

Food waste management taking off?

Exploring prevention and treatment strategies of food waste in the
airline industry: A case study on SAS

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Abstract

Airlines face significant challenges when it comes to sustainability. Globally, the airline industry is responsible for 2% of global emissions and, unfortunately, this number is only increasing (Air New Zealand, 2018). This makes aviation a key actor when attempting to meet the targets published by the IPCC of keeping the global average temperatures below 2°C of pre-industrial levels (IPCC, 2014). Without the potential for an electric airplane in the near future, the challenge for the airline industry is finding ways to be more sustainable despite such a carbon intensive industry, primarily due to aviation fuel. Food waste in the airline industry remains a largely unexplored topic despite the airline industry calling for a pivot to more sustainable behaviours, in part because the industry has been historically slow to incorporate more sustainable tactics. This thesis therefore outlines the current barriers facing the airline industry when it comes to food waste management prevention and treatment strategies by using a case study approach. The selected case study of Scandinavian Airlines System (SAS) gives insight to where food is most often can be wasted along the production chain, why this occurs, as well as how stakeholders are involved and interact along this supply chain. To answer the research questions, an in-depth literature review was conducted consisting of policy documents, sustainability reports, research studies and stakeholder websites, supported by 15 semi-structured interviews, which were used to inform and analyse the data. The evaluation of strategies used by SAS for prevention and treatment options were evaluated based on a framework constructed from components and recommendations from ISO 14001, FUSIONS, IEnvA, Food Loss and Waste Protocol, Zero Cabin Waste and Sustainable Aviation. These were chosen as they outlined the crucial elements for a successful and wholistic airline waste management system. The findings revealed that although SAS is ahead of its competitors when it comes to prevention, there are still techniques that can be implemented to improve its strategy in regard to the treatment options. Information from competitors was also compiled to provide comparisons and inspiration. The work concludes with recommendations of continuing innovation, appointing a waste management leader, increasing communication and improving industry collaboration. SAS has the chance to save more food from becoming waste, while simultaneously saving money and improving their brand.

Keywords: Food waste, waste prevention, waste treatment, supply chain analysis, airline industry, stakeholder analysis, sustainable consumption

Executive Summary

Problem definition

Food waste is generated at each step of the supply chain and has devastating environmental, economic and social repercussions: “roughly one-third of food produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tons per year” (Gustavsson, et al, 2011). Yet food waste specifically within the airline industry has been largely unexplored. This research highlights the knowledge gap regarding the quantity of food wasted on airplanes. The case study analyses a regional airline, SAS, to assess how their stakeholders interact, how food moves through their supply chain and where the biggest barriers exist regarding food waste for their company. The Swedish customer has been identified as highly informed on climate change-related issues and thus, is more willing to care about the sustainability tactics of SAS. Consequently, SAS needs to improve all aspects of their supply chain in order to compete with other regional transportation options since other aspects of aviation are not expected to become more sustainable.

Swedish context

In Sweden, the desire to fly has been decreasing, especially for domestic flights, the primary market for SAS. The reasoning behind the drop in domestic flights is due to the rising concern of Swedish citizens regarding climate change and the negative environmental consequences of flying. “In a recent survey, a quarter of Swedes said they had decided not to fly to save the planet” a term now called “flyshame” (Broom, 2019). This change in behaviour, even if it is just within Sweden, highlights the importance for airlines to be as environmentally friendly as possible in all aspects of their business. Airlines will increasingly have to compete with other forms of transportation as the Swedish government recently “adopted a national plan for infrastructure for the period 2018-2029. It is a total investment of SEK 700 billion and the largest railway investment in modern times” (Government of Sweden, 2018). This is impactful as the Swedish government wants to encourage citizens to commute more sustainably. This is a call to action for airlines to improve their sustainability tactics to maintain and attract customers.

RQ(s) & Methodology

The following questions were posed to determine the current impact of food waste from airlines and provide important insights for the industry to understand where food waste occurs despite the gap in knowledge. Simultaneously, this work can help promote awareness regarding the problem of food waste amidst an industry known for its destructive environmental actions. With this objective in mind, the following research questions were crafted.

RQ1: What are the underlying barriers facing the airline industry when it comes to food waste management and how does Scandinavian Airlines System (SAS) approach food waste management? With the SUB RQ: What does the food supply chain look like for an airline and where does waste occur?

To answer the first RQ questions, a literature review was completed to provide context and 15 semi-structured interviews, some in-person and some over the phone, were conducted involving influential stakeholders in the industry to determine the validity of the conclusions found in the literature review. A case study approach was used to provide a more in-depth understanding of the problem and how the stakeholders interact together. The main stakeholders observed were the three most relevant: the airline, airport and the catering company, as well as the suppliers, municipality, customers, and the International Air Transport Association. These interactions were mapped out to determine how they interrelate within the different rules and regulations.

RQ2: *Are the current practices used by SAS to prevent and treat the amount of food waste the best strategies available?* Followed by the SUB RQ2: *What are the potential next steps that SAS can pursue in lowering the amount of food waste?*

Research question two was addressed through a constructed conceptual framework to analyse the qualitative data and a scoring criterion were created to rate SAS on their waste management strategies. The framework contained components of ISO 14001, FUSIONS, IEnvA, Food loss and waste protocol, zero cabin waste and sustainable aviation. Each element of the framework was crafted to show perspectives from governments, environmental management systems, regionally produced documents, and airline-specific agencies to holistically evaluate the strategies of SAS. The sub-question combined the missing factions of the framework along with other actions that have taken place in the industry among competitors. Based on the suggestions pulled from industry, government and universally used standards, combined with using SAS as a lens of reference, it was determined if the strategies employed were useful and where improvements could be made.

Findings & Conclusions

The literature review indicated a knowledge gap regarding the amount of data collected from deplaned food waste. This demonstrates the need for additional data to help inform decisions made by the industry and draw attention to the issue. Based on the available data deplaned food waste makes up 9-32% of the total waste found on board. The reasoning behind the large range is due to the length and type of ticket purchased. The data showed that most waste occurs in long-haul flights and with first-class passengers. This is logical as many airlines have abandoned serving meals on shorter domestic flights and more food is served over longer distances. With the average waste generated per passenger calculated at 1.43 kg and taking an average of 20% food waste from that total, 0.286 kilograms or 200 g remains of wasted food. This is roughly equivalent to the weight of an average cup of coffee per person. Therefore, it could be assumed that when calculated at scale these seemingly small numbers add up quickly and produce large amounts of unnecessary waste in food, money, and resources. Even if the deplaned waste is recorded the information is typically kept internally and not recorded in sustainability reports due to the desire to maintain a competitive advantage. However, in an industry that is notorious for poor environmental impacts, it will become increasingly more essential for airlines to improve other aspects of sustainability as electric airplanes are not on the horizon and especially for SAS, train options are expected to become more readily available. Especially considering that other airlines have worked with their local government to either donate or reuse food that would have otherwise gone to waste.

The literature indicates that the terminology and methodology, regulations, customer perceived needs, difficulty forecasting, time-sensitive constraints, lack of leadership, poor communications between stakeholders and financial barriers all lead to blockages of improved prevention and treatment of waste management systems. These barriers stem from a need to uphold health and safety concerns, navigate inconsistent legislation, a lack of incentives to promote airline change, and overall a lack of data to accurately portray the scale of the problem.

The case study revealed that SAS has impressive preventative strategies to reduce food waste including scaling up their pre-booking and tracking the amount of food consumed on board to forecast the food needed more accurately. However, there are still many ways SAS can improve their strategies. Some include enhancing collaboration within the industry to promote regional improvements, communication with important stakeholders, electing a food waste champion and putting importance on innovation. Due to industry barriers, treatment options remain difficult to overcome. It is no surprise that SAS has focused on prevention as it is something they can directly control compared to treatment options, which are more difficult to influence. Although improved treatment options can be difficult it does not mean that SAS cannot attempt

to make changes. Tactics from competitors were analysed to see where SAS could improve and where they were demonstrating advanced waste management options. The competitors observed were as follows; Norwegian Air, Lufthansa, TAP Air Portugal, Virgin Australia, Air New Zealand and Gatwick Airport. Competitors like Air New Zealand, and Virgin Air have found ways to work with the local government to recategorize or donate their deplaned food. Top suggestions include SAS publishing their food waste data to maintain accountability and attempting to be an industry leader when it comes to waste management strategies to retain customers. Saving food can save SAS money, improve the brand image and help save valuable planetary resources. The framework showed that SAS has gained a rating of “achieved” mostly green (3/6) while meeting satisfactory requirements (2/6) (presented in the colour yellow) but also had (1/6) with significant room to improve (red).

Recommendations for airlines

Within the recommendations proposed there are small and large steps that can be taken to address the identified areas for improvement. For example, as data collection and distribution of deplaned food waste data is largely absent to the public, reporting the data already collected internally is a straight forward step that can signal transparency to consumers. The key recommendations for the selected case study and potentially other airlines are as follows; promote innovation, appoint a waste management leader, prioritize industry collaboration and strengthen communication.

Recommendations for customers

Recommendations for a consumer includes contacting the airline to communicate the importance of improved waste management and request that data be reflected within the sustainability report to ensure progress with visible actions they can implement to improve. Consumers that communicate that they are unwilling to fly because of environmental reasons could push airlines to implement environmental action more quickly to retain customers.

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Abbreviations

'AEA' -Association of European Airlines

'FLW' - Food Loss and Waste

'HACCP' - Hazard Analysis and Critical Control Point

'IATA' - International Air Transport Association

'ICW' - International Catering Waste

'IEnvA' – IATA Environmental Assessment

'IFCA' - International Flight catering Association

'FUSIONS' – Food Use for Social Innovation by Optimising waste preventioN Strategies

'SaMMA' - Samverkegruppen för minskat matavfall

'SAS' - Scandinavian Airlines System

'SDG' – Sustainable Development Goals

1 Introduction

1.1 Background

Wasted food is a problem on a global level and deserves the attention of the international community as reducing waste can improve “the economy, food security and the environment” (Clowes, K., Mitchell, P. & Hanson C., 2018). Currently, “roughly one-third of food produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tons per year” (Gustavsson, et al, 2011). This means that if food loss and waste were a country it would be “the third largest emitter after China and the United States in greenhouse gas emissions” (FAO, 2015). Food waste is generated at each step of the supply chain and has devastating environmental, economic and social repercussions. Food production, transportation, delivery and treatment requires significant environmental inputs like water, land and energy; thus, it is not just the food wasted itself but the combination of all of the environmental resources that go into producing the food for consumption that can negatively impact the environment. With increased pressure to negate the harmful impacts of climate change, shifting the food system to conserve existing resources and incorporate better food waste prevention practices remains important to ensure the food supply chain is as efficient as possible. Furthermore, beyond the environmental consequences, there is a clear economic downside for wasting food as well—“food loss and waste amounts to economic losses of \$940 billion worldwide per year” (Clowes, 2018). Addressing food waste is thus critical to reducing the climate impacts and resource efficiency of the food industry.

Although the gravity of the problem is clear, there is still limited research on the exact quantities of food waste globally and also within the specific context of Europe. The European Commission requested estimates of food waste from different sectors to more fully understand where the most waste was occurring in an attempt to find preventative solutions. In coordination with other researchers, the EU compiled their data and found that household waste captured the biggest portion of waste with 53% followed by food processing (19%), food service (12%), production (11%) and wholesale and retail capturing 5% of the waste (Stenmarck, et. al, 2016). A study from 2010 within the EU indicated that the catering and the food service sector in Sweden produced 298,880 tons of food waste compared to Germany in 2009 with 2,000,000 tons per year (Marthinsen, et. al, 2012). Concrete data is lacking within the larger global context, which radiates down into the smaller sectoral studies, although efforts within the EU have spurred quicker action to measure food waste. The topic needs to be better understood within the academic community to determine the most impactful changes; especially, at a global scale where the overarching problem of food waste has yet to produce the scale of data needed to fully grasp the problem.

Transitioning from a global and regional perspective, there is also limited food waste data collected within the transportation industry. Transportation includes many forms; defined under the international catering waste (ICW) it covers cruise ships, airlines, commercial yachts and boats, ferries armed forces ship and submarines (International Air Transport Association, 2018). Yet “most of the studied ferry ship operators (over 70%) do not mention food waste, sewage or grey water on their website” (Wilewska-Bien, M., Granhag, L., & Andersson, K., 2018). In the cruise ship industry, most food waste is discharge into the sea, making it difficult to track waste. It is estimated that cruise ships can generate “up to 3.5 kg of waste per day” per passenger demonstrating the large quantity of waste produced within another mode of transportation (Wilewska-Bien, et al., 2018). Within the example of ships, most food waste is discharged into the sea (Wilewska-Bien, et al., 2018). Although, one example shows a major ferry company transporting the food to a biogas plant (Wilewska-Bien, et al., 2018). Unfortunately, the full

extent of the number of the total waste produced in this sector remains largely unexplored in the current literature although it is assumed that transportation activities produces a significant amount of food waste. However, in other transportation sectors, such as airlines, food waste must be disposed of in existing facilities and could be more easily measured. The following section explores how food waste is addressed through the lens of the airline industry.

1.2 Problem definition

Compared to the global data on food waste or even within the sector of transportation, the amount of food collected in comparison within the airline industry is a comparatively small. That being said, food waste within the airline industry still accumulates, daily and all over the world, demonstrating the need to understand how this problem can be addressed. One study indicated that an airport with even 75 flights per day required 25,000 catering trays, and due to the scale of service it produced 10 tonnes of mix waste (Jones, 2004). The figure did not include the other “40,000 single items per aircraft (including linen/ napkins, headrest covers, blankets, newspapers, headsets, etc.), [that] may need to be sorted, cleaned, polished, refurbished, or discarded” (Jones, 2004). Though small compared to the scale of other environmental problems within aviation, the degree of waste collected remains relevant if the industry is expected to improve in all facets of sustainability.

Climate action within the airline industry primarily focuses on environmental issues like lowering carbon dioxide emissions, improving fuel efficiency, decreasing noise pollution or reducing energy consumption (Pitt, et al, 2002). Despite these important environmental issues, “large volumes of waste from aircraft and from airport activities are often equivalent to those of small cities” (Tofalli, et al, 2017). Catering on airplanes has been associated with flying since the inception of the aviation industry and yet, rarely customers on board rarely eat all the food they are given, which leads to food waste on a large scale (Sambo, N. P., 2018). Airlines do not want to diminish the luxury of travel and want to provide food to elevate the experience for their customers. Driven by the financial incentive to sell food onboard airlines have continued to provide food to meet consumer demands.

Gate Groups Annual Report (2018) found:

Even today, air passenger traffic is projected to double within the next fifteen years and expectations for a diverse food offering are on the rise. The in-flight catering services market is expected to grow at an average growth rate of 5% per year and reach a market size of US \$18 billion by 2021. (p. 6)

Data on food waste within the aviation industry has yet to take off despite the extensive reach of the industry in Europe. Overall, some data was collected based on the average of long haul and shorter flights. The International Air Transport Association, referenced from now on as IATA, indicated that “the sector generated 5.7 million tonnes of cabin waste in 2017” and projected that with current rates of growth for passengers “this waste volume could double in the next 10 years” (IATA, n.d.). It is important to note that within these 5.7 million tonnes the IATA reported they are not able to discern what portion of the cabin waste is specifically food-related. The United Nations outlined all the most pressing issues within sustainability and created targets to achieve by 2030, which resulted in 17 Sustainable Development Goals (SDG). The IATA expressed that “the sector is also keen to demonstrate its contribution to the United Nations Sustainable Development Goals (SDGs) including Target 12.3 which calls for a 50% reduction in food waste by 2030” (IATA, n.d.). The IATA recognized that the industry is not on track to meet the set goal, meaning that significant work will have to be done to reach the target. For the IATA to meet their desired goals of 50% food waste reduction it would be important to gather data on how much food is collectively being wasted. Furthermore, the goals of the UN the International Air Transport Association, the Swedish Government and several

airlines regarding food waste indicate that there is a clear appetite for better food waste management systems even despite a lack of data on the broader implications of the problem.

The average weight of food waste per passenger was 1.43 kg (low 0.82kg-high 2.50kg) and this data was collected from 17 flights with 3,721 passengers at the London Heathrow Airport. (Cabin Waste Activities, 2014). Sealed food and beverages made up 18.5% of the total weight (Cabin Waste Activities, 2014). Initially, a seemingly low weight per person begins to add up when looking at the total food waste collected. Food waste data is typically underestimated instead of overestimated and lacks industry-wide definitions of what constitutes food waste (A. Stenmarck, personal communication, June 25, 2019). For example, would a banana peel count as inedible? Furthermore, research studies generally include how they arrive at the amount of waste collected, however airline sustainability reports often do not include definitions of terminology or explicitly describe the collection methods used. This is an important factor to note when observing the numbers collected and comparing various studies. Waste management strategies, although seemingly unimportant to most airlines, have the potential to uncover both environmental and financial benefits. The waste composition and the scale of waste have only recently become a topic deemed worthy of study. Catering companies and airlines are now beginning to understand the importance of understanding their waste stream in order to improve the system. SAS, a company motivated to improve and proud of its sustainability achievements, was selected as a case study to understand how they prevent and treat their food waste.

1.2.1 Scandinavian Airlines System (SAS)

SAS, a leading airline in Scandinavia, employing a team dedicated to the environment and corporate social responsibility as well as integrating environmental consideration still lacks information regarding food waste and only makes limited mentions of food waste in their sustainability report (SAS Sustainability Report, 2018). One of the few mentions suggests that “plastic and food waste have also been significantly reduced by our pre-ordering meal services that ensure the correct amount of servings are taken onboard” (SAS Sustainability Report, 2018). Pre-order meals are the main focus of minimizing waste based on the report as the pre-order service is identified as expanding in the near term. However, there is no indication of whether SAS is tracking the amount of waste or how they are determining the effectiveness of the concept. With lower numbers of meals, it is assumed there is less waste. In the report, SAS identifies that they are working to improve “recycling of onboard waste, although this is challenging as waste must be handled in accordance with national legislation” which often requires waste treatment that “does not enable sorting and recycling” (SAS Sustainability Report, 2018, p. 13). The sustainability report does not specifically mention the legislation to which they are referring to but is assumed to be the international regulation under EU Regulation 1069/2009 (expanded upon in section 3.3.2). Based on the limited information on food waste available in the sustainability report this paper aims to understand the Scandinavian context, understand the factors that play a role in shaping how Scandinavian Airlines System handles their food and map the process to identify potential areas for improvement. The case study of SAS was chosen to further explore food waste in the aviation industry and contribute to the knowledge gap in this area because even an airline with stated intention to support sustainability and corporate responsibility nevertheless lacks sufficient coverage of the food waste issue.

1.2.2 Sweden’s Context

The International Civil Aviation Organization has identified that the number of passengers carried with global air transportation since 1970 has increased from less than 0.5 billion to 4 billion by 2015 (World Bank, n.d.). However, in the context of Sweden, a recent article produced

by the World Economic Forum has indicated that in Sweden the desire to fly has been decreasing, especially when looking at domestic flights. The reasoning behind the drop in domestic flights is thought to be the rising concern of Swedish citizens regarding climate change and the negative environmental consequences of flying. A recent survey found that “a quarter of Swedes said they had decided not to fly to save the planet” a term now called “flyshame” (Broom, 2019). This change in behaviour, even if it is just within Sweden, highlights the importance for airlines to be as environmentally friendly as possible in all aspects of their business. As well, airlines will increasingly have to compete with other forms of transportation as the Swedish government recently “adopted a national plan for infrastructure for the period 2018-2029” which includes “a total investment of SEK 700 billion and the largest railway investment in modern times” (Government of Sweden, 2018). Increased rail travel and sustainable commuting will negatively impact the market for air travel. The pressure to have a more sustainable business will become more important as “airlines are limited in what they can do because an electric aircraft could take a decade or two” (Interview 4, 2019). With jet fuel emissions producing most climate change inducing emissions analysing other factors that go into the business-such as waste management-can give airline companies a competitive advantage. Reducing food results not only in preserving resources for the sake of the environment but it also offers a financial incentive to cut costs if less food is ordered or if less needs to be disposed of. However, determining how much food waste is collected on airplanes compared to the total waste produced on flights has not been a priority for the industry so far resulting in limited data on the subject.

1.3 Research Questions

Although food waste is widely acknowledged to be a serious issue, both at the global level as well as in specific sectors such as the aviation industry, there remains a knowledge gap. This thesis aims to contribute to this gap by assessing the food supply chain in the aviation industry to support improved waste management strategies and clearly outline the barriers, not only for SAS, but other airlines.

1. RQ: What are the underlying barriers facing the airline industry when it comes to food waste management and how does Scandinavian Airlines System (SAS) approach food waste management?
 - a. *SUB RQ: What does the food supply chain look like for an airline and where does food waste occur?*
2. RQ 2: Are the current practices used by SAS to prevent and treat food waste the best strategies available?
 - a. *SUB RQ2: What are the potential next steps that SAS can pursue in lowering the amount of food waste?*

1.4 Concepts and Terms

Food waste occurs in different places within the supply chain when observing high-income countries and low-income countries. Within the high-income nations, the most waste occurs later in the supply chain at the consumer level, while developing nations have the most food waste losses during the earlier phases of the supply chain (The Eat-Lancet Commission, 2019). Food waste is not the only type of waste leaving airplanes (IATA - Cabin Waste., n.d.). However, the scope of this paper will focus on the content of food waste streams.

Table 1-1. 'Key definitions'

| | |
|--------------------------------|---|
| Food | “Any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be eaten by humans. ‘Food’ includes drink, chewing gum and any substance, including water, intentionally incorporated into food during its manufacture, preparation or treatment” (Stenmarck, et. al, 2016). |
| Deplaned food waste | “A specific type of MSW that is removed from passenger aircraft” (Pitt, et. al, 2002, pg. 6). Deplaned food waste is the organic matter that is discarded when a plane arrives in the airport. There are two types of food waste that exit a plane (1) cleaning waste and (2) catering waste” (Pitt, et. al, 2002, pg. 6). |
| Cleaning waste | “Leftover rubbish from items given to passengers on the aircraft such as newspapers, paper towels, plastic bottles, food dropped on the floor, amenity kits and plastic wrapping from blankets, pillows and headsets” (IATA Cabin Waste., n.d.). |
| Catering (galley) waste | “Comes from inflight meals, snacks and beverages served to passengers and can consist of leftover food, drinks and packaging which is placed back in the trolleys, in static or compactor bins. This waste can contain high volumes of liquid from unconsumed beverages and ice” (IATA - Cabin Waste., n.d.). |
| Food supply chain | “Is the connected series of activities used to produce, process, distribute and consume food. (Stenmarck, et. al, 2016). |
| Prevention | “Measures taken before a substance, material or product has become waste, that reduce: (a) the quantity of waste, including through the re-use of products or the extension of the life span of products; (b) the adverse impacts of the generated waste on the environment and human health; or, (c) the content of harmful substances in materials and products” (The Waste Framework Directive, 2010). |
| Re-use | “Any operation by which products or components that are not waste are used again for the same purpose for which they were conceived” (The Waste Framework Directive, 2010). |
| Preparing for re-use | “Checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing” (The Waste Framework Directive, 2010). |
| Recycling | “Any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. Includes the reprocessing of organic material but not energy recovery or the reprocessing into materials that are to be used as fuels or for backfilling operations” (The Waste Framework Directive, 2010). |
| Recovery | “Any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy” (The Waste Framework Directive, 2010). |

| | |
|-------------------|---|
| Disposal | “Any operation which is not recovery even where the operation has a secondary consequence, the reclamation of substances or energy” (The Waste Framework Directive, 2010). |
| Category 1 | This type of waste is designated for flights from outside the EU and is considered a high-risk due to the “spread of animal diseases exists, being dangerous to animal and human health if not properly disposed of” (Blanca-alcubilla, et. al., 2018). |
| Category 3 | This category is reserved for catering waste on flights within the EU (Blanca-alcubilla, et. al., 2018). |

Source: From Stenmarck, et. al, 2016; Pitt, et. al, 2002, pg. 6; IATA - Cabin Waste., n.d.; the Waste Framework Directive, 2010

1.5 Limitations & Scope

1.5.1 Limitations

As this thesis was not done in tandem with SAS as a company there was a limitation in collecting the quantitative data. This limitation is discussed further in the ethical section as it was legally not plausible for SAS to give up their internal data. That being said, this prevented exact data to be collected in order to understand the full extent of the deplaned food waste produced from SAS flights.

Another limitation was missing perspectives from certain stakeholders. No SAS customers or investors were interviewed to learn about their preferences regarding the food wasted on flights. This could have provided more depth to the results and given important insights to SAS on how food waste ranks compared to other sustainability initiatives as a customer.

Selecting a case study with a narrow scope provided a more in-depth analysis, but it is also a limitation since it cannot necessarily be applied to other airlines, or regions due to the complexity of the interactions between the stakeholders and national legislations. The limitations of the case study will be explored further in the methodology section.

1.5.2 Scope

To address the first research question, the scope of the literature review included global airlines to gain perspective on their strategies and communicate the limited data available. For the second research question, the scope was narrowed to look specifically at the context of the case study. This approach examined the strategies of SAS, analysing their domestic operation and relationships with their stakeholders including the Stockholm-Arlanda airport, the Sigtuna municipality, Gate Gourmet and SAS customers. This geographical scope was selected based on the author’s location and ability to conduct in-person interviews. The geographical scope was prioritized for this research as Scandinavia is known internationally to have high standards when it comes to environmental goals. With highly educated consumers and long distances between large cities in Sweden, it presents an interesting case to analyse. A domestic approach focusing on the SAS hub in Stockholm was selected since SAS has 280 destinations worldwide and understanding the supply chain in each destination with different regulations was beyond the allocated time commitment for the research project (Destinations within Scandinavia, Europe, Asia & US, 2019). The domestic lens provided a more holistic view of SAS with more in-depth information regarding the waste management system at the Stockholm-Arlanda Airport and the municipality of Sigtuna. When looking at the supply chain for food at SAS, the scope excluded the food produced in the SAS airport lounges, ground service, technical maintenance, cleaning waste and the SAS headquarters. The food waste produced by the

catering company, transported to the airplane, and then back to the catering company was analysed.

1.6 Ethical Considerations

Each participant volunteered to participate and was informed regarding the aim of the thesis (see Appendix for an interview guide of introduction). The interviewees were asked if they could be recorded for note-taking purposes and it was communicated that material would be deleted after submission; Their wishes were respected if they declined to be recorded and the names of each participant were kept anonymous. The interviews contained a mix of notes, transcribing and email correspondence to meet the needs of each participant. All contact information, interview recordings, and notes were collected and stored in an offline location to ensure confidentiality. All interviewees were treated with respect and their wishes were followed.

It is important to mention that no specific data was revealed by SAS regarding how much food waste was collected from the catering process and the methodology used for their collection. SAS did not allow the request to interview their catering company about SAS related questions. Unfortunately, they also did not grant permission to disclose sensitive information including how many food products were carried by the airline or who their suppliers were. Interviewee 1 explained that the data was restricted due to the operational strategy and the need for the information to remain confidential. This in itself was an indication of the level of competition within the industry, which will be discussed further in the findings section. It was explained that this level of caution was necessary due to the large number of resources SAS has invested in securing suppliers and the catering company to manage their product. SAS explained that the interview with Gate Gourmet could not contain any information about SAS. The wishes of SAS were granted and extra care was used when interviewing Gate Gourmet to only include questions that dealt with food waste in their supply chain generally.

1.7 Audience

SAS, other airlines and relevant stakeholders can use the findings of this research to improve their prevention and treatment strategies when it comes to food waste. The findings from this thesis can benefit SAS by gathering perspectives from their catering company, flight attendants, industry members like IATA and competitors to provide a more holistic picture of their waste management strategies. Second, consumers can seek to improve their knowledge about the topic and understand how to use their collective voices to motivate airlines to make important sustainability improvements within their business. As the industry has several barriers making this topic difficult to overcome, the results can help identify main themes that should be addressed. For example, working together as an industry in tandem with policymakers to overturn ineffective laws could help improve treatment strategies. Third, this thesis seeks to be a call to action or provide a framework to help other airlines evaluate their strategies. Further research is suggested to help standardize terminology, methodologies and encourage data to be collected to fully understand the gravity of the problem. Overall, this topic is relevant to industry members, academia and customers as it fills the information gap regarding the supply chain of deplaned catering food waste and by also issuing a conceptual framework to evaluate the overall sustainability efforts of an airline.

1.8 Disposition (Outline)

The contents of the research paper are as follows:

Chapter 1 gives essential background information for introducing the topic of food waste starting from global impacts, to regional, to country and industry-specific. The research

questions are presented in this chapter along with the concepts, terms, limitations, scope, ethical considerations and intended audience.

Chapter 2 presents the method of a case study and explores how the data was used to arrive at the results. This chapter also includes an outline for the reasoning behind selecting specific components of the framework.

Chapter 3 communicates relevant information found in the literature regarding the background information on the airline industry and how SAS fits into the context of the industry. It also delves into the known information regarding catering food waste. The industry barriers are also examined to provide understanding as to where food waste occurs in the first place.

Chapter 4 presents the overall findings; the case study of SAS, key insights from the interviews, how competitors are working to improve and the stakeholders relevant to SAS and a map of the food waste moving through the supply chain.

Chapter 5 evaluates SAS when measured under the categories established by the framework to determine if SAS achieves the best available practices for waste management with recommendations for both the industry and consumers.

Chapter 6 concludes with the main findings, while also providing examples for continued important research.

2 Methodology

This section describes the reasoning behind the selected methodology. The first step included conducting a literature review looking at sustainability reports from airlines, airports, and catering company websites, as well as, policy documents and academic articles. After understanding the context within the airline industry and pulling out the main barriers leading to ineffective prevention and treatment strategies, a case study approach was selected to provide a more in-depth perspective. From there, interviewees were selected based on their roles and expertise. Overall, this section outlines the step-by-step process that led to the results. Specifically, why a case study approach was selected, how the data was collected, the limitations and strengths, and the tools used for data analysis. A mixed method approach was used combining the literature review with interviews to legitimize the findings recorded in the literature review.

To address the first research question, *“What are the underlying barriers facing the airline industry when it comes to food waste management and how does Scandinavian Airlines System (SAS) approach food waste management?”* a case study approach was selected. The intention was to focus on this one company’s strategy to more holistically understand the influence of the airline industry and determine how the company of SAS is impacted when making decisions that shape their current and future strategies for the prevention and treatment of food waste. The *first SUB RQ* was answered through descriptive interviews and literature on the subject, resulting in a flow chart of the steps where food waste could occur.

An analytical framework was constructed to answer the second research question, *are the current practices used by SAS to prevent and treat the amount of food waste the best strategies available*, six different systems were used to determine if the current techniques from SAS compared to the best food waste saving practices presented in these systems to measure food waste. This framework, made up of six different checklists was rated on a scale of the significant room to improve, satisfactory and achieved. The author evaluated each component of the criteria based on the literature and interviews. On some occasions, it was explained in interviews that SAS was taking the proper actions but this could not be confirmed by external information, in which case it was assumed that the interviewee was reflecting the information accurately. Each tool was measured by using the checklists produced by the company and most often specifically created with the intention to be utilized by the industry. The main components of the rating system include evaluating how many achievements SAS has made when looking at the checklists or international standards offered in most components of the framework. A type of criteria was created to evaluate the strengths and weaknesses of SAS.

To answer the *second sub RQ of the potential next steps that SAS can employ to lower their food waste* a chart was made for improvements categorized into technological, institutional, legislation and policy and social options. This was followed by four main suggestions consolidated from the variety of options presented to showcase potential options for airlines.

2.1 Case Study

2.1.1 Justification for SAS case study selection

The case study method was selected because SAS was identified by background research to be the most environmentally driven, medium-sized, regional airline within the EU. For context, the Lufthansa Group is considered to be a large airline with 142.30 million passengers compared with the 30 million choosing to fly with SAS (Lufthansa Group AG, 2019; SAS Sustainability Report, 2018). Furthermore, SAS was selected due to their commitment to environmental initiatives and a customer base from a geographical region that prides itself on being environmentally aware. Some Swedish people are already transitioning to taking the train as a response to climate change

and the government remains a proactive force for promoting sustainability. More background information for the selection of the case can be found in the Literature Review section.

The system boundaries include SAS and their relevant stakeholders. The literature review and interviews highlighted the importance of each stakeholder; the catering company, in this case, Gate Gourmet, the airport, Stockholm-Arlanda, the municipality, IATA, customers, and competitors that all shape how SAS conducts their business. The findings section explores how and why they influence SAS. Therefore, SAS is the unit of analysis when observing the airline industry's influence on food waste management. An inductive approach was used to analyse the non-qualitative information. An inductive approach or gathering data to find patterns to develop an analytical framework was used to analyse this research. The literature review and interviews helped identify patterns in the barriers and drivers that exist.

2.1.2 Strengths

A single case study was used to provide comprehensive information within the food supply chain to deduce similarities within the rest of the airline industry. The single case study provides an in-depth sample to inform the industry, added flexibility and results which are often more likely to be accepted by the people in the field (Verschuren & Dooreward, 2010, p. 185). By focusing on one example this research was able to capture the complexity of the stakeholders involved that would have been difficult to capture in a survey or quantitative manner (Yin, R. K., 2009, p. 19). Interviewing relevant stakeholders within the industry presented explanations and descriptions with real-life applications. It also gave an important perspective that was elaborated through interviews to confirm or deny information collected by the literature review.

2.1.3 Limitations

With any case study, it is important to recognize the limitations as sometimes it can be difficult to apply the findings in the context of SAS to other airlines in the industry (Verschuren & Dooreward, 185). This is a common concern recognized by the scientific community when conducting a research study on one specific case. The goal is to “expand and generalize theories” based on the case study (Yin, R. K., 2009, p. 15).

Due to the semi-structured manner of the interviews, it could be difficult to replicate the results exactly even with the care taken by the researcher to be as accurate as possible. With semi-structured interviews allowing for more flexibility between interviewees, it could also reduce the reliability of the case study. A total of 14 interviews were conducted to gather the data. It is important to note that more interviews would have given potentially more holistic results and the level of secrecy surrounding the industry made it difficult to determine accurate numbers on the catering waste collected. Each person communicated their findings to the best of their ability. That being said, there is also the potential for interviewer and interviewee to have misheard or misinterpreted questions or answers. With qualitative data, there is always a potential for human error or misunderstanding, although the interviewer took care to clarify or ask if the interviewee needed the question to be repeated. It is important to remember that one researcher conducted all of the interviews and analysis. This research gives perspective into how SAS manages its waste management strategies and cannot be applied to all airlines.

2.2 Data Collection

A mixed method approach was used to collect data to deliver the most reliable results possible. A literature review was conducted from websites, sustainability reports from airlines, airports and catering companies to determine the barriers and drivers of the current waste management systems. To understand the breadth of the problem quantitative catering food waste data was gathered from relevant reports in the literature review to inform the analysis. Policy documents

and academic articles were used to understand the context of the industry and food waste on a global level. Based on the key themes found in the literature, Chapter 3, covers the main barriers within the industry to inform the circumstances that SAS is operating under. Exploring the literature helped place SAS in the context of the industry and reveal key competitors.

Screening of candidates for the semi-structured interviews was determined based on the author's interpretation of who was the most informed, derived from the literature review, and their ability to help answer the posed research questions. Five groups were created to make up the interview sample: SAS employees, public authorities, direct SAS stakeholders, other airlines and external industry input. These selected interviews gave a diverse range of responses and expertise to provide insightful information on the selected topic. Ideally, more interviews could have further validated the findings but due to the time constraints, the 15 interviews provided the required information to answer the objectives set out in this thesis. Table 2-1 presents the stakeholders interviewed, when the interview was conducted, their title, as well as, the reasoning behind seeking out their specific knowledge. When conducting the interviews, the interviewer took care when asking questions to avoid introducing bias by taking careful notes and if the interviewee allowed it, voice recordings to ensure the quotations were accurate. Initially, when setting up the interviews, the interviewees either confirmed the time and date via email or agreed to answer questions when called. All interviewees were given the context, approximation of time required to answer the questions and prepared with how the information would be used after the interview.

Table 2-2-1. List of contacts interviewed'

| Stakeholders Contacted | Person Interviewed | Reasoning behind conducting interview |
|--|--|--|
| SAS | | |
| 1 Conducted on June 3 | Environment & CSR at SAS <ul style="list-style-type: none"> • In-person interview • Transcribed and recorded | Give background on SAS and clarify material presented in the SAS sustainability report |
| 2 Conducted on May 9 | Head of Environment & CSR Department at SAS <ul style="list-style-type: none"> • Phone interview • Notes taken | Give background on SAS and clarify material presented in the SAS sustainability report |
| 3 Conducted on June 11 | SAS Flight Attendant <ul style="list-style-type: none"> • Phone interview • Notes taken | Understand how SAS rules works in practice. |
| Public Authorities | | |
| 4 Conducted on June 7 | IATA Environmental Program Manager <ul style="list-style-type: none"> • Phone interview • Notes taken | Provide context for industry. Understand the regulations |
| 5 Conducted on July 4 | Sigtuna Municipality <ul style="list-style-type: none"> • Phone conversation • Notes taken | Provide context for supply chain. To what extent are they involved. |
| 6 Conducted on June 7 | IATA Analyst Sustainability and environment member for external relations of IATA <ul style="list-style-type: none"> • Email conversation | To provide perspective of food waste in the airline industry within the context of IATA. |

| Airline Stakeholders | | |
|-----------------------------------|---|--|
| 7 Conducted on July 2 | Gate Gourmet Scandinavia <ul style="list-style-type: none"> • Phone interview • Notes taken | Provide context for supply chain. Determine how the process works in practice and where is the most food waste occurring. |
| 8 Conducted on July 4 | Gate Gourmet in Madrid, Spain <ul style="list-style-type: none"> • Phone call and email conversation • Notes taken | To understand their participation with LIFE+Zero cabin waste and understand how SAS is perceived in the industry. |
| 9 Conducted on July 4 | Swedavia Airports (Runs Stockholm-Arlanda Airport) <ul style="list-style-type: none"> • Phone interview • Notes taken | Background understanding for their involvement in food deplaned food waste. |
| Other Airlines | | |
| 10 Conducted on July 18 | Air New Zealand Sustainability Consultant <ul style="list-style-type: none"> • In-person conversation (occurred already) • Follow up phone call • Notes taken | Compare with another sustainable, regional airline and determine SAS's reputation when it comes to food waste prevention strategies |
| 11 Conducted on February 21 | LSG Group Catering company for Lufthansa Airlines <ul style="list-style-type: none"> • Phone interview • Notes taken | Explore how other catering companies are treating the issue of food waste to compare to Gate Gourmet |
| 12 July 31 | Norwegian Air <ul style="list-style-type: none"> • Email conversation | Compare with another sustainable, regional airline and determine SAS's reputation when it comes to food waste prevention strategies |
| Industry Input | | |
| 13 Conducted on June 22 | Food Loss and Waste Consultant <ul style="list-style-type: none"> • Phone interview • Notes taken | To provide perspective of food waste in the airline industry. |
| 14 Conducted on September 2 | OzHarvest <ul style="list-style-type: none"> • Phone interview • Notes taken | Understand the method and coordination with the Australian government used to take uneaten food and redistribute it to people in need. |
| 15 Conducted on July 26 | Gatwick Airport Commercial Operations Manager <ul style="list-style-type: none"> • Phone interview • Notes taken | Provide insight for an airport to treat on-site Category 1 waste |

Source: Created by the author

2.3 Analytical Framework

In order to identify if SAS has an effective strategy for preventing and treating food waste, a framework, Figure 2-1, was constructed to determine if the company was performing well and where they could make improvements. The framework contained components of ISO 14001, FUSIONS, IEnvA, Food loss and waste protocol, zero cabin waste, and sustainable aviation.

Each element of the framework was crafted to show perspectives from governments, environmental management systems, regionally produced documents, and airline-specific agencies to holistically evaluate the strategies of SAS.

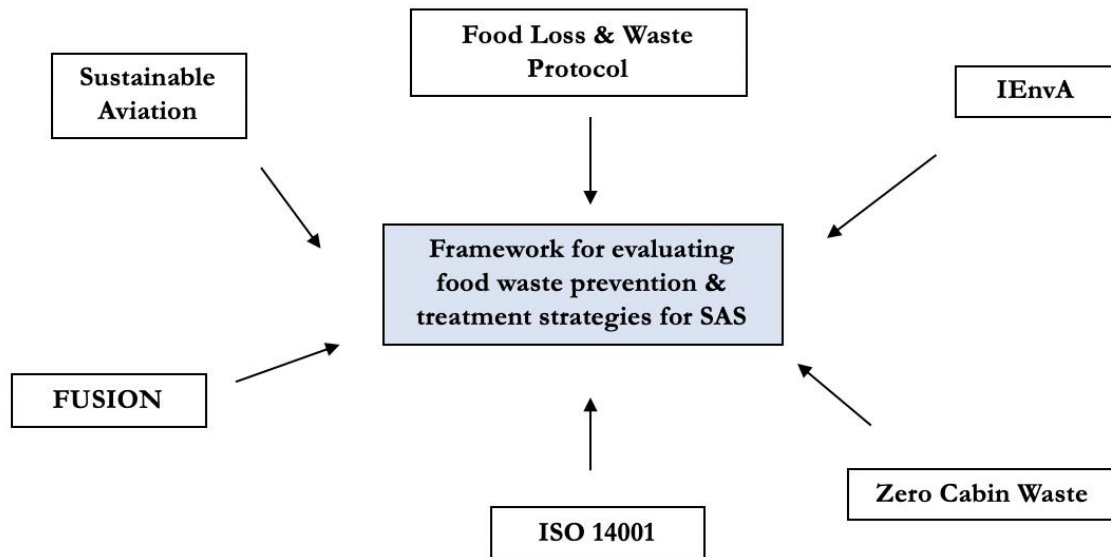


Figure 2-1. 'Analytical framework'

Source: Created by the author

Based on the framework presented above, a rating system was created to easily identify the progress of SAS. Each box was colour coded in the findings section with a rating of “achieved” presented as green, “satisfactory” as yellow, and “significant room to improve” represented by orange. To determine the sub question of *what are the potential next steps that SAS can pursue in lowering the amount of food waste?* A collection of recommendations was synthesized from the literature review, interviews and findings from the framework to provide insight into the best tactics to move forward as an airline and customer.

2.1 Justification of components in the framework

The following section describes each element within the framework to justify the importance of the selection and explain how it adds to the perspective of the case study. Other components of the tools listed below were considered. However, based on the limited access to the specific case study numbers and methodology a more rigorous and in-depth framework was not possible. ISO 14001, FUSIONS and the Food Loss and Waste category give less detailed instruction and were included to provide guidance to an airline wanting to start incorporating more sustainable waste management practices. Whereas IEnvA, Zero Cabin Waste, and Sustainable Aviation deliver more specific action items for an airline with more advanced waste management tactics. Both types of strategies were included to guide airlines, whatever their level of interest, to instigate improved waste management strategies.

2.1.1 ISO 14001

Due to SAS not releasing its specific catering food waste data and methodology of collection it is difficult to track the process that SAS has made, specifically when understanding the selected scope for the ISO 14001 certification. The reasoning behind selecting this tool for the framework was to analyse how SAS would perform based on the information collected from the interviews and literature review. For example, it was brought up that communication and training was an area that could use improvement. The plan, do, check and act system that ISO 14001 presents are important tools already used by SAS to aid their decisions and using it to direct their choices moving forward is extremely important. ISO 14001 was included in the framework because it presents the information that is missing in the external documents, giving SAS a chance to further their transparency. It is also relevant for other airlines that have not received the ISO 14001 certification and can hopefully direct their attention to see the value in the certification.

2.1.2 FUSIONS

The goal of the project FUSIONS from 2012 to 2016 was to work “towards a more resource efficient Europe by significantly reducing food waste” (About FUSIONS, 2016). FUSIONS had 21 project partners from 13 countries with a range of people delivering expertise in a variety of sectors from universities, research institutes, consumer organisations and businesses (Food Loss and Waste Protocol, 2016). The project was funded by the European Commission Framework Programme seven and ensured a “shared vision and strategy to prevent food loss and waste across the whole supply chain through social innovation” (About FUSIONS, 2016). Establishing data, synthesising information and recommending policy helped set a baseline for organizations to improve their food waste strategies. The purpose behind including the project in the framework was to present a method of how to measure the data. This is a key element when striving to produce accurate and reliable results.

2.1.3 IEnvA

The IEnvA is a program offered for free, is voluntary and acts as an airline-specific environmental management system that meets the ISO 14001:2015 standard, issued by the IATA. It offers airlines the opportunity to check off whether sustainability goals are meeting requirements and to reveal potential areas for improvement, as well as provide external assessments (IATA Environmental Assessment Registry, 2019). Selecting the IATA specific recommendations were an important addition to this lens of analysis to bring the perspective of the industry.

2.1.4 Food Loss & Waste

The food loss and waste protocol were created as a “multi-stakeholder partnership, which has developed the global food loss and waste accounting and reporting standard for quantifying food and associated inedible parts removed from the supply chain” (Food Loss and Waste Protocol, 2016). This international standard was deemed important as the industry has yet to establish solidified terminology and methods to account for food waste. Promoting this preestablished document that has been approved by experts ranging from the Food and Agriculture Organization of the United Nations (FAO), the United Nations Environment Programme (UNEP), the Waste and Resources Action Programme (WRAP), and the World Resources Institute (WRI) made the document relevant for the airline industry to draw inspiration and align their definitions (Food and Agriculture Organization of the United Nations & World Health Organization, 2000).

The specific section of the “guidance: accounting for and reporting on destination” was selected to help guide the selected case study airline, SAS, to improve the tracking of their waste streams.

This was considered to be crucial to SAS as the company focuses less on treatment due to the complexity and irregularity of the regulations across Europe. It was selected to provide insights for the airline selected in the case study as well as other airlines that are unsure of how to begin the process. The FLW Standard is extensive and with information on how the data is collected and the specific numerical food waste data, a more in-depth analysis could be conducted. However, as the case study did not offer specific data, only suggestions can be proposed. The FLW provides reliable information, which is why it was included in the framework.

2.1.5 Zero Cabin Waste

The literature review and interviews indicated the importance of establishing industry leaders to propel the industry to incorporate improved practices. The European Union funded this project to help establish data and understand the complexities of the issue. This project was selected to make up this framework as it remains influential within the industry. Not only does it bring attention to the problem and communicate that catering food waste is a problem in the first place, but the recommendations provide airlines with a process to improve their strategies.

The key stakeholders of Iberian airlines, Gate Gourmet, and Madrid-Barajas Airport are also relevant to the framework. As Gate Gourmet is an important stakeholder for the case study it gave important insights to explain how Gate Gourmet operates in different countries, offering new perspectives when analysing Gate Gourmet. An interview also identified Iberian airlines as a frontrunner within the industry giving the airline SAS analysed in the case study a potential leader to look to for inspiration.

2.1.6 Sustainable Aviation

The UK recognized the importance of distributing key aims for airlines flying into the UK. For this reason, the Sustainable Aviation was created in 2005 as a “long-term strategy which sets out the collective approach of UK aviation to tackling the challenge of ensuring a cleaner, quieter, smarter future for our industry” (Sustainable aviation, 2019). It was the first in the world to “bring together major UK airlines, airports, manufacturers, air navigation service providers and key business partners” (Sustainable aviation, 2019). Sustainable aviation produced the “aircraft cabin waste recycling guide” providing background information about what should be collected to recycle, the methods that can be used to collect the waste, the importance of communication, monitoring and feedback (Sustainable aviation, 2015). Each part was broken down into airlines, airports and cleaning companies. This collection of information helped inform the literature review and was therefore important to include when evaluating the case study.

The literature eluded to the fact that a few airports like Heathrow and Gatwick have been committed to sustainable waste management options. Heathrow participated in an audit and Gatwick Airport continues to make sustainable treatment options a priority. Thus, the recommendations offered by the UK government were identified as important to include in the framework. The recommendations offered a new perspective as it had specific action-items for each stakeholder involved.

3 Literature Review

This section contains the information gathered from websites of relevant airlines, airports and catering companies, along with sustainability reports, policy documents and research papers. The literature review is combined with the information articulated in the interviews to make up the conclusions presented in the findings section. Overall, the purpose of the literature review is to provide a more in-depth frame of reference giving context to the case study, explore the knowledge gap, and recognise the barriers that prevent food waste from meeting enhanced prevention and treatment strategies.

3.1 Airline industry background

This section explores how SAS, the selected case study, fits in with the European context. It provides the background on different European airlines in terms of passengers and the presence of the term “waste” mentioned in the websites or sustainability reports. Table 3-1 ranks the largest European airlines at the top of the table while comparing SAS and their waste management terminology paralleled to the smaller regional airlines like Norwegian and Wizz Air. It is impressive that when compared to much larger airlines SAS has a similar number of mentions, 23 (30 million), in their sustainability report, while Lufthansa only has 26 despite their much larger size (142 million passengers). The correlation between the number of mentions and a commitment to waste management is evident especially when looking at the SAS materiality analysis report. The report expressed that SAS as a company and its stakeholders first valued emissions, then waste and finally noise as relevant environmental issues that needed to be addressed (SAS Sustainability Report, 2018, p. 6). With SAS communicating that in their report that they believe that responsible business incorporates sustainability in the supply chain is an important factor to prioritize (SAS Sustainability Report, 2018, p. 6). SAS, as a smaller regional airline, could have more power to implement sustainability initiatives compared to a larger airline like Lufthansa.

The aim of Table 3-1 demonstrates how the industry was scanned and observed to see if waste was mentioned within the top airlines in Europe. It was assumed that if the report did not contain the word “waste” then it was not on the current agenda of the airline. However, mentioning the word waste alone does not necessarily mean that the company is reporting waste that is within the scope of this thesis. It is important to note that the term “waste” mentioned in the report could be referring to ground operations, the airport waste or waste from the corporate office. The keyword waste was used to provide a general insight into waste management within the airline industry within the scope of Europe.

Table 3-1. 'Top largest airlines in Europe from 2018 data'

| Rank | Airline | Subsidiaries | # of Passengers (millions) | # of times the term "waste" was mentioned in sustainability report | Source |
|------|-------------------------------------|---|----------------------------|--|---------------------------------------|
| 1 | Lufthansa Group | -Air Dolomiti -Austrian Airlines -Brussels Airlines -Eurowings Europe -Luftfahrtgesellschaft Walter -Lufthansa Cargo -Lufthansa CityLine -Swiss International Air Lines -Edelweiss Air -AeroLogic (50%) -SunExpress (50%) | 142.30 | 26 | (Lufthansa Group AG, 2019) |
| 2 | Ryanair | -Lauda -Ryanair Sun -Ryanair UK -Malta Air | 139.20 | 9 | (Ryanair, 2018) |
| 3 | International Airlines Group | -Aer Lingus -Anisec Luftfahrt -British Airways -IAG Cargo -Iberia -LEVEL -Vueling -Avios Group | 112.92 | 10* (Iberia is participating in the Zero Cabin Waste EU funded project and the Iberia report had 30 mentions) | (International Airlines Group, 2018). |
| 4 | Air France-KLM | | 101.45 | 1 | (KLM, 2017) |
| 5 | easyJet | | 88.04 | 0 | (easyJet, n.d.) |
| 6 | Norwegian Air | | 37.34 | 4 | (Norwegian, 2017) |
| 7 | Wizz Air | | 33.81 | 0 | (Wizz Air, 2019) |
| 8 | SAS Group | | 30.00 | 23 | (SAS Sustainability Report, 2018). |
| 9 | Alitalia | | 21.49 | 0 | (Alitalia, n.d.) |

Source: Created by the author.

3.2 Compiled food waste data

Based on the available data the following section showcased the knowledge gap by exposing the limited findings while demonstrating the need for more streamlined processes to measure and record data. The composition of the food waste found on board airplanes provides perspective on the percentage of waste from different types of flights. This compilation of data helps prescribe targeted solutions for future prevention strategies and provides a baseline understanding of the current waste streams. With limited background information, it can be difficult to understand the extent of waste produced and why it is created in the first place. Especially considering that the information is not readily available within the industry as most of the data was communicated by IATA audits and academia. Industry data would be extremely helpful to fill in the information gap. Data is important as it provides insight on where food waste occurs and sets a baseline for improvement. Thus, enhancing the solutions to be more specialized for each airline and helping the company improve its long-term goals. Before identifying the common barriers found in the sustainability reports, industry documents and the research papers, the data found in the introduction will be expanded upon to provide more information on the current food waste data.

Overall, food waste makes up around 5-32% (67% food waste is considered an outlier based on the other data available) of all catering waste with long-haul and first-class producing the most waste (Zero Cabin Waste, 2018). Table 3-2, communicates the findings presented from a study conducted from 1996-1997, which demonstrates the scarcity of the data if some of the only relevant data were collected before the 2000s, but overall it communicates the composition of what was measured. The data below was one of the first studies focusing on in-flight service composition. The leftover food (consumed) food contained the most waste in this specific study, indicating the importance of customer awareness to encourage passengers to not take food if they do not intend to eat it. In this way, unnecessary waste could be avoided and instead be donated or reused. Another realization presented within the study was that bread and beverages were among the most wasted items (Li, X. D., et al, 2003, p. 97). It is interesting to note that the researcher was interested in learning about the composition of the waste more than a decade ago but also shows that there was limited interest to devote resources to similar studies.

Table 3-2. 'Composition of food waste of long-haul flight based on full loading of passengers (unit: kg)'

| Materials | Economy class | Business class | First class |
|--|---------------|----------------|-------------|
| Leftover food (consumed) | 48.0 | 5.5 | 2.9 |
| Untouched food—salad | 8.5 | 1.4 | — |
| Untouched food—desert | 24.5 | 1.8 | 1.4 |
| Untouched food—main dish | 15.6 | 2.8 | 3.6 |
| Untouched food—bread | 28.3 | 3.3 | 2.5 |
| Untouched food—biscuit and cheese | 6.3 | 4.3 | 1.1 |
| Untouched food—beverage | 12.4 | 4.9 | 6.2 |
| Untouched food—sugar, milk, salt and pepper | 15.6 | 1.0 | 0.9 |
| Paper items (napkins etc.) | 3.3 | 0.9 | 0.2 |
| Polystyrene (PS) items (food containers and covers etc.) | 7.0 | 1.1 | 1.4 |
| Film plastic | 1.0 | 0.5 | 0.2 |
| Aluminium items (beverage cans, foils etc.) | 9.6 | 0.3 | 1.1 |
| Other items (cakes, cereal and fruits) | 11.3 | 3.6 | 4.6 |

Source: Li, X. D., et al, 2003, p. 97

This study was conducted by taking information from eight different flights over three different types of distances (short-Asian routes, medium-Australia, and New Zealand and long-Europe

and North America), to understand the waste management system with the hopes of minimising waste in the future (Li, X. D., et al, 2003, p. 97). The data from the long-haul flight provided important insights into the harsh reality that a large majority of the food was left untouched (Li, X. D., et al, 2003, p. 97). The study explained that depending on the type of ticket purchased and the length of the flight different quantities were wasted. In the economy class the findings showed that the food wasted was 9% of the total composition, business class with 12% and first-class with 21% of the food based on the total waste. With food waste making up 9-21% of the total waste collected and the average ranging from 152-244 kg per flight, catering food waste adds up quickly (Li, X. D., et al, 2003, p. 97; Mehta, 2015).

Similarly, to the data collected at the Heathrow Airport, a study from Detritus, a multidisciplinary journal for Waste Resources and Residues, indicated that an average passenger worldwide collects 1.43 kg of waste per trip. To reiterate, the findings from Zero Cabin Waste, catering food waste makes up approximately 20% of national and EU flights, while 32% of food waste was found coming from international flights (Zero Cabin Waste, 2018). The study conducted at Heathrow Airport indicated that food waste made up 20% of the aircraft cabin waste on average from the short and long-haul flights (Heathrow Airport Limited, 2011). Few airlines and airports are working to track why waste is occurring and how it should be dealt with as it has largely been absent from the aviation industry priorities regarding sustainability. Another report indicated that an increase in flight time meant more food wasted with less than 5% of catering food waste to Athens from the Larnaca International Airport (LIA) to more than 20% catering food waste with flights to Abu Dhabi from LIA (Tofalli, et al, 2017). With food waste from catering ranging from 9-32% depending on the flight time and type of passenger, the industry needs to focus more attention on this topic as only a handful of studies exist to indicate the extent of the problem. Therefore, if we assume that 1.43 kg is wasted per passenger and 20% of that total waste is food then 0.286 kilograms or 200 g, which is equivalent to about the weight of an average cup of coffee. At scale, domestic, regional, and international flights generate significant quantities of wasted food.

Table 3-3. 'Collected deplaned food waste data'

| | Catering waste data | Method | Source |
|---|---|--|--------------------------|
| 1 | International: 32% <ul style="list-style-type: none"> Of that total percentage, 12% was not sorted but contained food. Example carrots wrapped in plastic that were left uneaten. National & EU: 20% <ul style="list-style-type: none"> 8% not sorted but uneaten contained food. | <ul style="list-style-type: none"> 145 flights Stakeholders: Madrid-Barajas Airport, Iberian Airlines, Gate Gourmet Duration: 2 months 5 categories Calculated % by weight in kg *Funded by EU, most reliable and biggest sample | (Zero Cabin Waste, 2018) |

| | | | |
|---|--|---|---|
| 2 | <p>Economy class: 9%</p> <p>Business class: 12%</p> <p>First class: 21%</p> | <ul style="list-style-type: none"> • 8 flights • 3 types of distances (short, medium, long) • Economy class generated 0.38 kg of solid waste (total waste, not just food) per person and first class 2.84 kg per person. Based on full load on a Boeing 747-400 (“18 first class passengers, 56 business class passengers and 313 economy class passengers”) • 3 classes; economy, business class, first class • Base airport Hong Kong • Calculated % by weight in kg and sorted into category • Sorted manually • 14 categories | <p>(Li, X. D., et al, 2003)</p> |
| 3 | <p>18.5 %</p> <p>sealed food and beverages (from the total weight of 5.3 tonnes)</p> | <ul style="list-style-type: none"> • Average from short and long haul • Heathrow Airport • Calculated % by weight in kg • 17 flights • 3 721 passengers • Low 0.82 kg to high of 2.50 kg • Average 1.43 kg • IATA used this data | <p>(Heathrow Airport Limited, 2011)</p> |
| 4 | <p>Short flights (less than 3 hours): 5%</p> <p>Long flight: 20%</p> | <ul style="list-style-type: none"> • Larnaca International Airport • 7 categories • 27 airplanes • 4 different airlines • 4 months | <p>(Tofalli, et al, 2017).</p> |
| 5 | <p>Food waste 67%</p> | <ul style="list-style-type: none"> • 8 categories: paper, plastic, glass, food, cardboard, water • Measured in grams per tray • Food measured at 107 grams • From Gate Gourmet Data in UK | <p>(Jones, 2004)</p> |
| 6 | <p>9-20%</p> | <ul style="list-style-type: none"> • 8 categories of waste • Unclear of the methodology used | <p>(Mehta, 2015)</p> |

Source: Created by the author.

Overall, food waste data is limited and the table presents the most impactful results from the industry. Seemingly small numbers have large implications when looking at a global scale. Unfortunately, without the internal data collected by SAS, or other airlines, it is difficult to gauge how much waste is currently occurring.

3.3 Barriers to food waste prevention

The literature indicates that the terminology and methodology, regulations, customers’ perceived needs, difficulty forecasting, time-sensitive constraints, lack of leadership, poor

communications between stakeholders and financial barriers all lead to blockages of improved prevention and treatment of waste management systems. These barriers stem from a need to uphold health and safety concerns, navigate inconsistent legislation, a lack of incentives to promote airline change, and overall a lack of data to accurately portray the scale of the problem. This section explores each barrier based on the collected findings from the literature. To visually express the barriers within the airline industry, Figure 3-1, demonstrates that barriers exist not only for prevention strategies but also on the treatment side. Each bullet point will be discussed further in this section.

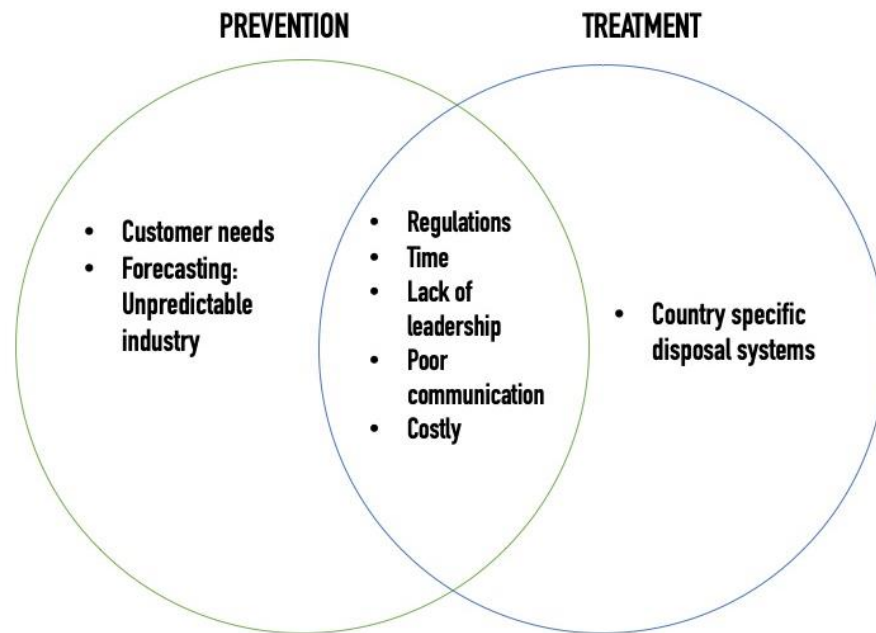


Figure 3-1. 'Barriers within airline industry regarding prevention and treatment'

Source: Created by the author

3.3.1 Terminology and methodology

Of the sustainability reports from airlines and subsequent stakeholders that did include some form of waste management information, the reports rarely showed information that explained the selected terminology and methodology. Without knowing the terms and methods of data collection it is difficult to understand the results of the study. A barrier that is preventing progress within the industry is the inconsistent terminology and a lack of clarity when it comes to unified food waste-related methodologies for collecting data. For example, within the study conducted in the Larnaca International Airport, it referred to edible and inedible food waste, further clarifying edible food as "bread, meat, fish, milk products, vegetables, fruits, sweets" (Tofalli, et al, 2017). While other reports only referred more generally to organic waste without explaining what that term meant in context (SAS sustainability report, 2011; Air New Zealand, 2018). It should be noted that SAS in an earlier 1999 sustainability report defined the term catering waste as "production and delivery of food and beverages for cabin service" (SAS, 1999). SAS remains unique as they explained the definitions that they used on their website if they were not found in the sustainability report. This should be recognized as an important step in the right direction as other sustainability reports do not even mention the term waste in the first place.

3.3.2 Regulations

Regulations play a significant role in impeding the efforts of the industry to improve their waste management treatment options. Airlines and subsequently catering companies experience strict regulations regarding health and safety as well as preventing the spread of diseases (Ross, 2014). The EU dictates in Regulation 852/2004 that food waste should be disposed of in a “hygienic and environmentally friendly way” if contamination is not a threat (European Parliament, 2004). However, for any international flight arriving in the EU the catering food waste is immediately categorized as Category 1, which is profiled as hazardous waste due to the potential for diseases to spread across countries. Food crossing country borders on airplanes could be “dangerous to animal and human health if not properly disposed of” (Blanca-alcubilla, et. al., 2018). The EU Regulation 1069/2009 designates that the only options for catering waste are disposal by incineration, co-incineration or landfilling (Government UK, 2014). Traceability is essential through the “entire chain of manufacturing, use and disposal... to prevent potential risks to public or animal health” (EU Law, 2019; Blanca-alcubilla, et al., 2018). Categorizing the International Catering Waste (ICW) differently makes it difficult to divert food waste from entering a landfill or being incinerated preventing potentially more beneficial methods of treatment. The approach is a preventative strategy to mitigate risk, however, a consultancy group found that “there is no evidence that ICW from airlines has caused an animal disease outbreak, even prior to the implementation of prescriptive legislation in force in many countries,” calling into question the effectiveness of the international law (IATA, 2018). The types of treatment options for catering waste, in theory, should include different paths (see Appendix 6.2 for the ideal treatment options).

The label of Category 3 waste is reserved for flights within the EU, which was bound originally by domestic laws and then became a regional law; however, in practice even with two separate categories (Category 1 and 3) the two waste streams are most often treated in the same way (Zero Cabin Waste, 2018). Due to the complexity of Category 1 and Category 3 most airlines struggle to find solutions for an alternative treatment to landfills based on the available domestic facilities. Ideally, Category 1 waste should be incinerated to meet health and safety regulations, while Category 3 waste could be composted or used for biogas. However, countries with the infrastructure already in place like Sweden, Category 1 and Category 3 typically both end up being incinerated, despite the strict rules that follow the handling of Category 1 waste.

When it comes to managing waste, the European Commission produced a waste hierarchy within the Waste Framework Directive that determines the appropriate action required to minimize waste, provide definitions and attempt to direct member countries to adopt meaningful action plans. This first step of the hierarchy includes preventing the waste from occurring in the first place, then reuse, recycle, recover with the last option as disposal (The Waste Framework Directive, 2010). Since most of the waste from airplanes is both domestic and international it is directed, in Sweden, to be incinerated for energy. Thus, falling under the recovery category within the waste hierarchy. The waste hierarchy exists to encourage movement up the hierarchy to achieve more efficient use of waste. SAS within Scandinavia has the treatment infrastructure available to incinerate their ICW. The EU Waste Directive that took effect in 2003 prevented organic and liquid waste from including landfill as a treatment option (SAS Group Environmental Report, 2001, p. 10). This did not impact SAS as incineration is primarily used in Sweden and Denmark but could become more difficult as more airports outside of Denmark and Sweden become stricter with their organic waste. When it comes to food waste, the EU has been primarily focused on improved treatment strategies over prevention strategies. Promoting alternatives to landfill to reduce GHG emissions continue to be prioritized. Some argue that this focus on treatment allows for consumers as well as the industry to continue with current levels of production instead of correcting problematic

behaviour that could be helped through improved prevention strategies (Marthinsen, et. al, 2012).

Another influential regulation is airlines are legally bound to provide food in the case of flight delays. According to the European Parliament under Article 9 of Regulation No 261/2004, “passengers shall be offered free of charge meals and refreshments in a reasonable relation to the waiting time” (European Union, 2004). Therefore, depending on the distance of the flight the airline should be prepared with food in case of delay. This requirement often results in more food than is needed, ending in unnecessary deplaned food waste.

Swedish Regulations

Nationally, Sweden continues to adapt its goals to prevent and treat food waste in a more efficient manner. Food waste is not a new topic within Sweden and the country participates in organizations that work to exchange knowledge on how to avoid food waste. One network is called SaMMA (Samverkegruppen för minskat matavfall) and 30 organization take part to exchange information (Marthinsen, et. al, 2012). “National authorities are also well represented; Ministry of Environment, Swedish EPA (Naturvårdverket), National Food Agency (Livsmedelsverket) and the Ministry of Agriculture and the Ministry of Rural affairs” (Marthinsen, et. al, 2012, p. 71). The initiatives to promote better regulations is a driver of improved behaviour. However, based on the information collected from the literature there does not appear to be pressure from the Swedish government on the airline industry. It is clear that the airline industry is complying with EU regulations to meet health and safety standards. However, due to the various hubs that airlines visit the domestic regulations appear to be more lenient. For example, the municipality is responsible when it comes to transport, processing and disposing of household waste, which includes businesses.

The following paragraph intends to explain the structure of the actors in charge of creating Swedish regulations. A sub-agency of the Ministry of Agriculture, “is the central administrative authority for matters concerning food (FAO UN & WHO, 2000). Sweden has 21 counties and 289 municipalities and “food control at the local level is the responsibility of the relevant municipal committee” (FAO UN & WHO, 2000). At the country level, the County Administrations “are responsible for coordinating food control within each county” (FAO UN & WHO, 2000). Further responsibilities of the NFA include inspection of “aircraft, along with railway carriages [and] providing guidance to regional and national authorities (FAO UN & WHO, 2000). Therefore, Sweden allows each municipality to determine its own rules and regulations to best fit their region, many of which have “introduced the voluntary collection of food waste and used the charge as an incentive” (Avfall Sverige, 2018, p. 36). It is cheaper for customers to sort than to have everything mixed together to incentivize new habits. To encourage recycling a weight-based system was created to charge more for increased weight per kilo. “Some municipalities with food waste collection have lower weight charges for food waste; in some municipalities it is free” (Avfall Sverige, 2018, p. 36). An example of an important Swedish waste management regulation is that “in June, the Government decided on clarified producer responsibility for packaging and newspapers as well as a mandatory collection of food waste. The new rules go into effect in 2021” (Avfall Sverige, 2018, p. 4). These rules impact the municipality that is collecting the waste from both catering companies and airports. Generally, the NFA dictates the overall message and then it is up to the individual municipalities to carry out the requirements within their district.

Avfall Sverige is a waste management association including both private and public companies with 400 members (Avfall Sverige, 2018). Although they are mostly in charge of municipal waste management. Their association drives crucial data collection and delivers important targets.

Avfall Sverige (2018) reports:

In 2018, Avfall Sverige adopted an ambition target, which the members are free to join in with or not: by 2025, the amount of food and residual waste shall have decreased by 25 percent. We call this our 25/25 target. Avfall Sverige is not satisfied with the goals found in the national waste plan. We are an ambitious industry and set goals that break new ground. The 25/25 target is another way for our members to get waste issues on the agenda and is a support for setting clear and measurable goals in the municipal waste plan. (p. 5)

This is relevant as the catering company distributes its (Category 3) food waste to the municipality. To demonstrate the type of information Avfall collects regarding food waste, the following table highlights the different options for disposal-anaerobic digestion, composting, energy recovery and landfill options on average in SEK for household food waste.

Table 3-4. 'Breakdown of household waste treatment in Sweden'

| Treatment charges for household waste, in SEK and excl. VAT 2017 | | | | |
|--|---------------------------------|------------------------|-----------------|-----------|
| SEK/tonne | Anaerobic digestion, food waste | Composting, food waste | Energy recovery | Landfill |
| Average | 515 | 605 | 490 | 900 |
| Interval | 360-680 | 500-820 | 380-670 | 670-1,250 |

Source: Avfall Web

The treatment charge refers to the median in Avfall Web. The interval shows the normal distribution of waste treatment charges.

Source: (Avfall Sverige, 2018, p. 36).

From 2013 to 2015 “the Swedish Board of Agriculture (Jordbruksverket) and the Swedish Environmental Protection Agency (Naturvårdsverket, SEPA), the National Food Agency Sweden (Livsmedelsverket) was given a three-year assignment to find ways in which to reduce food waste” (Swedish National Food Agency, 2013). Part of their conclusions explained that if all sectors decreased their waste by 20% the economic savings for firms and households were approximately 7, 6-8,6 billion SEK (Swedish National Food Agency, 2013). While, “the benefits from reduced environmental impact (avoidable environmental costs (greenhouse gas, eutrophication, acidification, NMVOC, human toxicity, ecological toxicity) are assessed to approximately 2,3-5,8 billion SEK” (Swedish National Food Agency, 2013). Demonstrating the financial benefit and incentive to make improvements within the supply chain. In 2018, the Swedish Environmental Protection Agency determined “at least 50 percent of the food waste from households, catering kitchens, shops, and restaurants is sorted out and treated biologically so that plant nutrition is utilized, and at least 40 percent of food waste is treated so that energy is also used” (Swedish Environmental Protection Agency, 2019, p. 6). In the context of the selected case study, it is increasingly crucial for Gate Gourmet to work together with SAS to meet the Swedish goals.

3.3.3 Perceived customer needs

Each airline crafts its own desired menu, which varies depending on the size of the flights, the expectations between classes, quick turn-around times, time of the day and dietary restrictions all for providing an ideal experience for the customer. A general manager for British Airways concluded that supplying more food than needed is not necessary as it is not a high concern for passengers in the context of the overall flying experience (King, T., 2001). Airline food, when discussed by the media, is often portrayed in a negative light calling it “tasteless, overcooked or uninspiring” (King, T., 2001). Typically, complaints about food go unreported as other airline-related issues often take priority, meaning that overstocking food might not be as important as it is perceived. Adapting what food enters an airplane and the quantity is dependent on the interaction between the airline and the catering company, which will be discussed further in the

findings section under stakeholders (4). The airline dictates the menu and the quantity with the expectation that the catering company delivers the correct amount. Decreasing the quantity of food is not yet commonplace despite a shift in more pre-ordered food with budget airlines (Tofalli, et al, 2017). "Our fear of not serving all passengers results in an increased load, which increases waste," says Peter Lawrance, head chef of Scandinavian Airlines (SAS). It is essentially a guessing game of how much passengers will want to purchase and how much they will consume of that purchase (Springer, 2017). The fear of not having the capacity to provide enough food for paying customers is preventing the industry from pivoting away from the current system.

3.3.4 Difficulty forecasting

On a similar note, the industry is particularly vulnerable to the difficulty forecasting based on the range of services they provide from short to long flights, while also different ticket options like economy-class to first-class. The aviation industry is prone to fluctuations due to a host of issues from the weather to mechanical problems. Flight delays, cancelled flights and a changing number of passengers can make it difficult to accurately predict the amount of food needed (Ross, 2014). A flight of 300 people could be cancelled resulting in 300 prepared meals wasted. The frequency of wasted meals due to fluctuations in the industry is still largely unknown, as airlines do not often report this information publicly since frequent cancellations can be detrimental to the reputation of an airline. Food orders for catering companies can change up to 30 minutes before a flight, which can be difficult for the catering company to deliver (Ross, 2014). Food is highly volatile and it is problematic for the catering companies to predict the correct amount needed to deliver to airlines. Forecasting the correct amount of the product can be difficult as some recipes call for a smaller amount than can be purchased. For example, a can of tomatoes is 7 kg but for the recipe only requires 3 kg of tomatoes (Ross, 2014). These calculations can all add up to wasted food. Section 4.3 maps out the production chain and demonstrates how waste occurs at every step. With forecasting remaining hard to properly identify, food is wasted to keep up with the demands of the airline and subsequently the passengers.

3.3.5 Time-sensitive

Time becomes a barrier to airlines attempting on board waste separation and fast turn-around times for take-off and landing. On board sorting is essential as the vast scale of the industry devotes little or no time to sorting between Category 1 and Category 3 after the waste has left the airplane. Waste logistics are crucial since a flight kitchen services 30 flights a day resulting in 15,000-20,000 meals needed for passengers (King, T., 2001). Therefore, efficiency remains hugely important for airlines and their stakeholders. Without prioritizing sorting on board, it can be demanding to make time for the process after all the waste has been thrown together, especially considering the money that would be required to pay someone to sort the waste.

In the case of Heathrow airport, onboard separation was required but due to the short-turnaround times, legislation about storage requirements and the risk of contamination on international flights the airport dropped the requirement for onboard separation (Heathrow Airport Limited, 2011). This demonstrates the complexity of the system when it comes to improved waste management as there were clear intentions with potential positive impacts, which had to be abandoned due to the restrictions in practice.

According to a study conducted in 2017 at the Larnaca International Airport in Cyprus, flights with less than three hours experienced difficulties in sorting waste on board when compared with longer flights. This was largely due to strict pressure to maintain proper safety protocol, combined with the limited space available on the airplane to sort (Tofalli, et al, 2017). These

conclusions were based on the findings from 27 airplanes and 4 different airlines over a time of four months (Tofalli, et al, 2017). Time is an important factor when looking into the barriers of improved food waste strategies as it can hinder on board sorting and cause problems with short turnaround times of flights.

3.3.6 Lack of understanding and leadership

A common trend within the airline industry is a general lack of knowledge about the quantities of food being wasted stemming from virtually no public data and limited leadership to drive forward progress. Inadequate data results in an incomplete understanding of the problem not only within the European context but in other regions around the world and unfortunately, this problem also exists within other sectors of the transportation industry. Referencing Table 3-1, easyJet, Wizz Air, Alitalia all had no mention of waste at all. The customer can infer based on the absence of information that the current strategy is inaction when it comes to managing waste (easyJet, n.d.; Alitalia, n.d.; Wizz Air, 2019). Air France-KLM with over 100 million passengers in 2018 had only one mention of waste and it was not pertaining to catering food waste, which denotes a level of non-commitment or general unawareness (KLM, 2017). Data is an essential first step to help indicate the total amount of food wasted. From there the data can be used to encourage action to reduce food costs.

An impactful example of this process is from Gate Gourmet in Zurich. The company prioritized learning about their waste flows and conducted a study to gather initial data. Gate Gourmet at this location produced 6.5 million flight meals in the early 1990s (Jones, 2004). Of those meals, stale bread alone resulted in 29.5 tonnes of food waste recorded from January to October in 1992 (Jones, 2004). The next year, after recognizing the massive quantity of bread waste, Gate Gourmet recognized the problem and was able to initiate action. Therefore, the number of bread wasted was only 2 tonnes (Jones, 2004). Gate Gourmet in the UK performed a study that analysed the composition of the waste coming off of the catering trays by separating and weighing the contents. It was found that food weighed 107 g per tray resulting in the total composition of food as 67% of the total (Jones, 2004). Data collection, in this case, was influential in directing the path of the company to change their habits to order less to waste less.

A global leadership strategy for aviation also remains absent. For example, aviation emissions are not included within the Kyoto Protocol and despite IATA efforts to quickly integrate effective waste management strategy, it has not gained priority status compared to CO2 emissions (Capocitti, S., Khare, A., & Mildenerger, U., 2010). The focus of the problem will continue to be on jet fuel emissions as it is the most pressing issue. This specific topic also has the relevant data to understand how damaging aviation is for the planet, whereas limited information is communicated about the levels of waste making it difficult to encourage action. Leadership within companies also remains essential to help shift waste management to become a companywide agenda. That being said, governments also have an important role to play to direct companies to adhere to minimum requirements. The IATA has given advice to airlines but the leadership strategy has failed to push meaning full action throughout the industry.

Despite a lack of specific numbers there seems to be a general understanding that food waste is an avoidable issue. In 2011 a study was conducted and “94% of canteen leaders say they are aware of avoidable food waste and do something to reduce the losses” (Marthinsen, J., Sundt, P., Kaysen, O., & Kirkevaag, K., 2012). Furthermore, “74% says they have a feeling of how much food is lost” (Marthinsen, J., et. al, 2012). Compared to the “16% that say they know exactly how much food is lost” (Marthinsen, J., et. al, 2012). Although this study was conducted within the hospitality sector and not specifically looking at the airline industry, lessons can be drawn as similar fears occur when looking at safety regulations or poor bad image of the brand

if food is saved from being wasted. Without acknowledging the problem of having a leader to push for improved waste management, it is difficult for progress to occur.

3.3.7 Poor communication between stakeholders

A lack of communication among stakeholders prevents impactful changes if each individual company works independently from each other. As an airport, it is not surprising that the focus is on the waste from the physical building without a strong focus on the waste from airlines. However, cooperation is essential as “around 60% of the waste generated in an airport environment comes off the aircraft themselves” (Pitt, M., & Smith, A., 2003, p. 105). It is vital that within different airports, airlines and catering companies’ collective goals are established to create effective waste management.

Not only are airlines and catering companies accountable for waste, but the airport also can play a role in improved practices. The Copenhagen and Oslo Airport provides an example of airports that fail to include their relationships with airlines when it comes to food waste documentation in their sustainability reports. Copenhagen airport has a detailed waste management plan but it does not distinguish between the composition of the total waste collected, which ideally would include the amount of food collected from flights (Baxter, et al, 2018). Copenhagen airport should expand its scope to include the waste coming from flights and not just the terminal and administration (Copenhagen Airport, 2014). Although it is important that the airport achieves its goal of reusing 50% of the waste generated from its daily operations by 2020 (Copenhagen Airport, 2014). The Oslo Airport report mentions cooperation with partners “to ensure the optimal and safe handling of waste” (Avinor, 2017, p. 45). However, it does not refer to the specific partners selected to improve the management of handling hazardous waste or what an optimal target entails for the company. On a more positive note, it does include that the Oslo airport wishes to help local waste management reduce the time and frequency of transporting waste (Avinor, 2017, p. 45). Both airports want to demonstrate that their airport is meeting climate requirements resulting in the tracking of waste produced in total with goals set to reduce the overall amount of waste within the airport. That being said, without collaboration between the stakeholders it will be difficult for the airport to reach their targets without all the stakeholders included.

3.3.8 Financial burdens

Extra costs can be detrimental to a budget-conscious industry and improved waste management treatment requires improved infrastructure which can require an upfront financial investment. An example of a financial burden would be the upfront cost required for an airport to install an on-site waste incinerator or a biomass boiler to process Category 1 waste, compared to sending waste to a municipal site. In the case of Gatwick airport, it received funding from the government to make the finances feasible (see 4.6.6 for Gatwick Airport details). Without the collaboration between the government and the airport, it would not have been possible to reach the waste management treatment goals set by the Gatwick airport (Decade of Change, 2016). According to Gate Gourmet in the UK, an on-site waste incinerator for an airport can require a capital investment between 2-2.5 million pounds per plant, requiring state permission and a team of specialists needed to build the facility along with costs associated with running it after it has been built (Jones, 2004). However, the benefits of having a disposal system that results in profit rather than creating costs are considered a beneficial long-term investment (Jones, 2004). An on-site waste incinerator would decrease transportation costs and decreased CO₂ emissions otherwise required for transportation (Jones, 2004). The airport could also benefit from using energy to heat or cool the airport (Jones, 2004). This potential option for an airport rivals the regular municipal incinerator because the fluctuation of municipal costs, transportation costs, the energy use is not necessary directly available to the airport but it does

not require the up-front investment of an on-site option. An airport-based waste management system could improve efficiency but the financial burdens have prevented airports from making the up-front investment.

Without customers demanding businesses to change the current system, there will be no incentive for businesses to invest and change the current forms of treatment. The difficulty of improved waste management practices was expressed in the 2018 Air New Zealand Sustainability Report, “to achieve our own ambitious waste reduction targets, we recognise we will need step changes in procurement practices, infrastructure, and a stronger waste reduction culture” (Air New Zealand, 2018, p. 55). It not only takes time to influence better customer and business behaviour but it takes financial resources to spread awareness.

Air New Zealand (2018) is a unique example:

It has some of the cheapest waste disposal costs in the world (it costs \$10 per tonne to send waste to landfill, compared with around \$170 per tonne in the United Kingdom), so there has been little financial incentive for New Zealanders to divert resources for reuse or recycling, or for investment in such infrastructure. (p. 55)

Without financial backing, it is difficult to prioritize sustainable goals including improved waste management agendas. Unless companies feel threatened to make changes from their customers it will be unlikely that waste management practices will receive funding.

4 Findings

This section presents the information collected from the case study of SAS, containing a compilation of points obtained from the interviews to validate the findings revealed in the literature review. The next section explores important stakeholder roles before mapping out the production chain to visualize the process and determine the biggest food waste hot spots. The final section showcases what competitors have accomplished when it comes to food waste management to help demonstrate to other airlines and SAS other potential opportunities.

4.1 SAS Case Study

This section aims to provide contextual information on the selected case study by understanding how the company integrates sustainability into its business, as well as general information relevant to interpreting the findings. The organization, the company culture, perception and business strategy are all important factors to consider when looking at the feasibility of waste management strategies.

To provide background information on the organization of SAS, the typical customer travels more than five times a year and therefore SAS offers a variety of destinations with frequent flight times (Kotze, 2017). The target customer base is “frequent travellers in Scandinavia” and people “located in major cities as well as smaller towns, well-educated, interested in technology and are high media consumers” (SAS Group Customers, 2019). Short-haul flights make up the majority of the customers and SAS wants to make sure their customers experience their crafted, seasonal menus to add to the customer experience (Skift, 2019). This is relevant to the waste management strategy because SAS knows its target audience and what they value. Customers value their time and want quick, easy solutions. Since their consumers are interested in technology and are relying on media the pre-ordering food option provides a solution for the airline to order less, for Gate Gourmet to handle less waste and gives consumers meals tailored to meet their needs. The organization, the company culture, perception, and business strategy play a role in how the issues within waste management are tackled.

By choosing SAS the client has access to the Star Alliance Program, a program that gives miles or points by flying with member airlines (Report SAS, 2019). SAS strives to deliver “punctuality, safety, care, easy travel and services for both business and leisure travellers” (Kotze, 2017). With the typical client in mind, SAS can tailor their services to fit the consumer, which is relevant when selecting their food options. There are different levels and a variety of options for more frequent flyers. The options available are as follows: SAS Go, SAS Plus and SAS Business. SAS Go Travellers have the option to pre-order (flights in Europe 80 minutes or longer). “On morning flights breakfast is available to pre-order when traveling on European, Nordic and Domestic flights longer than 60 minutes” (SAS Website, 2019). SAS Plus and SAS Business receive snacks and three-course meals free of charge. SAS Business has an a-la-carte menu and provides four different choices for the three-course meal. All travellers to the US and Asia have complimentary meal options (SAS Website, 2019). Scandinavian Airlines System (SAS), communicates their brand promise, “we make life easier by making time matter to travellers, to employees and to the planet” (SAS Website, 2017). With all of these available options for passengers, it requires SAS to have a sophisticated system to achieve the complexity of their orders.

The organizational structure of SAS allows the company to operate effectively when pushing their sustainability goal forward not only in the realm of waste management practices but in each department. President and CEO Rickard Gustafson shares, “sustainability is an integral part of our business and affects every decision we make” (SAS annual report fiscal year, 2018, p. 6). This statement was confirmed during Interview 1 as she felt sustainability seemed to be

embedded in all departments. As each department is required to fill out an environmental impact checklist if they want to order a new product. Each department can also use the environmental team to get advice if they want to push for a more rigorous environmental agenda (Interview 1, 2019). The interviewee also mentioned that having the Stockholm, Oslo, and Copenhagen hubs altogether in one office space has made it easier for employees to talk to each other and promote collaboration (Interview 1, 2019). In addition to sustainability goals integrated into each department, there is also a specific department to tackle environmental issues called the Environment & CSR department. This team works to make sure SAS achieves its short term and long-term goals.

Company culture allows the organization to meet its goals and drive new innovative solutions. The sustainability reports and the SAS website convey an important message that sustainability is a crucial element within the company. A history of sustainability-related documentation has helped preserve the Scandinavian mindset. This mindset is described as having a common responsibility to protect the environment. For example, in the sustainability report created in 1996, there is a section devoted to cabin operations, extremely rare within the industry. This section includes catering waste data recording the tonnes of waste from 1993 and each year following, while also distinguishing between the three bases of Copenhagen, Oslo, and Stockholm. The report mentions that “catering waste decreased by some 25%” between 1992 and 1995 (SAS Group Environmental Report, 1996, p. 13). SAS explains that “in the future, increased differentiation may be expected between charges for sorted and unsorted waste, and this gives SAS even more motivation to develop routines for sorting at source” (SAS Group Environmental Report, 1996, p. 15). This is impressive considering how forward-thinking SAS was to measure their waste, publish it and anticipate the need for an improved system. The company was able to set clear objectives, with a point leader, to layout specific targets to achieve (SAS Group Environmental Report, 1996, p. 15). This demonstrates a historical company-wide commitment to waste management rather than just a response to current news cycles elevating the issue of single-use plastic. Therefore, sustainability is not recently added to appeal to consumers now but has been historically integrated into the entire company. This is further confirmed with its environmental management system which was certified according to ISO 14001 and remains one of the few airlines that has achieved this international certification throughout the company (SAS Group, 2019). This level of certification promotes planning, implementation, evaluation and encourages improvement to reach the environmental goals of the company. SAS has two main sustainability targets they are working towards achieving by 2030, which are relevant but not related to waste management; “The first is to reduce our total carbon emissions by at least 25% compared with 2005, which exceeds the targets set by the International Air Transport Association (IATA, 2018). The second is that “we will use an amount of renewable jet fuel corresponding to our total domestic traffic” (Report SAS, 2019).

SAS has a clear willingness for innovation when it comes to managing onboard food. In 1996, an initiative called gate buffet was tested in Karlstad, Kristianstad, and Kiruna (Jones, 2007). The concept involved passengers selecting their own food in a buffet-style before they entered the airplane (SAS, 1999). This was established to help mitigate food waste and give passengers the freedom to take what they wanted and the quantity. They were also tested in Copenhagen, Stockholm, and Oslo but the service was eventually ended due to difficulty with the gate infrastructure. The Sustainability Report released in 1999 indicated that SAS’s goal was to reduce “waste volumes by 30% per meal served by 2001 compared with 1997” (SAS, 1999). This conveys that the company is willing to test new pilot projects and find better options to achieve their goals.

It appears that the current perception of SAS is synonymous with how the company wants to be perceived. The IATA Environmental Program Manager felt that SAS was “doing a good job

overall” and when asked why he felt that way he explained that “they have quite a bit of detail in their public statements” (Interview 4, 2019). He also felt that waste management is a relatively new concern for airlines and any progress regarding the onboard waste is unique (Interview 4, 2019). Maintaining a sustainably-minded brand reputation is extremely important to any company and this recognition of a job well done by the IATA indicates that SAS has shown their commitment to environmental initiatives.

4.1.1 Commitment to reporting

Waste management is not the key focus on the sustainability agenda of SAS. However, SAS has a commitment to reporting through the use of the Global Reporting Index and ISO 14001.

Overall, the company has not identified waste management as the number one focus area but SAS, unique in the sector, still acknowledges the problem and intends to elicit change. According to Interviewee 2, SAS is extremely aware of how customers are responding to the waste that they encounter on their flights and this plays a role in the strategy of the company (Interview 2, 2019). Interviewee 2 explained that passengers most likely will not be able to recognize an airplane that is the most fuel-efficient when boarding but it is easy for a customer to see the collection of waste on their tray table during the flight. For this reason, to align with their brand’s reputation of integrating all aspects of their business in a sustainable manner, they want to be disruptive in the industry and make an impact where consumers can visibly see their effort (Interviewee 2, 2019). Other key performance indicators (KPI) are not as readily available to the public, which is why waste management has become a focus area for SAS. It is an achievement that SAS has taken steps to enhance their pre-order service as it shows the ambition of the company to work on waste prevention (SAS Website, 2019). The interviews with SAS employees indicated that when it comes to measuring food waste there is internal data that is collected from both the airline and catering company. However, externally these statistics are not communicated. Therefore, for the consumer there is a lack of clarity regarding how much waste exists. Interviewee 4 expressed that he used to work for a medium sized airline that had 100 daily domestic flights, and he estimated that these domestic flights alone produced 6-10 tonnes a week of organic food waste (Interview 4, 2019). The SAS flight attendant communicated that in her experience there “is unfortunately a lot of waste” [when it comes to on board food waste] (Interview 3, 2019). In her experience there always seemed to be more food than necessary and she was often disappointed that they could not sell it again (Interview 3, 2019).

SAS uses the Global Reporting Index, an international organization that works on sustainability reporting, to maintain its environmental standards. According to the sustainability report under Effluents and Waste, SAS covers GRI 103 exploring the Management approach and GRI 306-2 looking into the waste by type and disposal method. GRI 103 requires for each material topic “an explanation of how the organization evaluates the management approach, including: the mechanisms for evaluating the effectiveness of the management approach; the results of the valuation of the management approach; any related adjustments to the management approach” (GRI Standards, 2016). The GRI Standard 306-2 requires that the company report the total weight of the hazardous and non-hazardous waste and denote the disposal method (Global Reporting Initiative, 2016). It also requires how the method of waste disposal was selected; “Disposed of directly by the organization, or otherwise directly confirmed, information provided by the waste disposal contractor, organizational defaults of the waste disposal contractor method” (Global Reporting Initiative, 2016). The GRI asks the reporting organization to provide the definition of hazardous waste supplied by the national legislation, not including wastewater when calculating the non-hazardous waste and “if no weight data are available, estimate the weight using available information on waste density and volume collected,

mass balances or similar information” (Global Reporting Initiative, 2016). This demonstrates a commitment to general environmental standards for waste management.

SAS indicated that they meet the ISO14001:2015 compliance as the “SAS Environmental Policy is overseen by Group Management and is applicable to all SAS products and services” (SAS Sustainability Report, 2018). The report explains that goals are revisited annually to check progress. The ISO 14001 standard is an important tool and SAS should be applauded for their commitment to integrating the standard throughout the company. “The system focuses on activities around administrative functions at the headquarter Frösundavik and around the main bases Stockholm-Arlanda, Copenhagen-Kastrup and Oslo-Gardemoen, but also includes other geographical areas through follow-up programs and contracted services” (SAS Website, 2019). Identifying the scope to include products and services is impressive for an airline that includes many different inputs and outputs. It is important to note that the sustainability report also includes the environmental goals of the company. Waste management is mentioned in the 2023 goals; “100% recycling where possible” but waste management is absent from 2020 and 2050 goals (SAS Sustainability Report, 2018). Although the materiality ranks environment including emissions, waste and noise as the top priorities the goals do not seem to reflect the catering waste problem (SAS Sustainability Report, 2018).

The sustainability report in 2001 indicated that “cabin accounts for 5% of airline operations’ environmental impact” (SAS Group Environmental Report, 2001). This included the food, beverages, packaging, disposable items, articles for sale, newspapers, chlorinated water and germicides. The report expressed that SAS switched their catering company and were able to increase their prevention of waste; this improvement was demonstrated with a reduction in costs related to a decrease in overall waste (SAS Group Environmental Report, 2001). With improved pre-sorting and increased recycling, the costs dropped by 33 MSEK. In the report from 2009 the cabin operations had dropped from 5% to 2% of the total environmental impact (SAS Group Sustainability Report, 2009). This demonstrates the influence that the catering company can have on improving the system and the progress SAS has made so far.

The 2013 sustainability report was the last year organic waste was mentioned as a distinctly separate category for onboard waste (SAS Group Sustainability Report, 2013). From 2014, onwards the most current report only features three categories; hazardous waste, unsorted waste and sorted waste (SAS Sustainability Report, 2014). Again, this refers to the office, ground service, and technical maintenance. From 1995 to 1999 the total number of meals decreased and most waste from catering was unsorted and the target was not reached (SAS, 1999). It would make sense that SAS would not want to publish when targets are not reached.

It is clear from the literature and the interviews that SAS is mainly focused on the prevention strategies compared to the treatment. Table 6-2 shows the most current numbers available in the SAS sustainability report, again showing that there is no data shown externally when it comes to catering food waste, the most abundant form of waste coming off the airplane.

Table 4-1. ‘SAS Sustainability Report data on waste collected’

| | Unit | FY2018 | FY2017 | Base year 2010 |
|-----------------|--------|--------|--------|----------------|
| Sorted waste | tonnes | 1,902 | 2,035 | - |
| Unsorted waste | tonnes | 175 | 173 | 815 |
| Hazardous waste | tonnes | 146 | 142 | 302 |

Source: SAS Sustainability Report October, 2018

There are several reasons for why specific food waste data is not included in airline's sustainability reports. First, they are simply not recording the data as it takes time, money and people to collect data. Second, the airline could identify other environmental priorities as more important. Third, releasing data could also highlight weaknesses, delayed or cancelled flights, that could be harmful to the brand. Another factor relating to why data is not public information could be due to a lack of approval from the communications team, as it takes time for the company to approve what becomes public information (Interview 10, 2019). Some airlines might not release data because it is still in the process and not completed. Below is the data on waste that SAS was willing to include in their sustainability report. This indicates that they are measuring waste yearly but does not indicate how they are measuring or the progress they are making when regarding food waste.

4.2 Stakeholder Roles

The following section combines the findings from the interviews conducted as well as sustainability reports, industry documents and relevant academic papers to validate the findings. It should be noted that the contact from Gate Gourmet Scandinavia was not legally allowed to discuss the specifics on SAS but could talk generally about food and waste within the supply chain.

4.2.1 Airline

Main roles:

- Forecast how much to order based on the passenger mix
- Determine suppliers or direct Gate Gourmet to select suppliers based on their preferences
- Select the menu based on price and seasonality of ingredients after tasting the meals
- Explain to flight attendants how to serve and dispose of the product
- Treat passenger food waste, not included in catering meals, by transporting food waste to the airport

This section explores the role of the SAS production chain from ordering the food to the treatment process. These conclusions were predominately based on interviews with the SAS Environmental and CSR department, and a SAS flight attendant.

According to Jones, (2007) SAS determines what food is served based on a host of factors;

The price of food, seasonality of food, cost of labour to make a food item, time required to serve the food, number of flight attendants available to serve food, time needed to consume food, ability of meal to be consumed in a small place on a plane, the time and effort needed to clear an item, the needs and desires of the passengers, odours that may penetrate the cabin, the ability of meal to be rethermalized and the ability of the meal to withstand low humidity and pressures. (p. 40)

All of these aspects are considered when the airline selects the menu. Forecasts are made to determine the passenger mix and guess how many people will book the special meals, while also calculating how many children and adults, first-class, business class, tourist class will book flights. The airline coordinated with the catering company to order and plan for the short-term, middle-term and long-term food orders. Alexander Lund, the production manager for SAS when interviewed for an article explained that the SAS dishes are changed every season to source the ingredients locally (Skift, 2019). SAS also has to be mindful of travellers that “fly twice in one day or several times a week, so they require variety. We change the menu about four times a week” (Skift, 2019). These numbers are calculated by the previous number of passengers to ensure an accurate number of meals and menu choices (Jones, 2004). Generally, there are more

options for first-class, which results in an increase in food waste among this passenger type (Jones, 2004). Food is wasted when passengers deny their meal or simply take the tray and eat a small portion or none (Jones, 2004). SAS has a specific employee that finds suppliers or communicates with the catering company, Gate Gourmet, to select the remaining suppliers based on the predetermined conditions. Coordinating the logistics and confirming that the variety of considerations have been met is tremendously important within observing the overall role of the airline.

Overall, the airline holds significant power when it comes to coordinating the meals offered on board. SAS wants to offer a customer experience that creates excitement around the menu. “We want our passengers to want our food and we are really proud of it” (Interview 1, 2019). Offering products like salmon from Norway and asparagus from Gotland is something they want their customers to remember. “We want to offer Scandinavian food and we want them to feel the Scandinavian influence” (Interview 1, 2019). According to Interviewee 1 the airline tries to meet consumer demands and recently that has meant offering more vegan options, while also being aware of frequent travellers that want variety (Interview 1, 2019). There was a test week last year with only vegan food for two weeks; “customers really liked it and it was great publicity” (Interview 1, 2019). That being said, Interviewee 1 explained that they will be repeating the two weeks of only vegan options again this year but if she were traveling five times a week she does not think that would be ideal option for frequent flyers. Since the airline values promoting their region, the menu remains an important factor when considering the role of the airline and is the first step in the process.

The flight attendant for SAS brought a fresh perspective to the discussion as she explained that each attendant receives an iPad explaining the flight information in detail to ensure the that the correct procedures have been addressed. When flying to the UK and Switzerland they have specific requests to sort the waste and the flight attendants in response carry out different actions (Interview 3, 2019). This demonstrates the capacity for flight attendants to sort on board and the potential to scale up on board sorting in different locations.

The airline is required to treat the waste that is not included with catering. For example, if external food is brought on board then the airline coordinates with the airport for treatment. This specific type of food waste is minimal in comparison to the food waste accrued from catering (Interview 7, 2019). The flows of the two waste streams are shown in Table 4-1.

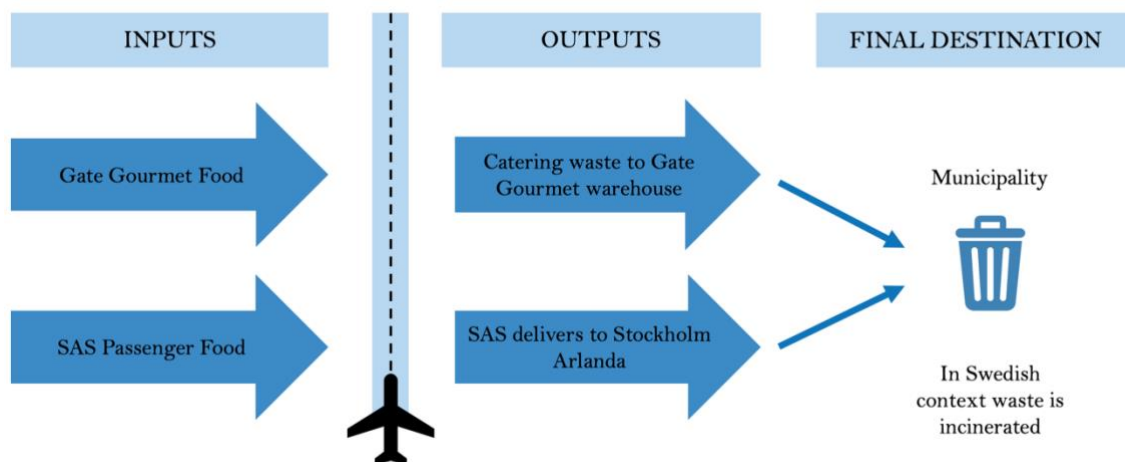


Figure 4-1. Input and outputs of food waste on airplanes'

Source: Created by the author

SAS created a cabin waste working group focused on lobbying to try and overturn the Category 1 waste regulations (Interview 2, 2019). SAS is currently operating under the assumption that the legislation will not change and therefore, the company believes that the time is well spent working on issues they can impact, indicating the importance of prevention. An illustration of this would be better forecasting for purchasing orders over debating new treatment options. Interviewee 6, an analyst for external relations of IATA, confirmed that these international regulations prevent companies from reusing or recycle waste from international flights, despite its environmental ambition (Interview 6, 2019). This inability to properly dispose of catering food waste, therefore, is not only problematic for SAS but for other airlines struggling to improve their system.

As mentioned in the literature review, in section 3.3.6., the lack of waste management leadership appears to stem from the limited knowledge available and, subsequently, the airline is the frontrunner when it comes to ordering food for their customers. If airline employers are not aware of the problem then it is difficult to inspire employees to find solutions. There is also high incentive to over-order, over-produce and over-assemble resulting in more waste than would originally occur. This type of overproduction mindset is common when observing an industry approach to ordering food. It should be noted that the airline industry has not been known to be a progressive industry when it comes to environmental action and a common theme throughout the interviews indicated that the environment, unfortunately, does not often take priority (Interview 10, 2019). The airlines have yet to see a large drop in customers due to environmental reasons, therefore, there is no motivation to improve when competitors are also not pursuing alternative methods.

To reiterate a previous point, the industry faces a significant financial barrier, further driving a lack of waste management motivation. Financial decisions drive the choices for every business and remain at the core of what is accomplished regarding waste management. With unpredictable fuel prices, it can be difficult for airlines to set aside more in the budget to improving waste management. Interview 6 explained that “cabin waste audits are extremely difficult to plan and implement” (Interview 6, 2019). An audit was produced in 2012-2013 by the IATA at Heathrow Airport and required the help of 17 organizations. This project included hiring a regulator for the entire six months of negotiating and planning (Interview 6, 2019). This reveals that waste management would have to be a higher priority for the airline industry to want to spend money on audits. This justifies why it remains difficult to find data produced by the airlines or airports and is often a third-party researcher. Another unseen financial burden, identified by Interviewee 7, was the potential for unions in Sweden to require an increase in salaries for flight attendants if another task of on board sorting is added to the job description (Interview 7, 2019). This could make it difficult for airlines to ask more of their employees. Especially considering that the catering costs make up only 3% of the total fiscal year for 2018, while most of the most are allocated to payroll and jet fuel (SAS Sustainability report, 2017). Lufthansa was asked to provide perspective on why more airlines were not doing more to combat the unnecessary waste and it came down to cost (Interview 11, 2019). Using resources to pay people to sort trash after it had already been collected was not a priority when budgets were becoming increasingly tighter due to rising fuel prices (Interview 11, 2019). The large upfront cost to implementing improved waste management systems creates a lack of motivation and prevents action. Airlines are highly influential when looking at the type of food selected and how it is managed throughout the production chain.

4.2.2 Catering Company

Main roles:

- ➔ Present options to the airline and craft personalized menu for the client
- ➔ Order from suppliers
- ➔ Quality check on food
- ➔ Assemble food
- ➔ Deliver food to airplane
- ➔ Pick up trolleys that were delivered
- ➔ Transport waste to municipality

The majority of the information was synthesized based on both of the Gate Gourmet interviews from Madrid and Scandinavia, as well as company reports and describes the process undertaken by the catering company when dealing with food. The job of the catering company is to take food from the suppliers, prepare the meal, deliver the food to the aircraft and pick up the leftovers when the flight returns. Initially, the catering company meets with the client and has a mini-presentation with the centralized culinary team, procurement team, and the client. Together they look at menus, taste it, make suggestions and then determine the price once the client has tasted the product in the second round (Interview 7, 2019). The client can then accept the price, accept the menu, prepare the logistics in advance and then put the menu in the system for their client. Then in the shorter term, the menus are combined with the forecast of the tax numbers and then a purchase order is created for each unit (Interview 7, 2019). Those purchases are sent to different suppliers with different time limits, depending on what type of food it is and where it is sourced (Interview 7, 2019). Food is then delivered from all of Europe as well as locally to fulfil the order.

Depending on where the food is sourced from it can be more difficult to switch orders if forecasts are projected incorrectly. With local food, it is easier to change the order on short notice. However, if the food is frozen and ordered from another country, it takes around one month in advance to switch the order. This makes it difficult to prevent food from being wasted if the orders are from international suppliers. Thus, it can be challenging for the catering company to meet short-term demands when dealing with international suppliers. The purchases are delivered to a designated area for receiving the goods where it is then checked against the purchase order. It then goes through a quality and weight check. If there are quality issues and the product is local then it can be sent back. If there is an issue with the food intended to last for the long-term Gate Gourmet alerts the supplier and then they do not accept the delivery. Small levels of waste are accrued at this level. The next step is to take the food into the warehouse and assemble the product. One example explained by the representative from the Scandinavian Gate Gourmet was that the Swedish weather in the summer of 2018 was especially sunny and warm. As a result, people cancelled their flights to the Mediterranean last minute to stay home to enjoy the Swedish summer (Interview 7, 2019). Therefore, the number of projected clients was not fulfilled resulting in significant food waste.

The interview with the SAS flight attendant revealed her experience witnessing the overestimations of waste first hand. For longer flights when they sell items like sandwiches they might only sell two or three for an entire flight and even if they sell more it “still can be quite a lot” of leftover food (Interview 3, 2019). Even when it comes to coffee and tea she finds that she often pours out significant amounts (Interview 3, 2019). On the shorter day-time flights, she always finds that there are always more rolls of bread than needed and she occasionally hears customers mentioning the amount of waste on their trays (Interview 3, 2019). This is consistent

with the findings in the literature review showing that bread was the most wasted food on flights followed by dairy products (Tofalli, et al, 2017). Another waste stream comes from long-term purchases since products have an expiration date. On some occasions, the food might be on the last day of usage and it will not be legally allowed to enter an airplane if it expires on the day of the flight. Based on the interview conducted the legal obligations are self-imposed it is published internally by Gate Gourmet; “In addition to fulfilling legal and regulatory requirements in the various jurisdictions in which we operate, we have implemented our own internal food safety control function and system” (Gategroup, 2014, p. 13). With self-imposed safety regulations to avoid risk, following the “World Food Safety Guidelines for Airline Catering” Gate Gourmet assures high levels of food safety. The “quality management system is based on the principles of ISO 22000” as well as the Hazard Analysis and Critical Control Point (“HACCP”) risk analysis” (Gategroup, 2014, p. 13). In addition to other health and safety rules, Gate Gourmet minimizes risk for all actors involved. The internal rules dictate that the food has “24 h from preparation to portioning and 24 h from portioning to delivery. For in-house cooked foods, the maximum time should be 48 h from preparation to portioning and 24 h from portioning to delivery” (Gategroup, 2014, p. 226). With a fear of making customers ill more food is wasted as the label indicates that the food is expired, whether or not the food has actually gone bad. The pressure to make sure the airline does not serve expired food to their customers dictates the behaviour and policies of Gate Gourmet.

Another occasion that waste occurs is in the process of cooking. Interviewee 7 mentioned the waste produced internally is a much smaller waste stream as it includes items like potato peelings within production. This could be a potential opportunity for Gate Gourmet to use “unwanted” food like potato peels and instead incorporate it into the product that they sell. Not only would it save resources but it could also elevate the company reputation.

Transportation is also a point in the production chain where food waste can occur. The food within the transportation vehicles cannot exceed a 5-degree rise in temperature. If a flight is delayed in the summer at the Stockholm-Arlanda Airport it can be problematic if a truck is stalling and waiting to board the meals onto the aircraft. This was confirmed in the interview with the SAS Head of the Environment and CSR department, explaining that if the cool chain is broken (transportation of moving the food from the catering facility to the airplane) the food must be thrown away (Interviewee 2, 2019). Interviewee 13, a food waste consultant, revealed that food can often spoil on the tarmac without sensors to determine the temperature, showing the vulnerability of food. The Association of European Airlines, AEA, guidelines have documented typical procedures if food has been loaded onto an aircraft regarding what specific temperatures need to be maintained and how it should be monitored (Farber, J. M., & Todd, E. C., 2000, p. 226). For example, if the temperature rises or the delay exceeds six hours then it is recommended that the food be substituted with new meals, resulting in waste.

The largest source of waste, according to Gate Gourmet Scandinavia, occurs when the trolleys are returned from the airplane to the Gate Gourmet warehouse. The process starts with the trolleys being removed from the airplane and brought back to the warehouse. Differentiating between organic catering waste with Category 1 and Category 3 is often problematic for catering companies because long-haul flights are required to quarantine Category 1 waste, while short-haul flights are assumed to not carry diseases or harmful pests meaning they can be taken for other methods of treatment. Based on the circumstances it is not surprising that most catering companies have very little incentive to spend money and time sorting organic waste between the two categories. In this case study, however, the waste is divided into two streams; Category 1 and Category 3 (Interview 7, 2019). The waste is taken to the municipality and then incinerated for energy. “Category 1 could be turned into recycling but nothing has been done so far” (Interview 7, 2019). None of the airlines have a requirement about how to handle the waste

when it comes to treatment (Interview 7, 2019). “At the moment, there is pressure on doing something for the environment and finally a discussion is happening with the clients to do something” and “pressure is coming from the public and not the government yet” (Interview 7, 2019). “They consider the airline industry to be outside the scope but there is high pressure to be sustainable from the public on airlines and they need to show that they are doing something” (Interview 7, 2019). The concept of flyshame was brought up to describe the pressure that airlines are feeling to improve their industry (Interview 7, 2019).

In the interviewee’s opinion “to do good recycling, you need cooperation between airlines and the catering company because the easiest way to deal with the waste is to sort on board” Gate Gourmet is starting to work with an airline (not able to reveal the name) to start sorting aluminium cans (Interview 7, 2019). However, different destination requires different rules. From a catering company perspective, it would be easiest for the EU to make a standard rule and Interviewee 7 anticipates something will probably come soon.

Food waste can be generated when untouched catering trays are mixed with used catering trays. If the trays are full and there is pressure to handle the waste quickly, pack the new load and deliver it to the next flight. It sometimes happens where the full trays are sometimes checked but then sorted and mistaken as used meaning that the untouched trays are wasted (Jones, 2007).

Treatment options for catering waste are the task of the catering company, even if it comes from the airplanes. The Scandinavian contact at Gate Gourmet mentioned that even if the company does attempt to implement new waste management changes it will be difficult to start when relying on the airport facilities since he views it as quite old (Interview 7, 2019). Gate Gourmet in Scandinavia is in an “active discussion with one of the energy companies, as they have shown interest in buying the food waste to make biogas” (Interview 7, 2019). Gate Gourmet is interested in this partnership but Gate Gourmet expressed to the energy company that in order for a partnership to work it would be the responsibility of the energy company to navigate the international regulations surrounding Category 1 Waste. Gate Gourmet would like to see the food waste used to make biogas but does not anticipate that the energy company will be able to overturn the legislations.

Interview 7 confirmed that “in 2018 we further worked on our waste management goals, including our active involvement in the European Union’s LIFE Zero Cabin Waste project in Spain” (Gategroup Holding AG, 2019). Within the Zero Cabin Waste Project, Gate Gourmet was able to “assess, evaluate and test opportunities to reduce waste throughout the cycle of airline catering, ranging from menu development, packaging, waste segregation on board and post-flight waste recycling” (Gategroup Holding AG, 2019). This opportunity provided the catering company with funding to analyse the process and set more comprehensive goals. However, communication between the catering companies even within Europe is not always easy since there is a department in each region that deals with “continuous improvement” where waste management would be handled. The interviewee indicated that communication between regions could be improved. For Gate Gourmet in Spain, it was indicated that there was a large frustration when it came to the difficulty of sharing information within the industry and internal tension (Interview 8, 2019). According to the Gate Gourmet interview, there is essentially no communication between airlines and airports on best practices or how to improve the system. In such a competitive environment sharing data is virtually non-existent.

Overall, the catering company, Gate Gourmet, indicated that the largest source of food waste occurs when they are picking up the uneaten and untouched food from the airplane. Interviewee 7, eluded that airlines should be more accurate when providing numbers for the catering company to prevent more food waste, while also indicating that 2020 will be a “big year for

sustainability” (Interview 7, 2017). Indicating that coordination with other regions and municipalities to establish common agendas. Catering companies have significant industry restraints and demand to meet from their stakeholders, while they carry out their main task of providing food to airplanes.

4.2.3 Airport

Main roles:

- ➔ Take food waste (not included with the catering food, only the food brought on the flight by the customer) collected from airplanes
- ➔ Transport for treatment

The airport itself does not handle the waste created from the catering service. There are different catering and cleaning companies that handle these services for the airlines. However, the airport does handle the leftover waste from the aircraft. For example, if someone brings a pizza box or other external food onto the airplane. Some airports have waste handling capabilities on-site to help streamline the process and potentially re-use the heat. Swedavia, who runs the major airports in Sweden, explained that they have a “responsibility and have taken tremendous care to follow the laws” (Interview 9, 2019). In the experience of the interviewee from Swedavia and the municipality, they are not in communication. When it comes to waste management the airport focuses mainly on not mixing the Category 3 and Category 1 waste. The reasoning behind the airport not taking more care to sort within the waste stream is because it is more than double the cost to sort (Interview 9, 2019). The airport makes sure to follow the EU regulations. However, the airport has not felt any pressure from the Swedish government to improve their current strategies. Indicating that involvement from the Swedish government could help push the industry to become more efficient. According to the airport sustainability report, “in the area of waste, the total quantity of waste per passenger is being reduced, and a number of airports have introduced the sorting of food waste” (Swedavia Airports, 2018). There is no indication of how they are working to reduce the quantity of waste and if they are collaborating with airlines to encourage better practices. That being said, the Swedavia airports “are certified under ISO 14001:2015 environmental and ISO 50001:2011 energy management standards (Swedavia Airports, 2018).

Stockholm-Arlanda Airport does not have any waste management goals. (Swedavia Airports, 2017). With a lack of attention on waste management, the airport could risk having increased fees for transporting all of the waste to be incinerated. The airport will not be able to reach more stringent goals in the future if they do not start the process earlier.

4.2.4 Supplier

Main roles:

- ➔ Selected by airline or catering company or both
- ➔ In this case, SAS selects some suppliers but not all

As SAS would not release their specific suppliers nonetheless “all SAS suppliers are required to meet our sustainability and social responsibility requirements, our purchasing policy, and the general terms and conditions of the UN Global Compact and other specific sustainability requirements” (SAS Sustainability Report, 2019, p. 18). SAS also prioritizes local options when available.

4.2.5 Municipality

Main roles:

- Offers facilities to treat waste
- Can provide resources for sorting

The waste that is collected from both the airport and the catering company is taken to the municipality facilities for treatment. Unless the airport has an onsite waste facility, however, that is currently very rare. In this case, the food waste collected from Gate Gourmet Scandinavia was originally collected by the Uppsala Municipality but is shifting to Märsta, which falls under the Sigtuna Municipality and will be the focus to remain as current as possible. The Sigtuna Municipality (Kommun) handles the waste that is delivered both from Gate Gourmet in Stockholm and the Stockholm Arlanda airport. After discussing the potential of using food waste for biogas as an alternative method to incineration with Gate Gourmet this process of an energy company reaching out to a potential customer was explored. Interviewee 5, explained that in his experience it was extremely uncommon that a company would reach out to a company like Gate Gourmet (Interview 5, 2019). Currently, the food waste received by household customers and businesses is used for biogas and compost. The Swedish government has given a target to each municipality in Sweden for 2020 and the Sigtuna Municipality, the municipality where the Stockholm-Arlanda Airport resides, is set to reach their targets. When asked about the airport the municipality felt that the overall food waste received did not make up a significant amount of their overall waste collected. In the opinion of the interviewee, he did not see the benefits of collecting airport waste but did not know how much catering waste was collected as it was often mixed with other restaurants or consumer waste (Interview 5, 2019). Ideally, the interviewee envisioned that the municipality would like to pick up the waste with cars that run on the biogas that the municipality creates. A lack of collaboration was revealed between the catering company and the municipality. The municipality did not find the need to increase communication as they were aware of the complex international regulations that apply to the airline industry and assume the airport had a larger understanding of the requirements and felt that they would reach out if they needed something more from the municipality. The municipality also did not appear to communicate with the airport and felt that Swedavia would have more information about collaboration.

4.2.6 Customer

Main roles:

- Pay for services
- Communicate food preferences
- Give feedback

The customer gives value by communicating their desires and needs. The customer, more often the frequent flyer, their target market, carries significant influence and power. For Air New Zealand, it gave the sustainability team the power to request and gain funding from the financial department (Interview 10). The airlines do not want the risk of losing customers or hurting their brand reputation by not meeting the demands of their consumers. However, it is unlikely for airlines to make quick changes when it comes to sustainability until people stop booking flights to signal the importance of environmental factors. When airlines are financially impacted by their unsustainable decisions, only then will they be motivated to incorporate more sustainable strategies. At the moment, customers have yet to signal that there will be consequences to incentivize airlines. With the term “flyshame” becoming more popular in Scandinavia, SAS

could be at risk to improve all aspects of their company, not just focusing on fuel and noise but also waste management.

It is also important to recognize how cultural desires for abundance play a role when the airline is attempting to meet customer demands. According to interview 11's perspective, as a flight attendant, employees and customers generally seem willing to help but change and high-level decision making is slow. Although employees are more and more involved board members take significant time to approve new improvements. Overproduction and maintaining a culture of abundance is normal and therefore, customers expect to have food on airplanes. Airlines then deliver for the sake of its brand identity, to provide an element of luxury, as well as financial profit (Mourad & Finn, 2019). As a customer, playing an active role in pre-booking helps minimize the demand for abundance and instead encourages producing exactly what is needed.

4.2.7 IATA

Main roles:

- Communicate industry standards to airlines
- Act as a united voice to disseminate information to governments

This is a trade association of airlines from all over the world. The vision of IATA is to “shape the future growth of a safe, secure and sustainable air transport industry that connects and enriches our world” (IATA, 2019). The IATA attempts to connect stakeholders together to help increase awareness of the widespread issues the airline industry is facing. The IATA wants to “hold regulators and governments to account, and strive for sensible regulation” (IATA, 2019). The IATA acts to bring airlines together to address larger issues. They are a relevant stakeholder as they created a specific environmental assessment for the industry, as requested by the airlines, called the IEnvA. Interview 4 also explained that waste management is a “relatively new thing,” which is why so few airlines cover the content in their reports.

In 2014, IATA had a project to “(1) determine data from CAT 1 waste for several airlines (2) establish a universal methodology (3) determine how to recover materials for in-flight operations (4) determine best practices” (Cabin Waste Activities, 2014). This allowed the IATA to determine the data of average weight per passenger of total waste (including the cabin and toilet waste) of 1.43 kg (low of 0.82 to high of 2.50 kg). Sealed food and beverages made up 18.5% of the total weight. Thus, learning from Air New Zealand on how to recategorize untouched food could be useful in lowering the amount of food wasted. This study also indicated the importance of collaboration and the need to properly sort and label.

Interview 4 indicated that it is important to note that each airline deals with ISO 14001 very differently and some airlines do not include the flight operations but if they do then it should include cabin waste. ISO 14001 has a complex scope and boundary, which can be confusing for consumers, as only some components within airline operations are covered. Some airlines choose to have a very narrow scope that only includes a limited portion of their process. One interview with IATA explained that if an airline doesn't include food waste management it is because the catering company is focused on making the operation work and they lack knowledge about the problem (Interview 4, 2019). The IATA has worked to create an industry-specific ISO 14001 to help airlines navigate the correct practices.

Power dynamics play a large role in the communication between stakeholders. The interview with the IATA revealed that catering companies are often overshadowed by airlines and airports. This largely impacts the interactions and communication making the process extremely

complicated and difficult (Interview 4, 2019). Even the stakeholders internally present a lack of comradery. Iberia is considered to be a partner of Gate Gourmet in the Zero Cabin Waste project (Gategroup, 2018). However, in reality, Iberia acts as a boss to both Gate Gourmet and the waste management team at the Madrid–Barajas Airport. This causes tension since the intention was to be partners working to improve the overall system together. One of the main goals of the EU funded project was focusing on finding an airport and airline that would be interested in a replication project but so far it has been difficult to collaborate based on the high levels of competition and uninterest in sharing data (Interview 8, 2019). Interviewee 7 also communicated the strict competition and the lack of cooperation within the industry (2019).

Interviewee 4, speaking on behalf of the IATA explained that “as much as we’d like to reuse or recycle, regulations don’t allow for that” (Pepper, 2018). He explained that with domestic flights it is easier to comply with recycling rules but overall, the shorter flights produce less waste compared to the international flights that land at EU airports (Pepper, 2018).

4.3 Map of the production chain

The production chain highlights the pockets of waste that occur from the suppliers to the treatment. Gate Gourmet explained that the majority of the waste is produced from the inflight service and that relatively small amounts occur from transportation, cooking and assembling and limited flight cancelations. The flow chart also reveals the potential for improved strategies, for example, sorting onboard can help if the airline wanted to donate food. Depending on the airport and airline, category 1 and category 3 can be combined. In the case of the Stockholm-Arlanda and SAS, the two streams are separated but both end up with incineration as the treatment.

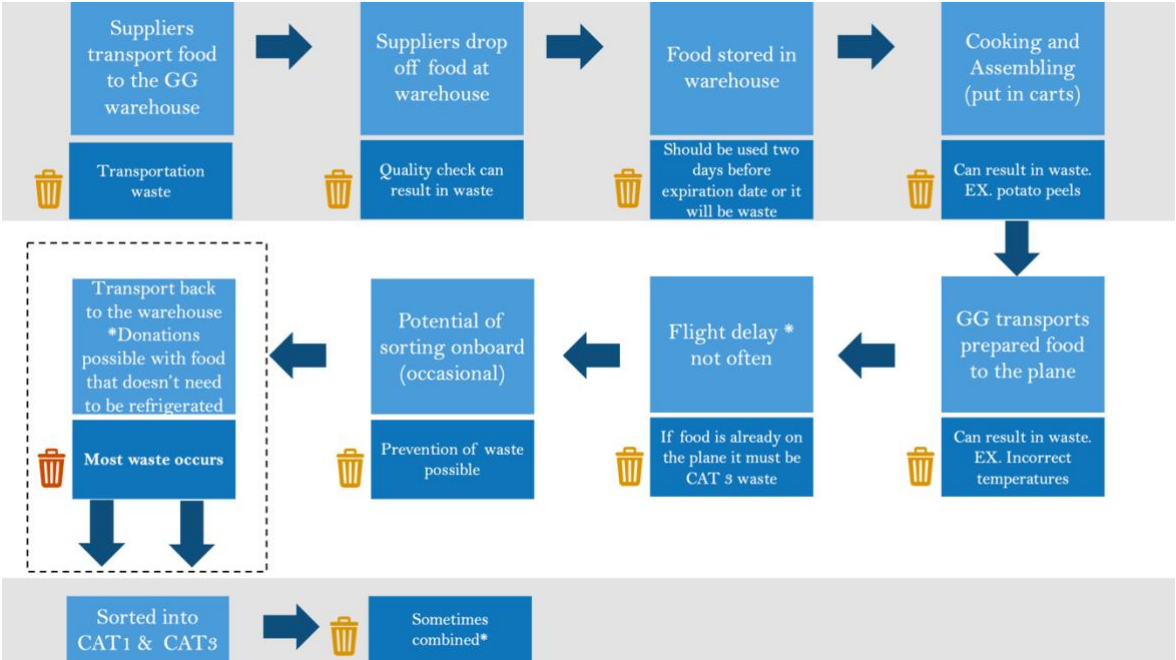


Figure 4-2. 'Map of airline food production chain'

Source: Created by the author

4.4 Stakeholder map

Overall, the three major stakeholders: the airline holding the most power, then the airport and catering company, have collective barriers that prevent effective collaboration. The solutions are relatively straightforward when it comes to treatment solutions; building the infrastructure

required to treat both Category 1 and Category 3 food waste is essential to motivating proper sorting. If there are no facilities to collect the waste and dispose of it the motivation will remain low to sort. A potential scenario could be that the airport invests in an onsite treatment plant, like Glasgow airport, potentially with funds from the government. The catering company, unlike Glasgow airport, as catering companies are typically physically located close to airports could collaborate to bring their food waste to the airport facility. This could encourage the airline to sort their food waste to send both Category 1 and Category 3 for enhanced treatment. Another scenario, since all three stakeholders produce waste, they all collaborate to invest, although this is unlikely as budgets remain rigid within the industry.

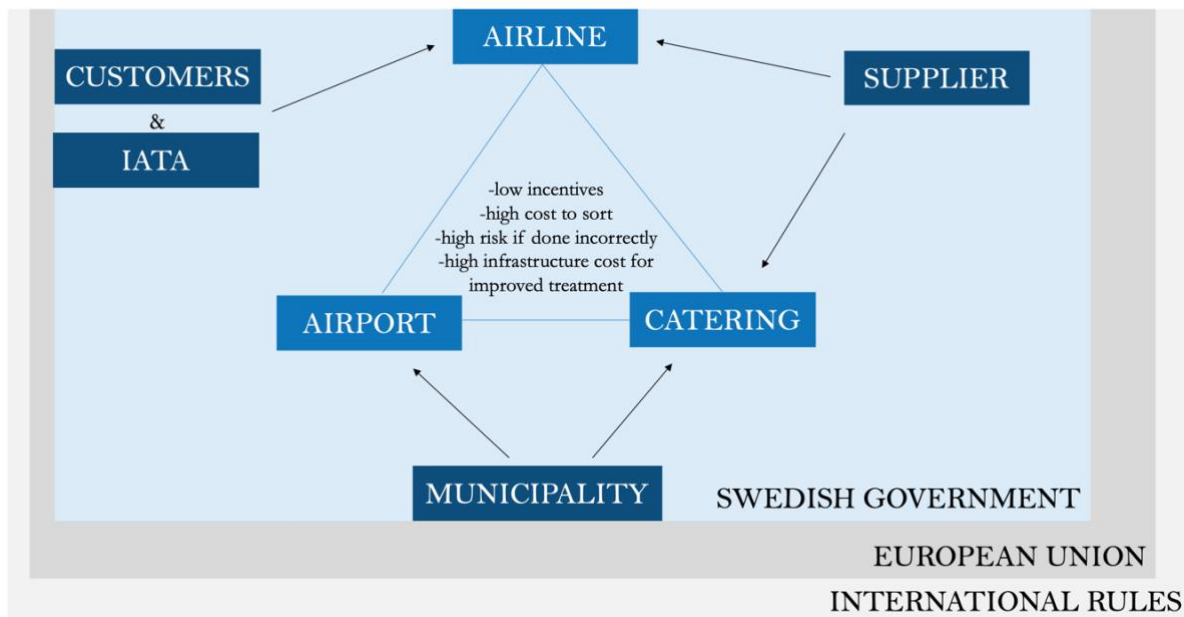


Figure 4-3: 'Airline industry stakeholder map'

Source: Created by author

This section aimed to explain the case study of SAS, while providing insight from the literature review and interviews. Along with outlining the roles of each stakeholder as well as mapping the production chain. The tactics used by competitors were also examined to understand where SAS exceeds the industry standards and where improvements can be made.

4.5 SAS strategies

4.5.1 Current plans described by SAS

The main focus of SAS according to the Head of Environment & CSR, is to direct their energy within the topic of prevention rather than treatment. The reasoning being is that SAS needs to prioritize what they can directly change, which is the food entering the airplane and not the treatment strategies because the treatment, in his experience, has been typically blocked by international laws depending on the airport (Interview 2, 2019). Interviewee 2 understands that under the current situation “most airports in the EU can’t recycle or don’t have the systems in place” making it difficult to enact widespread policies that address the issue with 125 destinations (Interview 2, 2019). Due to the lack of treatment options, all the waste in Sweden is typically burned and “there is nothing meaningful done with the waste” (Interview 2, 2019). In the EU 37% of all the municipal waste generated was sent to the landfill whereas 23% was incinerated (European Commission, 2014). However, SAS recognizes the problem and for this reason has a cabin waste working group focused on lobbying to try and overturn the current legislative barriers (Interview 2, 2019). As it was an internal group mentioned over the phone, no further data was found to indicate how the working group plans on overturning international legislation, the timeline they are operating under and what will be achieved if the laws are overturned.

The focus for SAS, based on the contents of the sustainability report stated that “offices, ground service and technical maintenance is measured, and divided into sorted, unsorted, and hazardous waste” (SAS sustainability report, 2018). Food waste directly from flights is excluded from this list and although the report explains that recycling is an element of improvement it can be difficult to comply with different national legislation, mentioned within the barriers section.

Pre-ordering meals is an important strategy for SAS when it comes to waste management. SAS Plus customers (premium economy) have meals included, while the economy or SAS Go pay before the flight (Skift, 2019). It is promoted when selecting the flight and is accessible through email and the application. Instead of having one meal for each person, it allows the airline to only provide food for the people who pay for it in advance and gives the consumer a better selection of choices. The study produced at the Larnaca Airport suggested that “pre-ordering could save more than 30% of the food that is disposed of” (Tofalli, et al, 2017). Since the data is protected it is unclear if SAS has experienced the 30% reduction of food waste since pre-ordering has been introduced. “Recently, SAS doubled the number of flights with pre-ordering options and pre-order options is now offered at a total number of approximately 80.000 SAS flights world-wide a year.” (SAS Website, 2019). Incorporating pre-order options into the short-haul, more than 80 minutes from the original 120 minutes since October 2018, has given SAS the option to decrease their food waste and improve customer satisfaction (SAS Website, 2019). Meaning that now SAS uses pre-order on 80.000 flights each year (SAS Website, 2019).

SAS encouraging increased pre-ordering options is a scientifically sound option for reducing waste and the strategy is important to continue. Research suggests that in the context of school cafeterias when schools require students to “take vegetables, only about 35% of the students actually consume the vegetables, resulting in substantial waste of food and resources” (Just, D. R., & Wansink, B., 2009). Another experiment demonstrated that when “required to take the carrots 69% (83 of 120) consumed the carrots, while 91% (94 of 103) of those choosing between carrots or celery consumed their vegetable” (Just, D. R., & Wansink, B., 2009). This indicates that with choices or when people order their food instead of having the requirement consumers are more likely to produce less waste. Overall, validating the choice that SAS has made on increasing pre-ordering.

SAS is starting to measure how much food is consumed to forecast the needed food more accurately (Interview 1, 2019). An optimization program is used in order to not load as much food if it is unneeded. For example, the option for breakfast was eliminated on some flights due to limited breakfasts consumed (Interview 1, 2019). In business class, you get breakfast if you want to but for the economy it is only offered if you pre-order the meal (Interview 1, 2019). Managing risk is also an essential part of running a profitable business “other significant progress includes optimizing the amount of food and beverages loaded onto each flight-to reduce waste, aircraft weight and, fuel consumption” (SAS annual report fiscal year, 2018, p. 6). This demonstrates that SAS has already identified the risk associated with the correct amount of food loaded onto the airplane and is working to change more accurately reflect the quantity they need.

The Environment and CSR team at SAS will continue to push innovative solutions and ask important questions. For example, “do customers really need this? And if they do can we change the material?” (Skift, 2019). They will also continue to train their staff on best practices to minimize the creation of waste. Firstly, they will continue to require flight attendants to sort recyclables when flying to countries like the UK and Switzerland that demand that the waste is sorted onboard (Interview 3, 2019). Secondly, they want to “work closely with the cabin crew to reduce usage and not hand out everything” (Skift, 2019). However, when asking the flight attendant about this close relationship to improve usage and not hand out everything she was sceptical as she did not experience it herself (Interview 3, 2019). SAS relies on Gate Gourmet to provide insight on how to prevent food waste from occurring, “they are the experts so they will have to help us with the problem or issue” (Interview 1, 2019). SAS, customers and Gate Gourmet are all applying pressure when trying to drive change (Interview 1, 2019). Gathering information about what consumers would like regarding their food onboard could be a useful

indicator to what should be provided. Understanding why customers leave their food uneaten or refuse meals can help SAS forecast and eliminate extra food onboard (Jones, 2007).

4.5.2 Future plans described by SAS

SAS appears to understand the true cost of the food that is wasted. Not only does the wasted food need to be transported for treatment but the extra weight of uneaten food also adds to the extra cost of jet fuel. Wasted fuel is burned transporting uneaten food. The following communicates the future goals derived from the SAS interviews and literature review.

Identified by SAS

1. Continue scaling up pre-booking.
2. Continue to measure the number of orders purchased to determine if less food onboard is needed onboard.
3. Continue dialogue Gate Gourmet to achieve the best outcomes for improved strategies.
4. Goal by 2030- 100% recycling where possible. This is not in scope for deplaned food waste but would result in improve overall waste management.

According to Interview 7 (2019):

Airlines need to share forecasting and data in a better way. Pre-order and a business opportunity to do something that is a-la-carte ordering. Like a restaurant where you order off a menu that requires IT solutions that are coming, (not 20 minutes) order a couple of hours before, enable catering company to minimize waste but has to be in tight cooperation with the airline. Maybe we should have a solution that is used with the SAS client site.

As a catering company, people call in to ask for specific orders and “it would be nice to give it to them” (Interview 7, 2019). Other airlines, like Qatar and Emirates, ask the customers what they would like for dinner and sell more exclusive food. Moving beyond a standard sandwich and offering food that allows the customer to pamper themselves or embrace their holiday could result in higher profits for both the airline and the catering company, as well as producing less waste (Interview 7, 2019).

Prevention strategies, important to SAS currently since they have identified that they can make the most impact within this sphere of influence, lacks clear targets in their current sustainability report for future options besides scaling up pre-ordering. That being said, this is only what was portrayed in the sustainability report externally, it is assumed that goals are set internally to meet the ISO 14001 standard. After Interviews 1 and 2, it appears that there are internal methodologies for both SAS and Gate Gourmet when it comes to tracking food waste. However, it should be noted that this remains secret and not for the public, making it difficult for the public to evaluate their progress.

Outside of the scope of this thesis but relevant to the overall waste management prevention strategies is that SAS is working to upgrade their recycling for 2030. This goal did not have specifics but it can be assumed after Interview 2 that this achievement would be for the SAS hubs in Copenhagen, Stockholm, and Oslo. Overall, no specific food waste, catering or cabin waste, are included in the sustainability reports and the interviews gave no indication to prevention strategies further than scaling up pre-ordering.

Treatment, a lower priority for SAS, has limited targets so far. The responsibility of transitioning from incineration to using food waste for compost or biofuel seems to be left to an energy company that is willing to take on international legislation. The airline and catering company

has not been able to overturn international regulation to use Category 3 waste as well as Category 1 waste. The appendix, 6.2, offers an exemplary plan for what an ideal treatment strategy would look like and can be a guide for SAS moving forward.

It is important to note that SAS is lucky to have incineration as the preferred method in Sweden because the infrastructure is in place to avoid landfill. The main takeaway for future plans is that improved treatment options offer the biggest potential for SAS. There is a lot to gain financially and through public relations.

4.6 Competitors

Strategies employed by competitors can provide important inspiration for SAS and other airlines looking to transition to more sustainable solutions with their deplaned food waste. Compared to Norwegian Air and Lufthansa, SAS surpasses the competition. SAS should be aware of the waste management work done by TAP Air Portugal, Virgin Australia, Air New Zealand, and the Gatwick Airport as they demonstrate value-added tactics. It should be noted that the following competitors were not evaluated by the framework created due to time restrictions; instead, they present inspirational elements that SAS can work to achieve.

4.6.1 Norwegian Air

Norwegian Air, arguably the most direct competitor in terms of region and a relatively similar number of passengers to SAS explained that the company is following the lead of SAS by introducing pre-ordering. This was echoed not only in the sustainability report but in an interview; “we are introducing pre-order meals on all flights over two hours in order to avoid having to throw away unsold food.” (Interview 12, 2019). The report itself also focuses on sorting waste on board specifically improving recycling paper products. “Our current initiatives involve the sorting of paper and recycling of other types of waste. This also applies to our partners at the airports” (Norwegian, 2017, p. 19). This was confirmed in the email correspondence with Norwegian air as the contact stated that in his opinion food waste was not the responsibility of the airline but mostly fell on the airport (Interview 12, 2019). His argument expressed that the airline had limited flexibility and it was the role of the catering provider and handling companies at the airports to take care of the logistics (Interview 12, 2019). Interviewee 12, also mentioned the role of strict regulations prescribed by the authorities as being particularly difficult to navigate (Interview 12, 2019). Overall, Norwegian seems to be trying to keep up with the initiatives already in effect at SAS.

4.6.2 Lufthansa

Focusing on another larger competitor, one with the highest mentions of the word “waste” and a high volume of customers, it would be expected that their commitment to sustainability would be higher. First, there is a lack of clarity regarding how Lufthansa is working with their partners to ensure that the waste is recycled at all airports with which they operate, making it difficult to determine their progress. Lufthansa has launched a program called Flygreener, working to permanently reduce waste on board (Lufthansa Group, 2017, p. 36). The Flygreener campaign works to encourage staff training in onboard sorting, increased access to information among employees and drive stronger partnerships between the LSG Group and Lufthansa airline (Lufthansa Group, 2017, p. 36). To drive movement on the Flygreener goals an “Empty-out campaign” was created to track 20 long haul and 50 short-haul flights in Munich to understand the composition of waste on trolleys (Lufthansa Group, 2017, p. 36). Lufthansa wants to have better pre-sorting on board and establish a better system for onboard liquid disposal (Interview 11, 2019; Lufthansa Group, 2017, p. 36). Interviewee 11, explained that flight attendants would put liquid into paper bins which would then contaminate the entire paper contents that would otherwise be recycled (Interview 11, 2019). The overall design of the trolley was a crucial factor

in how the waste was sorted on board and consequently dealt with once off the airplane. From the catering company's perspective, they provide the product and they are not responsible for the treatment of the waste when it is onboard. Improved communication between the catering company and the airline when it comes to onboard sorting could help improve the situation, which is why the Flygreener campaign was launched (Lufthansa Group, 2017, p. 36; Interview 11, 2019). Overall, the collective sustainability reports do not have a detailed analysis of deplaned food waste but are trying to shift to onboard sorting, which they have identified as a crucial step to better management strategies.

4.6.3 TAP Air Portugal

TAP Air Portugal, although it is not included in the largest airlines in Europe, demonstrates a commitment to waste management despite the size. The company also demonstrates its commitment by improving employee awareness of their waste. They celebrate World Environment Day on June 5th to encourage employees to try and select food with a lower water footprint (Sustainability Report-TAP Air Portugal, 2013). TAP Air Portugal uses the GRI Indicator and ISO 14001, similarly to SAS (Sustainability Report-TAP Air Portugal, 2013). However, in the case of TAP Air Portugal, the sustainability report contains the total quantity of waste for five years and how it was treated, which is a different measurement from the treatment of hazardous waste. It also includes how much of the funds are given to waste management over the same amount of time (Sustainability Report-TAP Air Portugal, 2013). TAP Air Portugal also donates their surplus food from the canteens "close to 23,000 meals and snacks" (Sustainability Report-TAP Air Portugal, 2013). To further address the issue of food waste TAP collaborated with other institutions to "use of leftover food served in-flight TAP aircraft which could, due to its condition, be distributed to partner institutions" (Sustainability Report-TAP Air Portugal, 2013). This level of transparency can be useful to the entire industry and stakeholders involved. While also preventing greenwashing¹ from occurring when many companies are trying to appear sustainable to their customers when in reality the commitments are non-existent or extremely low. SAS, as a competitor, should demonstrate to its customer base that they are fully committed to sustainability to compete with airlines like TAP Air Portugal that manages to hold itself accountable each year.

4.6.4 Virgin Australia & Qantas

The collaboration between Virgin Australia, OzHarvest and the Australian government is an example of how different stakeholders all committed to the same goal can achieve impressive goals. So far OzHarvest has "save[d] one million meals (333,000 kilos) since 2015" and given the meals to Australians in need ("More than one million..." 2019). OzHarvest is the driving force behind pushing the government to shift the liability from the company to the person consuming the food. "The first thing we did was get the Australian government to legislate that good food, that was still good for consumption, could be given away for free without any fear of liability" (Interview 14, 2019). The airline is one of the biggest food donors besides supermarkets, demonstrating the important impact the airline has on the entire community; especially considering that food insecurity impacts one in five children ("More than one million..." 2019). "Virgin Australia donates over 8,000 kilos of food each month, providing over 16,000 meals to people in need" ("More than one million..." 2019). The ability of the airline to collaborate with the government and a local non-profit conveys the positive impact food donations can have for everyone involved. The airline gains important recognition and improves its supply chain, while Australians benefit from the food donations. The minute that barrier was removed it was easier for companies to accept food donations.

¹ Greenwashing: "To make people believe that your company is doing more to protect the environment than it really is."
(Greenwash, n.d.)

Currently, OzHarvest works with Qantas and Virgin. With Virgin, they pull the food aside and the catering company, in this case, Gate Gourmet, allows for collection from their warehouse. In the case of Qantas, volunteers go to the warehouse and sort the food themselves (Interview 14, 2019). The airline was not involved when it came to lobbying the government, eight years ago the legislation changed but Virgin came to OzHarvest. Both the food from the airplane and airport is collected. They are only focused on domestic flights because Australia is an island and has very strict quarantine issues. Gate Gourmet also donates first-class food, if they make more than needs to enter the airplane (Interview 14, 2019). Essentially, OzHarvest works as a logistics company to move food from the catering company warehouse to the donation sites.

Interview 14, (2019) indicated that:

Every single item of food whether we collect from a supermarket or collect from Gate Gourmet or an airplane it is measured. That way we can go back to the airline and tell them exactly how much we've collected. We are a huge source of data for them and they start talking about their carbon footprint and it saves them money. We can show them they are throwing away 5,000 sandwiches or in their business, it is hard to prepare less and the nature of the catering world is they need to be prepared, which is why they have so much waste.

The law changing was the most impactful part of making the process a success. Iberia has reached out to learn about how they can try something similar in Spain (Interview 14, 2019). If the infrastructure was in Sweden it would be easy to replicate something similar (Interview 14, 2019). Airlines are excited to share the information since it does not focus on how much they are wasting but instead making them look good. "We make it easy for businesses since we collect and deliver directly to be donated. Qantas pays for the vehicles and driver, but OzHarvest trains the driver. OzHarvest would be happy to share their model and train more drivers" (Interview 14, 2019). "It is a beautiful staff engagement opportunity to get SAS to live and breathe its values and give some team members a day off a month or a year [to work on waste management]." SAS could trial a volunteer-led model and the PR would be "worth no marketing dollars as it makes the airline look like angels" (Interview 14, 2019). Indicating that the financial benefit would be within the marketing department. OzHarvest understands that there is currently limited data for determining the baseline but they strive to help businesses become more efficient. Incorporating donations for leftover food would eliminate waste and improve publicity for the airline.

SAS could gain a significant competitive edge if they made waste management a priority. "If any country should be able to do it, it is Sweden. Especially if they cared enough about it to do it" (Interview 14, 2019). There is potential to make great strides in the airline industry when it comes to mitigation and improved treatment of food waste. Interview 14, explained the massive financial benefit to investing in saving food. For example, "the Stockholm City Mission collects food that would otherwise be discarded and distributes it to vulnerable people" (Orava, H., n.d.). Every month, it collects 40 tonnes of food that would otherwise be thrown out (Orava, H., n.d.). It could be assumed based on the success with Virgin Airlines that if SAS collaborated with Stockholm City Mission it would give SAS unprecedented media attention and improve its brand. Food donations not only improve the lives of the people that need food but help the airline gain a competitive advantage.

4.6.5 Air New Zealand

Air New Zealand has been identified as a leader in the industry by an IATA analyst for having a sustainable approach to waste management. The company also made sure to convey the difficulty within the industry when working on waste management, "inflight waste continues to

present the biggest challenge, and is top of mind for both crew and customers” (Air New Zealand, 2018, p. 52). This presents a level of honesty and acknowledgment of difficulty to customers. The report also included the baseline year and their progress each year. The company attempts to be as transparent as possible about the upcoming goals and progress; “Standardising reporting, systems, and processes for working with regional ports will be a focus in the coming year” (Air New Zealand, 2018). Air New Zealand, wants to improve their separation on domestic flights as there is still limited compost and recycling options (Interview 10, 2019). SAS can learn from this level of transparency in its sustainability report.

Air New Zealand has set a goal to achieve the industry standard of IEnvA stage 2. SAS should strive to meet this standard as the “IEnvA certification represents global best practice for environmental management. Last year, Air New Zealand met stage one of the IEnvA programme following a successful external audit. Next year, they are set to achieve stage two certification under further external independent verification. “We also have hazardous waste that needs to be managed. Due to biosecurity risks and the hazardous nature of this matter, there are few options available for recycling these waste streams” (Air New Zealand, 2018, p. 62). The IEnvA helps airlines focus on strategies each year and report on their progress, which could be vital to SAS establishing environmental leadership in the industry.

Project Green is a project that demonstrates the positive aspects of creating powerful partnerships that can achieve significant change and it is “expected to divert 150 tonnes of waste from landfill annually” (Air New Zealand, 2018; Air New Zealand Press Release, 2017). This project was significant because it recategorized 40 food items to be reclassified if they are sealed and untouched. This allows the food to avoid the landfill and be used for a new flight (Air New Zealand Press Release, 2017). This process took 18 months and resulted in better tracking of food items that were loaded onto the airplane and lowered the cost of waste disposal as there was not as much waste going to the landfill (Air New Zealand Press Release, 2017). Project Green was able to shift the current strategy from relying on the treatment option of landfill, the least favoured option on the waste hierarchy, to a more preferable option of reuse. SAS can learn from this collaborative treatment strategy and create their own Project Green, to make a win-win scenario for all members involved.

That being said, Project Green was successful due to a variety of factors. As New Zealand is a small country it was easier to make direct contacts with relevant stakeholders. For example, the people within the Ministry for Primary Industries (MPI) were more easily accessible compared to a larger country according to the interviewee. The team worked closely with LSG Sky Chefs and their flight attendants to make sure proper sorting occurred and the supply chain was closely monitored. The process took several years to develop as the airline but pressure on the MPI and demonstrate why it was important in terms of a key performance indicator (KPI), explaining the risks of going through with the recategorization, and what was at stake if the project was not prioritized (Interview 10, 2019). From a marketing and brand perspective, the project made everyone involved gain sustainable credibility. Project Green addressed treatment strategies over prevention. The company has two goals; “85% diversion from landfill at Auckland ground sites by end RY18 (zero waste to landfill by end FY20” and “75% diversion from landfill at non-Auckland ground sites by end FY18” (Air New Zealand, 2018). The sustainability report, extremely transparent about their progress, conveyed that they did not reach their targets in 2018 as the waste generated increased (Air New Zealand, 2018). Air New Zealand calculated that 49% of dry (cabin) waste of international waste is not taken to the landfill but recycled. They also explain the difficulty required to find solutions in waste treatment plans. Air New Zealand is straight forward about the obstacles they face and our transparent when it comes to their progress on meeting their targets. Clear and transparent communication allows the reader

to trust the contents of the report. The progress is represented, which SAS could integrate into their sustainability report.

Air New Zealand has “invested in additional organic waste infrastructure and services at our major employee ground sites to help separate more waste at source”, while also working to help employees understand prevention and separation tactics (Air New Zealand, 2018).

4.6.6 Gatwick Airport

Gatwick, an airport outside of London, has made waste management a priority and therefore have continued to demonstrate a world-leading waste management system. Gatwick presents an interesting example of how the environmental targets of the airport helped drive significant waste management plans for all stakeholders involved. “The facility is the first at any airport in the world to process Category 1 airline waste on-site and convert it to low-carbon energy” (Decade of Change, 2016). Category 1 made up for about 20% of the Airport’s waste, it allows the on-site Materials Recycling Facility to capture the food waste and convert it into energy through the process of drying and using a biomass boiler (Decade of Change, 2016). This monumental progress, in regard to Category 1 waste as it will be used to heat the North Terminal in the future as the facility will produce more biomass than can be burned. “The facility is set to save 1,000 pounds in energy and waste management costs for every day it operates” (Decade of Change, 2016, p. 11). “No untreated waste to landfill and 70% reuse/recycling rate by 2020 (Decade of Change, 2016).

Originally, the waste management plans for the airport started in 2015 to set targets. The airport, working together with DHL to manage the logistics, began to include the government to achieve the 70% goal by 2020. The interviewee highlighted the importance of starting the process early was extremely important. The importance of definitions and scope is significant because Gatwick Airport collects the food waste from the cabin waste and not the catering waste. Therefore, food makes up a small portion of the waste today but in previous years food waste made up a larger portion of the total waste. Now the composition is mostly plastic which is not the most efficient fuel for the biomass boiler. The process of allowing the EU waste to be included in Category 3 waste took 18 months to process as the UK government wanted to make sure that the EU had sufficient regulations that were similar enough to the UK to prevent contamination. By focusing on “what can we control,” assuming that airlines would continue to operate with the same tactics the airport wanted to implement a system that tracks and records, they make sure to label the trash bag with Category 1 or Category 3 waste, sort the waste and measure the weight. With Category 1 waste it has strict protocol; for example, if a bag leaks the entire area has to be sanitized, the bags cannot touch the floor and the bins have to be locked (Interview 15, 2019).

This example indicates the importance of collaboration between stakeholders especially the airport, airline, and government. Interviewee 15 identified airlines that she felt were demonstrating best practices that could be adopted by other airlines to improve their waste management strategies. The first, “UK DEFRA issued guidance on their regulation to make it clear to airlines what can/can’t be recycled/reused” (Interview 15, 2019). The UK government produced decision trees to help airlines better understand how to improve their waste management strategies (DEFRA, 2011).

The interview revealed that an entire garbage bag full of recyclable material-newspapers, aluminium cans and plastic water bottles all with the intention to be recycled could be spoiled immediately if milk is spilled in the bag or a food item is added. Category 1 and Category 3 can both be separated and recycled. However, the second food is in contact with the other components everything must be incinerated on-site. “That's when you start to say okay we've

got a bigger problem because we are actively contaminating bags with this material” (Interview 15). More waste accumulates due to strict regulations to prevent the spread of disease.

The airport now has a larger operating budget because the waste must be sorted or “double-handled” to make sure the proper sorting has taken place. The value of recycling products has helped the financial costs as it is cheaper than having the waste incinerated or handled by a third party, in the context of the UK. The reasoning behind why more airports have not created their own on-site facility to capture Category 1 waste is due to cost. There are very few facilities that exist making it difficult to provide improved services to airlines. It was explained by interviewee 14 that airports act as a landlord, “it is a bit of a chicken and egg situation. Is it the airline’s responsibility or the airports?” (Interview 15, 2019). One of the entities needs to fund the facility but as costs to operate improved waste management is a high upfront cost, airlines do not take on the responsibility. When asked which airline was ahead in achieving waste management, the interviewee felt that all the airlines needed to improve. In his opinion, they all wanted to have the confirmation that the waste is treated in the best way but they also are not willing to change the infrastructure. It is more than just the airlines; designers of airplanes also need to think about waste management to make sure there is room on the airplane to properly sort. The responsibility does not fall on one sector, it is important to have everyone on board with making changes and prioritizing waste management.

Gate Gourmet, which has a facility close to the airport, could have their catering food waste processed at the biomass boiler, but those conversations are yet to occur (Interview 15, 2019). Ideally, the airlines need to sort onboard and have the segregation of waste be accurate to make sure the waste stream is not contaminated. Establishing the same type of plastic is also essential, as different airlines have different types of materials that make it hard to separate.

The main finding from the interview was collaboration is key. Without the airport discussing tactics with DHL and including the government in the dialogue the on-site facility would not have been created and the goal of reaching a 70% recycle/reuse would not have been achieved. Partnering with airports to inspire change could help SAS achieve improvements in its own waste management strategies.

5 Discussion and analysis

The following section uses the constructed analytical framework to understand the findings. The framework was created to assess the progress of SAS, based on the information available, and identify potential areas for improvement; therefore, answering the second research question, “*Are the current practices used by SAS to prevent and treat food waste the best strategies available?*” The analytical framework was developed by using different methods of evaluation from the airline industry, established food waste researchers and governmental documents. The second section provides recommendations that answer the *SUB RQ2*: “*What are the potential next steps that SAS can pursue in lowering the amount of food waste?*”

5.1 Framework

The constructed framework revealed that SAS achieved half of the selected systems and the other half it received the rating of satisfactory, as well as room for improvement (Figure 5-1). Overall, there are ways where SAS forges ahead in the industry when it comes to prevention strategies. As with any company, there are potential options to improve their waste management strategies. That being said, SAS has the structure to be innovative and a unique dedication to sustainability issues. They seem to be ahead of the industry when it comes to environmental awareness. SAS has the opportunity to make a difference and decrease deplaned food waste and treat it in a more sustainable manner.



Figure 5-1. 'Results from case study based on constructed framework'

Source: Created by the author

5.1.1 ISO 14001: Achieved

SAS is unique as “the SAS environmental management system has been certified according to ISO 14001 through the company since 2010” (SAS Sustainability Report, 2018). This is an impressive feat as most other airlines within the industry do not have an ISO 14001 certification that covers the entire company. This is a strategic advantage as SAS has already achieved this significant achievement in comparison with other airlines that have only implemented ISO 14001 within specific sectors of their business.

That being said, the information is solely based on the findings from the interviews from the two members of SAS. It still remains unclear how it is measured and the data stemming from this certification. However, in an interview with the person on the environmental team for SAS revealed that measurements are occurring; “Gate Gourmet makes the meals, gives it to the airplane and then takes all the trays in the trolleys back and that is what we measure” (Interview 1, 2019).

ISO 14001 has members follow the cycle of plan, do, check, act (SAS Sustainability Report, 2018). Figure 5-2 demonstrates that SAS has effectively planned to improve their waste management prevention strategies, with most of the focus on pre-ordering, while it is assumed that they do set procedures in order to achieve the certification and document their findings internally. It is unclear how SAS trains their employees and communicates information as the SAS environmental team felt that their training was sufficient but the flight attendant said that training was extremely limited. In training and communication, SAS can work to improve their

current system. No catering food waste data can be found or recorded, but it is assumed that internal monitoring and auditing are occurring to check if the plan is working. Again, it is unclear if the plan is working or if the goals are being achieved. Since no public goals have been indicated about catering food waste it is assumed after the interviews that progress is occurring. However, this can also be extremely limited as nothing is public, which holds the company accountable for their actions.

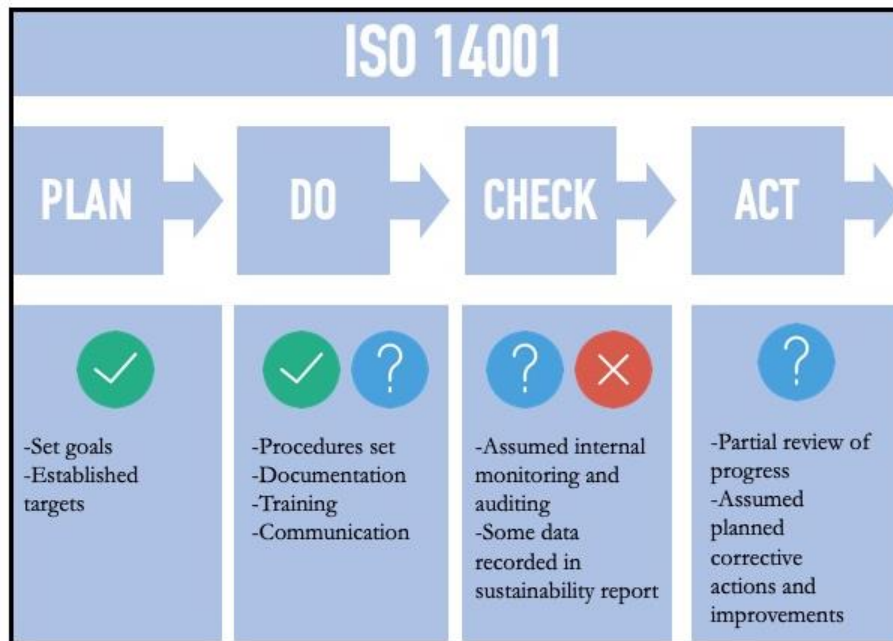


Figure 5-2. ISO 14001 framework analysing methods of SAS'

Source: Created by the author

As SAS has already incorporated the ISO 14001 system into its business the rating designated is "achieved." However, without external documents proving their commitments, there are still clear methods to improve. The purpose of ISO 14001's inclusion in the framework was to draw attention to the perceived lack of training, communication, and published data.

5.1.2 FUSIONS (Food Use for Social Innovation by Optimising Waste Prevention Strategies): Achieved

FUSIONS, funded by the EU, was created to help Europe be more efficient and reduce food waste across a variety of sectors "through socially innovative approaches" (Stenmarck, Å. et al., 2016, p. 3). Although this was produced to help the EU form a food waste policy framework, important lessons can still be applied to the context of the airline industry and catering food waste. The author has deemed the most relevant part for SAS and the catering company to be that "FUSIONS has divided the collection of desired food waste data into three sheets; Generated amounts of food waste, treatment of generated food waste and type of food waste products" (see table 5-1). These are essential elements which are necessary for reporting effective measuring of food waste (Stenmarck, Å. et al., 2016, p. 49). FUSIONS implies the importance of distinguishing how the waste is calculated making it a relevant tool.

There are several methods presented to help industries select the best one for their context. A waste composition analysis seems to be the most common way to measure for a catering company or an airport (Interview 15, 2019) as it includes taking the waste and separating it

before it is weighed and then classified into the identified fractions. The data can be analysed by different lenses; “availability, product category, life cycle stage, packaging, etc.” (Stenmarck, Å. et al., 2016, p. 34). Direct measurement and scanning can also be used to calculate the mass of the waste.

The second step of recording treatment could be calculating the tons wasted per year and breaking down the waste fractions into components where SAS can visualize the type of treatment (Category 1, since Category 3 is all currently incinerated) it will be easier to determine where to improve within treatment options. Third, the type of food waste broken down into products is helpful when crafting menus. This information has been gathered to help direct SAS and Gate Gourmet if they are not already collecting their catering food waste in this manner.

FUSIONS shows the importance of having collective definitions, establishing sound methodologies that can be evaluated for their effectiveness and establish possibilities for further research. A common terminology list has not been yet created by the IATA and various airlines have different definitions of their own. The common framework could be beneficial to the industry.

Table 5-1 'FUSIONS recommendations for food waste data collection'

| |
|--|
| 1. Generated amounts of food waste (tons/year) |
| 2. Treatment of generated food waste (%) |
| 3. Type of food waste products (%) |

Source: Stenmarck, Å. et al., 2016, p. 49

This section of FUSIONS was extracted as it demonstrates a relevant part of waste management. Without understanding how much occurs, where the treatment is occurring and the composition it can be difficult to make meaningful steps forward. The rating was based on the verbal confirmations in the interviews explaining that SAS does measure the amount generated (cleaning waste) and Gate Gourmet also expressed their measurements of the catering waste. Based on the understanding that some level of measurement is occurring the rating given for this category is satisfactory, as there is still room for improvement as nothing was mentioned in any interview about if the type of waste in % what has been calculated.

5.1.3 IATA Environmental Assessment (IEnvA): Achieved

To reiterate the purpose of the IEnvA, it is a voluntary program that was crafted to be an industry specific form of ISO 14001. In Europe, the only airlines that have achieved Stage 2 is Finnair and Icelandair (IATA Environmental Assessment Registry, 2019). The scope for both Finnair and Icelandair is directed to their flight operations and corporate activities (IATA Environmental Assessment Registry, 2019). There are minimum requirements when it comes to selecting a scope but the scope can achieve all six categories; flight operations (1), corporate facilities (2), maintenance, repair and overhaul facilities (3), ground handling activities (4), catering facility (5) and IEnvA Illegal Wildlife Trade Assessment (6). This industry-specific approach has helped integrate airline specific solutions to environmental challenges. However, only 15 airlines are IEnvA partner airlines–AeroMexico, AeroMexico Connect, Air Canada, Air Mauritius, Air New Zealand, AirLink, British Airways, China Southern, Finnair, Icelandair, LATAM Airlines, Philippine Airlines, QATAR Airways, South African Airways and Vueling (IATA Environmental Assessment Registry, 2019). The IEnvA could help potential SAS customers and investors understand the focus of its environmental achievements. The IEnvA Model has different stages and sub-stages. The first stage includes EMS Planning and legal compliance assurance. The second stage includes EMS implementation and review. The IATA

released a document summarizing their findings on the ICW findings. They concluded the following recommendations and this was compared to the strategies employed by SAS to evaluate if the company is on the right track to improved ICW regulations. Table 5-2 rates SAS using the recommendations proposed by the IATA to determine how well they rank when using the established criteria.

Table 5-2. 'Framework evaluating IATA and SAS compliance'

| IATA Recommendations | SAS compliance |
|--|---|
| Segregation of recyclables in the cabin cleaning waste streams based on visual inspections at airport material recovery facilities (MRFs). | -Outside scope of paper |
| Adoption of harmonized recycling guidance by regulators that allows for the recycling and reuse of materials uncontaminated by animal by-products (meat). | -Swedish government has produced information on what products can be recycled and reused |
| Mutual recognition of the animal health controls by countries with a similar status, such as North America and the European Member States, in order to downgrade the risk classification of catering waste, facilitating reuse and recycling. | -SAS working group created to push legislation to adopt better treatment methods (ICW guidelines) |
| Develop and implement new ingredient source controls that preclude animal as well as human disease vectors from meal ingredients. | -Try to source locally to give customers a Scandinavian experience |
| Introduce a menu plan that minimizes animal health risk based on the following ingredient hierarchy: zero food provision, vegetarian, cheese, fish, chicken, lamb, beef & pork | -Two weeks of only vegan options offered in 2018 and 2019 -Offer vegetarian option for pre-booking |
| On-board segregation of recyclables using the IATA published guidance on recycling from international flights to minimize the potential for contamination by animal products. | -Some recycling on flight to the UK, Norway and Switzerland (Category 3) |
| Segregation of waste streams at airports and catering facilities based on animal health status of countries of origin and destination. | -Gate Gourmet divides into Category 1 and Category 3 but everything is incinerated. Could turn Category 1 into recycling but nothing has been done in Stockholm/SAS context. -The SAS sustainability report explained they are working to help airports upgrade their infrastructure to recycle products like aluminium cans no mention of food collaboration. -Most airports in EU cannot recycle because they don't have the systems in place. -SAS will start with focusing on main hubs. |

Source: Adapted from IATA Environmental Assessment Registry, 2019

As five of the six categories within the IATA recommendations have been deemed completed, the ranking assigned to this section of the framework has been awarded achieved.

5.1.4 Food Loss and Waste Protocol: Satisfactory

The FL&W Protocol was created to account and report food waste. The part incorporated within the framework was the destination of the food waste as a system for encouraging better treatment options was deemed an important step in encouraging airlines to more actively participate in improved treatment strategies. The FL&P overall highlights the importance of a timeframe, what type of material (what is categorized as food compared to inedible parts), the destination of treatment and the boundary of the scope. This is echoed throughout the literature

as essential elements when understanding where the food waste occurs and what type of food is wasted find innovative solutions. As explained in the findings section, SAS is predominantly focused on the prevention strategies compared to the treatment strategies, as treatment implies relying heavily on regulations. Based on this, Figure 5-3 communicates how SAS can better understand their supply chain once the catering waste has left the airplane. Every stakeholder can participate in helping the airline gain important data. SAS needs to be the driver in communicating the importance of gathering relevant data and promoting dialogue between stakeholders to ensure an efficient supply chain. If the EU required airlines to work together with their selected airports and catering companies to track waste a more robust tree diagram could be used to understand how much waste is collected and where the waste ends up at each destination.

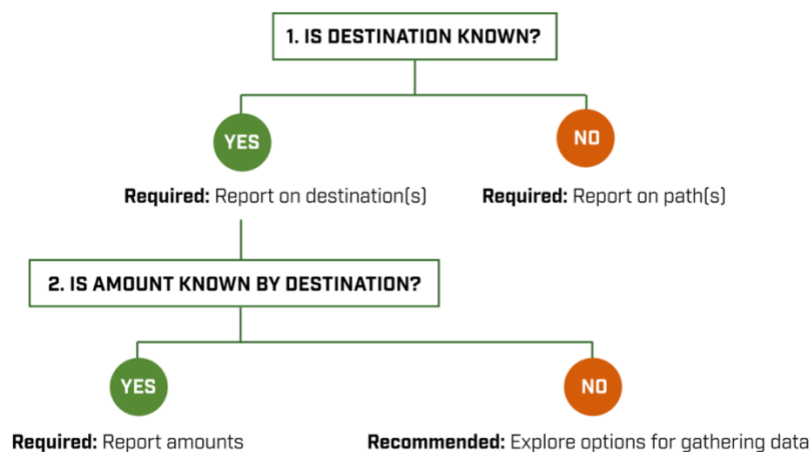


Figure 5-3. 'Example of Food Loss and Waste Treatment Plans'

Source: *Food Loss and Waste Protocol*, 2016, p. 42

It is assumed, based on the case study interviews collected from SAS, that the food waste data is currently collected and recorded deeming it a label of satisfactory. However, the SAS interviews hinted that the food waste data was only recorded in the Scandinavian hubs and not at their other destinations. This is assumed base on Interviewee 1, who communicated the difficulty of understanding what happens to waste at every airport where an SAS flight lands. A tree diagram, presented in Figure 5-3, clearly delineates this information and could help staff locate where information is lacking. The FL&W was included in the framework to offer to encourage SAS to track food waste at each destination moving forward despite different locations. This is a demanding ask but collaborating with the local airports is an important part of improved treatment options for not just SAS, but all airlines, to hold them all accountable for their waste.

5.1.5 Zero Cabin Waste: Satisfactory

This table has been filled out based on based on the interviews and what information was available within the SAS sustainability report. Zero Cabin Waste is an influential project that appears to have sparked action within Iberian airlines, Gate Gourmet and the Madrid-Barajas Airport. With the EU funding the project and pushing the region to transition to better waste management strategies, the findings of the project are essential when analysing SAS. This project provides a level of depth, specific to the airline industry, which provides a wholistic approach that SAS can use to improve their current strategies.

Table 5-3. 'Framework evaluating Zero Cabin Waste and SAS compliance'

| Zero Cabin Waste | SAS |
|--|--|
| Training plan for separation on board | -Only for UK and Switzerland |
| Face-to-face trainings: An environmental module has been included in the cabin crew trainings in which the ZCW Project is explained and how to perform the separation in the cabin. | -According to flight attendant no face-to-face training |
| Information available on the employee’s portal: In the internal website the crew finds a detailed document on the implementation of the project “Implementation of Zero Cabin Waste” and downloadable brochures and posters available. In addition, there is a video tutorial on how to separate waste using trolleys and on-board compactors. | -Some information for flight attendants. -Not Zero Cabin Waste specific |
| Crew Lounge: In the meeting room of the crew prior to boarding, leaflets and posters are available to remind Zero Cabin Waste Project and in which compartment the different waste should be deposited. | -Some information for flight attendants. -Not Zero Cabin Waste specific -Bins are labelled in headquarters |
| Briefing prior to boarding: The purser gives a series of indications to the Cabin Crew before taking off, among them, it is recalled that during the flight the good practices of separation on board will be put into practice. | -According to flight attendant no briefing. |

Source: Adapted from Zero Cabin Waste, 2018; Zero Cabin Waste, n.d.

Based on the fact that there are five components of this checklist and there are three attempts and two specific areas that need improvement the rating for SAS was given a satisfactory rating. Although SAS has been identified by other airline stakeholders as forward thinking and a leader when it comes to sustainable options, there are still impactful improvements that can be added or adjusted to better fit the needs of the airline. Other options include observing the current processes modelled by an LCA software to help implement actions and monitor progress (Zero Cabin Waste, 2017). The biggest take-away from the Zero Cabin Waste recommendations is improved staff training.

5.1.6 Sustainable Aviation: Room for improvement

UK recognized waste management as a priority and set out to strategize how the government could help assist the industry to improve. The recommendations produced after encouraging industry-wide collaboration especially between the airlines and the airport revealed how the two stakeholders could work together to improve waste facilities and conduct better pre-sorting of their waste (Sustainable aviation, 2019). Overall, it was also identified that communication remains a crucial component to the success of the project. For example, if the cabin crew is not well trained it can be problematic for other stakeholders involved trying to meet their own targets. Below two of the stakeholders were selected to evaluate; the cabin crews and the airline. Other stakeholders are mentioned in the larger report.

Specific to cabin crews and cleaning staff:

Table 5-4. 'Sustainable Aviation and SAS Compliance'

| Recommendations | SAS Compliance |
|---|---|
| Understanding barriers to recycling | -SAS interviews indicated that barriers were understood |
| Identifying triggers to encourage recycling | -Unclear if triggers are identified based on interviews |

| | |
|--|--|
| Clear messages on which materials can be collected | -Yes, when looking at flights into UK and Switzerland |
| Explaining contamination and why it is a problem | -Flight attendant did not receive training on why it was a problem |
| Reviewing cabin service provision to more easily allow recycling | -Unclear based on interviews |
| Considering impacts on service times and options to reduce these | -SAS interviews indicated they were working to reduce time and options |
| Identifying Environmental Champions within crews | -Flight attendant did not mention any such program |
| Making use of competitiveness between crews | -Not present based on interviews |
| Obtaining feedback from cabin crews | -Not present based on interviews |
| Providing information on where material collected goes and what it is made into. | -Not present based on interviews and literature review |
| Financial or other incentives | -Not present based on interviews |
| Sharing knowledge with other airlines | -Not present due to competition |

Specific to airlines:

| Recommendations | SAS Compliance |
|--|--|
| Inviting verbal and written feedback from crews | -Not present based on interviews |
| Adding recycling to existing post flight forms | -Not present based on interviews |
| Inclusion in mystery flyer audits | -Not present based on interviews |
| Random checks during turnaround | -Not present based on interviews |
| Base specific discussions on recycling between airlines and cleaners | -Not present based on interviews |
| Periodic waste composition analysis | -Unclear based on interviews |
| Providing feedback to crews especially on contamination issues | -Not present based on interviews |
| Requesting bag counts from cleaning companies | -Not present based on interviews |
| Random audits to check cleaning companies are recycling the material | -Unclear based on interviews but could be part of ISO 14001 checks |

Source: Adapted from Sustainable aviation, 2019

Overall, the framework highlights that standardization, planning and measuring remain crucial to progress. From larger demands to smaller initiatives, any change is better than no change. Standardization is important as it helps all airlines and stakeholders compete equally when it comes to waste management. Standardization presents difficulties with different country specific regulations for treatment options but a universal requirement to recycle could help airlines trust that their waste is treated in the most sustainable manner to achieve their personal goals. It would also help track the data more easily if everyone involved was measuring food waste and recording data. Eventually scaling up from regional standardization to international standards would help establish consistent regulation. Especially, regarding Category 1 that is extremely problematic for food waste and frustrating to airlines attempting more sustainable options.

It is important to reiterate that planning is essential. Every element within the supply chain has the potential to improve. For example, having staff sort waste onboard is extremely beneficial to the catering company and airport that needs to treat the waste. Training and establishing habits of separation occur before the municipality or airport is set up to handle the different fractions. This will make the transition easier when the airport does have the infrastructure in place to properly sort the waste. Collaborate with the airport and catering company to demonstrate interest in sorting can also help drive changes. In the case of the Gatwick airport, there was no interest expressed from Gate Gourmet to use the airport biogas facilities and the Gatwick waste management representative expressed that it would be a beneficial partnership (Interview 15, 2019). Demonstrating the need for planning and increased communication.

Measuring helps show companies where they can save food and therefore money. Engaging all employees to be mindful of measuring their food waste across the entire airline and stakeholders is imperative to helping any company become the best in the industry. A race to the top is beneficial for everyone when looking at ways to cut costs and sustain important resources.

5.2 Recommendations

The table below expresses types of strategies divided into key spheres (technological, institutional, legislation/policy and social) to capture the current strategies, both prevention and treatment, implemented by SAS. The table also includes pertinent recommendations aligned with the designated category.

Table 5-5. 'What are the current SAS strategies and what can be improve?'

| Spheres | Current SAS Strategies | Recommendations |
|-------------------------------------|---|--|
| Technological | <ul style="list-style-type: none"> ➔ Pre-orders ➔ Continue measurement (happening internally, not confirmed by this research) ➔ Continue to measure the number of orders and determine how many are eaten. This could help the airline orders less food. | <ul style="list-style-type: none"> ➔ Continue expanding pre-ordering ➔ Collect measurements (include in sustainability report) to determine how to reduce waste in long-haul and first class, since that is where the most waste is occurring. <ul style="list-style-type: none"> ○ Record in each hub and report information in sustainability report to be transparent and be held accountable. ○ Including Category 1 and Category 3 ➔ Work with designers of the airplane to design a structure that can meet the needs of the flight attendants to sort waste ➔ Promote innovation <ul style="list-style-type: none"> ○ Try new combinations of food (reduce the amount of meat or change packaging to keep food longer) and different ways to hand out the food ○ Try pilot projects in just one international or regional hub |
| Institutional (Business management) | <ul style="list-style-type: none"> ➔ Successfully integrated sustainability into entire company ➔ ISO 14001 into all aspects of business | <ul style="list-style-type: none"> ➔ The Swedish Government should enact more laws to put pressure on the industry (publish reports, move to better treatment options, help change international regulations) ➔ More training for staff to learn how to sort properly. Time pressure is a difficult issue to overcome but if SAS flight attendants have to recycle anyway for flights to the UK and Switzerland requiring universal tasks would promote better habits. <ul style="list-style-type: none"> ○ Appoint a leader to ensure staff is correctly trained |

| | | |
|------------------------|---|--|
| | | <ul style="list-style-type: none"> ➔ Put plans into place for food to be donated if there are cancelled flights ➔ Improve communication with stakeholders <ul style="list-style-type: none"> ○ Like Air New Zealand work with Swedish Government to recategorize certain products for reuse if they are unopened ○ Gate Gourmet ○ Municipality ○ Energy company <ul style="list-style-type: none"> ▪ Try to coordinate treatment of Category 1 for biogas ➔ Increased collaboration will increase trust between stakeholders and limit unequal power dynamic |
| Legislation and policy | <ul style="list-style-type: none"> ➔ Working group created to try to overturn legislation (explained in interview 2, no other sources found to confirm this information) | <ul style="list-style-type: none"> ➔ Become an EU wide leader in pushing ahead improved waste management strategies (most places do not have recycling capabilities) ➔ Set goal of IEnvA stage 2 |
| Social (consumer) | <ul style="list-style-type: none"> ➔ Offering two vegan weeks in 2018 and 2019 ➔ Offering Scandinavian dishes ➔ Locally sourced ingredients | <ul style="list-style-type: none"> ➔ Consumers need to communicate that they want improved waste management strategies ➔ Continue promoting vegetarian/vegan options <ul style="list-style-type: none"> ○ Will prevent spoilage and high energy use in production chain ➔ Offer less items in menu to reduce the need for multiple sources ➔ Consumer educational campaign to inform them about the problem and what SAS is doing to improve <ul style="list-style-type: none"> ○ engage the customer and demonstrate authenticity of company |

Source: Created by the author

5.2.1 Recommendations

Based on the sorted current tactics and associated areas for improvement the following section consolidates the findings into the top recommendations for the airline industry include promoting innovation, appointing a waste management leader, increasing industry collaboration and strengthening communication. These range from limited effort to maximum effort; for example, SAS could take small steps such as appointing a leader to inspire flight crews, to driving large-scale change by hosting a regional event to trade best practices. Large and small steps are both essential for improving the current waste management strategies.

Promote innovation

Regarding the case study, SAS has proven that innovation is possible and already encouraged within other sectors of the company. Using this to their advantage SAS can promote new ways to address sustainability problems. For example, running another piloting program to reintroduce gate buffets-buffet style where customers get to choose what they want to eat-could help prevent unnecessary waste, and could be improved through increased coordination with the airport to manage the infrastructure that was problematic in the past. Similar, to restaurants that weigh uneaten food and charge accordingly, SAS could ensure that customers are more aware of their actions. These changes could further help fund sorting of the waste to ensure improved treatment.

Running a pilot program to take untouched catering meals to the SAS lounge for consumers to purchase at half price could be an improved strategy for preventing waste. Unlike donations, it could bring in extra revenue for SAS and show customers the importance of sustainability, while giving them a good deal on the product. In addition, this would still promote the Scandinavian cuisine which is integral to SAS's brand. The business model would be similar to Karma, a Swedish food sharing application that encourages grocery stores, restaurants and bakeries to sell their uneaten food at half price (Karma, 2019). If there is still leftover food from the pilot a collaboration with Karma could be a useful tool if other people in the airport want to experience SAS food. However, another view from Interview 14 explained that Gate Gourmet would essentially have to have a store front to sell the food, which would be problematic and felt that there were "easier ways to get food to people than using an app" (Interview 14, 2014). Further business innovation to explore alternatives to implementing this approach would thus be needed.

SAS can also learn from other regional examples to innovate business models and better incorporate waste strategies into their organization. Some Asian airlines incorporate waste management strategies in their contracts for their crews to sort on board and a similar strategy could be adopted by SAS (Blanca-alcubilla, et al., 2018). Combining other successful strategies from different regions can be difficult when applied to the European context but could also set SAS apart from the regional competition.

Testing new methods to reduce waste based on customer preferences could also help SAS navigate new food combinations maximizing the amount of food consumed. For example, if bread is the most wasted food, provide information to customers and determine if increased knowledge alters behaviour. Updating and shifting the menu for on board meals could help determine customers favourites and attempting to maximize the amount of food consumed. SAS could partner with a university to conduct further research.

Appoint a waste management leader

Environmental leadership can make a large impact when it comes to a more sustainable waste management agenda. For example, a single person on the sustainability team at Lufthansa initiated a program called Flygreener, mentioned in section 4.6.3, elevating the sustainability efforts of Lufthansa. Without this one person driving the project Lufthansa would not have the program in place. A Lufthansa employee revealed that the company is "way behind other airlines like Iberia" (Interview 11, 2019). He explained further that Lufthansa has only started recycling PET this year due to the business incentive because the cost of recycled PET is growing. The interviewee did not view Lufthansa as an environmental leader in the industry as only one woman was the reason behind the environmental effort to improve their waste management strategy as a company. Yet this is also an excellent example of the influence a single "champion" employee can have on driving a company's sustainability.

Crucial elements to improved leadership within an organization include: a shared vision, appropriate skills of the workers to carry out the vision, incentives, resources and an action plan to achieve success (The Learning Accelerator, n.d.). Short-term strategies involve a committed manager sparking a desire amongst the staff to educate flight attendants. The flight attendants represent the company and encouraging leadership among flight crews to promote sustainable waste management values with customers could be an important way to demonstrate commitment. Long-term strategies could employ a more top-down approach of supporting staff, by providing time and resources to passionate employees interested in innovating improved strategies. Leadership could be any number of people working one day, a month, a quarter, a year on the subject depending on the level of importance. Empowered employees can become impactful management leaders to drive change within the company.

Industry Collaboration

In a highly competitive industry it can be difficult to encouraging dialogue between competitive airlines and subset stakeholders. Recording data, setting a baseline, and adhering to the predetermined goals is important internally. However, encouraging the industry to report their data and therefore improve accountability is essential to progress.

Pressure on stakeholders to improve their waste management strategies remains essential for wider industry improvements. Although the scope of this thesis observes Swedish domestic airline waste, which is incinerated, it is important to note that some SAS flight destinations send their waste to the landfill. For example, Interview 8, indicated that Gate Gourmet in Madrid sends everything to the landfill because it is currently cheaper than the biogas, compost or incineration alternatives. Thus, both Category 1 and Category 3 often ends up together, which results in increased methane emissions released into the atmosphere, further perpetuating climate change. By encouraging treatment practices that achieve results higher up on the waste hierarchy the EU is setting legally binding targets to limit landfilling (European Commission, 2014). A revision of the Landfill Directive explained the EU intends to “phase out landfilling by 2025 for recyclable waste (including plastics, paper, metals, glass, and bio-waste) in non-hazardous waste landfills, corresponding to a maximum landfilling rate of 25%” (European Commission, 2014). The EU wants to discourage unnecessary food waste and come up with strategies to prevent environmentally harmful strategies. SAS should prepare a comprehensive food waste strategy now, instead of struggling to meet the legislative requirements when they can be financially harmful. Encouraging airlines to put pressure on airports, municipalities, and catering companies to employ better waste management practices could be monumental when considering the fuel, it takes for sustainable airlines to bring their waste back to their hubs to treat their waste in more environmentally-friendly ways.

SAS has used collaboration in the past as a useful tactic (SAS Group Environmental Report, 2001). For example, “in 2001, SAS Airline chaired the International Flight catering Association (IFCA) environment committee” demonstrating leadership in environmental affairs (SAS Group Environmental Report, 2001). SAS has already demonstrated their capacity to be leaders when it comes to pushing environmental agendas. They helped set up the IFCA set up relevant information for catering companies with best practices and links (SAS Group Environmental Report, 2001). They have also worked with Star Alliance’s Environmental Advisory Group. However, the group activities were not continued after September 11th (SAS Group Environmental Report, 2001). SAS’s environmental index was also promoted to competitors with an attempt to share information and improve the industry. Although the results of this specific initiative were unclear it validates the capacity of SAS to collaborate.

Ideally, SAS would position itself as an industry leader and share their tactics to prevent waste and to encourage other airlines to improve their system. Describing their collaboration with stakeholders, their methodologies to collect data and the waste data they have collected could help build credibility and maintain their current sustainable reputation among customers that are less willing to fly. However, this information is sensitive as SAS wants to “to be disruptive in the industry and make an impact where consumers can visibly see the effort” (Interview 2, 2019). Thus, it can be difficult to justify exposing relevant information to competitors (Interview 2, 2019). By offering their data, knowledge and strategies, other airlines would benefit by implementing similar strategies with a risk that an idea from SAS could be used and improved, leaving SAS vulnerable to competition. This risk was reiterated as the access to data from SAS was concealed when asked for data to inform this thesis. On the other hand, the perceived risk could also be an opportunity for SAS to be a leader for the EU. For example, Iberia airlines received funding for EU Zero Cabin Waste Project and was able to communicate their sustainability agenda to customers and pivot to more sustainable waste management

strategies as EU regulations enact stricter policies. The transparent goals found in the SAS sustainability report demonstrate that they are tracking the waste with further plans for improvement, which would indicate to consumers a level of commitment not seen on most sustainability reports, setting SAS apart from its competitors. Communicating the heightened level of commitment to customers could also put pressure on other airlines to improve-applying pressure to the industry to improve and leading the movement could be extremely powerful for the brand.

Furthermore, SAS could host an industry-wide forum on waste management strategies within the EU to demonstrate their commitment to environmental improvements. Sharing their collected data could help drive necessary pressure on the industry and prevent food waste. Hi Fly and the Mirpuri Foundation came together to host the first ever Cabin Waste Forum, in order to help the stakeholders within the airline industry determine best practices and come up with new ideas to mitigate waste onboard (“New campaign,” n.d.). Hi Fly is a Portuguese charter airline with their base in Lisbon and the Mirpuri Foundation is a non-profit organization collaborating with a range from global authorities to individuals that funds programs that help solve worldwide problems (About Hi Fly, 2019; Mirpuri Foundation, n.d.). This forum mostly focused on single-use plastics and how to prevent plastics from entering the ocean and the information was only dispersed through press releases by both Mirpuri and Hi Fly (“New campaign,” n.d.). Although plastics was the focus of the forum there could be a possibility that SAS could host a forum to become a leader in broader waste management discussions or with a specific focus on catering waste.

Strengthen communication

In coordination with increased collaboration, strengthening communication between the stakeholders is essential to refining the entire process. This was echoed in an interview with the IATA explaining that effectively disseminating information is crucial and promoting clear communication is necessary to improve the roles that each company needs to perform (Interview 4, 2019). It is clear that power dynamics between the airline and their stakeholders are prevalent and allowing for increased dialogue between stakeholders could help improve trust and willingness to cooperate. For example, if engineers that design airplane cabins were included in addressing the problem of food waste on board they could design better options for storing (Interview 4, 2019). Prioritizing catering companies, airports, ground crew and municipalities to have a stronger line of communication could improve the outcomes of waste management. SAS seems confident that they are open to dialogues between their suppliers but as SAS dictated that one of their most important stakeholders, Gate Gourmet, was not able to comment on SAS as an airline, the open communication between the two companies was not confirmed. Even without a decisive answer, SAS should always strive for continuous improvement when it comes to communication.

Communicating the importance of waste management through data collection could help enhance the validity of SAS as a sustainable brand, as well as providing returns on investment and overall, a more effective use of resources. Engaging the customer could come in the form of an informative email-an easy, affordable way to disperse information, combined with the ticket. Lowering financial burdens and saving resources is another key factor behind improved waste management. Less food ordered from better forecasting, results in less weight and therefore, less fuel used. This saves the airline money and the subsequent greenhouse gas emissions. As little data has been collected it remains unclear the exact financial projections that could ultimately be extremely influential for an airline. With less food used, there is less of a toll on the environment as fewer resources are required.

5.2.2 Recommendations for the consumer

The airline industry continues to provide the quickest and easiest transportation services for customers despite tight budgets and high constraints. Although the industry itself carries the majority of the duty to pursue significant action, the role of the consumer can nevertheless be highly influential. Consumers can make their voices heard by communicating their desire for improved environmental strategies, beyond the CO₂ emissions produced, and put pressure on the airline to enhance every aspect of their business. If enough customers call the airline sustainability team or ask flight attendants for more information about their food waste it could help drive airline action. Interviewee 10 from Air New Zealand explained that waste prevention is valued and noticed by customers. A high volume of waste negatively impacts a brand's reputation of sustainability initiatives. In this case, the argument that customers were calling to complain allowed for waste management to gather the support and recognition from the upper management at Air New Zealand to secure the funding it needed to make the problem a more important priority at the company. Involved customers communicating their desires can provide more authority for sustainability teams to direct funds to environmental issues, especially if inaction could potentially hurt the reputation of the airline. The most radical action would be for consumers to choose not to fly and express their reasoning behind their choice.

6 Conclusions

Overall, food waste remains a large global issue with detrimental impacts. In the case of the transportation industry, it is a largely unexplored topic but most likely generates significant levels of food waste. This paper addressed food waste within the airline industry focusing on SAS as a case study to determine the industry barriers, investigate the production chain and understand the strategies for prevention and treatment options. As the aviation industry is relatively new to environmentally-friendly strategies and few companies are motivated to make sustainability efforts that take time and money. Especially considering that it is a highly competitive industry driven to offer their customers low prices, it is no surprise that waste management is not prioritized. Until waste management becomes a higher priority to everyone involved and money is allocated to the cause, food waste in the airline industry will continue to be problematic and remain a risk for sustainability goals as customers make higher demands, not just on SAS, but for all airlines.

The case study gave insight into one airline and how they manage deplaned food waste. It showed how the stakeholders interacted and demonstrated where food waste occurs. Competitors were researched to learn how other companies approach the topic and could potentially provide inspiration to SAS. The first research question, which asked “*What are the underlying barriers facing the airline industry when it comes to food waste management and how does Scandinavian Airlines System (SAS) approach food waste management*” and was answered by combining elements from the literature review and interviews. The outcomes indicated that significant barriers prevent SAS, and other airlines for that matter, from reaching their desired potential to achieve improved prevention and treatment strategies. The barriers include the physical restraints of an airplane, crucial time components, regulations, difficulty forecasting, limited data and absence of leadership and the lack of financial backing. The case study revealed that barriers for different treatment options have shaped SAS’s strategy to focus on prevention. The literature review also indicated that limited data exists preventing a full understanding of the problem and many airlines have inadequate waste management strategies overall. A further finding, demonstrated that due to limited communication between stakeholders it is difficult for collective strategies to emerge.

The *SUB RQ: What does the food supply chain look like for an airline and where does food waste occur* revealed that the most food waste within the supply chain occurs from the deplaned catering food waste and Figure 4-1 explored the hot spots of where waste could potentially occur, informed by interviews and validated through the literature review.

The second RQ of *are the current practices used by SAS to prevent and treat the amount of food waste the best strategies available* was addressed by evaluating the strategies within the developed framework. This framework attempted to bring together different perspectives from the airline industry, environmental management systems, research projects specifically targeted at understanding deplaned food waste and governmental evaluations to holistically evaluate SAS. Based on this assessment framework, SAS was found to be a high performer overall, with pre-booking remaining the most influential tactic and the majority of its ratings in the “achieved” category. However, there are some areas for improvement that remain as some elements only met the classification of “satisfactory” and “significant room to improve.”

Regarding, *SUB RQ2, what are potential next steps that SAS can pursue in lowering the amount of food waste*, the case study revealed that SAS has impressive preventative strategies to reduce food waste including scaling up their pre-booking and tracking the amount of food consumed on board to forecast the food needed more accurately. However, there are still many ways SAS can improve their strategies. Some recommendations include enhancing collaboration, improving

communication with important stakeholders, finding a food waste champion and continuing to support the company's ability to innovate. Due to industry barriers, treatment options remain difficult to address but competitors have found ways to work with the government to recategorize or donate food. Saving food can not only help retain customers but it also has the potential to save the company money, improve the brand image and help prevent the loss of valuable planetary resources.

The transportation sector, and particularly the airline industry, have flown under the radar when it comes to food waste management. More data is essential to get a better understanding of food waste hot spots as well as raise awareness of the significance of the problem. The literature review and interviews pointed to the knowledge gaps and helped identify the most significant barriers within the industry, highlighting the importance of more data collection to better inform the industry and provide more relevant and insightful solutions. Further research is essential to drive the industry forward and establish a baseline for long-term improvement. Yet ultimately it remains clear that there is significant potential in the airline industry to improve not only fuel efficiency, but also other areas of their business model, and food waste is one such aspect. Reducing the amount of food wasted through the aviation supply chain cannot only help cut costs and improve brand image, but also help drive industrial sustainability and meet climate targets.

Bibliography

- About FUSIONS. (2016). Retrieved August 20, 2019, from <https://eu-fusions.org/index.php/about-fusions>
- About Hi Fly. (2019). Retrieved July 22, 2019, from <https://www.hifly.aero/about/>
- Air New Zealand Press Release (2017, October 4). Air New Zealand leads the way with inflight waste. Retrieved July 18, 2019, from <https://www.airnewzealand.co.nz/press-release-2017-air-new-zealand-leads-the-way-with-inflight-waste>
- Air New Zealand. (2018). Air New Zealand Sustainability Report, 71. Retrieved from <https://p-airnz.com/cms/assets/PDFs/2018-Sustainability-Report.pdf>
- Alitalia. (n.d.). CSR. Retrieved August 5, 2019, from <http://corporate.alitalia.it/en/company/csr/index.html>
- Avfall Sverige. (2018). Annual Report 2018. Retrieved July 23, 2019, from https://www.avfallsverige.se/fileadmin/user_upload/1_om_oss/aarsberattelse_2018-eng.pdf
- Avinor. (2017). Annual and CSR report 2017. Retrieved February 27, 2019, from https://avinor.no/globalassets/_konsern/om-oss/rapporter/en/avinor-annual-report-2017.pdf
- Baxter, G., Srisaeng, P., & Wild, G. (2018). An Assessment of Airport Sustainability, Part 2—Energy Management at Copenhagen Airport. *Resources*, 7(2), 32. <https://doi.org/10.3390/resources7020032>
- Blanca-alcubilla, G., Bala, A., Hermira, J. I., De-castro, N., & Fullana-i-palmer, P. (2018). TACKLING INTERNATIONAL AIRLINE CATERING WASTE MANAGEMENT: LIFE ZERO CABIN WASTE PROJECT. STATE OF THE ART AND FIRST STEPS RE, 1–8. Retrieved from <https://digital.detritusjournal.com/articles/tackling-international-airline-catering-waste-management-life-zero-cabin-waste-project-state-of-the-art-and-first-steps/148#download>
- Broom, D. (2019, June 5). Sweden has invented a word to encourage people not to fly. And it's working. *World Economic Forum*. Retrieved June 8, 2019, from https://www.weforum.org/agenda/2019/06/sweden-has-invented-a-word-to-encourage-people-not-to-fly-and-it-s-working/?fbclid=IwAR3kDUY6FkNCL9brmM6AEnj_vXKiUR5qkfk1FuhBmzRv_mGsOrnuKwJcs
- Cabin Waste Activities, (2014). Airline/Airport: Environmental Management Cooperation LHR Cabin Waste Audit: Key Data, (February). Retrieved from <https://aci.aero/Media/894ced58-25c6-43bd-a36f-fae24702172d/TQ1y2A/Environment/3rd%20ACI%20Airport%20Environment%20Seminar/22%20godson%20iata%20deplaned%20waste.pdf>
- Capoccitti, S., Khare, A., & Mildenberger, U. (2010). Aviation industry - mitigating climate change impacts through technology and policy. *Journal of Technology Management and Innovation*, 5(2), 66–75. <https://doi.org/10.4067/S0718-27242010000200006>
- Clowes, Austin, Mitchell, P. & Hanson C. (June, 2018). “Why Measure?” *Food Loss and Waste Protocol, World Resource Institute*, Retrieved from www.flyprotocol.org/why-measure/
- Clowes, K., Mitchell, P. & Hanson C. (2018). THE BUSINESS CASE FOR REDUCING FOOD LOSS AND WASTE: CATERING A Report on Behalf of Champions 12.3 THE BUSINESS CASE FOR REDUCING FOOD LOSS AND WASTE: CATERING | SUMMARY FINDINGS, 1–14. Retrieved from <https://champions123.org/the-business-case-for-reducing-food-loss-and-waste/>
- Copenhagen Airport. (2014). Purpose of policy Internationally recognised standards, 3–5. Retrieved from <https://cph-prod-cdn.azureedge.net/4a4549/globalassets/8.-om-cph/uk-faktaark-a-responsible-company-environmental-and-climate-policy.pdf>
- Decade of Change. (2016). Performance Report Our journey to be the UK’ s most sustainable airport. Retrieved July 16. https://www.gatwickairport.com/globalassets/publicationfiles/business_and_community/all_public_ublications/corporate_responsibility/decade-of-change-2016-performance-report.pdf

- DEFRA. (2011). Guidance on applying the waste hierarchy to hazardous waste. *Framework of November 2011*, (November), 1–52. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69457/pb13687-hazardous-waste-hierarchy-111202.pdf
- Destinations within Scandinavia, Europe, Asia & US. (2019). Retrieved July 21, 2019, from <https://www.flysas.com/us-en/destinations/>
- EasyJet. (n.d.). Environment. Retrieved August 5, 2019, from <http://corporate.easyjet.com/corporate-responsibility/environment>
- European Commission. (2014). *Proposal for a directive of the European parliament and of the council amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and. Official Journal of the European Union.*, 0201, 1–23. <https://doi.org/10.1017/CBO9781107415324.004>
- European Parliament (2004, April 29). Regulation no 852/20014 of the European Parliament and of the council. *Hygiene of foodstuffs*. <https://doi.org/2004R0726-v.7.of.05.06.2013>
- European Union. (2004). *REGULATION (EC) No 261/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 February 2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights, and repealing Regulation (EEC) No 295/91*. Ec261/2004, (9), 7. Retrieved from https://www.aviationreg.ie/_fileupload/Image/Regulation_EC261_2004.pdf
- EU Law. (2019). Lex Access to European Union law. Retrieved August 5, 2019, from <https://eur-lex.europa.eu/legal-content/EN/TEXT/?qid=1448630804825&uri=CELEX:02011R0142-20150223>
- FAO. (2015). *Food Wastage Footprint & Climate Change*. Rome: FAO.
- Farber, J. M., & Todd, E. C. (2000). *Safe Handling of Foods*. Taylor & Francis. Retrieved from <https://books.google.se/books?id=B78FvN7NX34C>
- Food and Agriculture Organization of the United Nations & World Health Organization. (2000). Harmonization and Cooperation in Food Legislation and Food Control Activities in the, (October), 8–11. <http://www.fao.org/tempref/codex/Meetings/CCEURO/cceuro22/eu0012ae.pdf>
- Food Loss and Waste Protocol. (2016). *Food Loss and Waste Accounting and Reporting Standard (FLW Standard) – Version 1.0*. Retrieved July 16 http://flwprotocol.org/wp-content/uploads/2017/05/FLW_Standard_final_2016.pdf
- Gategroup. (2014). Annual Report 2014. Retrieved August 27, 2019 from <https://www.gategroup.com/media/1451/annual-report-2014.pdf>
- Gategroup (2018). Annual Report 2018. Retrieved August 27, 2019 from https://www.gategroup.com/media/1766/gategroup_ar-2018.pdf
- Gategroup Holding AG. (2019). Annual Report 2018. *GateGourmet*, 4(1), 166–169. Zurich Switzerland: Gate Gourmet. <https://doi.org/10.3934/math.2019.1.166>
- Global Reporting Initiative. (2016). GRI 306: Effluents and Waste. *GRI Standards, 2016*, 1–13. Retrieved from <https://www.globalreporting.org/standards/gri-standards-download-center/?g=dec8fd48-1dbf-453f-9d93-f746662dea78>
- Government UK. (2014, October 9). Handling and disposing of international catering waste. Retrieved August 5, 2019, from <https://www.gov.uk/guidance/handling-and-disposing-of-international-catering-waste>
- Government of Sweden: Ministry of Enterprise and Innovation. (2018, June 26). The Government's plan for infrastructure – how we build Sweden strong and sustainable. Retrieved from <https://www.government.se/press-releases/2018/06/the-governments-plan-for-infrastructure--how-we-build-sweden-strong-and-sustainable/>

- Greenwash: meaning in the Cambridge English Dictionary. (n.d.). Retrieved from <https://dictionary.cambridge.org/dictionary/english/greenwash>
- GRI Standards. (2016). Gri 103: Management approach 2016. *GRI Standards, 1*, 13. Retrieved from www.globalreporting.org
- Gustavsson, J., Cederberg, C., Sonesson, U., van Otterdijk, R., & Meybeck, A. (2011). *Global food losses and food waste: extent, causes and prevention*. FAO, Rome.
- Heathrow Airport Limited. (2011). Towards a sustainable Heathrow A focus on waste Lakeside “Energy from Waste” facility, near Heathrow.
- IATA - Cabin Waste. (n.d.). Retrieved February 27, 2019, from <https://www.iata.org/policy/environment/Pages/cabin-waste.aspx>
- IATA (2019). Environmental Assessment (IEnvA) Registry. Retrieved July 22, 2019, from <https://www.iata.org/whatwedo/environment/Pages/ienva.aspx?Query=SAS#>
- IATA. (2018, August 23). Strategies to Support Sustained Airline Financial Health. Retrieved March 3, 2019, from <https://www.iata.org/pressroom/pr/Pages/2018-08-23-01.aspx>
- IATA. (2019). Vision and Mission. Retrieved August 5, 2019, from <https://www.iata.org/about/Pages/mission.aspx>
- International Airlines Group. (2018). Stories & updates. Retrieved August 5, 2019, from <https://www.iagroup.com/en/sustainability/stories-and-updates#average-aircraft-cabin-waste>
- International Air Transport Association (June 14, 2018), *International catering waste: a case for smarter regulation*. 1–4. Retrieved from, <https://www.iata.org/whatwedo/environment/Documents/summary-icw-case-for-smarter-regulation.pdf>
- Interview 1 (2019, June 3) In-person interview [Wright, M]
- Interview 2 (2019, May 9) Phone call interview [Wright, M]
- Interview 3 (2019, June 11) Phone call interview [Wright, M]
- Interview 4 (2019, July 4) Phone call interview [Wright, M]
- Interview 5 (2019, July 4) In-person interview [Wright, M]
- Interview 6 (2019, June 7) Email [Wright, M]
- Interview 7 (2019, July 2) Phone interview [Wright, M]
- Interview 8 (2019, July 4) Email interview [Wright, M]
- Interview 9 (2019, July 4) Phone call interview [Wright, M]
- Interview 10 (2019, July 18) In-person interview [Wright, M]
- Interview 11 (2019, February 21) Phone interview [Wright, M]
- Interview 12 (2019, July 31) Email interview [Wright, M]
- Interview 13 (2019, February 24) Skype interview [Wright, M]

- Interview 14 (2019, August 22) Skype interview [Wright, M]
- Interview 15 (2019, July 26) Phone call interview [Wright, M]
- IPCC (2014). *Climate Change 2014: Mitigation of Climate Change*. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Jones, P. (2004). *Flight Catering (Second Edition)* Elsevier Butterworth-Heinemann. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=cat07147a&AN=lub.2228649&site=eds-live&scope=site>
- Jones, P. (2007) Flight-Catering, in Becker, H. And Grothues, U. (2006) *Catering- Management Portrait einer Wachstumsbranche in Theorie und Praxis*, Behr's Verlag: Hamburg Chpt 1.4.1, p. 39-55
- Just, D. R., & Wansink, B. (2009). Smarter Lunchrooms: Using Behavioral Economics to Improve Meal Selection. *Choices: The Magazine of Food, Farm & Resource Issues*, 24(3), 19–24. Retrieved from <http://search.ebscohost.com.ludwig.lub.lu.se/login.aspx?direct=true&db=a9h&AN=48294659&site=eds-live&scope=site>
- Karma. (2019). Rädde bra mat från att slängas. Retrieved August 6, 2019, from <https://karma.life/sv/radda-bra-mat/>
- KLM. (2017). KLM Annual Report 2017. Retrieved August 5, 2019, from https://www.klm.com/corporate/en/images/KLM_Annual_Report_2017_tcm729-1029524.pdf
- Kotze, R. (2017). Sustainability Analysis of the Airline Industry – Low Cost Carriers and Full Service Carriers, (June). Retrieved from <http://lup.lub.lu.se/student-papers/record/8923132%0A>
- Li, X. D., Poon, C. S., Lee, S. C., Chung, S. S., & Luk, F. (2003). Waste reduction and recycling strategies for the in-flight services in the airline industry. *Resources, Conservation and Recycling*, 37(2), 87–99. [https://doi.org/10.1016/S0921-3449\(02\)00074-5](https://doi.org/10.1016/S0921-3449(02)00074-5)
- Lufthansa Group. (2017). Balance - Key data on sustainability within the Lufthansa Group, 106. Retrieved from <https://www.lufthansagroup.com/fileadmin/downloads/de/verantwortung/balance2017epaper/#42>
- Lufthansa Group AG. (2019). SUSTAINABILITY REPORT BALANCE. Retrieved August 5, 2019, from <https://www.lufthansagroup.com/en/responsibility/sustainability-reports.html>
- Marthinsen, J., Sundt, P., Kaysen, O., & Kirkevaag, K. (2012). *Prevention of food waste in restaurants, hotels, canteens and catering*. <https://doi.org/10.6027/TN2012-537>
- Mehta, P. (2015). Aviation waste management : An insight. *International Journal of Environmental Sciences*, 5(6), 179–186. <https://doi.org/10.6088/ijes.6020>
- Mirpuri Foundation-For a Better World: Who We Are. (n.d.). Retrieved July 22, 2019, from <https://mirpurifoundation.org/who-we-are/>
- More than one million meals donated to food rescue organization OzHarvest. (2019). Retrieved July 9, 2019, from <https://gategroup.com/en-gb/we-innovate/more-than-one-million-meals-donated-to-food-rescue-organization-ozharvest/>
- Mourad, M., & Finn, S. (2019, May 29). Opinion | France's Ban on Food Waste Three Years Later. Retrieved June 27, 2019, from <https://foodtank.com/news/2019/06/opinion-frances-ban-on-food-waste-three-years-later/>
- New campaign to end plastic pollution. (n.d.). Retrieved July 22, 2019, from <https://mirpurifoundation.org/mirpuri-news/news/new-campaign-to-end-plastic-pollution/>

- Norwegian. (2017). Norwegian Sustainability Report. *Norwegian*. Retrieved from <https://www.norwegian.com/globalassets/ip/documents/aboutus/company/investor-relations/reports-and-presentations/sustainability-reports/norwegian-sustainability-report-2017.pdf>
- Orava, H. (n.d.). The Food Centre, Stockholm City Mission (Sweden). Retrieved from <https://www.norden.org/en/nominee/food-centre-stockholm-city-mission-sweden>
- Pepper, F. (2018, August 21). 'Everything gets destroyed': The difficult problem of plane passenger waste. Retrieved from <https://www.abc.net.au/news/2018-08-21/plastic-waste-created-in-plane-cabin-no-easy-solution/10117576>
- Pitt, M., Brown, A., & Smith, A. (2002). Waste management at airports. *Facilities*, 20, 198–207. <https://doi.org/10.1108/02632770210426684>
- Pitt, M., & Smith, A. (2003). Waste management efficiency at UK airports. *Journal of Air Transport Management*, 9(2), 103–111. [https://doi.org/10.1016/S0969-6997\(02\)00063-7](https://doi.org/10.1016/S0969-6997(02)00063-7)
- Report SAS (2019). SAS Annual Report – Fiscal Year 2018. *SAS Group*, (October). Retrieved from <https://www.sasgroup.net/en/sas-annual-report-fiscal-year-2018/>
- Ross, J. (2014). Food Waste in an Airline Caterer's Production Kitchen, (December), 81.
- Ryanair. (2018). Ryanair-FY-2018-Annual-Report. Retrieved August 5, 2019, from <https://investor.ryanair.com/wp-content/uploads/2018/07/Ryanair-FY-2018-Annual-Report.pdf>
- Sambo, N. P. (2018). PROCEDURES IN THE AIRLINE CATERING INDUSTRY: A STUDY OF AIR CHEFS SOUTH Dissertation presented for the degree of MASTER of MANAGEMENT SCIENCES (Hospitality and Tourism) DURBAN UNIVERSITY OF TECHNOLOGY.
- SAS. (1999). Environmental Report 1999, 2000. Retrieved from <http://www.electrolux.com/node289.aspx>
- SAS Group. (2019). Customers and customer offerings. Retrieved August 5, 2019, from <https://www.sasgroup.net/en/customers-and-customer-offering/>
- SAS Group. (2019). Environmental Management System (ISO 14001). Retrieved August 5, 2019, from <https://www.sasgroup.net/en/environmental-management-system-iso-14001/>
- SAS Group Environmental Report (2001). Retrieved from, <https://www.sasgroup.net/en/wp-content/uploads/sites/2/2014/09/SAS-Group-Environmental-Report-2001-English.pdf>
- SAS Group Sustainability Report (2013). Retrieved from <https://www.sasgroup.net/en/wp-content/uploads/sites/2/2014/09/SAS-Sustainability-Report-2013.pdf>
- SAS Group Sustainability Report (2009). Retrieved from, <https://www.sasgroup.net/en/wp-content/uploads/sites/2/2014/09/SAS-Group-Sustainability-Report-2009-English.pdf>
- SAS Sustainability Report (November 2016–October 2017). Retrieved from, https://www.sasgroup.net/annualreports/2017/wpcontent/uploads/2018/02/SAS_Sustainability_180129.pdf
- SAS Sustainability Report (November 2017–October 2018) *We Bring Home Perspective*. Retrieved from, <https://www.sasgroup.net/en/wp-content/uploads/sites/2/2019/01/sas-group-sustainability-report-2017-2018-english.pdf>
- SAS Sustainability Report (2014). Retrieved from <https://www.sasgroup.net/en/wp-content/uploads/sites/2/2015/01/SAS-Sustainability-Report-2014.pdf>
- SAS Website. (2019). Scandinavian Airlines Retrieved from SAS website: <http://www.flysas.com/en/uk/>

- Skift. (2019, June 13). Scandinavian Airlines Goes Local with Farm-to-Tray-Table Menus. Retrieved July 17, 2019, from <https://skift.com/2019/06/13/scandinavian-airlines-goes-local-with-farm-to-tray-table-menus/>
- Springer, K. (2017, July 18). Solving the aviation industry's food waste problem. Retrieved from <https://edition.cnn.com/travel/article/airlines-cabin-waste/index.html>
- Stenmarck, Å. et al. (2016). *Reducing food waste through social innovation*. European Commission-FUSIONS EU. Retrieved From <http://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf>
- Sustainable Aviation. (2015). Aircraft Cabin Waste Recycling Guide Page 1, 1–10. Retrieved from <https://www.sustainableaviation.co.uk/wp-content/uploads/2018/06/Aircraft-Cabin-Waste-Recycling-Guide1.pdf>
- Sustainable Aviation. (2019). A CLEANER, QUIETER, SMARTER FUTURE FOR UK AVIATION. Retrieved August 5, 2019, from <https://www.sustainableaviation.co.uk/about-us/our-story/>
- Sustainability Report-TAP Air Portugal (2013). Retrieved from https://www.tapairportugal.com/en/-/media/Institucional/PDFs/Annual-reports/Sustainability_Report_2013_EN.pdf
- Swedavia Airports. (2018). Annual and Sustainability Report 2018. Retrieved from http://ir.brf-global.com/conteudo_en.asp?idioma=1&tipo=52242&conta=44&id=197215
- Swedavia Airports. (2017). The Airports of the Future Are Here, Annual and sustainability report 1–7. Retrieved from <https://www.swedavia.com/globalassets/om-swedavia/roll-och-uppdrag/swedavias-annual-and-sustainability-report-2017.pdf>
- Swedish Environmental Protection Agency. (2019, April 17). Intermediate goals. Retrieved from <https://www.naturvardsverket.se/Miljoarbete-i-samballet/Sveriges-miljomal/Etappmal/>
- Swedish National Food Agency (2013). Summaries of reports from the Food Waste Reduction project 2013-2015, (April). Retrieved from <https://www.livsmedelsverket.se/globalassets/english/food-habits-health-environment/food-environment/report-summaries-from-the-swedish-food-waste-reduction-project-2013-2015-oktober-2016.pdf>
- The Eat-Lancet Commission. (2019). Food Planet Health. Retrieved at <https://eatforum.org/eat-lancet-commission/eat-lancet-commission-summary-report/>
- The Learning Accelerator. (n.d.). Tool: Knoster Model for Managing Complex Change. Retrieved from <https://practices.learningaccelerator.org/strategies/tool-knoster-model-for-managing-complex-change>
- The Waste Framework Directive. (2010). *Eastern and Central European Journal on Environmental Law*, (Issue 2), 101. Retrieved from <http://search.ebscohost.com.ludwig.lub.lu.se/login.aspx?direct=true&db=edshol&AN=edshol.heinjournals.ecejv14.15&site=eds-live&scope=site>
- Tofalli, N., Loizia, P., & Zorpas, A. A. (2018). Passengers waste production during flights. *Environmental Science & Pollution Research*, 25(36), 35764. Retrieved from <http://ludwig.lub.lu.se/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=edb&AN=133452250&site=eds-live&scope=site>
- Verschuren, P. & Doorewaard, H. (2010). *Designing a research project*. Eleven International Publishing.
- Vittuari, M., Azzurro, P., Gaiani, S., Gheoldus, M., Burgos, S., Aramyan, L., ... Bos-Brouwers, H. (2016). *Recommendations and guidelines for a common European food waste policy framework*. <https://doi.org/10.18174/392296>

Wilewska-Bien, M., Granhag, L., & Andersson, K. (2018). Pathways to reduction and efficient handling of food waste on passenger ships: from Baltic Sea perspective. *Environment, Development and Sustainability*, (0123456789), 1–14. <https://doi.org/10.1007/s10668-018-0192-1>

WizzAir. (2019). Welcome to the world of opportunity! Retrieved August 5, 2019, from <https://wizzair.com/en-gb/information-and-services/about-us/corporate-social-responsibility>

World Bank. (n.d.). *Air transport, passengers carried*. Retrieved May 28, 2019, from <https://data.worldbank.org/indicator/is.air.psggr?end=2017&start=1970&view=chart>

Yin, R. K. (2009). *Case Study Research: Design and Methods*. SAGE Publications. Retrieved from <https://books.google.se/books?id=FzawIAdilHkC>

Zero Cabin Waste. (2017, March 16). Cabin Waste Actions. Retrieved from <https://www.cabinwaste.eu/en/actions/>

Zero Cabin Waste (2018). Tipología de residuos generados en vuelos y estrategias de mejora. Retrieved July 9, 2019, from <https://www.google.com/search?q=TIPOLOGI%CC%81A+DE+RESIDUOS+GENERADOS+EN+VUELOS+Y+ESTRATEGIAS+DE+MEJORA&coq=TIPOLOGI%CC%81A+DE+RESIDUOS+GENERADOS+EN+VUELOS+Y+ESTRATEGIAS+DE+MEJORA&aqs=chrome..69i57j0j7&sourceid=chrome&ie=UTF-8#>

Zero Cabin Waste. (n.d.). Training plan for separation on board. Retrieved from <https://www.cabinwaste.eu/en/2019/04/09/training-plan-for-separation-on-board/>

Appendix

6.1 Interview Guide

It should be noted that each interview was semi-structured in order to catered the interview to fit the circumstance. Some questions were added to find out specific information from the person being interviewed. For example, the SAS flight attendant was asked, "Do you have training to practice onboard sorting?" This type of question would not be asked stakeholders like IATA or a catering company.

Intro

I am a Master's students from Lund University, studying Environmental Management and Policy. I am curious about what factors play a role in food waste mitigation and disposal strategies. I previously investigated barriers within the industry and I identified that SAS was a leader in Europe when it came to waste management. I am looking into; RQ: what are the underlying barriers facing the airline industry when it comes to food waste management and how does Scandinavian Airlines System (SAS) approach food waste management? And *SUB RQ: What does the food supply chain look like for an airline and where does the food waste occur?* And RQ 2: Are the current practices used by SAS to prevent and treat food waste the best strategies available? *SUB RQ2: what are potential next steps that SAS can pursue in lower the amount of food waste?*

I intend that this interview will not last longer than 40 min. I have several questions I would like to ask you and we appreciate that many of our question could prompt long and interesting discussions, however time considerations mean I might interrupt you at certain points in order to ensure we are able to ask all of the questions.

General Questions

1. How do you think SAS compares to other airlines when it comes to food waste?
2. How would you describe your target market? (sustainability focused?)
3. Are you aware of the other airlines also working to enhance food waste mitigation strategies?
 - Zero Waste in Madrid/Iberian airlines? "First" Zero Waste flight -Qantas Airlines
4. Are there certain sustainability **leaders** in each department? Or does each department operate independently?
 - Your department reports to a senior manager how do you interact with the financial team?
(Easy/difficult)

What are you doing now and where are you trying to go?

1. How many food products are offered by SAS?
2. What are the current SAS **strategies** doing to improve mitigation strategies?
 1. New tech?
 2. Scale up pre-order?
 3. Where do new ideas come from? Use other airlines as an example?
3. What is SAS **currently** doing to improve the current **disposal** strategy? Working with stakeholders to find better solutions to incineration?
4. What does SAS have planned for **future** strategies? Prevention and treatment?

Stakeholders

5. Who are your stakeholders you interact with? Could you walk me through the process of how food gets from the suppliers to treatment? Clarify with my map design.
6. Do you believe that all parties have an equal say?
7. Who would you say drives the most change? (consumers, staff, stakeholders?)
8. Can you tell me about recording data for catering waste? Is it different for each hub?
9. How is the airport and municipality involved?
10. Based on the existing data available, it has been calculated that on average, each person 9-20% food wasted. What are your thoughts on that number?

Regulations

11. What would you identify as the most prominent regulations regarding catering food waste?
12. How are the Swedish governmental regulations helping or hindering food waste mitigation strategies?
13. How are international regulations helping or hindering food waste mitigation strategies?
14. Anything else you would like to add?

6.2 EU Zero Cabin Waste-future waste management

The figure demonstrates what should ideally happen if waste management for deplaned food was managed in the most sustainable way possible. All airlines and airports should be striving for this model to be implemented. It would require widescale collaboration and significant improvement between stakeholder communication. Airlines would have to prioritize training flight attendants on proper separation on board, work with the Swedish government and catering company to recategorize products for re-use or donation, work with energy companies to redirect food waste from incineration to biogas, and direct airport employees and catering company employees to check waste is sorted correctly, measure amount and ensure that it is treated correctly.

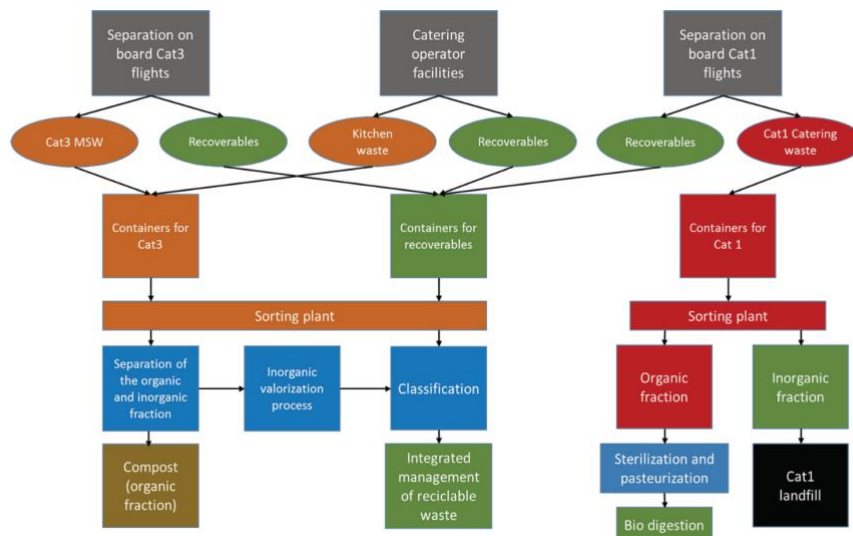


Figure 0-1. '6.2- Future waste management'

Source: Blanca-alcubilla, et, al., 2018, p. 2