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CUSTOMER WILLINGNESS TO PAY FOR CARBON OFFSETTING IN AVIATION: A THEORY OF PLANNED BEHAVIOR APPROACH

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Abstract

Willingness to Pay of Customers for Carbon Offsetting Programs in Aviation: Incorporating the Theory of Planned Behavior (TPB)

The aviation industry faces growing scrutiny for its environmental impact, particularly its contribution to global carbon emissions. Voluntary Carbon Offsetting (VCO) programs present an opportunity for mitigating aviation's environmental footprint by allowing passengers to financially compensate for their travel-related emissions. However, participation in such programs remains low, with global uptake rates below 10%. Understanding the psychological, economic, and structural barriers that influence consumer Willingness to Pay (WTP) for carbon offsets is critical for enhancing engagement and effectiveness.

This study investigates the factors shaping consumer participation in aviation carbon offset programs, particularly among frequent business travelers in the United States. Using the Theory of Planned Behavior (TPB) as a guiding framework, the research examines how attitudes, subjective norms, and perceived behavioral control (PBC) influence WTP. The study employs a quantitative approach, utilizing survey data collected through Prolific, and applies Tobit regression analysis to assess the determinants of WTP.

The findings reveal that attitudes toward carbon offsetting, shaped by environmental concern and perceived personal responsibility, are the strongest predictors of WTP. However, subjective norms (social pressure and peer influence) exhibit limited impact, suggesting that personal beliefs outweigh societal expectations in decision-making. Perceived Behavioral Control (PBC) plays a significant role, with higher financial constraints and lack of transparency acting as key deterrents.

This research contributes to both theoretical and practical knowledge by expanding the application of TPB within the aviation sector. It provides actionable insights for airlines, policymakers, and sustainability advocates to improve the design and communication of carbon offset programs. Strategies such as simplified pricing models, employer-sponsored offsets, and transparent project verification could enhance consumer trust and participation.

By addressing economic, psychological, and structural barriers, this study supports the broader goal of increasing aviation sustainability through consumer-driven offsetting initiatives.

Keywords: Carbon Offsetting, Willingness to Pay (WTP), Aviation Sustainability, Theory of Planned Behavior (TPB), Consumer Behavior, Environmental Psychology.

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1.1 Background of the Study

1.1.1 Global Context

The global climate crisis is among the most pressing challenges of the 21st century, demanding immediate and coordinated action to mitigate greenhouse gas (GHG) emissions. With increasing evidence of the adverse effects of climate change, including extreme weather events, rising sea levels, and biodiversity loss, addressing carbon emissions has become a critical priority for governments, industries, and individuals alike (IPCC, 2019). International agreements such as the Paris Agreement emphasize limiting global temperature increases to 1.5°C above pre-industrial levels, which necessitates significant reductions in GHG emissions across all sectors of the economy (United Nations Framework Convention on Climate Change [UNFCCC], 2015).

Carbon offsetting has emerged as a practical and scalable strategy for addressing the carbon footprint of various activities. This approach allows individuals and organizations to compensate for their emissions by funding projects that reduce or sequester an equivalent amount of CO_2, such as renewable energy installations, afforestation, or reforestation initiatives (Graver et al., 2019). By financing these efforts, participants contribute to net-zero emission goals while supporting sustainable development.

The aviation sector, in particular, has come under increasing scrutiny for its environmental impact. Despite representing only 2–3% of global CO_2 emissions, its contribution is projected to grow significantly, potentially accounting for up to 25% of the global carbon budget by 2050 under current trends (ICAO, 2019). Aviation is a so-called “hard-to-abate” sector, with limited availability of low-carbon alternatives for long-haul flights and a continued dependence on fossil fuels. These challenges make carbon offsetting an essential tool for mitigating the aviation industry's environmental impact.

1.1.2 Aviation Sector Focus

The aviation sector plays a pivotal role in the global economy, facilitating international trade, tourism, and cultural exchange. However, its environmental impact cannot be overlooked. Air travel produces the highest CO_2 emissions per passenger-kilometer among transport modes, making it one of the most carbon-intensive activities (Rajendran & Popfinger, 2022; Graver et al., 2019). The increasing demand for air travel, especially in emerging markets, compounds this issue. For instance, passenger numbers are expected to double by 2037, with most growth occurring in regions like Asia-Pacific (IATA, 2018).

Aviation emissions present unique challenges for mitigation. Long-haul flights, which account for a significant portion of the industry’s emissions, have limited technological alternatives. Sustainable Aviation Fuels (SAFs), while promising, remain costly and are not widely adopted. Additionally, operational efficiencies can only achieve marginal reductions in emissions, underscoring the need for supplementary measures like carbon offsetting (Becken & Mackey, 2017).

Despite these challenges, the aviation industry has taken steps toward sustainability through initiatives such as CORSIA (Carbon Offsetting and Reduction Scheme for International

Aviation), which aims to stabilize emissions at 2020 levels(ICAO, 2018). However, voluntary consumer-driven programs play a critical role in bridging the gap where regulatory measures fall short. Understanding the factors that influence participation in these programs is crucial for scaling their impact and aligning with global climate goals.

1.1.3 Importance of Consumer Behavior

Voluntary carbon offset (VCO) programs represent a consumer-driven approach to mitigating aviation's environmental impact. These programs allow passengers to compensate for the emissions generated by their flights by contributing to projects that reduce or sequester carbon elsewhere. However, consumer participation in VCO programs remains low, with global uptake rates ranging from 1% to 10% of air travelers (Choi & Ritchie, 2014; Mair, 2011).

Understanding the motivations and barriers influencing consumer willingness to pay (WTP) for carbon offsets is critical for improving adoption rates. Research suggests that psychological factors, such as environmental concern and perceived personal responsibility, alongside practical considerations like pricing and program transparency, significantly shape consumer behavior (Cordes et al., 2023). By identifying these drivers, airlines and policymakers can design more effective strategies to enhance participation.

This study focuses on addressing these gaps by exploring the motivations behind passenger engagement in carbon offset programs, particularly in the aviation sector. By examining WTP variations across demographic, cultural, and regional contexts, it aims to provide actionable insights for increasing the effectiveness and accessibility of VCO initiatives. This research contributes to a deeper understanding of consumer behavior in aviation and supports global efforts to achieve sustainable development.

1.2 Problem Statement

Despite the growing urgency to address aviation's contribution to climate change, participation in voluntary carbon offset (VCO) programs remains critically low. Studies indicate that fewer than 10% of air travelers globally engage in these initiatives, with adoption rates in some regions falling below 1% (Choi & Ritchie, 2014; Mair, 2011). This lack of participation undermines the potential of carbon offsetting as a viable strategy for mitigating aviation's environmental impact, especially as passenger numbers are projected to increase in the coming decades (IATA, 2018). The aviation industry's ability to align with global climate goals is therefore hindered by insufficient consumer engagement in VCO programs.

Several barriers contribute to this low participation rate. A lack of awareness and understanding about the availability and benefits of VCO programs is a primary obstacle, as many passengers remain unaware of these initiatives or their environmental significance (Hooper et al., 2008). Additionally, skepticism about the effectiveness and transparency of offset programs further diminishes consumer trust and willingness to pay (WTP) (Babakhani et al., 2017). Economic constraints, such as the perceived high cost of offsets relative to ticket prices, also deter participation, particularly among price-sensitive travelers (Choi et al., 2018). Structural issues, including poor integration of offset options within booking systems and inconsistent practices across airlines, exacerbate these challenges (B. Zhang et al., 2019).

Compounding these barriers is a significant knowledge gap in understanding the psychological and behavioral factors influencing consumer decisions to participate in VCO programs. While existing research has explored general pro-environmental behaviors, there is a lack of sector-specific studies addressing the unique context of aviation. For example, how attitudes, social influences, and perceived behavioral control (PBC) shape WTP remains underexplored. Furthermore, the interplay between these psychological motivations and barriers like cost and skepticism requires deeper investigation.

These challenges are particularly pronounced among frequent business travelers in the United States, who constitute a significant portion of aviation emissions due to their high travel frequency. Despite their greater potential for impact, this group's motivations and barriers to participating in VCO programs remain understudied. Business travelers often navigate corporate policies, time constraints, and employer-sponsored programs, all of which influence their willingness to pay for carbon offsets.

Addressing these gaps is critical for stakeholders, including airlines, policymakers, and sustainability advocates. For airlines, increasing participation in VCO programs offers an opportunity to enhance their environmental credentials, meet corporate social responsibility goals, and align with consumer demand for sustainable travel options. Policymakers can use insights from this research to design targeted interventions, such as financial incentives or public awareness campaigns, to improve adoption rates. Finally, understanding passenger motivations and barriers is essential for advancing global sustainability efforts and achieving net-zero emission targets.

This study seeks to address these challenges by investigating the key factors driving or hindering consumer engagement in VCO programs within the aviation sector, with a focus on frequent U.S. business travelers. By applying the Theory of Planned Behavior (TPB), which examines how attitudes, subjective norms, and perceived behavioral control influence willingness to pay, this research contributes to the development of effective, scalable solutions for increasing participation in carbon offset initiatives.

1.3 Research Objectives and Questions

The overarching objective of this study is to investigate the factors influencing consumer participation in voluntary carbon offset (VCO) programs within the aviation sector. Specifically, the study aims to understand the motivations driving U.S. business travelers, who take five or more flights annually for work purposes, to engage in carbon offsetting. These travelers represent a significant demographic due to their frequent flying patterns and potential to make a substantial environmental impact. Beyond identifying motivations, the study also seeks to examine the psychological, economic, and structural barriers that might hinder participation among this group. Additionally, it aims to assess the effectiveness of financial incentives and the perceived benefits of co-benefits, such as biodiversity conservation and community development, in encouraging these travelers to offset their emissions.

In addressing these goals, the study seeks to answer key research questions, including the primary inquiry into what motivates frequent business travelers in the United States to purchase carbon offsets for their flights. It also investigates how psychological, economic, and structural factors influence their decisions, the extent to which financial incentives and co-benefits play

a role in encouraging engagement, and the ways airlines and policymakers can design targeted interventions to enhance adoption. This includes exploring how corporate policies and seamless integration of offset options during booking processes could positively impact their participation.

By exploring these dimensions, the study bridges existing knowledge gaps and provides a nuanced understanding of consumer behavior in the context of aviation carbon offsetting. The findings will contribute to the development of tailored, effective strategies that increase participation rates among frequent business travelers, ultimately supporting global efforts to mitigate the environmental impact of aviation.

1.4 Significance of the Study

1.4.1 Academic Contributions

This study contributes to the growing body of literature on consumer behavior in sustainability, particularly within the aviation sector. While prior research has extensively explored pro-environmental behaviors, limited attention has been paid to the unique challenges and motivations associated with voluntary carbon offset (VCO) programs for air travel. By addressing this gap, the research provides aviation-specific insights into willingness to pay (WTP), focusing on the psychological, social, and economic drivers behind the engagement of frequent business travelers in the United States.

The study advances theoretical understanding by applying the Theory of Planned Behavior (TPB) to examine consumer decision-making processes. TPB focuses on how attitudes, subjective norms, and perceived behavioral control (PBC) shape behavioral intentions and actions. By exploring these components within the context of VCO programs, the study provides a comprehensive framework for understanding consumer motivations and barriers. Furthermore, this research offers insights into how these psychological factors operate within the specific demographic of frequent business travelers, enhancing the applicability of TPB to address global sustainability challenges in the aviation sector.

1.4.2 Practical Applications

The findings of this research have significant practical implications for both airlines and policymakers. By identifying the key motivators and barriers influencing participation in VCO programs among frequent U.S. business travelers, the study provides stakeholders with actionable insights to enhance program design and communication strategies. For airlines, understanding the unique motivations of business travelers can enable more effective integration of carbon offset options into ticket booking platforms. This includes improving transparency, emphasizing the co-benefits of offset initiatives, such as environmental conservation and community development, and leveraging employer sponsorship of offsets as a potential strategy.

Policymakers can utilize the research findings to address barriers to participation by implementing targeted incentives, such as subsidies or tax benefits, tailored to frequent business travelers. Furthermore, these insights can support public awareness campaigns aimed at dispelling misconceptions about carbon offset programs and fostering trust in their

effectiveness. By addressing these areas, both airlines and policymakers can play a pivotal role in enhancing consumer engagement with VCO initiatives and advancing global sustainability efforts.

1.4.3 Societal Relevance

At a broader level, this research aligns with global sustainability efforts, particularly the United Nations' Sustainable Development Goals (SDGs). By promoting participation in carbon offset programs, the study supports SDG 13 (Climate Action), contributing to the reduction of aviation-related greenhouse gas emissions. Furthermore, the emphasis on co-benefits, such as biodiversity conservation and community development, aligns with SDG 15 (Life on Land) and SDG 11 (Sustainable Cities and Communities), highlighting the multifaceted impact of offset programs.

Understanding the motivations of frequent U.S. business travelers is essential for bridging the gap between pro-environmental attitudes and actionable behavior. By addressing this issue, the study not only contributes to achieving net-zero emission targets in the aviation sector but also fosters a broader cultural shift toward sustainable travel practices. This research, therefore, holds significant value for academia, industry, and society, advancing the shared goal of mitigating climate change through collaborative action.

1.5 Scope

This study focuses on voluntary carbon offset (VCO) programs within the aviation sector, examining the factors that influence passenger behavior and motivations to engage in these initiatives. The primary emphasis is on understanding consumer willingness to pay (WTP) for carbon offsets, with particular attention to psychological, economic, and structural drivers.

The target demographic for the research is U.S. residents who regularly take five or more flights annually for business purposes. This group represents a significant contributor to aviation emissions due to their frequent travel patterns. By analyzing the attitudes and behaviors of these frequent business travelers, the study aims to identify key patterns and variations in WTP that are shaped by professional obligations, corporate policies, and individual environmental concerns. The research specifically examines the role of employer-sponsored offsets and streamlined integration of offset options within booking systems as factors influencing engagement.

The focus on the aviation industry is motivated by its substantial contribution to global greenhouse gas emissions and the critical role of consumer-driven offset programs in mitigating its environmental impact. By targeting frequent business travelers, this study provides actionable insights into addressing the unique challenges and opportunities within this sector, contributing to broader efforts to enhance sustainability in aviation.

1.6 Theoretical Framework

1.6.1 Overview of Theories

The present study is grounded in the Theory of Planned Behavior (TPB), which provides a robust foundation for understanding consumer behavior, particularly the psychological and social factors influencing willingness to pay (WTP) for voluntary carbon offset (VCO) programs in the aviation sector.

The Theory of Planned Behavior, developed by Ajzen (1991), emphasizes that behavior is influenced by three key components: attitudes, subjective norms, and perceived behavioral control (PBC). Attitudes refer to individuals' positive or negative evaluations of a specific behavior, such as purchasing carbon offsets, based on their perceived outcomes. Subjective norms involve the social pressures individuals experience from significant others, such as colleagues, peers, or professional networks, to either engage in or avoid a behavior. Meanwhile, perceived behavioral control represents an individual's assessment of their ability to perform the behavior, which is influenced by factors like convenience, cost, and access. This framework is particularly relevant for exploring the motivations of frequent business travelers, as it directly links these factors to decision-making processes and subsequent behavior in professional travel contexts.

1.6.2 Application of TPB in the Study

The TPB framework is applied in this study to analyze the psychological and social determinants of consumer participation in VCO programs. By focusing on attitudes, subjective norms, and PBC, the study explores how these factors shape the willingness of frequent U.S. business travelers to pay for carbon offsets and engage with VCO initiatives. For instance, attitudes help explain travelers' evaluations of the benefits and costs of offset programs, subjective norms reveal the influence of professional or corporate pressures on participation, and PBC highlights the perceived ease or difficulty of engaging in offsetting behaviors, particularly within time-sensitive business travel.

1.6.3 Relevance to Research Questions

The application of TPB directly informs the study's research objectives and questions. TPB explains how attitudes, subjective norms, and PBC influence the motivations of frequent business travelers to purchase carbon offsets, addressing the primary research question: What motivates frequent U.S. business travelers to purchase carbon offsets for their flights? By using this framework, the study seeks to uncover the cognitive and social factors that drive or hinder participation in VCO programs. This approach provides actionable insights for improving program design, tailoring offset options to business travelers, and increasing engagement among this high-impact demographic.

1.7 Chapters Outline

This thesis is structured into five chapters, each of which contributes to a comprehensive understanding of the factors that influence consumer participation in voluntary carbon offset

(VCO) programs within the aviation sector. Each chapter builds upon the previous one to create a logical progression of ideas, guiding the reader through the research objectives, analysis, and contributions to the field.

Chapter Two explores the existing body of knowledge on carbon offsetting, with a specific focus on the aviation sector. It examines the psychological, economic, and structural drivers and barriers to consumer participation in VCO programs. The Theory of Planned Behavior serves as the guiding framework for this analysis, elucidating how attitudes, subjective norms, and perceived behavioral control influence WTP. The chapter also analyzes demographic trends specific to frequent business travelers and identifies research gaps that justify the study's focus on this group.

Chapter Three details the methodology adopted for the study. It explains the research design, sampling methods, data collection techniques, and analytical procedures employed to address the research questions. The rationale for selecting U.S. business travelers as the target population is thoroughly discussed, alongside an overview of the quantitative and qualitative methods utilized. This chapter ensures the transparency and robustness of the study's methodological approach.

Chapter Four presents the findings of the research, linking them to the theoretical framework and literature reviewed in Chapter Two. It provides a critical analysis of the motivations, barriers, and demographic factors that influence consumer behavior regarding carbon offsetting, with specific attention to the professional and corporate context of business travelers. The results are contextualized within the existing body of research, offering valuable insights and identifying patterns that align with or diverge from previous studies.

Finally, Chapter Five concludes the thesis by summarizing the key findings and their implications for academia, industry, and society. This chapter provides practical recommendations aimed at airlines, policymakers, and corporate stakeholders to enhance the design and adoption of VCO programs. Additionally, it outlines directions for future research, emphasizing areas where further investigation could contribute to advancing knowledge and improving the sustainability of the aviation sector.

Chapter 2: Literature Review

Chapter 2: Literature Review

2.1 Introduction

This chapter critically examines the existing literature on carbon offsetting in the aviation sector, with a specific focus on frequent business travelers in the United States. By exploring the application of the Theory of Planned Behavior (TPB), the chapter seeks to understand and explain consumer decision-making within this high-impact demographic. TPB's core constructs—attitudes, subjective norms, and perceived behavioral control—offer a robust framework for examining willingness to pay (WTP) for carbon offset programs in the context of professional air travel.

The chapter integrates findings on behavioral, economic, and demographic factors influencing participation, highlighting the unique motivations and barriers faced by frequent business travelers. It also identifies key gaps in the literature, including the underrepresentation of aviation-specific studies targeting this demographic, the limited exploration of corporate influence on WTP, and the need for tailored financial incentives and streamlined program integration. These gaps underscore the importance of studying frequent business travelers, who represent a significant opportunity for enhancing engagement in carbon offset programs.

By addressing these gaps, this chapter establishes a strong theoretical and empirical foundation for the research presented in subsequent chapters. The insights gained aim to inform the design of effective, scalable offset programs tailored to the aviation sector and the professional travel context.

2.2 Understanding Carbon Offsetting in Aviation

Carbon offsetting has emerged as a critical tool in mitigating the environmental impacts of industries with high carbon footprints, such as aviation. This section explores the foundational aspects of carbon offsetting, beginning with its definitions and mechanisms, and progresses to examine how these mechanisms align with the sector's unique challenges and opportunities. Special attention is given to the role of frequent business travelers, whose travel behaviors significantly contribute to aviation emissions. Understanding these foundational components is essential for framing the broader discussion on adoption trends, participation factors, and behavioral insights covered later in this chapter.

2.2.1 Definition and Mechanisms

Carbon offsetting is a compensatory mechanism designed to mitigate environmental impacts by neutralizing carbon dioxide equivalent (CO_2e) emissions. This approach is particularly relevant to addressing the carbon footprint of aviation, characterized by high per-passenger CO_2 emissions compared to other transport modes (Rajendran & Popfinger, 2022; Graver et al., 2019). Frequent business travelers, who often fly multiple times a year, contribute disproportionately to these emissions. Without substantial intervention, aviation's contribution to the global carbon footprint, currently estimated at 8%, is projected to increase by 300% by 2050 (J. Higham et al., 2019; Lenzen et al., 2018). The implementation of robust carbon offset measures is therefore critical to mitigating aviation's impact on climate change.

At its core, carbon offsetting relies on activities that either remove carbon from the atmosphere or prevent additional emissions. Carbon sequestration, the process of capturing and storing atmospheric carbon, remains a cornerstone of offset initiatives. Examples include afforestation and forest preservation projects, which absorb CO_2 over time and contribute to ecosystem restoration (Becken & Mackey, 2017; Cordes et al., 2023). Renewable energy projects, which displace fossil fuel use with clean energy sources such as solar and wind power, also play a pivotal role in reducing reliance on carbon-intensive technologies. These initiatives are particularly impactful when integrated into offset programs that target frequent flyers, as their recurring contributions could amplify the cumulative benefits of such efforts.

Scholars classify offset mechanisms into four primary categories: biological sequestration, renewable energy development, energy efficiency enhancements, and mitigation of non-CO_2 greenhouse gases such as methane and nitrous oxide (Polonsky et al., 2011). While these mechanisms are broadly applicable, tailored communication about their relevance to business travel could enhance participation rates among frequent travelers.

To ensure the effectiveness and credibility of carbon offset programs, both robust project design and reliable oversight are essential. Independent third-party verification is critical to maintaining transparency and fostering trust among stakeholders, including frequent business travelers and their employers. By providing impartial assessments, these organizations ensure that offset projects meet rigorous standards of additionality, measurability, and permanence. This oversight not only enhances the reliability of emissions reductions but also reinforces the broader sustainability goals of offset programs, including biodiversity conservation and social equity (Hamrick & Gallant, 2017; Kollmuss et al., 2008; Tao et al., 2021).

As the aviation sector works to address its significant carbon footprint, carbon offsetting offers a practical and scalable solution. However, initiatives must address persistent challenges related to transparency, credibility, and consumer engagement—particularly among frequent business travelers, whose participation could drive meaningful reductions in aviation's environmental impact. The following sections explore how voluntary and mandatory offset programs complement each other in promoting sustainability within the aviation sector.

2.2.2 Frameworks for Carbon Offsetting in Aviation

Carbon offsetting in aviation operates within two primary frameworks: voluntary and mandatory mechanisms. While distinct in their implementation, these approaches work synergistically to address the sector's substantial carbon footprint and promote sustainable practices. By integrating individual and institutional efforts, they may create a comprehensive strategy for achieving global sustainability goals.

Voluntary carbon offset programs (VCOs) empower consumers to take individual responsibility for their carbon footprints by financially supporting projects aimed at mitigating climate change. These initiatives, which include renewable energy projects and afforestation efforts, enable individuals to offset emissions from activities such as air travel (Yu, 2021; Wang, 2020). Beyond their direct environmental benefits, VCOs contribute to raising awareness about personal carbon footprints and fostering long-term behavioral changes toward low-carbon lifestyles (Zhou et al., 2024). Additionally, they serve as a catalyst for businesses to adopt offset strategies, thereby aligning operational goals with sustainability objectives (Wei

& Ding, 2022). The dynamic nature of VCOs demonstrates their potential to drive growth in voluntary carbon markets and promote consumer engagement in sustainability.

In contrast, compliance-based carbon offset programs operate within legally regulated frameworks, requiring businesses to purchase carbon credits to meet mandatory emission reduction targets. Examples include cap-and-trade systems such as the European Union Emissions Trading System (EU ETS), which ensures strict accountability for emissions reductions (Colmer et al., 2024). While compliance markets operate on a larger scale, voluntary markets are rapidly gaining momentum due to increasing consumer awareness and willingness to engage (Hamrick & Goldstein, 2016; Blasch & Farsi, 2014). Together, these frameworks address emissions reduction through both institutional accountability and individual action, underscoring the complementary roles of voluntary and compliance mechanisms in advancing aviation sustainability.

Within the aviation industry, voluntary offset schemes typically allow passengers to contribute to emission reduction efforts during the ticket purchase process, often through optional payments or loyalty rewards (Lu & Shon, 2012; Mair, 2011). For instance, Qantas has integrated VCO options directly into booking platforms to simplify the process for consumers (Burns & Cowlishaw, 2014; Zhang et al., 2019). However, as participation in these programs remains globally low, challenges such as consumer skepticism about transparency and the effective use of funds must be addressed (B. Zhang et al., 2019). Transitioning to compliance-based frameworks, regulatory initiatives such as the Carbon Offset and Reduction Scheme for International Aviation (CORSIA) mandate offsetting requirements for international airlines, aiming to cap emissions at 2020 levels by 2027 (ICAO, 2018; ICAO, 2019). While effective, these mandates face criticism for increasing costs and limiting consumer choice. To address these concerns, scholars recommend integrating voluntary mechanisms alongside mandatory policies to enhance both flexibility and consumer engagement (H. L. Kim & Hyun, 2021).

Airlines play a pivotal role in bridging voluntary and compliance-based offset frameworks. The International Air Transport Association (IATA) reports that over 50 airlines currently offer offset programs, highlighting the growing recognition of their importance (Mello, 2024). Industry leaders such as British Airways and KLM Royal Dutch Airlines have developed innovative offset programs that encourage consumer participation. KLM's "Fly Responsibly" campaign, for example, integrates accessible offset options and promotes reduced baggage weight to minimize emissions (H. L. Kim & Hyun, 2021). Similarly, Air France and KLM have combined Sustainable Aviation Fuel (SAF) with offsetting strategies to broaden their environmental initiatives (H. L. Kim & Hyun, 2021; Park et al., 2024).

Despite these advancements, global adoption rates for voluntary schemes remain limited due to trust issues and perceptions of ineffectiveness (Choi et al., 2018; Babakhani et al., 2017). Airlines that focus on building transparency and integrating offset programs directly into ticketing systems—such as United Airlines' "Eco-Skies Carbon Choice" program—demonstrate how streamlined processes can enhance consumer engagement (United Airlines, Carbon Choice carbon offset program, 2017; Burns & Cowlishaw, 2014).

By combining the strengths of voluntary and compliance-based frameworks, the aviation industry can build a robust foundation for advancing carbon offsetting. Voluntary programs empower individuals to take direct action, while compliance initiatives enforce global emission

reduction targets. Together, these complementary approaches foster consumer trust, promote accountability, and contribute to the sector's long-term sustainability goals.

However, despite the promising potential of these frameworks, their success depends significantly on consumer adoption. Examining how these programs are received across different regions and demographics reveals critical insights into the disparities in adoption rates, consumer attitudes, and willingness to pay (WTP) for offsetting efforts.

2.3 Adoption Rates and Trends

Carbon offset programs, while gaining global recognition, exhibit significant disparities in adoption rates, shaped by cultural influences and consumer behaviors. To fully understand these variations, it is essential to synthesize global trends, regional preferences, and the findings from monitored case studies that explore willingness to pay (WTP) across diverse contexts. By integrating these elements, a clearer and more cohesive perspective emerges on the factors driving or hindering the adoption of carbon offset initiatives.

2.3.1 Global Perspectives and Regional Trends in Carbon Offsetting

Global adoption rates of carbon offset programs in aviation remain notably low, despite growing awareness of the sector's environmental impact. Studies report that participation in voluntary carbon offset (VCO) programs ranges between 1% and 10% of air travelers worldwide, illustrating a persistent gap between consumer awareness and actionable behavior (Choi & Ritchie, 2014; McLennan et al., 2014; Mair, 2011). This disparity underscores the challenges of promoting sustainable practices and achieving widespread participation in aviation offset initiatives.

In Europe, consumer engagement with VCO programs exemplifies this trend. Hagmann et al. (2015) found that while 32% of EU passengers were aware of carbon offset schemes, only 8% had utilized them, with Germans comprising 84% of the study's respondents. These findings emphasize the influence of regional and cultural factors on adoption rates (Hagmann et al., 2015; Lu & Wang, 2018).

However, comprehensive data on pricing, participation rates, and consumer motivations remain limited, hindering the development of initiatives that align with consumer expectations (Mello, 2024). Addressing these gaps is critical to increasing the appeal and effectiveness of offset programs. By improving transparency, simplifying access, and emphasizing local projects with demonstrable impacts, airlines and policymakers can drive higher participation rates and advance the aviation sector's sustainability goals.

2.3.2 Regional and Cultural Variations

Regional and cultural differences may significantly influence attitudes toward carbon offset programs, shaping both consumer willingness to participate and adoption rates. These variations are driven by factors such as cultural norms, economic conditions, and environmental awareness, which together determine how individuals perceive and act upon their responsibility for climate action.

In collectivist societies, such as those in East Asia, social pressure and subjective norms often play a dominant role in shaping pro-environmental behavior. Tao et al. (2021) demonstrated that Chinese consumers are more likely to participate in voluntary carbon offset (VCO) programs when their social environment supports such actions, as collectivist values emphasize alignment with societal expectations. Similarly, Park et al. (2024) highlighted the importance of perceived social approval in decision-making, underscoring the role of societal influence in shaping individual behaviors.

Moral obligation is a crucial factor influencing participation in carbon offset programs across regions, particularly where government regulations or technological solutions fall short of addressing climate challenges comprehensively. In such contexts, individuals who view climate action as a personal responsibility are more likely to engage with offset initiatives. For instance, in regions with weaker regulatory frameworks, fostering a sense of moral responsibility has proven effective in enhancing participation (Kim et al., 2016). This dynamic interaction between cultural values, societal norms, and individual responsibility highlights the importance of tailoring regional efforts to align with local moral and social expectations. Such alignment not only resonates with local populations but also strengthens the global adoption of carbon offset programs.

Regional disparities in awareness and understanding of carbon offset programs further contribute to these variations. In Europe, for instance, higher public awareness, coupled with supportive government policies such as carbon taxes and green travel incentives, drives greater adoption rates (Cordes et al., 2023). In contrast, many Asian consumers, despite expressing high levels of WTP, exhibit low actual adoption rates due to limited knowledge about aviation's environmental impact and the benefits of offsets (McKercher et al., 2010; Shaari et al., 2020). Addressing these informational gaps through targeted educational campaigns has been shown to significantly increase engagement. Lu and Shon (2012), for example, demonstrated that providing clear and accessible information about offset programs can substantially improve WTP and participation.

Cultural and economic factors also shape program preferences. For instance, European consumers tend to prefer offset programs that fund reforestation and forest protection projects over those focused on aircraft technology improvements or alternative fuels (Rotaris et al., 2020). In collectivist cultures, by contrast, social incentives and public recognition may play a larger role in driving participation(Tao et al, 2021). Tailoring offset programs to align with these regional preferences and leveraging cultural values can enhance their appeal and effectiveness.

2.3.3 Case Studies Comparing Willingness to Pay (WTP) Across Regions

Empirical studies reveal significant regional differences in willingness to pay (WTP) for carbon offset programs, driven by varying levels of environmental awareness, economic conditions, and cultural values. These disparities highlight the need for tailored strategies to address regional preferences and barriers, ensuring greater alignment with consumer expectations.

In Europe, consumers demonstrate relatively high WTP for voluntary carbon offset (VCO) programs, reflecting the region's strong pro-environmental attitudes and supportive policy environment. Approximately 56.5% of Europeans report a willingness to pay for offsets, with

specific values varying based on project type and traveler demographics (Cordes et al., 2023). In Italy, for example, air travelers are willing to pay between €12 and €38 per ton of CO_2 or €14 to €66 per flight, depending on factors such as distance traveled and the type of project financed (Rotaris et al., 2020). In European countries, Forest protection and reforestation projects are particularly favored, underscoring the importance of visible environmental benefits in driving consumer preferences. Cultural discussions in countries like Germany and Sweden further bolster pro-environmental attitudes, with societal emphasis on environmental responsibility encouraging higher participation in offset programs (Cliff, 2014;Bösehans et al., 2020).

In contrast, Asia presents a pronounced attitude-behavior gap. While 74.1% of surveyed participants express WTP for carbon offset programs, actual adoption rates remain below 1% (McKercher et al., 2010; Shaari et al., 2020; Cordes et al., 2023). Limited knowledge about aviation's environmental impact and the benefits of offsets largely accounts for this disparity. Lu and Shon (2012) highlighted the effectiveness of educational campaigns in addressing these gaps, demonstrating that providing accessible information significantly improves WTP and consumer engagement. Such findings underscore the potential for targeted communication strategies to overcome informational barriers and translate pro-environmental attitudes into tangible actions.

Australia represents a unique case in the adoption of VCO programs, influenced by shifting public opinion and policy changes. Despite the introduction and subsequent repeal of a carbon tax, Australians exhibit higher adoption rates for VCO programs compared to other regions (Cordes et al., 2023). This trend may be partially explained by increased awareness of environmental issues, such as droughts and wildfires, which vividly illustrate the potential impacts of climate change. In Australia, younger travelers and individuals with higher education levels are particularly engaged, reflecting the demographic factors that influence participation (Cordes et al., 2023). However, skepticism about the credibility of offset programs and inconsistent practices remain significant challenges, limiting broader adoption (McLennan et al., 2014).These regional case studies highlight the critical role of tailored approaches in promoting carbon offset programs. By addressing cultural and economic factors, as well as regional variations in awareness and preferences, airlines and policymakers can design initiatives that resonate more effectively with diverse consumer bases. Such efforts are essential for increasing global participation and advancing the aviation sector's sustainability objectives.

While case studies offer valuable insights into regional and cultural variations in adoption, understanding the broader factors shaping participation in carbon offset programs requires a more detailed examination. Key demographic variables, such as age, income, and education, intersect with psychological, economic, and structural challenges to influence consumer behavior. The following sections delve into these factors, exploring how demographic and regional influences, trust and awareness gaps, cost considerations, and structural barriers shape willingness to pay (WTP) and participation rates in carbon offsetting programs.

2.4 Factors Influencing Participation in Carbon Offsetting Programs

Understanding the factors that drive consumer participation in carbon offset programs is essential for developing initiatives that effectively address barriers and appeal to consumer

motivations. Demographic characteristics—such as income, education, and age—interact with regional, cultural, and psychological influences to shape willingness to pay (WTP) and engagement levels. While socioeconomic factors like financial capacity and environmental awareness play a pivotal role, regional and cultural contexts further impact participation trends. This section examines these interconnected dimensions, offering a comprehensive analysis of how socioeconomic, psychological, economic, and structural factors influence decision-making in aviation carbon offset programs.

2.4.1 Demographic Factors Shaping Willingness to Pay (WTP)

Demographic factors are critical in shaping consumer participation in carbon offset programs. Key socioeconomic variables such as age, income, and education play a pivotal role in influencing individual attitudes and the capacity to engage in sustainable behaviors. Higher income and education levels often correlate with greater willingness to pay (WTP) for carbon offsets due to enhanced environmental awareness and financial capacity. Younger generations, in particular, tend to exhibit a stronger inclination toward pro-environmental behaviors compared to older groups, reflecting shifting priorities and values across generational cohorts.

Income and Education as Determinants of WTP

Income and education are critical predictors of willingness to pay (WTP) for carbon offset programs. Research consistently shows that higher-income individuals exhibit greater pro-environmental behavior and are less sensitive to price changes compared to their lower-income counterparts (Ma et al., 2021; Denstadli & Veisten, 2012). Individuals with more disposable income are better equipped to support sustainability initiatives, which increases their likelihood of participating in offset programs. Conversely, financial constraints among low-income groups often reduce their engagement, underscoring the role of socioeconomic status in shaping participation (Cordes et al., 2023).

Education also plays a significant role in shaping WTP, as it enhances environmental awareness and fosters positive attitudes toward carbon offset programs. More educated individuals often demonstrate a stronger commitment to pro-environmental behaviors, driven by their greater understanding of climate change and mitigation strategies (Carlsson & Johansson-Stenman, 2000; Gupta, 2016; Seetaram et al., 2018). However, the effect of education is nuanced; some highly educated individuals express skepticism about the efficacy of offset programs, which can reduce their likelihood of participation (Qi et al., 2019).

Age and Generational Differences in WTP

Age significantly influences willingness to pay (WTP) for carbon offsets, with younger individuals consistently demonstrating a higher likelihood of participation compared to older generations. Studies by Mair (2011) and Seetaram et al. (2018) highlight that younger consumers, particularly those with higher education and income levels, exhibit stronger pro-environmental attitudes and greater WTP. This generational disparity may stem from shifting priorities and heightened environmental awareness among younger cohorts, who often perceive climate action as a pressing issue.

Generational cohorts, such as Millennials and Generation Z, are particularly receptive to voluntary carbon offset (VCO) programs due to their strong preferences for sustainability and climate action (Schwirplies et al., 2019; Segerstedt & Grote, 2016). These individuals, who are generally more educated and environmentally aware, are more likely to embrace carbon offset initiatives and other pro-environmental behaviors. Their openness to innovative solutions and commitment to environmental responsibility make them a key demographic for promoting carbon offset programs (B. Zhang et al., 2019).

In contrast, older individuals often engage less frequently in carbon offset programs, potentially due to lower levels of environmental concern or limited exposure to offset opportunities. However, some exceptions exist; for instance, Galley and Clifton (2004) found that older females often participate in broader pro-environmental behaviors, suggesting that generational differences in WTP are not universal across all contexts.

This intersection of age, education, and environmental awareness underscores the importance of targeting younger, educated individuals to drive higher participation in carbon offset initiatives. By tailoring campaigns and messaging to resonate with this demographic, stakeholders can leverage their strong environmental commitment to advance the adoption of carbon offset programs.

2.4.2 Barriers to Consumer Participation in Carbon Offset Programs

The aviation sector's significant contribution to global greenhouse gas emissions has positioned carbon offset programs as a critical tool for mitigating environmental harm. However, despite growing awareness of the aviation industry's environmental impact, these programs face substantial challenges that limit their adoption and effectiveness. Key barriers, including psychological skepticism, economic constraints, and structural inefficiencies, prevent broader consumer engagement and program success.

The following sections explore the factors that contribute to low participation rates in voluntary carbon offset (VCO) programs. These include the pervasive lack of awareness about offset opportunities, psychological barriers such as trust and skepticism, and economic challenges like price sensitivity. Additionally, structural obstacles, including fragmented implementation and inconsistent practices, further complicate adoption. Understanding and addressing these barriers is essential for enhancing consumer participation and advancing the aviation sector's sustainability goals.

Low Participation Rates and Awareness Gaps

Global adoption of voluntary carbon offset (VCO) programs among air travelers remains strikingly low, with participation rates ranging between 1% and 10% (Choi & Ritchie, 2014; Mair, 2011). This limited engagement, coupled with less than 1% of global airline emissions currently being offset (Zelljadt, 2016; Wendt et al., 2024), underscores the pressing need for enhanced consumer participation and more effective program designs. A primary factor contributing to this low adoption is the pervasive lack of consumer awareness regarding the availability and purpose of carbon offset programs.

Studies reveal that fewer than 50% of passengers at Manchester Airport were aware of emissions offset opportunities, with only 10% expressing an intention to participate (Hooper et al., 2008). Similarly, research in Canada by Dodds et al. (2008) found that no more than 16% of travelers were familiar with carbon offsets, highlighting the widespread knowledge gap. This limited awareness not only impacts willingness to pay (WTP) but also stymies broader participation, demonstrating the need for targeted educational campaigns to bridge these gaps.

The gap between environmental awareness and actionable behavior compounds the issue. These dynamics create critical barriers to bridging awareness and action, emphasizing the necessity for solutions that directly address consumer knowledge and motivation.

Psychological Barriers, Skepticism, and Trust

Psychological barriers significantly hinder consumer engagement in carbon offset programs, driven by skepticism about their effectiveness, distrust of their legitimacy, and a broader sense of detachment from individual responsibility. Many travelers lack a clear understanding of how carbon offsetting works, which often translates into doubts about its efficacy (Chi et al., 2021). Research by Denton et al. (2020) highlights that insufficient knowledge about climate change and offset mechanisms frequently deters participation. Similarly, Brouwer et al. (2008) and Lu and Shon (2012) reported that fewer than 5% of respondents fully understood voluntary carbon offset (VCO) programs, with many unaware of aviation's significant contribution to climate change.

Adding to this challenge is the perception among many travelers that offsetting is an external responsibility, often delegated to airlines or regulatory bodies rather than being seen as an individual obligation (Sonnenschein & Smedby, 2019). This detachment is further exacerbated by the phenomenon of free-riding, where individuals assume that others will contribute to offset initiatives, thereby reducing their own sense of urgency to act (Foster et al., 1997). These behavioral dynamics compound the barriers created by skepticism and lack of awareness, making it even more difficult to engage consumers in offset programs.

Skepticism about program transparency and credibility remains a significant obstacle to consumer participation in carbon offset programs. Many consumers question whether their contributions genuinely lead to meaningful emissions reductions or are instead used for profit maximization by airlines or offset providers (Cheung et al., 2015). Greenwashing—the disparity between an organization's environmental claims and its actual practices—further intensifies these doubts (Higham et al., 2014). Programs that lack third-party certifications or fail to clearly communicate how funds are allocated are often perceived as less trustworthy, diminishing willingness to pay (WTP) and participation rates (B. Zhang et al., 2019; Wendt et al., 2024).

Addressing Psychological Barriers: Trust and Transparency

Building trust through transparency is essential for overcoming psychological barriers. Research demonstrates that programs featuring robust certification standards, detailed explanations of fund utilization, and consistent methodologies significantly enhance credibility and WTP (Liu et al., 2023; Kollmuss et al., 2008). For instance, British Airways' fixed-rate

offset charges of £3, £10, and £20 exemplify how transparent and standardized processes can foster consumer trust and encourage broader participation (Choi et al., 2018).

Moreover, trust in institutions plays a pivotal role in mitigating skepticism. Amin et al. (2017) found that institutional trust reduces skepticism and increases public participation in environmental initiatives. Similarly, Xu et al. (2022) noted that higher trust alleviates concerns about transparency and accountability, fostering greater willingness to engage in sustainability programs. By aligning their environmental claims with measurable outcomes and clearly showcasing the tangible impacts of offset programs, airlines and offset providers can bridge the trust gap and foster consumer confidence (Babakhani et al., 2017; B. Zhang et al., 2019).

While psychological barriers such as skepticism and lack of awareness are significant, they are often intertwined with economic and structural challenges. For example, distrust in offset programs can magnify consumers' sensitivity to costs, further reducing participation rates. Addressing these interconnected barriers requires a comprehensive approach that integrates transparent communication with affordable and accessible program designs. The next section will explore how economic and structural factors influence consumer engagement in carbon offset programs and outline strategies for overcoming these challenges.

Economic and Structural Barriers to Carbon Offset Adoption

Economic and structural factors significantly shape consumer participation in carbon offset programs. High costs, price sensitivity, and fragmented implementation within the aviation sector present formidable challenges that reduce engagement and limit the effectiveness of voluntary carbon offset (VCO) initiatives. Understanding these barriers is essential for designing programs that align with consumer expectations and encourage broader participation.

Economic Barriers and Price Sensitivity

Economic considerations, such as income, ticket pricing, and perceived financial trade-offs, play a central role in determining willingness to pay (WTP) for carbon offset programs. High offset costs relative to ticket prices often deter consumers, particularly those with lower incomes or competing financial priorities. Offset fees can range from less than €1 to over €55 per ton of CO_2 saved, creating perceptions of offsets as additional burdens rather than integral components of travel expenses (Choi et al., 2018; Sonnenschein & Mundaca, 2019). Price sensitivity further exacerbates this issue, with studies revealing that 70% of respondents identified cost as the primary determinant of their decision to purchase offsets, compared to only 20% who prioritized environmental awareness (Kortsch & Händeler, 2024).

Addressing these economic barriers requires innovative approaches to reduce perceived financial burdens. One such method is bundling offset costs with ticket prices, which simplifies participation and increases accessibility. The next section explores how bundling strategies can mitigate price sensitivity and encourage greater consumer engagement in carbon offset programs.

Bundling Strategies: Addressing Price Sensitivity

Economic theory suggests that modestly priced carbon offsets face relatively inelastic demand, making bundled pricing strategies an effective means of increasing adoption. Bundling offset costs with ticket prices as mandatory charges with opt-out options has proven particularly effective in minimizing perceived financial trade-offs and simplifying decision-making. For instance, Araña et al. (2013) demonstrated that this approach increased WTP by reducing the cognitive burden associated with separate offset payments. Additionally, embedding offset costs directly into ticket prices ensures that participation feels less burdensome and aligns with consumer preferences for seamless integration (Greiner & Rolfe, 2004).

Transparency about how funds are used further enhances the effectiveness of bundled pricing strategies. Providing detailed information about offset projects and their tangible benefits—such as forest preservation, renewable energy development, or community support—builds consumer trust and fosters greater engagement (Liu et al., 2023). Presenting offset costs in relatable terms, such as "per flight" rather than "per ton of CO_2," has also been shown to increase consumer acceptance by simplifying the framing of expenses (Wendt et al., 2024).

2.4.3 Structural Challenges

Structural Barriers: Fragmented Implementation and Lack of Standardization

Structural barriers within the aviation industry further hinder the adoption of carbon offset programs. One major issue is the fragmented implementation of offsets, with many airlines failing to integrate offset options effectively into their ticketing systems. Research indicates that consumers are more likely to participate in programs that are highly visible and easy to access, yet many passengers remain unaware of offset opportunities during the checkout process due to poor promotion and inconsistent integration (Burns & Cowlishaw, 2014; Y. Kim et al., 2016). Enhancing integration through preselected opt-in features and simplified processes could make offsetting a seamless part of the booking experience, thereby boosting participation rates.

A lack of standardization across airlines also undermines consumer trust and program scalability. Among the 320 International Air Transport Association (IATA) member airlines, only 50 currently offer VCO options, and there is significant variability in pricing models, methodologies, and verification processes (Park et al., 2024). For example, Air New Zealand charges $30 per ton of CO_2 for its "Fly Neutral" program, while Air France and KLM link offsets to Sustainable Aviation Fuel (SAF) at prices ranging from $80 to $759 per ton. By contrast, Qantas Airways charges as little as €0.20 per ticket for SAF purchases, illustrating inconsistencies that confuse consumers and reduce participation (Park et al., 2024; Qantas, 2015).

2.4.4 Overcoming Economic and Structural Barriers

To address these economic and structural challenges, the aviation industry must prioritize affordability, transparency, and standardization. Bundling costs into ticket prices, ensuring consistent pricing models, and adopting uniform certification and verification processes are critical strategies for enhancing consumer trust and engagement. Programs that incorporate co-benefits, such as biodiversity conservation or community development, further enhance perceived value and encourage participation (Kollmuss et al., 2008). Additionally, transparent

communication about how offsets are priced and the environmental impacts they deliver can help bridge trust gaps and foster long-term consumer confidence (Choi & Ritchie, 2014).

While economic and structural barriers are critical to understanding low participation rates in carbon offset programs, they are closely intertwined with behavioral dynamics that influence consumer decision-making. The next section will explore these behavioral gaps, focusing on the disconnect between pro-environmental attitudes and actual behavior, as well as the psychological mechanisms that underlie this divergence.

2.5 Behavioral and Theoretical Insights

Understanding the behavioral and psychological factors that influence participation in carbon offset programs is vital for addressing the barriers to adoption. While many consumers recognize the importance of mitigating aviation's environmental impact, their actions often fail to align with these pro-environmental attitudes. This misalignment highlights the need to explore the drivers of consumer behavior, the barriers they face, and the frameworks that can guide effective interventions. The following sections examine key behavioral challenges, such as the attitude-behavior gap, cognitive dissonance, and moral licensing, before transitioning into the theoretical foundations provided by the Theory of Planned Behavior (TPB). These insights offer a comprehensive lens through which to understand and address the complexities of consumer decision-making in sustainability initiatives.

2.5.1 Behavioral Gaps in Carbon Offset Adoption

The disconnect between pro-environmental attitudes and actual behavior, often referred to as the attitude-behavior gap, represents a significant challenge to carbon offset adoption. While many consumers express concern about aviation’s environmental impact, they frequently prioritize convenience, affordability, or necessity over sustainability. This divergence highlights the complex interplay of psychological factors that shape consumer decision-making, including moral licensing, cognitive dissonance, and the phenomenon of the "Flyer’s Dilemma."

The Attitude-Behavior Gap: A Persistent Challenge

Despite high levels of environmental awareness, participation in carbon offset programs remains critically low, with global averages of 1%–2% per flight (Choi & Ritchie, 2014; Mair, 2011). This gap between attitudes and actions reflects a common psychological barrier: the tendency to externalize responsibility. Many consumers perceive offsetting as the obligation of airlines or regulatory bodies, rather than a personal duty to mitigate environmental harm (Sonnenschein & Smedby, 2019). This externalization of accountability is compounded by free-riding behavior, where individuals rely on others to take action, diminishing their own sense of urgency to participate (Foster et al., 1997).

Moral Licensing and the "Flyer's Dilemma"

Moral licensing—a psychological phenomenon in which individuals justify unsustainable actions by emphasizing prior pro-environmental behaviors—further complicates consumer decision-making. For example, environmentally conscious travelers may rationalize frequent flying by citing other compensatory actions, such as recycling or adopting a vegetarian diet (McDonald et al., 2015). This cognitive mechanism allows individuals to maintain a sense of environmental responsibility while continuing behaviors that contradict their values (Núñez Alfaro & Chankov, 2022).

The "Flyer's Dilemma," described by Higham et al. (2014), captures the tension between consumers' desire to travel and their awareness of aviation's environmental impact. This dilemma often manifests in behavioral responses such as justification, reduction, or avoidance of air travel. While some travelers seek to offset emissions through VCO programs, others struggle to reconcile their environmental concerns with the convenience and necessity of flying. Addressing this dilemma requires solutions that align sustainable travel options with consumer priorities, making offsets more appealing and accessible.

Cognitive Dissonance: Aligning Attitudes with Actions

Cognitive dissonance, defined by Festinger (1957) as the discomfort caused by inconsistencies between attitudes and actions, plays a significant role in consumer behavior regarding carbon offsets. Passengers who recognize the environmental harm of flying may experience psychological discomfort when they fail to act on this awareness. However, the absence of viable alternatives often limits their ability to align behavior with pro-environmental values. For instance, limited availability of affordable and convenient offset options exacerbates this dissonance, reducing participation rates (Higham et al., 2014).

To mitigate cognitive dissonance, airlines and policymakers must create environments that enable consumers to act consistently with their values. Strategies such as integrating offset options seamlessly into ticket booking systems and emphasizing the tangible benefits of participation can reduce psychological discomfort and foster pro-environmental behaviors.

2.5.2 Overcoming Behavioral Barriers Through Targeted Interventions

Addressing behavioral barriers requires a multifaceted approach that combines psychological insights with practical solutions. Educational campaigns that emphasize the co-benefits of carbon offsets, such as biodiversity conservation or community development, can enhance consumer motivation by reframing offsets as valuable contributions rather than optional expenses.

Furthermore, leveraging social influence through subjective norms can drive behavioral change. Research indicates that individuals are more likely to adopt pro-environmental behaviors when they perceive social approval or peer endorsement (Whitmarsh & O'Neill, 2010). Airlines can capitalize on this by showcasing collective participation rates or highlighting endorsements from trusted organizations to foster a sense of community and shared responsibility.

The barriers to carbon offset adoption—whether psychological, economic, structural, or behavioral—underscore the multifaceted nature of the challenges facing voluntary carbon offset programs (VCOs). Bridging the gap between environmental intentions and actionable participation requires a coordinated effort that integrates transparency, consumer education, and program accessibility. By addressing skepticism and fostering trust through clear communication and standardized practices, airlines and policymakers can empower consumers to make informed decisions.

Moreover, aligning offset programs with consumer priorities—such as affordability, simplicity, and visible environmental impact—can help reduce the cognitive and financial barriers that deter participation. Bundling strategies, transparent reporting, and culturally tailored initiatives represent key opportunities to advance the appeal and effectiveness of these programs.

To deepen our understanding of consumer behavior in this context, it is essential to explore the underlying psychological, social, and contextual factors influencing participation. One critical approach to examining these dynamics is through behavioral and theoretical frameworks. Among these, the Theory of Planned Behavior (TPB) provides a robust lens for analyzing pro-environmental actions, including willingness to pay (WTP) for carbon offset programs. By focusing on key constructs such as attitudes, subjective norms, and perceived behavioral control, TPB helps unpack the complexities of consumer decision-making and sheds light on how these elements interact to shape behavior.

The following section delves into the TPB framework, offering insights into its components and their application to sustainability practices. This exploration not only enhances our understanding of consumer motivations but also provides actionable strategies to overcome barriers and encourage broader adoption of carbon offset programs.

2.6. Theoretical Framework: The Theory of Planned Behavior (TPB)

2.6.1 Overview of TPB

The Theory of Planned Behavior (TPB), introduced by Ajzen (1991), offers a robust framework for understanding behaviors influenced by both internal and external factors. Building on the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), TPB incorporates Perceived Behavioral Control (PBC) to address scenarios where external barriers, such as cost or resource availability, may limit volitional actions. This extension makes TPB particularly relevant for predicting environmentally significant behaviors, including participation in carbon offsetting programs.

In TPB, behavior is determined by three key components: attitudes, subjective norms, and PBC. These components interact to shape behavioral intentions and, ultimately, action. For example, in the aviation sector, a passenger's decision to participate in a voluntary carbon offset (VCO) program depends not only on their attitudes toward offsetting but also on perceived social pressure and their ability to navigate external challenges like financial costs or access to information (Park et al., 2024).

Attitudes: Attitudes are an individual's evaluation of a behavior based on its anticipated outcomes. In the context of carbon offsetting, passengers who believe that offset programs effectively mitigate climate change are more likely to participate. Conversely, skepticism

regarding program efficacy can result in negative attitudes and low engagement (Park et al., 2024). These attitudes are further influenced by the subjective value assigned to the outcomes, such as the perceived environmental benefits of offset contributions (Ajzen, 2012).

Subjective Norms: Subjective norms reflect the perceived social pressures to engage in a behavior. In collectivist societies, such as East Asia, social approval and peer encouragement play a critical role in shaping pro-environmental intentions (Shi et al., 2017). For instance, Tao et al. (2021) demonstrated that Chinese consumers are more likely to purchase VCO programs when supported by their social networks. These findings highlight the importance of peer and societal influence in driving participation in offset programs.

Perceived Behavioral Control (PBC): PBC reflects an individual's perceived ability to perform a behavior, considering both internal and external constraints. In aviation carbon offsetting, external barriers—such as cost and informational gaps—significantly influence PBC. Addressing these barriers through accessible payment options and simplified processes can increase consumer engagement (Park et al., 2024). Interestingly, research indicates that consumers with limited knowledge about offset programs are more reliant on PBC, while those with greater understanding are more influenced by attitudes and subjective norms (Y. Kim et al., 2016).

2.6.2 Key Behavioral Constructs of TPB and Their Influence on Willingness to Pay

Understanding willingness to pay (WTP) for carbon offset programs requires examining the interplay of psychological, social, and contextual factors, as conceptualized within the Theory of Planned Behavior (TPB). TPB identifies attitudes, subjective norms, and perceived behavioral control (PBC) as key determinants of behavioral intentions, offering a comprehensive framework to analyze WTP. These constructs collectively shape decision-making, providing insights into how consumers perceive and act upon opportunities to engage in voluntary carbon offsetting (VCO).

2.6.2.1Attitudes and WTP: Environmental Concern and Personal Responsibility

Attitudes toward carbon offsetting—shaped by environmental concern and a sense of personal responsibility—are pivotal in driving WTP. Individuals who acknowledge the threats posed by climate change often develop positive evaluations of offset programs, viewing them as actionable solutions to mitigate environmental harm (Choi & Ritchie, 2014). Such attitudes are reinforced by moral responsibility and the desire to protect future generations. Research consistently demonstrates that individuals who feel personally accountable for their carbon emissions exhibit higher WTP for offset programs; Conversely, when responsibility is shifted to external entities, such as airlines or governments, consumer engagement diminishes (Becken, 2007; Kroesen, 2013; Lu & Shon, 2012).

Shared responsibility models, where both passengers and institutions collaborate on emission reductions, have been shown to significantly enhance WTP (Gössling et al., 2007; Schwirplies et al., 2019). Furthermore, Xu et al. (2022) observed that fostering positive attitudes toward climate action strengthens participation, emphasizing the role of transparent communication

and co-benefits, such as biodiversity conservation and community development, in bolstering positive perceptions of offset programs.

2.6.2.2 Subjective Norms: Social Influences and Cultural Values

Subjective norms, defined as perceived social pressures to engage in a behavior, play a critical role in shaping consumer participation in carbon offset programs. Social influences, including peer approval and societal norms, strongly impact WTP, particularly in collectivist cultures where group expectations often guide individual actions (Du & Pan, 2021). For example, Tao et al. (2021) identified that subjective norms significantly influenced Chinese consumers' decisions to participate in VCO programs, highlighting the importance of social approval in promoting pro-environmental behaviors.

Moral responsibility and guilt also interact with social influences, further motivating WTP. Feelings of guilt about environmentally harmful behaviors, such as frequent air travel, have been shown to increase participation in offset programs (Bamberg & Schmidt, 2003). Similarly, exposure to environmental crises amplifies individuals' moral obligation to engage in sustainability efforts (Sisco et al., 2017). Empirical studies, such as those by Y. Zhang et al. (2017) and Whitmarsh and O'Neill (2010), underscore the role of subjective norms in aligning individual behavior with societal expectations, demonstrating how cultural and social contexts influence pro-environmental actions.

2.6.2.3 Perceived Behavioral Control (PBC): Facilitating Participation

Perceived Behavioral Control (PBC), which reflects an individual's perception of their ability to engage in a behavior, is a crucial determinant of WTP. PBC is shaped by both internal factors, such as confidence and knowledge, and external factors, including cost and accessibility. Consumers with higher perceived control are more likely to participate in offset programs, especially when barriers like complexity and high costs are minimized (Park et al., 2024).

Simplifying the purchasing process, such as integrating offset options into airline ticketing systems, has been found to positively influence consumer behavior (Choi & Ritchie, 2014; Mair, 2011). Transparency about how funds are allocated and the environmental impacts of contributions further enhances PBC, addressing common concerns about program credibility (Baumeister, 2017; Gössling et al., 2007). For instance, British Airways' fixed-rate offset charges of £3, £10, and £20 illustrate how standardized pricing models can reduce complexity and encourage participation across markets (Choi et al., 2018).

Economic considerations also significantly influence PBC. High offset prices can deter participation, particularly among consumers with limited disposable income (Shrivastava et al., 2019). Financial incentives and affordable pricing models have been shown to alleviate these barriers, increasing WTP by reducing perceived financial burdens (Sonnenschein & Mundaca, 2019). Conversely, programs offering tangible co-benefits—such as forest preservation or community development—resonate more strongly with consumers, enhancing both perceived value and participation rates (Tao et al., 2021).

The interplay of attitudes, subjective norms, and perceived behavioral control (PBC) illustrates the complexity of consumer decision-making in carbon offset programs. These constructs offer

a nuanced understanding of the psychological and contextual factors that influence willingness to pay (WTP). By addressing practical barriers, leveraging social influence, and enhancing positive environmental attitudes, organizations can foster greater engagement in voluntary carbon offset (VCO) programs.

This behavioral framework is not limited to carbon offsetting alone; its principles extend to various sustainability practices, providing valuable insights into how individuals adopt pro-environmental behaviors. The next section explores the application of the Theory of Planned Behavior (TPB) to broader sustainability contexts, including recycling, energy conservation, and carbon offsetting initiatives. These examples illustrate TPB's versatility and effectiveness in guiding sustainable practices and overcoming behavioral barriers.

2.6.3 Application of TPB to Sustainability

The Theory of Planned Behavior (TPB) has been extensively applied to understand and predict a wide range of pro-environmental behaviors, offering valuable insights into the motivations and barriers that shape sustainable practices. Its components—attitudes, subjective norms, and Perceived Behavioral Control (PBC)—have proven instrumental in analyzing behaviors such as recycling, energy conservation, and participation in carbon offset programs.

2.6.3.1 Recycling Behaviors

TPB has been widely utilized to examine recycling behaviors, which are influenced by individual attitudes, social pressures, and perceived control over resources. Positive attitudes toward recycling, combined with strong subjective norms and a sense of self-efficacy, significantly enhance recycling intentions (Tonglet et al., 2004). For instance, individuals who value environmental preservation and feel socially supported in their efforts are more likely to engage in recycling practices. However, external barriers—such as time constraints or a lack of accessible recycling facilities—can impede these intentions, even among those with favorable attitudes (Tonglet et al., 2004). This highlights the importance of addressing structural and situational barriers to strengthen the predictive power of TPB in promoting recycling behavior.

2.6.3.2 Energy Conservation

Energy conservation behaviors, such as reducing household energy use or adopting energy-efficient technologies, also demonstrate TPB’s applicability in understanding sustainability practices. Positive attitudes toward energy-saving practices, coupled with social encouragement, significantly influence energy conservation intentions (Chen, 2016). For example, studies incorporating personal norms alongside TPB components found that moral obligations enhanced its explanatory power for energy-saving behaviors (Du & Pan, 2021). This suggests that integrating ethical dimensions into TPB can provide a more comprehensive understanding of consumer motivations in the context of energy conservation.

2.6.3.3 Carbon Offsetting Programs

The aviation sector's carbon offset programs, particularly voluntary carbon offset (VCO) initiatives, offer a compelling application of TPB. Attitudes toward carbon offsetting play a pivotal role, as individuals who believe in the efficacy of offset programs and their ability to mitigate climate change are more likely to participate (Brouwer et al., 2008; Mair, 2011). Furthermore, a sense of moral responsibility to address aviation's environmental impact strengthens these attitudes, encouraging greater engagement.

Subjective norms also exert a strong influence on offsetting behaviors, especially in collectivist cultures where social approval and peer encouragement are key motivators (Shi et al., 2017; Tao et al., 2021). In these contexts, individuals are more likely to purchase offsets when they perceive that significant others—such as family, friends, or colleagues—approve of their actions.

PBC underscores the importance of addressing practical barriers to participation. In aviation, financial costs, informational gaps, and procedural complexities often hinder consumer engagement with offset programs (Park et al., 2024). Simplifying payment options, providing clear and accessible information, and promoting the ease of participation can enhance consumers' perceived control, ultimately increasing adoption rates. Research indicates that individuals with limited knowledge about carbon offset programs rely more heavily on PBC, while those with greater awareness are influenced by their attitudes and subjective norms (Y. Kim et al., 2016).

2.7 Research Gaps

Despite extensive research on carbon offsetting, significant gaps persist that hinder the effective implementation and scalability of voluntary carbon offset (VCO) programs in the aviation sector. These gaps span sector-specific, demographic, and behavioral domains, necessitating further investigation to address the unique challenges posed by aviation-related carbon emissions and the role of frequent business travelers.

One prominent gap lies in the insufficient focus on frequent flyers, particularly business travelers, who represent a disproportionately high share of aviation emissions due to their frequent travel patterns. While existing studies on carbon offset programs often generalize willingness to pay (WTP) across various traveler groups, they rarely account for the distinct characteristics of business travelers. Factors such as corporate travel policies, time constraints, and the potential for employer sponsorship significantly influence their WTP but are inadequately explored. Addressing these nuances is critical for developing tailored strategies that resonate with this demographic and enhance their participation in offset programs.

Another significant gap is the lack of exploration into the role of employers and corporate sponsorship in offsetting behaviors. Business travelers often operate within frameworks shaped by their employers, making corporate incentives and integration with expense management systems pivotal to offset adoption. Understanding how organizational policies and professional obligations interact with individual motivations could provide actionable insights for program design.

Theoretical gaps also remain evident, particularly in extending the Theory of Planned Behavior (TPB) to account for variables such as trust in employer-sponsored offsets, transparency in offset programs, and the influence of co-benefits, such as corporate social responsibility alignment. Integrating these factors into the TPB framework could enhance its predictive power for understanding offsetting behaviors in professional travel contexts. Additionally, the interplay between demographic factors—such as income, job roles, and employer type—and psychological constructs like attitudes and perceived behavioral control remains underexplored. Addressing these gaps could provide a nuanced understanding of how to effectively engage frequent business travelers.

In conclusion, addressing these research gaps requires a multidimensional approach that integrates insights into frequent flyer behavior, the role of corporate frameworks, and expanded behavioral models. By focusing on these areas, future research can deliver actionable strategies to enhance participation in carbon offset programs, contributing to sustainability goals and the reduction of aviation-related emissions.

2.8 Summary and Conclusion

2.8.1 Summary

Chapter Two provides a comprehensive review of the literature on voluntary carbon offsetting (VCO) within the aviation sector, using the Theory of Planned Behavior (TPB) as an analytical lens. It examines how attitudes, subjective norms, and perceived behavioral control interact with economic, psychological, and demographic factors to shape consumer willingness to pay (WTP) for offset programs. While the aviation industry's substantial environmental footprint underscores the potential for carbon offsetting to serve as a scalable solution, the chapter identifies persistent barriers to consumer engagement. These include skepticism about program transparency and effectiveness, economic constraints that heighten price sensitivity, and structural challenges such as poor integration of offset options into corporate travel frameworks.

The chapter also highlights significant variations in adoption rates and behaviors among different demographic groups, emphasizing the unique characteristics of frequent business travelers. Insights into employer-driven policies, time-sensitive travel demands, and corporate sponsorship opportunities underscore the need for targeted interventions tailored to this high-impact demographic.

By synthesizing these findings, the chapter identifies critical gaps, including the limited exploration of frequent business travelers as a key demographic, the lack of focus on corporate frameworks, and the need to extend TPB to incorporate factors such as institutional trust and financial incentives. These gaps emphasize the necessity for innovative strategies that integrate trust-building measures, effective communication, and employer-aligned pricing models. The chapter lays the groundwork for the methodological approaches outlined in Chapter Three, which aim to address these gaps and provide evidence-based solutions to improve the adoption of VCO programs in the aviation sector.

2.8.2 Conclusion

This chapter provides a comprehensive review of the key factors influencing consumer participation in voluntary carbon offsetting programs within the aviation industry. By applying the Theory of Planned Behavior, it elucidates how psychological, social, and structural factors interact to shape consumer behavior, with a particular focus on frequent business travelers. The chapter also identifies critical barriers, such as skepticism, corporate alignment challenges, and economic constraints, and emphasizes the role of employer policies and demographic factors in shaping willingness to pay and program engagement.

The insights derived from this review highlight the complexity of consumer decision-making in this domain and reinforce the need for targeted strategies to bridge the gap between environmental attitudes and actionable behavior. By identifying gaps in the current literature—such as the limited research on frequent business travelers and the need to integrate corporate factors into TPB constructs—this chapter establishes the foundation for the methodology outlined in the next chapter. The findings underscore the importance of advancing interventions that address these gaps and foster sustainable practices in the aviation sector.

CHAPTER THREE: RESEARCH METHODOLOGY

Chapter 3: Research Methodology

3.1 Introduction

This chapter outlines the research methodology used to explore the factors influencing the willingness to pay (WTP) for carbon offset programs among male frequent U.S. business travellers. The decision to focus exclusively on male participants reflects the study's objective of narrowing its scope by excluding gender-based comparisons, which have been extensively examined in prior literature. For instance, Sonnenschein and Smedby (2019) found that female travellers exhibited a higher WTP for carbon emissions offsets and demonstrated greater sensitivity to environmental protection during both domestic and international air travel. Similarly, Zhou et al. (2024) and Cordes et al. (2023) highlighted gender differences in environmental attitudes, with females often displaying stronger pro-environmental behaviour. However, the evidence is not entirely consistent—while Mair (2011) hypothesized that older female consumers would demonstrate greater WTP for voluntary carbon offsets (VCOs), this was not supported, whereas Rice et al. (2020) found the opposite. Given these mixed findings and the geographic focus of many existing studies—such as research on air travellers in Hong Kong (McKercher et al., 2010), the Netherlands (Brouwer et al., 2008), and Sweden (Gössling et al., 2009)—this study focuses on male frequent travellers in the United States. By doing so, it aims to provide a more nuanced understanding of the psychological and behavioural drivers of WTP within this demographic, which has received comparatively less attention in WTP research related to carbon offsets. This approach ensures alignment with the research questions and objectives outlined in previous chapters.

The chapter begins by discussing the research design, which integrates both descriptive and exploratory approaches to investigate the factors shaping participation in carbon offset programs. The rationale for selecting male frequent travellers is incorporated into the methodological framework, emphasizing the importance of understanding individual decision-making processes rather than broader social influences. The sampling strategy and the decision to recruit participants through Prolific are also detailed, highlighting the platform's ability to efficiently target and engage high-quality respondents who meet the study's eligibility criteria. Additionally, the process of survey development is explained, demonstrating how the questionnaire was structured based on the Theory of Planned Behaviour (TPB) to capture measurable insights into attitudes, perceived behavioural control, and subjective norms.

Furthermore, this chapter outlines the data analysis techniques used to evaluate the findings, ensuring methodological transparency in examining the relationships between key variables. Ethical considerations, including informed consent, participant confidentiality, and data protection measures, are also addressed to demonstrate adherence to academic research standards. Finally, the chapter acknowledges potential methodological limitations, such as the gender-specific focus and the reliance on self-reported data, and reflects on their implications for the generalizability of the study's findings.

3.2 Research Design

This study employs a survey design to investigate the factors influencing male frequent U.S. business travellers' willingness to pay for carbon offset programs. This approach allows for a structured examination of the psychological and behavioural components that shape

participation in offsetting initiatives while also uncovering patterns that may not be immediately apparent. The descriptive component facilitates an overview of participant characteristics and general WTP trends, whereas the exploratory component examines potential relationships between key variables, contributing to a more nuanced understanding of decision-making in the context of carbon offset purchases.

By focusing on male frequent travellers, the study aligns its research scope with its objective of assessing individual rather than social influences on WTP. This targeted research design ensures that the study remains methodologically rigorous while allowing for statistical inference and behavioural analysis, making it relevant both for academic discourse and industry applications.

3.2.1 Quantitative Approach

This study employed a quantitative methodology to collect and analyse data on participants' beliefs, behaviours, and willingness to pay (WTP) for carbon offset programs. A structured survey instrument was used to ensure consistency and comparability across responses, enabling robust statistical analysis. The survey was designed to align with the Theory of Planned Behaviour (TPB), allowing for an examination of the relationships between key psychological constructs—attitudes, subjective norms, and perceived behavioural control—and participants' willingness to engage in carbon offsetting.

The questionnaire, administered through the Prolific platform, consisted of closed-ended questions using Likert scales to capture participants' attitudes toward carbon offset programs, their perceptions of social and professional influences, and their sense of control over offsetting their emissions. Additionally, participants were asked to indicate their WTP for carbon offsets using a scenario-based question that presented the cost of offsetting a round-trip flight from Los Angeles to New York. For those unwilling to pay the full offset cost of $18, a follow-up question allowed them to specify the amount they would be willing to contribute, ensuring a comprehensive measure of WTP within the range of $0 to $18.

This structured data collection approach facilitated the application of inferential statistical methods, enabling the study to test whether TPB constructs significantly predicted WTP. Given that WTP responses were limited to a range between $0 and $18, with some participants indicating no willingness to pay, a suitable statistical approach was required to account for these constraints. The rationale for selecting the Tobit regression model, which addresses the censored nature of the WTP data, is further explained in the data analysis section of this chapter.

3.2.2 Application of the Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB) serves as the primary theoretical framework for this study, providing a structured approach to examining the psychological and social factors that influence willingness to pay (WTP) for carbon offset programs. According to TPB, behavioural intentions are shaped by three key constructs: attitudes, subjective norms, and perceived behavioural control (PBC). This framework allows the study to investigate how male frequent travellers make decisions about voluntary carbon offsetting and whether these psychological

drivers influence their willingness to contribute financially to environmental sustainability initiatives.

Attitudes refer to participants' evaluations of the effectiveness and benefits of carbon offset programs. TPB suggests that individuals who perceive carbon offset programs as effective and beneficial will be more inclined to engage in offsetting behaviours. In this study, attitudes were measured by assessing participants' trust in the environmental impact of carbon offsets and their perception of personal responsibility in reducing flight-related emissions.

Subjective norms capture social and professional influences on behavioural intentions. This construct measures the extent to which individuals feel social or professional pressure to participate in carbon offset programs, such as encouragement from colleagues, employers, or peer networks. Given that frequent travellers often belong to corporate or professional environments, subjective norms may play a role in influencing offsetting decisions through organizational policies, social expectations, or corporate sustainability commitments.

Perceived behavioural control (PBC) reflects an individual's assessment of their ability to engage in a particular behaviour, including perceived ease, affordability, and accessibility of that action. In the context of this study, PBC evaluates whether participants find carbon offsetting financially feasible and easy to implement during their flight booking process. TPB suggests that individuals who perceive offset programs as affordable and convenient will be more likely to participate in them.

By incorporating TPB into this research, the study aims to connect psychological constructs with real-world environmental outcomes in the aviation sector. Understanding the role of attitudes, subjective norms, and perceived behavioural control will provide insights into how frequent travellers engage with carbon offset programs and inform strategies for increasing participation.

3.2.3 Research Hypotheses

To structure the analysis, this study proposes three hypotheses derived from the Theory of Planned Behaviour (TPB):

1. H1 (Attitudes Hypothesis): Participants who perceive carbon offset programs as effective and beneficial will exhibit a higher willingness to pay.
2. H2 (Subjective Norms Hypothesis): Participants who experience greater social or professional pressure to offset emissions will exhibit higher willingness to pay.
3. H3 (Perceived Behavioural Control Hypothesis): Participants who perceive carbon offset programs as affordable and accessible will exhibit a higher willingness to pay.

These hypotheses establish the basis for statistical testing in Chapter Four, where their validity will be assessed using Tobit regression analysis. The next sections of this chapter outline the study's target population, sampling strategy, data collection methods, and analytical approach, ensuring that the methodology is well-structured for addressing these hypotheses.

3.3 Target Population and Sampling

3.3.1 Target Population

The target population for this study comprises male frequent travellers residing in the United States who self-identify as individuals who regularly take flights for various purposes, including business, leisure, or education. This demographic was chosen due to its substantial contribution to aviation-related carbon emissions, making it a critical group for examining participation in carbon offset programs.

Participants were initially recruited using Prolific's pre-screening criteria, which targeted individuals who had reported taking five or more flights annually at the time of registration. However, responses to a follow-up survey question about actual flight frequency revealed some discrepancies, with a portion of respondents reporting fewer than five flights per year. This discrepancy is likely due to the fact that Prolific does not regularly update participants' demographic information, meaning that their reported flight frequency may no longer reflect their current travel habits. As a result, the study includes participants who consider themselves frequent travellers , rather than imposing a strict numerical threshold. This approach ensures that the sample remains representative of individuals with consistent flying habits while acknowledging variations in self-reported travel frequency.

The decision to focus exclusively on male participants aligns with the study's objective of streamlining its scope and excluding gender-based comparisons, which fall outside the research focus. Gender differences in environmental attitudes and behaviours have been extensively documented in existing literature, allowing this study to instead focus on other psychological and behavioural drivers influencing willingness to pay (WTP) for carbon offsets. By narrowing the research population to male frequent travellers , the study aims to examine factors that directly impact WTP without the confounding influence of gender-related variations already explored in prior studies.

3.3.2 Prolific as the Recruitment Platform

This study utilized Prolific as the primary participant recruitment platform due to its ability to efficiently target specific demographics and ensure high data quality. Prolific offers advanced demographic filtering capabilities, allowing researchers to pre-screen participants based on gender, residency, and self-reported travel habits, ensuring that the sample aligns with the study's criteria.

One of Prolific's key advantages is its rigorous participant vetting process, which enhances data reliability and response validity. Unlike other crowdsourced platforms, Prolific pre-screens participants for attentiveness and engagement, reducing the likelihood of low-quality responses or survey fraud. Additionally, the platform facilitates rapid recruitment and survey completion, making it an efficient tool for behavioural research that requires timely data collection.

The suitability of Prolific for behavioural and consumer research has been well-documented in prior studies. For example, Peer et al. (2022) highlight that Prolific consistently produces high-quality data, outperforming other online panels in terms of participant engagement and response accuracy. Given these strengths, Prolific was deemed the most appropriate platform

for accessing U.S.-based male frequent travellers while maintaining methodological rigor and research validity.

3.3.3 Sampling Method and Size

The study employs a purposive sampling approach, ensuring that recruited participants align with the research's specific focus on male frequent travellers. The recruitment process was designed to include screening questions that verified eligibility based on gender, U.S. residency, and self-identified flight frequency. Although participants were initially pre-screened via Prolific's targeting filters, a follow-up question within the survey allowed for a more accurate assessment of travel frequency, ensuring that only those who consider themselves frequent flyers were included in the study.

The target sample size of approximately 100 participants was determined to balance statistical rigor with practical constraints such as time and resource limitations. This sample size was deemed sufficient for conducting meaningful statistical analyses, particularly given the study's reliance on Tobit regression modelling, which efficiently handles censored dependent variables. While the study aimed to maximize sample size to enhance generalizability, it remained constrained by the availability of eligible participants meeting the specified criteria.

By employing purposive sampling, the study ensures that the data collected reflects the perspectives of individuals who regularly engage in air travel, making them a relevant group for analysing willingness to pay (WTP) for carbon offsets. This targeted approach enhances the validity and applicability of the findings, particularly in the context of behavioural research on sustainable travel choices.

3.4 Data Collection Methods

3.4.1 Survey Development

The data for this study was collected through a structured survey designed to align with both the Theory of Planned Behaviour (TPB) framework and the study's research objectives. The finalized questionnaire was systematically structured into several key sections to comprehensively address the research questions.

The survey began with demographic questions, capturing participants' age, education level, and flight frequency to ensure eligibility and provide contextual background for the analysis. Participants were also asked about their prior familiarity with carbon offset programs, including whether they had previously heard of or used such programs.

To create a realistic context for decision-making, an imaginative scenario was introduced. Participants were asked to consider a round-trip flight from Los Angeles to New York, emitting approximately 587 kilograms of CO_2 per passenger. The survey informed participants that carbon offsetting provides a mechanism to mitigate these emissions by supporting projects that reduce or remove CO_2 from the atmosphere.

Based on this scenario, participants were asked whether they would be willing to pay $18 to fully offset the emissions, reflecting current pricing from the voluntary carbon market. For those unwilling to pay the full amount, a follow-up question prompted them to specify how

much they would be willing to pay to offset a portion of the emissions, requiring them to input a numerical value between $0 and $18.

The questionnaire also incorporated Theory of Planned Behaviour (TPB) constructs, measuring attitudes, subjective norms, and perceived behavioural control (PBC). Participants were asked to rate their beliefs regarding the effectiveness of carbon offset programs, the influence of social and professional networks, and the perceived affordability and accessibility of offsetting options.

To supplement the quantitative analysis, the survey concluded with an open-ended question, allowing participants to share additional thoughts or feedback on carbon offset programs. This qualitative input provided deeper insights into the motivations, concerns, and decision-making processes behind WTP for voluntary offsets, complementing the structured data collected through the Likert-scale items.

3.4.2 Prolific Platform Execution

The survey was administered through Prolific, a widely recognized platform for behavioural research, which facilitated efficient participant recruitment and data collection. Prolific's pre-screening tools ensured that only eligible participants—male U.S. residents who self-identify as frequent travellers—were included in the study. This approach allowed for precise demographic targeting, ensuring alignment with the research objectives.

To maintain data integrity, attention check questions were embedded within the survey, helping to confirm that participants remained engaged and provided reliable responses. Additionally, Prolific's secure interface allowed for seamless data collection, ensuring that responses were submitted in a timely and structured manner. The platform's reputation for high-quality data and participant engagement, as supported by Peer et al. (2022), further reinforced its suitability for this study.

3.4.3 Pre-Testing

Before full-scale data collection, the survey instrument underwent a pre-testing phase with a small sample of participants to assess its clarity, reliability, and functionality. This step was critical to ensure that questions were easily understandable, logically structured, and effectively measured the intended constructs within the Theory of Planned Behaviour (TPB) framework.

Feedback obtained from the pre-test was systematically analysed, leading to modifications in question wording, scale formatting, and response options. These refinements enhanced the survey's coherence and ensured that participants could respond accurately and consistently. The pre-testing phase also addressed potential technical issues, such as navigation flow and response entry limitations, ensuring a smooth experience for participants during full-scale data collection.

3.5 Data Analysis Techniques

The collected survey data was analysed using a combination of descriptive and inferential statistical methods. These techniques were selected to provide a comprehensive understanding of participants' willingness to pay (WTP) for carbon offset programs and to explore the relationships between TPB constructs and WTP.

3.5.1 Descriptive Analysis

Descriptive statistics were used to summarize and characterize the sample, providing an overview of participant demographics, behavioural tendencies, and prior engagement with carbon offset programs. These analyses included age distribution, education levels, and reported flight frequency, establishing a detailed profile of the sample.

Additionally, descriptive analysis was used to assess participants' familiarity with carbon offsets, calculating the percentage of respondents who had previously heard about or used such programs. Willingness to pay (WTP) for carbon offsets was also examined by summarizing responses to whether participants were willing to pay the full offset cost of $18 and, for those unwilling, the amount they were willing to contribute toward partial offsetting. These descriptive insights provided foundational behavioural patterns, supporting further inferential analysis.

3.5.2 Inferential Analysis

Inferential statistical methods were employed to analyse the relationships between TPB constructs and WTP. Given the nature of the WTP variable, which includes a large number of zero responses (participants unwilling to pay) and an upper limit of $18 (full offset cost), a Tobit regression model was selected as the primary analytical method.

The Tobit model accounts for the left-censoring at zero and right-censoring at $18, ensuring a more accurate estimation of the factors influencing WTP than standard linear regression. The model assessed the predictive power of attitudes, subjective norms, and perceived behavioural control in determining participants' WTP for carbon offsets. Results indicated that attitudes and perceived behavioural control significantly influenced WTP, while subjective norms were not a significant predictor, suggesting that carbon offsetting decisions are largely personal rather than socially driven.

In addition to regression analysis, Pearson correlation coefficients were calculated to assess the strength and direction of relationships between TPB constructs and WTP. Furthermore, comparative analysis examined differences in WTP across demographic subgroups, such as education levels and flight frequency, providing insights into which participant characteristics influenced offsetting behaviours.

Before conducting these statistical analyses, the dataset was reviewed for inconsistencies, missing values, and outliers. Responses containing invalid entries, extreme outliers, or incomplete data were excluded to maintain data integrity and ensure the reliability of the findings. This data-cleaning process resulted in a final sample size of 94 participants, as reflected in the Tobit regression output.

To further enhance analytical rigor, structural equation modelling (SEM) was considered as an optional advanced technique if sample size permitted. SEM would allow for assessing both

direct and indirect effects of TPB constructs on WTP, providing a more holistic understanding of behavioural mechanisms influencing carbon offset decisions.

3.5.3 Software for Data Analysis

To ensure robust and reliable analysis, the study employed R as the primary statistical software for data processing, modelling, and visualization. R was used to conduct descriptive and inferential statistical analyses, including correlation tests, regression modelling, and advanced visualization techniques.

Given the censored nature of the WTP data, a Tobit regression model was implemented using specialized statistical packages in R. This approach was chosen over standard linear regression to account for the left-censoring at zero, ensuring a more accurate estimation of the factors influencing WTP.

This approach ensured that the study's findings were statistically valid, replicable, and aligned with best practices in behavioural research.

3.6 Ethical Considerations

This study adhered to rigorous ethical standards to ensure the integrity of the research process and the protection of participants' rights. Ethical concerns related to informed consent, data privacy, participant compensation, and well-being were carefully addressed throughout the research process.

3.6.1 Informed Consent

Before participating in the survey, individuals were provided with a clear and detailed explanation of the study's purpose, objectives, and procedures. They were explicitly informed that their participation was voluntary and that they had the right to withdraw at any time without penalty. To ensure anonymity and confidentiality, no personally identifiable information was collected, and all responses were securely stored. Participants indicated their informed consent by checking a designated box at the beginning of the survey, affirming their understanding and willingness to participate.

3.6.2 Data Privacy and Confidentiality

Strict measures were implemented to protect participant data and ensure confidentiality. All responses were fully anonymized, preventing any linkage to individual participants. The data was securely stored in password-protected files and was accessible only to the research team. Furthermore, survey responses were used exclusively for academic purposes, as outlined in the consent form. These precautions ensured that ethical research practices were upheld throughout data collection and analysis.

3.6.3 Fair Compensation

Participants recruited through Prolific were compensated fairly and transparently, following the platform's guidelines. Compensation was calculated based on the estimated survey completion time, ensuring that participants were adequately rewarded for their effort. This approach not only upheld ethical research standards but also encouraged engagement and high-quality responses.

In conclusion, this chapter established a comprehensive methodological foundation for the study, ensuring alignment with its objectives and theoretical framework. The following chapter will present the findings derived from the data collected, offering critical insights into the factors influencing male frequent travellers' engagement with carbon offset programs.

CHAPTER FOUR: RESULTS AND ANALYSIS

Chapter Four: Results and Analysis

4.1 Introduction

This chapter presents the empirical findings derived from the survey responses and statistical analyses conducted to examine the willingness to pay for carbon offset programs among male frequent travellers in the United States. The analysis follows a structured approach, beginning with an overview of the demographic characteristics of the sample, including age distribution, education levels, and flight frequency. This is followed by an examination of participants' familiarity with carbon offset programs and their prior engagement with such initiatives. The discussion then shifts to willingness to pay, capturing both full and partial contributions while highlighting trends across different demographic groups.

To further investigate the relationships between key psychological constructs and willingness to pay, inferential analyses were conducted using Tobit regression. This method was chosen due to the censored nature of the willingness-to-pay data. Some respondents indicated a willingness to pay zero dollars, leading to left-censoring in the dataset. Additionally, since the survey imposed a maximum willingness-to-pay amount of eighteen dollars, participants who might have been willing to pay more were constrained by this limit, resulting in right-censoring. The Tobit model accounts for both lower and upper boundaries, allowing for a more accurate estimation of the factors influencing financial contributions to carbon offsetting. The chapter concludes with robustness checks and a discussion of the broader implications of these findings within the context of sustainable aviation.

4.2 Descriptive Statistics

4.2.1 Demographic Profile of Participants

The study’s sample comprised ninety-four male frequent travellers residing in the United States. Initially, ninety-six respondents participated, but two cases were excluded due to inconsistencies in their reported flight frequency. The age distribution of the sample was diverse, with the largest proportion belonging to the 25 to 34 age group, representing approximately 46.81 percent of the total participants. The second-largest age group was 35 to 44, accounting for 25.53 percent. Smaller proportions were observed among older groups, including 12.77 percent in the 45 to 54 range, 8.51 percent in the 18 to 24 range, 5.32 percent in the 55 to 64 range, and 1.06 percent among those aged sixty-five or older. The predominance of younger and middle-aged respondents aligns with expectations, as frequent travellers often include professionals engaged in work-related travel.

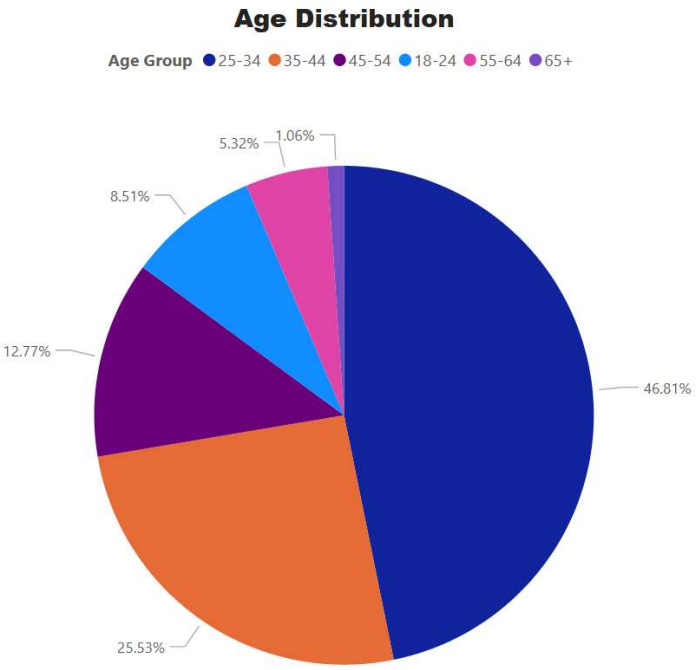

Figure 1: Age Distribution of Participants

The educational background of respondents suggests a highly educated sample, with nearly half, or 46.81 percent, holding a bachelor's degree. An additional 42.55 percent had obtained a graduate degree or higher, further reinforcing the notion that frequent travellers tend to have higher academic qualifications. A smaller proportion of 7.45 percent had completed high school, while 3.19 percent preferred not to disclose their educational background. The high levels of education among participants may influence their environmental awareness and decision-making regarding voluntary carbon offset programs.

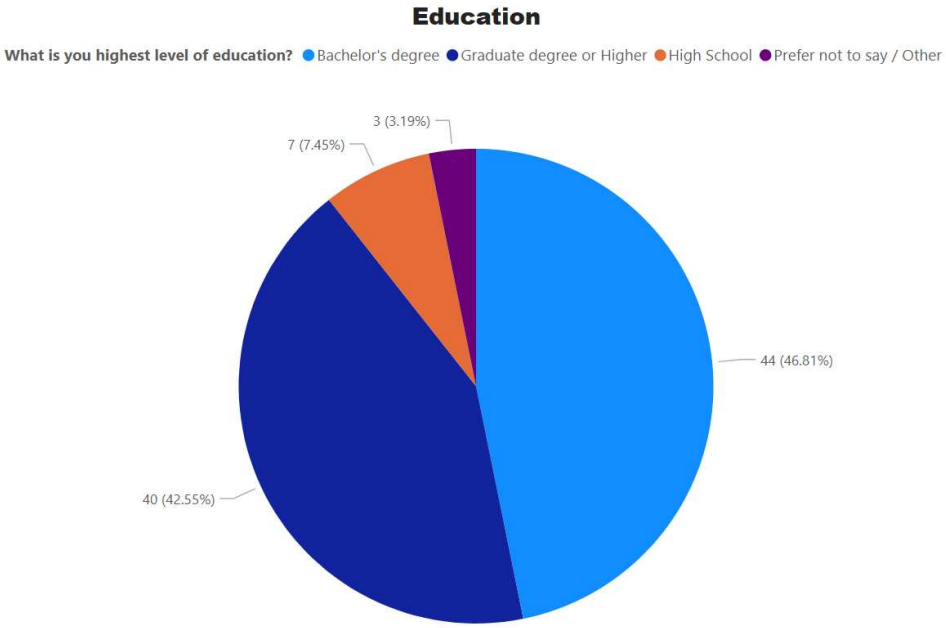

Figure 2: Educational Background of Participants

Flight frequency among respondents varied, with the sample divided into four travel frequency groups. The largest category, comprising 51.06 percent of participants, reported taking between one and five flights per year. This finding suggests that even those who travel infrequently engage in discussions about carbon offsetting. The second-largest category, representing 29.79 percent of the sample, consisted of individuals taking six to ten flights annually. A smaller subset, or 11.7 percent, reported taking between eleven and fifteen flights per year, while only 7.45 percent of respondents traveled more than fifteen times annually. This distribution reflects a range of travel behaviours, providing a nuanced understanding of the sample's engagement with air travel.

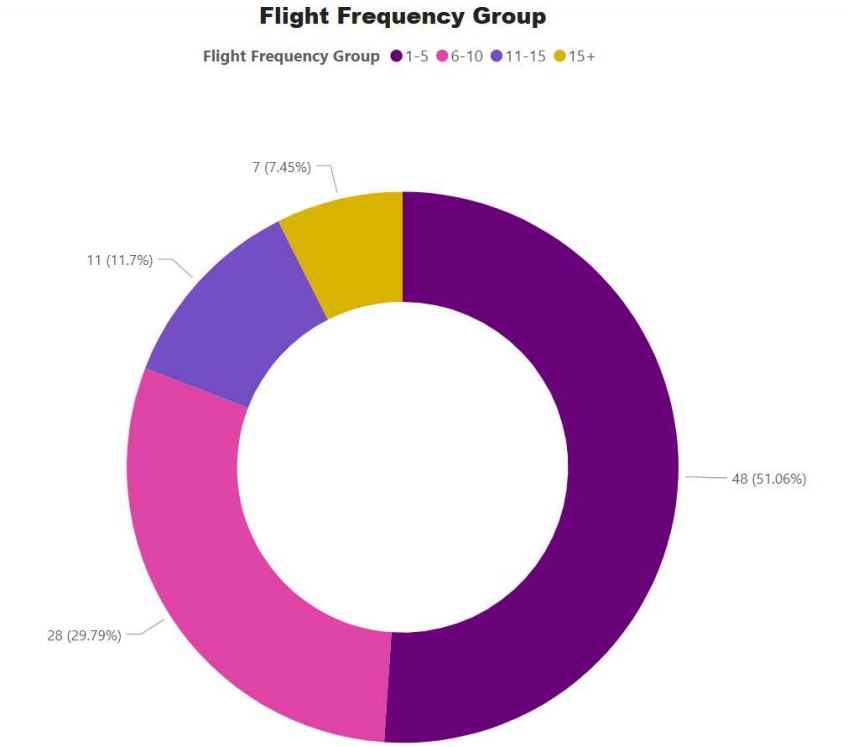

Figure 3:Flight Frequency of Participants

4.2.2 Familiarity and Prior Engagement with Carbon Offsetting

Assessing participants' familiarity with carbon offsetting programs was an essential aspect of this study, as prior knowledge can influence financial contributions to sustainability initiatives. When asked whether they had heard about carbon offset programs before taking the survey, 77.66 percent of respondents indicated awareness, while 22.34 percent stated they had not previously encountered the concept. This suggests that the majority of frequent travellers are familiar with carbon offsetting, which could impact their willingness to participate in such programs.

Despite this high level of awareness, actual participation in carbon offset programs remained relatively low. The survey findings revealed that only 23.4 percent of respondents had previously offset their flight emissions, while 76.6 percent had never done so. This discrepancy between awareness and engagement highlights a well-documented behavioural gap, suggesting that while travellers may recognize the existence of carbon offset programs, they may not necessarily perceive them as accessible, effective, or financially justifiable.

These findings provide a foundation for further analysis into the psychological and behavioural factors that shape willingness to pay for carbon offset programs. The next section will explore the extent to which attitudes, subjective norms, and perceived behavioural control influence willingness to pay, using Tobit regression modelling to account for censored responses.

4.2.3 Willingness to Pay for Carbon Offsets

The analysis of willingness to pay (WTP) for carbon offset programs revealed varying levels of financial commitment among respondents, demonstrating a spectrum of engagement. As shown in Table 1, the mean WTP across the sample was approximately $11.45, with a median of $18.00 and a mode of $18.00, indicating that a significant portion of respondents were willing to pay the full offset cost. The standard deviation of $7.06 reflects moderate variability in WTP responses.

Table 1:Summary Statistics for Willingness to Pay (WTP)

Statistic	**Value**
Mean	11.45
Median	18.00
Mode	18.00
Standard Deviation	7.06
Minimum	0.00
Maximum	18.00
Sample Size (n)	94

A substantial proportion of participants demonstrated a high level of financial commitment, with 57 participants (60.64%) indicating a willingness to pay the full offset cost of $18.00. This suggests that many respondents perceive carbon offsetting as a valuable and justifiable expense. Conversely, 15 participants (15.96%) reported zero willingness to pay, indicating potential barriers such as financial limitations, scepticism regarding the effectiveness of carbon offset programs, or a lack of perceived personal responsibility.

Among those unwilling to pay the full amount, WTP responses varied widely, reflecting different perspectives on the perceived value of carbon offsetting. Contributions ranged from $1.00 to $17.00, with certain amounts—particularly $3.00, $5.00, and $10.00—being more commonly selected. This variation suggests that while some respondents acknowledge the importance of offsetting their carbon emissions, they may find the full cost prohibitive or prefer to contribute a smaller, more manageable amount. The presence of these lower contribution levels underscores the potential benefits of implementing flexible pricing structures that

accommodate varying financial capacities, thereby encouraging broader participation in carbon offset programs.

Table 2:Frequency Distribution of Willingness to Pay (WTP)

WTP ($)	**Frequency (n)**	**Percentage (%)**
0	15	15.96%
1	5	5.32%
3	5	5.32%
5	7	7.45%
8	1	1.06%
10	4	4.26%
12	3	3.19%
15	2	2.13%
17	2	2.13%
18	57	60.64%
Total	94	100%

Table 2 presents the frequency distribution of WTP responses, illustrating the range of financial commitments across the sample.

The distribution reveals that the majority of participants either selected the maximum amount of $18.00 or opted for significantly lower amounts, highlighting a polarized pattern of financial commitment. This polarization suggests that while some individuals are fully committed to offsetting their carbon emissions, others may require more accessible pricing options to encourage participation.

These findings provide a foundation for further examination of the psychological and behavioural factors that shape WTP. The next section will assess the extent to which attitudes, subjective norms, and perceived behavioural control influence WTP, utilizing Tobit regression modelling to account for censored responses and evaluate the predictive strength of key theoretical constructs.

4.3 Inferential Analysis: Testing TPB Constructs on WTP

This section presents the results of the Tobit regression analysis, which examines the influence of the Theory of Planned Behaviour constructs—attitudes, subjective norms, and perceived behavioural control—on participants' willingness to pay for carbon offset programs. The nature of the willingness-to-pay responses required a methodological approach that accounts for the

censored structure of the data, as participants' responses were limited to a minimum of zero dollars and a maximum of eighteen dollars. The Tobit model was selected to address this issue, ensuring a more precise estimation of relationships between psychological predictors and willingness to pay. The focus of the analysis remains on the direction of these relationships and their statistical significance rather than the magnitude of coefficients, given the differences in interpretation between Tobit and standard linear regression models.

To assess each of the theoretical constructs, participants were asked to respond to a series of structured survey questions related to their attitudes toward carbon offsetting, the extent to which they felt social pressure to participate in such initiatives, and their perceived level of control in engaging with carbon offset programs. These self-reported measures were designed to capture the cognitive and behavioural factors that potentially shape financial contributions toward carbon offsetting.

4.3.1 Justification for Tobit Regression

The choice of Tobit regression over linear regression is grounded in the nature of the data collected. In this study, willingness to pay is not a fully continuous variable, as some participants were unwilling to pay anything, while others reached the upper limit of the predefined payment scale. This left- and right-censoring effect makes standard ordinary least squares regression an inappropriate analytical tool, as it assumes an unrestricted dependent variable. Ordinary least squares does not correct for the fact that the observed values for willingness to pay are constrained at both ends, which can lead to biased estimates and an incomplete understanding of the determinants influencing financial contributions to carbon offsetting.

By using the Tobit model, the analysis incorporates both those participants who expressed no willingness to pay and those who were limited by the imposed maximum amount. This approach provides a more reliable interpretation of the relationship between willingness to pay and the three psychological constructs under investigation. The model estimates not only the likelihood of contributing to carbon offset programs but also the extent of contribution among those who are willing to participate financially.

4.3.2 Regression Results and Interpretation

The results from the Tobit and Ordinary Least Squares (OLS) regression analyses indicate that attitudes toward carbon offsetting and perceived behavioral control (PBC) have significant relationships with willingness to pay (WTP), while subjective norms do not exhibit a statistically meaningful influence. The direction of the estimated coefficients suggests that individuals with stronger positive attitudes toward carbon offsetting and those who perceive greater ease in participating in offset programs are more inclined to contribute financially. Table 3 presents the results from both the Tobit regression model, estimated with robust standard errors, and the OLS regression model, also using robust standard errors for comparison.

Table 3:Regression Results for Willingness to Pay (WTP) for Carbon Offsets

Variable	Tobit Estimate	Std. Error	z-value	p-value	OLS Estimate	Std. Error	t-value	p-value
Intercept	-581.318	411.447	-1.413	0.158	-562.214	399.312	-1.408	0.159
Attitude Score	8.812	2.468	3.571	0.000	8.452	2.422	3.491	0.001
Subjective Norms	-0.845	2.342	-0.361	0.718	-0.731	2.287	-0.320	0.749
Perceived Behavioral Control (PBC)	5.642	2.330	2.422	0.015	5.278	2.262	2.334	0.020
Year of Birth	0.273	0.207	1.324	0.186	0.261	0.199	1.311	0.191
Flights Per Year	-0.401	0.319	-1.255	0.209	-0.393	0.311	-1.263	0.208
Log(scale) (Tobit)	2.704	0.181	14.974	<0.001	-	-	-	-

Legend:

- Dependent variable: Willingness to Pay (WTP) for carbon offsets (USD)
- Tobit model accounts for censoring at $0 and $18
- Both models estimated with robust standard errors to correct for heteroskedasticity

The results indicate that attitudes and perceived behavioral control are significant predictors of WTP in both models, whereas subjective norms do not have a significant effect. The coefficients for the Tobit model are slightly larger in magnitude compared to OLS, reflecting the model's adjustment for censored data. The consistency of these findings across both estimation methods supports the robustness of the relationships identified.

Attitudes toward carbon offsetting were found to have a positive and statistically significant association with WTP. The coefficient of 8.812 in the Tobit model and 8.452 in the OLS model suggests that for each one-point increase in the attitude score, participants' WTP increases by approximately $8.81 and $8.45, respectively. This finding aligns with prior research indicating that individuals who perceive carbon offset programs as effective and morally justified are more willing to financially support such initiatives (Brouwer et al., 2008; Mair, 2011).

To assess attitudes, participants rated their agreement with the following statements on a seven-point Likert scale:

- "I believe carbon offset programs are effective in mitigating the environmental impact of aviation."
- "Reducing my carbon footprint through offsetting makes me feel like a responsible global citizen."
- "Every passenger has a role to play in reducing aviation-related environmental impacts."

Respondents with higher attitude scores demonstrated greater WTP, reinforcing the importance of fostering positive perceptions about the benefits of carbon offsetting.

In contrast, subjective norms did not exhibit a statistically significant relationship with WTP, as evidenced by the non-significant coefficients of -0.845 (Tobit) and -0.731 (OLS). This finding diverges from prior studies that have emphasized the role of social approval and societal expectations in shaping pro-environmental behaviors, particularly in collectivist cultures (Du & Pan, 2021; Tao et al., 2021). The lack of significance in this context suggests that carbon offsetting is perceived as a personal decision rather than one driven by social pressure.

Subjective norms were measured through participants' responses to the following statements:

- "The people I care about would approve of me offsetting the emissions from my flights."
- "My coworkers or professional network supports the idea of carbon offsetting for business travel."
- "My employer encourages me to offset the carbon emissions of my flights."

The absence of a significant relationship indicates that while social influences may affect other sustainability behaviors, they play a lesser role in voluntary carbon offset purchases, where individual beliefs and financial considerations may have greater influence.

Perceived behavioral control (PBC) demonstrated a positive and statistically significant effect on WTP in both models, with coefficients of 5.642 (Tobit) and 5.278 (OLS). These results suggest that individuals who perceive offsetting as accessible, financially manageable, and straightforward are more likely to contribute.

PBC was assessed through agreement with the following statements:

- "I have enough knowledge about how carbon offset programs function to participate effectively."
- "The cost of carbon offset programs is reasonable compared to the environmental benefits."
- "Offsetting my flight emissions is financially manageable for me."
- "It is simple to access carbon offset programs when booking flights."

The positive association between PBC and WTP aligns with research emphasizing the importance of reducing barriers to participation (Araña et al., 2013; Greiner & Rolfe, 2004). Individuals who feel confident in their knowledge of offset programs and perceive the cost as justified are more likely to support such initiatives financially.

Although demographic variables such as year of birth and flights per year were included as covariates, neither exhibited a statistically significant relationship with WTP. This finding suggests that psychological factors, rather than demographic characteristics, are the primary drivers of carbon offsetting behavior.

The next section further examines the study's hypotheses based on these regression results.

4.3.3 Hypothesis Testing

Based on the regression results presented in Table 3, the study's hypotheses were assessed in relation to the statistical significance and direction of the estimated relationships.

- The hypothesis stating that participants with more positive attitudes toward carbon offsetting would be more willing to pay was supported, as attitudes exhibited a positive and statistically significant relationship with WTP ($\beta = 8.812$, $p < 0.001$).
- The hypothesis suggesting that subjective norms would influence WTP was not supported, as no statistically significant relationship was observed ($\beta = -0.845$, $p = 0.718$).
- The hypothesis that participants with higher perceived behavioral control (PBC) would be more willing to pay was supported, as PBC exhibited a positive and statistically significant effect on WTP ($\beta = 5.642$, $p = 0.015$).

4.3.4 Summary of Key Findings

The inferential analysis demonstrates that attitudes and perceived behavioural control are significant determinants of willingness to pay for carbon offset programs, while subjective norms do not appear to have a meaningful impact on participants' payment decisions. These findings suggest that efforts to increase engagement with carbon offset programs should focus primarily on fostering positive attitudes toward offsetting and reducing perceived barriers to participation rather than relying on social influence strategies. The observed lack of significance for subjective norms may indicate that carbon offsetting is perceived as a voluntary and individualized action rather than one driven by external social pressures. While previous research has shown that social approval can influence environmental behaviours in some cultural contexts, the findings from this study suggest that carbon offsetting decisions are more strongly driven by personal beliefs and perceived ease of engagement. The potential reasons for this discrepancy will be explored in subsequent sections.

4.4 Additional Analysis and Robustness Checks

This section presents additional analyses to validate the robustness of the findings and explore alternative explanations. The analysis first examines willingness to pay differences across demographic groups, followed by an assessment of whether interaction effects exist between key predictors. Finally, robustness checks, including the use of robust standard errors and alternative model specifications, are reviewed to ensure that the primary results remain stable and reliable.

4.4.1 WTP Differences Across Demographic Groups

An additional analysis was conducted to examine whether willingness to pay varied based on demographic characteristics such as age, education level, and flight frequency. The expectation was that individuals with higher education levels, younger age groups, or more frequent travellers might exhibit higher WTP, given their greater potential exposure to climate-related discussions and sustainability initiatives. However, when these demographic variables were included in the Tobit model, none were found to have a statistically significant relationship with WTP. Specifically, age (β=0.2734\beta = 0.2734β=0.2734, p=0.1855p = 0.1855p=0.1855), education level, and flight frequency (β=−0.4010\beta = -0.4010β=−0.4010, p=0.2094p = 0.2094p=0.2094) showed no significant influence on WTP.

These results suggest that age, education, and flight frequency do not systematically influence willingness to pay for carbon offsets. This finding contrasts with previous research suggesting that higher education levels correlate with greater pro-environmental behaviour. In this study, attitudes and perceived behavioural control remain the key predictors of WTP. Furthermore, the lack of significance for flight frequency indicates that being a more frequent flyer does not necessarily lead to greater engagement in offset programs. This challenges the assumption that individuals who travel more frequently feel a stronger obligation to offset their carbon emissions. Future research should explore whether other demographic factors, such as income level or geographic location, may influence WTP.

4.4.2 Interaction Effects and Alternative Explanations

To explore potential interaction effects, additional models tested whether attitudes or perceived behavioural control (PBC) might interact with demographic variables such as age or flight frequency. These interaction terms were included in extended versions of the Tobit model. However, none of the interaction terms yielded significant improvements in model fit or explanatory power, suggesting that demographic characteristics do not moderate the relationship between psychological factors and WTP.

One potential explanation is that carbon offsetting decisions are primarily driven by intrinsic psychological factors rather than demographic attributes. This aligns with previous research suggesting that attitudes and perceived control are stronger determinants of voluntary sustainability behaviour than external demographic characteristics. The absence of significant interaction effects reinforces the idea that the decision to offset emissions is relatively uniform across different subgroups, rather than being influenced by age or flight frequency. These findings highlight the importance of targeting psychological drivers in efforts to increase engagement with carbon offset programs, regardless of demographic differences.

4.4.3 Robustness Checks and Alternative Model Specifications

To verify the reliability of the findings, the Tobit model was estimated using robust standard errors, which account for potential heteroskedasticity and provide more accurate standard error estimates. The results from this estimation showed no substantial changes in the significance levels or direction of the coefficients, confirming the stability of the primary findings. The significance of attitudes and perceived behavioural control remained strong, while subjective

norms continued to exhibit no statistically significant relationship with willingness to pay (WTP).

In addition, a more comprehensive Tobit model was estimated, incorporating demographic variables such as age, education level, and flight frequency. The inclusion of these additional variables did not enhance the model's explanatory power, as none of the demographic factors were found to be statistically significant. This result further supports the conclusion that demographic characteristics do not play a meaningful role in predicting WTP beyond the core psychological constructs of attitudes and perceived behavioural control.

The consistency of these findings across different modelling approaches underscores the robustness of the main results. Both the standard and extended Tobit models produced similar estimates, reinforcing the reliability of the identified relationships. The use of robust standard errors ensures that the reported significance levels and confidence intervals accurately reflect the underlying data, strengthening the validity of the study's conclusions.

4.5 Interpretation of Key Findings

This section contextualizes the empirical findings within the broader literature on consumer behaviour and sustainable aviation. The results confirm that attitudes and perceived behavioural control significantly influence willingness to pay for carbon offsets, whereas subjective norms do not. These findings have implications for understanding how individuals make decisions regarding voluntary environmental contributions and suggest targeted strategies for increasing engagement with offset programs.

4.5.1 Attitudes and WTP: Strength of Environmental Beliefs

The significant positive relationship between attitudes and willingness to pay for carbon offsets suggests that participants who hold more favourable views of carbon offsetting are more likely to contribute financially. This finding aligns with previous research, which indicates that individuals who believe in the effectiveness of carbon offset programs may be more inclined to engage in such initiatives as a means of mitigating their personal carbon footprint (Brouwer et al., 2008; Mair, 2011).

One possible explanation for this pattern is that some individuals may view offsetting as a moral responsibility, believing that travellers should take accountability for the environmental consequences of their flights. When carbon offsetting is framed as an ethical duty rather than a voluntary transaction, individuals may experience a stronger intrinsic motivation to participate, regardless of external pressures. This suggests that moral considerations could play a role in shaping willingness to pay, as travellers who perceive a personal obligation to address their carbon emissions may be more willing to make financial commitments toward offset programs.

Additionally, trust in the legitimacy of carbon offset providers might influence attitudes toward participation. Travellers who perceive offset programs as transparent, credible, and capable of delivering measurable environmental benefits may be more willing to invest in them. In contrast, scepticism regarding the effectiveness of offsets could act as a barrier, limiting participation among those uncertain about whether their contributions genuinely lead to emission reductions. These factors highlight the importance of clear communication and

credible offsetting initiatives in fostering positive attitudes that translate into actual financial engagement.

Survey responses support these findings, as participants who expressed strong agreement with statements such as "I believe carbon offset programs are effective in mitigating the environmental impact of aviation" and "Reducing my carbon footprint through offsetting makes me feel like a responsible global citizen" exhibited higher willingness to pay. This suggests that efforts to strengthen public confidence in the impact of carbon offsets, possibly through greater transparency and clearer messaging, may enhance participation rates in such programs.

4.5.2 Lack of Influence of Subjective Norms

The results indicate that subjective norms do not significantly influence willingness to pay for carbon offsets, suggesting that social expectations and perceived peer approval may not play a decisive role in shaping travellers' offsetting decisions. While previous studies suggest that social influence is a strong determinant of pro-environmental behaviours, particularly in collectivist cultures where community norms often guide individual actions (Du & Pan, 2021; Tao et al., 2021), this study's findings suggest that carbon offsetting is largely perceived as a personal decision rather than one shaped by external social pressures.

One potential explanation for this lack of influence is that carbon offsetting is a relatively private action that lacks visibility compared to other environmentally friendly behaviours. Unlike recycling or using reusable shopping bags—both of which can be observed by peers and reinforced through social approval—carbon offsetting is usually done online at the time of booking a flight, without any direct visibility to friends, family, or colleagues. As a result, travellers may not feel strong social pressure or receive feedback from their network, reducing the influence of subjective norms on their decision-making process.

Additionally, the individualistic cultural context of the study sample may contribute to the weaker role of subjective norms. The participants, primarily U.S.-based travellers, are likely embedded in a social environment that emphasizes personal autonomy and individual decision-making over collective conformity. In contrast to collectivist societies, where social norms and peer influence strongly dictate behaviour, individualistic cultures place greater weight on personal beliefs and perceived control over choices. This may explain why subjective norms, which rely on external social validation, were not found to be significant in predicting WTP.

Another possible reason for this finding is that carbon offsetting has not yet reached the status of a widely accepted social norm. Unlike established pro-environmental behaviours such as recycling or energy conservation, which enjoy strong societal consensus, carbon offsetting remains a relatively niche practice. Many travellers may not perceive a clear expectation that responsible travellers should always offset their emissions, leading them to rely more on personal attitudes and feasibility considerations rather than on perceived social pressure. Moreover, inconsistent messaging from businesses and employers regarding sustainability practices may further weaken the perceived normative expectation for offsetting.

It is also possible that offsetting is framed more as a personal moral choice rather than a behaviour dictated by external influences. If travellers view carbon offsetting as a self-directed

ethical decision rather than a socially encouraged behaviour, they may base their choices on their own values rather than on how others perceive them. This may explain why those who offset do so out of personal conviction, while those who do not are less concerned with external approval or disapproval.

These findings suggest that airlines, policymakers, and environmental organizations may need to explore ways to strengthen social expectations around carbon offsetting to increase participation. Possible strategies include greater visibility for those who offset, the integration of offsetting into group travel norms, and stronger corporate travel policies that emphasize sustainability. The implications of these potential interventions will be explored further in Chapter 5.

4.5.3 Perceived Behavioural Control (PBC) and WTP

The positive and statistically significant relationship between perceived behavioural control and willingness to pay suggests that travellers who feel they have the ability to offset their emissions—whether due to affordability, accessibility, or knowledge—are more likely to do so. This finding aligns with prior research indicating that reducing perceived barriers to participation enhances engagement in voluntary sustainability programs (Araña et al., 2013; Greiner & Rolfe, 2004).

One possible reason for this effect is that when travellers perceive offsetting as simple and straightforward, they may feel more confident in their ability to participate. Programs that integrate offsetting into the booking process, provide clear explanations of their impact, or minimize effort required to opt in may enhance travellers' sense of control, thereby increasing their likelihood of participation. Conversely, if offsetting is perceived as complex, time-consuming, or difficult to access, even environmentally conscious travellers may forgo participation due to a lack of perceived ease.

Another important factor could be financial feasibility. Travellers who believe that offset costs are manageable within their budget may feel a greater sense of control over their decision to participate. If offset prices are perceived as too high relative to the overall cost of travel, this may act as a deterrent, regardless of pro-environmental attitudes. Some airlines have sought to address this barrier by bundling offset costs into ticket prices or offering automatic opt-in programs, strategies that may help reduce financial concerns and simplify participation (Araña et al., 2013).

Survey responses further support these interpretations. Participants who agreed with statements such as "Offsetting my flight emissions is financially manageable for me" and "It is simple to access carbon offset programs when booking flights" were more likely to report willingness to pay. These findings suggest that when travellers feel that offsetting is easy to do and within their financial means, they are more inclined to take action.

Given these insights, addressing perceived accessibility and cost concerns could be key strategies for increasing participation in carbon offset programs. This could involve providing clearer, more transparent information on offset options, ensuring that offset choices are presented in a user-friendly manner, and implementing pricing strategies that make offsets feel

like a more natural and integrated part of travel expenses. These potential solutions will be explored further in the next chapter.

4.6 Summary of Results

The analysis confirms that attitudes and perceived behavioural control significantly influence willingness to pay (WTP) for carbon offset programs, while subjective norms do not. Additional analyses indicate that demographic variables such as age, education, and flight frequency do not meaningfully impact WTP, reinforcing the idea that offsetting decisions are driven by individual psychological factors rather than demographic characteristics.

The estimation of the Tobit model with robust standard errors, along with an extended model that incorporated additional demographic variables, confirmed that the main findings remain stable across different model specifications. The consistent significance of attitudes and perceived behavioural control, coupled with the non-significance of subjective norms, highlights the reliability of the results. These findings suggest that airlines and carbon offset providers should focus on strengthening environmental beliefs and reducing barriers to participation rather than relying on social influence strategies.

4.7 Limitations

While this study provides valuable insights into willingness to pay (WTP) for carbon offset programs, several methodological limitations should be acknowledged. These limitations relate to sampling constraints, potential biases, and methodological assumptions, which may influence the generalizability of the findings.

4.7.1 Sampling Limitations

This study employed a purposive sampling method using Prolific, which, while effective, may not fully represent the broader population of frequent U.S. business travellers . The sample might overrepresent individuals who are already familiar with online surveys or hold strong environmental attitudes, potentially biasing the results toward more sustainability-conscious respondents. Additionally, since Prolific does not regularly update participants' demographic information, some participants' reported flight frequency may no longer reflect their current travel habits, introducing further sampling variability.

4.7.2 Response Bias

The study relied on self-reported survey responses, which are subject to various forms of response bias that may affect data accuracy. For instance, social desirability bias may have led participants to overstate their willingness to pay for carbon offsets, aligning their responses with perceived social norms rather than their actual behaviours (Podsakoff et al., 2003). Additionally, recall bias may have influenced participants' reported familiarity with carbon offsets, as their recollection of past experiences might be inaccurate. These biases are common in self-reported data and should be considered when interpreting the study's findings.

4.7.3 Constraints of Online Platforms

While Prolific provides high-quality participant engagement, online platforms may not fully capture the complexity of motivations and decision-making processes compared to qualitative methods such as interviews or focus groups. Furthermore, participants completing the survey in an online setting might experience attention fatigue, particularly if they perceive the questionnaire as lengthy or repetitive, which could affect response quality. Research suggests that prolonged survey completion times can lead to decreased attentiveness and response accuracy, particularly toward the end of the survey (Galesic & Bosnjak, 2009; Deutskens et al., 2004). This limitation highlights the need to balance survey comprehensiveness with participant engagement to ensure data reliability.

4.7.4 Simplification of Carbon Offsetting Scenarios

The study employed an imaginative scenario describing a round-trip flight from Los Angeles to New York, emitting approximately 587 kilograms of CO_2 per passenger, with an offset cost of $18. While this scenario was designed to be realistic and relatable, it simplifies the complexities of actual carbon offset programs. In real-world settings, offset costs and mechanisms vary widely across airlines, project types, and verification standards. These differences may affect participants' actual willingness to pay, as some may base decisions on specific offset providers or corporate-sponsored initiatives. Furthermore, the scenario does not account for employer-sponsored offsets, which could significantly alter participants' decision-making processes. Future studies should explore more dynamic and personalized offset scenarios to capture a broader range of real-world factors influencing WTP.

4.7.5 Limited Scope of Analysis

The study applies the Theory of Planned Behavior (TPB) to examine behavioural drivers of WTP but does not incorporate other potential influencing factors such as cultural attitudes, regulatory policies, or technological awareness. These factors may play a significant role in shaping participants' decisions about carbon offsetting. Future research should consider integrating additional psychological and structural factors, such as environmental awareness, social norms within different cultural contexts, and evolving regulatory frameworks, to provide a more holistic understanding of willingness to pay for sustainable travel option.

Despite its robust methodological approach, several limitations were acknowledged. These included potential self-reporting biases, as participants may have over- or under-reported their willingness to pay due to social desirability bias or recall issues. Additionally, the use of a purposive sampling method via Prolific may have resulted in a sample that is not fully representative of all U.S. business travellers, limiting generalizability. Furthermore, the imaginative scenario used in the survey simplified real-world complexities of carbon offset pricing and airline practices, which may have influenced participants' responses. These limitations should be considered when interpreting the findings and highlight opportunities for future research to refine and expand the analysis.

CHAPTER 5: DISCUSSION AND CONCLUSION

Chapter 5: Discussion and Conclusion

5.1 Introduction

This chapter interprets the empirical findings presented in Chapter 4 within the context of existing literature, the Theory of Planned Behaviour (TPB), and the study's broader research objectives. By analysing the relationships between attitudes, subjective norms, and perceived behavioural control (PBC) and their influence on willingness to pay (WTP) for carbon offset programs, this discussion aims to contextualize the results, explain unexpected findings, and outline implications for both theory and practice.

The findings reveal a strong and statistically significant influence of attitudes and PBC on WTP, indicating that individual beliefs about carbon offset effectiveness and ease of participation play a pivotal role in shaping behaviour. These results are consistent with previous studies demonstrating that attitudes are among the strongest predictors of pro-environmental behaviours (Brouwer et al., 2008; Mair, 2011). Similarly, PBC has been shown to enhance engagement in sustainability initiatives, particularly when financial and access barriers are minimized (Araña et al., 2013; Greiner & Rolfe, 2004).

In contrast, subjective norms did not significantly influence WTP, a finding that diverges from research conducted in collectivist cultural settings, where social expectations strongly predict pro-environmental behaviours (Tao et al., 2021; Du & Pan, 2021). This suggests that carbon offsetting may be perceived as a private, individual decision rather than a socially influenced behaviour, particularly within individualistic cultures such as the United States. Additionally, the study found no significant effect of demographic factors such as age, education, or flight frequency, reinforcing the idea that psychological determinants—rather than sociodemographic characteristics—are the primary drivers of voluntary carbon offset participation.

The following sections examine each key finding in greater depth, linking them to the TPB framework and existing literature, while exploring their theoretical and practical implications for sustainable aviation.

5.2 Interpretation of Key Findings

5.2.1 Attitudes and Willingness to Pay

The study found a positive and statistically significant relationship between attitudes toward carbon offsetting and WTP, aligning with previous research emphasizing that beliefs about offset effectiveness and moral responsibility strongly influence participation (Brouwer et al., 2008; Mair, 2011). Respondents who perceived carbon offset programs as effective climate mitigation tools and believed that every passenger has a role to play in reducing aviation-related environmental impacts exhibited a higher likelihood of financial commitment.

From a theoretical standpoint, this finding supports the TPB framework, which asserts that attitudes toward a behaviour are key determinants of behavioural intentions (Ajzen, 1991). In this case, attitudes toward offsetting were shaped by a combination of personal environmental values, moral responsibility, and trust in offset providers. Prior research has shown that individuals who perceive climate action as a moral duty tend to demonstrate greater willingness to engage in offsetting (Becken, 2007; Gössling et al., 2007).

Several psychological and structural factors may explain the strong effect of attitudes on WTP. One key factor is perceived environmental benefit—travellers who believe in the tangible effectiveness of carbon offset projects, such as afforestation and renewable energy investments, are more likely to contribute financially (Becken & Mackey, 2017; Cordes et al., 2023). Trust in carbon offset providers also plays a crucial role, as consumers tend to hesitate in engaging with programs perceived as non-transparent or ineffective (Hamrick & Gallant, 2017; Tao et al., 2021).

Additionally, emotional responses to climate action may reinforce attitudes. Research suggests that travellers experience eco-guilt when engaging in carbon-intensive activities like frequent flying, and offsetting serves as a mechanism to alleviate this guilt (McDonald et al., 2015; Núñez Alfaro & Chankov, 2022). Participants who expressed a sense of responsibility for their emissions often viewed offsetting as a way to neutralize their impact, strengthening their commitment to pay. One participant described offsetting as "a small price to pay for doing my part in reducing my footprint."

5.2.2 Perceived Behavioural Control and Willingness to Pay

Perceived behavioural control (PBC) emerged as a strong and statistically significant predictor of willingness to pay (WTP), reinforcing the notion that the perceived ease, affordability, and accessibility of carbon offset programs play a crucial role in shaping consumer engagement. This finding is in line with previous research suggesting that when individuals feel that offsetting is straightforward and financially manageable, they are more inclined to participate (Araña et al., 2013; Greiner & Rolfe, 2004).

A key component of PBC is the level of knowledge and confidence individuals have regarding carbon offset mechanisms. Respondents who reported being well-informed about how offset programs function demonstrated a higher willingness to pay, supporting the idea that awareness and access to clear information are essential in fostering participation (Lu & Shon, 2012; Chi et al., 2021). Prior studies indicate that many consumers remain skeptical or lack sufficient understanding of offset initiatives, which in turn limits their engagement (Brouwer et al., 2008; Sonnenschein & Smedby, 2019). This skepticism was evident in participant feedback, with some expressing doubts about the credibility and effectiveness of offset programs. One respondent noted, "How do we know this money really goes to these causes and, more importantly, who is validating that the programs are legitimate?" Such concerns highlight the need for greater transparency and third-party verification in offsetting initiatives to enhance consumer trust and perceived control.

Another critical aspect influencing PBC is financial feasibility. Many travellers perceive offsetting as an additional expense rather than an integral part of their flight purchase, making cost a significant barrier to participation (Sonnenschein & Mundaca, 2019). However, research suggests that integrating offset fees into ticket prices or implementing opt-out mechanisms can improve participation rates by reducing the psychological friction of making an active purchasing decision (Araña et al., 2013). This aligns with participant feedback indicating that ease of access plays a key role in determining engagement.

These findings suggest that enhancing consumer confidence, increasing transparency, and streamlining the offsetting process can significantly improve participation rates. Addressing

common concerns regarding legitimacy and simplifying the payment process—such as through default opt-in options or bundled pricing—may further strengthen perceived control and encourage greater adoption of offset programs.

5.2.3 Lack of Influence of Subjective Norms

In contrast to attitudes and PBC, subjective norms did not emerge as a significant predictor of willingness to pay, a result that diverges from findings in collectivist cultures where social expectations and peer influence strongly shape pro-environmental behaviours (Du & Pan, 2021; Tao et al., 2021). The absence of a significant effect suggests that carbon offsetting may not be widely perceived as a socially driven behaviour but rather as a personal, individual decision.

One possible reason for this lack of significance is the low visibility of carbon offsetting as a behaviour. Unlike sustainable practices such as recycling or using reusable bags—both of which are easily observable and often socially reinforced—offsetting occurs privately during the booking process. Without clear social approval or disapproval, individuals may feel little pressure to conform to any perceived norm (Whitmarsh & O'Neill, 2010).

Another contributing factor could be the individualistic cultural orientation of the study sample, which was composed of U.S.-based travellers. Research suggests that in individualistic societies, behaviours tend to be guided more by personal attitudes and perceived control rather than by social expectations, whereas in collectivist cultures, group consensus and peer endorsement play a greater role in shaping environmental decisions (Shi et al., 2017; Kim & Hyun, 2021).

Additionally, carbon offsetting remains a relatively niche and underpublicized practice, which may explain its weak association with subjective norms. Unlike well-established sustainability efforts such as recycling—where social expectations and institutional reinforcement are strong—carbon offset programs have yet to reach a level of mainstream acceptance where they are widely perceived as the norm (McLennan et al., 2014). A lack of strong social reinforcement could mean that individuals do not view offsetting as a necessary action to gain social approval or avoid social disapproval.

The absence of a significant effect for subjective norms suggests that strategies aimed at increasing participation in carbon offset programs may need to focus less on social pressure and more on enhancing personal attitudes and perceived control. While norm-based interventions may work in some contexts, the findings indicate that simply emphasizing the social desirability of offsetting may not be enough to drive behaviour change. Instead, airlines, policymakers, and sustainability advocates may need to increase awareness, improve transparency, and enhance ease of participation to effectively encourage engagement in carbon offset initiatives.

5.2.4 Lack of Significant Demographic Effects

The study also found no significant effect of demographic factors, such as age, education, or flight frequency, on WTP. This contradicts some previous studies linking higher education or frequent travel with increased environmental engagement (Hsu et al., 2019).

One possible reason for this finding is the relative homogeneity of the sample. The participants were male frequent travellers in the United States, which may reduce variability in responses. Additionally, within the TPB framework, demographic attributes typically exert indirect effects, meaning that their influence may be mediated through attitudes, norms, and PBC rather than exerting direct effects on WTP (Ajzen, 1991).

5.3 Theoretical Implications

The findings of this study contribute to the broader application of the Theory of Planned Behaviour (TPB) in understanding pro-environmental decision-making, particularly in the aviation industry. The results reinforce key elements of the TPB framework while also raising important questions about its applicability to voluntary carbon offsetting behaviours.

Attitudes and perceived behavioural control (PBC) emerged as significant predictors of willingness to pay (WTP) for carbon offsets. Travellers who held positive views regarding the effectiveness and necessity of carbon offsetting were more likely to contribute financially. Similarly, those who perceived offsetting as financially manageable and easy to access demonstrated a greater likelihood of participation. These findings align with prior research that highlights the role of positive attitudes in shaping pro-environmental behaviours and the importance of PBC in reducing psychological and financial barriers to participation (Brouwer et al., 2008; Mair, 2011; Araña et al., 2013; Greiner & Rolfe, 2004).

However, the study fails to uncover a significant relationship between subjective norms and WTP for carbon offsets. The results indicate that social expectations surrounding carbon offsetting do not significantly impact travellers' willingness to pay. This finding contrasts with previous research in other sustainability domains, where social influence plays a critical role in driving behaviour, particularly in collectivist cultures where peer expectations strongly shape decision-making (Du & Pan, 2021; Tao et al., 2021). The absence of a significant effect in this study suggests that carbon offsetting may be perceived as a private, individual decision rather than a socially motivated action.

Unlike recycling or reducing plastic use, which are visible to others and reinforced through social feedback, carbon offsetting occurs at the point of ticket purchase, often in isolation. Without tangible reinforcement from peers, social expectations may have limited influence, which could explain the lack of statistical significance for subjective norms.

Another possible explanation lies in the cultural and professional context of the sample. The study focused on frequent male travellers in the United States, a demographic that tends to exhibit individualistic rather than collectivist decision-making tendencies. Prior research has shown that in individualistic cultures, behaviours linked to personal agency and self-determination often take precedence over socially driven norms (Shi et al., 2017; Park et al., 2024). Furthermore, many frequent travellers book flights for work-related reasons, where corporate policies and financial considerations may override the influence of personal social networks. In such cases, subjective norms from peers and family members may hold less weight compared to professional expectations or employer sustainability policies. Beyond the standard TPB constructs, trust and scepticism emerged as critical underlying themes affecting WTP. Several participants expressed doubts about the legitimacy of carbon offset programs, with one stating, "Most carbon offset organizations are a scam," while another asked, "How do

we know this money really goes to these causes?" These concerns suggest that trust in offset programs acts as a moderating factor that influences both attitudes and PBC. If travellers doubt the legitimacy of offsets, even those with positive environmental attitudes may hesitate to participate. This aligns with previous research highlighting that credibility and transparency are key determinants of consumer engagement in sustainability initiatives (Hamrick & Gallant, 2017; Kollmuss et al., 2008).

The implications of these findings suggest that while TPB remains a robust framework for understanding voluntary carbon offsetting, its explanatory power may vary depending on the nature of the behaviour in question. Traditional TPB applications often assume that subjective norms influence actions because individuals seek social approval. However, when behaviours are inherently private, financially driven, or occur in transactional settings with little social visibility, the role of subjective norms may be diminished. Future refinements to TPB may benefit from differentiating between descriptive norms (what people observe others doing) and injunctive norms (what people believe others think they should do) to better capture the complexity of decision-making in environmental contexts.

5.4 Practical and Managerial Implications

The results of this study provide valuable insights for airlines, policymakers, and corporate travel managers seeking to increase participation in carbon offset programs. Given that attitudes and perceived behavioural control emerged as the strongest predictors of WTP, practical interventions should focus on strengthening positive attitudes toward carbon offsetting while enhancing consumers' perceived ability to participate.

5.4.1 Airline Industry and Offset Providers

One of the most effective ways to influence attitudes is by building trust in the legitimacy and impact of carbon offset programs. Many consumers remain sceptical about whether their contributions genuinely result in meaningful environmental benefits, which can discourage participation (Hamrick & Gallant, 2017; Tao et al., 2021). This scepticism was evident in participant responses, where some voiced concerns about offset credibility: "It just seems like another added tax" and "How do we know this money really goes to these causes?"

To address these concerns, airlines and offset providers should prioritize transparency by clearly communicating how funds are used and providing verifiable data on emissions reductions. Independent third-party certifications, impact reports, and accessible explanations of offset project outcomes could help establish credibility and reinforce positive attitudes.

Additionally, embedding offsetting information within the ticket purchasing process, rather than presenting it as an afterthought, may enhance awareness and legitimacy, making participation feel like an integral part of the travel experience rather than an optional add-on.

Since perceived behavioural control also significantly influences WTP, increasing the ease and accessibility of offset participation is crucial. Many travellers support offsetting in principle but find the process too complex, inconvenient, or financially unmanageable. Simplifying the payment process by integrating automatic offset options, opt-out models, or default selections within airline booking platforms could substantially increase participation rates. Previous

studies suggest that when travellers do not need to make an active decision to participate, participation rates rise dramatically (Araña et al., 2013; Greiner & Rolfe, 2004).

Airlines that bundle offset costs into ticket prices, rather than requiring an additional step, may see higher engagement while minimizing psychological barriers to participation. Subscription-based or corporate-sponsored offset programs could also be explored to allow frequent travellers to offset their flights continuously rather than making individual decisions for each booking.

5.4.2 Policy and Regulatory Bodies

Government agencies and regulatory bodies may play an important role in promoting carbon offset programs, particularly by introducing incentives for voluntary participation. Unlike mandated emission reduction policies, which primarily target airlines, well-designed government initiatives could encourage individual travellers to engage in carbon offsetting without imposing compulsory measures.

One potential policy approach is the introduction of tax credits or financial incentives for travellers who purchase offsets. If governments were to offer tax deductions for carbon offset contributions, similar to those available for charitable donations, it could increase consumer engagement. Additionally, recognition schemes for carbon-neutral flights—such as "green traveller" rewards or loyalty program incentives—might provide non-monetary motivation for travellers to participate. However, the effectiveness of such incentives would likely depend on factors such as consumer awareness, perceived fairness, and ease of claiming benefits.

Beyond financial incentives, public education campaigns may also help raise awareness about carbon offset programs. Many participants in this study expressed scepticism regarding the effectiveness and credibility of offsets, questioning where their money actually goes. A government-backed awareness initiative that clearly communicates the environmental impact of offset programs, explains how funds are used, and showcases success stories could help reduce uncertainty and improve public trust in the system. However, it is important to recognize that information campaigns alone may not be sufficient; previous studies suggest that combining education with structural incentives tends to be more effective in changing behaviours (McLennan et al., 2014).

Another major challenge in the voluntary carbon offset market is the lack of standardization across programs. Currently, variability in pricing, project types, and verification processes appears to contribute to consumer scepticism and distrust (McLennan et al., 2014). Establishing industry-wide guidelines for carbon offset verification and transparency could enhance legitimacy and reduce perceptions of greenwashing. Governments and international regulatory organizations, such as the International Civil Aviation Organization (ICAO), might play a role in enforcing standardized certification criteria for carbon offset projects to ensure additionality, transparency, and measurable emissions reductions. However, implementing such regulations would require industry cooperation and consumer confidence in third-party auditing systems.

Furthermore, integrating carbon offsetting into broader climate policies—such as cap-and-trade systems or national carbon pricing strategies—could help strengthen consumer confidence by demonstrating that offset initiatives are part of a comprehensive approach to

climate mitigation. If airlines and governments collaborate to create verified offset programs with regulatory oversight, travellers may feel more confident that their contributions are making a tangible difference. However, the extent to which policy interventions can overcome consumer scepticism remains an open question, as some travellers may still view offsetting as a corporate responsibility rather than an individual duty.

In sum, government intervention in the carbon offset market should creating financial incentives, increasing transparency, and standardizing verification processes. These efforts may help reduce scepticism, encourage greater participation, and align individual offset purchases with broader national and global climate goals. However, the effectiveness of such measures would likely depend on consumer trust, ease of participation, and the perceived fairness of offsetting mechanisms.

5.4.3 Corporate Travel Management

A significant portion of air travel is conducted for business purposes, positioning corporate travel policies as a potentially powerful mechanism for increasing participation in carbon offset programs. Given that many business travellers do not personally book or pay for their flights, employer-driven policies and incentives may have a notable influence on offset adoption rates.

Companies that choose to mandate or subsidize offsetting for business travel could help normalize offsetting behaviour among frequent travellers, potentially transforming it from an optional personal choice into a more standardized sustainability practice. Some organizations have already begun integrating carbon neutrality goals within their corporate sustainability policies, and incorporating offset purchasing into expense reimbursement processes might encourage widespread adoption (Park et al., 2024). Such an approach could ensure that sustainability efforts are not solely dependent on individual environmental attitudes but are instead reinforced by institutional policies that shape travel behaviour at an organizational level.

Beyond direct subsidies, corporate visibility and transparency regarding offset participation may further support pro-environmental behaviour. If companies were to publicly report their carbon offset contributions, it might create a ripple effect that extends beyond business travel. Employees who observe their workplace actively offsetting emissions may be more inclined to adopt similar behaviours in their personal travel choices. Over time, this type of institutional reinforcement could gradually shift social norms, potentially increasing the visibility of carbon offsetting and helping address the lack of significant subjective norm effects observed in this study.

Furthermore, organizations might enhance employee engagement in sustainability initiatives by incorporating carbon offset options into corporate travel portals or automating contributions within business expense systems. Airlines that collaborate with corporate travel management firms to provide pre-integrated offset solutions may improve adoption rates by making participation more effortless and routine.

Ultimately, leveraging corporate sustainability policies to promote carbon offsetting could help institutionalize environmental responsibility, making participation less reliant on individual attitudes and more embedded within standard business practices. By shifting some

responsibility from individual choice to corporate policy, companies may play a crucial role in scaling up voluntary offset programs and fostering a long-term cultural shift toward sustainable business travel.

5.5 Limitations of the Study

While this study provides valuable insights into the psychological determinants of willingness to pay (WTP) for carbon offsets, several limitations must be acknowledged. These limitations pertain to the sample characteristics, cross-sectional design, reliance on self-reported data, and censoring effects in WTP measurement. Addressing these concerns is essential for refining future research and strengthening the generalizability of findings.

5.5.1 Sample Characteristics

One of the primary limitations of this study is the homogeneity of the sample, which was composed exclusively of male frequent travellers in the United States. While this demographic represents a high-emission segment of airline passengers, its narrow scope restricts the generalizability of the findings. Given that previous research has indicated gender-based differences in pro-environmental behaviours—where female travellers often demonstrate higher environmental concern and participation in sustainability initiatives (Hsu et al., 2019; Bösehans et al., 2020)—the absence of female respondents may have biased the results toward lower WTP.

Similarly, the focus on frequent travellers limits the applicability of findings to the broader population of airline passengers. Occasional travellers, who may perceive flying as a luxury rather than a necessity, could exhibit different attitudes toward carbon offsetting. Furthermore, geographical and cultural factors likely shape WTP for offsets. Research suggests that passengers from European and Asian markets often display higher engagement with voluntary carbon offset (VCO) programs compared to those in North America (Lu & Wang, 2018; Cordes et al., 2023). As such, cross-cultural comparisons are needed to determine whether the lack of subjective norm significance observed in this study is unique to the United States or whether similar patterns exist elsewhere.

5.5.2 Cross-Sectional Design

This study employed a cross-sectional survey methodology, capturing WTP intentions at a single point in time. While this approach provides a snapshot of current attitudes and behavioural predictors, it does not account for temporal changes in attitudes, social norms, or financial considerations that may influence WTP.

For example, environmental awareness campaigns, policy changes, or climate-related events may cause shifts in public perceptions of carbon offsetting over time. Additionally, individual financial circumstances fluctuate, meaning that respondents who were unwilling to pay at the time of the study may be more inclined to offset in a different economic climate. A longitudinal study design—tracking participants' WTP across multiple flights—could better capture

dynamic changes in behaviour and identify potential turning points in carbon offset participation.

Moreover, the behavioural intention gap remains a significant challenge in sustainability research. Studies indicate that self-reported environmental intentions do not always translate into real-world behaviour (Mair, 2011; Choi & Ritchie, 2014). While the present study measured stated willingness to pay, actual purchasing patterns may differ due to contextual factors such as last-minute pricing concerns, payment convenience, or distractions during the ticket booking process. Future research should explore observational or experimental methods, such as tracking offset purchases directly through airline websites, to validate whether stated WTP aligns with real consumer behaviour.

5.5.3 Measurement Constraints

A further limitation of this study lies in the use of self-reported data collection, which is inherently susceptible to social desirability bias. This form of response bias occurs when individuals provide answers that they believe are more socially acceptable or aligned with societal norms, rather than reflecting their true beliefs or behaviours (Podsakoff et al., 2003). In the context of this study, respondents may have overstated their willingness to pay (WTP) for carbon offsets to present themselves as more environmentally conscious, aligning their responses with perceived pro-environmental expectations rather than their actual behavioural intentions. This bias is particularly relevant to environmental research, as individuals may feel pressure to demonstrate socially responsible behaviours, even if these actions do not translate into real-world decisions.

The potential influence of social desirability bias could be especially pronounced in the case of attitude measures. Participants may express strong environmental values and favourable attitudes toward carbon offsetting when responding to survey items, but these attitudes may not always lead to concrete financial commitments when faced with real purchase decisions. This discrepancy between reported intentions and actual behaviour is a well-documented challenge in sustainability research and may partially explain why some participants reported high WTP despite broader evidence of limited uptake of carbon offset programs in practice (Kollmuss et al., 2008; Hamrick & Gallant, 2017).

Moreover, the survey items measuring subjective norms may not have fully captured the diverse social influences that shape environmental behaviour. While the study assessed approval from friends, coworkers, and employers, other social pressures—such as media influence, environmental advocacy groups, or political ideologies—may also contribute to WTP for carbon offsets (Tao et al., 2021). Expanding the measurement of subjective norms in future research could provide a more comprehensive understanding of its potential influence, particularly in contexts where social expectations play a more pronounced role.

5.6 Recommendations for Future Research

Given the limitations identified, several recommendations can guide future studies to build upon and extend the findings of this research. These recommendations focus on enhancing

methodological rigor, expanding participant diversity, exploring real-world behaviours, and considering alternative theoretical frameworks.

5.6.1 Longitudinal Studies and Behavioural Tracking

Future research should adopt a longitudinal approach, tracking WTP over time to observe whether attitudes, subjective norms, or financial feasibility change across multiple flights. Longitudinal studies could also assess whether external factors, such as climate-related events or new sustainability policies, influence travellers' decisions to participate in carbon offset programs.

Additionally, incorporating behavioural tracking methodologies—such as analysing actual offset purchases on airline booking platforms—would provide stronger empirical evidence on how WTP translates into real purchasing behaviour. Airline collaborations allowing researchers to monitor offset transactions in anonymized consumer data could address the intention-behaviour gap more effectively.

5.6.2 Expanding Cross-Cultural Comparisons

To determine whether the non-significance of subjective norms is unique to U.S.-based frequent travellers, future studies should conduct cross-cultural research on carbon offset participation. Comparative studies in Europe, Asia, and Latin America could reveal whether subjective norms play a more pronounced role in collectivist societies, where social approval often shapes consumer behaviour more strongly (Du & Pan, 2021; Tao et al., 2021).

By examining the same TPB constructs across different cultural contexts, future research could refine the role of social influences in sustainability decisions and identify regional best practices for promoting carbon offset engagement.

5.6.3 Experimental and Field Research Designs

Field experiments in real-world airline booking settings could test whether pricing models, default offset options, or framing effects influence actual offset purchase rates. For instance, A/B testing different offset pricing schemes—such as fixed-rate vs. voluntary contribution models—could identify which approach leads to the highest participation rates.

Additionally, testing default opt-in mechanisms (where offsets are pre-selected but allow opt-out) versus opt-in models (where travellers must actively choose to offset) could provide insights into whether default settings influence decision-making in airline sustainability choices (Araña et al., 2013).

5.6.4 Alternative Theoretical Frameworks

While TPB remains a strong predictor of pro-environmental behaviour, incorporating additional behavioural models could offer a more comprehensive view of carbon offset participation. The Value-Belief-Norm (VBN) theory (Stern, 1999), for instance, emphasizes

moral obligation and personal norms as primary motivators of environmental actions. Given the findings that attitudes and moral responsibility strongly influenced WTP, integrating VBN theory could improve the understanding of intrinsic motivations.

Similarly, Behavioural Economics models, such as Nudge Theory (Thaler & Sunstein, 2008), could explore how framing carbon offsets in ways that reduce cognitive load impacts consumer participation. Insights from prospect theory and loss aversion effects may help in designing more effective offset communication strategies.

5.7 Conclusion

The findings of this study reinforce that attitudes and perceived behavioural control are strong predictors of willingness to pay for carbon offsets, while subjective norms were not statistically significant. These insights contribute to both theoretical advancements and practical strategies for increasing carbon offset adoption. Future research should focus on longitudinal approaches, behavioural tracking, cross-cultural comparisons, and experimental interventions to refine our understanding of sustainability decision-making in the aviation sector.

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