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Pro-Environmental Behavior and Motivation to Offset Flight Emissions among Flight Passengers

Master Thesis

Manuel Henle

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Supervision

Dr. Petra Bättig-Frey
ZHAW Life Sciences und Facility Management, Grüentalstrasse 14, CH-8820 Wädenswil

Verena Berger
ZHAW Life Sciences und Facility Management, Grüentalstrasse 14, CH-8820 Wädenswil

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Abstract

Voluntary offsetting of aviation emissions by passengers is an important cornerstone of decarbonising the aviation industry and to individually contribute to climate change mitigation. Many studies have attempted to understand, predict, or promote pro-environmental behavior (PEB) in everyday life. Although a large part of the world's population is aware of climate change and its profound consequences, this awareness is not necessarily reflected in air travel behavior. To enhance the motivation to offset flight emissions among flight passengers, this study focuses on the identification of factors that have an impact on pro-environmental behavior in air travel. These factors provide the foundation to communicate convincing messages to passengers. Using a quantitative field study involving a final sample of 454 passengers, it is shown that individuals who behave sustainably in everyday life also feel obligated to do so when travelling by plane. However, there is a great deal of uncertainty regarding compensation programs and their effectiveness in offsetting emissions. The following factors show a significance in relation to flight emission offsetting behavior: obligation to offset emissions, consciousness that air travel generates emissions, the ascription of responsibility and an ecological worldview. Younger people are more influenced by their social environment and habits. Frequent flyers feel less obliged to offset their flight for emission. All other factors influencing pro-environmental behavior in everyday life have no significant impact on passengers' compensation behavior. The results thereby question the suitability of using pro-environmental theories as the only explanation for behavior. Practical solutions such as providing more opportunities to compensate flight emissions outweigh addressing norms and values in a dedicated communication strategy.

Table of Contents

1 Introduction and Motivation

1.1 Problem Analysis

Even if Switzerland's national climate targets of having net-zero greenhouse emissions by 2050 were met, it would not lead to the achievement of the minus two degrees Celsius targets which were agreed at the Paris climate conference in 2015. More extensive measures to lower carbon emissions further are urgently needed to reach the goals of the agreement (Henne et al., 2018). Thereby, air travel is extremely important within the subject of carbon emissions caused by the transportation industry (Gössling et al., 2007). Aviation accounts for eleven percent of all greenhouse gases in Switzerland in 2019 (BAFU, 2020) and estimated 2.8% of global emissions before the Corona pandemic began (Friedlingstein et al., 2020). Regulatory measures try to lower emissions in aviation such as the EU Emission Trading Scheme and other policy instruments (Presno et al., 2021). In addition to regulatory measures, airlines can contribute to decarbonize aviation by fleet modernization, operational efficiency, and the use of Sustainable Aviation Fuel (SAF) and other biofuels (Gössling et al., 2007). Unfortunately, the development of such technologies is not happening fast enough, and it is not expected that the aviation industry will outstrip the targeted gains in efficiency (Schmidt et al., 2018; Kröller-Schön et al., 2018). To avert this trend, the most effective way to reduce emissions of air travel is obviously to fly less. However, the aviation industry is expected to stabilize from the Corona crisis until 2024, after which it will resume steady growth (SWISS, 2021). Therefore, an important lever is the passengers' willingness to compensate their flight emissions. Recent studies have shown that only a small percentage of passengers are willing to offset their emissions voluntarily (Araghi et al., 2014).“We can conclude that the cost of the compensation has no meaningful influence on the decision to compensate one’s flight-related emissions in our data” (Berger et al., 2022). In an observational field study with a sample of 63,520 bookings, Berger et al. tried to find out what the willingness-to-pay for voluntary CO_2 compensation of a flight is. The mean value for voluntary compensation was just one euro. In addition, they concluded that the price of a flight compensation has no influence on the decision to compensate (Berger et al., 2022). Therefore, it is necessary to find out what drives and motivates passengers to offset their flight and to review new non-financial reasons that motivate voluntary offsetting.

1.2 Objectives and Research Question

Further to the above, the example of SWISS International Air Lines (SWISS) clearly shows that the willingness to compensate is still very low among passengers. The compensation rate on SWISS flights is only one percent as of 2021, which is still the highest rate within the Lufthansa Group (SWISS, 2021). For these low compensation numbers to be driven up, three things must be accomplished. First, the reasons why so few people compensate must be identified. Second, for a more general understanding, it must be analyzed what makes passengers behave more environmentally conscious and compensate their flight. And third, the tangibility of the offer and the transparency in communication from SWISS must be improved

accordingly. There are many studies on pro-environmental behavior (PEB) which show that factors such as demographic, social and cultural and economical factors, values, attitudes and responsibilities influence an environmentally friendly behavior (Kollmuss & Agyeman, 2002; Jensen, 2002). However, PEB in aviation differs from PEB in everyday life (Tanner, 1999). This means, for example, that people who always pay close attention to correct recycling or are involved in an environmental organization do not automatically act in an environmentally conscious manner when it comes to air travel (McKercher et al., 2010). Therefore, it is important to further analyze the different factors that enable or even restrict PEB in aviation.

This leads to the research question of this paper: *"Do the factors for pro-environmental behavior in everyday life have an influence on the likelihood that a passenger will offset his or her flight emissions, and what are the main drivers to do so?"*

The answer to the research question serves to derive communication content that should be chosen to convince passengers to offset. Accordingly, the subsequent follow-up question on the topic is how messages should best be formulated so that they encourage guests to offset their emissions.

1.3 Research Methodology

To overcome this research gap, the present thesis highlights opportunities for SWISS to establish tangible and more transparent customer communication regarding flight compensation. Qualitative information and possibilities are currently discussed within the SWISS sustainability team. This study reviews the motivators found for pro-environmental behavior on airline passengers using a quantitative questionnaire. In addition, the survey reviews what an airline could improve to create more tangible offerings for its customers. Out of these insights, the work aims to find the key motivations and derive possible messages for flight passengers which are convincing to offset flight emissions. The communication content is evaluated in the SWISS lounges by means of several small information displays and on board of SWISS aircrafts by means of announcements from the cabin crew.

At this point it should be mentioned that the author currently works at SWISS. The data and information used in this thesis regarding SWISS are used with the consent of SWISS.

2 Literature Review

In a first step, the following chapter gives an overview of environmental impacts, improvement efforts, and emission offsetting in air transport. In addition, current communication of airlines about offsetting possibilities for passengers are covered. In a second step, the theoretical foundations on the topic of pro-environmental behavior are summarised to create the basis for the empirical part of the thesis.

2.1 Environmental Impact of Air Traffic

The aviation industry is part of our modern world and connects businesses and people around the globe and is steadily growing (Lee, 2021). The International Air Transport Association (IATA) expects overall traveler numbers to reach 4.0 billion in 2024, exceeding pre-COVID-19 levels with an increase of 3% compared to 2019 (IATA, 2022). It is predicted that in 2037, 8.2 billion people travel by air per year (IATA, 2022). This growth is caused by a market deregulation which took place in 1978 as well as due to the growing middle class especially in China and India (Gössling & Peeters, 2007). Those trends led to the establishment of low-cost carriers. The creation of bargain prices and cheaper flight tickets were the reason that travelling by air was affordable for more people (Gössling & Peeters, 2007). Airfares today are around 90% lower than the same journey would have cost in 1950 (IATA, 2018). In 2018, 57% of world tourists travel to their destinations by air on 1303 different airlines with a total of 31'717 aircrafts on 45'091 routes between 3759 airports (IATA, 2018).

2.1.1 The Role of Air Travel in the Economical World

Air travel has become extremely important for our social and economical world. The aviation sector provides more than 63.5 million jobs, which account for 3.6% ($2.7 trillion) of the global economic activity (IATA, 2018). Especially in developing countries, aviation plays a crucial role in increasing economic growth (ICAO Symposium, 2005). Most commercial goods such as electronics, food, or clothes are imported by air (Gössling & Upham, 2009). Air travel also carries 35% of world trade by value, but less than 1% by volume. In addition, air transportation makes the rapid delivery of medical supplies possible, which has become very important during the COVID-19 pandemic. It also improves the quality of life by making cultural and leisure experiences possible, by enhancing standards of living, by mitigating poverty, and by promoting social inclusion through transportation to remote areas such as small islands in the middle of an ocean (ICAO Symposium, 2005).

2.1.2 Environmental Impact

Even if the cultural, social, and economical benefits caused by the aviation industry are evident, there are many environmental impacts that are caused by aviation as well and must be tackled. In the last 100 years, the global temperature has risen by 1 degree Celsius. This change in climate is leading to major impacts on our ecosystem. If temperatures continue to rise at this speed, many planetary boundaries will be crossed, such as biosphere integrity or ocean acidification. This in turn will have an impact on humanity and lead, for example, to floods, food shortages or extreme weather events (NASA, 2020). These developments hit our planet and humanity hard and would worsen the current state. Indirectly, this would also have an impact on the aviation industry. Extreme winds have a negative impact on aircraft technology, airport operations and the flying experience itself. The aviation industry is thus caught in a great tension between the benefits and the negative effects caused by it. Air transportation currently contributes a lot to the global

greenhouse gas emissions and climate change due to the combustion of fossil fuels (see Figure 1). During takeoff and landing, aircrafts produce exhaust fumes and noise that cause disturbances to surrounding residents and the environment (Upham et al., 2003). The emissions passenger aircrafts produce remain longer in the atmosphere because they are flying at an altitude of ten to twelve kilometers (Conboye & Hook, 2019). Further, aircrafts also produce various pollutants that have a negative impact on global warming. The reduction of the estimated 2.8% global CO_2 emissions from aviation is an important building block on the way to the desired state of climate-neutral transport (Thess, 2020). Besides CO_2, aviation is responsible for other emissions such as nitrogen oxides (NO_X) and water (H_2O) emitted at flight altitude. At an altitude of 8 - 13km, NO_x emissions result in a greater global warming effect (Abdullah et al., 2016). Water vapor is produced by aircraft engines at high altitude and condenses into droplets to form consideration trails or contrails which are visible and have an effect on global warming as well (Abdullah et al., 2016). These emissions and the CO_2 emissions combined, the aviation industry caused 3.5% of the anthropogenic effective radiative forcing in 2011 (Lee et al., 2021).

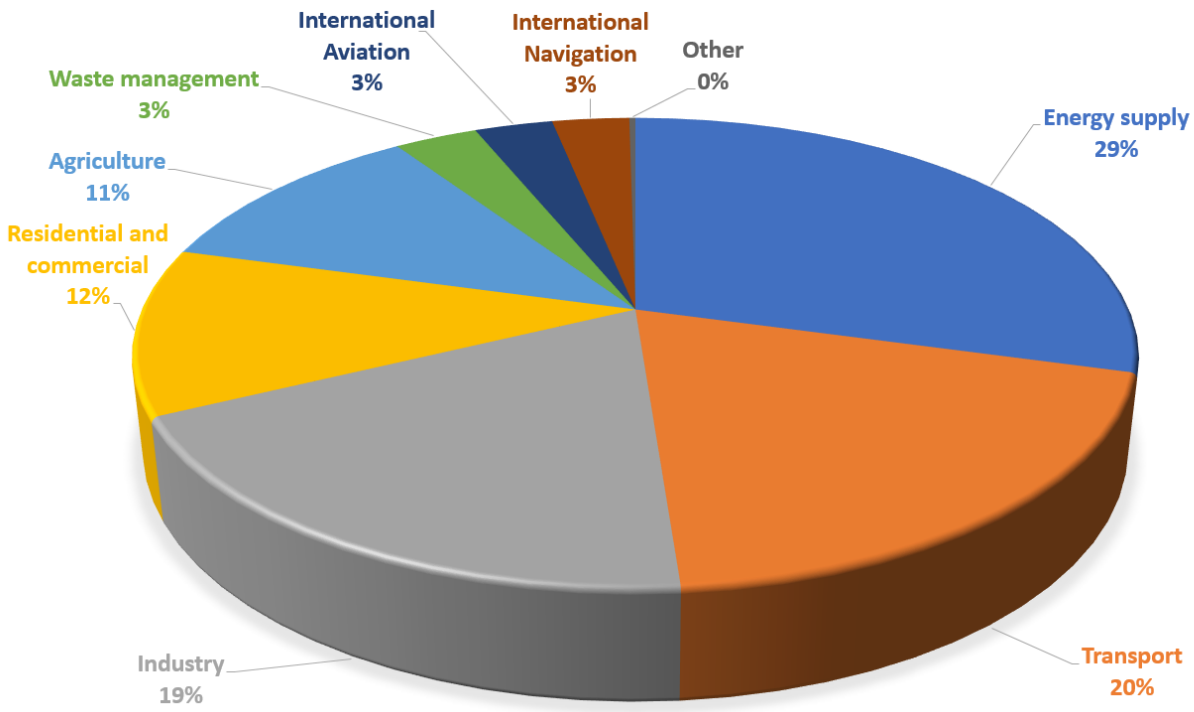

Figure 1: Sectoral greenhouse gas emissions by IPCC sector in 2014 (own diagram based on EEA Agency (EEA Agency, 2016))

On top of the carbon emissions, other typical pollutants are water vapor from the engines creating clouds containing frozen water, which have a warming effect on the planet, and nitrogen oxides which are destroying the ozone layer (Conboye & Hook, 2019). Due to these additional pollutants, the effect of emissions from air travel is one of the emissions caused by humans that pushes anthropogenic climate change the most. One year heating a home of an average person living in Europe is accounted for the same emissions as one single trip from Europe to New York (Conboye & Hook, 2019); European Commission,

2020). It is difficult to fully detect how many emissions one flight produces per passenger as other factors must be considered as well. For example, low-cost airlines such as Ryanair or EasyJet emit a lot of emissions, but they are more efficient when it comes to emissions per kilometer as they do not offer first or business class like premium airlines. In addition, low-cost carriers are mostly fully booked. As a result, per capita emissions decrease because emissions are distributed among a larger number of passengers. (Conboye & Hook, 2019).

2.1.3 Increasing Emissions due to Growth

Even if the Covid pandemic stopped the carbon dioxide emissions from commercial aviation worldwide, it is already visible that the emissions start rising again (see Figure 2). The air traffic emissions are expected to continue growing at 3-4% per year (Hinnen et al., 2017).

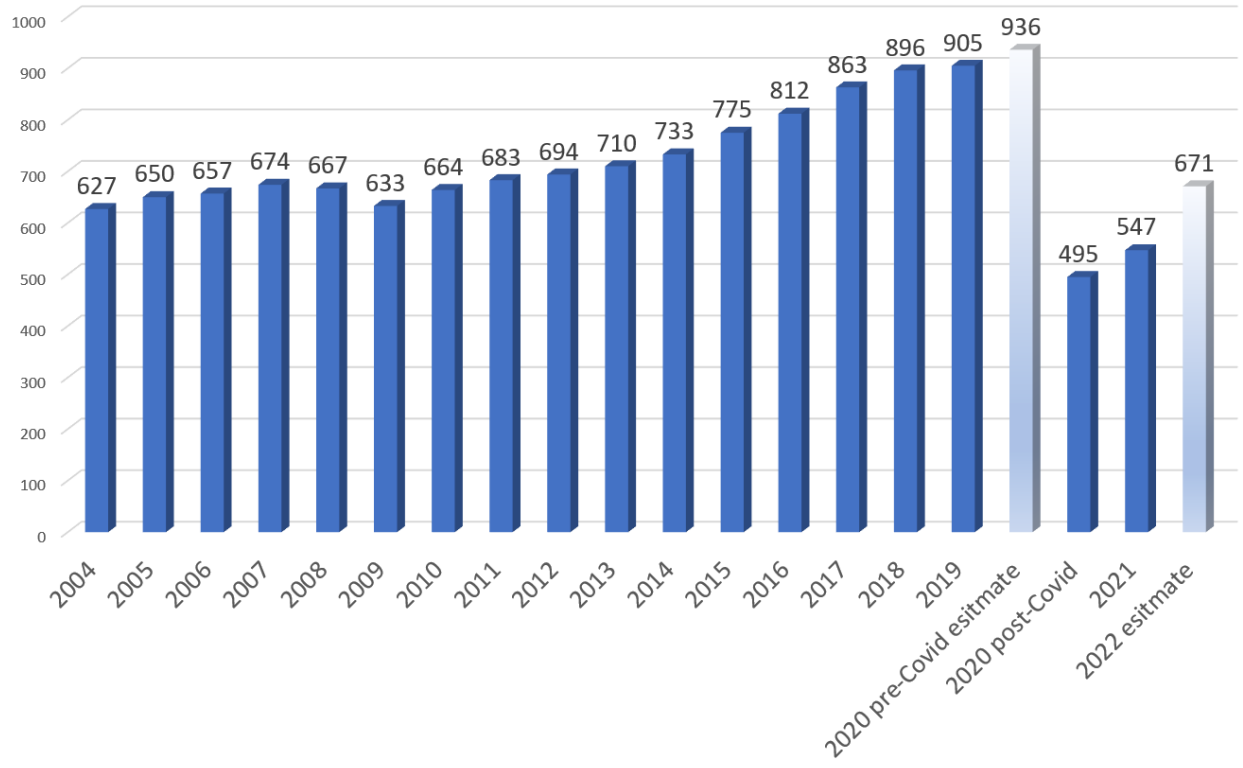

Figure 2: Carbon dioxide emissions from commercial aviation worldwide from 2004 to 2022 (own diagram based on Statista (Statista, 2021))

Emissions are rising even though the aviation industry is becoming more efficient. The reason is that globally, more and more people are flying because they can afford it. Conversely, this means that if air travel did not become more efficient, the increase would be much higher (Abdullah et al., 2016). Therefore, new technology and modernisation alone are not enough to make air travel greener. The aviation industry is willing to take more responsibility and has set many goals to reduce its impact on the climate. Airlines are trying to reduce emissions within the next 30 years about 50% and IATA is trying to build a zero-emission aviation industry (IATA, 2022).

2.2 Measures to Reduce Emissions in the Aviation Industry

To be competitive in today's economy requires a strategy that incorporates environmental sustainability (Abdullah et al., 2016).

2.2.1 General Approaches

In general, most airlines secure an economical flight plan to save fuel by reducing the aircraft size if it cannot be filled or by changing the taxi or cruise speed (Niu et al., 2016). Another approach is to train pilots to fly more ecofriendly by constant descent and reduced acceleration to save fuel usage and noise pollution. Another measure is to choose more environmentally friendly onboard products, for example avoid single use plastics and use local products for inflight catering (Brons et al., 2002). Also, by choosing inflight facilities, airlines can reduce weight. SWISS, for example, installed lighter seats made from carbon fiber on their European fleet. To rate airlines sustainability efforts in different sectors, the table below covers all the sectors where an airline can become more environmentally friendly.

Table 1: Measures for airlines to become environmentally friendly (Abdullah et al., 2016)

Main Measures	Specific Measures
Daily Operational Efforts	• Flight Planning • Ground Operations • Fuel Management Program • Aircraft Weight Reduction Incentives • Greening Onboard
Strategic Planning and Corporate Policies	• Fleet Renewal • Commute Option Program
Corporate Environment Management Practices	• Corporate Social Responsibility • Environment Management System

Airlines need to be careful when reducing services since it could have a negative effect on the service quality and on the whole operation of a flight. Therefore, most of the airlines invest in upgraded equipment and processes that increase fuel efficiency and optimize routes and procedures resulting in a better product quality of the airline which is a win-win situation (Abdullah et al., 2016).

Another approach towards emission reduction in the aviation industry are new aircraft technologies and Sustainable Aviation Fuel (SAF). Predictions show that those implementations are key for the future (see Figure 3).

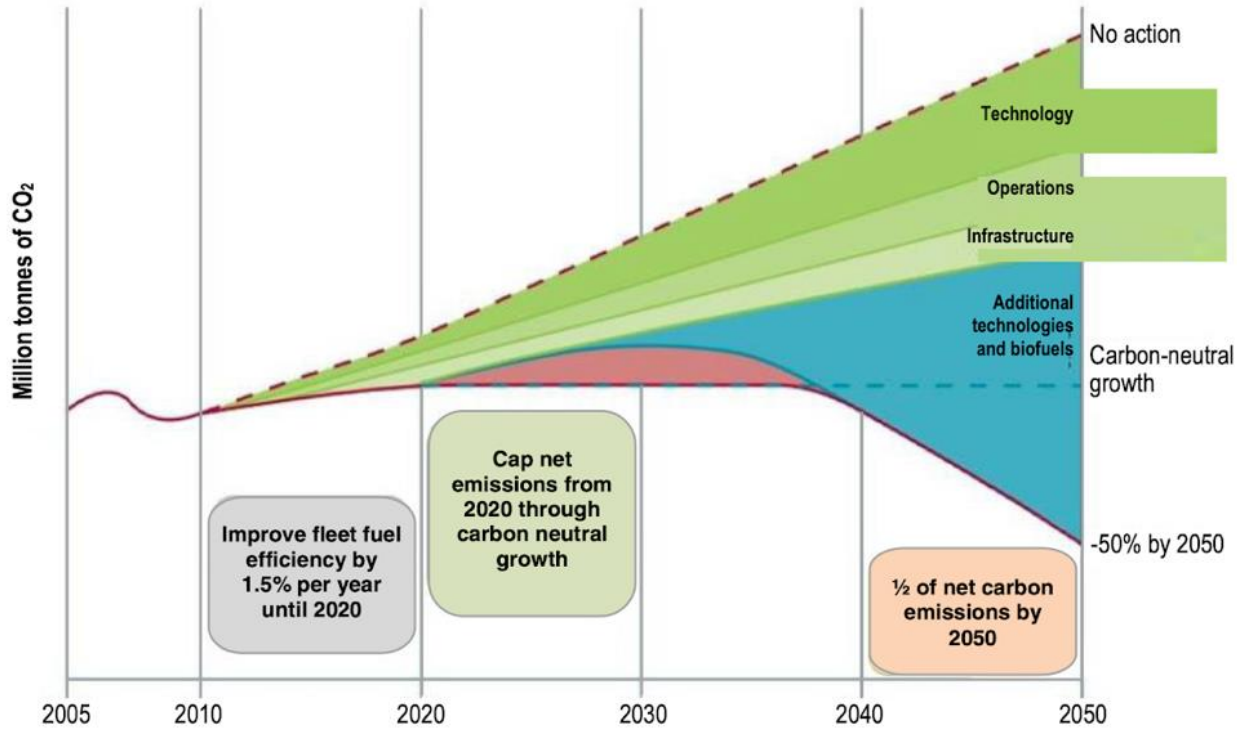

Figure 3: Carbon emission growth of future predictions depending on different measures in the aviation industry (Abdullah et al., 2016)

Airplane manufacturers have improved the efficiency of aircraft technologies inventing electric or even hydrogen-powered aircrafts (Conboye & Hook, 2019). In addition to an overall rethink of flying and aircraft technology, individual parts of an aircraft have been improved in efficiency. For example, IATA has introduced new engines, wing types or fuselages which airlines should introduce in their fleet in the future (IATA, 2021a). Another innovation to reduce paraffin consumption and thus avoid emissions was introduced by SWISS in 2022 in collaboration with Lufthansa Technik and BASF (a German chemical company). “AeroSHARK” is a surface film that resembles a shark skin. This film improves the aerodynamics of the aircraft and can reduce drag by about 1% (Lufthansa Group, 2021). This innovation will be installed on the entire Boeing 777 fleet of the Lufthansa Group and can thus save 3700 tons of kerosene annually, which corresponds to about 50 flights from Zurich to Shanghai (Lufthansa Group, 2021).

2.2.2 Sustainable Aviation Fuels

In addition to the aircrafts, which are constantly being improved technically, a lot of research is also being done on the development of new, sustainable fuels. The Lufthansa Group for example is partnering with various companies developing and producing Sustainable Aviation Fuel (SAF). The core idea of SAF is that carbon is extracted from existing, sustainable biomass or gases for reuse and converted into fuel. Further, SWISS and the Lufthansa Group have concluded a strategic collaboration with the Synhelion company to bring its solar aviation fuel to market (SWISS, 2021). The intention is to produce electricity-based kerosene

trough a “power-to-liquid process which produces synthetic crude oils from CO_2, electricity, and water” (SWISS, 2022). The major advantage of this is that carbon is extracted from the atmosphere and a synthetic gas is produced with the help of sunlight and water. This can then be used to produce aircraft fuel. In this way, only as many emissions are released during the flight as were previously removed to produce the fuel. This sun-to-liquid fuel closes the fuel carbon cycle: when combusted, it will only produce as much CO_2 as went into its manufacture (SWISS, 2022).

However, the introduction of SAF and power-to-liquid fuels brings a whole host of difficulties. Issues such as quality standards, sustainability in production, distribution system at various airports, and economic efficiency are currently major hurdles for a large-scale introduction of SAF (SWISS, 2021). In addition, the alternative fuels are only available in very small quantities, and it seems unrealistic to be able to produce large quantities of them in the near future (Davison, 2014; Efthymiou & Papatheodorou, 2019). The price of SAF is between five to ten times higher than conventional kerosene in 2022 (SWISS, 2022).

Although aviation technology has improved, emissions increased by 70% in 2020 compared to 2005. Given the projected growth of the aviation industry, this exceeds improvements in fuel efficiency. (Kroesen, 2013; Lee et al., 2009). More measures than Sustainable Aviation Fuel, new technologies and operational measures are needed to meet IATA's ambitious targets of halving aviation emissions by 2030. In the next chapter, offsetting in aviation will show how emissions can be kept under control despite increasing demand and supply.

2.3 Carbon Offsetting of Flight Emissions

The basic idea of offsetting is to balance the emission of a certain amount of greenhouse gas emissions, which cannot be avoided in one place but can be compensated for in another place (R. M. Stern et al., 1997). Almost every airline in the aviation industry tries to compensate their emissions by offering their passengers the opportunity to offset their flight individually and voluntarily (Berger, 2022). This means that they transfer the monetary balancing costs caused by the emissions to the consumer. The idea is not to stop air travel, but to reduce the impact (Juven & Dolnicar, 2017). The airlines invite their passengers to voluntarily spend some money to help offset emissions through their climate protection programs or through investment in SAF (Niu et al., 2016). Before a donation can be made, the amount to offset the emissions must be determined. There are many different methods (see Table 2) to estimate the emissions of a given air journey, including fixed prices, third-party programs, internal and external methods (Becken & Mackey, 2017).

Table 2: Approaches to define measurements to offset carbon emissions (Becken & Mackey, 2017)

Approach	Description
Fixed Price	The airline adds a fixed price to a ticket to offset carbon emissions. Usually between CHF 5 to 10 per ticket
Third-Party	The airline provides a link to an organization that offers carbon offsetting or to an existing carbon calculator
Internal Method	The airline provides specific data on fuel consumption, fleet composition, and load factors. They are used to determine produced emissions either per passenger-kilometer or specific flight sectors
External Method	A methodology developed externally is used to estimate produced emissions

The most common system airlines are using to let their customers compensate is that - after booking a ticket - the passenger transfers a donation to a provider such as “myclimate” (or “Compensaid” in the case of SWISS), the amount of which is based on the CO_2 emissions of the flight. Figure 4 shows a sample process.

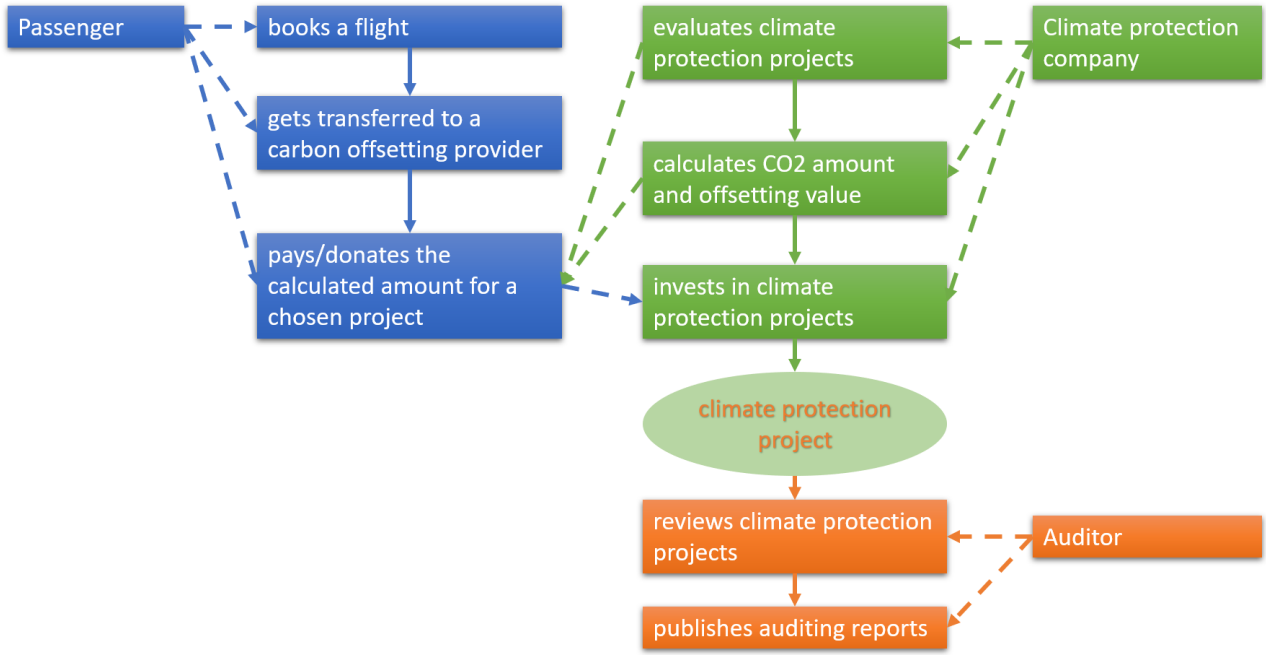

Figure 4: Traditional carbon offsetting process for flight emissions, own illustration according to Thess et al. (Thess et al., 2020)

In return, the passenger receives a compensation promise. The airline’s climate protection company uses the donated money to finance projects that compensate emissions. The projects are audited by an external and independent organization and then published. There are several different carbon offsetting programs. Mostly, developing countries in Africa, Asia or South America are supported with projects financed by

offsetting funds (Becken & Mackey, 2017). As an example, SWISS is actively supporting energy projects in Indonesia, waste management projects in the Amazon rainforest in Brazil or forest protection by distributing solar cookers in Madagascar to stop deforestation and to reduce carbon emissions.

2.3.1 Controversial View on Current System

The current compensation system is controversial because it lacks clarity and has some difficulties in implementation. Passengers and the public have no access to project data and are dependent on the truthfulness of the audit reports and the independence of the inspectors (Thess et al., 2020). It is difficult to determine which measures are the most plausible and credible because each airline sets up different measures and often does not publicly disclose their facts and figures. It is not possible for an interested citizen to obtain measurement data as required for a professional verification of CO_2 savings (Thess, 2021). Another criticism is that emissions are compensated at a different atmospheric level. As already described above, at the higher altitude, CO_2 emissions cause condensation trails which last up to 18 hours in the atmosphere and are responsible for a faster warming up than at sea level (Abdullah et al., 2016). This makes it difficult to compare the effectiveness of climate compensation programs from airlines to mitigate climate change. In chapter 2.6, different possibilities and approaches are highlighted how an airline such as SWISS could proceed to communicate their measures credible and to encourage guests to compensate.

2.3.2 Attitude of Passengers

People's distrust of airline offsetting programs has also been observed in many studies. Two types of people with different views of rationality have been identified. On the one hand, there are groups that can be described as deniers. They do not recognize that air travel is linked to climate change and do not take climate issues into account when booking an airline ticket because they vehemently deny that flying negatively affects climate change (Lassen, 2010). On the other hand, there are the bystanders. While they do not negate the negative effect on climate change caused by air travel, they have chosen not to consider this issue for various reasons contrary to their general environmental behavior (Lassen, 2010).

Most travelers are not willing to change their lifestyle unless forced to do so by regulations. It is also an important observation that some individuals prefer to offset their emissions by paying rather than reducing their air travel. In addition, some travelers feel powerless and do not believe that their behavior will make a difference to climate change. Other reasons against offsetting include scientific skepticism, mistrust, sustainable lifestyles in other areas of daily life, belief in a technical solution and externalization of responsibility (Araghi et al., 2014). “Green fatigue" is also an important phenomenon that explains why aviation emissions offsetting does not work. "Green fatigue" describes individuals who feel overwhelmed by green activities (McKercher et al., 2010). There is also a risk that travelers perceive the airline's environmental efforts and communication as "greenwashing" (Baumeister & Onkila, 2017).

2.4 Communication of Airlines about Offsetting Programs

The criticism of airline compensation programs indicates that current customer communication is not working properly (Araghi et al., 2014). This chapter briefly summarises how airlines currently try to promote their compensation programs. Almost every airline provides information about corporate responsibility and sustainability efforts on its website. Most of them communicate ambitious goals, such as carbon neutrality by 2050. Despite these goals, not a single airline shows how they measure their progress towards their goals by means of an annual CO_2 report or anything similar. However, to achieve a certain credibility regarding their climate goals, the airlines list their changes in more sustainable inflight products, more efficient fleets or plastic and waste reduction. For example, while Delta Airlines emphasises its efforts regarding Circular Economy by reprocessing old flight uniforms and other materials, EasyJet communicates about the complete reduction of plastic on board (Delta, 2022; EasyJet, 2021). However, the fact that the absolute majority of emissions are caused by the burning of jet fuel is rarely emphasised. Thus, it is not made clear to the customer that he or she could be used as a big lever to help the airlines achieve the ambitious goals by offsetting his or her own emissions. When it comes to communicating compensation of emissions, airlines usually choose two main topics for their communication strategy: both environmental protection and CO_2 neutrality in air travel are proclaimed in general (see Table 3). In addition, the websites of the airlines show in which climate projects or more sustainable fuels the offset payment is invested and how the emissions are thereby compensated. Rarely is it mentioned that everyone should contribute to reducing aviation emissions. Only Singapore Airlines chooses a more direct way of pointing out that without the contribution of passengers, reducing emissions in a greater scale is currently not feasible.

Table 3: Communication of airlines about emission offsetting

Airline	Communication about emission offsetting
Lufthansa Group (for Lufthansa, SWISS and Austrian)	"Protect the environment. Offset CO_2. Make your air travel CO_2 neutral now. Fly with SAF. Avoid CO_2" (Lufthansa Group, 2021)
United	"By offsetting your flight, you will retire carbon credits and directly support community-driven activities that protect and restore critical forests around the world." (United, 2019)
Ryanair	"Our Carbon Offset Programme and new Carbon Offset Calculator allows our customers to also play a role in offsetting emissions and make the environmentally conscious decision when they choose to fly." (Ryanair, 2021)
Airfrance /KLM	"Learn about your carbon footprint and plant a tree." (Airfrance, 2020)
British Airways	"Make your flight carbon neutral with high quality, verified emission reduction projects or a new

Airline	Communication about emission offsetting
	option where 10% of the emission reduction comes from sustainable aviation fuel." (British Airways, 2019)
American Airlines	"Our purpose is to take care of people on life's journey each and every day. We also take pride in doing our part to take care of the planet — and we value your commitment to joining our efforts." (American Airlines, 2020)
Singapore Airlines Group	"Singapore Airlines is committed to protecting the environment – but we cannot do it alone. With our carbon offset programme, you too can help by offsetting the carbon emitted from your flight." (Singapore Airlines Group, 2020)

Despite these communication efforts, compensation rates for all airlines are extremely low. At SWISS, it is also not known which communication content motivates customers to compensate. This thesis aims to determine a communication mode that leads passengers to compensate for flight emissions, since the communication measures taken so far have not yet produced significant results in terms of the number of compensations of flight emissions.

2.5 Compensation at SWISS

With a view to use its resources on the ground as sparingly as possible and to reduce its own carbon dioxide emissions, SWISS has set itself two ambitious ecological objectives: to halve its CO_2 emissions from their 2019 level by 2030, and to achieve net-zero CO_2 emissions by 2050 (SWISS, 2020). To achieve this ambitious goal, SWISS passengers must also make their contribution through voluntary offsetting.

At SWISS, flight passengers have the option to offset their CO_2 emissions on a flight route online via the "Compensaid" platform. In this way, SWISS has already invested almost EUR 1.5 million in Sustainable Aviation Fuel. This corresponds to a reduction of 14'903 tonnes of CO_2 since 2019 (SWISS, personal communication, 2021). But in 2019 alone, a total of 5'807'021 tonnes of CO_2 were caused by air traffic from Switzerland (BAFU, 2020). On the "Compensaid" platform, passengers can enter their planned journey in a first step. Then they can choose whether they want to invest their money in climate projects or in Sustainable Aviation Fuel. When investing in climate projects, it is more cost-effective for the customer than investing in SAF. Current facts and figures from the "Compensaid" platform from October 2021 show that the number of passengers who compensated their flight is very low.

Table 4: Key figures for compensations done by SWISS passengers (Lufthansa Group, 2021)

Key figures	Number / Value in October 2021
Customers who compensate per day on average	40
Customers who compensate per booking class	1'113 Economy, 91 Business and 2 First Class
Average compensation price	Mean value: 46€ Median: 28€
Average compensation price by route	approx. 15€ short-/medium-haul, approx. 100€ long-haul
Average compensation share	30% SAF, 70% myclimate

After integrating the CO_2 compensation option directly in the booking process on the website of SWISS, the compensation rate has risen from an average compensation rate of 1% per month to 9.13% (number of bookings = 26'519) within 5 days after the introduction of the option in the booking process of May 30, 2022 (SWISS, 2022). This shows impressively that tangibility and placement of the offer plays a crucial role in boosting carbon emission offsetting.

However, there are still many obstacles that explain why passengers do not offset. In an internal survey of the Lufthansa Group, 60% of the passengers expect a different travel experience when they compensate their flight. This demand cannot be changed easily. However, 50% of the 128 customers surveyed would rather compensate if the offer were more tangible (Lufthansa Group, 2021). This requirement can be supported by creating new touchpoints with the offsetting platforms and the compensation experience based on the Customer Journey of SWISS. The following chapter explains how a higher tangibility could be achieved.

2.6 Tangibility Options for Carbon Offsetting Promotion

'Tangibles' are aspects of a service that can be "felt" and are "visible" for a customer without actually purchasing the service (Panda & Das, 2014). In other words, tangibility can be defined as the degree to which a service portrays its clear concrete image and intangibility can be defined as lack of physical evidence (McDougall & Snetsinger, 1990). When it comes to measuring service quality, tangibility is the first crucial parameter, further reliability, responsiveness, assurance and empathy are measures to meet customers desires about a service (Boshoff & Gray, 2004). Tangibility is a key influence in generating customer awareness and reaction about a service (Panda & Das, 2014). Also for carbon offsetting programs in aviation, it is crucial to give customers many platforms where they are made aware of the offer and can

make direct use of the compensation option on flights to fulfill the “visible aspect” and the “physical evidence” of tangibility (SWISS, 2021; Lovell et al., 2009). There are many different alternatives when it comes to promoting the option to compensate a flight. Ideally, in the case of an airline, many incentives and interventions should be placed on the entire “customer journey” of a flight guest. A “customer journey” is defined from the start of the interaction of the airline such as the ticket purchase, all the way until the end of the experience when arriving back home after the trip. In between, many different touchpoints allow to interact with the customer (SWISS, 2021). Figure 5 shows various ideas how an airline could create tangible touchpoints and create more awareness about carbon offsetting for flights. The touchpoints try to trigger the customer on different levels such as information provision, involvement, or appreciation (SWISS, 2021). For example, from an offered green priority boarding when offsetting the flight, on to a speech of the “Maitre de Cabine / purser” after boarding the plane, ending with a “post flight email” after the whole journey, can help to create more awareness, tangibility, and an understanding on the topic. Some of the ideas like rewarding with a train voucher are financial incentives. These will be neglected in the context of this work. The aim is to explore what information appeals to customers' internal behavior patterns and not to test a reward system. Internal behavior patterns are seen as a key driver in mitigating the environmental impacts of air travel. Another way to encourage behavioral change is to use eco-labels (Baumeister & Onkila, 2017).

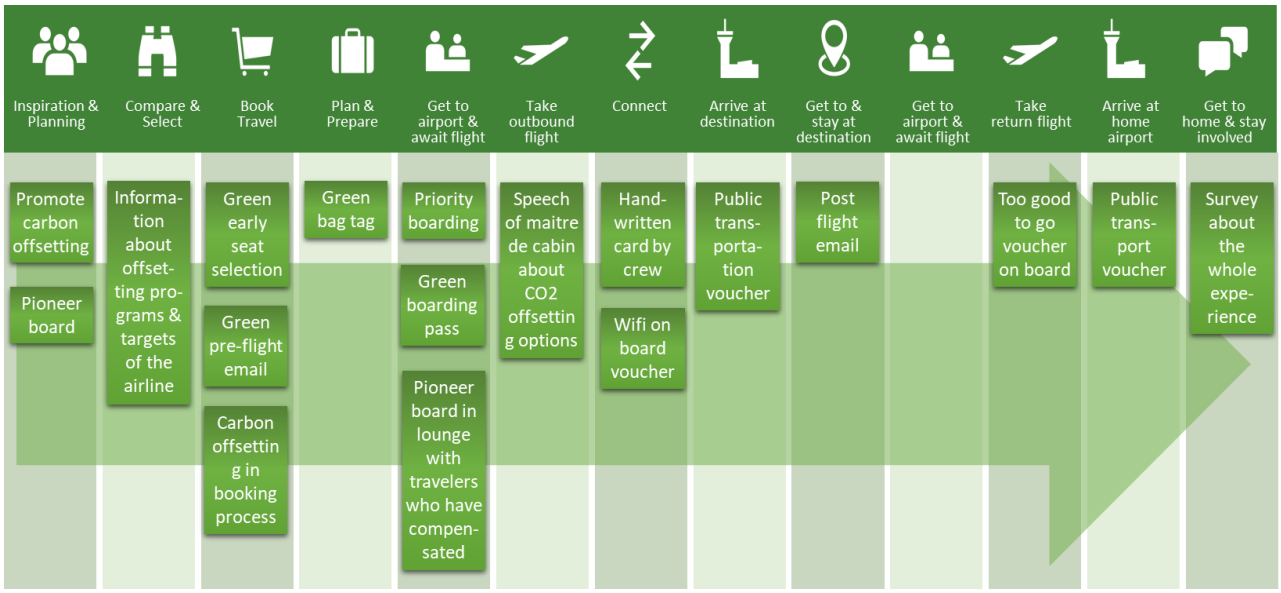

Figure 5: Possible interventions and tangible offers according to SWISS (SWISS, 2021)

Having information and touchpoints on a topic available does not always lead to more awareness and in turn to more environmental consciousness and behavior (Scarles et al., 2017). It is just a first step to activate different psychological reactions of an individual (Blok et al., 2015). To understand those psychological processes which can turn into the direction of an environmental-friendly behavior such as

offsetting voluntarily flight emissions, the theory of pro-environmental behavior is analyzed in the following chapters.

2.7 Pro-Environmental Behavior (PEB)

Behavioral change is one of the most important levers when it comes to stopping climate change (Randles & Mander, 2009). Especially in the airline industry, there is a huge opportunity to slow down the emissions of the airline industry by changing people's behavior. To understand how pro-environmental values arise, it is crucial to understand where the theory of pro-environmental behavior (PEB) comes from.

Pro-environmental behavior has not been clearly defined. First, the term environment should be understood as a public good and not as "surroundings". From this perspective, alternative terms for PEB arise, such as “responsible environmental behavior”, “environment-friendly behavior” or “ecological behavior” (Kurisu, 2015). The most common definition of PEB is “action that can mitigate a negative impact on the climate” (Li et al., 2019) such as reduction of negative impacts and the increase of positive impacts (Kurisu, 2015). People behave in environmentally relevant ways to varying degrees. They also differ in the types of environmentally significant behavior they engage in (Markle, 2013). This difference in behavior means, for example, whether people recycle, which means of transport they choose, how they reduce their energy consumption or whether they buy sustainable products (Kollmuss & Agyeman, 2002). In the past years, the human desire to reach comfort, enjoyment, power, personal security, and mobility, has become a negative impact on the environment (Kurisu, 2015). Modern technology such as an airplane is one of those human desires. Against this background, it is difficult for people to behave in an environmentally friendly way contrary to their human desire. Despite this tension between human desire and negative impact on the environment, it is possible to live in an environmentally friendly way. Researchers and organizations developed a list of 200 recognized PEB’s in different categories such as ecological lifestyle, selection of renewable energy, green buildings and home, support for CO_2 reduction projects, waste, and recycling and many more. In the section of support for CO_2 reduction projects, selection of carbon-offset products is one example for an identified PEB (Kurisu, 2015).

2.7.1 Theories to Explain PEB

After enrolling the definition, categorization, and an example of PEB, there are many important theories which examine internal or psychological variables related to behavior, such as values, beliefs and attitudes (De Groot & Steg, 2009). The “Theory of Reasoned Action” by Fishbein and Ajzen (1975), the “Theory of Planned Behavior” by Ajzen (1981), the “Norm-Activation Model” by Schwartz (1977), and the “Value Belief Norm Theory” by Stern et al. (1999) have been developed to explain how PEB can arise.

2.7.1.1 Theory of Reasoned Action

The theory of reasoned action (TRA, see Figure 6) takes on how behavior is determined by the intention of an individual, because it is the strongest predictor of actual behavior (Ajzen & Fishbein, 1975). The intention is influenced by two variables, which are the "attitude toward the behavior" and the "subjective norm". These attitudes involve the "behavioral belief" and the "normative belief" (Ajzen & Fishbein, 1975). The "behavioral belief" describes a person's belief with regard to the consequences of specific acts (Cordano et al., 2010). The "normative beliefs" consist of how a person should act and behave (Conner & Armitage, 1998). This model is applicable to PEB, but it has to be taken into account that in this theory, behavior is only determined by the intention, and other influences of circumstances are not considered (Kurisu, 2015). This means that the model can only be used if the target behavior is under control. For example, even if a person wants to behave in a certain way, perhaps they do not at the end because of lack of knowledge, time or ability to conduct the behavior (Kollmuss & Agyeman, 2002).

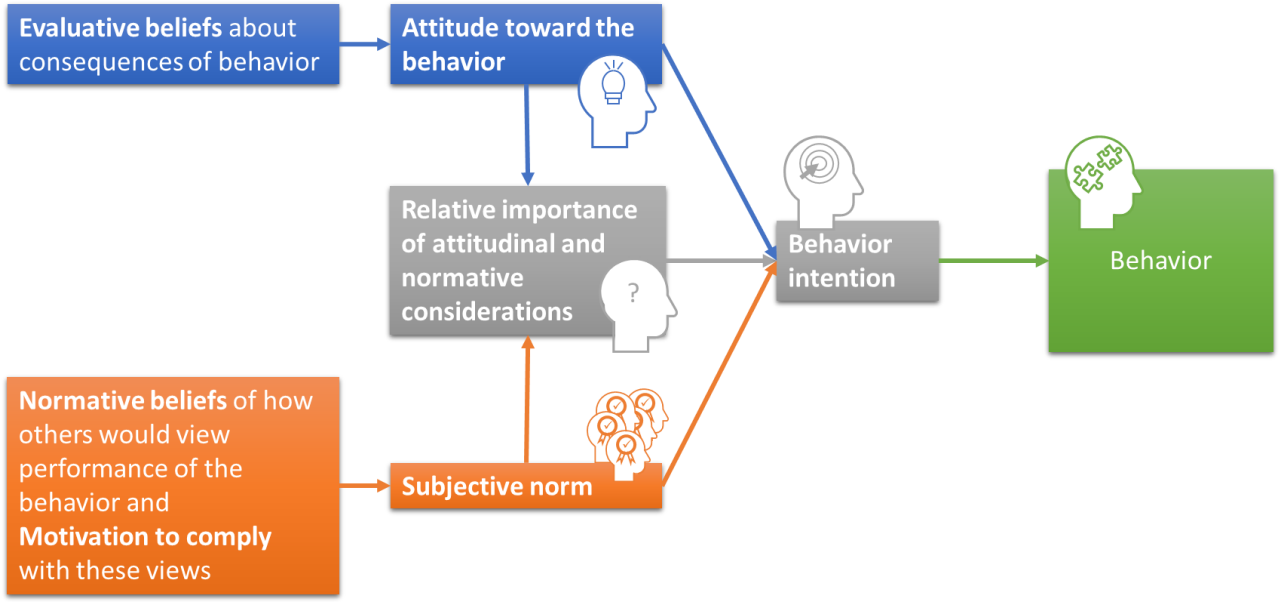

Figure 6: Theory of reasoned action, own illustration according to Kurisu (Kurisu, 2015)

This model shows that when it comes to PEB, a behavior can be explained with beliefs, attitudes, and the social norm, but other factors such as time to conduct the behavior or knowledge play an important role as well.

2.7.1.2 Theory of Planned Behavior

To mitigate the limitations of the theory of reasoned action, Ajzen suggests the theory of planned behavior (TBP, see Figure 7) by introducing a new variable. The "perceived behavioral control" explains the perception of the actor on how much they can control the behavior (Ajzen, 1991). In other words, it could be defined "as belief in one's own capacity to organize the target behavior" (Kurisu, 2015). Like this, it considers the actors' perception of their ability, affordability, available time, and knowledge (Conner,

2020). It is assumed that the greater the subjective confidence that the behavior is under control, the more likely it is that the behavior will be carried out (Ajzen et al., 2011). This theory has been applied to many studies. 185 studies were analyzed and it was proven that the theory of planned behavior explained between 27% and 39% of the variance in behavior and intention, respectively (Armitage & Conner, 2001). Based on the theory of planned behavior, it is expected that the intention to act predicts PEB also among flight passengers.

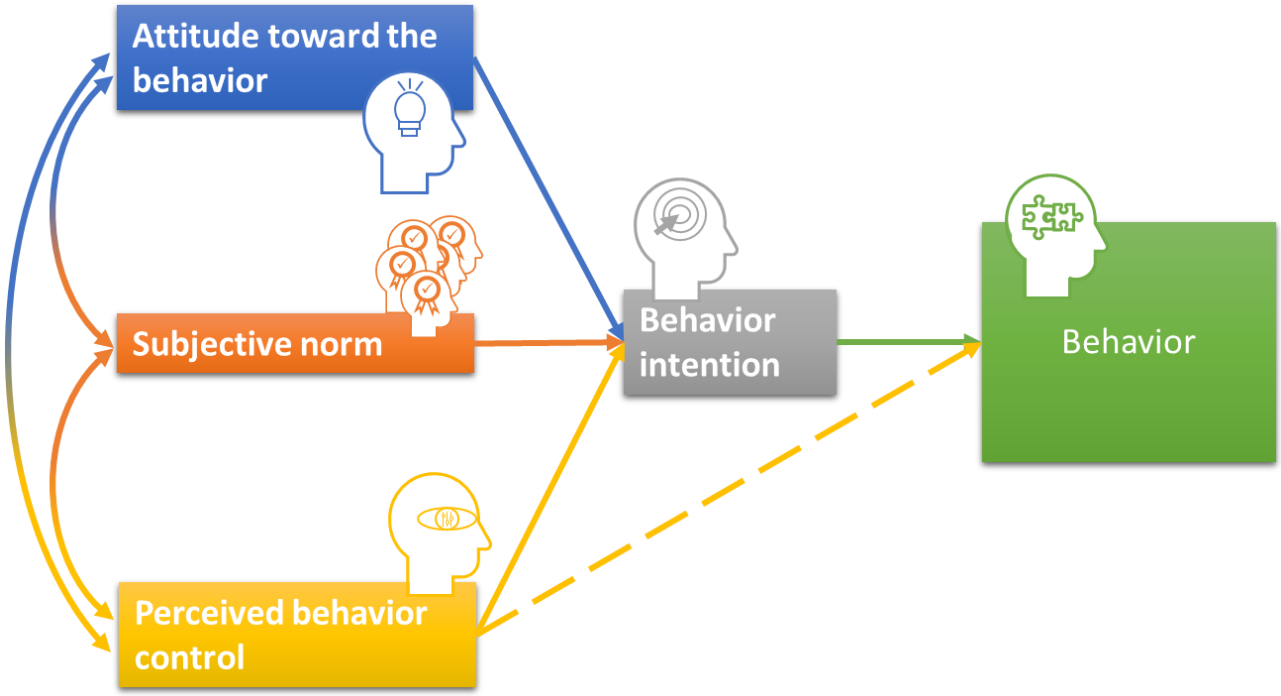

Figure 7: Theory of planned behavior, own illustration according to Ajzen (Ajzen, 1991)

2.7.1.3 The Norm Activation Model

Besides "the intention to act" from the TBP-model, the norm activation model was developed to explain altruistic behaviors such as helping others or the environment (see Figure 8). The core of this model is formed by personal norms (Onwezen et al., 2013). For a certain target behavior, the moral norm (personal norm) is needed to activate this behavior. The personal norm is only activated if there is an "awareness of consequences" and an "ascription of responsibility"(Schwartz, 1977). In other words, the awareness that performing or not performing a specific action has certain consequences and the feeling of responsibility for performing a specific behavior (Onwezen et al., 2013). The described model can be differentiated in four steps.

4 steps of the norm activation model by Schwartz (Schwartz, 1977)

1. Activation steps: perception of need and responsibility
2. Obligation steps: norm construction and generation of feelings of moral obligation
   → Activation of pre-existing or situationally constructed personal norms

3. Defense steps: assessment, evaluation, and reassessment of potential responses
   → Assessment of costs and evaluation of probable outcomes
   → Reassessment and reduction of the situation by denial
4. Response step
   → Action or inaction response

The illustration below shows how awareness of consequences and the responsibility of denial influences the activation of personal norms which lead to altruistic behavior.

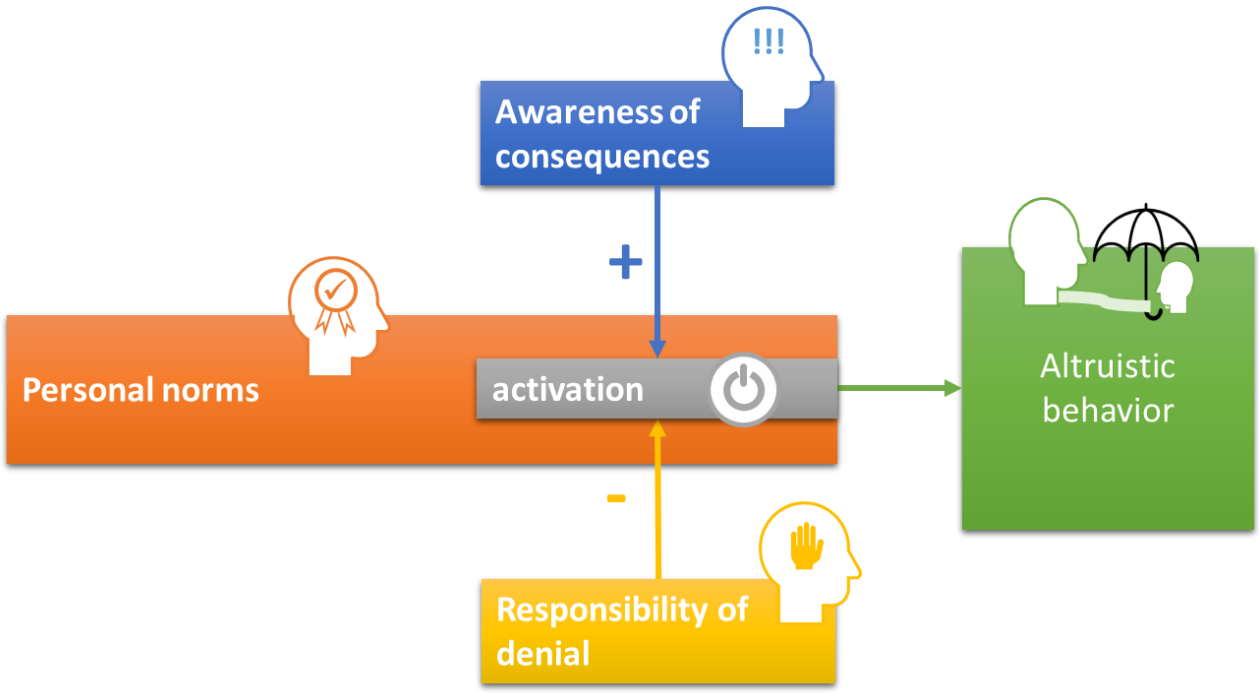

Figure 8: The norm activation model, own illustration according to Kurisu (Kurisu, 2015)

2.7.1.4 The Value-belief-norms Theory

The theory of reasoned action, the theory of planned behavior and the norm activation model build the base for models for PEBs (Kurisu, 2015). Stern categorized in the value-belief-norms theory (VBN, see Figure 9) the different PEBs into four types, which are “environmental activism”, “nonactivist behaviors in the public sphere”, “private-sphere behaviors” and “behaviors in organizations” under consideration of beliefs and norms given by the previous theories and the New Ecological Paradigm (NEP) scale which is a scale about environmental focused attitudes developed by Dunlap and Van Liere (Stern et al., 1999; Dunlap & Van Liere, 1978). Like this, personal values, NEP, awareness of consequences, ascription of responsibility beliefs and personal norms are combined in one theory (Kurisu, 2015). The personal values are differentiated into three types which are “biospheric”, “altruistic” and “egoistic” (Stern et al., 1999). The PEB stream starts from these general personal values and continues to a more environment-focused attitude (NEP) (Kurisu, 2015). Then, the personal norms are activated from the beliefs by awareness of

consequences and the ascription of responsibility (Schwartz, 1977). Out of this stream, the target behavior originates. An interesting observation about values is provided by a study that assumes that interventions to maintain a positive self-concept can motivate people to act morally (Bolderdijk et al., 2013). It was compared whether an information with biospheric benefits or egoistic benefits had a more positive effect on the customer. As an example, it was asked; "Do you care about the environment? Get a free tyre check" and "Worried about your finances? Get a free tyre check". The biospheric appeal may persuade more people than the economic appeal because they felt more comfortable with the biospheric appeal. It is therefore suggested that moral activation is a better intervention than monetary incentives (Bolderdijk et al., 2013; Kurisu, 2015).

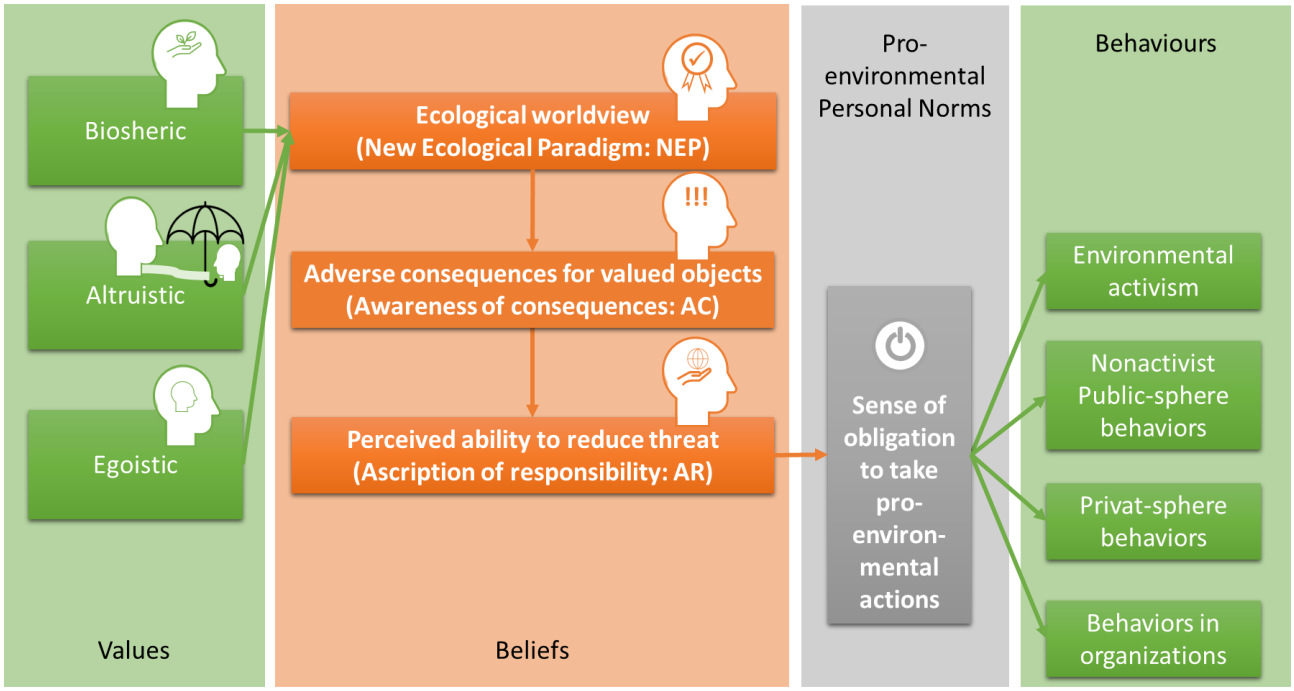

Figure 9: The Value-belief-norms Theory, own illustration according to Kurisu (Kurisu, 2015)

In relation to this model, it was found that PEB and the commitment to the NEP scale is most common among people whose values are “social altruistic” and “biospheric”. In contrast, “egoists” are negatively related to PEB (Kollmuss & Agyeman, 2002). Such a result can be tested in the present study to understand what values influence air travel emission compensation behavior.

2.7.1.5 Attitude Behavior Gap

From the theories it can be concluded that influencing beliefs, values and norms are the reasons to achieve behavior change. On top of that, even if in many cases the perceived personal costs outweigh the benefits, many people indicate that they find sustainability worth supporting. However, this is rarely reflected in correspondingly sustainable behavior (Tonner, 2017). The attitude behavior gap describes the “inconsistency displayed between consumer attitudes and actions, where a consumer may have a positive attitude towards sustainable consumption that is not expressed in the actual purchase behavior" (Norstedt

& Sjölinder, 2021). For promoting carbon offset of flight emissions, the gap between pro-environmental attitudes and the final behavior is a daunting challenge. Often, the reported attitude towards sustainability and the actual behavior do not coincide (Gupta & Ogden, 2006). It is common for climate matters that there is an attitude-behavior gap or an awareness-action gap (Randles & Mander, 2009). Kollmuss and Agyeman identified four triggers for this gap. First, attitudes change over time and can therefore be temporary. If there is a time-gap between the collection of attitudes and the consequent behavior, the attitudes are not present anymore when it comes to the action (Kollmuss & Agyeman, 2002). For example, before the invasion of Russia into Ukraine, most of the Swiss population was against upgrading military resources in Switzerland. This attitude seems to change because of recent incidents. Second, the gap can result from direct or indirect experiences. A direct experience is if an individual experiences negative impacts from climate change on his own, for example through floodings in the hometown. An indirect experience is when an individual learns about the floodings in a newspaper. The direct experience leads to a higher correlation between attitude and behavior (Kollmuss & Agyeman, 2002). Third, the gap can develop from normative influences. Social norms are key when it comes to shape attitudes such as traditions in the family. If the attitude of a family shows an unsustainable behavior, it is likely that the children's gap between attitude and behavior will grow bigger. Fourth, the measurement of attitude and behavior is crucial. There are many contradictory studies about attitude-behavior correlation because most of them measure attitudes broadly, because they ask self-reported questions. As an example how to avoid this broad measurement, instead of asking if an individual cares about the environment, it should be figured out what actions an individual takes in the context of environmental friendly behavior (Kollmuss & Agyeman, 2002).

Therefore, above four triggers of the attitude behavior gap need to be considered when constructing a survey about factors influencing PEB. To design questions that are as concrete as possible and to avoid attitude-behavior gaps within the participants of the survey, it is important to know the factors that cause PEB.

2.7.2 Factors Influencing PEB

There are many scales and characterizations such as the "New Environmental/Ecological Paradigm (NEP)" proposed to assess environmental attitudes (Kurisu, 2015). This thesis focuses more on how those attitudes arise and what reasons have an influence on pro-environmental behavior, especially on flight emission offsetting. To provide a comprehensive coverage of influential factors concerning PEB in aviation (see Table 5), eleven different factors have been identified and studies about air travel behavior have been linked to the factors (Kollmuss & Agyeman, 2002; Wind, 2022).

Table 5: Factors concerning PEB in aviation according to Kollmuss & Agyeman (2002)

Group	Example / description of factor Links to studies / papers
Demographic factors	Gender, education, income, age, employment, martial status, social status play an important role when assessing PEB (Juvan & Dolnicar, 2017).
	Studies have shown that older travelers offset their flights more often and take shorter flights and fly less often (Barr et al., 2010). Women are often more engaged and show more empathy towards climate change. Men are more willing to change their behavior (Lehmann 1999).
Economic factors	If an individual behaves sustainably, they choose the cheapest way when it comes to monetary cost as well as time and effort. If PEB does not need much effort to comply, the attitude towards it is the highest. The more expensive a sustainable behavior gets, the lower is the chance that an attitude of an individual is pro-environmentally (Diekmann and Preisendoerfer, 1998).
	There are contradictory results when linking income and travel behavior. High environmental behavior and high-income correlate in some studies, in other words, people with low income travel less because they cannot afford it (Juvan & Dolnicar, 2017). A study from Berger et al. even proofed the fact that the income does not affect the willingness to pay for compensation and that the willingness to offset carbon emissions from flights is, independent of the salary, only around one euro (Berger et al., 2022).
Social and cultural factors	If a country attributes a high cultural value to the environment (for example for its natural reservoirs), they have a different approach towards PEB (Kollmuss & Agyeman, 2002).
	There are no studies found which show that social and cultural factors have an influence on the motivation to offset flight emissions.
Internal factors	Environmental knowledge, priorities, awareness, values, attitudes, responsibilities, motivation and emotions are internal factors (Kollmuss & Agyeman, 2002c). One of the most important factors is the motivation to execute a certain behavior. (Kurisu, 2015). Most of these factors are explained by the theories enrolled in 2.2.1.
	Individuals do not often plan environmentally sustainable vacations with the specific intention of keeping their environmental impact as low as possible (McKercher et al., 2010).
Values	Values shape the intrinsic motivation and are influenced by family, peer groups and life experiences. Role models, organizations, experiences of environmental destructions, childhood experiences in nature and education are examples forming values of an individual (Kollmuss & Agyeman, 2002).
	It is shown that even if individuals have values which are supporting the environment, it does not mean that they reduce their frequency of air travel significantly (Barr et al., 2010).
Attitudes	Attitudes are defined as negative or positive feelings about a person, object, or issue (Kollmuss & Agyeman, 2002). The “theory of reasoned action” in chapter 2.2.1.1 describes how attitudes influence behavior and by which factors (such as social and personal norms) attitudes are influenced by. For air travel compensation, these social norms are not yet established (Miller et al, 2010).
	Behavioral change is mostly possible trough social norms. This assumption was proved by some studies about recycling behavior which show that if a big part of the society participates, it becomes normal to do (Ajzen, 1991). For air travel compensation, environmental-friendly social norms are not yet established (Miller et al., 2010).

Group	Example / description of factor
	Links to studies / papers
Knowledge	Two different topics of knowledge help predicting PEB: The knowledge about environmental problems and causes as well as the knowledge about which actions (such as offsetting emissions) can be executed to mitigate climate change (Kollmuss & Agyeman, 2002).
	To promote more sustainable air travel, it is key to raise awareness and communicate educatively to encourage more pro-environmental behavior (Kollmuss & Agyeman, 2002c) (Miller et al., 2010). However, the availability of information does not always influence air travel behavior and does not explain it sufficiently, as nowadays most individuals know that air travel is a burden to the climate, but their air travel behavior is not changing (Higham & Cohen, 2011).
Emotional investment	Having an emotional investment for an environmental topic is crucial for shaping beliefs, values, or attitudes. Having a certain level of knowledge is necessary to build up emotions (Kollmuss & Agyeman, 2002).
	Guilt is less likely to activate PEB than sadness, pain, anger, and fear. Denial, apathy, and rational distancing are reactions that prevent people from PEB (Kollmuss & Agyeman, 2002c).
Responsibility and priorities	When the pro-environmental behavior of an individual is congruent with the personal priorities they have, the motivation to act in a specific way increases (Kollmuss & Agyeman, 2002).
	A big part of flight passengers does not feel responsible for the greenhouse gas emissions from air travel. Individuals prefer waiting for collective actions instead of feeling personally responsible (Moreno & Becken, 2009).
Habits	When a person has been showing a certain PEB, she or he will likely continue acting this way. Once a certain behavior has become a habit, it is much harder to change as individuals neglect information that does not match with their habits (Kollmuss & Agyeman, 2002).
	If the goal is to change the air travel behavior, it must be considered how habits were formed, reinforced, and then sustained (Steg & Vlek, 2009). It is shown that people who already purchase green services are likely to do so when flying in an aeroplane as well (Hinnen et al., 2017).
External factors	External factors are services, conveniences, or social norms. The better the services are, the more likely people will use them (Scarles et al., 2017).
	Travelers do not always act rationally. Therefore, external factors are not decisive for sustainable behavior when travelling. To change traveler's air travel behavior, it is important to target intrinsic motivations instead (Miller et al., 2010).

The criticism of the eleven factors for PEB is that they are widely overlapping and make it difficult to distinguish between different motivations to act pro-environmentally (Wind, 2022). Especially internal and external factors can be managed under the given circumstances of this study, as they are existing from the viewpoint of the individual (Blok et al., 2015). Among the researches that tried to find the factors which induce people to adopt pro-environmental behavior, this strategy is also applied (Li et al., 2019). In addition, to develop a comprehensive model for factors influencing the passenger's motivation on CO_2-compensation of a flight, findings from other studies should be considered.

2.7.3 PEB Studies on Air Travel Behavior

Through previous attitude behavior research based on the theories presented in this work, it is possible to gain a better understanding on how normative influences, individual values and psychological factors affect air travel behavior (Araghi et al., 2014). Most research on this subject has been qualitative studies such as face-to-face interviews or the use of focus group discussions. This research design is an important limitation for the findings (Barr et al., 2010; Cohen & Higham, 2011; Hares et al., 2009; Kroesen, 2013; McKercher et al., 2010). There are a few studies that prove that a person with high pro-environmental values would reduce air travel. From this it is concluded that some individuals that behave environmental-friendly in everyday life would transfer this PEB to air travel (Van Birgelen et al., 2011). However, more studies show the reverse. Even though a large part of the world's population is aware of climate change and its severe consequences, this consciousness is not necessarily reflected in air travel behavior (Araghi et al., 2014). Many individuals with a high pro-environmental awareness still travel with a high frequency by plane and are not willing to change that behavior (Cohen & Higham, 2010; Kroesen, 2013). Some studies have even shown no association between PEB and leisure air travel (Kroesen, 2013; Randles & Mander, 2009). Other research has even revealed a negative association between people with strong pro-environmental values and their air travel behavior (Barr et al., 2011).

PEB in aviation differs from PEB in everyday life (Lassen, 2010). Therefore, it is important to further analyze the different factors that influence, enable, or even restrict PEB, especially in aviation. From the studies analyzed, it can be assumed that people who are environmentally conscious still fly a lot and that not all factors can be associated with PEB behavior among flight passengers. Therefore, carbon emission offsetting programs are the only remaining lever within the framework of the PEB theory that passengers might respond to since they do not have to completely give up flying. There are also some studies on this topic that have collected interesting findings on the motivation of passengers to offset their CO_2 emissions.

People's behavior towards voluntary carbon offsetting was explored and it was observed that about 10% of people were willing to offset (Mair, 2011). The segment of passengers which is already willing to contribute towards climate change mitigation may be the best target group for behavioral change (Mair, 2011). However, this contrasts with a study in which only one out of 52 respondents had purchased an offset (Tartaglia & De Grosbois, 2009). Other studies also noted that only 2% of respondents ever opted for compensation for their travel (Gössling et al., 2007). These results are more in line with the current compensation rate at SWISS and the Lufthansa Group, which is about one percent in 2020 and 2021 (SWISS, 2022). According to a survey from 2008, passengers' skepticism about whether the carbon tax helps solve climate problems at all is the most powerful explanation for not opting for it (Brouwer et al., 2008). In addition, the lack of transparency about offset programs, already discussed in the chapter 2.3, can also be a reason why people do not engage in offset programs (Becken, 2007). While many studies have

contradictory views about this topic, a study conducted as early as 1999 showed that greater knowledge about environmental issues is the most important driver for taking action. In addition, consumers who are more environmentally aware were found to be more likely to participate in climate change mitigation strategies than other consumers (Lee & Moscardo, 2005).

2.8 Willingness to Pay

For a holistic view of voluntarily offsetting flight emissions, the willingness to pay is also included. In a recent study the median willingness-to-pay to voluntarily offset a ton of carbon dioxide from flight-related emissions is equal to zero, with the mean willingness-to-pay being around 1 EUR (Berger et al., 2022). Other studies found that the estimated willingness-to-pay for offsetting a ton of CO_2 ranges between 1 EUR to rather high amounts of nearly 50 EUR (Sonnenschein & Smedby, 2019). Another study concludes that "the cost of the compensation has no meaningful influence on the decision to compensate one's flight-related emissions". Even the ticket price has no significant effect on the compensation behavior. Only the spending on ancillary service relates to a higher likelihood to pay for offsetting flight's carbon emissions. This shows that the more an individual spends for additional services, the more likely he or she compensates flight emissions (Berger et al., 2022). In another study, it is even found that 20% of those passengers who are interested in purchasing supplementary services have a strong preference for green airline services (Hinnen et al., 2017). This observation can be retested in this study. Further, the willingness to compensate is dependent on the perception of the contribution of air travel to climate change (Hinnen et al., 2017). Another study showed that even passengers with low environmental values would consider offsetting their air travel emissions independent from economic factors. The main reason for this is not to give away charities, but to take responsibility (McKercher et al., 2010). In another willingness-to-pay study on air travel and climate change mitigation, it is shown that a substantial demand for climate change mitigation action among flight passengers exists, but there is no connection with an economic factor (Brouwer et al., 2008).

As a summary of the literature review, the following conclusions can be drawn.

- If the airlines' climate targets, as well as the global community's macro-level climate targets are to be met, air passengers are required to reduce or – at least – to offset their emissions immediately.
- The current communication content of airlines about compensation possibilities has limited impact on passengers' compensation behavior. In addition, there is a great deal of uncertainty regarding compensation programs and their effectiveness in offsetting emissions.
- The theories on pro-environmental behavior provide guidance on how to motivate people to change their behavior in favour of the environment.
- According to other studies, psychological variables outweigh economic factors when it comes to air travel emission offsetting.

3 Hypothesis Development

Complementing existing studies on pro-environmental behavior in other sectors as well as in the airline sector, the focus of this study is to give orientation on the motivation of flight passengers to offset emissions and to find appropriate communication possibilities for airlines to promote compensation programs. Through empirical research, the different triggers which lead to behavior to offset carbon emissions for a flight are modelled. The target PEB is “Offset flight emissions”. This behavior is influenced by the willingness to compensate for flight emissions. The factors influencing the willingness to compensate are for example values or beliefs (see blue box in Figure 10). From this point, the individual factors (variables) can be broken down further. In the example of “values”, there are the variables “biospheric”, “egoistic” or “altruistic” which are then operationalised into individual items in the research of the paper. The overlapping variables from the theory about factors influencing PEB are eliminated, and the model is downscaled to a mix out of the "theory of reasoned action”, the “theory of planned behavior”, the “value-belief-norms theory”, and PEB factors which are selective and disjunctive.

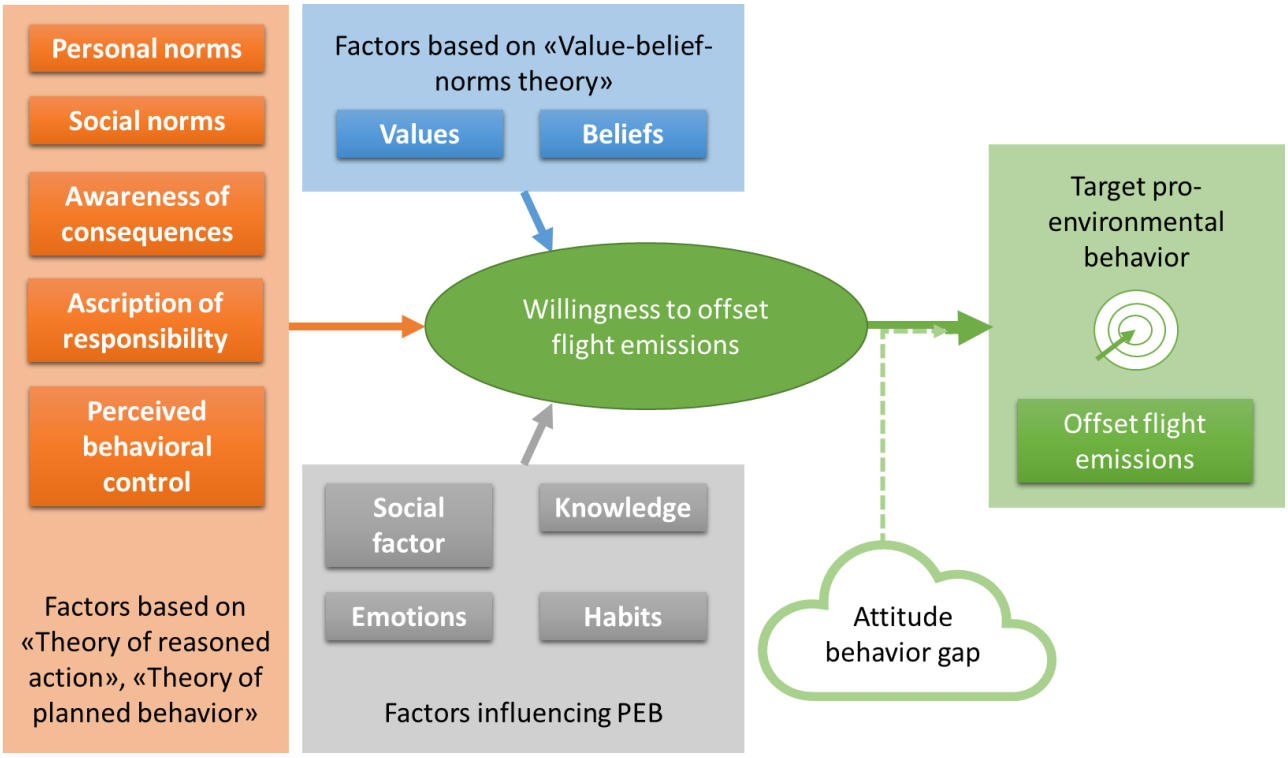

Figure 10: Path diagram for willingness to offset flight emissions

At this point, the research question shall be repeated:

> **Research question:** *“Do the factors for pro-environmental behavior in everyday life have an influence on the likelihood that a passenger will offset his or her flight emissions, and what are the main drivers to do so?”*

To answer the research question, the author first analyzes how the factors for PEB in everyday life differ in comparison to PEB in aviation. Second, the different influencing factors on flight compensation behavior are investigated. In a third step, the different factors are compared with each other to understand what influencing factors are key to understand flight passengers' behavior.

As discussed in the theoretical part of this thesis, PEB in everyday life differs from PEB in aviation. Previous research has shown that a large part of the world's population is aware of climate change and its severe consequences, however, this consciousness is not reflected in air travel behavior (Araghi et al., 2014). Many individuals with a high pro-environmental awareness still travel a lot by plane and are not willing to change this behavior (Cohen & Higham, 2010; Kroesen, 2013). That means even environmentally conscious people fly. In summary, giving up flying is not being considered. However, it can be assumed that environmentally conscious people would compensate for their flight. The author first wants to test the following main hypothesis to gain an understanding if people who are aware of climate change and show PEB in everyday life are willing to offset flight emissions in general:

> ***H1:*** *Individuals who show a pro-environmental behavior in everyday life do not compensate their flights by default.*

By getting a well-founded answer to this main hypothesis the author can derive both – potential general behavioral considerations as well as an understanding for the differences between PEB in everyday life and in aviation – that might hinder passengers to compensate flights.

To further deep dive on the topic, more hypotheses are developed. Theory shows that psychological factors influence the intention and also behavior plays a role to motivate individuals. H2 is connected with H1 and wants to test in a different way, if and which triggers for PEB from the theories enrolled in this work are applicable to CO_2 emission offsetting behavior.

> ***H2:*** *The target behavior of "offsetting flight emissions" is controlled to different degrees by the factors that cause pro-environmental behavior.*

It is assumed that certain attitudes, values, and norms motivate passengers more than others to compensate for their flight. If these key elements can be identified, these values can be applied in compensation communication. Previous studies do not show a clear picture which factors are the main reasons for compensation. Some identify knowledge of the process and emotions as a trigger, while others only recognise that the price of compensation does not matter (Berger et al., 2022).

To sharpen H2 and to identify the different independent variables with their degree of influence, further hypotheses can be formulated within the assumption that psychological factors drive the intention to compensate flights. It is assumed that awareness of consequences and ascription of responsibility from the

TPB model are not the reason that causes an individual to compensate. Previous research has shown that people are aware of the harm they cause by flying but negate the fact (Conboye & Hook, 2019) or they do not feel responsible and await for collective actions instead of feeling personally responsible (Moreno & Becken, 2009). It is assumed that personal and social norms are the main reasons in the TPB model that motivate passengers to offset.

> ***H2a:*** *People whose personal and social norms strongly tend towards pro-environmental behavior are more likely to compensate for their flight.*

In addition, passengers' values can be queried with the help of the VBN theory. In related studies, it has been observed that while passengers like nature and the environment (biospheric), they can also be self-interested (egoistic) (Kollmuss & Agyeman, 2002c). For this purpose, it is assumed that the values of the passengers are rather selfish, and the altruistic thought is smaller.

> ***H2b:*** *Values of passengers who offset flight emissions are egoistic and biospheric, but less altruistic.*

To complement the factors of social pressure, emotion, habit, and knowledge influencing PEB, it is assumed in H2c that individuals await collective actions instead of feeling personal responsible. When emotionally connected with the action and when usually offsetting emissions and knowing about the climate change, the assumed offsetting rate is higher (Kollmuss & Agyeman, 2002).

> ***H2c:*** *The factors "habit", "value" and "knowledge" as well as social and emotional factors influence the offsetting of flight emissions.*

In chapter 5, "Results", the above hypotheses are being tested with the methodology described in the next chapter.

4 Methodology

This chapter explains the research design as well as the statistical tools used to conduct the analysis. At this point, the research topic of this study shall be repeated to remind the reader of the central aim of this research:

The thesis aims to show what factors influence a flight passenger towards the behavior of compensating flight emissions to elaborate on what triggers flight passengers could be driven to compensate their flight. From that, the additional objective is to develop communication content to achieve a higher compensation rate.

To contribute to a more holistic assessment of the motivation of flight passengers for their flight-related carbon emission offsets, the current work reports on a quantitative survey. Studies and data research can be categorized with respect to the objective. Exploratory research is often the first step within a study,

helping the researcher to become familiar with the topic and to identify variables that form hypotheses at a later stage (Weiers, 2010). Descriptive research, as the name suggests, aims at describing something while in causal research, "the objective is to determine whether one variable has an effect on another" (Weiers, 2010). The predictive research finally wants to forecast something in the future. This study focuses in a first step on descriptive research, aiming at describing current flight behavior and offsetting behavior within the target group as well as describing values, norms, or habits of flight passengers. In a second step, causal research should help to understand the influence on different factors explaining flight offsetting among the sample. It incorporates descriptive as well as causal research by first describing flight passengers' general behavior and attitudes and second explaining it through influential factors.

4.1 Survey Construction

The survey works on a self-report assessment where individuals are asked to provide information on the properties of the behaviors they perform. Individuals can respond to this request by completing online questionnaires. Self-report data can be collected at a low cost for the researcher and is attractive because of the possibility of large sample sizes or for inclusion into large-scale survey research (Lange & Dewitte, 2019). To explain the questionnaire as structured as possible, the instrument is grouped according to the different theories on factors influencing PEB mentioned in the current work. The questions and items are taken or adapted from known scales in pro-environmental behavior research from Kurisu (2015) and Schultz & Zelezny (1998). Questions about factors derived from the TRA and TPB theories are from the pro-environmental behavior scale book from Kurisu about motivation to recycle and adapted for air travel behavior (Kurisu, 2015). It uses as a basis the same scale as Markle which identified no less than 42 unique multi-item PEB measures in 49 reviewed studies (Markle, 2013). Since not all items are applicable to air travel behavior, questions about values from the VBN theory are taken from the scale about values and pro-environmental behavior at the workplace (Schultz & Zelezny, 1998). Adopting and adapting scales in PEB research is of major importance because it was recognised early on that there is no consistency in the scales in PEB research (Dunlap & Van Liere, 1978) (Markle, 2013). In a last step, specific questions such as the "Compensaid" offer from SWISS and interventions for more tangibility as well as the sustainability behavior of the individuals are checked. Demographic questions end the survey to describe the sample and to understand effects such as education or age on the compensation behavior. The questionnaire was thus divided into 6 different blocks.

- Start & Intro
- Block 1: Check psychological factors for PEB / altruistic behavior to find the motivators for flight compensation
- Block 2: Identifying motivators by checking the influence of the value-belief norm theory
- Block 3: Factors influencing PEB by Kollmuss & Ayegeman (specific to CO_2 compensation)
- Block 4: SWISS "Compensaid" offer, interventions

- Block 5: Sustainability Behavior
- Block 6: Demographic Questions

The survey consists of 25 questions and takes approximately five to seven minutes to fill out. The average processing time ultimately was 5min 59s. The survey is provided in English and German. The survey took place entirely online. The operationalisation of the hypotheses and the response options to the questions were largely based on Likert scales. A six-point response format from 1 = *disagree* to 6 = *strongly agree* was chosen. In this way, it was deliberately avoided that the respondent could pick a middle ground and had to state his or her preference (Paier, 2010). This method partly counteracts the limitations of self-assessment-based surveys, which are discussed in the following.

Limitations of self-report measures of pro-environmental behavior are that it is highly unlikely that all respondents have the same idea of self-assessment (Lange & Dewitte, 2019). As an example, the question "In my personal daily life I behave sustainable (e.g., recycling, energy savings, conscious meat consumption)" can be assessed differently. Individuals are often biased observers of their own behavior (Berger et al., 2022). They may also want their answer to be consistent with the other responses they gave throughout the survey, the way they desire to behave, or the expectations or preferences of the researcher. Studies examining the last possibility typically find small and non-significant correlations between self-report measures of PEB and social desirability scales (Milfont, 2009). In the survey of this work, the intention of the researcher is not stated and the respondents are not informed about the aim of the study to avoid social desirability (survey, see appendix A). Figure 11 shows the relationship between research question, survey blocks and hypotheses.

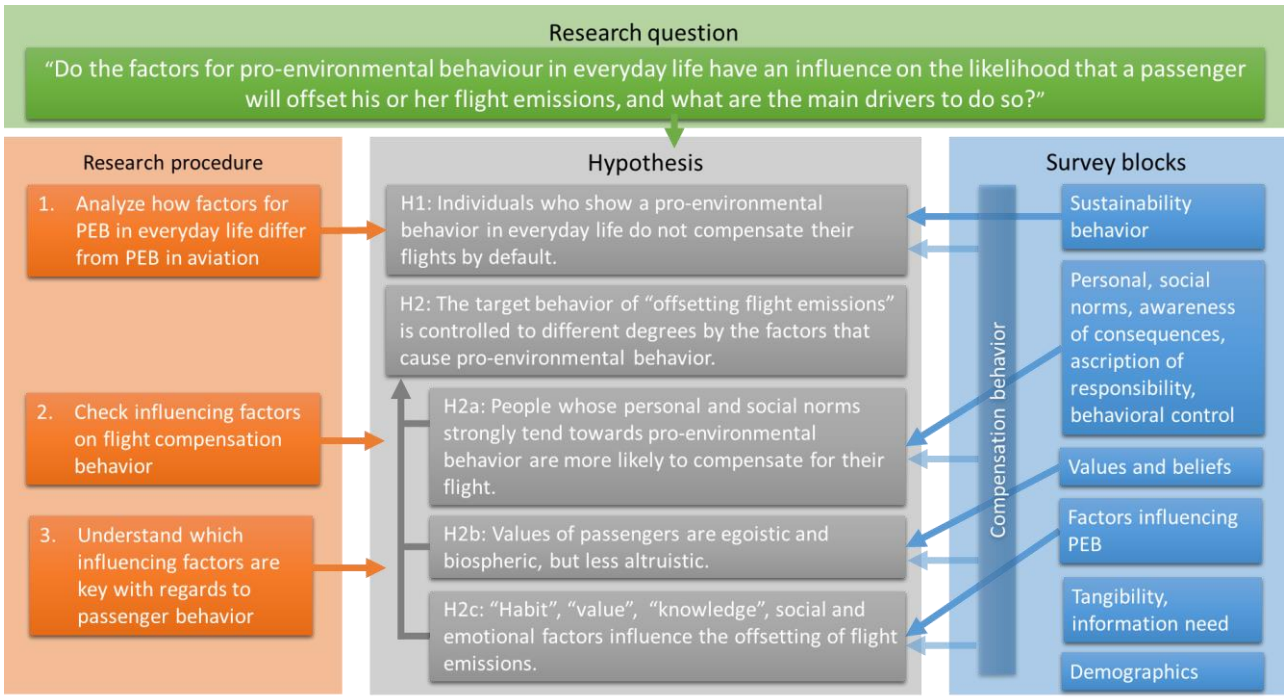

Figure 11: Survey construction based on hypothesis

4.2 Pretest of the Survey

The survey was constructed under consideration of the guidelines for setting up self-reported behavior testing (Dono et al., 2010). There are four different key aspects which need to be considered when setting up questions in a quantitative survey about behavior. First, it is important to avoid technical terms and to use easier expressions. Second, unclear definitions should be avoided. Third, double-barreled questions should be left out, and fourth, the carry-over effect should be avoided (Dono et al., 2010). Especially the technical terms and the double-barreled questions were a challenge for the present survey. To check the quality, the entire questionnaire was checked by three independent persons. In particular, the comprehensibility of the questions was analysed by the respondents. In addition to these analyses, the items were tested with six more respondents to evaluate the scales used for the survey. The task of the respondents was to check the comprehensibility of the items used and, if necessary, to make suggestions for changes. This feedback allowed to avoid suggestive questions in order not to steer the answers in a certain direction and to achieve a better separation between the questions (Paier, 2010). After the questions had been specified and incomprehensible points had been removed, the questionnaire could be finalised.

4.3 Sample and Variables

The survey design determines the temporal mode of data collection (Diekmann, 2004). To answer the research question of this thesis, a cross-sectional design was used. Data collection took place at one measurement point. The data collection period covered 25 days, from 11.05.2022 to 05.06.2022. The subjects were recruited online via institutional mailing lists, social media, forums, and career networks. The respondents were invited by email to participate in this study. In addition, two samples were taken at Zurich Airport where departing passengers were approached and asked to fill out the survey. There were no experimental conditions, and anyone could participate in the field study under natural circumstances. However, it was important to ensure that these were passengers who had flown in recent years. A filter question is integrated at the beginning of the survey. The population therefore necessarily consists of people who have already flown in a passenger aircraft and speak German or English. If this study were to be reviewed or similar results collected, these conditions (language and flight behavior) would have to be met. This would then ensure reliability, i.e. the reproducibility of the measurement results (Diekmann, 2004). In total, 549 persons clicked on the link to the online questionnaire and 459 finished it completely which results in a response rate of 84%. Five respondents have never flown in the last 10 years and were therefore not considered. To avoid mistakes when analyzing the data, it was primarily adjusted with regards to the two following issues: only completed questionnaires were evaluated, and participants who completed the questionnaire in less than two minutes were checked to see if the answers made sense, e.g., if all the answers were ranked with the same importance. However, no surveys had to be disregarded.

The study consists of many independent (influential) variables, which are the main objective to explain the dependent variable of CO_2 compensation behavior which is asked by the question: "*Have you ever compensated your flight emissions?"* The design of the study ensures that the dependent variable (whether a flight has been compensated for CO_2) is isolated from possible confounding influences on the independent variables. For this purpose, control variables such as age, gender, number of flights per year or level of education were included in the study. The items of the independent variables are factors for pro-environmental behavior such as "*if all people would CO_2-compensate their flights, I would do it too*" or "*Emissions are caused by the airline I fly with. I'm not responsible for that*" (see survey in appendix A).

4.4 Statistical Tests for Data Analysis

The main idea of the analysis is to relate the reasons to pro-environmental behavior to "*compensate / not compensate flight*". From this, it is possible to statistically ascertain which reasons for flight compensation play the most important role.

Before the analysis, the gathered data was prepared. The dataset was checked for missing data and outliers. The data was then analyzed using statistical software R Studio. It allows a simplified and at the same time precise sorting and treatment of datasets. One of the most useful statistics involves comparing two samples to examine whether a correlation between them is significant or not (Weiers, 2010). The Chi-square test is a statistical test procedure that can make statements about the relationship between variables that are either nominally or ordinally scaled. The Chi-squared test is also a type of hypothesis test. It is often also referred to as the chi-square goodness-of-fit test or chi-square independence test since the test examines the relationship between the variables in terms of stochastic independence. The presentation and calculation are mainly done using cross-tabulation. The observed frequencies are compared with theoretically expected frequencies. The strength and direction of the correlation are then determined with the Cramer's V coefficient (Brosius, 2013).

The Chi-square coefficient is calculated as follows:

$$X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{O_i}$$

where
X^2 = Chi-square coefficient
n = number of observations
O = Observed value for i
E = Expected value for i

The Cramer's V coefficient is calculated as follows:

$$Cramer's\ V = \sqrt{\frac{X^2}{n \cdot \min(r-1, c-1)}}$$

where
X^2 = Chi-square coefficient
n = number of observations
r = number of rows of the cross table
E = number of columns of the cross table

Two crucial groups in the example of this work would be "compensators" and "non-compensators". To conduct a Chi squared test, the data must fulfill the criteria of following a normal distribution and should be ordinal or categorial scaled (Brosius, 2013). As with all significance tests, the larger the sample size, the more likely it is that even small differences will be significant. Therefore, a significant result does not say anything about the strength of the effect (correlation) (Navarro, 2013). Therefore, after each chi-square test, an association test is carried out to check the explanatory power. Therefore, the correlation test "Assocs" in R Studio is used. This permits to test associations of categorial or ordinal variables and bases on the same idea as the better-known correlation tests (cor-tests) for metric data. With the Carmer's V value stated by the association test, it is observable how strong the explanation capacity of the variable on another is (1 = perfect explanation, 0 = no explanation).

As a last statistical method, the logistic regression analysis shall be discussed. This test is being used to show relations between one or several independent variables (x) and a dependent variable (y). The aim is to find a causality between the data sets that allows to explain the influence that the independent variables have on the dependent variable. Logistic regression analysis is based on maximum likelihood estimation (MLE) and differs from the least squares method used in linear regression analysis. (Weiers, 2010). For a multiple logistic regression, the following general regression equation is being used:

$$P(y = 1) = \frac{1}{1 + e^{-z}}$$

where
$P(y = 1)$ = probability that y = 1
z = Logit (linear regression model of the independent variables)

With the following formula for z:

$$z = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \epsilon$$

where z = Logit (linear regression model of the independent variables)

β_0 = a constant

$x_1, x_2, \ldots, x_k$ = values of the independent variables, x_1, x_2, …, x_k

$\beta_1, \beta_2, \ldots, \beta_k$ = partial regression coefficients for the independent variables, x_1, x_2, …, x_k

ϵ = random error, or residual. (Weiers, 2010)

The resulting formula can be used to calculate the probability that the dependent variable y becomes 1:

$$P(y = 1) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \epsilon)}}$$

The partial regression coefficients explain how much the value of the dependent variable changes in average when the value of the independent variable increases with one unit. Theoretical considerations play a central role in the selection of variables in the model. The model should be kept as simple as possible (Navarro, 2013). Therefore, not too many independent variables are included in the model, but separate models are calculated according to the theory blocks.

The assumptions are that the dependent variable is a vector containing only 0 and 1. With this, a model for logistic regression can be created in R Studio with the command "glm" and the argument "family=binominal". Then an omnibus test is performed to check whether the model with the independent variables is better explained than by the null model (without independent variables). Next, the minimum adequate model is determined using AIC (Akaike Information Criterion) (Shipley & Douma, 2020). Using the odds ratio, the steepness of the relationship between the independent and the dependent variable can be determined. The adequacy of the selected model was then checked using G^2 statistics and "component + residual plots" and was not violated. The model quality can be expressed with a pseudo-R^2 in a logistic regression:

$$R^2 = 1 - Devianz\ Total\ /\ Devianz\ Residue$$

4.5 Implementation of Two Communications Examples at SWISS

The survey results provide the basis for an adapted communication to SWISS passengers. In 2021 and 2022, SWISS has chosen several touchpoints along the customer journey (see Figure 5) to place messages about offsetting flight emissions. In this thesis, on the one hand, a verbal communication on board of the aircraft about the offsetting option is evaluated. This gives customers the option to pay a compensation fee by scanning a QR code displayed in the inflight entertainment system during their flight. SWISS tests this option on several long-haul flights. By offering the possibility to offset on board, SWISS reaches a different

target group that cannot be reached during the booking process for various reasons, for example because they do not book their flights themselves or do not book via swiss.com. Feedback from cabin crew and the current number of compensations paid on board indicates if the communication platform is a successful option. On the other hand, SWISS provides a new communication option in their lounges at Zurich and Geneva airport. This option consists of small information displays (A4 format) which are located on several tables in the lounges. The wording for the displays is already derived from the results of this thesis. (see display in appendix B). Again, the customer can scan an integrated QR code on the display which prompts him or her to the “Compensaid” website of SWISS. In addition, SWISS has the possibility to track the number of accesses based on these QR code scans. In this thesis, the two options are reviewed for their advantages and disadvantages and discussed qualitatively.

5 Results

The empirical study should add evidence for what reasons flight passengers are willing to voluntarily offset flight emissions. The given hypotheses in chapter 3 will be tested and confirmed or rejected accordingly.

5.1 Descriptive Aspects

A total of 459 participants took part in the survey. 5 answers had to be removed from the data because they had not flown in the last ten years. 48.9% (n = 222) of the remaining 454 participants were women and 50.4% (n = 229) men. 3 participants stated to be divers. The age of the participants varied as described in Figure 12. More than two third (70,9%, n = 322) of the participants possess a university degree or a degree of a university of applied sciences. Even in the two samples taken among passengers at Zurich Airport this rate was 50%. It seems that people with higher education are more likely to participate in such surveys.

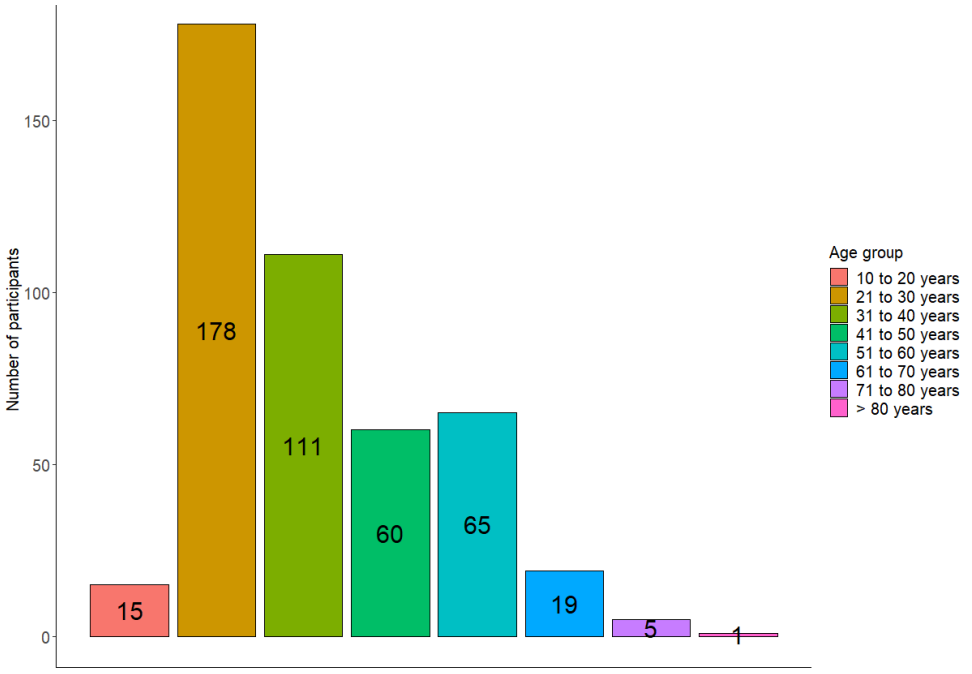

Figure 12: Participants by age

Regarding flight behavior, the following aspects can be observed in the sample (see Figure 13). Most of the respondents (59%, n = 266) do not take business flights but there is a considerable number of frequent flyers as well (more than 5 flights per year, 16%, n = 71). Most respondents (77%, n = 348) take 1 to 5 private flights per year. Again, quite a high number of participants fly more than 5 times per year for private reasons (17%, n = 78).

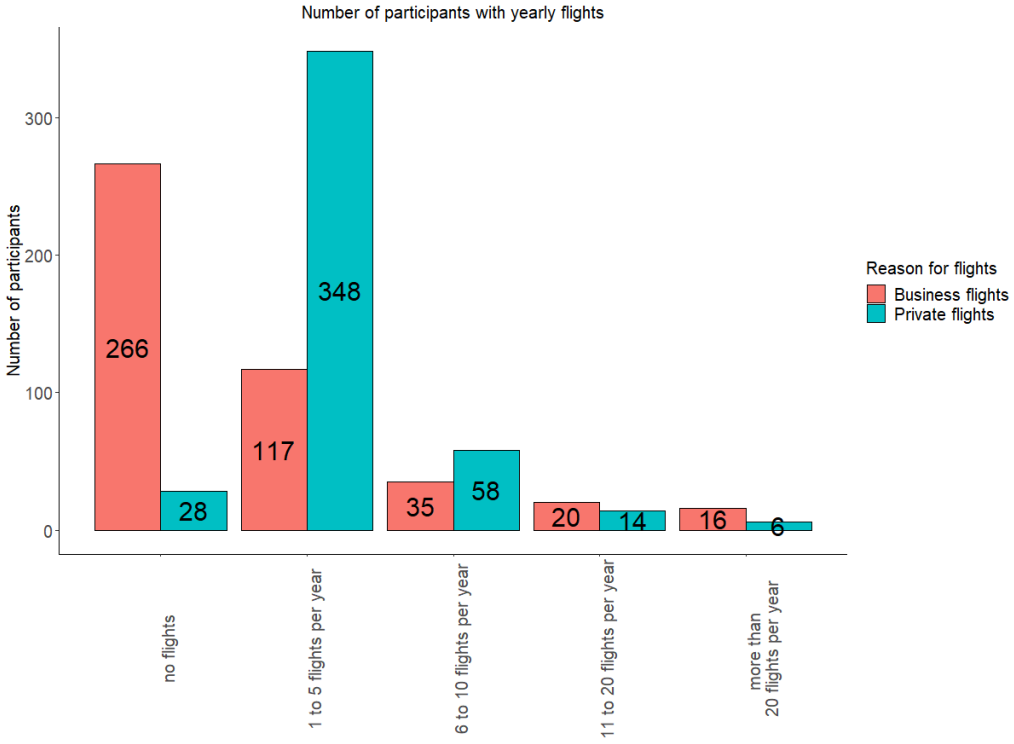

Figure 13: Number of participants by number of yearly flights

Regarding the choice of flight class, it can be observed that 0.2% fly First Class, 11.5% Business Class, and 88.3% Economy Class (see Figure 14).

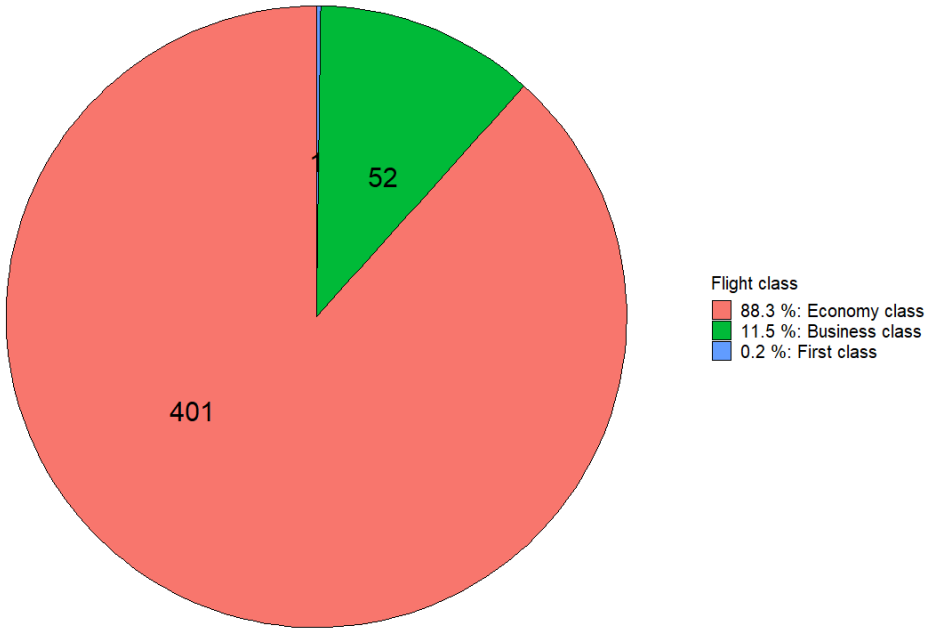

Figure 14: Number of participants by flight class for private flights

The following descriptive observations can be made to describe the compensation behavior. A total of 153 persons have already compensated once (see Figure 15).

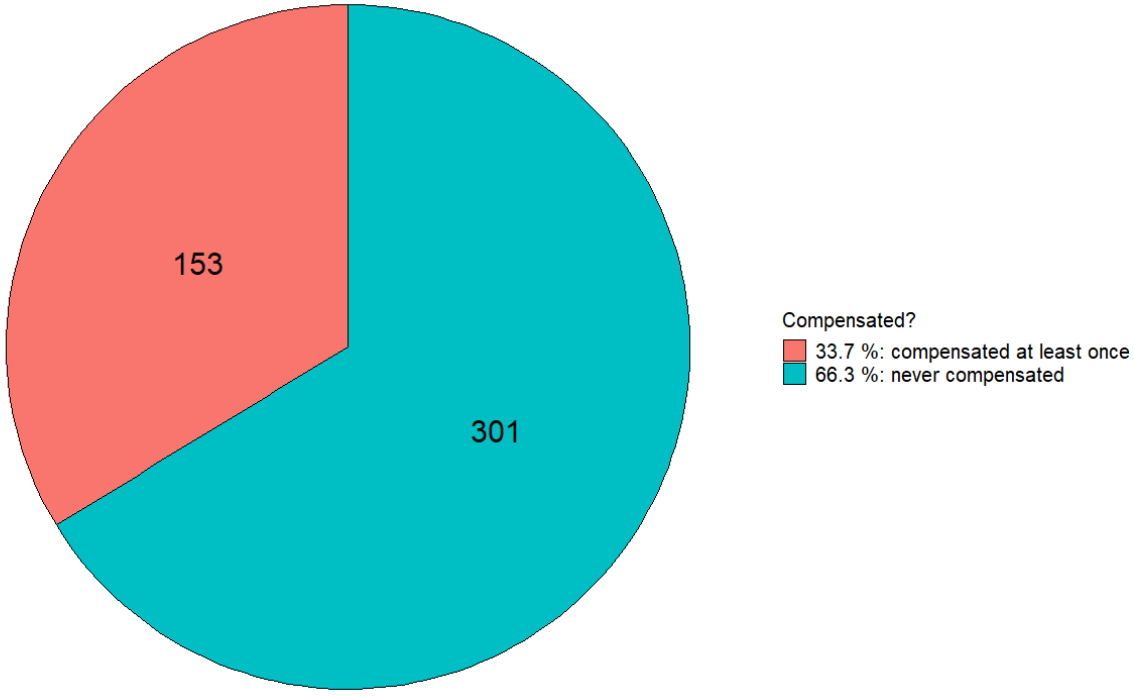

Figure 15: Number of participants who (at least once) compensated / never compensated

At first sight, the high compensation rate comes as a surprise considering the figures based on previous studies mentioned in section 2.7.3. On the one hand, the high number might be a result of the fact that many participants have a high level of education, and it can be assumed that a higher education level might result in a higher compensation rate. On the other hand, some of the positive answers might have been influenced by social desirability. It is a fact that people tend to automatically increase their satisfaction in surveys, which is a serious threat to the validity of self-reported data (Caputo, 2017). This topic is further elaborated in chapter 6.1.

The compensation offering of SWISS is known by 31% of the sample. This knowledge of the platform "Compensaid" correlates with the actual compensation behavior. A chi-square test of independence revealed a significant association between the knowledge about the "Compensaid" offering and the compensation behavior, $X^2(1) = 11.76$, $p < .001$. When asked whether carbon offsetting for air travel is the right approach to compensate flight emissions, about half of the respondents (48%, n = 218) favor this approach, while the other half (52%, n = 236) are less convinced that this is a good solution (see Figure 16).

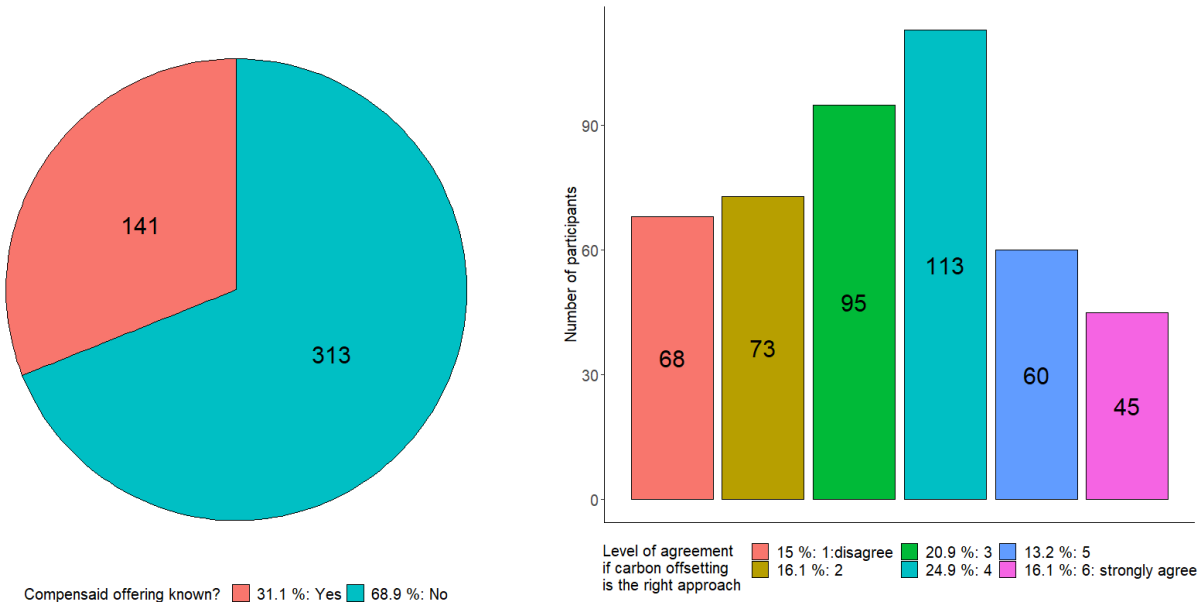

Figure 16: Knowledge of "Compensaid" offering and agreement to the approach of carbon offsetting

To conclude the descriptive analysis, it can be observed that the majority of respondents consider themselves to behave sustainably in everyday life (69%, n = 312). See Figure 17.

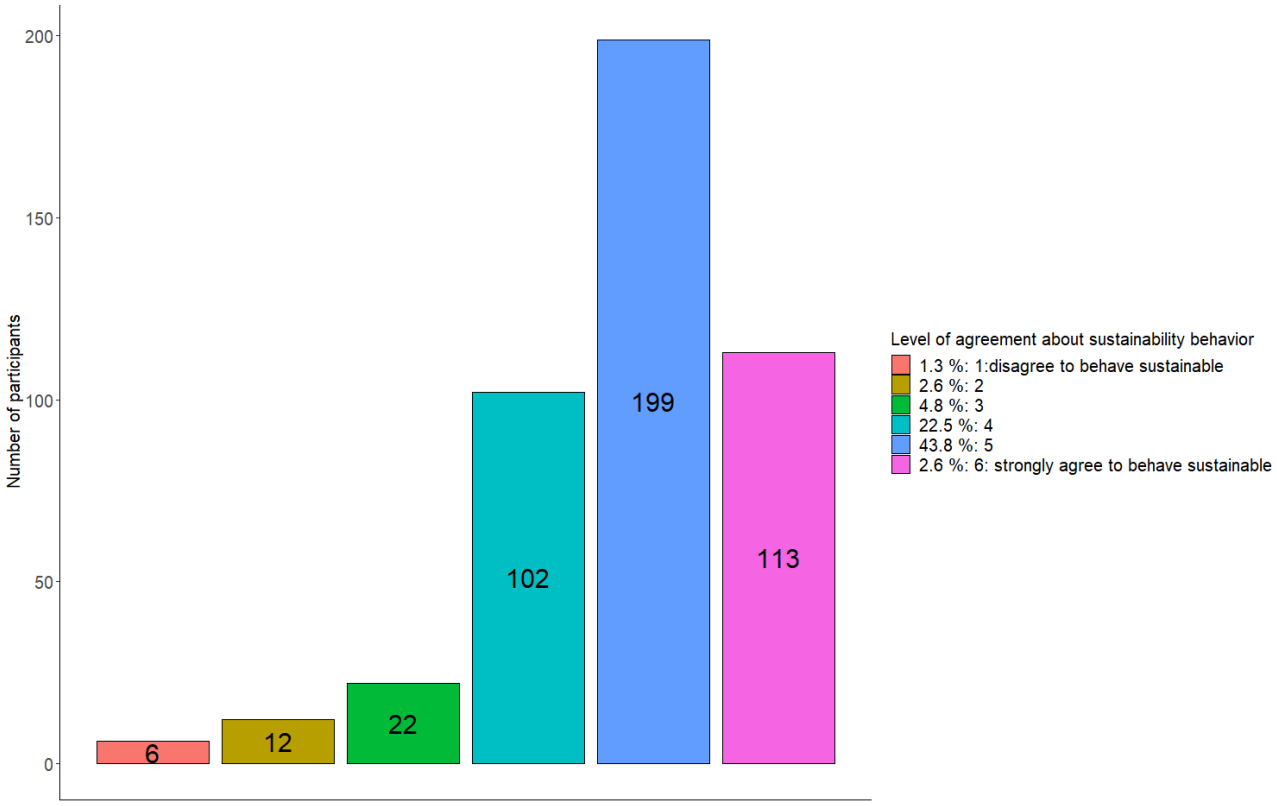

Figure 17: Number of participants who consider themselves behaving sustainable

5.2 Characterisation of a Flight Passenger

To better understand the descriptive aspects and the attitude of a flight passenger in general and how he or she thinks about the issue of emission offsetting in air travel, a typical passenger is characterised below by the mean values of the responses of all survey participants. The labels of the spider chart from Figure 18 are mentioned in brackets.

Her name is Clara, she is 35 years old and has a university degree. She usually flies 1-5 times a year for private purposes, very rarely for business reasons. She does not feel obliged to offset CO_2 (Obligation to compensate) and does not have any pressure from her social environment to offset her flight (Expected to compensate). However, she is well aware that air travel emits a high proportion of CO_2 emissions and contributes strongly to global warming. She is even aware that she is responsible for the emissions and not the airline she flies with (Responsible for emissions). Her value attitudes are as follows: social justice (Importance of social justice), equality and a world of peace (Importance of a world of peace) are very important to her. Accordingly, she pursues an altruistic approach. Regarding her values about the natural environment, she wants to avoid pollution (Importance of pollution prevention) and nature is very important in her life. She also believes that the earth offers only limited resources (Awareness of limited resources). She is not particularly selfish, she has no preference to have an influence on other people (Importance of influence) and desire for wealth (Importance of wealth), and authority and social power are not particularly important to her. She describes herself as a woman who, even if her whole environment

were to compensate for her flight, would not let herself be influenced by it (Influence by others). She does not often offset the CO_2 emissions from other services and purchases of products (Offset on other occasions). In general, she is unsure whether the offset system is the right approach to reduce emissions. At the same time, she does not know how many emissions she causes. Therefore, she does not currently offset her flights. Not because it is too expensive or too time-consuming for her, but because she wants more transparency about the use of her money and would prefer to be able to decide for herself in which projects she invests. Nevertheless, she finds that she is quite sustainable in her everyday life.

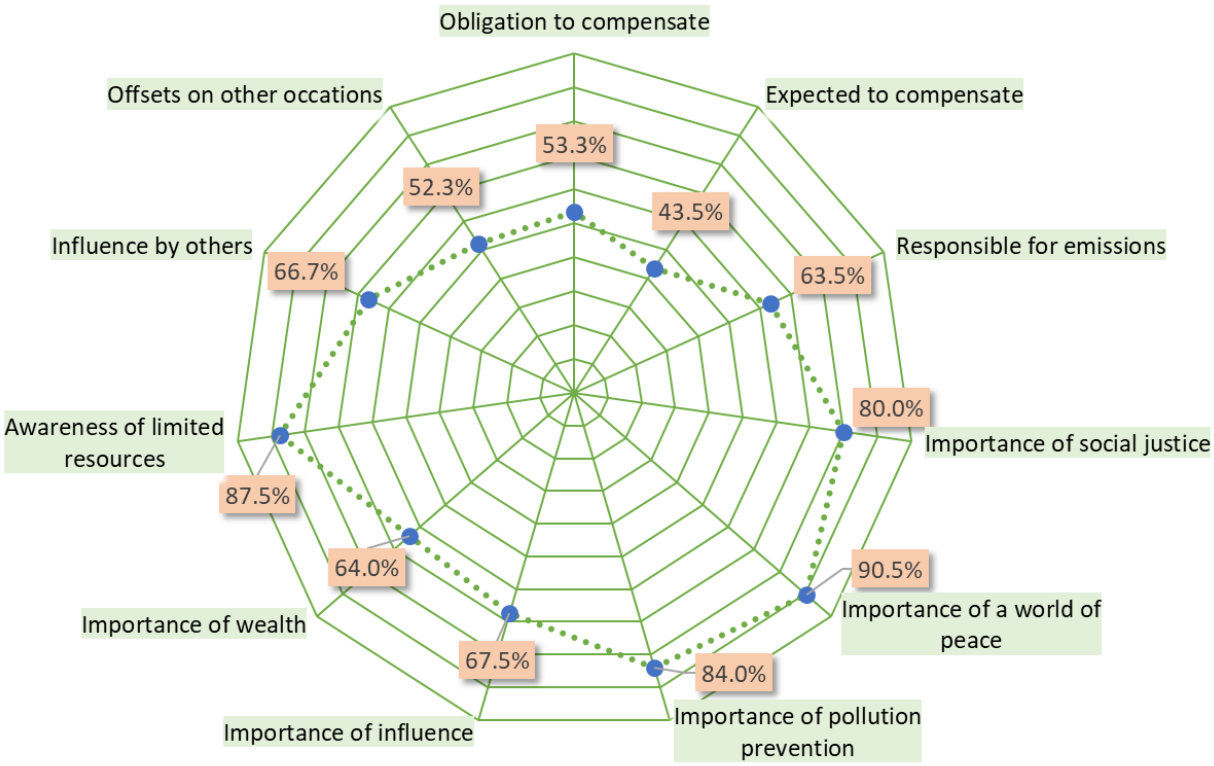

Figure 18: The «average» passenger

After these descriptive findings about the survey participants and an analysis of passengers in general, the hypotheses are tested in the following.

5.3 Testing of Hypothesis 1

To test hypothesis 'H1: Individuals who show a pro-environmental behavior in everyday life do not compensate their flights by default' different variables were examined.

5.3.1 Compensation Behavior and Sustainability Behavior

As explained in the methodology chapter, to test this hypothesis, the two variables of compensation behavior for air travel and self-reported sustainability behavior were examined. The Pearson Chi-square test of independence shows a significant relationship between the compensation behavior and the self-

reported sustainability rating, $X^2(5) = 18.07$, $p = .003$. Individuals who behave sustainable in everyday life more likely offset flight emissions. However, the subsequent association test shows that the relationship between sustainability behavior and flight compensation behavior is only marginally explained (contingency coefficient = .20, Cramer's V = .20). Based on that, the hypothesis that individuals who show a pro-environmental behavior in everyday life do not compensate their flights by default must be partly rejected.

The calculation of the Chi-squared coefficient is shown in below contingency table (see Table 6). Green cells show observed numbers which are higher than the expected numbers and red cells show those which are lower than expected.

Table 6: Calculation of Chi-squared coefficient

Observed numbers		Self assessment with regards to general sustainability behavior (Level of agreement)						
		1: Disagree to behave sustainable	2	3	4	5	6: Strongly agree to behave sustainable	Sum
Flight Compensation Behavior	Compensated at least once	1	0	4	26	83	39	153
	Never compensated	5	12	18	76	116	74	301
	Sum	6	12	22	102	199	113	**454**

Expected numbers (=sum of row * sum of column / number of participants)		Self assessment with regards to general sustainability behavior (Level of agreement)					
		1: Disagree to behave sustainable	2	3	4	5	6: Strongly agree to behave sustainable
Flight Compensation Behavior	Compensated at least once	2.0	4.0	7.4	34.4	67.1	38.1
	Never compensated	4.0	8.0	14.6	67.6	131.9	74.9

Chi-squared coefficient	(Observed - Expected)^2 / Expected	0.5	4.0	1.6	2.0	3.8	0.0
		0.3	2.1	0.8	1.0	1.9	0.0
	X-squared (sum of above)						**18.073**

The value range for the Chi-squared coefficient for the sample is (n = number of observations, M = number of categories of the variable with less categories):

$$0 \leq x^2 \leq x^2_{max} = n \cdot (M-1) = 454 \cdot (2-1) = 454$$

The Chi-squared coefficient of 18.07 is slightly above the critical value of 11.07 (according to Chi Squared Table, (Beyer, 2019)) for 5 degrees of freedom and for a 5 percent probability which shows a significant but small dependence between the two variables since the calculated coefficient is just a bit higher than the critical value but much lower than the maximum value. It is important to mention that based on this test it cannot be concluded that sustainability behavior causes compensating flights. The independence test only proves that there is a significant relationship between the two. Also, when assuming metric data for the sustainability behavior, with a Pearson's product-moment correlation test, a correlation between sustainability behavior and compensation behavior is found, r (452) = .15, $p = .002$.

In general, both groups have a very high level for self-reported sustainability (see Figure 19).

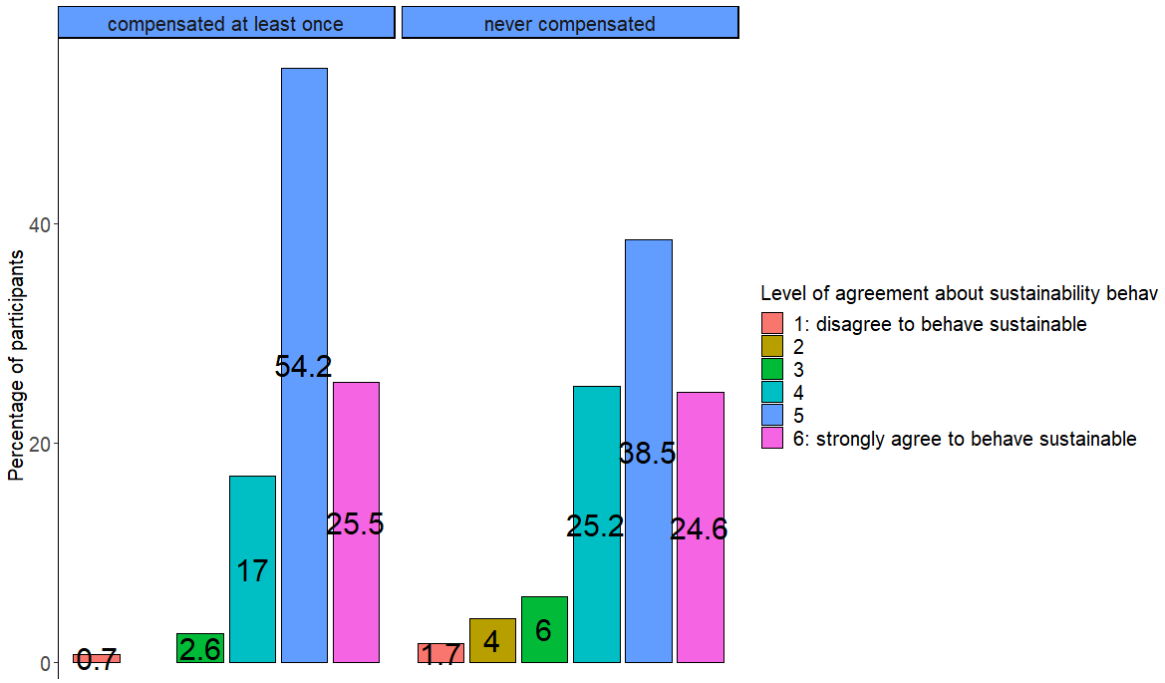

Figure 19: Percentage of participants who consider themselves behaving sustainable grouped by respondents who compensated / did not compensate

However, compensators have slightly overreported to behave sustainably compared to non-compensators. This can be better observed with a correlation line between sustainability behavior and compensation behavior (see Figure 20).

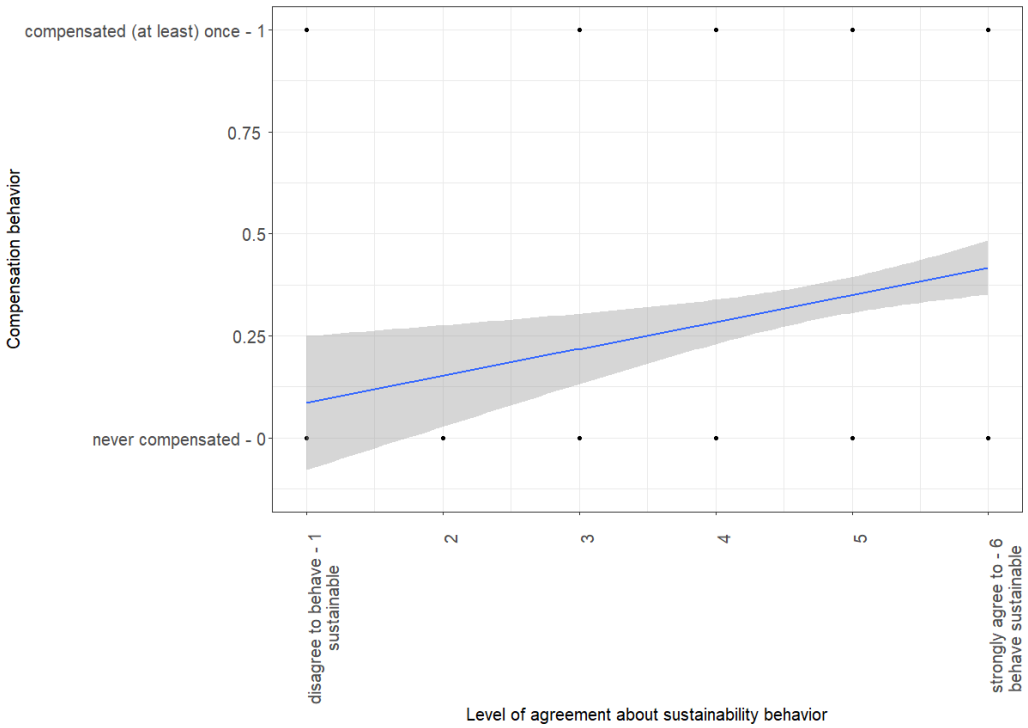

Figure 20: Correlation between sustainability behavior and compensation behavior

To determine the strength of the association between the two nominal variables, Cramer's V measure can be used. Because the sustainability rating information is coherent whether a person offsets or not, it can be assumed that a person's sustainable behavior does not predict by default that they will also offset their air travel. In addition, it was observed that attitudes toward sustainability did not explain passengers' compensation behavior well (Cramer's V = .20, where value 1 is the perfect explanation of one variable by the other and 0 is no explanation at all).

To check more closely whether these findings are also reflected in other variables of the survey, further tests will be discussed in the following.

5.3.2 Everyday Norms and Obligation to Compensate Flight Emissions

Instead of verifying the hypothesis only on self-reported behavior, the following also examines relationships between norms. In this way, the connection between sustainability in everyday life and compensation behavior during air travel can be analysed in more detail. Norms in everyday life, such as throwing away glass bottles in the trash, are compared with the obligation to compensate flight emissions.

The Pearson Chi-square test of independence shows a significant relationship between the personal norm of recycling glass and the obligation to compensate flight emissions, $X^2(25) = 67.49$, $p < .001$. The subsequent association test shows that the relationship between the personal norm of recycling glass and the obligation to compensate flight emissions is only marginally explained (contingency coefficient = .36, Cramer's V = .17). This result underlines that hypothesis 1 is not entirely applicable, since people who follow sustainable norms in everyday life also feel a greater obligation to compensate for their flight emissions. However, this association is again only weakly explained, i.e., sustainable norms in everyday life only explain sustainability awareness in air travel to a weak degree.

5.3.3 Sustainability Behavior and Considering Offsetting the Right Approach

Lastly, it was examined whether sustainably minded individuals find offsetting in air travel the right approach to reduce emissions in the aviation sector. This test can be used to check whether people who adopt to a sustainable behavior also find offsetting flight emissions the right approach.

The Pearson Chi-square test of independence shows a significant relationship between the sustainability behavior and considering the system of CO_2 compensation of air travel the right approach to offset emissions, $X^2(25) = 52.20$, $p = .001$. The subsequent association test shows that the relationship between the sustainability behavior and considering the system of CO_2 compensation of air travel the right approach to offset emissions is only marginally explained (contingency coefficient = .32, Cramer's V = .15). Based on the contingency table, it can be explained that people who behave sustainably tend to be unsure whether CO_2 offsetting for flight emissions is the right approach.

5.3.4 Summary of Results for Hypothesis H1

Hypothesis 1 *"Individuals who show a pro-environmental behavior in everyday life do not compensate their flights by default"* can be partially rejected (see Table 7). It was found that:

- The more sustainable a person is, the more likely he or she is to offset their flight for CO_2 emissions. However, this effect is very marginal, as the strength of the correlation is weak.
- The more sustainable a person is in everyday life, the more likely they feel obliged to offset their flights.
- The more sustainable a person behaves, the more critical he or she is with regards to the approach of offsetting CO_2 from air travel to reduce emissions.

Table 7: Summary of the results for hypothesis 1

Test	Test method	Significance (*p* value)	Degrees of freedom	Chi-squared coefficient	Cramer's V coefficient
Sustainable behavior related to compensation behavior	Pearson Chi-square test of independence and association test	.003	5	18.07	.20
General sustainability norm related to obligation to compensate	Pearson Chi-square test of independence and association test	< .001	25	67.49	.17
Sustainable behavior related to approach of offsetting emissions	Pearson Chi-square test of independence and association test	.001	25	52.20	.15

At this point, as mentioned in methodology section, it will be shown that the results of the Chi2 test of these three evaluations must be taken with caution, since the larger a sample is, the more likely the statistical test will indicate significance (Qian, 2016). Therefore, the association test of the Cramer V should be weighted higher, which does not provide strong explanations of the associations in all three tests.

These results show that people who show pro-environmental behavior in everyday life also have a sustainability consciousness when it comes to flights, even if the dependence is only weak. Therefore, the results of hypothesis 2 should provide information about which factors of the PEB theories have the most influence on the compensation behavior for flight emissions.

5.4 Testing of Hypothesis 2

To identify the different factors and their degree of influence, logistic regression models according to the previously discussed theories and matching hypotheses (H2a, H2b, H2c) were drawn. A first logistic

regression was conducted in 5.4.1 to test for the influence of the theory of reasoned action and the theory of planned behavior, where it was assumed that pro-environmental personal and social norms are the main reasons to compensate a flight. A second logistic regression was modeled to analyze which values are most common among flight passengers (chapter 5.4.2). A third logistic regression was modeled to understand which factors influencing PEB are most relevant when it comes to air travel emission offsetting (chapter 5.4.3).

5.4.1 Obligation of Individuals as Main Driver to Compensate

Offsetting behavior during air travel (yes/no) was investigated as a function of obligation, expectation, awareness of consequences and ascription of responsibility regarding emissions offsetting when flying. The best model according to AIC (AIC = Akaike Information Criterion, model selection) contained all variables except the variable that queries the respondent's expectations of his or her environment regarding CO_2 compensation. In addition, the omnibus test of the model shows a value of .29, which is above the significance threshold of .05 and proves that the explanatory power of the new model is higher than that of the null model. Accordingly, the following logistic regression equation can be set up:

$$P_{Flight\ Compensation}(y = 1) = \frac{1}{1 + e^{-(-2.675 + 0.593 \cdot x_1 - 0.293 \cdot x_2 + 0.355 \cdot x_3 - 0.296 \cdot x_4)}}$$

where x_1 = obligation to offset emissions

x_2 = air travel generates emissions

x_3 = awareness of causing emissions

x_4 = not being responsible for emissions

If the degree of obligation to offset emissions when flying increases by one unit, the relative probability that a person has already offset their flight once increases by 90% (1.90 - 1 = .90). For consciousness regarding aviation emissions and its contribution to climate change, the odds ratio is lower than 1 (and the sign of β correspondingly negative). Surprisingly, this means that when the awareness increases that flight emissions are partly responsible for the global temperature rise and the climate change, the relative probability that respondents have already compensated their flight decreases by 25% (0.75 - 1 = -0.25). However, if one's own ascription of the responsibility of self-inflicted flight emissions increases, the relative probability that a person has already compensated for their flight increases again by 43% (1.43 - 1 = .43). These two observations must later be interpreted with caution, as awareness of climate change impacts from flying and actual compensation behavior only indicate a significance at the 0.05 level. Finally, the logistic regression model describes that for people who see the airline and not themselves as the polluter for flight emissions, the relative probability to compensate their flight decreases by 26% (0.74 - 1 = -0.26). Table 8 shows an overview of the logistic regression with the significant predictors, the corresponding regression coefficients, the standard error, and the odds ratio (= the relative probability).

Table 8: Logistic regression predictors for hypothesis H2a

Variable / predictor	Regression coefficient β	Standard deviation	Degree of freedom	Significance *(p)*	Odds ratio
Obligation to offset emissions	0.641	.1	1	< .001	1.90
Awareness that air travel causes emissions	-0.293	.1	1	.014	0.75
Ascription of responsibility	0.355	.1	1	.005	1.43
Not causing emissions myself	-0.296	.1	1	.004	0.74
Constant	-2.675	.6	1	< .001	0.07

To check the model validity, two classification models were selected according to the variant of the Pseudo-R^2. According to Cox&Snell R^2, the check of the model yields a value of 0.22, according to Nagelkerke R^2 a value of 0.31. This value is above the threshold value of 0.1 and the model thus has a moderate explanatory power (Muijs, 2004). In addition, below classification table (see Table 9) was created to check how many of the participants the model correctly assigns to "compensated" and "never compensated" with a threshold value of 0.5 (default).

Table 9: Classification table

	Never compensated	Compensated at least once	Sum
Never compensated	264 (true negatives)	37 (false positives)	301
Compensated at least once	79 (false negatives)	74 (true positives)	153
Sum	343	111	454

It can be observed that 74 (true positives) of the 153 compensators and 264 (true negatives) of the 301 non-compensators were correctly classified. The correct classification rate is therefore (264 + 74) / 454 = 74.5%. To visualize the result, Figure 21 shows a ROC curve (ROC curve = Receiver Operating Characteristic curve). The area under the blue ROC curve to the diagonal must show as large an area as possible. With a 100% classification rate, which means that the model would be 100% correct, the ROC curve would look like the green lines (Navarro, 2013).

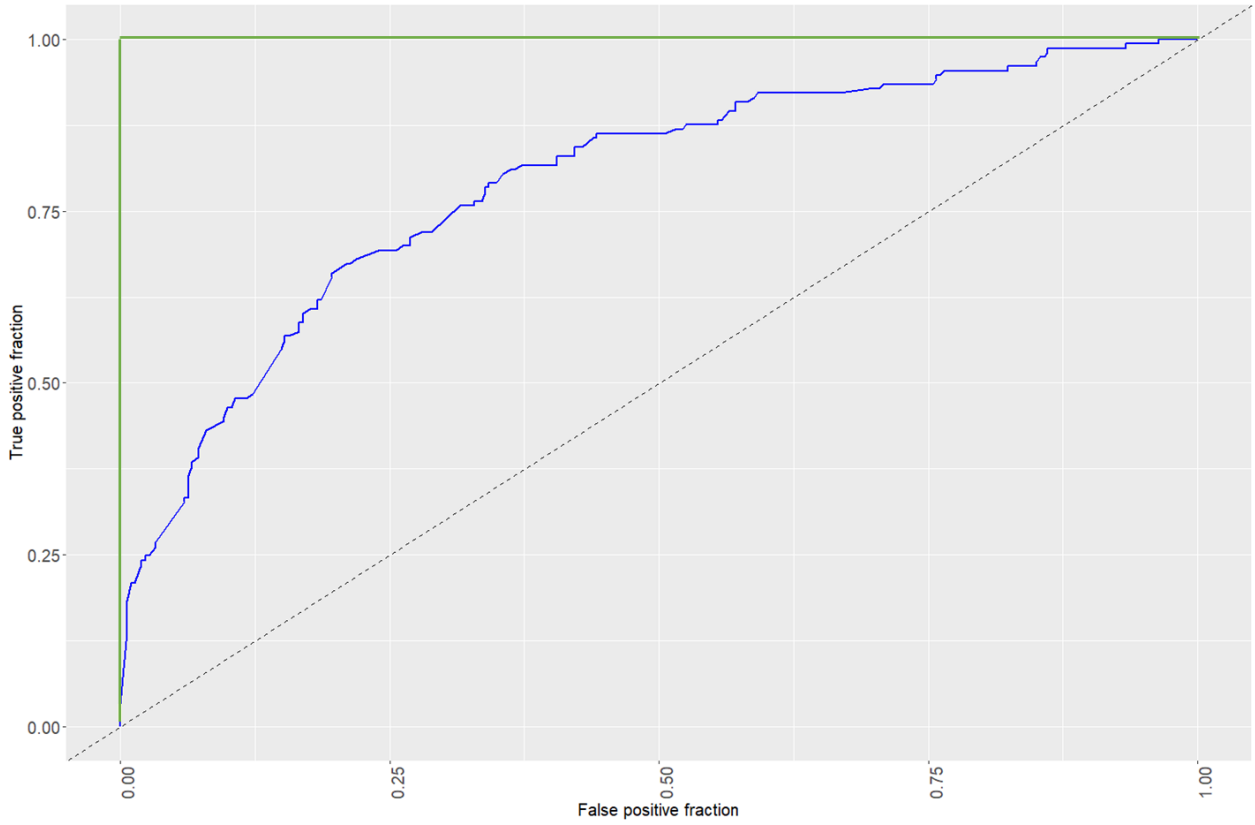

Figure 21: ROC curve for regression model of hypothesis H2a

5.4.2 Individual's Values Cannot Predict the Probability of Offsetting Behavior

Compensation behavior for air travel (yes/no) was set as a function of altruistic, biospheric and egoistic values. The best model according to AIC contained the variables social justice, prevention of pollution, wealth and authority, with authority not indicating significantly. The omnibus test of the model gives a value of 0.002, which is below the significance threshold of 0.05, indicating that the explanatory power of the new model is not significantly better than the null model. According to Cox&Snell R^2 (= .08) and Nagelkerke R^2 (= .11), the model is on the borderline of poor explanatory quality. Therefore, no model can be set up with values as predictors for the compensation behavior of air travel emissions. The hypothesis that compensators and non-compensators differ in their values can be rejected accordingly. Also, no significant dependencies were uncovered when reviewing only younger respondents (< 41 years) or when reviewing only male or female respondents.

Only for flight behavior (number of flights per year) a significant correlation was found using a logistic regression. For people who carry out more than 5 flights per year, the relative probability of compensating their flight decreases by 77 % (0.23 - 1 = - 0.77) if the egoistic values (wealth) increase by one unit (odds ratio = 0.32, p = .001, df = 1, n = 78). In other words, the more important wealth is to a frequent flyer, the less likely he or she is to offset his or her flight emissions. The Nagelkerke R^2 measures .23, which according to Muijs (2004) corresponds to a modest explanatory power of the model. (Muijs, 2004).

Since values cannot describe compensation behavior in general, chapter 5.5, “Other Observations”, descriptively evaluates what currently prevents people who have stated that they have never compensated from changing their attitude. These additional descriptive observations allow a more general picture of passengers to be created.

5.4.3 General Factors for PEB Cannot Predict Offsetting Behavior

The compensation behavior for air travel (yes/no) was defined as a function of the social and emotional factors as well as the factors knowledge, habit, and value. Again, no model could be found that describes a relationship between the predictors and the dependent variable "flight compensation" in a logistic regression. The hypothesis, that the factors “habit”, “value” and “knowledge” as well as social and emotional factors influence the offsetting of flight emissions, is rejected accordingly.

More detailed investigations of the sample revealed a weak dependence in the age group < 41 years. Younger participants show the following behavior patterns when the predictor variable increases by one unit, i.e., the agreement to the statement when the independent variable increases. If a person's social network offsets their flights for emissions, the relative likelihood of young people also offsetting their flight increases by 23.5%. If young people also offset on other occasions, then the chance of them offsetting their flight emissions also increases by 28.5%. The Nagelkerke R^2 is .13, which according to Muijs (2004) corresponds to a modest explanatory power of the model (Muijs, 2004).

5.4.4 Summary of Results for Hypothesis H2

The factors obligation to offset emissions, the consciousness that air travel generates emissions, and the ascription of responsibility to the individual show a significance in relation to flight emission offsetting behavior. These factors are all derived from the “theory of reasoned action” and the “theory of planned behavior”. All other possible predictors from the "value-belief-norm theory" and the "factors influencing PEB in general" for the offsetting of aviation emissions do not offer significant explanations. Accordingly, only hypothesis H2a can be verified. Hypotheses H2b and H2c are rejected. Thus, the main hypothesis H2 is partially rejected.

In addition, the value analyses of hypothesis H2b within the frequent flyer group show that the relative probability of frequent flyers to compensate for flight emissions decreases with increasing pursuit of wealth / increasing egoistic values. For "factors influencing PEB in general life", it is evident within the group of young participants that the factors “social surrounding” and “habit to compensate on other occasions” show a positive correlation with the compensation behavior of flight emissions.

5.5 Other Observations

5.5.1 Ecological Beliefs and Offsetting Behavior

Further research was conducted on passenger beliefs. It was examined whether individuals which have an ecological worldview (see chapter 2.2.1.4) offset their flight emissions. The Pearson Chi-square test of independence shows a significant relationship between the ecological worldview of "the earth offers limited resources" and the flight offsetting behavior, $X^2(3) = 14.11$, $p = .003$. The subsequent association test shows that the relationship between the belief that "the earth only offers limited resources" and the compensation behavior for flight emissions is only marginally explained (contingency coefficient = .17, Cramer's V = .18). Based on the contingency table and Figure 22, it can be explained that people who offset flight emissions tend to have a more ecological world view, but the relationship is weak.

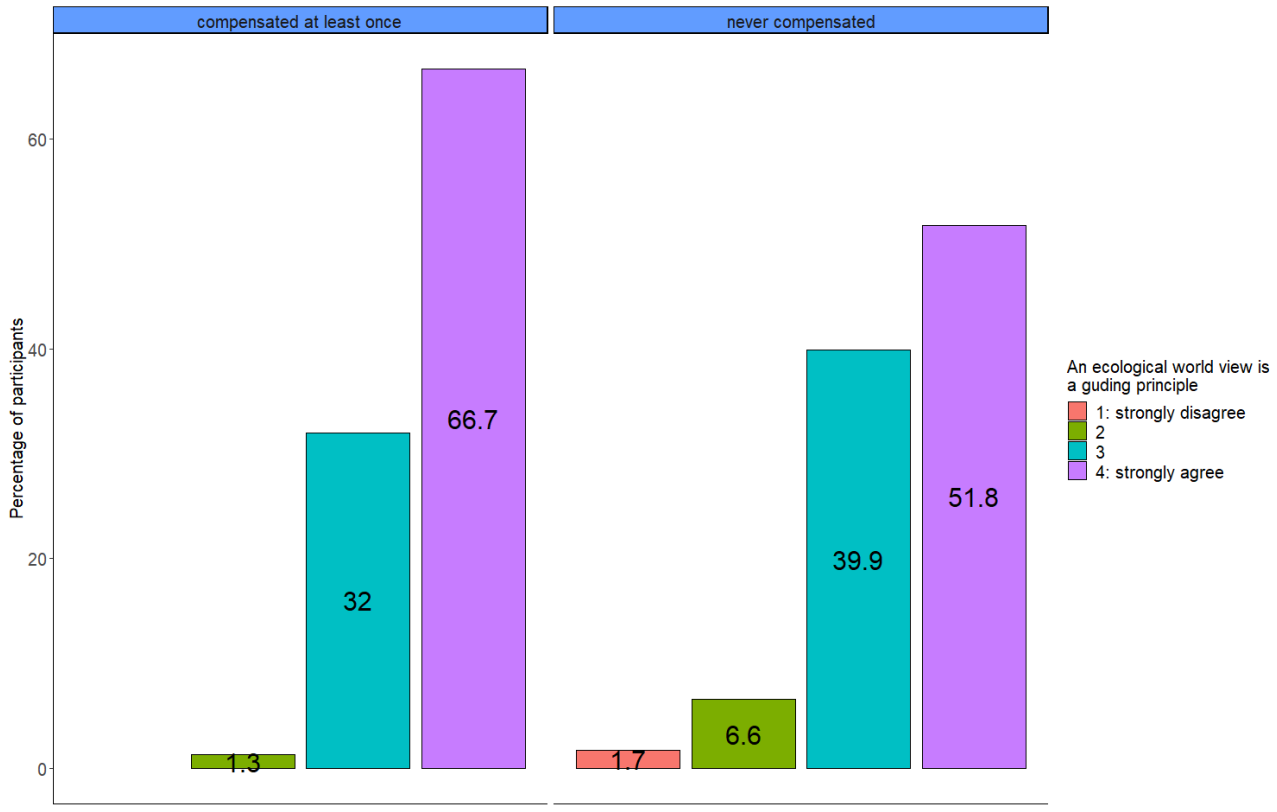

Figure 22: Percentage of participants with an ecological world view grouped by people who compensated / did not compensate

5.5.2 Barriers for Emission Offsetting

Filter questions in the questionnaire asking whether a person had ever compensated his or her flight made it possible to identify and take a closer look at all the people who had never compensated. Out of a sample of 301 non-compensators, 58.8% request more transparency about the use of their compensation payment. Only 5.6% of the non-compensators say transparency does not make them more likely to compensate for their flight. This statement is underlined by the participants' indication that they would prefer to decide for themselves which projects and funds they would invest in if they were to make an

offset payment (57.8% of the non-compensators). 51 participants (= 17%) consider a compensation payment for flight emissions to be useless. As already found in literature, the price of the compensation payment does not play an important role. When asked if compensation is too expensive, 82.1% answered that the payment is not too expensive for them and not the reason for not compensating flights. Also, the effort to pay does not seem to be a driver for people not to compensate. Only 23.2% of all non-compensators state that it is too cumbersome to run the compensation process.

Passengers who stated that they had already compensated at least once were also asked two more questions. Again, despite offsetting, many compensators demand more information and transparency and want to know in which projects SWISS invests and what happens with their money. Table 10 shows a summary.

Table 10: Participants' feelings about compensating / not compensating

Topic	Yes	No
Non compensators feelings about emission offsetting		
Compensation is too expensive	17.9%	82.1%
Compensation process is too complex	23.2%	76.8%
Require more transparency about the use of the payment	58.8%	41.2%
Choose projects myself	57.8%	42.2%
Compensation is useless	17%	83%
Compensators feelings about emission offsetting		
Receive enough information about my payment	22.9%	77.1%
Require more information about compensation projects	81%	19%

Another barrier to compensate for air travel mentioned in literature is the "Attitude Behavior Gap", which was also investigated. Since this phenomenon was already considered in the construction of the questionnaire, no significant difference was detected between attitude of a flight passenger (finding it important to behave in an environmentally conscious way) and the effective behavior (flight compensation). The correlation between attitude towards offsetting flight emissions and effective behavior is already identified in the testing of hypothesis 1.

5.5.3 Frequent Flyer Analysis

Since the sample also includes people who fly infrequently, the group of people who can be categorised as frequent flyers was examined in more detail and observations were made about their attitudes and behavioral patterns concerning the sense of obligation to offset flights. People who fly more often feel less obliged to compensate their flight (see Figure 23). 30.8% of frequent flyers have only a weak sense of obligation and only 2.6% feel a strong urge to compensate their flight for emissions. Even among those who fly less frequently, the sense of obligation tends to decrease, i.e., there are slightly more people who fly less

frequently but do not feel obliged to offset their flight. However, when this decrease is compared with that of frequent flyers, a very clear trend can be seen that frequent flyers feel even less obliged. This finding must be taken into account in the interpretation part of this work when searching for motivators for compensation.

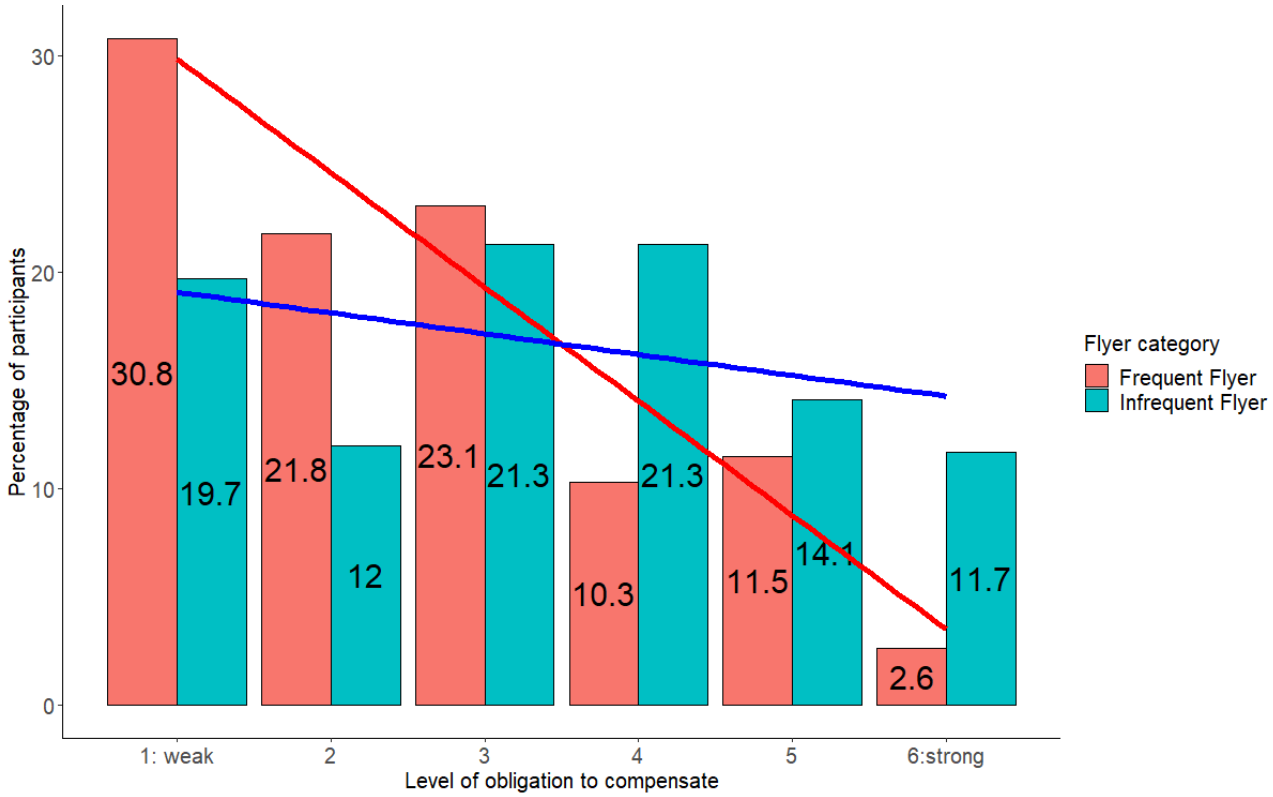

Figure 23: Percentage of participants by level of obligation to compensate

5.6 Model Development for the Prediction of Compensation Behavior

In response to the question and in order to develop a model with the essential factors, the results are summarized in the following:

- There is a connection between sustainability behavior and compensation behavior. People who show a pro-environmental behavior in everyday life are also more likely to compensate their flight emissions. This forms the basis for the finding that the factors that predict an individual's sustainability behavior also apply to some extent to air travel compensation behavior.
- The following factors show a significance in relation to a person's flight emission offsetting behavior: obligation to offset emissions, consciousness that air travel generates emissions, the ascription of responsibility and an ecological worldview. Younger people are more influenced by their social environment and habits. All other factors influencing pro-environmental behavior in everyday life have no significant impact on passengers' compensation behavior.

- Knowledge and trust in the offsetting process play an important role and need to be improved to achieve the goal of more passengers offsetting emissions.
- From the identified factors that influence offsetting behavior, communication content can be developed to achieve a higher compensation rate (see chapter 5.7).

It is important for people to know that flying causes emissions, but at the same time it is important to realize that there are other ways for them to reduce or offset flight emissions. It is essential to appeal to personal norms when passengers are asked to compensate for emissions. The primary trigger at the moment is to make it as easy as possible for the customer to access the compensation option and also to let them know that their investment will benefit the environment. Based on these findings, below model is developed to predict passengers' offsetting behavior based on possible motivations (see Figure 24).

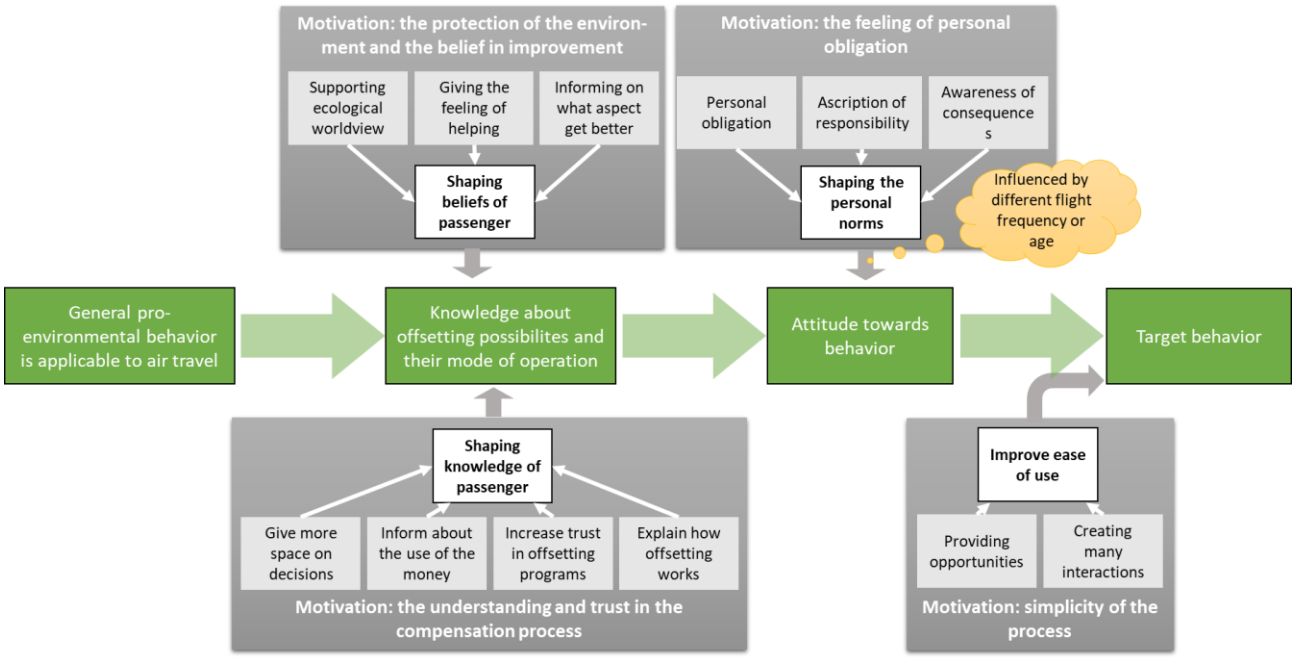

Figure 24: Model of influences on the compensation behavior of passengers

The model shows which factors predict attitude and ultimately behavior toward compensation. However, the model does not represent a central point: along this model, there are obstacles that prevent people from performing the desired behavior despite appropriate motivation (see chapter 6.1). Old behavior patterns serve as an example of such a barrier (Kollmuss & Agyeman, 2002). Based on this model, the next chapter develops a content-based communication strategy that addresses all factors that could potentially lead to compensation.

5.7 Communication Strategy

The most important step is to place the offer to offset carbon emissions at as many places along the traveller's customer journey as possible and in an easily accessible way. Then, the content of the

communication should be formulated based on the factors found for offsetting air travel emissions. An airline should publish these on its platforms with the aim of meeting the motivation for offsetting as far as possible and not activating any defensive attitudes or lack of understanding of the topic among passengers.

Figure 25 shows possible communication suggestions to promote compensation offers (in this example, the option to offset emissions by investing in Sustainable Aviation Fuel). The content of the communication briefly attempts to address all factors that influence compensation behavior for flights. Depending on the medium on which this communication is published, additional information can also be provided. The proposal in Figure 25 is intended only as a guide or for messages that need to be formulated in a small area with limited space, such as during the booking process on a website or on a small A4-sized display in an airport lounge.

Figure 25: Possible communication messages

This model does not represent that after activating his awareness and personal obligation, the customer can choose for himself about which project he wants to have more knowledge and information (after step 2). This additional step would also fulfill the factor of self-determination by the customer. In addition, it is assumed that the order in which the individual factors are addressed also plays a role. This would need to be verified in a follow-up study. It should also be noted that people who already have a positive attitude toward sustainability respond better to such communications. This has already been shown in another study. The segment of the flying public which is already willing to contribute towards climate change mitigation, may be the best segment to target with behavioral change messages intended to encourage in travel choices required to mitigate climate change (Mair, 2011).

In the context of this work, however, not only the segment of sustainable passengers was addressed, but the aim was to reach as many travellers as possible. The two options chosen for the placement to advertise the compensation option at SWISS resulted in the following.

First results of the short test trial with onboard communication by cabin crew show that the compensation program was successfully brought to the attention of the new target group. Through the trial, all passengers were addressed, even if they did not book their flight themselves. As some additional views of the compensation page were measured via inflight entertainment system, it can be stated that guests have engaged with the topic. However, the onboard compensation payment rate was very low. No quantitative evaluation is possible within the scope of this work, as this first test of SWISS has not yet been completed. Nevertheless, qualitative observations can be made as to why the compensation rate has been low so far. One reason for this is that the cabin crew could not always make the announcement. Another reason is that a lot of information is already communicated at the time of the announcement at the beginning of the flight. As a result, many passengers can no longer process all the information. Possible further reasons and suggestions for improvement are shown in chapter 6, “Discussion and Conclusion”.

Further, no figures about compensation numbers are yet available from the experiment in the lounges. The main result is the layout of the displays promoting the compensation offering (see appendix B). The result of the development of such a display shows that although the relevant factors influencing compensation behavior can be taken into account, the content cannot be fully implemented. Reasons for this are language guidelines of SWISS, but also conflicting interests regarding communication with customers between the marketing and sustainability department. Overall, the two touchpoints along the customer journey are feasible options for SWISS to place messages about offsetting flight emissions and to reach more passengers.

6 Discussion and Conclusion

This chapter now reflects on the results in light of the theoretical principles and identifies implications. In a first step, the author tries to give explanations for the findings and for the hypotheses under consideration of various aspects. Limitations will be pointed out regarding the research design, the data and the topic itself. In a second step, the implementation of communication content at SWISS is discussed. In a third step, a personal reflection is provided on the experiences gained during the work and cooperation with SWISS. In a fourth and last step, an outlook for further research opportunities will be given.

6.1 Critical Reflection of the Results

In this chapter, the results of the statistical part are reflected, critically assessed, and compared to other studies.

6.1.1 Pro-environmental behavior in general and in aviation

As described in chapter 5.3, the hypothesis that pro-environmental behavior differs in air travel compared to everyday life can be partially rejected. The observation that these behaviors differ was made in 2010 (Lassen, 2010). In the meantime, the global sustainability mindset has changed considerably and is getting more important. Meanwhile, the issue is a high priority topic on the public, economic and political agenda. This could be the reason why today, people who show a sustainable behavior in everyday life also reflect this behavior when travelling by air. Nevertheless, the result of this study shows that sustainable behavior in everyday life only weakly predicts that an emission offset for flights will be made. This result may be due to the fact that people who strongly behave in an environmentally sustainable manner do not travel by air at all and were therefore not covered by this survey. It also seems that people who claim to be sustainable but still travel by plane are simply not consistent enough and make an exception to their sustainable principles when travelling by air.

This assumption is due to the observation that also non-compensators state to behave sustainably which shows that there are still some differences in attitudes towards sustainable behavior in general and in sustainable flight behavior specifically. This observation is further strengthened by the result that sustainable individuals tend to be unsure whether carbon offsetting is the right approach at all which indicates that the current system of flight compensation is not entirely convincing for the respondents.

In addition, and as mentioned in the theory, the uncertainty as to whether investments are made in climate projects and whether they have a positive effect at all is also a factor in the passenger's decision to compensate. This uncertainty can be explained by the fact that the offsetting of flight emissions usually happens in the distant future, except in the case of investments in Sustainable Aviation Fuel. Thus, people do not know whether their payment will ever have a noticeable impact on reducing emissions. (Baumeister & Onkila, 2017). This observation also supports the results of this study.

At first glance, the high rate of compensating persons in the sample provides a surprising result compared to reality. 33.7% of the respondents have compensated their flight at least once. However, the rate can not be compared with the current compensation figures of SWISS of 1% (see section 2.5) which has – after integrating the option to compensate into the booking process – increased immediately to 10%. The Swiss compensation figure is a value which shows the percentage of compensated flights, but the questionnaire asked for one-time compensation. It can therefore be assumed that many participants have compensated once but do not compensate on a regular basis. In addition, the high rate could be due to the following limitation of the survey type: the survey was conducted on a voluntary setting, and participants were informed in advance that the survey was about emission offsetting from flying. This means that interested individuals who have already had contact with offsetting may have participated while others did not access the survey at all. In addition, as already mentioned in the results, social desirability plays a major role in this

question (Paier, 2010). Thus, an above-average number of people also state that they behave sustainably in their private everyday life. These limitations could have been counteracted by asking facts (e.g., how long do you shower, how do you drive to work, etc.) about sustainability behavior. In this way, the question setting would not be quite so transparent (Diekmann, 2004).

In summary, people who behave sustainably in everyday life are also more sustainable when flying. However, the attitude patterns are not very strong, possibly also because passengers are too poorly informed about the compensation system and because they have too little self-determination about how their compensation payment is used. In addition, the high proportion of response in the direction of "very sustainable" in self-reported sustainability behavior in everyday life should be treated with caution. If all people behaved as sustainably as reported, anthropogenic climate change and waste problems would not be as acute as they are today. The main finding of the comparison of sustainability behavior in everyday life and air travel is that the principles and factors of the activation for sustainable behavior can also be applied to compensation for air travel.

6.1.2 Factors influencing emission offsetting

Many conflicting and competing factors shape our daily decisions and actions (Kollmuss & Agyeman, 2002c). There are several influences for behavior that have not been elaborated on in this study, such as the fact that if an individual wants to establish a new behavior, he or she has to practice it (Scott, 2002). Also, the extent to which personality traits and character have an influence on pro-environmental behavior is not discussed. The income level of an individual is another important factor for showing pro-environmental behavior (Denstadli & Veisten, 2020) and is not considered in the current study. And last but not least, differences in behavior of different nations or ethnicities of the world with different political and economic backgrounds have an important influence on shaping pro-environmental behavior (Song & Choi, 2020). For example in Europe, pro-environmental attitudes are rather high (Berger et al., 2022). Therefore, applying the pro-environmental behavior theories to passengers flying via Zurich Airport is a good basis - but transferring the results to groups of people in other countries or continents must be done with caution.

It can be stated that people who behave pro-environmentally in everyday life also offset their flights for emissions more likely (see hypothesis 1). The factors for sustainable behavior in everyday life offer a starting point for a communication to promote offsetting programs and to motivate customers to offset flights for emissions, however, only to a limited extent. The obligation to compensate, the awareness of consequences and the ascription of responsibility show that they have the potential to motivate passengers to offset their flight for emissions. All other factors show no significant influence. It is worth mentioning that frequent flyers feel less obliged to compensate. This means that their personal norm and attitude towards PEB when flying is lower. For frequent flyers when travelling privately, the appeal to this norm may be less important, as they are not influenced by it. What is particularly interesting about the entire sample

is that the social norms within the theories of attitudes do not yield any significant results. Respondents whose environment expects that they should offset their emissions do not act accordingly. In general, the expectation of friends and the own expectation towards friends to compensate for a flight is rated very low. It appears that addressing social norms in compensating does not work. The execution of compensation does not usually take place in public and thus there is no influence from social norms. It may also be that querying social norms did not work due to limitations of the research design. In a self-report survey, it is difficult to ensure that everyone rates their attitudes on a scale in the same way. Typically, the social environment always plays a big role when it comes to exploring attitudes and behavior patterns (De Groot & Steg, 2009). Apparently, however, this is not the case when it comes to offsetting flight emissions. Therefore, it is concluded that appealing to personal norms, i.e., that people feel responsible for their own flight emissions, can encourage more offsetting and are a key trigger for flight emission offsetting. However, care must be taken in the selection of topics to be addressed to passengers. It seems that if constantly talking about global warming, climate change and ecological disasters, a known phenomenon emerges: the “Green fatigue”, meaning the exhaustion of having to take endless moral choices when they do not seem to make a difference (McKercher et al., 2010). The «green fatigue» is also reflected in the current results. The majority of passengers are already aware that flying has a bad CO_2 balance and is causing a lot of emissions. There is even a defensive attitude (passengers who know that flying increases climate change and global temperature still do not compensate). However, according to Kollmuss and Agyeman, in order to change attitudes (personal norm), information is always needed, which forms attitudes (Kollmuss & Agyeman, 2002c). Therefore, providing information should not simply be abandoned, but should start where passengers are still uninformed. The results show that passengers are unaware of the high emissions they personally emit when flying and how airlines intend to balance these emissions. First, more information about the flight compensation offer is needed so that the customer can develop a positive opinion (attitude) towards it. Second, this attitude needs to be addressed so that the passenger feels obligated to compensate for his or her flight (see chapter 5.7).

Besides the personal norms, another observation provides an interesting insight into pro-environmental behavior when flying. Young people are more influenced by their social environment and are more likely to follow the habits of their peers when it comes to CO_2 compensation. Platforms such as Instagram or Tiktok offer great potential to influence the social environment of young people (Omar & Dequan, 2020). Therefore, these communication channels could be used to influence young people's later behavior patterns.

However, across all participants of the survey, it is evident that different values, emotional factors and habits do not predict compensation behavior. These factors do not provide a guide on how to design flight compensation communication content for the entire target audience. In addition, it is very difficult to

change people's values with a simple communication anyway (Schultz & Zelezny, 1998) (Hardima & Whelan, 2014).

6.1.3 Other aspects shaping offsetting behavior

In contrast to values and habits, a person's beliefs seem to have an influence on their compensation behavior. People with an ecological worldview are more likely to compensate. Therefore, it is important to strengthen and promote people's ecological worldview. In another example, this is successfully done: by studying visitors in national parks, Ramkissoon et al. showed that high place attachment and increased quality of life can be provided by pro-environmental behavior, highlighting the positive impact of pro-environmental behavior on people's lives and on nature's ecological development (Ramkissoon et al., 2018). With those 'green' approaches, they feel greater safety, health and convenience (Abdullah et al., 2016). Using the example of offsetting flight emissions, the aim should be that people develop the belief that by offsetting their emissions, they benefit themselves as well as nature. This approach is supported by the descriptive evaluation of all respondents. A large proportion of the participants in the survey state that protecting the environment, living in harmony with nature and making correct use of our planet's limited resources are important to them.

Another important pillar was the question about expectations for the compensation possibilities. Lack of transparency and self-determination as well as lack of trust in the compensation system emerge as obstacles to compensation. In addition to the considerable mistrust, the possibilities to compensate are also still limited. Airlines should offer customers many more opportunities along the customer journey (see chapter 2.6) to offset their flight emissions. The rapid increase in the compensation rate from approx. 1% to 9.37% within 5 days of the introduction of the compensation option in the SWISS booking process shows that this approach is proving successful (SWISS, 2022).

6.2 Implementation of Communication Content at SWISS

Within the scope of this thesis, it was examined how an advertisement of the compensation offer on board works with a speech by the flight attendants on the one hand and with a visual advertisement in the SWISS lounges on the other hand.

The opportunity to promote compensation programs on board attracts the attention of passengers regardless of whether they then actually make a compensation payment directly on board. The compensation rate on board was very low during the test, but SWISS was able to record a few views of the compensation page accessed via inflight entertainment system. This means that the guests have at least explored the topic. Therefore, it is possible that these persons could consider compensation in the future. Awareness of the topic and the specific offer of SWISS is thus increased. Actively promoting the topic seems to be very important. The test on board showed that due to operational difficulties of the cabin crew, some

announcements could not be made and thus some potential for more compensation was lost. Through a specific advertising measure, such as a more prominent integration of the compensation option in the entertainment system on board, the views could clearly be increased, and the promotion of the offer would no longer be dependent on the announcement of the crew. The on-board communication platform offers considerable potential to reach passengers through the following points, which need to be examined more closely:

- Passengers who did not have the time and patience to compensate during the booking process
- Passengers who did not book on swiss.com
- Passengers who did not book themselves
- Passengers who did not want to spend additional money because they had just paid for a flight and were made aware of the offer at a better time

Advertising the compensation offer in the lounges has the advantage that it can be carried out independently of the cabin crew. Only visual communication is used for this purpose. But even here, along with the many different other advertisements placed in lounges, it is difficult to get the attention of customers. On the one hand, a lot of advertising space is sold to partners in SWISS Lounges, which is contractually regulated. On the other hand, other departments apart from the sustainability department also have the demand to place communication content about their topics in the lounges. Therefore, putting the ideas into practice turns out to be difficult. There are many variables that prevent or interfere with promoting compensation. Nevertheless, there is still a lot of unexploited potential at SWISS to advertise its compensation offering. To do so, further tests are required to identify the potential in detail, and the topic of sustainability must be brought even more into the focus of the corporate strategy so that it takes priority over other topics.

6.3 Personal Conclusion

At this point, the general collaboration with SWISS and the customer communication about CO_2 offsetting developed during the practical implementation together with SWISS will be discussed.

The SWISS sustainability team members were very helpful and committed to support the project. It was easy to obtain information about SWISS necessary for this thesis. However, surveying SWISS customers turned out to be the first difficulty, as due to recent downsizing of the staff, the market research department was run through the Lufthansa Group, and they did not have the resources to provide access to customers via the research tool. With the solution of addressing passengers departing from Zurich Airport, it was nevertheless possible to obtain a large sample for the present work. Unfortunately, SWISS had other priorities during this tense period caused by the Corona crisis, but also in the period that followed with the subsequent relaxation of entry regulations and the huge demand to again travel by air.

Another point to mention is the implementation of communications at SWISS. In theory, it seems like there are countless touchpoints along the customer journey where customers can learn about the offer of the compensation option. However, on the one hand, it is difficult to implement such communications due to external factors such as various regulations from other companies such as the airport authorities or ground handling companies. For SWISS, for example, the ground handling company Swissport performs the check-in for SWISS passengers in a hall owned by Zurich Airport. As a result, many regulations have to be considered before a small display board can be set up. On the other hand, internal factors, such as the weakening of the economic and personnel situation of SWISS after the Covid19 pandemic also play a role here and make any immediate implementation difficult. Currently, there is simply a lack of manpower and resources for additional activities. Nevertheless, it is encouraging to see how SWISS is trying to advance the topic of sustainability with the available means and resources.

6.4 Research Outlook

Practical solutions such as providing additional opportunities to compensate flight emissions outweigh addressing norms and values in a dedicated communication strategy in a first step. However, a concrete promotion focusing on the found factors influencing emission offsetting on flights would certainly reinforce the probability to do so in a second step once more opportunities to compensate trough different touchpoints along the customer journey are available. Of course, such communications would have to be tested in a follow-up work. The follow-up study should contain different communication content, based on the findings of this work, and should be placed along different touchpoints along the customer journey. It is very important to measure how people react to the communication in different places, i.e., at check-in, on the plane or after the journey. The findings from the compensation on board trial and in the SWISS lounges increase awareness and provide insights into the advantages and disadvantages of choosing the right environment for compensation. It can be stated that a very important point for the actual performance of a behavior is the environment in which a person is approached and whether he or she feels comfortable in that environment to perform the behavior as well as whether he or she also has time to respond to the offer. While a customer may be stressed during the booking process, he or she may have more time to compensate on board or in the lounge. A future study should now measure which communication is most effective and where, such as whether they lead to the most compensation at the time of booking, or on the plane, in the lounges, or even in a post-flight communication.

A completely different approach is that the compensation amount is already included in the ticket price by default. People who do not want to compensate would then have to actively uncheck the option to compensate. This approach is based more on the theory of nudging. This theory suggests that people should be persuaded to choose a desired behavior without coercion (A. T. Schmidt & Engelen, 2020).

Another interesting research outlook is the fact that in Switzerland there is again a discussion whether a mandatory flight tax should be introduced. The reason is that offsetting one's own emissions still does not seem a behavioral priority for most passengers (Berger et al., 2022). However, another study shows that Swiss air travel behavior alone is not the key to reduce carbon emissions on a global scale (Wind, 2022). In addition, the introduction of a tax would mean that the intrinsic motivation of passengers to offset flight emissions would no longer be necessary, as it would become mandatory for every passenger to pay more for environmental protection. Research could be conducted on whether this method of coercion changes the mindset and belief of passengers about offsetting in a negative sense. Because ultimately, even with a CO_2 tax on flight tickets, there will be investment in offsetting programs, simply with less freedom for the customer to decide how they want to invest their money. In principle, it would be positive if funding for climate protection would then increase rapidly. On the negative side however, people might no longer activate their ecological beliefs when they book flights and no longer think about the fact that they cause further emissions with every new flight booking. As a final research impulse, it should be critically reviewed that self-reports and intentions were measured in the present study. It is suggested that environmental social science should make more behavioral enquiries in order to be able to better measure attitudes and values (Brick et al., 2021).

7 References

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8 List of Figures

9 List of Tables

10 Appendix

A. Survey

Intro:

As part of my master's thesis, I am working on the topic of "CO_2 emissions from air travel". The survey will take approximately 10 minutes. Your participation in this survey is anonymous.

Thank you for participating.

-> Theme not specifically defined to prevent framing.

Filter question: Have you traveled with a passenger plane in the last 10 years? YES / NO

-> If not, you are already at the end.

Block 1: Check psychological factors (internal factors) for PEB /altruistic behavior to find the motivators for flight compensation.

Norm activation model by Schwartz

Scale by Kurisu: Testing altruistic behavior for recycling, adapted to air travel emission compensation

Please indicate your level of agreement with the following statements.

Answer Categories: disagree / strongly agree (Scale 1-6)

	Target factor	**Item**
V1	Ice breaker question: *Personal norm* *(Here, answer categories: not at all/extremely)*	*How much does it bother you to throw glass into the waste?*
V2	*Personal norm*	*I feel obliged to offset my CO_2 emissions when I travel by air.*
V3	*Social norm*	*V1: I expect my friends to compensate CO_2 emissions for their flights.* *V2: My friends expect me to compensate CO_2 emissions for my flights.*
V4	*Awareness of consequences*	*Air travel generates a high share of CO_2 emissions and contributes heavily to global warming.*
V5	*Ascription of responsibility*	*V1: When I fly, I'm aware that I'm causing a lot of emissions.* *V2: Emissions are caused by the airline I fly with. I'm not responsible for that.*

V6	*Perceived behavioral control*	*It is entirely up to me whether I act in an environmentally conscious manner.*
Block 2: Identifying motivators by checking the influence of the value-any norm theory Value-belief norm theory by Stern et al. Scale from Blok et al.: Survey on PEB at the workplace adapted to air travel emission compensation		
Please assess to what extent these values are guiding principles in your life. Answer Categories: not important to me at all, not important to me, important to me, extremely important to me (scale 1-4)		
V7	*Values* *Self-transcendence-altruistic*	*Social justice (correcting injustice, care for the weak)* *Equality (equal opportunity for all)* *a world of peace (free of war and conflict)*
V8	*Values* *self transcendence-biospheric*	*Prevention of pollution (conserving natural resources)* *Unity with nature (fitting into nature)* *Protecting the environment (preserving nature)*
V10	*Egoistic*	*Influential (Having an impact on people and events)* *Wealth (material possessions, money)* *Authority (the right to lead or command)* *Social power (control over others, dominance)*
V11	*Beliefs: Ecological Worldview (NEP)*	*The Earth offers limited space and resources.*
Block 3: Factors influencing PEB by Kollmuss & Ayegeman (specific to CO_2 compensation) Items from Kollmuss & Aygeman Note: Only the factors which do not correlate with the norm activation theory are tested.		
Please indicate your level of agreement with the following statements. Answer Categories: disagree / strongly agree (Scale 1-6)		
V12	*Social factor* *Because: "On a collective level, this phenomenon is observable. "When it comes to air travel emissions, individuals prefer awaiting collective actions instead of feeling personal responsible" (Miller et al. 2019).*	*V1: If all people would CO_2-compensate their flights, I would do it too.* *V2: I alone can't help with a CO_2 compensation. All passengers on a flight would have to take part.*

V13	*Factor emotion* *Because: Guilt is less likely to trigger PEB than sadness, pain, anger, and fear (Kolmus Aygeman, 2002)*	*I tend to compensate my emissions when I feel connected to the project funded by it.*
V15	*Factor habit*	*I also offset emissions on other occasions (bus rides, refueling, or online shopping).*
V16	*Factor value*	*I think the system of CO_2 compensation of air travel is the right approach to offset emissions.*
V17	*Factor knowledge*	*V1: I know how much CO_2 emissions are emitted by my flight trip.*
Block 4: SWISS Compensaid offer, interventions Information Need, Offer Tangibility, Behavior Detection		
Please indicate your level of agreement with the following statements. Answer Categories: Yes / No		
V18	*Tangibility*	*Are you familiar with the Compensaid offer from Swiss International Air Lines?*
V19	*Attitude Behavior gap with personal norm of block 1*	*Have you ever compensated your flight emissions?*
		If yes:
V20a	*Information Need*	*When it comes to CO_2 compensation, do you feel you get enough information about what is happening with your money?* *Would you like to have more information on which projects Swiss International Air Lines is investing in?* *What would you like to see in terms of improving the offering of Swiss International Air Lines?* *(open comment)*
		If no:
Please indicate your level of agreement with the following statements. Answer Categories: Disagree / Strongly Agree (Scale 1-6)		
V20b	*Burden*	*Compensation for my air travel is too expensive for me.* *The execution of the compensation payment is too time-consuming or too complicated for me.*

		I want more transparency about the use of my compensation payment. *If I had easier ways to compensate for my flight, I would do so.* *I want to select the projects that I invest in myself.* *I consider it useless to compensate flights.*
Block 5: Sustainability Behavior Check variable to find out how sustainably a person assesses himself or herself.		
Please indicate the extent to which the following statements are true. Answer Categories: Disagree / Fully Agree (Scale 1-6)		
V23	*Check if a person is sustainable*	*In my personal daily life, I behave sustainable (e.g., recycling, energy savings, conscious meat consumption).*
V24	*Check Flight Behavior*	*V1: How many times a year do you fly on business trips?* *V2: How many times a year do you fly privately?* *(Number)*
V25	*economic factor (selection grid)*	*In which class do you normally conduct your private air travel?* *Answer categories: First Business Economy*
Block 6: Demographic Questions		
Y1	*(open space)*	*How old are you?*
Y2	*(m, f, d) male female divers*	*Please specify your gender.*
Y3	*(Selection Grid Analogous to PST)*	*What is your highest level of education?* *Answer categories:* No schooling completed Elementary/secondary school High school Trade/technical/vocational training *University or higher*
End: You have now reached the end of the survey. Please submit your responses now. Thank you very much for your participation.		

B. Information Display in SWISS Lounges