Understanding Environmental Sustainability Initiatives in Four leading Airlines

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Abstract

What are the environmental sustainability initiatives implemented by Finnair, Qatar Airways, Qantas, and Air New Zealand to reduce the environmental impacts? To address this question four leading airlines were chosen as case companies. A comprehensive analysis was conducted to investigate environmental sustainability initiatives of airlines. A critical focus for the reduction of direct emissions from the aircraft has been implemented by Finnair by rejecting carbon offsetting with a net zero target of 2045. Net Zero target of 2050 have been set by Qatar airways, Qantas and air New Zealand, and the strategies have been adopted ranging from fuel efficient aircrafts, biodiversity conservation, fuel optimization programs to alternative propulsion technologies. Sustainable Aviation fuel usage has been targeted by all airlines but earlier goal set by Finnair. The use of modern fleet for the fuel efficiency enhancement has been targeted by Qatar airways. Up to different content the circular economy practices have been implemented by each airline, and conservation efforts to protect biodiversity have been most extensively practices by Air New Zealand. Information was gathered from each company sustainable reports, official websites, press releases and industry publications to exam the alignment with SDG 13. During the documentation analysis insight into common initiatives, key patterns and unique strategies were identified. Shared efforts were identified including: SAF and carbon offset programs while distinct strategies such as environmental policies for specific regions and waste management. The findings provided insights into how airlines progress towards greener operations and presented how various approaches and contributions supported industry's goals to mitigate climate change.

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Description

Keywords/tags (subjects)

Airline industry, Sustainable aviation, SDG 13, Circular Economy, Carbon Emissions.

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Table of Contents

Table

Figure

1 Introduction

Air travel has become the most popular means of transportation in the global tourism business, allowing millions of people to travel across borders quickly and effectively. Air travel has grown tremendously over the last several decades as a result of its transformation from a luxury service used only by the wealthy to an accessible form of transportation for ordinary people. Gössling et al. (2007) explained approximately 42% of international tourists use air transportation. From 1970-2000 air travel developed five times faster it was in 1970. Similarly, in 2005 Boeing predicted that there was annual increment of 4.8% until 2024, while Airbus in 2004 predicted a 5.3% annual growth until 2023. This growth is due to increased competition in the industry, new airline companies, ticket prices getting lower, and expansion of airline networks. (Gossling et al.,2007). This constant expansion has helped to boost global connections and economic opportunities around the world.

Today air travel is the foundation of international tourism industry, which employs the greatest number of people worldwide (Gössling, 2007). About 4 million people are directly employed by the aviation sector, which also brings in $400 billion annually and contributes US$1.4 trillion to the world economy. It also supports 24 million indirect jobs in associated industries (Gössling, 2007).

Although there are various economic benefits can be seen, the aviation industry faces many environmental challenges. According to Paraschi et al., 2024 although air travel business contributes to global economic advantages while supporting people to move worldwide, it also presents significant environmental challenges such as emission of greenhouse gas (GHG) which cause climate change. As a significant contributor to climate change, aviation is responsible for 1.9% of global greenhouse gas emissions, 2.5% of CO_2 emissions, and 3.5% of effective radiative forcing (Paraschi et al., 2024). In addition to carbon emissions, the airline industry is also associated with energy depletion, lots of waste generation, noise pollution, and biodiversity loss. (Paraschi & Poulaki, 2021).

As aviation industry continues to grow, the requirement of sustainable environmental practices is a rising concern to balance with the industry economic significance which means the need for sustainable environmental practices in aviation is urgent and increasingly prioritise globally.

This study will be based on sustainability concepts such as Triple bottom line (TBL), Circular economy theory and Sustainable development Goal 13- Climate Actions (SDG 13). First part of the thesis is the literature review, where academic journal articles, research studies, reports from aviation bodies will explore to identify the existing sustainable theories, sustainable models, and concepts. In

the second part of this thesis, data will collect from selected four commercial airlines to investigate ongoing sustainable environmental practices and responsible environmental practices in the industry from the source of publicly available sources including each airline's official websites: sustainability reports, media release articles.

2 Research Objectives and Research Problem

The air travel is an important section to the tourism sector and both industries depend on each other. Aviation has a major and growing role in contributing to global warming. Hence the aviation industry must explore sustainable aviation strategies to lower GHG emissions without limiting mobility of people which is essential to the future of both industries (Gossling et al., 2007). Future of the air travel industry and its ability to survive depends on methods for cutting greenhouse gas (GHG) emissions without reducing traveler activities (Gössling et al., 2007).

The aviation industry has implemented several mitigation strategies after identifying the environmental challenges during the past few decades (Paraschi & Poulaki, 2021). To promote sustainability in aviation, national and international authorities, aviation organizations, airlines, airports, and aircraft manufacturers have implemented innovative technology, environmental management systems, and regulations. Following sustainable practices in the businesses may create long-term benefits for the company, environment and society. While many airlines have made publicly declared to be sustainable and have set a number of environmental initiatives there is limited research has been done on how these strategies are actually implemented across different airlines. Most of the research focus on individual airlines or general trends rather than conducting a comparative analysis of practical implementation. This lack of comparison makes it difficult to determine which strategies are most effective and how well align with sustainable development gaol 13, or ICAO and IATA.

Aim of this thesis is to bridge the knowledge gap by analysing four leading airlines in the industry from operational perspective and offer insight on how industry should transition to environmental sustainability.

The research question is: What are the environmental sustainability initiatives implemented in Finnair, Qatar Airways, Qantas, and Air New Zealand to reduce the environmental impacts?

The findings might be beneficial for airline management that have not yet integrated environmental sustainability initiatives into the business core strategies. On the other hand, the finding can support

decision makers, researchers, environmental organizations, and passengers or the general public who concern about environment impact of air travel. The scope of this study is limited to the selected commercial airlines, and it focuses exclusively on the environmental sustainability dimension excluding social and economic aspects due to time and scope limitations. During the analysis, similar patterns across each airline will identify and identify themes for a comparison. Scope is limited to onboard environmental initiatives of these airlines. Additionally, the research does not include primary data collection methods such as interviews or surveys. This narrow down will provide a comprehensive detailed analysis on how green initiatives are practising on board in selected airlines. The environmental aspect of sustainability, particularly in aviation, is the most concerning part, which contribute to global climate change. Keeping the environment as the sole focus makes it possible to examine.

Figure 1 Airline logos

Four leading airlines have chosen to do the analysis and the logos are showing in figure 1. The first airline is Finnair and is the national airline in Finland which was founded in 1923. Finnair is one of the oldest airlines operates that connect Europe, North America and Asia through main hub in Helsinki airport. member of the one world alliance in 1999. At present Finnair fly to more than 80 destinations. Sustainability is the core concept of it and long-term goals is to become carbon neutral. The goal of the is to keep freedom and benefits as well as reduce the impact on the environment. Finnair operates modern fleet of 70+ aircraft, basically airbus models with fuel efficient planes like A350 while providing travel comfort and reduces emissions (Finnair, n.d). Second chosen case company is Qatar airways and founded in 1993, and the national airline in Qatar. Currently travel over 170 destinations globally. The headquarters are located in Doha. Qatar airways operate 146 aircrafts in current fleet and a member of one world alliance in 2013 (Qatar airways, n.d). The third chosen case company is Qantas which is the largest domestic and international flag carrier in Australia. According to Qantas (n,d) founded in the Queensland in 1920.Back then registered as Queensland and northern Territory Aerial services limited. Recognized as world's leading long-distance airlines. At present Qantas group focuses on transporting passengers through Qantas and Jest star.

Qanta provide service for 100destinaitons round Australia and world. Fleet consist of Airbus A 380, Boeing 787, Airbus A330, Boeing 737, and arriving soon Airbus A350. Third case company which will investigate in the thesis is Air New Zealand. This airline operates a global network service for passenger and cargo transport to, from and withing New Zealand. Each year Air New Zealand carries over 400 flights daily to 49 domestic and international destinations, carrying over 16 million passengers annually. (Air New Zealand, n.d.). Air New Zealand is founded in 1939 (as Tasman Empire Airways Limited, or TEAL) and operated through south pacific from New Zeaando t Australia to Hongkong, and Singapore and Tahi, Hawaii and Los Angeles. Founding stake holders were Australia (30%), New Zealand (50%) and Britain (20%) in 1938. After wards, Britain left in 1953, and New Zealand took complete ownership in 1961. Headquarters are located in Auckland (Britanica, n,d). The research objective is to examine and compare the environmental sustainability initiatives adopted by the selected airlines.

3 Sustainability Theories , Concepts and Environemntal Strategies in Air Travel

This thesis examines the concept of sustainability in commercial airlines by applying the theories of Triple Bottom line (TBL), Circular economy (CE) model and concept of Sustainable Development Goal 13- Climate action. Based on these theories analysis will investigate how airlines integrate environmental aspects into their sustainability strategies.

Researchers have developed various definitions for sustainability. Some definitions concentrate on the environmental aspect, emphasising the need of protecting ecosystems, reducing pollution, and conserving resources. Others emphasize certain social issues such as equity, human welfare and community resilience. When considering sustainability form economic point of view it is connected with long term profitability, Corporate Social Responsibility (CSR), and responsible resource management.

''In 1987, the United Nations Brundtland Commission defined f as meeting the needs of the present without compromising the ability of future generations to meet their own needs.'' (United nations, n.d). This definition is the most frequently mentioned definition of sustainability. In addition to this, Elkington (1997) explained sustainability is understood through triple bottom line framework, which

includes three key dimensions of social, economic and environmental. The term "green" incorporates both environmental and economic aspects. Concerning the environment, sustainability underlines interconnection, resilience, and flexibility of ecosystems. (Morelli, 2011).

John Elkington in 1994 introduced the concept of Triple bottom line (TBL). The term “Company bottom line” refers to net profit. But Elkington’s idea of the triple-bottom-line approach states that instead of only focusing on profits, businesses need to focus on social and environmental impacts. According to this approach companies need to work simultaneously on three bottom lines known as 3 Ps: Profit, People, Planet (Investopedia, n.d).

Triple bottom line is a concept related to sustainability introduced by Elkington (1994, as cited in Alhaddi, 2015). According to Goel (2010, as cited in Alhaddi, 2015), TBL is an approach to analyse an organization's performance and success along three important dimensions: economic, social, and environmental. Similarly, Alhaddi (2015) stresses the idea of TBL concept which is commonly used to evaluate sustainability by using environmental, social, and economic factors (Elkington, 1997, as cited in Alhaddi, 2015).

Sustainability has been studied and defined by a number of researchers from different points of view. Kotob (2011) argues that numerous studies have tried to define sustainability, however, some have limited understanding of the idea, considering only certain aspects of the concept. For example, in operations management, sustainability is frequently approached from an ecological perspective without taking social factors into account (Sarkis et al., 2001). On the other hand, sustainability is defined as “offering the potential for reducing the long-term risks associated with resource depletion, fluctuations in energy costs, product liability, pollution, and waste management” (Shrivastava, 1995, p. 955). However, Sarkis (2001), suggests that the literature on operations management frequently applies an ecological approach to sustainability while disregarding its social component.

Although there are various definitions for the concept of sustainability, businesses must overcome significant challenges to achieve sustainability (Kotob, 2011). One of the main challenges is the perception of sustainability efforts are costly. Hoffman and Bazerman (2005) recognise this issue and point out that social and environmental projects do not necessarily result in immediate financial benefits. However, they point out that companies start to realise the long-term advantages of sustainability. Rather than asking whether being eco-friendly is profitable, the focus now is on how sustainable practices may create long-term benefits for companies and society.

Circular Economy and Waste Management Onboard

Circular Economy (CE) can define as a model of reusing, recycling, repairing, leasing, sharing and repairing products where life cycle of the product extends. It is a practical way of minimum reducing waste. By recycling materials keep in the economy wherever possible. This is the opposite way of linear economy where the concept of take -consume – and throw. (European parliament,2015)

The airlines have recognized the importance of CE such as reducing, reusing, and recycling waste from the flight operations to reduce environmental footprint. Passengers show concern of single-use plastics in marine environment; governments pay attention of reducing food waste and also airlines concern legal system will stop responding these challenges (IATA, n.d).

IATA (n,d) emphasize the volume of cabin waste may rise during the coming years in the absence of smarter regulations. Cabin waste management laws need to simplify and support airlines to integrate them into strategies as well as promoting the development of technological solutions will lower industry costs and promote circular economy.

The traditional linear economy model creates environmental issues. Hence airlines are increasingly implementing CE practices to address these issues. According to a study by Reyes et al. (2022), airlines apply cabin waste recycling, biodegradable materials usage in in-flight services, and reducing single-use plastics. The study emphasizes airlines implementing various principles such as inflight products and services redesign to reduce waste and use effective recycling and reuse initiatives. When airlines follow these programmes, it helps to improve resource efficiency and maintain economic sustainability as well. Moreover, the authors highlight the necessity of collaboration among stakeholders such as waste management companies and suppliers to overcome challenges.

The United Nation 2030 agenda address 17 sustainable Development Goals (SDG). This thesis focuses on the sustainable development goal 13- climate action: which has a direct link related to sustainable transportation. The main goals of sustainable transportation are enhancing safety, providing universal accessibility, environmental and climate impacts reduction, increasing efficiency, and resilience to achieve sustainability goals (United Nations, 2021). According to United nations SDG 13 targets are listed including: encourage all countries to be prepare for resilience and increase adaptive capacity for the climate change challenge and include climate change mitigation solutions in national planning policies and strategies. (United Nations, n.d).

3.1 Environmental Sustainability in the Airline industry

Environmental sustainability is a significant concept in sustainability studies. It is known as conservation and responsible use of natural resources to ensure wellbeing of future generations. Many researchers have examined its principles, difficulties, and real-world applications, such as protecting ecosystems, reducing wastes and using resources wisely. This section of the literature review will explore how different authors define and analyse the concept of environmental sustainability. It will focus on Goodland (1995), Goodland and Daly (1996), Morelli (2011), Correia (2018), and Sutton (2004). Theses researchers' perspectives on environmental sustainability, definitions, principles and challenges will review during this part.

Environment sustainability is preserving natural resources and making sure that resource consumption doesn't exceed the Earth's capacity (Goodland, 1995). Goodland (1995), use the word "maintenance of natural capital" where it includes ecosystems such as forests, lakes, oceans soil, life support system such as clean air, water and biodiversity. Goodland and Daly (1996) emphasise that environmental sustainability is different form economic and social sustainability. This is because it is controlled by the natural boundaries of the earth and cannot be compromised. Likewise, Correia (2018) includes the triple bottom line (TBL) concept into sustainability discussion and emphasise the necessity of balancing economic, environmental and social factors. However, Goodland and Daly (1996), argue that combining environmental factors with social and economic factors make it harder to create effective sustainability strategies. Sutton (2004) highlighted sustainability should be protecting the environmental values that are important. Moreover, Sutton (2004) explains sustainability includes not only keeping the environment safe but also regenerating the environmental systems. In a similar manner, environmental sustainability defined as "A condition of balance, resilience and interconnectedness that allows human society to satisfy its need while neither exceeding the capacity of its supporting ecosystems to regenerate necessary services nor diminishing biological diversity" (Morelli 2011). Moreover, Morelli (2011) claims environment should come first since economy and society cannot exist without healthy planet, although the concept of triple bottom line gives equal weight to the economy, society and environment (Morelli 2011).

Similarities in Authors Perspectives on Environmental Sustainability

All the above-mentioned authors agree that, maintaining natural capital and minimising damage to the environment are essential for environmental sustainability. Goodland and Daly (1996) and Correia (2018) point out the necessity of sustainable practices and policies while accepting the imitations of unregulated economic expansion. These authors support following sustainable practices into businesses such as waste reduction and energy efficient methods. According to Goodland (1995) sustainable development should combine the aspects of social, economic and environmental and these three should use to start development of sustainability.

Goodland and Daly (1996) brought out biophysical boundaries and they argue that sustainability needs to be viewed as an ecological requirement that is different from social and economic factors. Correia (2018) integrate the triple bottom idea, and he argues that if any business can find a balance between environmental goals and social economic objectives. Good land (1995) is against the idea of replacing natural resources with man-made things and he strongly believed that nature cannot be replaced with that. In contrast Correia (2018) gives different perspective to Goodland explaining sustainability as a path to grow any business economically while balancing environmental aspect.

All the authors and journal articles selected on this part agree on addressing environmental issues urgently but each of their methods different based on their viewpoint. Some of them suggesting changing environmental policies, focusing more on nature limitations and implementing business strategies. Goodland and Daly (1996) strictly prioritise on environmental viewpoint by giving less focus on economic growth. However, Correia (2018) present a border view on how businesses can apply sustainability concept within a financial strategy were maintaining a balance between social, and economic development and protecting the environment.

Aviation Organizations and Their Role in Environmental Sustainability

European Aviation Safety Agency (EASA), the International Civil Aviation Organisation (ICAO), the International Air Transport Association (IATA), and the Airport Council International (ACI) are the main organizations play broader roles in the aviation industry. They are responsible for aviation safety, regulations, technology and make global coordination. IATA has concentrated on issues related to air travel's efficiency, security, and cost, as well as more recently, sustainability and equality. The association encourages collaboration among its member airlines and other interested parties. (Loh, 2023). Setting rules and procedures for civil aviation is the ICAO's main goal, especially when

it comes to the actual flight process but also, more and more, environmental protection and climate change mitigation. (Loh, 2023)

EASA's mission is to ensure aviation industry maintain high standards of environmental protection including Climate change mitigation, air quality improvement, and noise reduction. (EASA. n,d) However, in order to reduce the environmental impact, businesses which have a significant impact on earth need to adhere to the guidelines and regulations established by these organizations. Moreover, it is essential that these organizations regularly monitor and ensure the airlines follow them.

Airline industry makes significant impacts on the earth such as noise pollution, air pollution, climate change, greenhouse gas (GHG) emissions, and carbon dioxide (CO_2) and gained attention over the past fifty years (Mahashabde et al., 2011). Marsov (2021) explains air travel accounts for approximately 3.4 percent of worldwide CO_2 emissions, making it a major contributor. Gosling et al. (2007) explains the most of these emissions are released in the upper troposphere and lower stratosphere at heights of 10–12 km. Hence at this altitude there is a greater effect on ozone, cloud formation, and radiative forcing than near the surface of the earth.

Since emissions from air travel have a greater impact on cloud formation and the ozone layer than emissions from ground transport, aviation sustainability programs have received more attention (Gössling et al., 2007). Reducing harmful emissions help to build healthier community and preserve natural resources for future generations. Therefore, air travel needs a special attention. (Penner et al., 1999, as cited in Gössling et al., 2007, p. 403). As a result, sustainable aviation is becoming an urgent concern. (Deniz, 2024). Alameeri et al. (2017) implementing sustainable aviation practices can make air travel greener and environmentally friendly, allowing people to continue travelling the world without harming the environment.

To address these environmental challenges Xue, Chen, and Yu (2025) has suggested six main pathways to shift in to sustainable aviation: Sustainable aviation fuel (SAF) adoption, using technologies that do not emit greenhouse gasses such as electrical and hydrogen propulsion ,efficiency improvement in flight operations and air traffic control , implementation of strong sustainability policies to achieve net zero emissions, encourage alternative transport, integrate digital technologies particularly artificial intelligence and digital twin.(Xue.et al, 2025)

Adoption of Sustainable aviation fuels (SAF) can drastically lower emissions which is one of the most important sustainable aviation strategies. Other projects are, minimising the use of single-use plastics, and enhancing fuel efficiency. Airlines also seek to reduce their environmental impact in seven

major areas: noise reduction, air pollution, emissions, waste management, energy efficiency, water conservation, and biodiversity protection (Deniz, 2024). In this thesis two sustainable aviation projects will discuss deeply.

3.2 Green Initiatives in Commercial Airlines

In this thesis author will focus on green agendas that have been originated by International Civil Aviation Organisation (ICAO), and the International Air Transport Association (IATA), align with United nations SDG 13 -Climate Action.

Both sort -term and long-term initiatives are part of company green initiatives as long as there is a contribution to the environment. The international civil aviation organization (ICAO) holds a key role in environmental conservation coordinating countries together for aviation industry. ICAO collaborates with its member states under Chicago Convention, to address environmental issues. ICAO focuses on three main areas: local air quality, aircraft noise, and climate change and aviation emissions (ICAO, n.d.). ICAO has set targets for the aviation industry and created international aviation standards to achieve the objects. ICAO works to increase production and usage of sustainable aviation fuels (SAF) and clean energy. Furthermore, ICAO works to improve aircraft and engine technology to increase fuel efficiency as well as to reduce carbon offsetting putting the Carbon Offsetting and Reduction Scheme to protect environment (CORSIA) (International Civil Aviation Organization [ICAO], n.d.). The ICAO global coalition has established to support and encourage environmentally friendly international aviation practices. The partnership gives an opportunity for stake holders in the industry to collaborate and make innovative solutions to reduce greenhouse gas emissions. Three main goals of the coalition are: raise awareness of current efforts to lower CO2 emissions in aviation, recognise industry leaders who are leading sustainable technologies, and reinforce partnerships that promote sustainable aviation. (International Civil Aviation Organization [ICAO], n.d.).

The International Air Transport Association (IATA) offers a number of sustainability projects to promote environmental sustainability in aviation. IATA strongly advises airlines to adopt them although these projects are not mandatory. Among the other several projects, sustainable aviation fuels (SAF) usage, and reducing cabin waste are the main green initiatives which will be analysed in the next part of the thesis.

Meanwhile, IATA (n.d.) highlights company is committed to sustainability by applying best practices to reduces negative environmental impacts and promoting positive social values. According to IATA (n,d) the aim of the aviation industry is to achieve net-zero carbon emissions by 2050. There are

some innovations introduced to achieve this goal including increased use of sustainable aviation fuels (SAF), development of using electronic and hydrogen powered aircrafts which can cut up to 80% of emissions. By improving air traffic management, and optimising flight routes help to reduce fuel wastage and congestion at airports. There are certain actions taken by IATA to reducing noise pollution and wastage generation (IATA, n.d).

Perryman et al. (2022) emphasize that ICAO has implemented strategic goals to guide airline industry align with SDGs particularly align with SDG 13 climate action with CORSIA. Measures that are closely related to lowering the carbon footprint of the aviation sector via lowering emissions, carbon offsetting, and technical innovations. (ICAO, n,d)

Many airlines have developed own sustainability plans focusing on reducing emissions, improving fuel efficiency, and adopting greener technologies. This research applies Environmental Sustainability theory to evaluate how airlines can minimize their environmental impact through waste management practices and sustainable aviation fuel usage, aligning with Sustainable Development Goal 13 (SDG 13).

While the terms “sustainable practices” and “responsible environmental practices” use interchangeably, this thesis follows terminology adopted by case companies. Initiatives that fall with in the category of responsible practices can consider as efforts that contribute towards border sustainability goals. According to Coles et al. (2014) the most common ways of being environmentally responsible are innovation, technical improvements and comply with environmental regulations.

The primary objective of this Theis is to investigate both long-term sustainability initiative such as Sustainable aviation fuel (SAF), net zero 2050 commitments, CORSIA as well as short term responsible efforts aimed at reducing environmental impacts of current operations such as reducing single use plastics, and waste on flight. This thesis adopts term ‘’green initiatives’’ to investigate different environmental actions implemented by airlines including short term responsible measures and long-term sustainability strategies. While some airlines refer to their efforts as sustainable or responsible, during this research these actions will evaluate them collectively under the broad term green initiatives. Although some initiatives investigate in this thesis might be used by certain scholars’ responsible initiatives, this thesis retain the term sustainable practice because those actions will contribute to long-term environment goals and are align with IATA, ICAO, SDG13 , and internationally recognized sustainability frameworks.

Sustainable Aviation Fuels

Sustainable Aviation Fuel is an important initiative to minimise carbon emissions from aviation business which was originated by ICAO but also IATA has researched a similar project which is a long-term environmental initiative. According to ICAO (n,d) SAF is produced according to sustainability standards from waste or renewable resources such as non-food crops, waste oils, fats, and municipal refuse and it is a substitute for conventional jet fuel. The ICAO's technical research indicates that SAF has the best chance of significantly reducing global CO2 emissions in aviation (ICAO, n.d.). Air travel for tourism is one of the main causes of the 3.4% of global CO2 emissions that come from aviation (Gössling & Peeters, 2007). Air pollution is largely caused by aircraft emissions (Gössling et al., 2014). This emission trigger climate change. Hence all the global airlines need to increase usage of SAF as a solution to reduce GHG emissions. However, Raman et al., (2024) explains that 38.9% of SAF research mainly focus on SDG 13 climate action that significantly reduce greenhouse gas. According to IATA (n,d.), SAF is a liquid fuel already being used by commercial aviation which can reduce co2 emissions by up to 80%.

In 2016 there were 500 flights used SAF and 8 million SAF litters produced, in 2022 there were 450,000 flights have used SAF & 125+million SAF litters produced, by 2025 there will be 20 million flights use SAF & 5 billion litters will use per year. (IATAtv,2022) However, practical analysis needs to implement how airlines need to integrate SAF into their operations. In the second part of this research author investigates how case study companies incorporate SAF into the operations of airlines.

The websites of the IATA and ICAO do not address financial obstacles that airlines encounter when adopting SAF in practice. Lack of necessary regulations and awareness among countries are the main reasons behind the limited usage of SAF as a new alteration fuel. (Wang et al., 2024). The most recent data from the International Air Transport Association (IATA) shows that SAF production increased to 480 thousand tonnes in 2023, twice the amount of 2022. Even with its steady growth, SAF production level is still significantly lower than the demand (Wang et al., 2024).

According to IATA, SAF could help the aviation industry to reach net zero co2 emissions by 2050 reducing emissions 65%. It will need a significant rise in SAF production to satisfy the growing demand. As regulations improve, carbon offsets decline, and costs become more competitive with fossil fuels, SAF production is predicted to increase the highest in the 2030s (International Air Transport Association [IATA], n.d.).

Alternative fuels like HEFA and FT have been utilised safely in the aviation sector recently and could eventually replace traditional jet fuel without requiring changes to the infrastructure that is now in place. However, in order to boost the use of SAF, production costs must fall. IATA and ICAO must work with airline companies and aircraft manufacturers to lower CO2 emissions during commercial flights and encourage the use of alternative fuels in order to accomplish this (Yilmaz & Atmanli, 2017)

Cabin Waste Management

Cabin waste is one of the green projects led by IATA which is a major challenge in airline industry. There are two main types of waste on airplanes known as cleaning waste and catering (galley) waste. IATA recognises the significance of tackling this problem and works to find solutions. Most packaging and utensils on aircraft are composed of single-use plastics due to weight and safety considerations. The goal of this project is to help airlines to follow waste management rules and promote innovative waste management technologies (IATA, n.d).

Cabin waste categorises into two main types. Cleaning waste which includes leftovers like magazines, newspapers, textiles (such as pillows, blankets, and headrest protectors), paper towels, plastic bottles, food spilt or put in seat-back pockets, amenity kits, and plastic wrapping from headsets, blankets, and pillows. Medical waste, including spent needles, and items from restroom trash cans are also included in this category. Usually cleaning staff collect this waste in plastic bags and dispose through airport waste management system. The other type is catering waste which is generated from in-flight meals and beverages distributed by cabin crew such as partially consumed and unopened beverages collect in bins, gally carts and compactors. Mainly left over drinks, melted ice. Unused alcohol stored in sealed carts and send to warehouses under custom supervision. Flight crew separate recycle materials paper, plastic bottles and aluminium cans to recycle. (IATA cabin waste handbook, 2019). Without proper regulations cabin waste will dramatically increase in the upcoming years. IATA is dedicated to simplifying and regulate cabin waste regulations and to promote new technological solutions that will reduce industry costs and support a circular economy. (IATA, n.d.).

In 2012 IATA conducted a waste composition analysis (WCA) trial at London Heathrow Airport (LHR). This analysis conducted on both cleaning and catering waste between September 2013 and January 2014 from 17 foreign flights. Every flight generated an average of 352.71 kg of waste, of which 19.5% came from cleaning waste, 23.5% from catering waste that was disposed of in bins and compactors, and the majority, 57%, from leftover food and packaging that was put back in trolley carts. (IATA cabin waste handbook,2019).

These results brought attention to the enormous amount of waste produced during flights and the necessity for the airline sector to adopt more effective waste management practices. The scope of this research limits to these two green practices by the selected case commercial airlines and how those practices help to reduce environmental degradation which will be analyse in the next chapters.

Li et al. (2003) carried out a waste composition analysis to understand the type of waste collected during flight. This study mainly focused on total eight Cathey Pacific Airlines flights included medium-distance flights routes of Australia and New Zealand, short-distance flights routes of Asia, and long-distance flights routes of Europea and North American services. The waste classified into two streams known as galley waste and cabin waste. Galley waste from compactors and waste bins collected by cabin crew during inflight services. While cabin waste includes trash from passenger compartments after landing. Food leftovers and packaging materials in meal trays stored in food carts and deliver straight to catering services for processing. This study sorted food waste into categories to see what could be recycled. The results found out that types of waste change depending on flight routes, service class, which shows the significance of implementing waste reduction and recycling strategies in airline sector. (Li et al., 2003).

The study from Li et al. (2003) emphasizes the amount of garbage generation differ based on the class of travel per passenger. First class passengers generate highest solid trash per person (up to 2.84kg) while passengers from economy class generate lowest a solid waste per person (up to 0.38kg). This increase causes due to high weight-to-volume ratio items like newspapers, glass bottles, food waste. Moreover, waste from long and medium haul flights waste generation is higher than short haul flights since offering more meals and onboard services. (Li et al., 2003)

Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

CORSIA, is a first global market base programme created by ICAO, to reduce environmental impacts from aviation industry which is a long-term environmental initiative. In order to achieve the ICAO's aspirational aim of carbon neutral growth, it supports various aviation in-sector emissions reduction initiatives such technical advancements, operational enhancements, and sustainable aviation fuel (ICAO, n.d). CORSIA align with international climate goals including Paris agreement and is closely connected to SDG 13 -climate action which aim to reduce climate impact in aviation.

International aviation has been regulated by CORSIA from January 1, 2019, when all airlines had to submit an annual report on their CO2 emissions. Offset obligations have been applied on foreign flights as of January 1, 2021 (IATA, n.d).

This programme helps to make aviation more environmentally sustainable by encouraging airlines to take the responsibility for their own carbon emissions. Airlines must offset the extra emissions by investing projects such as planting trees, supporting clean technology and investing renewable energy projects.

4 Reseach Methodology.

This study applied Qualitative Document Analysis approach which is a systematic process to review printed and electronic documents (Bowen, 2009). Qualitative studies do not use statistics and focusses on how individuals construct the world and interpret their experiences rather than heavily relying on facts (Merriam & Tisdell, 2016, as cited in Morgan, 2022). This approach includes analyzing range of document types including academic journal articles, industrial re-ports, articles from newspapers, books and institutional reports which is useful especially when direct field work is limited or impractical. Any text containing documents can be potential source for qualitative analysis (Patton, 2015, as cited in Morgan, 2022). Although document analysis can provide insightful information, it is an underused approach in qualitative research. It enables scholars to meaningfully examine texts that already exist, particularly in situations where alternative approaches would not be possible. This approach is important when there is restriction to access participants or ethical limitations make interviews and observation difficult (Morgan, 2022).

The term "document" can apply to a broad range of content, including visual sources like images, videos, and films. (Merriam & Tisdell, 2016, as cited in Morgan, 2022). Documents are valid source since it gives the information of organizational values, and decisions. Documents offer reliable, invisible, and economical data that may be examined repeatedly (Bowen, 2009). The analysis focused on four airlines companies: Finnair, Qatar airways, Qantas, and Air New Zealand. The document analysis approach used as the primary method to examine environmentally sustainable projects launched by each case companies. Secondary data from the materials collected from the online publicly available sources such as airlines official websites, air-lines annual sustainability reports, press and media releases, and industry specific reports from IATA and ICAO.

The data used for Finnair data analysis, collected from multiple sources including official website of Finnair, annual sustainability report 2024 and four inflight videos recorded during traveling flight AY 1981. These documents selected due to credibility, transparency and direct relevance to research objectives. For Qatar airways sources included Qatar airways group sustainability report 2022-2023 (only focused on pages 20-27 environmental sustainability), official website, and press release from Qatar Gulf Time published on 2020. For Qantas airline documents are on two sustainability reports for 2023, 2024 and the official Qantas website. Air New Zealand analysis is a review of documents including 2023 Air New Zealand Annual sustainability report, the 2024 Annual result report, and the 2030 Air New Zealand emission reductio n guide released on May 1, 2025, Neste Corporation Press release (2019) , and the content from airline Official website. Refer appendix table 3. Pre-existing data or the secondary data using is similar to observations and interviews. Texts in articles, books and other documents follow a similar way of information gathered by a researcher in an interview. Data from the sources such as documents, videos, can explain believes of people and experiences in the same way as data gathered through observation and interview. (Merriam & Tisdell, 2016, as cited in Morgan, 2022).

According to Fereday and Muir-Cochrane (2006), thematic analysis is a method of identifying patterns in the data, with emerging themes serving as the categories for analysis. According to Morgan (2022) thematic analysis approach included Documents reading and re reading to identify similar patterns of each document and then identified themes by focusing shared meaning related to environmental practices. In this thesis themes are identified as net zero emissions, sustainable aviation fuel, fleet modernizations, circular economy, and waste management. All these themes reflect responsible and long-term environmental initiatives commonly adopted in airline industry. After coded data under these themes a comparative thematic analysis conducted to interpret findings according to existing literature, sustainability goals from IATA, ICAO, and SDG 13.

Four themes identified for Finnair and Qatar airways while five themes were identified for Qantas and Air New Zealand. Refer Table 1. In the Thematic approach, themes or patterns are defined as the end results of data analysis (Braun and Clarke, 2006). This approach reflects the unique sustainability priorities and reporting structure for each airline. Braun and Clarke (2006) high-lighted thematic analysis consist of six steps: familiarization with gathered data, initial codes generation, identify themes, reviewing themes, naming themes and define them, and produce the report. These steps will follow to analyses the gathered data. Moreover, this study begins with the Knowledge and ideas gathered by the author during literature review following an approach and it is guided by

existing theories and concepts related to sustainability. The analyses will describe green projects presented in the official sources and categorize them according to the themes. Only the topics align with environmental sustainability will include in the analysis part. Once all four airlines analyzed the findings categorized and summarized using a table to make visually appealing similarities and differences in sustainability strategies across four airlines which enhanced the analytical depth. Refer Table 2.

The reliability of this thesis is supported by the uses of official, transparent, verifiable and repeatable analytical process. The documents are credible sources such as ICAO, IATA, government publications or official airline publications and. Study relies on secondary data with multiple document types available in publicly online, and it is including critical framework-based analysis (TBL, circular economy and SDG 13) which increase the reliability and trust worthiness. This methodology was chosen because it is the best match for the research objectives. Although lack in Pearson interviews is acknowledged as a limitation detailed, reliable data make the findings meaningful and trustworthy.

Airlines	**Identified Themes.**
Finnair	Theme 1: Emissions reduction. Theme 2: Using Sustainable Aviation Fuel. Theme 3: Circular Economy practices and Waste Management. Theme 4: Protect Biodiversity.
Qatar Airways	Theme 1: Emission reduction. Theme 2: Sustainable Aviation Fuel (SAF) Integration. Theme 3: Circular Economy practices and Resource efficiency. Theme 4: Biodiversity Conservation and wildlife protection.

Qantas	Theme 1: Climate Action and Carbon Reduction. Theme 2: Sustainable Aviation Fuel (SAF). Theme 3: Fuel Efficiency. Theme 4: Circular Economy practices and Managing Waste. Theme 5:Partneship to protect Biodiversity.
Air New Zealand	Theme 1: Net Zero goals. Theme 2: Sustainable Aviation Fuel (SAF) usage. Theme 3: Modernising fleet renewal and increase Operational Efficiency. Theme 4: Waste Management. Theme 5: Protect Biodiversity.

Table 1.Themes developed during analysis process of each airline.

5 Results of Environmental Sustainability initiatives of Case Companies

5.1 Finnair

Reduction of Carbon Emission

One of the most prominent themes identified when referring Finnair's communications channels is the co2 emission reduction, and Finnair recognize it as the most critical environmental challenge. The most important aspect identified from the Finnair communication channel is its strategy prioritizes direct emission reduction measures over traditional offset mechanisms. It includes minimising scope 1 emissions which directly come from aircraft operations using several actions. Furthermore Finnair (2024) claims the core factor of its climate responsibility is mitigation of emissions from aircrafts. This is directly aligned with SDG13 climate action which is a proactive and efficient operational change rather than relying on market base measures such as carbon offsets programmes.

This theme includes investments in sustainable aviation fuel (SAF), Finnair's long-term climate goals, and the company's fleet modernisation efforts, which are all intended to improve fuel efficiency and

lower its carbon footprint. Finnair official website identifies carbon dioxide emissions as the single most pressing issue for any airlines and has taken many steps for the reductions. (Finnair,2025). The airline has set a clear science-based target to cut carbon emissions intensity (CO2e/RTK) by 34.5% in 2033 using 2023 as the starting point. This target has validated by The Science Based Targets initiative (SBTi). SBTi is a global organization support companies to set targets for the emission reductions align with a latest climate science.

When a company talks about "Offsetting emissions" it means paying for the environmental projects such as planting trees or investing renewable energy projects (wind, or solar) to cancel out own carbon emissions. However, these offsets take place elsewhere rather than reducing the pollution actually creating by the company. Finnair is committing to make changes with its own operations to reduce carbon emissions rather than relying on carbon offsets. The airline is implementing a number of significant actions including increasing the use of sustainable aviation fuel (SAF), weight reduction of the aircraft, optimising flight routes, replacing its fleet with more fuel-efficient aircraft, fuel efficient flight planning, and enhancing operational efficiency. (Finnair,2025). Finnair sustainability report 2024 states its commitments to achieve carbon neutrality by 2045 in line with United Nations Sustainable Development Goal 13 (Climate action). Among them increasing the SAF use with in next ten years is the most important step. According to the Finnair sustainability report in 2024 more than half of future carbon dioxide reduction will depend on the usage of Sustainable Aviation Fuel (SAF). Therefore, when the demand increases from the global airlines in the future and the availability of SAF to fulfil the demand are major challenges in aviation industry. Moreover, since SAF is expensive than the conventional jet fuel the affordability for the airline to purchase SAF is another challenge.

The direct actions taken by Finnair addresses both scope 1 emissions coming straight from its aircraft operations and scope 3 emissions including upstream environmental impact of fuel production and use. Finnair reported its carbon emissions intensity per revenue tonne kilometre was 976 CO_2e in 2023. The airline is aiming to become net zero emission by 2050. Finnair committed not to rely on carbon offsetting and instead focusing on direct ways or operational measures to decarbonize flights align with SDG 13 climate action.

Finnair inflight videos act as a branding and educational tool to promote its environmental values and sustainable approaches directly to the passengers. These onboard videos play a crucial role in communicating Finnair commitment and dedication to environmental sustainability, making awareness and encouraging travellers to participate in carbon reduction efforts during their journey.

These videos clearly convey the message of becoming carbon neutral by end of 2045. As the first step of halve all CO2 emissions by the end of 2025. This approach is not only implemented into company regulations but also added in to practical steps that gives the passengers in a narrative and visual format captured in the statement “Sustainability is not just another goal. It is the only way to make sure that you can keep exploring the world in the future. We are committed to leading the way in the industry when it comes to sustainability”.

Finnair’s approach focusses on optimising flight planning, a modern fuel-efficient fleet with short routes, investing in more fuel-efficient flight planning and flying, reducing the weight of the aircrafts, increasing sustainable fuel usage and investing in circular economy and material management. The inflight videos illustrate real examples such as redesign lighter passenger seats, trolleys, seat belts, table ware and carpets. For example, by mentioning that a one-kilogram reduction each seat saves 336 kg per aircraft, when multiplied over 350 daily flights, outcome in significant fuel savings and lower emissions. Finnair present these figures in a clear and measurable way help passengers to understand benefits from even small changes. This approach aligns with the Finnair sustainable report 2024.

In the video another important aspect highlight by Finnair is encouraging passengers to pack lighter, by reminding “no measure is too small. This idea emphasizes increasing customer awareness to play their role to reduce emissions by bringing lighter bags to make a big difference when reading across hundred flights each day. This form of communication will bring a sense of collaboration between passengers and airline to support Finnair’s climate goals.

The inflight videos claim sustainability is more than emissions. Finnair present itself as a responsible airline not just for the planet but also ensure that both passengers and personnel are taken care of both in the air and on the ground. This approach aligns with sustainable development goal SDG13 which focuses on climate action and SDG 8 of decent work and economic growth. The addition of expert voice to the video such as Sara Mosebar, A350 programme Manager at Finnair gives credibility and authenticity to the airline commitments as she mentioned “Acting more sustainably is the only way to make sure that you can keep exploring the world in future”. These videos provide insight on Finnair’s focus on practical changes within the airline such as improving system, inventing new technologies and shifting towards circular economy.

Finnair inflight videos explain how it has applied fuel efficiency strategies in practical way to reduce operational carbon emissions. Before each flight, airline calculates precise amount of fuel require

to complete the journey safely by avoiding over fuelling, the airline prevents the aircraft from becoming overweight and burn more fuel. Furthermore, the airline uses single engine taxiing for wide body aircrafts as much as possible which can save 100 KG fuel in taxing. During flight airline seek fuel optimisation as well. During landing the airline frequently use Continuous Descent Approach (CDA) of aircraft descend with constant angle rather than traditional step down approach.in step down descent very altitude change during step-down descents requires levelling off, increasing engine thrust, fuel consumption, and noise. Because CDA avoids these intermediate level-offs, landings are quieter, smoother, and use less energy.

Finnair claims that, up to 80% of approaches to Helsinki Airport, adopt CDA which results in annual fuel saving almost two million kilogrammes. This practice contributes by addressing noise pollution and supporting climate action under SDG 13 while enhancing overall operational sustainability. Finnair inflight videos are a powerful way to convey company vision to the passengers. Through these videos Finnair illustrate how small thought full changes can lead a significant environmental benefit both from passengers and airline.

Using Sustainable Aviation Fuel

Finnair identifies Sustainable aviation fuel (SAF) as the most practical and best approach to reduce emissions in the aviation industry. Hence, strategy of reducing carbon footprint in Finnair relies on SAF. Particularly for long-haul flights, the airline emphasises SAF as the best approach to cut aviation-related emissions. (Fin-Nair, 2025). Decarbonization is an approach of reducing carbon dioxide (co2) emissions associated with aviation industry to mitigate climate change. SAF can blend with traditional jet fuel and safe to use in current aircrafts without infrastructure modifications or engines. Compare to traditional jet fuel SAF can reduce 80% of carbon emissions. (Finnair,2025). In 2023, Finnair’s total fuel consumption was only 0.24% from SAF, and the airline is making efforts to increase this percentage. To comply with new EU standards, it is requiring a minimum of 2% SAF by 2025 and 6% by 2030, and the airline is getting ready to comply. (Finnair ,2025). As Finnair moves to more environmentally friendly flying, it's a significant change. The annual report claims, since jet fuel is now responsible for over 75% of Finnair's overall carbon impact, using more SAF will help to reduce emissions.

Finnair and Neste works together: a pioneer in renewable fuels to supply SAF in Finland. Additionally, the airline is a member of the Oneworld alliance, which has committed to reach a 10% level in

SAF uptake by 2030. Neste is Finnair’s biofuel partner and the world’s largest producer of SAF refined from waste. This is in line with Finnair's strategy for industry-wide and regional cooperation in the use of sustainable fuel. Video 2 describes how SAF can drastically reduce emissions, the blending capacity with fossil fuels, and how customers can support SAF projects. These kinds of videos help the passengers to get the insight of airlines responsibility towards sustainable future.

However, the high cost and limited availability of SAF create major challenges for its large-scale use. To overcome this, strong customer support and a significant increase in global SAF production are essential. Finnair acknowledge in the 2024 annual report that the available solutions to achieve these objectives are exposed to a number of risks and uncertainties. Notably, there are issues of SAF availability and affordability in the future. As well as the challenge of purchasing next generation aircraft and the uncertainty of government policies. Each of these factors may have an impact on how easily the airline can achieve its climate objectives.

Circular Economy Practices and Waste Management

Official website in Finnair’s Environmental policy strongly focusses on circular economy principles. Across all departments, the airline's "100% Material Management" program aims to reduce, reuse, recycle, recover, and dispose of waste materials ethically (Finnair, 2025). It includes steps such as reusing textiles, cutting back on single-use plastics, and recycling construction and electronic waste. The airline has an advanced waste management system to manage no waste from flights passing through Helsinki is dumped in landfills. To cut down on food waste, Finnair also encourages pre-ordering and provides extra food to charities (Finnair, 2025). These actions are aligned with the principles of a circular economy model and show dedication to a system thinking approach and circularity in design.

As per the annual report 2024, Finnair has progressively adopted circular economy principles into the daily activities of the business from the aircraft lifecycle to the service offered onboard. The policy focuses on four main areas: material reduction, reuse, recycling and repairability which is moving from linear consumption towards a closed loop system (circular economy). In 2024 airline achieved a 10-tonned reduction in catering waste. On the other hand, due to effective onboard and ground waste minimisation techniques the amount of waste per passenger has decreased considerably in recent years, from 0.34 kilogramme in 2021 to 0.21 kg in 2024. In the same period, the

recycling rate has increased from 22% to 28%, which is a great improvement: especially trash sorting is a challenge in aviation environment.

During the analysis of Finnair inflight videos, it is evident that the airline has focused on reducing its environmental impact by minimizing waste and material management in inflight services. According to this video the airline is committed to halving single use plastic which is and food waste by end of 2022. This is a great example of how commercial airlines can incorporate environmental sustainability approaches since it a direct implementation of circular economy practices of waste minimization, and resource efficiency which is align with SDG climate action.

Finnair inflight video claims that on a day it flies approximately 350 destinations on average, and every item used on board, including packaging, cutlery, and glasses, has an influence on the environment. Senior Manager of work safety and quality at Finnair kitchen emphasize the significance of achieving goals in material management. Finnair reported by 2022 approximately 80 tonnes of single-use plastics eliminated form its flights due to improved packaging strategies and product design. The fact that none of the waste from aircraft landing at Helsinki Airport is dumped in landfills is another indication of the significant advancements made in waste management. Rather, it is transferred to be used again as heat, electricity, biogas, or for recycling materials. This systematic approach to material management is a shift from linear consumption models towards circular approaches.

Additionally, the airline was able to decrease the amount of packing material used in its onboard menu options on European flights by about 50%. Additionally, specific product-level changes have been implemented, such as the removal of single-use milk jiggers from the majority of flights, the switch to cardboard containers for long-haul meal services from aluminium trays, and the substitution of recycled and recyclable PET cups for conventional plastic cups. Sustainable alternatives to plastic cutlery are being used instead. The airline's dedication to continuous development through methodical measurement and review is demonstrated by the evaluation of every onboard item to find environmentally friendly alternatives.

The airline enables passengers to support in environmental sustainability initiatives through pre - ordering meals prior to flight departure to ensure passengers get the meal of their choice and reduce unnecessary food and package wastage significantly. In addition to this approach passengers are reminded to keep plastic cups, bottles and cans free of liquids or trash to facilitate effective recycling. This inflight video is advised passengers to take additional minor steps, such bringing your own water bottle and recycling cups for refills, to help cut down on trash throughout the journey.

These initiatives reflect a shift in passenger behaviour that align with company environmental sustainability goals. Moreover, it is an excellent attempt to reflect the interconnectedness of consumer behaviour and organizational sustainability performances.

Protect Biodiversity

Finnair official website claims that criminals misuse air transportation to smuggle endangered plants and animals. This illegal wildlife trade is a critical global issue and worth at least $19billion annually. Finnair is taking actions against this. The airline is dedicated to spreading awareness and assisting in the stopping of this harmful activity as a signatory to the Buckingham Palace Declaration and a registered participant in IATA's Illegal Wildlife activity (IWT) program. (FINNAIR,2024). Furthermore, Finnair is committed to using only sustainable aviation fuel that produces according to environmental standards set by international aviation rules, CORSIA and/or EU RED II. Hence, the airline can make sure the dramatic rise in SAF production throughout the coming years is carried out in a sustainable manner.

According to Finnair sustainability repot 2024 Finnair does not have developed a transition plan or resilience analysis particularly on biodiversity and economic plan. The biodiversity approach is still in the early stage. However, these issues are considered as part of the climate and SAF strategies, emphasizing that fossil fuel impact biodiversity directly and indirectly to climate change. The dedication of the airline to protect ecosystems and dependence on certified SAF show alignment with new sustainability standards. But the lack of accurate figures and goals are weaknesses in the managing biodiversity.

5.2 Qatar Airways

Emissions Reduction

The sustainability report emphasizes climate change as the central concern in the sustainability framework as well as incorporating in the company long-term strategic goals.Qatar airways aim to reach net Zero Carbon Emissions by 2050 in line with the Oneworld Alliance goals for the global aviation sector. As a result, the airline massively invests in next generation aircraft, such as Boeing 787-9, which is capable of a 20% higher fuel efficiency compared to previous models. In addition to that the company has implemented a Fuel Optimisation Program that was initiated in 2015. This program uses technologies including lighter aircraft materials, enhanced engine performance monitoring, and optimised flight routing to systematically minimise fuel usage.

The report further acknowledges that sustainability goals achievement needs more than technological advancement. Additionally operational transformations are equally essential. By integrating both approaches -new technology innovations and modifying operational practices is a proactive leadership which Qatar airways demonstrate towards sustainable future.

Sustainable Aviation Fuel (SAF) Integration

Qatar Airways sustainability report has committed to use 10% Sustainable Aviation Fuel (SAF) by 2030 as part of its overall fuel use, emphasising the crucial role that alternative fuels contribute to reducing aviation emissions. The airline working closely with suppliers to promote SAF and Their approach goes beyond pilot projects; it also includes active supplier partnerships and involvement in SAF promotion networks that will speed the fuel's worldwide commercialisation. This proactive approach shows that airlines consider SAF is not only as an environmental responsibility but also as a necessary step to maintain long term competitiveness in the global market.

Circular Economy practices and Resource efficiency

Sustainability report emphasise that throughout its operations, Qatar Airways incorporates the circular economy concept, which aims to reduce waste, maximise resource recovery, and optimise energy and water use. One of the main goals is to have zero water discharge from its Doha operations and zero waste to landfill at Hamad International Airport (HIA) by 2030. Programs like recycling, reducing single-use plastics, and optimising potable water on aeroplanes are examples of initiatives that show a comprehensive dedication to resource management. Incorporating circular economy principles into its core flight operations as well as supporting services like catering and airport management helps Qatar Airways achieve a wider sustainability goal that spans its whole business ecosystem.

Furthermore, Qatar airways committed to apply circular economy principles the operations by minimising waste and recovering materials. Qatar airways ‘’Quisine’’ on-board dining experience is an initiative to reduce single use plastics onboard increase the use of recyclable and biodegradable materials by 80%. Silverware cutlery and natural wooden stirrers are used instead of single use plastics in this initiative. In addition to this website explains catering department in Qatar airways recycle over 1,000 tonnes of packaging materials, 52 tonnes of magazines, and 5,000 gallons of cooking oil annually. Additionally, composting green landscaping waste helps to promote local biodiversity by lowering the need for chemical fertilisers.

The airline reduces food waste and supports food security programs in Qatar by redistributing 200–300 kilogrammes of excess food and beverages per day in partnership with the local charity Hifz Al Naema. In terms of water conservation, the airline follows at General Electric's 360 Foam Wash technology to clean aircraft engines, which has resulted in a significant reduction in water usage. Furthermore, Hamad International Airport recycles wastewater for irrigation, and corporate buildings have incorporated smart water technology like motion-sensor taps and condensate water for cleaning.

Overall, Qatar airways integration of circular economy practices, to the operations is a forward-looking approach for environmentally sustainable aviation industry. Qatar Airways establishes itself as a responsible leader in the changing global aviation sector by integrating sustainability into its core operational activities, passenger services, and administrative procedures.

Biodiversity Conservation and Wildlife Protection

The Sustainability report focus on biodiversity conservation in environment sustainability. The airline follows a strict zero-tolerance policy when transporting illegal wildlife and wildlife products. This is aligned with global conservation programmes including United for wildlife and strictly prohibits the transportation of illegal wildlife and wildlife products. This theme shows how Qatar Airways has expanded its environmental responsibilities to include ecosystem protection and the preservation of species worldwide, going beyond emissions and waste. Through employee training, passenger education, and partnerships with environmental organisations, the airline positions itself as a champion for moral and sustainable logistics.

According to Qatar airways website environmental strategy of the company is closely followed by IATA and ICAO. Airline claims that this is to ensure its effort to maintain the highest international standards. Moreover, Qatar airways emphasise the investment in maintaining one of the youngest and most technologically advanced fleets in the world. The airline places a high priority on using fuel-efficient aircraft designs in addition to ongoing engine and airframe engineering improvements to reduce noise pollution and carbon emissions. Qatar Airways has carried out more than 80 projects under its Fuel Optimisation Program with the goal of lowering fuel usage and enhancing network connectivity effectiveness. Improved flight routes, partnerships with industry participants, and operational advancements that reduce fuel use during flights are among the initiatives. This shows that environmental sustainability is being incorporated at each stage of Qatar Airways' daily operations rather than being viewed as an external need. It also displays an integrated operational focus

on continuous development. The website emphasizes the airline is committed to use SAF 10% by 2030.

In addition to the company communication channels, a press release from Qatar Gulf Times have mentioned about the airlines fuel optimization initiatives. According to Gulf Times (2020), a number of initiatives have established by the airline to improve fuel efficiency and reduce carbon emissions as part of its sustainability efforts. The airline's fleet is among the world's youngest and the most fuel-efficient, with Airbus A350 and Boeing 787 aircraft, which are renowned for using less fuel and emitting less pollutants than their older counterparts as per the airline's annual report Fiscal 2020. (John. P ,2020)

Furthermore, Qatar airways monitoring carbon emission by participate in ICAOS's Carbon offsetting and Reduction scheme (CORSIA) and being fully compliant with the European Union Emissions Trading System (Gulf Times, 2020). Additionally, the airline has kept its certification under the Environmental Assessment Programme (IEnvA) of the International Air Transport Association, which acknowledges compliance with strict environmental criteria in aviation. (John.P ,2020)

5.3 Qantas Airline

Climate Action and Carbon Reduction

According to 2023 sustainability report Qantas has established a Climate Action Plan (CAP), which aims a 25% reduction of net emission by 2030, using 2019 as the baseline year, and achieve net zero emissions by 2050. The airline is working to achieve this goal by investing in carbon offset projects, fleet renewal with efficient aircraft, establishing a carbon pricing (ICP) and the incorporation of climate measurements into executive performance. As part of the planning, Qantas conducts a Scenario-based analyses are to evaluate both physical and transitional climate concerns.

As per 2024 Sustainability Report of Qantas, the airline repeats the committed to reaching net-zero carbon emissions by 2050 and a 25% reduction in net emissions by2030. The previously mentioned independent goal of a 1.5% yearly increase in fuel efficiency drops explaining that short to mid-term challenges make that difficult right now. The airline is now showing a broader view to the environment by integrating its Climate Action Plan into a Nature Action Plan (NAP) and focusing on three main decarbonisation pillars. These are Sustainable operations, SAF and carbon markets. Airline has already invested over $100 million into these efforts through climate funds. The green Tier program

of Qantas has inspired more than 700,000 frequent flyers to participate, ensuring stakeholder engagement in ecofriendly activities.

Sustainable Aviation Fuel (SAF)

Qantas aims to increase SAF by 10% in 2030 with the aid of a $400 million Climate Fund. Initial investments were made in regional biofuel plants (such as those in Queensland) and collaborations with Jet Zero and Lanza Jet. The business actively supports for domestic SAF policy. (Qantas Sustainability Report 2023). The airline is still aiming to use 10% SAF, by 2030, but now supported by major financial investments. The airline is becoming a member of Sustainable Aviation Fuel Financing Alliance (SAFFA) joining with Airbus and Air France-KLM. Moreover, the conversion of woody biomass to SAF was tested as part of the Wheatbelt SAF feasibility project, which moved on to the pilot stage. Furthermore, Qantas started investing in the U.S. in relation to SAF, demonstrating a global supply strategy that extends beyond Australia. Qantas Sustainability Report 2024.

Qantas official website claims SAF is the core strategy to low lower carbon emissions and emphasize the target of using 10% SAF mixing with conventional jet fuel by 2030.Furthermore the airline is working to increase SAF production in Australia.

Fuel Efficiency

The airline target to improve fuel efficiency by 1.5% annually supporting fleet upgrades such as Airbus A220s. (Qantas Sustainability Report 2023.) In 2024 Qantas removed 1.5% target stating that it is no longer regarded as a short-term goal that can be consistently met. Instead of that the airline introduced a detailed operational efficiency roadmap that includes more than 60 specific activities ranged from fuel burn optimization, aircraft performance improvement and innovation smart engineering transformation and also encouraging sustainable mindset in frontline staff. (Qantas Sustainability Report 2024). Qantas website claims more fuel-efficient aircrafts (Airbus A350S) will add to the fleet while maintaining efficient flight operations to reduce emissions.

Circular Economy and Waste Reduction

Qantas aimed to eliminate single-use plastics by 2027 and landfill waste by 2030 (not including quarantine waste). Main Composting, recycling, and interacting with suppliers were key tactics. (Qantas Sustainability Report 2023). Circularity emphasises as the main key feature of both Climate and Nature plan at Qantas. The 2024 sustainability report highlights several aspects, including the removing 100 million single-use plastic products from operations and implementing inflight recycling on 85% of Qantas domestic flights and 99% of Jetstar domestic services. (Qantas Sustainability Report 2024).

Partnerships to protect Biodiversity

A partnership has established with the Great Barrier Reef Foundation to support coral restoration and enhance the resilience by Qantas. In addition to this project the airline started the Wheatbelt reforestation as a carbon offset strategy (Qantas Sustainability Report 2023). The airline is investing $10 million over the next decade to Reef Restoration Fund to protect Australia's marine ecosystems, and additionally airline launched Silva Capital Fund to support Australian carbon Credit unit by investing in local reforestation projects (Qantas Sustainability Report 2024).

Looking into both sustainability reports of Qantas 2023 and 2024 as well as official website it is clear that the airline made a change from setting goals and putting them into practice. Qantas present a clear environmental strategy with defined targets and transparent communication. The 2024 report illustrates how Qantas has integrated sustainability into all aspects of its business, from investing in sustainable aviation fuel (SAF) and conserving the environment to reducing waste and enhancing day-to-day operations. Beyond merely operating an airline, Qantas is taking the lead in determining the direction of environmentally friendly aviation in Australia and around the world. The airline presents itself as a pioneer in the regional for decarbonising air travel. As well as the initiatives demonstrate true leadership in promoting more sustainable air travel and highly support global goals such as the UN's Sustainable Development Goals (SDGs), particularly climate action (SDG 13).

5.4 Air New Zealand

Net Zero goals

The goal of reaching net zero carbon emissions by 2050 is one of the main focusses of Air New Zealand's sustainability strategy. This long term target is supported by short term goal (interim targets) to reduce carbon intensity (amount of carbon dioxide emitted per unit of activity such as per passenger -kilometre flown) by 28.9% in the year of 2030, compared to what the airline emitted in 2019(baseline year).The approach of Air New Zealand towards mitigating climate change is broader that includes low-emission technologies investment, exploring alternative energy sources, and renewing aircraft fleet. For instance, the airline is exploring potentials to use hydrogen powered and electric aircrafts for short -haul flights. This commitment from the airline aligns with SDGs especially Goal 13 of climate action.

Sustainable Aviation Fuel (SAF)

In emissions reduction strategy in Air New Zealand SAF plays an important role. The airline committed to integrate SAF into 10% of its total fuel mix by 2030.

Neste Corporation Press release (2019) claims that Air New Zealand and Neste signed a significant agreement for supply 23,000 tonnes (30 million litters) of Neste My sustainable Aviation Fuel (SAF) which is the Air New Zealand's largest SAF purchase to date. It will be used at the airports in Los Angeles (LAX) and San Francisco (SFO) through February 2026. Air New Zealand states that this purchase will meet SAF goal which accounts for 1.6% of Air New Zealand's total fuel supply for financial year 2025. Furthermore, the airline states that, although this is a small portion of total fuel usage it is four times more than the volume used in fiscal year 2024.

Modernization Fleet and Operational Efficiency

The airline's attempts to reduce its carbon footprint by modernisation of its fleet with fuel-efficient aircraft such as Boeing 787 and Airbus A321neo which shows a great improvement in fuel consumption and emission compared to old models. (Boeing company claims these aircrafts can reduce 20-25% fuel burn). Moreover, Air New Zealand implementing various operational strategies to further reduce impacts to the environment including single-engine taxiing to reduce emissions and fuel consumption, lighter aircraft design with lighter materials, instead gasoline powered ground support equipment with electric alternatives, and optimised flight routing were put into place. By incorporating sustainability into the operational core of its business, Air New Zealand hopes to minimise its direct and indirect environmental consequences.

Waste Management & Protect Biodiversity

Air New Zealand's sustainability report claims by 2025, the airline intends to reduce the amount of waste that ends up in landfills by 50%.

Air New Zealand works with the Department of Conservation (DOC) for conservation, help protect and enhance New Zealan’s natural environment while supporting ecological restoration of New Zealand’s biodiversity and support native species protection. To offset remaining emissions, the organisation looks into natural alternatives such as forest regeneration programs. Additionally, Air New Zealand has transported more 4,500 than conservation dogs, and endangered animals with breeding throughout the country, assisting with breeding initiatives, veterinary care, and habitat restoration. ” We’ve transported over: 230 takahē, 1,400 pāteke, 600 native reptiles, 400 kiwi, and 300

conservation dogs to name a few''. (Air New Zealand, n.d.). After analysed data of four airlines companies a final comparison table created to demonstrate to compare how each airlines sustainability projects align or differ with one another and what are the strategies for the future. (Ref. table 2)

Theme	Finnair	Qatar Airways	Qantas	Air New Zealand
Carbon emission reduction & Climate Action.	Net Zero by 2045. Target of 34.5% co2 intensity reduction by 2033. Reducing direct emissions with scope 1 & 3. Carbon offsetting is not accepted as the core strategy. Finnair committed not to rely on carbon offsetting and instead focusing on direct ways or operational measures to decarbonize flights align with SDG 13 climate action. Main initiatives are SAF, fuel efficient fleet and operational improvements.	Net zero by 2050. Investment in fuel efficient/ next-generation aircraft, including the Boeing 787-9. Fuel Optimisation Programs implemented: uses technologies including lighter aircraft materials, enhanced engine performance monitoring, and optimised flight routing to systematically minimise fuel usage. Operates one of the youngest fleets. Invested in aircraft engineering advancements to lower noise and increase fuel efficiency (e.g., lighter airframes, newer engines). Participate in ICAOS's - CORSIA and fully compliant with the European Union Emissions Trading System	Net Zero by 2050. Target of 25% emission reduction by 2030 base line 2019. Scenario based climate risk analysis. $100 million investment in climate funds. Green Tier frequent flyer program. (700,000+ members)	Net Zero by 2050. 28.9% reduction in carbon intensity by 2030 (baseline 2019) Exploration of hydrogen and electric aircraft for short haul flights. Low emission technological investments and align with SDG 13.
Sustainable Aviation Fuel (SAF)	SAF partnership with Neste. SAF is accounted for 0.24% of fuel consumption in 2023. Goal is to use 2% SAF by 2025 and 6% by 2030 as EU regulations.	Goal of using SAF 10% by 2030. Supplier partnerships and SFA promotion network.	10% SAF target by 2030. Investment in regional biofuel plants. SAF partnership Jet zero, Lanza jet, SAFFA Global SAF Wheatbelt SAF pilot project (woody biomass conversion)	SAF target of 10% total fuel mix by 2030. Largest SAF purchased of 23,000 tons of MY SAF (largest SAF acquisition to date) SAF to be used at LAX and SFO until Feb 2026. Fleet upgrades Boeing 787, Airbus A321 neo, Single engine taxiing, reduction aircraft weight, electric GSE, optimizing flight paths.

Circular Economy & Waste management.	Passenger awareness via inflight videos displays onboard. The airline's "100% Material Management" program aims to reduce, reuse, recycle, recover, and dispose of waste materials ethically. From 2021-2024 waste reduction per passenger reduced from 0.34Kg to 0.21Kg	Incorporates with the circular economy concept: reduce waste, maximise resource recovery, and optimise energy and water use. Goal of zero water discharge from its Doha operations and zero waste to landfill at Hamad International Airport (HIA) by 2030. Reduction of single use plastics "Quisine". Recycling 1000+ tonnes of packaging, 52 tonnes of magazines,5000 gallons of oil. Water saving through 360 Foam wash tech and smart taps in the airport.	Eliminate single-use plastic by 2027 $ 100 million plastic items removal from operations. Inflight recycling 85% of Qantas domestic and 99% Jetstar domestic. Zero landfill waste by 2030.	50% Landfill waste reduction by 2025. Emphasis on circular resource usage and sustainable sourcing; promoting a gradual shift in consumer habits
Biodiversity and Wildlife protection.	Still in the early stage of biodiversity strategy. No dedicated biodiversity goal or plan. Member of IATA illegal Wildlife trade program and Buckingham Declaration.	Zero tolerance policy on illegal wildlife trafficking. Partnership with global conservation organizations. Staff training and passenger awareness.	Partnership with Great Barrier Reef Foundation and $10 million investment in to reef restoration fund. Silva capital fund to support local restoration and Australian Carbon Credit Unit(ACCUs)	

Table 2.Comparison of Environmental Sustainability Initiatives of Selected Airlines.

6 Discussion

What are the environmental sustainability initiatives implemented by Finnair, Qatar Airways, Qantas, and Air New Zealand to reduce the environmental impacts? In response to the research question the analysis reveal all airlines have committed to reducing carbon emissions and work towards achieving goals of climate action aligning with SDG 13. Finnair has a long-term target of becoming net zero by 2045, and a short-term target of carbon dioxide intensity reduction of 34.5% by 2033. The main point which highlighted from the analysis is Finnair not accepting carbon offsetting as the core strategy but mainly focusing on reduction of direct emissions (scope 1 & 3) ,operational decarbonization through sustainable aviation fuel, fuel efficient fleet and improving operational efficiencies.

Qatar airways, Qantas, Air New Zealand have set net zero target by 2050. Qatar airways rely heavily on investing fuel efficient aircrafts and technology optimization, Qantas allocated $100 million to

implement green frequent flyer program, Air New Zealand highlighted exploring propulsion technologies of hydrogen and electrical aircraft for domestic short distance flights. Moreover, all four airlines concentrate on SAF aiming at approximately 10% of fuel mix by 2030. But Finnair has set an earlier goal of 2% by 2025 by making partnership with pilot projects and suppliers to increase SAF production.

Each airline implemented circular economy practices up to different extents. Finnair "100% material Management" gives a clear indication of waste reduction measures per passenger. Qatar airways aim to send zero waste landfill, and zero waste discharge from airport operations. Qantas claim to eliminate single use plastics in 2027 and expect high-rate recycling in inflight service. Air New Zealand targets to reducing landfill waste encouraging passengers to make consumer behavior.

Finnair is still in early stage in biodiversity without dedicated goals but participating in certain programs of illegal wildlife trade. Qatar airways follow zero tolerance policies and partnership with global conservation groups. Qantas has established a partnership with the Great Barrier Reef Foundation to support coral restoration and enhance resilience and invest in local ecosystem projects. Air New Zealand partnership with the Department of Conservation (DOC) to protect and enhance New Zealan's natural environment while supporting ecological restoration of New Zealand's biodiversity and support native species protection. To offset remaining emissions, the airline looks into natural alternatives such as forest regeneration programs. Additionally, Air New Zealand facilitated transporting conservation dogs, and endangered animals to protect wildlife.

The primary objective of this thesis was to understand environmental sustainability strategies adopted by four leading airlines. The findings show that while all four airlines have accepted the importance of environmental sustainability strategies, and set long-term net zero goals, there are notable differences in the level of action, commitment and involvement in implementing these practices.

The analysis shows many initiatives aligning with ICAO, IATA and SDG 13. However, there is a concern of this point questioning whether this alignment is the genuine concern about the environmental concern or to maintain the reputation of the airline and to comply with the regulation. On the other hand, the environmental initiatives are aligned with Xue et al (2025) who emphasized that SAF is the nearby solution in terms of decarbonizing which can reduce 80% of co2 emissions but adaptation has limitations due to high costs and infrastructure issues. For example, Finnair's clear strategies for adoption of SAF and fuel-efficient practices aligned with industry guidelines. Similarly waste reduction and light weight catering options of Qantas and Air New Zealand align with the

pathway of increasing flight operations efficiency through fuel-efficient practices, and weight reduction.

However, Xue et al. (2025) focused on challenges when shifting to sustainable aviation. One of the main challenges authors pointed out in this article is the high costs of SAF which is more expensive than traditional jet fuels. This high cost of challenge makes harder for airlines particularly budget airlines to transform into sustainable aviation. As a result, airlines mostly rely on carbon offset programmes instead of investment in greener technologies. Moreover, biofuels, synthetic fuels, and hydrogen-powered aircraft are examples of technological developments that are still in the early stage and require investment, research and supportive infrastructure (Xue et al., 2025). Correia (2018) argues that economic growth is significant in businesses, but it can be achieved by following sustainable business methods like circular economy models and green innovative which will help to reduce environmental impacts.

Even though the green initiatives launched by these four leading airlines are positive, it's important to figure out how much these approaches actually contribute to reducing environmental damage. Goodland and Daly (1996) highlighted the importance of preserve natural capital by stopping resource depletion beyond nature’s carrying capacity. During the analysis it is clearly noted that SAF was one of the major aspects. Finnair stands out showing clear SAF targets while Qantas and Air New Zealand also show strong commitment to reduce waste and adopting circular economy practices. According to the data, Finnair is already getting ready for the EU mandate of 2% SAF by 2025 and 6% by 2030, while only employing 0.24% SAF in 2023. Qantas and Air New Zealand have shown commitment to reduce emissions by establishing partnerships and conducting SAF trials as well. Qatar airways less active in adopting SAF while investigating in fleet efficiency. Due to lack of necessary regulations and awareness among countries are the main reasons behind the limited usage of SAF as a new alteration fuel. Furthermore, SAF production level is still significantly lower than the demand (Wang et al., 2024).

However, all airlines promote long-term goals such as carbon neutrality by 2050, but short-term actions do not clearly mention in the documents. While these long-term goals impressive the lack of short-term efforts make a doubt whether those goals are realistic. Even though the airlines plan to become carbon neutral by 2050, the emissions they produce every year until then still contribute to the climate change.

Correia (2018) encouraged companies to adopt renewable energy investments, follow energy efficient methods, and circular economy practices (closed loop production systems) to support sustainability methods. Four airlines follow cabin waste reduction, circular economy and TBL principles approaches which are align with Correia. For example, Finnair digitalization cockpit manuals and biodegradable cutleries onboard, Air New Zealand uses biodegradable packages onboard, Qatar airways reduced single use plastics through a program of “Quisine” aims to zero landfill waste by 2030, recycling 1000+ tonnes of packaging, 52 tonnes of magazines,5000 gallons of oil, Qantas aim to recycle 85% of inflight waste and 99% Jetstar along with zero landfill waste by 2030. By decreasing single-use plastics and promoting recycling, these activities promote the environmental and social components of the TBL and are in line with Morelli's (2011) demand for ecosystems to be resilient and balanced. However, replacing plastics with paper or wood can create new environmental challenges such as deforestation or more energy use in production that global airlines need to focus on. There is a growing trend of highlighting green credentials through official websites of the airlines but how much this working practically or is this just marketing? Hence, the airlines need to do the communication in a responsible way ensuring transparency and accuracy in sustainability reports since there will be a risk of green washing.

Many sustainability goals of these airlines are set for 2030 and beyond, which could potentially delay the immediate actions require to mitigate climate change. This aligns with the warnings from ITB berlin 2025, the keynote speaker Gossling emphasized the urgent need of acting responsibly before climate change causes irreversible damage to global tourism. The speaker warned extreme weather conditions could significantly disrupt the global tourism within next 80 years by claiming aviation industry being the main culprit. During his speech he pointed out the government and individuals show a slow motion in taking actions. The speaker emphasizes the actions are taking in slow motion from both government and individual. Tourism and aviation are like both sides of a coin which notably tourism contribute 8.8% global emissions with aviation recognized as a primary source (ITB Berlin YouTube video, 2025).

Marsov (2021) explains air travel accounts for approximately 3.4 percent of worldwide CO_2 emissions, making it a major contributor. Gosling et al. (2007) explains the most of these emissions are released in the upper troposphere and lower stratosphere at heights of 10–12 km. Hence at this altitude there is a greater effect on ozone, cloud formation, and radiative forcing than near the surface of the earth.

Salesa et al. (2022) proposed a framework align with CE model of inflight products and service re-designing, which is currently using by Finnair according to inflight video. Finnair's approach focusses on optimising flight planning, a modern fuel-efficient fleet with short routes, investing in more fuel-efficient flight planning and flying, reducing the weight of the aircrafts, increasing sustainable fuel usage, and investing in circular economy and material management. The inflight videos illustrate real examples such as redesign lighter passenger seats, trolleys, seat belts, table ware and carpets.

Through out the study it is clear that initiatives could be viewed through both sustainable and responsible perspective. However, the presentation of these projects in sustainability reports and the academic literature often goes more in the direction towards sustainable thinking. For example, managing plastic waste can be view as either a sustainable or responsible action. This is due to the majority of academic sources focus more on long-term solutions such as following circular principles, using resources effectively and monitoring environmental effects using transparent data. These initiatives reflect a genuine commitment to environment.

In conclusion, comparison analysis prove that all four airlines have recognise the need to address the environmental impacts immediately, the approach level and commitment vary depend on each airline. Some airlines have taken proactive steps to implement SAF, initiatives to conserve biodiversity, while others rely on carbon offset programmes, and fuel efficiency enhancements but not all airlines doing the same amount of work towards environmental sustainability. This emphasizes the need for a consistence global strategy, supported by international aviation bodies, to regular monitor all airlines to ensure they work together in the same way. Therefore, genuine contribution, transparency and accountability are essential to achieve a meaning full environmental progression with strong regulations established by aviation authorities.

7 Conclusion

The findings confirmed that all four airlines have committed to be carbon neutral by 2050, However, the current actions are not strong enough to meet these promises while showing different levels of transparency and commitment to the initiatives. Finnair is in the frontline in SAF implementation and circular economy initiatives. Finnair primarily focus to reduce direct emissions from its aircrafts by focusing on scope 1 and 3. Qantas and Air New Zealand focused on waste reduction and inflight

product redesigns. Qatar airways by contrast shows limited SAF adoption but more on fleet efficiency and carbon offset programs. However, carbon offset does not actually lower emissions from its own flights. Not investing in innovative, new, low emission technologies like SAF or hydrogen powered aircraft, it raises a concern whether the sustainability efforts are genuinely driven by a commitment to environmental responsibility or to maintain the company reputation or is it just to avoid penalties from aviation authorities. SAF is considered as an important solution to reduce carbon emission in aviation. Even though it is a great solution for the reduction of emissions it is not widely used due to high cost and limited availability. Meanwhile, these four airlines promote their green credentials in marketing which can be a risk of green washing if real actions do not match with public claim.

The study suggests that the airlines show signs of progress but still in the early stages of true environmental transformation. Many initiatives still seemed in the surface level than gone to deep level. To genuinely address the climate crisis rather than staying on the minimum level, airlines need to do more than meeting minimum standards. Sustainability needs to be in the core in their operations and future strategies and not only for the sake of to maintain company image and avoid penalties form aviation bodies.

Overall, this thesis emphasizes that environmental sustainability in aviation need responsible initiatives of rather than future promises. Aviation industry cannot rely only on future targets while continuing high emission from the operations in the present. A significant negative impact to the environment may still occur before sustainability goal is achieved. Urgent actions need to start immediately to mitigate the harm and only setting goals is not enough to be environmentally sustainable. Aviation authorities need to implement stronger policies and continuous monitoring all airlines to ensure they work together in the same way. Therefore, genuine contribution, transparency and accountability are essential to achieve a meaning full environmental progression with strong regulations established by aviation authorities.

8 Limitations , Etchical Considerations , and Future Directions

This analysis relied on secondary sources such as corporate annual reports, official websites and press release which may not reflect the full scope of operational strategies. Moreover, lack of direct interviews makes limitations of analysing practical data from the companies. The document analysis is especially useful when researchers do not have an opportunity to conduct research using other

qualitative methods (Morgan, H.2021). In addition, for that the core concept of sustainability is balancing the pillars of profit, planet, and people. This study focusses only on environmental sustainability, which means more research is needed to assess how these airlines achieve a balance between environmental objectives and social and economic sustainability.

This research conducted as per JAMK university of Applied Sciences ethical guidelines. Since the study was based on document analysis of publicly available sources such as annual sustainability reports, official websites, press releases, and academic literature there was no human participation directly involved and ethical approval not required to complete the thesis.

All data sources cited as per APA 7. AI tool chat GPT was used to understand the academic journal articles, and refining language. This tool was used to understand the comprehensive academic journals reading and used responsibly but did not replace authors critical analysis, findings and judgements. AI tool limited to enhance the clarity of literature review articles while reading, and all other interpretations and conclusions present in this thesis are the own work of author.

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Appendices

Appendix 1

Finnair	Qatar Airways	Qantas	Air New Zealand.
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Four inflight videos recorded during the flight AY 1981. (21/04/2025)	Press release from Qatar Gulf Time published in 2020. https://www.gulf-times.com/story/674881/qatar-airways-fuel-optimisation-initiatives-ensure-improved-efficiency-carbon-reduction.	Official Qantas website https://www.qantas.com/au/en.html	Airline official website and Press Release. https://www.neste.com/news/neste-to-supply-sustainable-aviation-fuel-saf-to-air-new-zealand-marking-the-airline-s-largest-purchase-of-saf-t https://www.aviationpros.com/ground-handling/press-release/55250776/neste-north-america-neste-to-supply-23000-tons-of-saf-to-air-new-zealando-date. https://www.airnewzealand.co.nz/

Table 3.Source for the analysis