were distributed between 3 and 10 levels of agreement.

As a follow-up a voluntary open-ended question was asked regarding what alternative solutions did participants see to voluntary offsetting. 64 out of 103 participants chose to provide their responses to this question. Some participants suggested various different taxes, flying less, not flying at all, the use on carbon neutral fuel, technological advancements within aviation, legislative changes, consumers making changes in other aspects of their lives, increased regulations and transparency and companies automatically offsetting every passenger's flights. Some answers from participants also stated that the pressure or the decision should not be left to the customer. One participant stated that the culture around flying should be changed and that instead of giving customers points for miles flown, they should award points based on the most sustainable miles. Another mentioned that all government subsidies which benefit from the aviation industry should be removed and funding should be reallocated towards sustainable development and environmental projects.

5 DISCUSSION

This penultimate chapter discusses the findings made and connects the findings to the theoretical framework. The research questions are addressed within this chapter by comparing pre-existing literature to the findings made by the survey conducted. The chapter begins by looking at the overall climate change behaviour and air travel habits of participants along with similar studies conducted. The following sub-chapter discusses consumer perspectives related to voluntary offsetting and more specifically within the aviation industry. Next, the responsibility of voluntary offsetting is addressed by trying to discern who consumers seem to carry the responsibility of the emissions caused by air travel and thus the responsibility distribution of voluntary offsetting. The following sub-chapter considers the potential alternative solutions to voluntary offsetting in terms of climate change mitigation both based on the results of the survey as well as solutions presented within the theoretical framework. The following sub-chapter discusses the recognized challenges regarding voluntary offsetting such as the feasibility of it as well as the regulative challenges discovered. Lastly, the limitations of this thesis are addressed and explained, and future research recommendations are made.

5.1 Climate Change & Aviation

When asked how worried participants were about climate change the average was an 8.3 out of a possible 10, which indicated that participants feel worried about climate change. However, on the opposing side some literature has also found that while there is a strong acceptance on sustainability issued, some are not concerned about sustainability (Haug & Hassinggaard, 2022).

The worry about climate change does not appear to correlate positively with voluntary offsetting habits of participants since while a significant percentage of participants were concerned with climate change, the majority of participants had not offset their emissions voluntarily before. When looking at the possible reasoning why participants who are more concerned than average with climate change had not offset their emissions before a few potential reasons came up. The findings indicated that many of the participants do not fly that often and hence do not see that they need to offset their emissions. In fact, many participants had reduced the amount they fly, thus essentially reducing their emissions from flying as well. Additionally, many of the participants were not aware about voluntary offsetting before and many did not trust voluntary offsetting. Existing literature does strongly criticize the reliability of voluntary offsetting as well as the lack of regulations regarding it.

Considering that only 8% of the 103 participants said that they would not offset their flights in the future, there is a clear potential for consumers to offset

their flights in the future. This rises some questions regarding the reasoning why they have not yet offset their emissions. Looking at the literature as well as the findings from the survey, participants either are not aware of voluntary offsetting, do not trust it to work or feel that they don't travel enough to need to offset. The survey result showed that 37% of participants were not aware about voluntary offsetting as a possibility which was the largest reason why participants had not offset their flights before, this was tied with the reason that voluntary offsetting being too expansive. Communication regarding voluntary offsetting may be lacking as seen from the results of this survey as well as the findings from pre-existing literature (Gössling et al., 2009; Guix et al., 2022; Karhunmaa et al., 2023).

5.2 Consumer perspectives on voluntary offsetting

Considering how few participants had offset their flights before, it was important to investigate the potential reasons which would explain this consumption habit. A few different outlooks emerged from the results, starting with the question which asked why participants had not offset their flights before. Out of the 84 participants who had not offset their flights before, 31 stated that they were not aware about offsetting at all. This was the most frequent answer, along with the reason that offsetting is too expensive. The finding that a significant number of participants are not aware about voluntary offsetting correlates with the findings made by Karhunmaa et al. as their study found that carbon offsetting is generally a" widely unknown and unsettles phenomenon" and a fourth of their respondents did not know what carbon offsetting means (2023).

Based on the findings from the study as well as the literature (Karhunmaa et al., 2023), it appears that while consumers may be willing to pay for voluntary offsetting, they do not trust it fully. Generally, voluntary offsetting criticism has been placed on the lack of transparency, the overall feasibility of it as a climate change mitigation tool and the methods themselves. There may be many reasons that could explain the distrust and when looking at the available literature it appears that the lack of regulations may be one cause. As mentioned previously, at this moment in time within Finland, as well as many other countries, the VCM is not regulated or monitored. Literature has considered whether there is enough evidence supporting the offsetting claims and due to this discussion focusing about regulating voluntary offsetting have become more prominent (Karhunmaa et al., 2023). Consumers themselves within Finland seem unaware about offsetting, which may indicate that once regulations take place and the criteria for offsetting schemes becomes stricter, there may be possibilities for consumers to be willing to offset their emissions from flying. This was supported by the survey results which showed that a significant portion of participants may consider offsetting their emissions in the future, which indicated a potential shift in their previous voluntary offsetting behaviour.

The correlation matrix that was conducted between the survey's Likert-scale questions showed a few correlations that should be highlighted. Firstly, the largest correlation was found between the question "I feel worried about climate change" and "I believe that offsetting should be done together with other climate actions", the correlation between these two was a 0.53. This could indicate that while participants on average did not strongly agree with the statement that offsetting alone impacts climate change mitigation, those worried about climate change may believe that if done together with other climate actions, it could prove to be beneficial. The result suggesting that those who are more concerned about climate change are also more supportive of the idea to implement offsetting along with other climate actions. There was one negative correlation found and it was between the questions "I believe that offsetting alone can impact positively on climate change mitigation" and "I believe that offsetting does not affect climate change mitigation" with a correlation of -0.53. This negative correlation is unsurprising as the two statements contradict each other. However, as participants' agreement levels for these statements were both near an average of 4.5 out of a possible 10, there were few participants that were strongly opinionated on the matter. Thus, explaining a possibility why, the negative correlation is not even stronger. As the belief that there are alternative solutions to voluntary offsetting negatively correlated with the belief that offsetting alone can positively impact climate change mitigation, there are implications that those who believe in alternative solutions are less likely to believe in the effectiveness of voluntary offsetting. The worry participants felt towards climate change did not appear to translate into believing in voluntary offsetting. The Likert scale related findings had similarities to Karhunmaa et al.'s findings where 33% of Finnish citizens agreed that offsetting is an effective way to mitigate climate change and only 6% viewed international offsetting actors as trustworthy (2023). Along with the findings from this study the belief that while consumers could see themselves offsetting in the future, currently there is a severe lack of trust towards the offsetting sectors and those providing offsetting services.

5.3 Voluntary Offsetting Responsibilities

When asked who do consumers deem to be responsible for offsetting the emissions caused by aviation, the participants answers indicated that they felt that the airlines should be primarily held responsible, but some did also answer that both consumers and airlines should be responsible to offset the emissions. 2 of the participants felt that voluntary offsetting should be solely the consumers responsibility. This was also represented when asked what alternatives participants saw to voluntary offsetting as many mentioned separately that offsetting should not be the responsibility of the customer and it should be automatically included in their tickets. Findings in this survey are similar to those made by Karhunmaa et al. as their survey, which focused on the perceptions of

Finnish citizens around carbon offsetting, found that many respondents felt that voluntary offsetting as a concept overall place the responsibility of climate change mitigation incorrectly as it adds the responsibility to individual citizens instead of governments and organizations (2023).

When looking at the correlation between whether participants had offset their flights before and where they felt the responsibility of offsetting lies within table X, it can be seen that none of the participants who has offset their flights before felt that offsetting should be solely the consumers responsibility. In general, only 2 participants of the survey felt that the responsibility of offsetting should be on consumers. There are correlations as well as differences to existing literature with this finding. The majority of participants who had not offset their flights before felt that offsetting should be the airlines' responsibility. This could explain why those participants had not offset their flights before as literature had indicated that if passengers feel responsible for the emissions, they are more willing to pay for offsetting.

5.4 The challenges with voluntary offsetting

While going through the survey answers as well as existing literature, there emerged a few key challenges regarding voluntary offsetting. Only a few participants were familiar with voluntary offsetting overall and even fewer had offset their flights before. Similar findings regarding lack of knowledge and information have been made by existing literature (Karhunmaa et al., 2023; Ritchie et al., 2021), indicating that voluntary offsetting is still quite unknown.. Another challenge is the distrust that individuals have towards voluntary offsetting as well as towards airlines. This distrust could be rooted from a few different places, one potential reason is the lack of regulations as well as the lack of consequences for not following through on their claims. Some studies have shown that the scepticism around offsetting is often linked to whether the projects actually deliver on their claims (Karhunmaa et al., 2023). Willingness to offset can be linked towards the trust consumers have around offsetting (Karhunmaa et al., 2023) which could explain why the majority of participants had not offset their flights before.

5.4.1 Regulations on voluntary offsetting

The lack of trust consumers have regarding offsetting could be linked to lack of regulations in place. Consumers seem to remain unaware of which offsetting schemes are reliable if any are. Considering that currently in Finland there is no legislative measures in place that monitor voluntary offsetting the distrust consumers have towards it is understandable. The Finnish Ministry of the Environment have published good practices regarding voluntary offsetting

but there currently is no authoritative figure responsible if those practices are not followed. The reason behind the lack of regulations within Finland seems to be because the EU is preparing its guidelines on the topic and member states appear to want to wait for the EU level instructions before setting regulations on a national level. It does appear that the level of distrust is so high currently towards the functionality of offsetting as well as towards the operators that regulations would need to be strict and based on the produced impact of offsetting projects.

5.4.2 Feasibility of voluntary offsetting

There are different offsetting projects that are currently on the VCM, but the most common ones seen in the aviation industry are reforestation projects, conservation projects sustainable aviation fuel, renewable energy projects and community projects. Additionality is an issue which has been raised against carbon offsetting which refers to the risk that the offsetting project would do something which would have been done even without offsetting. Another issue is that offsetting projects will most likely be implemented later than when the emissions are being caused. Considering the urgency being raised in terms of climate change action needed, it could be argued that the carbon needs to be removed at the same time as the emissions are being caused. However, even if these issues could be solved at the current state consumers do not seem to be invested in utilising offsetting services to mitigate their emissions. This consumer behaviour shows that other methods of mitigation need to be considered and should offsetting continue, projects would require regulations and accountability measures.

5.5 Alternatives to voluntary offsetting

5.5.1 Sustainable aviation fuel

While sustainable aviation fuel is often being offered as an offsetting project, it could be argued that it could also function as an alternative solution to voluntary offsetting. Should sustainable aviation fuel replace the use of jet fuel, it would hypothetically reduce the direct emissions caused by air travel. As stated earlier, there are challenges focusing on the production of sustainable aviation fuel and questions whether it can be produced at a scale that could truly replace jet fuel without producing more emissions in the production phase. If it would become possible to produce SAF at scale, there may be indications that the pricing should be automatically included in ticket prices. The findings of this study indicated that offsetting would not necessarily need to be voluntary but taken into account in air fares.

5.5.2 Reducing impact elsewhere

As existing literature places criticism from consumers (Gössling et al., 2009; Gössling & Dolnicar, 2023; Karhunmaa et al., 2023) as well as from scientists (Calel et al., 2021; Watt, 2021) on voluntary offsetting, it is important to consider the potential alternatives to voluntary offsetting. Literature has pointed towards that a large driver in climate change is over consumption which also applies to the travel habits of consumers (Van de Ven et al., 2018; Whitmarsh et al., 2021). Explaining why many have highlighted the importance of reducing consumption and flying less when possible. Participants of this study were asked what alternative actions they take regarding traveling in order to reduce their emissions, if any. Figure 2 depicted the actions participants have taken to reduce their flying related emission. The majority of participants choose the most direct route, 46% of participants have reduced their flying from before and 33% of participants try to avoid flying overall. The reduction of flying compared to before shows a shift in consumption habits. While there are many possibilities behind the reasons for participants to have reduced their air travel, one explanation is for them to reduce their emissions.

When asked whether participants try to reduce their carbon footprint in other aspects of their lives. 92% of participants stated that they do try, after which a follow-up question focusing on the ways that they have tried to reduce their impacts was asked. These results were represented in figure 3, in which you could see that from the 94 participants that try to reduce their carbon footprint, 90 (96%) recycle their waste, 74 (79%) use active transportation and 73 (78%) sells or donates their clothes once they are done using them. These were the three most popular methods, and the least popular method was not eating meat at all, which 17 participants said they do. A significant number of participants have taken actions to reduce their emissions in other aspects of their lives, which may indicate a trend that focuses more on being environmentally conscious that could translate into flying habits. Some participants had highlighted that they limit their consumption in all aspects as well as they can and prefer to buy things second hand.

5.6 Limitations & Recommendations for future research

There are a few different limitations to this study. The sample size of this survey mainly included female participants and adults under the age of 35. There were significantly fewer participants who were over 35 years old and fewer male participants than female participants. Due to this it may be unreliable to draw definite conclusions regarding the distribution of different demographic groups as another's sample size was larger than the others. While there are limitations, the research does correlate with existing literature, such as the lack of information consumers have regarding voluntary offsetting and their distrust towards

voluntary offsetting. This study showed that most participants had not offset their flights before, and many were not aware about voluntary offsetting before. Another limitation was that overall, there was a smaller sample size for this study, which is why it may be beneficial to repeat the study with a significantly larger sample size in order to verify the reliability of data.

Based on the criticisms placed both by existing research and those participating in this study, an interesting future research topic would be the feasibility of voluntary offsetting as a tool against climate change. Elaborating further on the findings of this research and making recommendations towards the future of voluntary offsetting and perhaps trying to identify potential future trends within the field. Additionally, very few participants had offset their flights before which may indicate a need for future research to focus on the reason why consumers do not offset their flights.

6 CONCLUSION

The focus of this thesis was to better understand the feasibility of voluntary offsetting as a climate change mitigation tool and to focus on where consumers placed the responsibility of voluntary offsetting. This chapter concludes the thesis by summarizing the discussions. The summarization has been done by addressing the research questions. The literature used within this thesis dates between 2008 and 2023.

The balancing between climate change mitigation while nurturing a growing industry such as the aviation industry, creates a complex situation. Due to the increasing threats of climate change, actions in order to mitigate the impacts are needed immediately. As voluntary offsetting and offsetting overall have been raised as crucial tools to reach carbon neutrality, many questions have been raised. Existing literature has focused previously on whether consumers are willing to pay for voluntary offsets within the aviation industry, whereas this research focuses on understanding the connection consumers have to voluntary offsetting as well as who do they feel is responsible for offsetting the emissions of air travel. The research focuses also on the potential alternatives to voluntary offsetting, due to the criticisms raised against it in previous literature. The findings of this survey support existing literature in the sense that participants were also sceptic towards voluntary offsetting, if they were even aware of it at all.

This research identifies that one of the main tools that has been proven to help mitigate GHG emissions is the overall reduction of emissions as consumers are generally sceptic as well as unaware about voluntary offsetting. Whether the reduction of emissions should occur through innovations which reduce the emissions from air travel (e.g. electric aircrafts and sustainable aviation fuel) or through reducing the consumption habits overall and thus reducing the emissions caused by aviation is yet to be seen. The results of the survey showed that many of the participants already do not fly often and have reduced their flying which may be a trend that will continue to grow in the future.

As consumers become more aware of the environmental impacts of air travel, their decisions are increasingly shaped by a desire to align their personal choices with broader sustainability goals. The findings from this survey have indicated that individuals are not easily willing to support voluntary offsetting due to their lack of knowledge on the topic as well as the unreliability of it. Instead, many suggested that they have reduced the amount they fly, and some supported the idea of increasing flight taxes, including voluntary offsetting within ticket prices and generally increasing prices of flights in a way that will force individuals to fly less than before. Considering that participants were shown to worry about climate change it is understandable that many of them have taken actions to reduce their carbon footprint in other aspects of their lives even though they have not offset their emissions before. While the findings of

this study showed that the majority are worried about climate change, other literature has shown that climate change worry does not necessarily translate into a change in consumption habits regarding flying.

Understanding these evolving patterns is crucial for policymakers, industry stakeholders, and researchers seeking to address the environmental challenges posed by the aviation sector and foster more sustainable consumption habits. Considering the distrust citizens have towards voluntary offsetting, as well as offsetting overall, it may be a good time for policymakers and companies to consider whether this approach is the correct response in the fight against climate change. While it is understandable that zero neutrality cannot be achieved without offsetting, perhaps the terminology itself is misleading, as the measurement and data regarding what is actually offset is limited. Despite that offsetting relies on the premise that emissions caused in one place by a certain activity can be offset by removing the same amount of those emissions elsewhere, there is little long-term data proving that this is actually the case. Even before offsetting, companies as well as individuals have donated money towards causes that aim to protect the environment, including reforestation projects. Considering that certain offsetting schemes still rely heavily on reforestation as an offsetting tool, there are questions also revolving around the additionality or lack thereof more specifically, future research should focus further on the feasibility of voluntary offsetting as well as alternative tools.

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APPENDICES

APPENDIX A: Survey

Welcome page:

"This survey will contribute towards a Master's thesis aiming to better understand the relationship consumers have with the voluntary carbon offsetting of flights.

All answers are greatly appreciated! The survey is anonymous, and all answers are treated confidentially. Participation is voluntary so if you do not want your answers sent you are free to stop answering at any time."

1. **I feel worried about climate change.**

   Please indicate your agreement to the statement above

   Opinion scale: 0-10 (0=I strongly disagree 10=I strongly agree)

2. **How often do you fly on average?**

   Please choose the closest applicable option

   a) Once a week or more
   b) 2-3 times a month
   c) Once a month
   d) Once every 2-3 months
   e) A few times a year
   f) Once a year or less
   g) Never

3. **Have you offset your flights before?**

   (Includes a link to an infographic)

   a) Yes
   b) No
   c) I don't know

If answered "Yes" in question 3 then the questions continue to question number 4, in other cases the next question jumps to question 11.

4. **How often do you offset your flights on average?**

   Please choose the closest applicable option

   a) I always offset my flights
   b) I offset my flights on a regular basis
   c) I occasionally offset my flights
   d) I rarely offset my flights
   e) I have offset my flights once or twice

5. **How have you offset your flights before?**

   a) Through an airline
   b) Through an offsetting provider
   c) Other

6. **If other chosen in question 5, please specify through what other method you have offset your flights.**

   Open question

7. **I feel less guilty when I offset flights**

   Please indicate your agreement to the statement above

   Opinion scale 0-10 (0=Strongly disagree, 10=I strongly agree)

8. **Why have you offset your flights?**

   Open question

9. **What offsetting project have you funded through offsetting your flight before?**

   a) Sustainable aviation fuel (SAF)
   b) Climate project (for example, reforestation)
   c) Renewable energy projects
   d) Local community projects
   e) I don't know
   f) Other

10. If other chosen in f, please describe what other offsetting project you have funded through offsetting your flight.

After this the questions will jump to question 14

If chosen No/I don't know in question 3, follow up questions:

11. Are you familiar with voluntary offsetting?

(Includes a link to an infographic)

a) Yes
b) Sort of
c) No

12. Why have you not offset your flight before?

a) Too expensive
b) I was not aware about offsetting
c) I don't see any benefits in offsetting
d) Too difficult
e) Other

13. If chosen other in question 12 please state your reasons

Open question

14. Would/Will you offset your flights in the future?

a) Yes
b) Maybe
c) No

15. It is important to me that the flights I book are sustainable.

Please indicate your agreement to the statement above

Opinion scale: 0-10 (0=I strongly disagree 10=I strongly agree)

16. I believe that there are alternative solutions to voluntary offsetting

Please indicate your agreement to the statement above

Opinion scale: 0-10 (0=I strongly disagree 10=I strongly agree)

17. What alternatives do you see for voluntary offsetting?

Open question

18. I believe that offsetting alone can impact positively on climate change mitigation.

Please indicate your agreement to the statement above

Opinion scale: 0-10 (0=I strongly disagree 10=I strongly agree)

19. **I believe that offsetting does** not **affect climate change mitigation.**

    Please indicate your agreement to the statement above

    Opinion scale: 0-10 (0=I strongly disagree 10=I strongly agree)

20. **believe that offsetting should be done together with other climate actions.**

    Please indicate your agreement to the statement above

    Opinion scale: 0-10 (0=I strongly disagree 10=I strongly agree)

21. **Which of the following statements do you agree the most with?**

    a) I feel that carbon offsetting flights should be the consumers responsibility.
    b) I feel that carbon offsetting flights should be the airlines responsibility.
    c) I feel that both consumers and airlines should be responsible for offsetting their flights.

22. **How convenient is offsetting flights in your opinion?**

    Please indicate your agreement to the statement above

    Opinion scale: 0-10 (0=I strongly disagree 10=I strongly agree)

23. **Have you taken other actions in order to reduce your emissions from traveling?**

    a) I try to avoid flying whenever possible
    b) I fly less than before
    c) I choose the most direct route possible
    d) I fly only in economy class
    e) I try to fly an airline that is more sustainable than others
    f) Other

24. **If other chosen in 23, what other actions have you taken?**

    Open question

25. Do you try to reduce your carbon footprint/environmental impact in other aspects of your life?

a) Yes
b) No
c) I don't know

26. In what ways do you try to reduce your carbon footprint in other aspects of your life?

a) I use public transport whenever possible
b) I use active transportation whenever I can (cycling, walking etc.)
c) I recycle my waste
d) I buy second hand products whenever possible
e) I sell/donate my clothes when I am done using them
f) I try to buy the most sustainable products available
g) I consume local and seasonal products whenever possible
h) I have limited my meat consumption
i) I don't eat meat at all
j) I use renewable energy
k) Other

27. If chosen other, in what ways do you try to reduce your carbon footprint=

Open question

28. What is your age?

a) Under 18
b) 18-24
c) 25-34
d) 35-44
e) 45-54
f) 55-64
g) 65 and over

29. What is your gender?

a) Female
b) Male
c) Non-binary
d) I would rather not say
e) Other

30. What is your employment status?

a) Full-time
b) Part-time
c) Unemployed
d) Student
e) Retired
f) I would rather not say

31. What is your highest achieved education level?

Please note that Option C refers to the equivalent of a Bachelor's degree and Option D refers to a Master's degree and Doctorate degree levels.

a) Primary school
b) Secondary school
c) University/College
d) Post graduate
e) I would rather not say

32. Do you have anything you would like to add?

If you would like to elaborate anything further, feel free to mention it here!

Open question

Ending page:

"Thank you for your time!

Your time and answers are highly appreciated!"

APPENDIX B: Survey infographic