Sustainable Aviation – A research collaboration of CFAC and IWOE

Topics for Master Theses
Sustainable Aviation – Topics for Master Theses

Context
Achieving sustainability is one of the most significant challenges humanity faces in the future. One sector that is of high relevance is the aviation industry. Therefore, the institute for environment and the economy (IWOE) launched in collaboration with the Center for Aviation Competence (CFAC) a research project which addresses the most relevant questions of this topic from a management perspective. The research project is currently based on seven main topics, all of which are to be processed as a master's thesis. The idea is to build a fundament of knowledge based on the master students theses and then, based on a synthesis of all theses and additional work from the institutes to generate a book covering the topic sustainable aviation from a management perspective. Students working on the project have the opportunity to be part of the author team for the final research product (book).

Requirements
- Strong motivation and interest in sustainability and aviation topics
- Strong analytical skills and academic record, willingness to collaborate with other students
- No exchange semester in fall-term (2019) and spring-term (2020)
- Attendance at the research meeting (about 3-4 for the whole project)
- Willingness to contribute to publications beyond the master's thesis (e.g., contribution to a book chapter based on the master thesis)

Application
Applications should cover a brief statement of motivation for the topic in general and for the specific topic you want to choose (half a page in total). Further, you should already outline how you would approach (method, literature) the topic you chose (half a page). Additionally, you should provide a short CV and your academic record (bachelor and master). Applications should be sent to adrian.mueller@unisg.ch until 26th of September 2019.

Timeline
27th of September (end of second semester week): Final allocation of topics for master thesis
9th of October, 09:00 at IWOE (Rosenbergstrasse 51): Kick-off Meeting (90 min - Mandatory)
Beginning of Spring Semester 2020: Mid-Meeting
End of Spring Semester 2020: Final Meeting

Contact: For any questions, please contact Adrian Müller (adrian.mueller@unisg.ch)
1. Going Green: Long-Term Transformation of Airlines Towards Full Sustainability

1.1. Introduction
Climate change and increasing air pollution are among the most significant challenges facing humanity in the coming years. One industry that is increasingly coming under the spotlight in the public debate on reducing greenhouse gas emissions is the aviation industry, as it leads to very high per capita CO2 emissions and will continue to grow strongly in the future. In Europe, this is already resulting in the first movements, such as "flight shame," which regard flying as one of the top environmental sins and therefore call for renunciation. Since the social and political pressure on the industry will continue to grow in the future, sustainability and the path to it are currently at the top of the strategic agenda for many airlines.

In addition to numerous measures that can be implemented in the short term, a complete transformation is needed in the long term in addition to pollutant-neutral and sustainable flight services. The airlines have a duty here. Even if the necessary technologies are not yet available to fully implement this transformation, airlines are well-advised to plan the transformation process as early as possible, to define a roadmap and milestones, and to plan the required resources as well as the internal change management. One possibility of many to initiate this process at an early stage is the concept of ambidextrous organizations. It means that two business units of a company are strictly separated because they pursue different goals within the same industry. One example is Easy Jet and Wright Electric, which jointly develop electric aircraft, separate from their business units. However, there also other ways for airlines to achieve a full sustainable transformation.

The aim of this master thesis is to develop a long term (10-15 years) strategic transformation road map for airlines to achieve full sustainability. The road map should contain milestones and strategic objectives for the most critical dimensions (technology, corporate culture, management and skills, vision, resources, and others, if applicable) of the transformation. The support is provided by standard change management literature and transformation approaches for more sustainability. Besides the road map, it will also be necessary first to define what full sustainability for an airline means and then later to define reporting and control mechanisms to monitor progress. The final thesis should cover the road map coupled to a bunch of strategic recommendations for airlines.

1.2. Research Objectives
- Definition of full sustainability for airlines
- Long term (10-15 years) strategic transformation road map for airlines to achieve full sustainability
- Milestones and strategic objectives for the road map
- Strategic objectives about technology, corporate culture, management and skills, vision, resource-allocation, etc.
- Guidelines and recommendations for long term transformation
- Reporting, incentives, and monitoring for transformation

1.3. Required skills
This research project requires strong skills in strategy and management, with a focus on change management, technological transformation, sustainability, and aviation. Students should have analytical and conceptual skills, as well as long-term thinking capabilities.

1.4. Literature

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Title</th>
<th>Year</th>
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<tbody>
<tr>
<td>Lozano, R. (2013).</td>
<td>Are companies planning their organisational changes for corporate sustainability? An analysis of three case studies on resistance to change and their strategies to overcome it.</td>
<td>2013</td>
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</tbody>
</table>
2. Going Green: Short term actions for airlines to become more sustainable – an assessment of different sustainability measures

2.1. Introduction

Climate change and increasing air pollution are among the most significant challenges facing humanity in the coming years. One industry that is increasingly coming under the spotlight in the public debate on reducing greenhouse gas emissions is the aviation industry, as it leads to very high per capita CO2 emissions and will continue to grow strongly in the future. In Europe, this is already resulting in the first movements, such as "flight shame," which regard flying as one of the top environmental sins and therefore call for renunciation. Since the social and political pressure on the industry will continue to grow in the future, sustainability and the path to it are currently at the top of the strategic agenda for many airlines.

In addition to a long-term transformation towards the use of renewable and CO2-neutral technologies in the airline industry, short-term measures for greater sustainability are already central. Examples of measures that can be implemented quickly are:

- the increased use of so-called Bio Fuels (e.g., KLM on specific routes)
- the reduction of plastic and the increase of sustainable food in catering (e.g., Emirates)
- the offer (e.g., Swiss and Lufthansa) or inclusion of CO2 compensation payments in the ticket price
- partnerships with sustainable transport companies (e.g., high-speed train providers, such as Emirates and TGV in France)

From an airline perspective, the listed measures for more sustainability are all considered as being more costly and rather inefficient than other options, which is a crucial aspect in an industry with high price competition. However, the situation could also be viewed differently, namely as an opportunity for airlines to differentiate themselves. If implemented correctly, these measures can, in turn, be translated into differentiation advantages in the market and even lead to new profitable business models. Additionally, introducing sustainability measures might serve as a hedge or preparation against future obligations that will come from the policy.

The aim of this master thesis is to analyze and evaluate the various short-term measures for greater sustainability at airlines. The assessment should be based on the following criteria: feasibility (time and cost needed for implementation), CO2/environmental benefit savings, benefit/marketing potential for airlines and hedge against future requirements (no disposable plastic, kerosene tax, etc.).

The listed measures and criteria serve as a starting point. Additional measures and criteria for evaluating them can also be identified and analyzed during the research process. The aim of the master thesis is to show how airlines can contribute to more sustainability in their industry in the short term and what the
benefits are, not only for the environment but also for the airlines. Based on a comprehensive analysis of the measures, recommendations for airlines and politicians should be made at the end.

2.2. Research Objectives
- Identification of measures/options for airlines to become more sustainable in the short-run (1-5 years)
- Evaluation of measures concerning
  o Feasibility (cost-benefit, time for implementation)
  o Environmental impact (reduction of co2 and other emissions)
  o Marketing opportunities and image branding (differentiation)
  o Hedge for future requirements (no disposable plastic, kerosene tax)
- Attractive intermodal traveling partnerships for airlines (cost-benefit sharing)

2.3. Required skills
This research project requires strong analytical skills with a background in management, marketing, sustainability, and aviation. Students should be able to identify, analyze and evaluate operative and strategic actions of airlines based on different criteria.

2.4. Literature

**Web Pages:**
- [https://flygrn.com/page/sustainable-air-travel](https://flygrn.com/page/sustainable-air-travel)
- [https://www.airtransat.com/de-CH/tgv-air?search=flight&flightType=RT&pax=1-0-0-0](https://www.airtransat.com/de-CH/tgv-air?search=flight&flightType=RT&pax=1-0-0-0)

**News Papers:**

**Airlines:**
KLM CO2ZERO Program:
- [https://www.klm.com/travel/ch_de/customer_support/customer_support/legal_information/terms_conditions/co2zero.htm](https://www.klm.com/travel/ch_de/customer_support/customer_support/legal_information/terms_conditions/co2zero.htm)

**International Journal of Sustainable Aviation:** [https://www.inderscience.com/index.php](https://www.inderscience.com/index.php)
3. Technology Assessment for Sustainable Aviation

3.1. Introduction
In recent years, there has been a rising global awareness about the impacts of the aviation industry on the environment. Although this is not the only environmental impact, public pressure especially demands the reduction of CO₂ emissions. The CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) requires a CO₂ neutral growth of the aviation industry from 2020 onwards. In consequence, airlines are renewing their fleets with new, more fuel-efficient aircraft to reach the CORSIA targets. More efficient conventional engine technologies, however, are only one area where technology can and must help to mitigate aviation’s global impact on climate and the environment. The goal of this thesis is to identify, categorize, analyze, and evaluate the relevant technologies that will help make aviation more sustainable. The focus is to be on the managerial aspects such as feasibility, cost-effectiveness, and the potential to have an impact on the industry in the long run. Technological details are not the main interest of this study. We expect the author to consider the broader impacts of aviation on the environment, including all greenhouse gasses (not just CO₂), waste, noise, and many more. Also, a broad scope in terms of the overview of technologies is welcomed, i.e., not a sole focus on aircraft propulsion systems or biofuels, but also to include technological levers that actors in the aviation system might have (e.g., airports or suppliers).

3.2. Research Objectives
- Identification and categorization of relevant technologies (overview) in terms of making aviation more sustainable in all parts of the aviation system
- Analysis of feasibility and cost-effectiveness of these relevant technologies
- Evaluation of the potential of the technologies to disrupt (have an impact) on the aviation industry in the long run.
  ➢ Outlook on cost development
  ➢ Estimation of time-to-market and a forecast of the adaption/diffusion
- Managerial impacts: provide an extensive literature review and possibly exciting cases as a point of reference for managers interested in the topic
- Academic contributions: identify research gaps and opportunities

3.3. Required skills
This research project requires strong skills in strategy and management, with a focus on innovation management, technological transformation, sustainability, and aviation. Students should have analytical and conceptual skills as well as a keen interest in technological topics.
### 3.4. Literature

#### Biofuels


#### Materials, engine and propulsion systems, aircraft design and airframe configuration, other technology


#### Systems perspective

4. Policy Framework for Sustainable Aviation

4.1. Introduction
In the light of recent climate strikes, calls for policy measures to mitigate the negative impact of aviation on the environment become louder than before. On a national level, several states have already announced carbon taxes, while on the multinational level the CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) framework reduces CO2 emissions compulsory for airlines. These are just two examples of possible policy measures to make aviation more sustainable.
This thesis aims to identify and describe the components of a policy framework for sustainable aviation and to evaluate the feasibility of the measures.
The framework can include regulatory, market-based (taxes, emission charges, subsidies, tradable permits), and voluntary measures. The evaluation of the framework answers the questions of what should be fostered? What should be taxed? Moreover, what should be banned?. In answering these questions, the author will come across general and specific implementation problems for a sustainable policy framework. These problems should be listed, and possible solutions to these issues for governments and nations should be derived. The thesis should have a broad perspective on sustainability and not only focus on CO2 emissions.

4.2. Research Objectives
- Identify the components of a policy framework for sustainable aviation
- Show how a useful policy framework to foster sustainable aviation should look like
  ➢ What should be fostered (technologies, partnerships, and many more)?
  ➢ What should be taxed (fuel, weight, flying, and many more)?
  ➢ What should be banned (advertising, technologies, and many more)?
- Show general and specific implementation problems for this framework
- Show how governments can overcome these problems
- Managerial impacts: provide an extensive literature review and exciting cases as a point of reference for managers and politicians interested in the topic and suggest measures
- Academic contributions: identify research gaps and opportunities

4.3. Required skills
This research project requires experience and knowledge in (international) law or international policymaking, as well as a basic understanding of economics (incl. taxation, and market-based measures). Students should have analytical and conceptual skills, as well as long-term thinking capabilities.
4.4. Literature


Web Pages


ICAO Policy & Regulation: https://www.icao.int/sustainability/Pages/economic-policy.aspx

ICAO CORSIA: https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx
<table>
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<tr>
<th>IATA:</th>
<th><a href="https://www.iata.org/policy/environment/Pages/default.aspx">https://www.iata.org/policy/environment/Pages/default.aspx</a></th>
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</table>
5. Consumer Perspective (short-term): Consumer Decisions on Travelling

5.1. Introduction
In a general travel context, customers are facing many complex and repeated decision processes. Many studies have been conducted that examine the travelers’ psychological processes during judgment or choice tasks (i.e., motivation studies), which choices are made among the alternatives considered and what cues are most important on the judgment or the choice of a specific destination or mode of travel. This thesis aims to look at consumer decisions in the specific aviation context and especially in the light of a recent global sustainability discussion.

With extensive literature research and an empirical part, this study helps to explain the relevant decision criteria with a focus on price, intermodality, and sustainability. In conclusion, the thesis suggests strategies how airlines and governments can influence this behavior (e.g., Nudging?, Eco-Labels?, Carbon Offsets?, and many more). As this is a broad topic, it requires a structured and focused approach in terms of theoretical analysis and the choice of methods. This study focuses on a short-term perspective.

5.2. Research Objectives
- Identify the relevant decision criteria in the decision process whether to choose air travel or an alternative.
  ➢ Mainly focus on the role of sustainability and price on the decision.
- Show the benefits of combining different modes of transport (intermodal travel, e.g., train and airplane) from a customer’s perspective.
- Suggest/identify opportunities to influence the travel behavior considering the relevant set of criteria
  ➢ E.g., Nudging, Eco-Labels, Carbon Offsets, and many more.
- Managerial impacts: provide an extensive literature review and a catalog of relevant criteria for marketers and government officials to understand and influence travel behavior
- Academic contributions: identify research gaps and opportunities

5.3. Required skills
This research project requires strong skills in marketing, with a focus on behavioral economics or consumer behavior/consumer psychology. Students should have analytical and conceptual skills, as well as long-term thinking capabilities.
5.4. Literature


Hall, C. M. (2013). Framing behavioural approaches to understanding and governing sustainable tourism consumption: Beyond neoliberalism,“nudging” and “green growth”? . Journal of Sustainable Tourism, 21(7), 1091-1109.


6.1. Introduction
“Flight shame” – a trend or a fad? The term that emerged in the 2019 school strikes for climate, supposedly represents a societal change. While it was omnipresent in the media, it is still unclear whether it influences people’s (air) travel behavior. Initial passenger data indicates that this could be a case of the well-documented attitude-behavior gap in environmentally-friendly behavior. This thesis examines consumer’s self-reflection, expectations, acceptance, and behavior.
Do customers think that flying is bad? If yes, does it also influence their behavior? This research project will identify why/why not customer behavior is changing because of the global discourse on the climate impact of the aviation industry. In doing so, it will also evaluate customer’s acceptance of new technologies that could potentially play a significant role in mitigating aviation’s negative impact on climate change. The topic consists of various subthemes that are interconnected and therefore requires a particular focus on a precise, methodical approach. This study has a long-term perspective.

There is a possibility that a recent large (n=3000+) representative dataset can be provided for detailed analyses.

6.2. Research Objectives
- Examine what expectations passengers have of airlines in terms of sustainability
  o What drives the expectations and what are the consequences for airlines?
- Explore how customers reflect on flying.
  o What role does “flight shame” play? Does the concept exist in reality? If yes, what is it?
  o Do customers think that one should fly less in the long run? What influence does this have on behavior now and in the future?
- Understand the passenger behavior
  o Is there evidence for pro-environmental behavior?
  o Is there evidence for an attitude-behavior gap?
- Show the acceptance of new technologies
  o Fully electric and battery-powered aircrafts
  o Autonomous aircraft (big passenger aircraft & small drones)
- Managerial impacts: make a forecast on how passenger’s attitude and behavior might change and how airlines could react to it.
- Academic contributions: Help understand the concept of “flight shame” and allocate it in existing theories. Identify research gaps and opportunities.
6.3. Required skills
This research project requires strong skills in marketing or management, with a focus on behavioral economics or consumer behavior/consumer psychology. Students preferably have analytical and quantitative skills as well as long-term thinking capabilities.

6.4. Literature

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<tr>
<th>Pro-environmental behavior, attitude-behavior gap</th>
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7. Sustainable Infrastructure – Impact & Contribution by Airports

7.1. Introduction
Airports operate a static infrastructure (minimal location options) to serve airlines, passengers, and other aviation stakeholders (e.g., ground operators, maintenance, retail facilities, hotels, etc.). In the same time, aerodromes generate a significant impact on the region’s mobility, environmental and social system, using resources and emitting carbon oxides, noise and light, as well as affecting the landscape and the natural ecosystem.

Airports are both following demands (connectivity and networks of airlines) and generating demand (attractiveness to passengers and service providers), putting them in an influencing role for sustainable growth and responsible governance. The focus of the student thesis is to highlight the relevance of airports within the aviation system concerning managerial practices to affect the environmental behavior of stakeholders (airlines, passengers, visitors, employees, service providers).

- Environmental impact of airports:
  - Emissions (Noise, carbon)
  - Water consumption
  - Waste/energy management
  - Wildlife, heritage & landscape

- Externalities:
  - Community impact
  - Airport Collaborative Decision Making (A-CDM)
  - Modal split: air-ground-air hubs (Integration)

- Managing the impact:
  - Incentive schemes (fees, charges, duties)
  - Public relations
  - Long-term planning

7.2. Research Objectives
- Understand the impact of airports on local/regional landscapes and communities
- Describe the relationship/integration between airports and mobility stakeholders
- Evaluate the options to manage the airport infrastructure in an economically and environmentally viable manner
- Identify the elements of long-term planning vs. short-term success/impact regarding sustainability efforts
- Identify best practices around the world regarding energy management and emission reduction
- Develop recommendations (short and long-term) for airports to realize sustainable aviation
7.3. Required skills
This research project requires strong skills in strategy and management, with a focus on infrastructure management, regional economics, and public management. Students should have analytical and conceptual skills as well as a keen interest in technological topics.

7.4. Literature

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