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Food Waste Reduction in Commercial Aviation: Operational Constraints, Regulatory Frameworks and the Role of Catering Structures

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Abstract

This dissertation analyses food waste management in the aviation industry, with a close focus on the role of airlines and catering providers. Further attention is given to the constraints imposed by regulatory and biosecurity frameworks, and the applicability of Spain´s Law 1/2025 on the Prevention of Food Loss and Waste.

The study follows a qualitative and more comparative approach based on academic literature, regulatory and institutional documents, and publicly available information from airlines and suppliers, including sustainability reports, annual reports, websites, and industry publications. In addition to these public sources, an interview an inflight experience manager at Iberia supports the analysis by providing further insight into outsourced catering responsibilities, International Catering Waste restrictions, and the practical implications of the Spanish legal framework for a major international airline.

Through the analysis of the Iberia case and various over airlines and suppliers, the findings show that, at present, prevention is the main strategy to reduce food waste, particularly using demand forecasting systems and AI. On the other hand, downstream methods such as donation and recovery are more limited. The conclusion is that International Catering Waste and other biosecurity restrictions are at the forefront of food waste management acting as a barrier to a more circular process. The Iberia case also suggests that the new Spanish food waste law has limited practical applicability in an international airline context when compared to regulatory frameworks take priority.

Keywords:

food waste, aviation, International Catering Waste, catering, biosecurity, circular economy

Resumen

Este Trabajo de Fin de Grado se centra en la gestión del desperdicio alimentario en el sector de la aviación, enfocando en el papel de las aerolíneas y los proveedores de catering. Se presta especial atención a las restricciones impuestas por los marcos normativos y de bioseguridad, así como a la aplicabilidad de la Ley 1/2025, de Prevención de las Pérdidas y el Desperdicio de Alimentos, de España.

El estudio sigue un enfoque cualitativo y comparativo, basado en la literatura académica, documentos normativos e institucionales, e información de dominio público procedente de aerolíneas y proveedores, incluyendo informes de sostenibilidad, informes anuales, sitios web y publicaciones del sector. Además de la información pública, una entrevista a un responsable de experiencia a bordo de Iberia respalda el análisis al aportar información adicional sobre las responsabilidades en materia de residuos de catering y las implicaciones prácticas del marco legal español para una gran aerolínea internacional.

A través del análisis del caso de Iberia y de diversas aerolíneas y proveedores, los resultados muestran que, en la actualidad, la prevención es la principal estrategia para reducir los residuos alimentarios, en particular mediante el uso de sistemas de previsión de la demanda y la inteligencia artificial. Por otro lado, los métodos posteriores, como la donación y la recuperación, son más limitados. La conclusión es que los residuos de catering internacional y otras restricciones de bioseguridad se sitúan en primera línea de la gestión de residuos alimentarios, actuando como una barrera para un proceso más circular. El caso de Iberia también sugiere que la nueva ley española sobre residuos alimentarios tiene una aplicabilidad práctica limitada en el contexto de una aerolínea internacional, en comparación con los marcos normativos que tienen prioridad.

Palabras Clave:

Desperdicio alimentario, aviación, catering aéreo, International Catering Waste, bioseguridad, economía circular

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Chapter 1 - Introduction

Motivation

Tens of thousands of flights operate everyday across the world, and most of them carry some form of onboard catering. Once loaded onto the aircraft, these products may quickly become waste if they are not consumed or if regulatory conditions prevent their reuse or recovery after the flight. Food waste has become an important sustainability issue because of its environmental, economic, and social impact (United Nations Environment Programme, 2024). Although it is often discussed in relation to households, retail, and hospitality, there is not much discussion with regards to the aviation sector. This raises the interest into study how food waste is produced, managed, and limited in an aviation setting.

Airline catering can be particularly complex due to its logistics, food-safety requirements, time pressure, and international controls. In particular, waste from international flights may be classified as International Catering Waste (ICW), which is subject to specific treatment and disposal requirements because of biosecurity and animal health concerns. Considering this, food waste management in aviation is not easily understood solely through general sustainability actions and circular economy objectives. It must also be compared to the regulatory and operational challenges faced by an airline, and how it realistically impacts their day-to-day operations.

A recent Spanish law regarding food loss and waste also raises questions for the aviation industry. Ley 1/2025, de 1 de abril, de prevención de las pérdidas y el desperdicio alimentario, aims to prevent and reduce food loss and waste across the food chain. It establishes a hierarchy of priorities in which prevention and redistribution for human consumption are prioritised before other forms of recovery or disposal (Ley 1/2025, 2025). The law applies clearly to sectors such as retail, hospitality, restaurants, and food distribution. However, its application to airline catering is less direct. Although the law is not specifically designed for the aviation sector, it raises relevant questions about whether and how its obligations may apply to airline catering, particularly when catering services are provided by external suppliers. This is especially important because food waste in aviation is shaped not only by national food waste policy, but also by

international operations, biosecurity rules, and the specific treatment of international catering waste (International Air Transport Association, 2019, 2024a). For this reason, this dissertation focuses on food waste management in airline catering, with particular emphasis on Spain's new food waste legislation and the international regulatory framework affecting catering waste in aviation.

Additionally, and from a personal perspective, the topic of this dissertation stems from a broader academic and professional interest in aviation and sustainability. The relationship between airline catering, regulation, and food waste reduction seems particularly relevant because it combines the operational complexity with something that is becoming a sustainability challenge globally.

General objective

The general objective of this dissertation is to analyse food waste management in airline catering within the commercial aviation sector. It examines how food waste is generated and managed, and how these practices are shaped by catering structures, international regulatory requirements, and the new Spanish legislation on the prevention of food loss and waste. This general aim is developed through the following specific objectives:

Specific objectives

- To analyse the current situation exploring public information available of food waste management in commercial aviation, identifying the main sources of waste generation and the critical points within the airline catering chain.
- To examine the regulatory framework affecting food waste management in aviation, with particular attention to European regulation, International Catering Waste (ICW) restrictions, and the new Spanish law on the prevention of food loss and waste.
- To examine how different airline catering structures may shape the ability of airlines to prevent, monitor and manage food waste.
- To examine the main structural challenges affecting the implementation of circular economy practices in airline food waste management, considering legal, operational, sanitary and biosecurity factors.

Methodology

This dissertation follows a qualitative approach, based primarily on academic literature, regulatory and institutional frameworks, and publicly available information from airlines and catering suppliers. These sources include annual reports, sustainability reports, airline websites, press releases, and industry publications from organisations such as IATA.

To address the first two specific objectives, a review of academic literature and regulatory sources was conducted. The purpose of this review was to establish the current context of food waste in the aviation industry and to examine the legal and operational framework affecting airline catering waste. This literature helped explain how airline catering operates as a logistical chain and identify the main challenges and constraints affecting food waste management, particularly the impact of International Catering Waste regulations on airlines operating international routes. Academic literature was mainly searched through databases such as Scopus and Google Scholar. The regulatory analysis was based on legal and institutional sources, including European Union regulations and directives, Spanish legislation, official guidance from public authorities, and industry documents from organisations such as IATA.

To address the third and fourth specific objectives, selected airline cases were analysed using publicly available information. These sources included annual reports, sustainability reports, airline websites, press releases, and other company publications. The aim was to identify the main practices reported by airlines in relation to food waste prevention, monitoring and management.

During the research process, it became clear that food waste management in aviation does not depend only on airlines, as catering providers also play an important role in production, logistics and waste handling. Therefore, selected catering companies were also included in the analysis. The criteria used to select the airlines and catering companies are explained in more detail further in the study.

The academic and regulatory literature was used to establish the current context of food waste in the aviation industry. It helped explain how airline catering functions as a

logistical chain and identify the main challenges and constraints affecting food waste management, particularly the impact of International Catering Waste regulations on airlines operating international routes.

To structure the analysis of the selected cases, the study uses an adapted food waste hierarchy based on the academic and regulatory literature. This framework helps classify the practices reported by airlines and catering providers into different levels of food waste management, such as prevention, redistribution for human consumption, reuse, recycling, recovery, and disposal. This provides a common structure for analysing the different cases without treating the research as a fully systematic comparison.

After reviewing the publicly available information, some questions could not be fully answered through documents alone. For this reason, an interview was conducted with an Inflight Experience Manager at Iberia. The interview helped complement the documentary analysis and clarify issues related to outsourced catering, International Catering Waste restrictions, and the possible impact of the recent Spanish food waste law on a Spanish international airline. More details about the interview process are provided in the chapters to come.

It is worth clarifying that informal conversations with industry professionals helped provide general background context on the practical realities of food waste management in aviation. Although these exchanges are not treated as primary evidence in the study, they contributed to a broader understanding of the sector.

Structure of the Dissertation

From this point, the dissertation is structured as follows. The second chapter presents the regulatory and theoretical review, establishing the main concepts and legal frameworks needed to address the objectives related to food waste regulation, International Catering Waste, and airline catering operations. The third chapter provides an overview of waste management in the aviation industry, with particular attention to how food waste is generated and managed within airline catering. The fourth chapter explains the methodology used to address the research objectives. The fifth chapter analyses selected airline and catering provider case studies in order to identify reported practices related to food waste prevention, monitoring, and management. The sixth chapter focuses specifically on the Iberia case study and the interview conducted with an Inflight Experience Manager, which helps examine the relevance of the Spanish food waste legislation in the context of a Spanish international airline. The seventh chapter discusses the main findings from the case studies in relation to the dissertation's objectives. Finally, the eighth chapter presents the conclusions and identifies possible future lines of research.

Chapter 2 – Regulatory and Theoretical Frameworks

Regulatory Frameworks

2.1 Global Context on Food Waste

Food waste is just one of many elements that creates problems for the world on an economic and sustainable level. Be it costs to manage food waste, over-predicting consumption, contributing to greenhouse gas emissions, or preventing mass landfill, among many other impacts and effects (IPCC, 2022; Schanes et al., 2018).

Food waste reduction forms part of goal 12, ensuring sustainable consumption and production patterns, within the 17 Sustainable Development Goals (SDG). Specifically, target 12.3 aims, “by 2030, [to] halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses” (United Nations, 2025a). Its progress is tracked through indicator 12.3.1, analysing the Food Loss Index (FAO) and the Food Waste Index (UNEP). Although these goals are not yet currently legally binding obligations under international law. They are political commitments discussed by global leaders and it is expected that countries will adopt national frameworks to advance them in the future.

The United Nations Environment Programme (UNEP) measures food waste at retail, food service and households for SDG monitoring, standardising baselines, and comparability without creating legal duties. According to the UNEP Food Waste Index report 2024, it is estimated that globally there were approximately 1.05 billion tonnes of food waste in 2022, 19% of food available to consumers, with a distribution of 60% to households, 28% to the food service, and 12% to retail (UNEP, 2024a).

The Food and Agriculture Organizations of the United Nations (FAO) sets out guiding principles and recommended actions for governments and supply-chain actors to combat against the issue of food waste. Their studies and measurements suggest that no real progress has been made in the reduction of food loss since 2015, with food loss globally after harvest on farm, transport, storage, wholesale, and processing (excludes retail) remaining around 13% (FAO, 2025).

Meanwhile none of these guidance policies are legally binding, the 2030 Agenda by the UN encourages countries to enforce some regulation to succeed with goals to make the world a safer and long-lasting environment.

2.1.1 European Union: General Food Waste Law and Targets

The European Union (EU) is a prime example of nations who are implementing new updated policies that are legally binding, inspired by the United Nations 2030 Agenda. The EU has created the Waste Framework Directive (WFD), with a 2025 amendment which enforces its Member States to achieve at least a 10% reduction in food waste in processing and manufacturing by 2030, and 30% less per capita in retail, restaurants, food services, and households. The amendment came into force on October 16, 2025, after a provisional political agreement earlier in the year (European Commission, 2025).

To ensure comparability, the EU has implemented a uniform method for measuring food waste. The Commission Delegated Decision (EU) 2019/1597 sets out the common methodology and the minimum quality requirements that each Member must apply when recording for food waste under the WFD. The methodology allows for progress tracking for the 2030 targets.

Member States must measure food waste annually, in tonnes of fresh mass, separately for five stages: primary production, processing/manufacturing, retail/distribution, restaurants/food services, and households. They must use in-depth methods: direct weighing, waste-composition analysis, diaries/logs, mass balance, or coefficients, with documented sampling and quality controls to ensure comparability. The European Commission has total oversight of food waste control in the EU (The European Commission, 2019).

To accompany this EU regulation in place, businesses of certain sizes must also disclose waste and circular economy information and sustainability statements prepared under the European Sustainability Reporting Standards (ESRS) and Corporate Sustainability Reporting Directive (CSRD). Although CSRD governs reporting rather than operational targets, it does reinforce the measurement and transparency that is expected to accompany the WFD's reduction goals. Under the CSRD scope, micro-businesses are

not obligated to publishing non-financial information. It is stated that listed SMEs are in scope from 2026 (except micro businesses).

2.1.2 Spain: National Framework and Sector Reach

Looking more closely at one country within the European Union, Spain is an example of a Member State that operates within the wider EU legal and policy framework while also developing national regulations that address food waste directly and indirectly. The following three Spanish laws are relevant to food waste prevention to different degrees: some address food loss and waste directly, while others contribute indirectly through broader rules on circular economy, sustainability, and non-financial reporting.

i: Law 1/2025 on the Prevention of Food Loss and Waste (BOE, 2025)

Spain's Law 1/2025 establishes a comprehensive framework to prevent and reduce food loss and waste across the entire food chain, with aims of promoting bio/circular economy, prioritising human consumption where safe, and strengthening measurement, planning, and awareness. Its obligations include:

- **Prevention Planning and Action:** businesses must have prevention plans and measurements in place relative to their business activity, placing human consumption first through application of a hierarchy of uses. Examples such as redistribution, donation with food safety and traceability guarantees.
- **Measurement and Information:** Aligning with national/EU methodologies, this law also requires quantification of food waste and indicators highlighted to track food waste reduction.
- **Governance and Awareness:** Throughout the process, effective and monitored coordination must also be effective across all participating agents within the food chain, such as, production, processing, distribution, and catering/hospitality. Also, the requirement of having awareness initiatives to reduce waste.

ii: The Waste/Circular Economy Law 7/2022 (BOE, 2022)

Law 7/2022 is a compilation of generic rules for waste management and contaminated land in Spain. It aligns national practice with the EU's objectives of waste hierarchy and

circular economy. It is an inclusive law that applies to all generators of waste, both public and private.

The law prioritises prevention first; wherever it is possible waste generation should be avoided and other uses found for resources, such as an eco-design, reuse, or working to increase the product life. Next is the separate collection and advanced recycling of materials. To prevent direct landfill of materials, key fractions such as packaging or bio-waste should be separated as early as possible to improve the recovery of reusable or recyclable materials. The law also enforces 'Extended Producer Responsibility' (EPR) stating that producers have the responsibility to finance and organise the management of waste which is generated from their products. Finally, another core principle is the monitoring of performance. Parties should keep auditable records and report information to authorities where appropriate.

Although this law is not directly specific to food waste, it highlights the operating conditions for organisations that generate waste in Spain. Therefore, it is a regulatory foundation that supports prevention measures consisting of organic materials such as food.

iii: Non-Financial Reporting Law 11/2018 (BOE, 2018)

Before the implementation of the EU's new CSRD/ESRS policy, Spain had a national disclosure law on Non-Financial Information (NFI), Law 11/2018, which adapted the earlier NFRD (2014/95/EU). It has applied to large Spanish groups since 2018, meaning reports published since 2019. It required a Non-Financial Information Statement that entailed various aspects including environmental matters, employee and social issues, human rights, and anti-corruption. The law emphasises material, comparable and verifiable indicators, board responsibility, risk due diligence across the value chain, and independent verification of the statement.

As previously mentioned, the EU has recently implemented its Corporate Sustainability Reporting Directive (CSRD). Effective as of 2024 reporting, it supersedes and develops the old NFI model, including more companies and stricter disclosure requirements (including waste/circulatory elements). The national Spanish law 11/2018 acts as a backbone regulation for Spain in areas where CSRD has not been fully incorporated still

having an impact on many businesses. However, those companies that are now in scope of CSRD must report under ESRS, enhancing even further the reporting requirements for companies.

2.2 Theoretical Frameworks

Despite food waste restrictions being heavily influenced by regulatory frameworks, impacting the airline industry profusely, particularly biosecurity and International Catering Waste (ICW) regulations, the situation can be analysed from various theoretical perspectives demonstrating from an operational and strategic level of how airlines are shaped by capabilities, pressures and sustainability paradigms.

As there are various levels to this complex topic within the aviation industry, this study delves into three different but complementary theoretical perspectives:

1. Circular Economy Theory
2. Resource-Based View (RBV)
3. Institutional Theory

Together, these three frameworks allow for multidimensional analysis of food waste management in aviation from systemic, strategic, and regulatory perspectives. This study will apply these theories to multiple cases and examples of airlines such as Iberia to see the effects of food waste management and how airlines act upon decision making and operations.

2.2.1 Circular Economy

The circular economy (CE) is a sustainability model facilitating the replacement of the more traditional “take-make-dispose” system. The circular economy searches for ways to continue the life cycle of goods or in this case waste to create regenerative cycles prioritising prevention, reuse, recycling, and resource recovery therefore preventing unnecessary disposal and landfill (Geissdoerfer et al., 2017). By prioritising these methods, this hierarchy aligns closely with the waste management hierarchy, by which prevention is the most desirable outcome, followed by reuse, recycling, recovery, and finishing with disposal (Nakornkao & Mongkalig, 2022).

Theoretically, the aviation industry has ample opportunity to implement circular practices, especially when considering waste prevention and material recovery. However, large quantities are generated with IATA estimating that over 20% of cabin waste consists of food and beverages that have not even been touched or opened (Nakornkao & Mongkalig, 2022). Following this, in the UK a recent study showed that approximately 89,000 tonnes of ICW waste entered the waste system in 2022, but due to regulations, all of it went to incineration instead of following the circular economy trail and finding an alternative for the waste (Pennington et al., 2025).

Despite the constraints the airline industry faces, airlines and caterers are implementing upstream circular strategies. Examples such as pre-order meal systems to reduce overproduction, supplier coordination to minimise spoilage, and AI-supported forecasting systems. It is believed with AI, food waste has reduced by up to 30% through predictive analytics and improved inventory control (Kanwal et al., 2025).

In summary, the Circular Economy theory provides a systemic lens to evaluate where there are blockages and restrictions to circularity. Upstream innovation is one of the few feasible methods within aviation catering operations.

2.2.2 Resource-Based View (RBV)

The Resource-Based View (RBV) argues that resources and capabilities that are valuable, rare, inimitable, and organised result in a sustained competitive advantage (Barney, 1991). RBV shifts the focus of regulatory compliance to the capabilities from within a business to manage challenges effectively and strategically.

As will be discovered through the case study analysis, in the aviation industry, food waste reduction does not solely rely on the rules and regulations set by governing bodies, but also the airlines ability to implement measures to reduce waste. Capabilities such as demand forecasting, supply chain coordination and digital monitoring systems can impact levels of food waste as measurements and effective decision-making can take place. Where airlines may have the opportunity to find alternatives for their waste rather than incineration, but the subject matter of having the resources available to carry out those activities, is what can affect the reduction of food waste.

Recent studies also show that customer satisfaction is influenced by how an airline considers the requirements and needs of its passengers, especially in catering, such as dietary requirements, food choice and the service provided. Chen (2022) discovered the positive relation between a pre-order option and passenger satisfaction. Operationally it also allows airlines to better manage forecasting of meals on board flights by not over stocking aircraft with extra meals.

Artificial Intelligence (AI) is a resource that is becoming more effective across all industries and in the airline industry it is no exception. AI isn't just a tool to forecast demand, but it can also be used for food safety and supply chain monitoring. Often food waste can come from the production in which food spoils before reaching its destination or human error results in ineffective inventory. Technical systems such as real-time temperature control, spoilage prediction, and inventory control can reduce unnecessary resource loss and improve operational reliability (Kanwal et al., 2025).

2.2.3 Institutional Theory

Institutional Theory is the reverse of RBV. It emphasises the external pressures on organisational behaviour. DiMaggio and Powell (1983) argue that businesses become very alike due to three institutional pressures: coercive (regulatory), normative (professional standards), and mimetic (imitation under uncertainty).

In aviation, coercive pressure is a key restriction for airlines to reduce food waste. ICW regulations and animal by-product laws mandate procedures that airlines must follow. Regardless of the objectives of airlines and their desire to want to implement a more circulatory system, regulations prioritise biosecurity and disease prevention (Pennington et al., 2025).

Normative pressures originate from industry bodies, in aviation context that would be IATA, providing frameworks and protocols that all airlines must follow as discussed in the regulatory framework section.

Mimetic pressures are those that stem from the actions of others in the industry and the standardisation of practices. If one airline implements something and it appears effective, then surely another airline will implement the same practices.

Through the case study analysis that follows, it will become apparent that Institutional Theory helps explain why certain food waste measures are implemented, or not. In particular, it highlights the role of competing institutional logics, such as the friction between circular sustainability objectives and biosecurity protection requirements.

2.3 Analytical Framework for this Study

To facilitate a balanced analysis across the various airlines and specialised caterers that assume the catering responsibilities for the airline industry, below is an adaptation of the general food waste hierarchy for application in the airline industry. In the European and Spanish regulatory context, waste and food waste management are generally structured around a hierarchy that prioritises prevention, followed by uses linked to human consumption, recovery, or valorisation, and finally disposal as a last resort. However, in the airline industry, once catering items enter the aircraft, these stages do not have equal opportunities for an airline or the catering supplier. Taking this into consideration, the table proposes a personal revision that is more suitable for aviation-specific food waste management operations which can be applied to the real-life cases discussed in chapter 2.

Table 1: Adapted Food Waste Management Hierarchy

Level	Stage	Definition in aviation	Typical measures in airlines / catering agents	Feasibility in aviation
1	Prevention	Avoiding surplus food being loaded onto the aircraft or reducing waste materials generated in the kitchen during preparation.	Implementation of technology including AI to carry out demand forecasting, meal pre-order, meal-skip option, crew meal preparation, and menu planning.	Very High
2	Commercial Redirection for Human Consumption	Finding alternative solutions within the airline to redirect surplus meals for human consumption.	End-of-day discount offers, lounge sales, staff canteen solutions, alternative sale channels.	Medium <i>primarily upstreaming</i>
3	Donation for Human Consumption	Redistribution of surplus meals or food products without financial intent.	Donations from the catering kitchens to social communities and charities.	Limited
4	Animal Feed / By-Product Use	Producing products not for human consumption for use by other living species.	Animal feed production, authorised by-product uses for pre-flight residues.	Low
5	Valorisation / Recovery	Recovery of food materials for energy conversion with benefits for the airline industry.	Composting, bio-digestion, waste-to-energy transformation such as biogas.	Limited <i>to non-restricted items</i>
6	Disposal / Incineration	Last resort option; all waste ending in landfill or incineration with no other alternative.	Incineration or landfill where applicable.	High <i>where biosecurity enforcements are in place</i>

Source: Author's own elaboration based on Ley 1/2025, Ley 7/2022, Commission Delegated Decision (EU) 2019/1597, Regulation (EC) No 1069/2009, and IATA and Aviation Sustainability Forum (2024).

Chapter 3 - Waste Management in the Aviation Industry

This section examines how food waste fits within the wider context of waste management in the aviation industry. It first outlines the regulatory and operational framework followed by airlines, including the role of IATA and other aviation-specific guidance. It then discusses the main types of waste generated during flights, focusing especially on food catering waste and the biosecurity rules that affect how it can be handled. The section concludes with real-life examples showing how catering practices, safety requirements and operational constraints can contribute to food waste in aviation.

3.1 The Role of IATA and Cabin Waste

The International Air Transport Association (IATA) is the global trade association which represents more than 300 airlines across the world, accounting for the majority of air traffic globally (IATA, 2025a). Additional to its global commercial coordination role, they also develop operational standards, safety protocols, and sustainability guidance for the aviation industry. Cabin waste management in recent years, has become more prominent in IATA's actions and planning, especially with the increase of environmental scrutiny in aviation (IATA, 2024a).

To understand the complexity of waste in the aviation industry, IATA sets out how waste can be defined in an aircraft setting. According to IATA (2019; 2024b), all waste generated within an aircraft during flight operations is referred to as "cabin waste." This includes all materials collected during the flight and when the aircraft has landed and is being cleaned. As shown in Figure 1, IATA classifies cabin waste into two main waste streams: catering, or galley, waste, and cleaning waste.

Figure 1: Cabin Waste Classification



Figure 1. Cabin Waste Streams (IATA, 2019)

Stream 1: Catering Waste

Also commonly referred to as “galley waste,” catering waste includes all food, beverages, packaging, and service items which have been removed from the aircraft during the de-catering process at the end of a flight or end of the day (IATA, 2024b). The role is carried out by the catering supplier or the airline itself, depending on the catering structure of the airline and the destination. It contains both consumed and unconsumed food, opened or unopened, which are returned to the trolleys, including: meal trays, packaging, bottled drinks, and various food products of all types.

A Cabin Waste Composition Audit carried out at Singapore Changi Airport in 2024 found that catering waste represented the dominant share of total cabin waste. According to the audit, catering waste accounted for approximately 85% of all cabin waste, while the average amount of cabin waste generated was 0.94 kg per passenger (IATA, 2024b). In addition, an earlier analysis conducted at London Heathrow Airport found that passengers generated an average of 1.43 kg of cabin waste per flight, 39.2% of which consisted of sealed or untouched food and drinks (IATA, 2019).

These figures show that catering waste represents a significant source of onboard aircraft waste and that a considerable proportion of this waste may remain sealed, untouched, or not directly exposed to passengers by the time the aircraft is de-catered. One important factor explaining this situation is the type of flight operated, particularly whether the flight is domestic or international. This distinction is relevant because

different regulatory and biosecurity requirements may apply depending on the origin and destination of the flight.

As shown in Figure 1, catering waste can be divided into two further streams: national waste and international catering waste (ICW). While national waste may allow for a wider range of management options, such as reuse, recycling, donation or disposal, international catering waste is generally subject to stricter controls. These limitations are mainly linked to biosecurity requirements, which can restrict how onboard food and catering materials are handled after landing.

This regulatory framework forms part of the EU's animal by-product regulation, designed to prevent the spread of transboundary animal diseases. Under Regulation (EC) No 1069/2009, catering waste "from means of transport operating internationally" is classified as Category 1 material, the highest possible risk out of a total of three (European Parliament & Council, 2009, p.12);

- This first category consists of all animal by-products which pose the highest risk to human life and must be destroyed or disposed of in a highly secure way. As a result, international catering waste is subject to strict handling and disposal requirements, which can limit opportunities for reuse, donation, or recovery.
- The second category which is still classed as a high risk, consists of animal by-product materials which are not category 1 and can be treated or processed in such a way that allows for the reuse of the products, emphasising the strict controls that must be in place.
- Category 3 are those materials fit for human consumption, although are not intended for that purpose. These goods can be processed into animal feed, pet food, and other authorised uses providing that they are not brought in internationally from another country.

If any product comes into contact with a Category 1 material causing contamination, then all items will be classed as Category 1 and therefore be ICW. The most common method of disposal for ICW is incineration.

As a result, the disposal pathway of catering waste greatly depends on the type of flight that is being operated.

Stream 2: Cleaning Waste

The diagram also identifies cleaning waste as the second mainstream of cabin waste. Cleaning waste refers to waste collected by cleaning contractors at the end of a flight or operating day. This may include passenger-generated waste such as food brought on board, newspapers, items left in seat-back pockets and lavatory bin waste (IATA, 2024b). Like catering waste, cleaning waste may be subject to different handling and disposal requirements depending on the type of flight operated. Where cleaning waste contains or has been contaminated by international catering waste or other Category 1 material, it may need to be managed under the stricter controls applicable to that category.

The Scale of the Issue

The large volume of cabin waste generated by airlines makes its classification particularly important, because the category assigned to the waste determines the management options available after landing. IATA estimates that airlines generated approximately 3.6 million tonnes of cabin waste globally in 2023, with projections suggesting that this could double by 2040 in line with estimated traffic growth (IATA, 2025a).

In 2022 alone, Pennington et al. (2025) estimated that in the United Kingdom, approximately 89,000 tonnes of ICW entered the UK waste system. Due to the biosecurity ICW regulatory requirements, most of this material was incinerated.

3.2 The Conflict Between ICW Regulation and the Circular Economy

Like many regulations and global interests, the world is often faced with conflicts of interest, and the aviation industry is no exception. Considering the structure and classification of cabin waste, there is a strong conflict between two exterior pressures. On one hand, there is the circular economy, where catering waste covers the majority of cabin waste. With large quantities of this waste containing unopened or untouched items, the circular economy promotes another chance for goods or waste before being sent for disposal. On the other hand, is the ICW regulation by which the same waste is classified as Category 1 materials and waste and therefore must be destroyed if arriving on an international flight.

There is direct conflict between biosecurity regulation and sustainability objectives. The circular economy principle prioritises prevention, reuse, recycling, and resource recovery before disposal (Geissdoerfer et al., 2017). This would suggest that, unopened, untouched food items as well as segregated packaging would form part of the circular economy, rather than goods being destined directly for incineration. However, International Catering Waste regulations override these pathways for all international flights.

IATA has also acknowledged this conflict and identifies the rising tensions between both sides. In recent sustainability articles, they argued that the current ICW enforcements create high barriers to circular waste management within the aviation industry (IATA, 2024a). IATA claims that the high-control routes of disposal for Category 1 waste results in no option for donation, reuse or conventional recycling, even when the sanitary risk is low. According to IATA, the issue is not the objective of biosecurity protection itself, but the 'one-size-fits-all' approach that does not consider the actual contamination risk.

There are also calls for a more risk-based, harmonised “smarter regulation” centred on comparable evidence (IATA, 2024a). To generate this evidence, IATA and the Aviation Sustainability Forum propose the methodology below to quantify kilograms of waste per passenger, sealed-unused items, recoverables, and contamination, enabling proportionate policy and operational changes (IATA & ASF, 2024).

The IATA/ASF 2024 methodology standardises:

- i. Material taxonomies – aluminium, plastic, paper cartons, sealed vs opened food/beverage, liquids, amenities.
- ii. Waste location mapping - galley carts, bonded carts, compactor boxes, toilet bins.
- iii. Auditable procedures – contamination checks for ICW vs non-ICW streams and item-level recording of sealed food/beverages that are suitable for reuse.

This methodology allows for equal observation and analysis as to the quantity of recyclables that have been lost to ICW Category 1 waste, providing an industry-level response to the tension between biosecurity risk and resource recovery.

3.3: Examples of Operational Implications as a Result of This Conflict

On an operational level, the tension between biosecurity requirements for ICW and circular economy objectives becomes visible in the aviation industry. Several real-world examples illustrate how regulatory frameworks can restrict waste prevention, reuse, or recovery options, even when the materials concerned are sealed, unused or recoverable.

Unconsumed Food and Sealed Bottled Water

IATA reported that 23.4% of cabin waste consists of unconsumed food and beverages, including sealed water, which accounts for 4.9% of that total. Other items such as fruit juice, yoghurt, milk, and untouched meals are also part of this figure (IATA, 2019). Concluding that due to regulations, almost a quarter of waste are items that were never consumed.

From a circular perspective, this untouched “waste,” is multiple missed opportunities for redistribution to other flights, reuse in supply chains, or controlled recycling. Yet again, the conflicting ICW regulations prohibit these actions and on international flights these goods are Category 1 waste material and are therefore destroyed, regardless of their condition.

Northern Ireland – Great Britain Flights

A solid example of the restrictions that ICW impose on air travel and food waste are flights between Northern Ireland and Great Britain. Despite Northern Ireland being within the UK, the recent Brexit regulations and the Northern Ireland Protocol which governs the rules and regulations around the transportation of goods between Northern Ireland, the Republic of Ireland and Great Britain, results in waste incoming on flights from the rest of the UK to be classed as ICW and therefore must be incinerated. However, the same flight operating the return sector back to the UK does not have this restriction and all waste can be separated and classed as domestic waste upon arrival (UK Government, 2025).

In practice, the same products placed in the same aircraft have completely different waste outcomes depending solely on when the waste is removed from the aircraft. The waste itself does not change, but the regulations do.

Although physical contamination risk of animal by-products is a concern, it is apparent that it is not the only waste management decider. Waste management is governed by institutional geography, regardless of the condition of the products.

KLM: Circular Economy Under Constraint

KLM implemented a programme at its Hub, Schiphol Airport in Amsterdam, in which its used coffee grounds collected from its flights is recycled and converted into compost and biogas (KLM Royal Dutch Airlines, 2023).

This programme highlights that circular activities are feasible to some extent. However, KLM can only carry out this initiative on domestic and intra-EU flights in which waste is not considered as Category 1 high risk ICW. The objective of KLM is to highlight that although upstreaming is the more apparent method of reducing food waste, there are still some ways in which airlines can make a difference and stand themselves out in a crowded and restricted market when it comes to sustainability.

Chapter 4. Aspects Relevant to the Analysis (Methodological Considerations)

This chapter delves into the methodological background of the analysis which will be developed in the coming sections. As previously identified, food waste management is particularly complex in the aviation industry, and therefore the study combines the analysis of publicly available information published on business websites and sustainability reports using a case study approach. In addition to this, an online interview was also conducted to complement the already documented information and clarify remaining doubts regarding the topic. Therefore, the purpose of this section is to explain the analytical categories used, the criteria for selecting the cases used, the sources of information, some limitations, and a brief consideration as to why an interview impacts the study.

4.1. Catering models in the airline industry

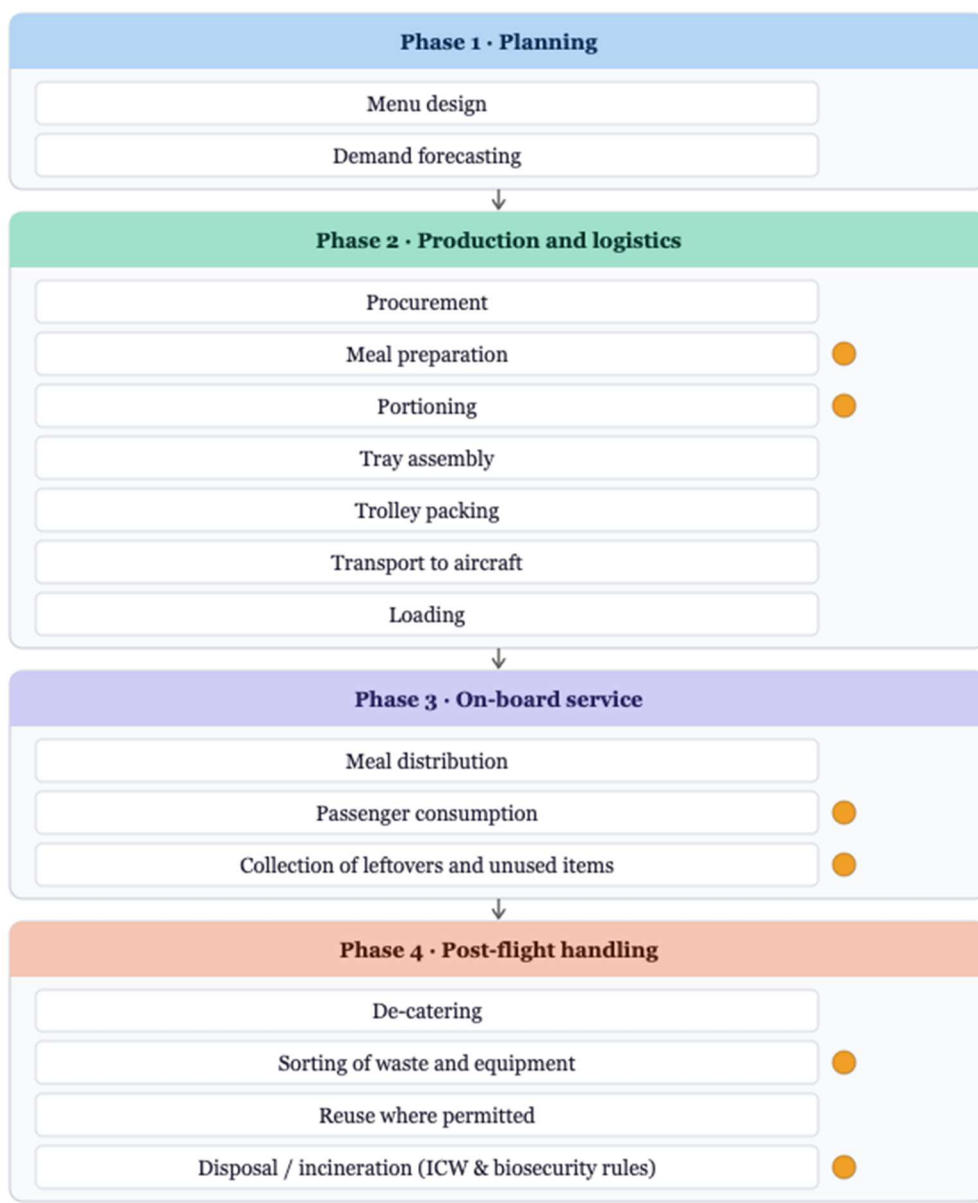
Every airline has a tailor-made service for catering regardless of the source of the catering loaded onto the aircraft. However, to analyse the food waste in the aviation industry and the effects, it is imperative to understand how catering systems function and the distribution of responsibilities depending on the source of catering. The element of airline catering is considered as one of the most complex logistical components within the daily operations of an aircraft. It involves the coordination of food production, supply chains, transportation, onboard service, all whilst considering strict regulatory and operational constraints. The key difference to airline catering compared to other industries are the tight turnaround slots that airlines have between flights, while ensuring food safety, service quality and compliance to rules and regulations (Ivanovic & Vujic, 2007).

From an operational point of view, the catering process can often be seen as a multi-stage logistical chain connecting airlines, airport catering facilities, and aircraft operations.

As seen in figure 2 below, the process usually begins with the menu design and forecasting demand which is carried out between the airlines and the catering suppliers.

Meals are then produced and prepared in specialised catering facilities which are often local in the vicinity to the airport. Said meals are stored into catering trolleys alongside all necessary equipment and transported to the aircraft in a catering truck for loading. When the aircraft arrives at its destination or returns to the hub, all catering stock including unused meals, catering equipment and galley waste are decatered and returned to catering or waste facilities to be sorted and disposed according to biosecurity regulations at that particular destination (Ivanovic & Vujic, 2007; IATA, 2019).

Figure 2: Flight Catering Process



● Food waste generation point

Source: Adapted by the author from Ivanovic and Vujic (2007) and IATA (2019).

As discussed previously, food waste can be produced at various stages of the catering process and so the operational chain described above is important to keep in mind. Depending on the stage of the process, airlines and caterers are faced with not just operational challenges but also regulatory pressures with frameworks such as the International Catering Waste governing regulation. Unless the food waste is generated and handled in the catering facilities prior to the flight, all food waste may be considered Category 1 waste depending on the flight and destination (IATA, 2019).

Due to this complex process and the requirement of careful consideration at various stages, not all airlines organise their catering in the same manner. As Ivanovic and Vujic (2007) explain, airlines may alter their catering structures depending on their scale of operations, their financial resources, and strategic objectives. There are three main pathways to cater an aircraft:

1. In-house Catering

Airlines may choose to have their own catering facilities, sourcing, cooking, and providing all necessary catering equipment and meals for their flights to maintain direct control over coordination and service standards.

2. Outsourcing

Other airlines may choose to contract catering suppliers with large industrial kitchens to supply their catering. These caterers typically supply meals to various airlines at airports across the globe. As soon will be discussed, outsourcing is becoming ever more popular in the aviation industry due to rising costs and said suppliers able to benefit from economies of scale, by supplying multiple airlines at one hub. Examples include DO&CO, Gate Gourmet, LSG Sky Chefs and dnata, who operate globally with various stations supplying to multiple airlines.

3. Hybrid Catering

Given the geographical scale and logistical complexity of airline operations, fully in-house catering is not always feasible. Under a hybrid catering model, an airline may manage catering operations directly at its main hub while outsourcing catering services to contracted providers at other airports, particularly at outstations or long-haul destinations.

The distinction is important as it provides an analytical basis to compare how different airlines respond to food waste and related operations. It can also partially answer why some airlines have greater capacity to adapt and implement prevention, monitoring, and recovery measures.

4.2. Criteria for selecting airlines and catering providers

Given the wide variety of airlines, their services, catering models, and size, selecting a broad range of airlines with effective information about food waste is vital in analysing the sector in this study. The selected case studies were therefore guided by a combination of operational scale, catering structure, and the availability of relevant public information.

Firstly, a ranking was selected based on the number of annual passengers, as waste is generated by people and the figures highlight operational scale. More passengers and greater volume generally mean greater catering activity and therefore more potential for food waste generation (The Flying Engineer, 2026). On this basis, the study first considered the twenty largest airlines globally by passenger numbers.

Table 2: Adapted Top 20 Airline Ranking

Rank	Airline / Group	No. PAX (M)	Ownership	Catering model	Catering provider
1	American Airlines	275.5	American Airlines Group	Outsourced	Gate Gourmet, LSG Sky Chefs
2	Delta Air Lines	239.9	Delta Air Lines Inc.	Outsourced	Gate Gourmet, LSG Sky Chefs
3	Southwest Airlines	231.4	Southwest Airlines Co.	Limited catering	Gate Gourmet
4	United Airlines	212.9	United Airlines Holdings	Outsourced	Gate Gourmet, LSG Sky Chefs
5	Ryanair	209.6	Ryanair Holdings	Outsourced	Gate Gourmet, dnata
6	China Southern Airlines	148.9	China Southern Air Holding	Mixed	China Southern Catering
7	China Eastern Airlines	145.8	China Eastern Air Holding	Mixed	Eastern Air Catering
8	IndiGo	134.9	InterGlobe Aviation	Outsourced	TajSATS Air Catering
9	Lufthansa Group	131.3	Lufthansa Group	Hybrid	LSG Sky Chefs
10	International Airlines Group (IAG)	122.1	IAG	Outsourced	DO&CO, Gate Gourmet
11	Air China	115.9	Air China Group	Mixed	Air China Catering
12	easyJet	102.5	easyJet plc	Outsourced	dnata, Gate Gourmet
13	LATAM Airlines	101.3	LATAM Airlines Group	Outsourced	Gate Gourmet
14	Air France–KLM	93.6	Air France-KLM Group	In-house subsidiaries	Servair, KLM Catering Services
15	Turkish Airlines	85.2	Turkish Airlines Group	Joint venture	Turkish DO&CO
16	Wizz Air	62.8	Wizz Air Holdings	Outsourced	Gate Gourmet
17	Aeroflot	55.3	Aeroflot Group	Mixed	Aeroflot Catering
18	Emirates	53.0	Emirates Group	In-house	Emirates Flight Catering
19	Qantas	52.0	Qantas Group	Joint venture	dnata / Qantas Catering
20	Alaska Airlines	49.2	Alaska Air Group	Outsourced	Gate Gourmet

Source: Adapted by Author with reference to *The Flying Engineer* (2026). *World's largest airlines by passengers*. Available at: <https://theflyingengineer.com/worlds-largest-airlines-by-passengers/>

The ranking only showed the number of passengers and the airlines with their position, and so the ranking was useful to adapt the table to include the type of catering and their providers across the largest airlines. Of the twenty airlines included in the ranking, sixteen primarily operate an outsourced catering process, while very few are inhouse or hybrid catered. Looking at passenger numbers, the ranking represents approximately 2.6 billion passengers annually, of which 86.1% travel on outsourced catered flights, compared with 8.9% travelling on inhouse catered flights and around 5% on hybrid models (The Flying Engineer, 2026). This suggests that outsourced catering is not a marginal arrangement but holds a dominant position in modern airline operations.

However, airline size alone was not sufficient as a criterion. Since the aim of the study is to not only describe the scale of food waste in airlines, but to examine how food waste is managed under various organisational conditions, catering structure was also taken into account. Considering this, the final airline sample was refined to include cases representing in-house, outsourced, hybrid, and joint-venture catering models, allowing for a wider comparative view across different forms of operational control. The distinction is important because it may influence the extent to which airlines are able to implement prevention, monitoring, and recovery measures.

Additionally, two further airlines were selected as part of the analysis (Finnair and Japan Airlines JAL), as they provide useful information that benefits this study. Finnair operates a hybrid model and reports detailed information on food waste and ICW constraints, while JAL provides a non-European example of food waste reduction practices under quarantine-related restrictions. Their inclusion therefore strengthens the comparative analysis by adding cases that are especially informative in relation to the research objectives.

Finally, to complete the study, three catering providers were selected, following the dominant role external caterers play in the top ranking. The caterers selected are, DO&CO, Gate Gourmet, and dnata. Since outsourced and hybrid models distribute food waste responsibilities across multiple actors, analysing catering providers is only fitting, in order to understand how food waste is handled beyond the airline itself. The three companies were selected based on their relevance to the sampled airlines and the availability of publicly accessible information relating to food waste management.

4.3. Sources of Information Used, Analytical Approach and Limitations

The study focuses primarily on publicly available information from the company websites. These sources include sustainability reports, annual reports, environmental statements, corporate websites, press releases, and industry publications. Multiple regulatory and institutional documents are also used to establish the operational and legal context of food waste management in the aviation industry with emphasis on International Catering Waste and related biosecurity restrictions. These practices were then applied to the adapted food waste hierarchy, which was previously discussed, allowing for a more relevant comparison of the industry.

After careful consideration of the information available, questions and doubts were still unanswered and so an interview was also conducted to clarify doubts that could not be rectified from the public information. This interview is the main source of information for the Iberia Case Study linking the airline industry to local Spanish laws regarding food waste.

Basing the study on publicly available information also limits the extent of the analysis as relying solely on public disclosures does not analyse independently verified food waste performance reported practices. Information published can also be vague and broad, as opposed to a detailed development into specific matters such as an overview to sustainability objectives rather than dissecting each objective. Therefore, the study should be perceived as an analysis of documented practices rather than a direct measurement of actual outcomes.

Besides the source of the information, there is also the issue of the balance of information published from each airline. Some make direct reference to food waste issues and objectives, others mention it and no more, and some do not even consider it in their reports published.

4.4 Analytical Hierarchy Applied in the Study

To ensure consistency across the multiple case studies that will be reviewed in the following section, this dissertation includes a personally adapted framework which applies measures considered applicable to the airline industry related to food waste

handling. Rather than treating all sustainability actions as equal, the hierarchy allows for close assessment into each practice implemented by each airline or catering supplier.

As previously presented in the last block, it consists of six levels varying from prevention to redirection to recovery and then incineration. It is important to consider this as it highlights the differences in operations between the airline sector and other industries that are affected by food waste management.

4.5 Iberia Case Study and Interview with Iberia Manager

Iberia was selected as the case study because it represents a Spanish airline operating with outsourced catering, making it especially relevant for examining both the distribution of responsibilities between the airline and the caterer and the possible implications of the recent Spanish food waste law in the aviation sector.

Before the interview, Iberia's publicly available sustainability and corporate information was reviewed in order to identify which issues had already been reported and which still required clarification. This showed that public information on onboard waste was limited.

For this reason, the interview had four main objectives:

- To clarify how responsibilities for food waste management are divided between Iberia and its catering provider
- To understand how ICW restrictions affect the airline's practical options
- To examine whether the Spanish food waste law has any real operational effect in this context
- To identify what food waste measures are realistically possible within an outsourced catering model

The interview lasted approximately 30 minutes and was recorded and transcribed online via Microsoft Teams with Iberia's Inflight Experience Manager, who has over 10 years experience in the industry. The interview was then reviewed in order to identify the most relevant information for the study. The questions asked can be found in Appendix 1.

Chapter 5: Airline and Catering Provider Case Studies

This chapter delves into the airline and catering cases selected to provide an analysis and examine how different actors within the aviation industry handle food waste in practice with their operations. It will also consider the main actions and measures reported by the businesses in relation to prevention, redistribution, recovery, and disposal.

It begins with an overview of the top 20 largest global airlines by passenger volume, before selecting some of the airlines to analyse in more detail, considering their catering structure and actions.

5.1 - Emirates

Dubai based Emirates operates flights across the world, transporting around 53 million passengers in 2024, placing it as the 18th largest airline by passenger numbers (The Flying Engineer, 2026). The airline is a useful example of an airline with extensive control over their catering operations, as they operate through Emirates Flight Catering (EKFC) at their base hub, Dubai International Airport (DXB). EKFC acts as one of the largest airline catering facilities across the globe, as they produce more than 225,000 meals per day for their own airline and other airlines who operate out of Dubai airport (Emirates, 2025). This structure allows Emirates to withhold direct control of meal production, catering logistics, and waste management duties.

As part of their catering system, they have introduced several initiatives and programmes centred around the reduction of food waste. For example, its use of artificial intelligence forecasting systems that help analyse passenger booking data and assess demand patterns to estimate meal requirements more precisely. According to EKFC, the technology implemented has contributed to reducing catering food waste by around 35% (Emirates Flight Catering, 2020). Furthermore, the carrier has invested in waste treatment infrastructure, consisting of a high-volume biodigester that can use organic food waste to generate water that can be reused for agricultural purposes (Emirates, 2025).

The Emirates case illustrates the abilities and prominent levels of control an airline can have by producing their own catering. There is more flexibility operationally to trial and implement modern technologies and experiment circular waste management solutions. The problem constantly raised in this study is that a large global airline will experience and encounter a high level of international waste that will be subject to regulatory disposal methods according to the International Catering Waste regulations.

5.2 - KLM

KLM Royal Dutch Airlines is another relevant example of airlines seeking to improve the food waste situation within their catering operations. The airline is part of the Air France – KLM Group, operating a huge international network from its main base Amsterdam Schiphol Airport. Also, part of the group is KLM Catering Services, which manages the production and logistical operations of the catering for KLM flights. They are KLM's specialised catering partners.

Like Emirates and other airlines, KLM is also adopting its own forecasting technologies and systems to combat against the growing sustainability pressures and costs associated with catering waste. This initiative is one of many that aims to reduce surplus food onboard and improve resource efficiency throughout the business. In particular, the airline uses two systems: TRAYS, which predicts passenger numbers, and MOBS (Meal On Board System), which receives passenger numbers per flight and cabin class (KLM, 2024a). The new AI technology allows the airline to analyse passenger booking behaviour, demand patterns, and route characteristics to predict requirements for each flight more accurately. They find that between 3% and 5% of passengers show up late or do not even show up for their flights. Stated by KLM, they say that this approach has greatly impacted meal planning and reduced the number of unused meals on flights (KLM, 2024b; KLM, 2025).

According to KLM, a three-month analysis showed that this approach resulted in 63% less food waste compared to catering an aircraft for every booked passenger on a flight according to a 3-month analysis, annually saving 111,000 kg of meals catered by KLM at Amsterdam airport (KLM, 2024a). This makes KLM a useful example of how forecasting systems can contribute to food waste prevention at the earliest stage of the hierarchy.

In addition to the forecasting scheme mentioned above, KLM has also introduced methods to improve the circular economy. As previously mentioned, KLM has been using the coffee grounds collected from eligible non-ICW flights and is producing compost and bio-based products (KLM, 2021). This shows that airlines with control of their waste from being internally catered have the ability to look further beyond the prevention stage. At the same time, it also highlights the operational difficulties that airlines face when regulatory frameworks impede on certain objectives, such as the ICW framework restricting certain products and waste from being reused or redistributed on other flights, particularly on international flights due to biosecurity restrictions.

KLM in its Climate Action Plan also highlights the limits of having to outsource catering. In relation to decarbonizing catering, it responds that KLM only has control of outgoing catering on all flights from Amsterdam and return European flights as it would cater the aircraft from Amsterdam for both sectors. As a result, flights from the 60-70 intercontinental destinations on KLM's network remain outside this scope (KLM, 2024b). The case of KLM therefore shows both the limits and possibilities of food waste reduction in aviation: while airlines can improve forecasting and introduce more circular activities, the extent of their control is restricted by both operational and regulatory structures.

5.3 - Turkish Airlines

Continuing with airlines within the ranking, Turkish Airlines presents a slightly different structure of catering, promoting a joint venture with DO&CO creating the catering subsidiary Turkish DO&CO. The subsidiary produces all inflight meals in Turkey for the airline. The Turkish carrier transported around 85 million passengers over the past year, placing it as the 15th largest carrier in the world by passenger volume (The Flying Engineer, 2026). Through its joint venture, the airline is able to maintain significant coordination between the catering production and services offered onboard, all taking place at its hub in Istanbul.

The airline has implemented several initiatives with the intention of improving sustainability performance and reducing waste across its global operations. Among the large airlines, Turkish Airlines is one of the few that offers a food donation programme. The programme allows the airline to redistribute excess food, to charities and other

social organisations and programmes, which have not yet entered the inflight catering chain (food that has not entered the aircraft). This is done by offering passengers the option to state that they do not want a meal on board. They do this prior to the flight by managing their booking up to 24 hours before departure (Turkish Airlines, n.d.).

This highlights the airline's attempt to reduce waste generated onboard and prevent unnecessary landfill but also provide their passengers with an option to have the meal. It is also a practical solution to offering flexible options but also avoiding regulations that impede effective disposal or reuse of food.

Like the previous cases, Turkish Airlines is also partaking in analysis of operations within the primary stages of the catering process before food enters the aircraft. Improved planning processes and resource management are presented as ways to combat against easily avoidable waste. The measures highlight the importance of cooperation between airlines and catering providers in reviewing current practices and maximising upstreaming waste prevention wherever possible, as once the catering is loaded onboard, reuse and donation is much more limited (Turkish Airlines, 2024).

5.4 - Qantas

Australian flag carrier Qantas and its airline group rank as the 19th largest in the world, carrying approximately 52 million passengers in the last year (The Flying Engineer, 2026). However, unlike some of the previously discussed airlines, Qantas has even less internal control as it sold the "Qantas Catering Group" in 2018 (Qantas Newsroom, 2018). The catering firm was sold to dnata, part of the Emirates Group with the intention of allowing the airline to build relations with a global catering specialist while maintaining strong influence over menu design and service development through multiple suppliers. Qantas is therefore an interesting case as they are a relevant example of an airline that has moved externally while still retaining some influence over their service concept.

In their latest sustainability report, Qantas addressed a broad circularity agenda and several waste reduction efforts. On a wider level in 2025, they reported the removal or replacement of more than 21 million single-use plastic items, an increase in waste diversion from landfill to more than 40% where they have direct control, and the exploration of recovery pathways for food waste, donation and waste-to-energy. This

includes materials treated as quarantine waste. Beyond the aircraft they have expanded their plans to six lounges and its Mascot headquarters, by which they have composted more than 10 tonnes of food waste each month, as well as promoting efforts at their main domestic terminal in Sydney, terminal 3 (Qantas, 2025a).

Although not all these measures relate directly to inflight catering waste, the Qantas case remains useful because it shows how an outsourced airline may address food waste and circularity in areas where it retains greater operational control. In this sense, its approach appears broader than direct onboard food waste prevention and is more closely linked to the wider sustainability management of waste across the business.

Beyond direct operations, the airline has also supported household food-waste awareness through its partnership with the Saveful app, which rewards users through the frequent flyer programme (Qantas Airways, 2025b). It is imperative to consider this as an indirect initiative rather than an operationally direct response to food waste in airline catering.

Therefore, the Qantas case illustrates the possibilities and limits of food waste reduction through an outsourced catering model. While they report several broader circular initiatives, its role in direct food waste management is more limited according to the information published, compared to other airlines with greater control over their catering.

5.5 - Lufthansa

Lufthansa, Germany's flag carrier airlines, and the Lufthansa Group hold a strong connection with sustainability and is another important case in relation to food waste management and sustainability. In the ranking, it appears as the ninth largest airline group in the world, carrying about 131 million passengers annually (The Flying Engineer, 2026). Although the Lufthansa Group previously owned catering company LSG Sky Chefs, it has since sold the business. However, their sustainability report in 2024, shows that they remain engaged in food waste reduction through their implementation of improved data systems and collaboration with their catering partners (Lufthansa Group, 2024; Lufthansa Group, 2025a).

Lufthansa is currently investing in new data-driven tools to reduce inflight food waste. With its first launch in Frankfurt, the Group introduced the AI system “Tray Tracker,” which scans all meal trays when returned to the dishwashing stage after a flight and analyses many factors such as whether the meal was fully consumed, partly touched or untouched. It also records the route and cabin class in order to improve meal planning in initial stages of the process and help with meal load planning decisions (Lufthansa Group, 2025b; Lufthansa Group, 2025c). The airline group also stated that they aimed to reduce short haul food waste by 50% by 2025 compared with 2019 levels, although the latest sustainability report has not yet confirmed if they reached this target. They also stated that on their long-haul flights, they are working with their catering partners to improve data transparency before they can establish targets (Lufthansa Group, 2024).

In line with the regulatory tensions discussed above, Lufthansa Group has also identified ICW rules as a barrier to more circular food waste management in aviation. According to the Group, existing EU rules on ICW from flights arriving from outside Europe restrict opportunities for recycling and reuse, often resulting in incineration or landfill disposal. Lufthansa therefore calls for a revision of the EU animal by-products framework in order to better balance biosecurity requirements with sustainability objectives (Lufthansa Group, 2023).

In response to these restrictions, the airline has introduced several measures aimed at reducing food waste before it reaches the disposal stage. These include pre-ordering systems, reduced meal loading, and selling surplus food products at discounted prices at the end of the day or a rotation of flights. In 2022, the group prevented 80,000 food products from being thrown out. Lufthansa itself saw a 45% decrease in perishable food discarded in 2022 compared to 2021 (Lufthansa Group, 2023).

The Lufthansa case shows that despite having external caterers, the airline can still implement measures and data-based analysis to reduce food waste in the airline industry. Data collected can be used to reduce food orders for flights, operations can be redesigned, all whilst not handling the actual catering process themselves. At the same time, it also illustrates how regulatory constraints continue to limit what can be done with food waste once it has entered the inflight catering chain.

5.6 - Finnair

As seen in the previous cases, airlines generally provide less publicly available information about food waste than other sectors in the travel and hospitality industry, such as hotels. However, Finnair is a particularly useful example, that despite being a relatively small airline, it provides more detailed information on food waste and related regulatory constraints. The airline operates a hybrid catering system, by which all catering from its hub at Helsinki is managed in-house, with external catering for those international destinations. In 2017, Finnair terminated its contract with LSG Sky Chefs and brought its Helsinki-based operations in-house. This allowed the airline to increase its direct control over catering activities at its main hub, whilst catering outstations continue to be managed by external providers.

Finnair has introduced several measures aimed at reducing food waste through upstream prevention and improved demand forecasting. In particular, it promotes order-based catering by allowing passengers to pre-select their meals before the flight, especially on long haul routes. This allows the airline to reduce unnecessary food waste linked to surplus catering loaded onto the aircraft (Finnair, 2025a; Finnair, 2025e). Through their optimisation efforts, Finnair reports that in 2025 it achieved a reduction of approximately 11 tonnes of catering waste, highlighting the impact that effective planning can have on operational efficiency and sustainability (Finnair, 2025b).

The airline provides significantly detailed information about its food waste, including the structural limitations of reducing food waste within the airline industry. Finnair reports that 58% of total waste mass originates from food and packaging returning from international flights outside the EU, and that due to the animal health regulations relating to International Catering Waste, all of this waste must be treated as Category 1 waste and therefore incinerated (Finnair, 2025b). The airline has also expressed concern around the high restrictions, stating that such waste may have potential for energy recovery and that unfortunately the waste cannot be separated into biowaste streams under the current framework (Finnair, 2021).

In addition to food waste, Finnair also refers to the impact of ICW on wider sustainability objectives. For example, the airline has trialled recycling initiatives involving cardboard

packaging and small plastic bottles on flights arriving in Helsinki, although recycling rates remain limited due to the large amount of waste classified as ICW (Finnair, 2025c; Finnair, 2025d). Whilst this measure is not directly related to food waste reduction, it complements how ICW restrictions affect circularity and waste management more broadly.

The case of Finnair is therefore particularly relevant because it shows both the possibilities and the limits of food waste management in aviation. On one hand, greater control over catering operations allows the airline to implement preventive measures and improve forecasting. On the other hand, the case clearly illustrates how regulatory restrictions continue to limit the scalability of circular economy practices once food enters the inflight catering chain.

5.7 - Japan Airlines (JAL)

Japan Airlines (JAL) is the second airline in this study that does not appear in the global passenger ranking but provides useful public information about food waste reduction methods. The airline operates an in-house catered structure through its subsidiary company JAL Royal Catering, allowing the airline to maintain direct control over the monitoring and managing of food waste within catering operations (Japan Airlines, 2025a).

JAL's waste approach stems from a "4R" strategy: reducing, reusing, recycling, and replacing. At the production stage, the carrier analyses food waste by category each month and adjusts stock levels, purchasing, and production quantities accordingly. Like a few other airlines, JAL has also introduced many demand-based methods, such as the "Meal Skip Option," allowing passengers to opt out of taking an inflight meal before departure. This option helps reduce unnecessary catering onboard and is linked to the airline's "Table For Two" programme, donating every meal not wanted on a flight to those who need it more (Japan Airlines, 2022; Japan Airlines, 2025a). In addition, they also offer pre-ordering to boost even further demand forecasting efficiency.

At the same time, JAL also makes clear the limits of what can be achieved once food has entered the inflight service chain. According to the airline, leftover inflight food must be incinerated due to quarantine rules, which negatively affects the application of its 4R

strategy. JAL also refers to non-food recycling streams where recovery is still possible (Japan Airlines, 2025a).

The case is particularly relevant because it shows that the restrictions affecting food waste management are not limited to the European Union's ICW framework. While JAL is not applying EU ICW rules in Japan, Japanese quarantine restrictions create a similar barrier for international-flight food waste. Official guidance from Japan's Ministry of Agriculture, Forestry and Fisheries states that in-flight meals containing fresh fruits and vegetables cannot be brought into the country, and that in-flight meals containing meat products also cannot be brought in. In both situations, passengers are advised to consume meals containing these products onboard and to not bring any leftovers with them. The guidance explains that these restrictions are in place to prevent the entry of plant pests and livestock diseases into Japan (Ministry of Agriculture, Forestry and Fisheries of Japan, Plant Protection Station, n.d.).

When JAL introduced the Meal Skip Option, the measure also received public attention. Some reactions were positive, particularly in relation to its environmental and charitable aspects, while others questioned whether it also functioned as a cost-saving measure. Although this does not alter the operational relevance of the initiative, it shows that food waste measures may also be interpreted through reputational and consumer expectations.

The case of JAL therefore shows that strong catering control can support food waste prevention and monitoring, while also illustrating how quarantine-related restrictions continue to limit what can be done with leftover inflight food once it has entered the aircraft.

Taken together, the airline cases show that food waste reduction in aviation is shaped by both catering structure and regulatory constraints. These common patterns are discussed in greater detail in block 7.

5.8 - External Caterers

Whilst airlines play a central role in planning their inflight service, menu design, and broader sustainability strategies, airlines who have adopted a hybrid or outsourced

catering structure will find that all operational management of catering is carried out by the contracted catering specialists. These caterers operate large-scale kitchens close to airports, often catering many airlines at the same time from the same place. As a result, they have direct control of food waste management including creation, handling, and disposal of waste. For this reason, it is crucial to examine some of the biggest airline caterers in the world and analyse some of the methods they put into practice and see how it may differ from airlines directly controlling the catering themselves.

5.8.1 - DO&CO

DO&CO is a global airline catering provider, supplying catering services to multiple full-service carriers across Europe, The United States, the Middle East, and Asia. Operating in more than 30 countries, its catering services are based on large-scale production facilities located close to international airport hubs. In addition to supplying airlines directly, it also operates joint ventures, such as Turkish DO&CO, providing exclusive catering services to Turkish Airlines (DO&CO, 2025a).

Like all other external catering firms, DO&CO holds direct responsibility for meal preparation, portioning, loading the catering onto the aircraft and post-flight handling, including waste disposal. Given the large scale of the company and the large volumes of hundreds of thousands of meals produced per day, even a slight improvement in production efficiency can have a significant impact on food waste reduction. In its CSR report, DO&CO states that they place emphasis on resource efficiency, waste reduction, and responsible sourcing, aiming to optimise production processes to minimise surplus food during the preparation phase (DO&CO, 2025a).

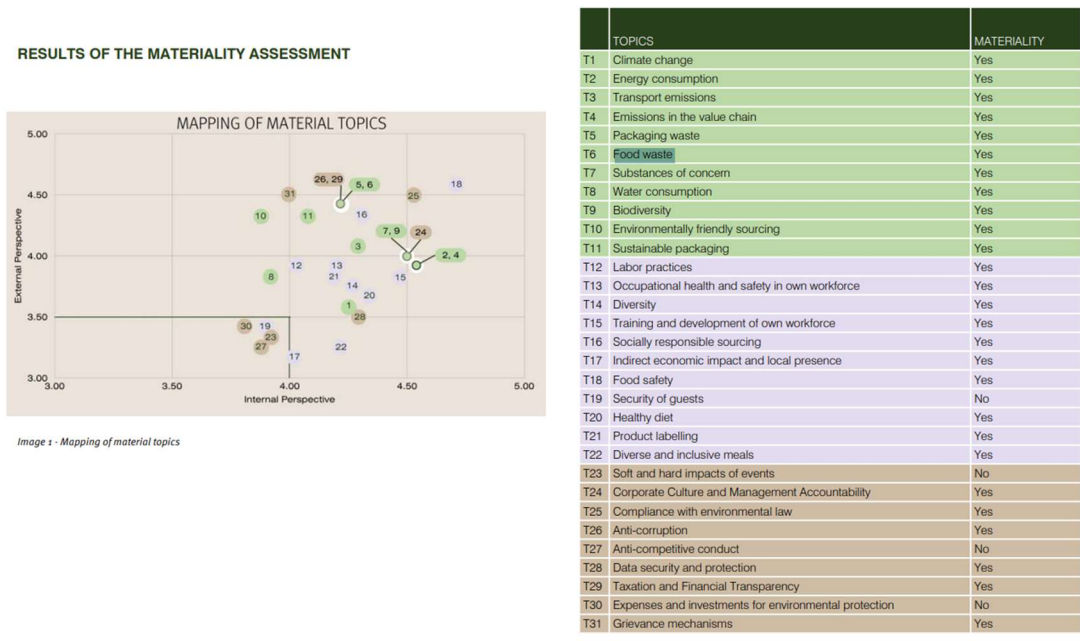
The airline catering supplier has also committed to the target of achieving zero food waste to landfill by 2030, aligning with their broader circular economy objectives (DO&CO, 2025b). However, this target raises an important question in the context of airline catering, since regulations such as ICW restrictions limit the reuse, recycling, and the redistribution of items that have been on international flights.

DO&CO also reports several measures intended to reduce food waste. These include the use of artificial intelligence to analyse trends, the composting of food waste to convert it into a resource for agriculture, staff training related to water consumption and

production planning, and greater attention to inventory control, particularly in relation to perishable goods (DO&CO, 2025a). In its latest sustainability report, DO&CO explains that it reuses kitchen scraps, trimmings, offcuts, and bones to prepare stocks and just before considering disposal. This process helps reduce food waste by keeping edible or usable materials within the production process and reflects a more circular approach to catering operations.

Finally, DO&CO’s sustainability report includes a materiality assessment in which food waste is identified as a material topic for the company. As shown in Figure 2, food waste is considered relevant from both internal and external stakeholder perspectives, indicating that it is not only an operational issue but also a significant sustainability concern for the business (DO&CO, 2025a).

Figure 3: DO&CO materiality assessment highlighting food waste as a relevant issue for internal and external stakeholders



Source: DO&CO (2025a).

5.8.2 - Gate Gourmet

Part of gategroup, Gate Gourmet is one of the world's largest airline catering suppliers, operating worldwide providing to multiple airlines at many major international hubs. The group caters to hundreds of millions of passengers annually, highlighting the potential impact that a large company like Gate Gourmet could have on food waste reduction within the aviation industry (gategroup, 2025a; gategroup, 2025b).

Within gategroup's ESG strategy, food waste is identified as a key material issue. The company reports measures focused on process optimisation, collaboration with airline customers, and improved demand forecasting in order to align production volumes more closely with actual passenger demand (gategroup, 2025b). The company has also launched the “#mindfulness” campaign, which aims to encourage more responsible food consumption and handling practices throughout its catering facilities (gategroup, 2024).

In its recent ESG reporting, the group also states that it has adopted a framework that prioritises reduction, reuse, and recycling over standard disposal. The group aims to achieve “zero food waste solutions” across operations, which is already starting to see an impact. By the end of 2024, 20% of reporting units were sending organic waste to compost or recycling (gategroup, 2025c). At the same time, the company recognises that progress is limited in some regions due to insufficient composting infrastructure, which affects the expansion of these practices.

The Gate Gourmet case shows how food waste management is integrated into a broader ESG and operational framework. It also highlights that, even where caterers have direct control over production operations, food waste reduction remains influenced by airline demand patterns, infrastructure availability, and the wider constraints affecting aviation waste management.

5.8.3 - dnata

dnata is the final example of a global catering company included in this study. Part of the Emirates Group, dnata operates not only in airline catering but also in the retail sector across several international airports. The company serves numerous airlines, playing a

significant role in production, logistics and post-flight handling. Its position within the Emirates Group also gives it a partially vertically integrated model, linking airline operations with catering services and enabling closer coordination across parts of the aviation catering supply chain (dnata, 2025a; Emirates Group, 2025).

The catering supplier has focused on many sustainability initiatives to combat against food waste, improve resource efficiency and generate a social impact. One example is food donation and redistribution of food. dnata is Australia's largest airline catering supplier, and during Covid-19 the company donated 550,000 surplus food items, equivalent to 180,000 meals to various charities across the country (dnata, 2025b). This is particularly relevant because the food was redirected before entering the inflight chain and therefore before stricter operational and regulatory constraints applied.

Furthermore, in 2021, dnata entered an agreement with Blue Aqua Food Tech aimed at reducing waste across the catering production chain. The initiative uses bioconversion processes to transform leftovers from the catering production into alternative outputs rather than sending them directly to disposal (dnata, 2025c). Although the public information available does not provide a detailed technical explanation of the final input, the example remains useful because it shows that surplus organic material may be redirected through alternative recovery processes at the production stage.

They do recognise however, that there are various constraints affecting the achievement of sustainability objectives. The company calls for greater collaboration with infrastructure providers to improve waste management systems and other facilities in airports, as currently they see restrictions on circular activities (dnata, 2025d). Interestingly, the company has highlighted that it is not solely the airlines and the catering supplier that have control of food waste reduction, but also airports and surrounding infrastructure at catering locations to be able to appropriately manage waste.

From an analytical perspective, dnata provides a useful example of how airline-linked catering suppliers can address food waste at various stages of the catering chain. Its initiatives suggest that, beyond prevention, catering providers can also support redistribution, recovery, and alternative uses for surplus food and organic waste when

these cannot be avoided. At the same time, the case also shows that such measures depend on coordination with other actors and remain affected by wider infrastructure and regulatory constraints.

5.9 - Conclusion

Overall, the catering provider cases show that external caterers play a key role in airline food waste management, particularly in relation to meal production, logistics, and post flight handling. These findings are examined further in the final discussion section, where they are considered alongside the airline case studies and the Iberia interview evidence.

Chapter 6. Iberia Case Study

6.1 Introduction to Iberia

Iberia, Spain's flagship carrier and part of International Airlines Group (IAG), provides a particularly relevant case for this study. Firstly, as a Spanish airline, it allows the analysis to explore whether Spain's recent food waste law has practical implications for the aviation sector. At the same time, Iberia's international network means that its catering and waste management practices are shaped by regulations in multiple jurisdictions, as the airline operates an extensive network covering more than 140 cities with a growing fleet of more than 160 aircraft (Iberia, 2026).

The airline is externally catered by DO&CO catering services, making Iberia a fully outsourced catered airline. This makes the case useful for examining the extent to which food waste affects an airline with limited direct control over its catering operations, and for considering how responsibilities are distributed between the airline and the catering provider.

6.2 Analysis of the publicly available information

After reviewing Iberia's publicly available sustainability information, the airline presents itself as committed to circular economy activities and efforts to improve the environment. However, in the documents analysed, this information identified relates mainly to general waste reduction and circularity measures, rather than to onboard food waste specifically. For example, Iberia reports initiatives such as reducing plastic waste onboard by 2,000 kg, aiming for elimination of single-use plastics, reusing materials, extending product life, and improving waste separation systems across all areas of the airline (Iberia, 2024a; Iberia, 2024b). While these actions are relevant from a circular economy perspective, they do not provide detailed information on food waste prevention or management within Iberia's onboard catering operations.

The main exception is the pre-ordering scheme that Iberia has introduced, allowing passengers to preorder their meals before boarding the aircraft. The aim is to align catering stock onboard more closely with actual passenger demand for catering and prevent overstocking to reduce food waste where possible (Iberia, 2021). Apart from this,

there is very little public information available directly relating to food waste. On its circular economy page they state, “We continue to expand our screening services, such as pre-order, to load essential food on the plane, avoiding food waste” (Iberia, 2024a).

The lack of public information raised an important question for this study. If the airline is publicly committed to sustainability and the circular economy principles, why are there few visible food waste reduction actions? The issue becomes more apparent when considered alongside the previous airlines and caterers analysed. Even other externally catered airlines provided more specific information about food waste. The prior analysis suggested that there is not only an influence by corporate sustainability ambition, but also external legal and operational constraints, particularly the International Catering Waste regulation limiting reuse and redistribution of goods on international flights (European Commission, 2023). Locally in Spain, the food waste law 01/2025, also raises questions about whether it has any practical relevance for a Spanish airline operating from Madrid.

6.3 Questions that motivated the interview

Given the lack of detailed public information, the opportunity to interview someone from Iberia became particularly valuable for the study. Several questions and doubts emerged from the documentary analysis. In particular, the interview was intended to clarify:

- How regulatory pressures affect Iberia’s decisions in relation to food waste
- Whether conflicting legal and sanitary conditions create barriers to action
- What controls and responsibilities Iberia holds in relation to its catering partner
- Whether the Spanish food waste law has any practical effect on airline operations
- What can realistically be done to improve the current food waste situation in the airline sector
- Whether passengers are genuinely concerned about food waste onboard

In order to address these issues, an interview was conducted with the Senior Manager of Inflight Experience at Iberia.

6.4 Contributions of the Interview

The interview clarified several issues that were not visible in the public information. It confirmed that food waste management in aviation is not impossible, but a problem shaped by legal, sanitary, and structural limitations. In the case of Iberia two main constraints were identified: the International Catering Waste framework, and the outsourced catering model. As clarified in the interview, ICW is “a conflict we have to live with” (translated by the author), since once food has entered the aircraft on international flights, there is no easy way to separate, reuse, donate, or redistribute it.

In terms of catering structure, it was also made clear that Iberia’s relationship with external company DO&CO affects the control the airline has over catering operations. The manager explained that “overall, the responsibility is theirs, and the management of waste is theirs” (translated by the author). With no direct access to preparation, portioning, loading, or waste control, the airline instead seeks to influence outcomes through planning and service design. This helps explain why there are few catering-linked initiatives published by Iberia compared with some of the other cases included in this study.

The manager did reveal that “crew meals are one of the items that generate the most waste” (translated by the author), suggesting that some of the most relevant waste streams may also be linked to the internal operations and not only passenger consumption.

When external regulatory pressures were discussed, the interviewee explained that the Spanish food waste law does not currently have a significant impact on the airline industry. In her view, there were already previous discussions and regulations in place, and the current law mainly represents an updated version. Having said that, there are other conflicting pressures particularly ICW that override the local Spanish law due to health. The Inflight Experience manager believes that it needs to be reevaluated should the industry want to improve sustainability levels.

As the ICW regulation states, all Category one food products or anything that has come into contact with them, must be incinerated. However, the interview also showed that some limited adjustments are still possible. Iberia has modified parts of their inflight

service to separate certain foods on board the aircraft and store them separately to avoid cross contamination. Condiments such as salt, pepper and small sachets are now offered on an on-demand basis, rather than giving them to each passenger. If they are not used, they can be used on subsequent flights. The same applies to drinks, like high value alcohol which does not come into contact with animal by-products.

The interview further addressed what can still be done to improve sustainability under current restrictions. The manager explained that, given the high level of restrictions surrounding onboard food waste, the airline focuses on other ways to improve sustainability and become more circular. Iberia has partnered with one of its main wine suppliers in order to use grape residues in products for its amenity kits and has also worked with the designer of its uniforms to use discarded materials and donated cabin crew uniforms to make amenity kit bags. Although these measures do not directly address onboard food waste, they show that the airline is attempting to pursue circularity in other areas of its operation.

The interview also addressed passenger attitudes towards onboard food waste. The Inflight Experience Manager explained that passenger reactions vary. Some passengers may be concerned about sustainability, while others continue to prioritise service quality, variety, and choice onboard. As a result, efforts to reduce food waste may need to be balanced against passenger expectations regarding the availability and quality of meals.

When asked about the future of food waste management in aviation, and whether changes to the current regulatory framework could enable further action, the Inflight Experience Manager explained that she did not expect these issues to be resolved easily or in the near future.

6.5 What the Iberia case contributes

The Iberia case and interview help clarify how food waste management operates in practice within an externally catered airline. In Iberia's case, the airline promotes a broad sustainability and circular economy strategy but reports very few visible food waste reduction measures beyond pre-ordering and limited changes to the onboard service of certain uncontaminated items. At first sight, this lack of reporting might suggest a weakness or a gap in the airline's sustainability strategy. However, the interview

indicates that the explanation lies less in a lack of interest and more in the interaction between outsourced catering responsibilities, ICW requirements, and wider sanitary restrictions.

For this reason, the Iberia case is particularly useful in showing how public sustainability reporting may not fully reflect the practical limits faced by airlines in relation to food waste. Rather than allowing broad generalisations, the case provides one detailed example of how legal, operational, and biosecurity constraints interact in practice within a major international airline.

Chapter 7: Discussion of Results

This block discusses the main findings of the case analysis in relation to the aviation-adapted food waste hierarchy and the theoretical frameworks presented in prior sections. Rather than delving into each case once again, the discussion considers the cases comparatively in order to identify common patterns, key differences, and the main structural constraints affecting food waste management in aviation.

7.1 Comparative Application of the Airline Food Waste Hierarchy

Considering the different ways in which food waste can be managed, this section applies the aviation-adapted hierarchy introduced in chapter 2 to the airline cases analysed in this study. By using the same six levels for comparison, the table makes it possible to identify what each airline is doing, which stages receive the greatest attention, and whether ICW or other biosecurity restrictions are explicitly recognised as a limitation affecting food waste management.

Table 3: Applied Adapted Action Framework

Airline	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	ICW / Biosecurity
Catering model	Prevention	Commercial Redirection	Donation for Human Consumption	Animal Feed / By-Product Use	Valorisation / Recovery	Disposal / Incineration	Recognition of Constraints
Emirates <i>In-house</i>	AI forecasting and analysis to improve meal planning and reduce catering waste.	<i>None identified.</i>	<i>None identified.</i>	<i>None identified.</i>	Bio-digestion using organic materials to generate reusable water.	ICW states all international waste must go to highly controlled disposal.	<i>Not clearly stated.</i>
KLM <i>In-house</i>	AI forecasting, TRAYS and MOBS system implementation, demand-based catering planning.	<i>None identified.</i>	<i>None identified.</i>	<i>None identified.</i>	Coffee ground residues converted into compost and bio-based products on eligible flights only.	Reuse and recovery not permitted on international flights.	Yes, indirectly – through non-ICW distinction.
Turkish Airlines <i>Joint Venture</i>	Opt-out meal option and resource management and planning for upstreaming.	<i>None identified.</i>	Donations of food that has not yet entered the inflight catering chain.	<i>None identified.</i>	<i>None identified.</i>	Limited reuse once food is onboarding most flights.	<i>Not explicitly stated.</i>
Qantas <i>Outsourced</i>	Data analytics and technology to analyse catering requirements and customer behaviours.	<i>None identified.</i>	Donation referred to but within broader recovery pathways; not a standalone programme.	<i>None identified.</i>	Composting more than 10 tonnes of food waste per month; waste-to-energy considered where Qantas has operational control.	ICW restrictions lead to all waste on international flights going to landfill or incineration.	Limited / Indirect.
Lufthansa <i>Outsourced</i>	Tray tracker, pre-order, reduced meal loading, data-driven catering planning.	Discounted sale of surplus food products.	<i>None identified.</i>	<i>None identified.</i>	<i>None identified.</i>	All international food waste directed to incineration or landfill.	Yes, explicitly referred to.
Finnair <i>Hybrid</i>	Pre-ordering, order-based catering, forecast optimisation.	<i>None identified.</i>	<i>None identified.</i>	<i>None identified.</i>	No current action; energy recovery under consideration as a potential future pathway.	Majority of waste classified as ICW from non-EU flights.	Explicitly referred to.
Japan Airlines (JAL) <i>In-house</i>	Meal skip option, pre-order, monthly food waste analysis, ongoing stock adjustments.	<i>None identified.</i>	Donation linked to the "Two for Table" programme originating from the meal skip option.	<i>None identified.</i>	Strong emphasis on non-food recycling streams, but no specific food waste valorisation identified.	Leftover inflight food is incinerated after every flight.	Yes, through Japanese quarantine regulations.
Iberia <i>Outsourced</i>	Pre-ordering, condiments provided on demand, limited separation of untouched items.	<i>None identified.</i>	<i>None identified.</i>	<i>None identified.</i>	No food-related valorisation; circularity efforts focused on other operational areas within the airline.	ICW regulations direct all waste to disposal.	Yes, confirmed through interview.

Source: Author's own elaboration based on airline sustainability reports and communications (2023–2025) and the food waste hierarchy framework adapted from Ley 1/2025, Ley 7/2022, Commission Delegated Decision (EU) 2019/1597, Regulation (EC) No 1069/2009, and IATA and Aviation Sustainability Forum (2024).

On first sight, the table highlights three main patterns. First, prevention is clearly the most common strategy across all airlines. Second, the middle stages of the hierarchy remain much less developed. Third, disposal remains a common outcome once food has entered the aircraft on international routes and becomes subject to ICW or similar biosecurity restrictions. These patterns are discussed in greater detail in the following sections.

7.2 Discussion by Hierarchy Levels

When the airline cases are examined through the aviation-adapted hierarchy, the clearest pattern is the strong concentration of actions at Stage 1, prevention. Across the sample, airlines report forecasting systems, AI tools, pre-ordering options, meal-skip schemes, stock adjustment, and other forms of demand-based planning. This suggests that the greatest practical scope for reducing food waste in aviation lies before food enters the aircraft.

By contrast, the middle stages of the hierarchy are far less developed. Commercial redirection and donation appear only in a limited number of cases and generally only when food has not yet entered the inflight catering chain. Animal feed or by-product use is almost absent, whilst valorisation or recovery appears only in selected cases and usually in non-ICW contexts or at earlier stages of the catering chain.

Finally, disposal or incineration remains a common outcome once food has entered the aircraft on international routes. The hierarchy therefore shows not only what airlines are doing, but also where the practical limits of circularity appear within airline catering operations.

7.3 ICW and Biosecurity Constraints

The principal finding of this study is that food waste management in aviation is shaped not only by sustainability ambition or operational ability, but also by biosecurity regulation. Across the cases analysed, International Catering Waste and similar quarantine-related restrictions appear as the main structural barrier preventing airlines from moving further down the food waste hierarchy. While prevention is possible,

opportunities for redistribution, reuse, and recovery become much more limited once catering has been loaded onto the aircraft.

The cases also show how differences in the extent to which airlines explicitly recognise this restriction. Finnair and Lufthansa refer to it clearly, identifying ICW as a barrier to more circular food waste management (Finnair, 2025b; Lufthansa Group, 2023). The relevance of these constraints also extends beyond the European Union. JAL shows that similar limitations exist outside the EU ICW framework, since Japanese quarantine rules also require strict controls over inflight food waste and restrict what can be brought into the country (Japan Airlines, 2025a; Ministry of Agriculture, Forestry and Fisheries of Japan, Plant Protection Station, n.d.).

This helps explain why the lower stages of the hierarchy remain weakly developed in aviation. While these stages may be desirable from a circular economy perspective, they are often blocked once food enters the inflight chain. The cases therefore show that ICW and related biosecurity restrictions are not a secondary issue, but a central factor shaping what is possible and what is not in airline food waste management.

7.4 Catering Structure and Organisational Control

The catering structure influences the extent to which airlines can directly monitor, manage, and redesign food waste practices. In general, airlines with in-house or hybrid catering arrangements seem to have greater visibility over the different stages of the catering process. This is visible in cases such as Emirates, Finnair, and Japan Airlines, where inhouse catering is associated with more direct reporting on food waste and a broader ability to implement preventive measures.

However, airlines operating under outsourced or joint venture arrangements appear to have less direct control over catering production and post-flight waste handling. The airline may still influence waste outcomes through service design, forecasting, pre-order, and supplier coordination, but there is no full chain management. Qantas, Turkish Airlines, and Lufthansa are examples of airlines that follow this structure.

7.5 Discussion of Catering Supplier Results

Catering suppliers reinforce the idea that food waste management in aviation cannot be understood by the simple actions of airlines. External partners play an important role in meal production, coordination, and post-flight handling, which places them in a central position within the food waste chain. The cases of DO&CO, Gate Gourmet, and dnata show that catering providers can influence waste outcomes particularly in production, where there is greater scope for process optimisation, forecasting, inventory, and management of surplus materials.

The findings also suggest that caterers do not operate independently. Their actions remain influenced by airline demand patterns, the degree of coordination with airlines, infrastructure available at airports, and regulatory restrictions. This is particularly visible in dnata, who highlight the importance of airport waste management systems and infrastructure, and in the cases of DO&CO and Gate Gourmet, where broader sustainability targets are still limited by operational and regulatory conditions.

Overall, the catering provider results suggest that food waste management in aviation is a shared issue distributed across multiple stakeholders. Catering companies may have greater operational control than airlines at certain stages of the chain, but their ability to reduce, recover, and redirect food remains shaped by the wider structure of the aviation system.

7.6 Iberia Interview Outcomes

The interview with Iberia adds a practical dimension to this study. While the airline presents itself publicly as committed to circular economy activities and broader environmental improvement, the interview helps explain why this is not matched by more visible food waste measures in onboard catering. The evidence highlights two main constraints: the outsourced catering model and the regulatory requirements surrounding ICW.

The interview confirms that Iberia's outsourced catering limits the airline's direct control over food preparation, loading, and post-flight handling. As a result, the airline's role is concentrated more in planning and service design than in direct waste management. At

the same time, the interview strongly reinforces the importance of ICW as a practical barrier for airlines, especially on international routes.

A concern that was highlighted in this study was the Spanish food waste law introduced last year. According to the interview, the law does not currently have a significant practical effect for Iberia since there are already stronger sanitary and biosecurity requirements in place. The case therefore suggests that the existence of national food waste legislation does not necessarily translate into direct operational impact in the airline sector when other regulatory frameworks are already present and take priority.

The Iberia case therefore helps explain why some airlines may report broad sustainability ambitions but relatively few visible food waste measures. Rather than indicating a lack of concern, the interview suggests that the practical scope for action is constrained by the interaction between outsourced responsibilities, sanitary requirements, biosecurity regulation, and the limited applicability of national food waste law in this context, given the international nature of airlines.

7.7 Link to the Theoretical Frameworks

The theoretical frameworks presented previously can be linked to this study. Firstly, from a circular perspective, the analysis shows that the aviation sector presents a clear tension between circular ambitions and operational reality. While some measures such as forecasting suggest attempts to move away from waste generation, the lower stages of the hierarchy remain heavily impacted once food enters the aircraft. The study therefore shows that circularity in aviation is possible mainly at the upstream stages of the process, while regulations restrict downstream options.

Secondly, the findings are consistent with the Resource-Based View theory. Greater control of catering suggests a better position to monitor waste, redesign processes, and implement preventive measures. The results also show that operational capability does not only depend on ownership, but also access to data, coordination with suppliers, and the degree of control over the different stages of the catering process.

Finally, the results also reflect the relevance of institutional theory. Food waste management in aviation is influenced by coercive pressure, particularly regulation and

biosecurity requirements, but also by normative pressures linked to sustainability reporting, industry guidance, and wider environmental expectations. In some cases, reputational and competitive dynamics also appear to encourage the adoption of similar initiatives, such as forecasting systems, pre-order, or meal-skip options. Overall, the study suggests that food waste management in aviation is not determined only by internal willingness to act, but by the interaction between organisational capabilities, institutional pressures, and the structural limits imposed by the sector's regulatory environment.

Chapter 8. Conclusions

8.1 Main Findings

This dissertation aimed to analyse food waste management in airline catering within the commercial aviation sector. In particular, it focused on how food waste is generated and managed, how different regulatory frameworks affect what airlines and catering providers can do, and how the new Spanish food waste law may apply to this sector. The study also considered the role of different catering models in the prevention, monitoring, and management of food waste. The following conclusions summarise the main findings obtained in relation to these objectives. The limitations of the study and possible future lines of research are then presented in the next section.

First, the dissertation has shown that food waste in airline catering is generated within a highly specific operational context. Unlike other food-service sectors, airline catering depends on demand forecasting, passenger numbers, route characteristics, loading decisions, strict time pressures, and the organisation of catering before and after the flight. For this reason, food waste management in aviation cannot be understood only as a general sustainability issue. It is also a logistical and operational issue, shaped by the moment at which food enters the aircraft and by the limited possibilities available once the flight has taken place.

Second, the study has shown that the regulatory framework is one of the main factors limiting food waste management in the sector. While European and Spanish policies promote prevention, measurement, redistribution, and circularity, these objectives can come into conflict with International Catering Waste regulations and other biosecurity restrictions. Once food enters the aircraft on international routes, the possibilities for reuse, donation, recycling, or recovery become extremely limited. In this sense, the main challenge in aviation is not necessarily the absence of interest in reducing food waste, but the limited practical space in which circular solutions can be implemented.

Third, across the cases analysed, prevention appears to be the most visible and widely used approach. Measures such as forecasting systems, AI tools, pre-ordering, meal-skip options, and stock adjustment are far more visible than downstream actions such as

donation or alternative uses. This suggests that the greatest practical scope for reducing food waste in aviation lies before food enters the aircraft. Once products are loaded and especially once they have travelled internationally, food waste management becomes much more constrained.

Fourth, the findings suggest that catering structure influences the degree of control airlines have over food waste management. Airlines with in-house or hybrid catering arrangements appear to have greater visibility over meal production, forecasting, and waste monitoring, while outsourced and joint-venture models tend to distribute responsibility across multiple stakeholders. However, the study also shows that food waste management in aviation is a shared issue, since catering providers play a central role in production-stage optimisation, logistics, and post-flight handling.

Finally, the Iberia case helps illustrate how these wider patterns operate in practice within an outsourced airline model. The interview suggests that Iberia's limited visibility of food waste measures is not simply the result of weak sustainability commitment, but rather the consequence of outsourced catering responsibilities and International Catering Waste-related restrictions. It also indicates that the new Spanish food waste law does not currently have a significant practical effect in the aviation context, since stronger sanitary and biosecurity requirements continue to determine what is possible in practice. Overall, the dissertation concludes that food waste management in aviation is shaped less by the absence of technical solutions than by the regulatory and operational conditions within which those solutions must function.

8.2 Limitations and Future Research

This study is subject to several limitations. First, it relies primarily on publicly available corporate information, which means that it analyses reported practices rather than independently verified food waste performance. Second, the depth and quality of reporting vary considerably between airlines and catering providers, making direct comparison difficult in some cases. Third, the interview evidence is limited to one airline case, which provides valuable insight but does not allow broad generalisation across the sector. Finally, the study does not include direct operational waste data, which restricts the possibility of measuring actual food waste performance or comparing the effectiveness of specific initiatives.

Further studies could incorporate more interviews with airlines, caterers, and airport stakeholders in order to gain a broader view of how responsibilities and constraints are distributed across the sector. Research based on direct operational data would also be valuable to compare reported initiatives with actual waste outcomes. In addition, comparative studies across different countries and regulatory contexts could help clarify whether more differentiated or risk-based approaches to ICW and similar quarantine rules might allow greater compatibility between biosecurity protection and circular economy objectives in aviation.

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Annex

BLOQUE 1 – Realidad Operativa

1. ¿Podrías explicarme brevemente cómo se reparten las responsabilidades de catering entre Iberia y DO&CO?
2. Desde tu experiencia, ¿en qué fase se genera más desperdicio: previsión, producción, servicio a bordo o post-vuelo?
3. ¿Qué tipo de productos se desperdician más frecuentemente?
4. Si no existieran las restricciones de ICW, ¿qué haríais diferente en la gestión del catering devuelto?

BLOQUE 2 – ICW (Conflicto estructural)

5. ¿Qué impacto real tiene el ICW en la gestión del desperdicio en Iberia?
6. ¿Existen diferencias claras entre vuelos intra-UE y extra-UE en términos de gestión de residuos?
7. En tu opinión profesional, ¿las reglas de ICW son proporcionales al riesgo sanitario real?
8. En la práctica, ¿dirías que ICW condiciona más la gestión del desperdicio que cualquier otra normativa ambiental?

BLOQUE 3 – Ley 1/2025 y materialidad

9. En el informe de sostenibilidad, los residuos aparecen como “no material.” ¿Podrías explicarme cómo se ha llegado a esa conclusión?
10. Aunque no sea considerado un tema material prioritario, ¿crees que el desperdicio alimentario podría ganar relevancia estratégica en el futuro?
11. ¿Crees que el propio marco regulatorio (ICW) influye en que no se perciba como una palanca estratégica clara?

BLOQUE 4 – Medición y Futuro

12. ¿Dispone Iberia de KPIs específicos para desperdicio en catering o está integrado dentro de residuos generales?
13. ¿Cómo ves la evolución de este tema en los próximos 3–5 años? ¿Qué tendría que cambiar para avanzar de forma significativa?