

Why Is Airline Food Dreadful?

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Food waste generated on flights is emerging as an issue in the aviation industry. Passengers are pivotal actors in airline food consumption and responsible for their unsustainable actions towards the in-flight catering process. This research investigated factors affecting passengers' food wasting behaviour by conducting an in-depth survey.

Design for sustainable behaviour

Food waste

In-flight catering service

Consumer behaviour

Behaviour change

1. Research Context

Food waste is a pressing issue that has gained considerable attention worldwide. The Food and Agriculture Organization of the United Nations (FAO) reported that 46 percent of the world's food losses and waste occurs at the end of the food chain (distribution, sale and final consumption) ^[1]. In addition, food that has been spoiled can be ascribed to individual consumer shopping or eating habits ^[1]. To address this issue, the Sustainable Development Goal (SDG) 12 of the 2030 Agenda for Sustainable Development addresses responsible consumption and production to ensure companies and people adopt sustainable development and lifestyles. One of the pivotal targets of SDG 12 is to substantially reduce waste generation through prevention, reduction, recycling and reuse by 2030. To achieve the overarching goal, target 12.8 ^[2] requires that *'by 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature'*, indicating the importance of individuals in food waste prevention and reduction.

Chapman ^[3] stated that *'the sustainability crisis is a behavioural issue, and not one simply of technology, production, and volume'*. He pointed out that behaviour is rated as an important driver in material consumption. Food wasting behaviour has been explored mainly in household and public contexts. The former was studied based upon behaviour patterns of specific consumer groups through observation, self-report survey and interviews to identify key determinants causing the food waste. Such studies found that intentions and habits were major factors impacting consumers' food waste ^{[4][5][6][7]}. The public context is more diverse in terms of food wasting behaviour, including but not limited to university canteens, restaurants and supermarkets ^{[8][9][10]}. It was found that situational factors were associated with consumer's food wasting behaviour, including food serving, timing, types of food and packaging. Nevertheless, studies of consumer food wasting behaviour have been context driven and only identify some of factors associated with food wasting behaviours. A research gap is to comprehensively explore the factors that affect consumer's food wasting behaviour.



(a) Before eating the airline meal;



(b) after eating the airline meal

2. Food Waste in the Aviation Industry

The aviation industry in recent years has paid increasing attention to the food waste issue, particularly in the cabin service sector of full-service airlines due to the amount of food wastage and the corresponding impact on the environment and economy. Full-service airlines refers to traditional airlines where their in-flight catering service is included in the price of the ticket. Given that the aviation industry is very strict with food safety and food quality, once loaded, the unconsumed airline meals are regarded as catering waste even if the meals remain unopened. The traditional treatments for airline waste disposal are landfill and incineration, which causes greenhouse gas emissions and contributes significantly to climate change ^[11].

The International Air Transport Association (IATA) reported that 5.7 million tonnes of onboard waste was generated in 2017 ^[12]. Based on this number, an estimation of cabin waste volumes indicates that the waste volumes are likely to double over the next ten years. At the global level, air passengers generate 0.52 kg to 1.81 kg of waste, including catering waste, depending on flight length and cabin class ^[13].

Li ^[14] conducted an in-flight service waste composition analysis, indicating that food waste was the largest category of cabin waste. In this study, food waste refers to food scraps and unopened meals. The results also indicated that economy class generated more leftover food compared to business and first class. This study addressed the fact that recycling the recyclable items from cabin waste potentially contributes to global environmental protection but no solutions for tackling food waste were identified.

As of 2014, catering waste accounted for 80.5% per flight, including sealed and loose food and beverages contributed (39.2%), unconsumed food and beverages and untouched meals (23.4%), liquid and packaging (18%) ^[13].

In recent years, initiatives have been proposed to reduce airline cabin waste to achieve zero cabin waste ^[15], as well as encouraging passengers to engage in food waste prevention. A shift from food supply chain to food

consumption has been found indispensable to achieve a sustainable aviation industry and promote responsible consumption.

The project 'LIFE zero cabin waste' ^{[16][17][18][19]} aimed to reduce the amount of airline cabin waste that ends up in landfill and prevent the generation of waste, particularly in the case of Spanish airlines. In this project, several studies had proposed solutions to tackle food waste issue mainly focusing on recycling and reusing the recyclable materials ^{[18][20]}. Solutions to reduce airline food waste were mainly proposed from the airline's perspective. However, recycling and reusing airline waste are not the most promising solutions for airline food waste. Unlike the other recyclable materials identified in this study, food waste cannot be reused or recycled. Food waste generated on international flights is subject to strict regulations in some countries (i.e., European Union, USA, Australia and Canada). The common treatments for collected cabin food waste is landfill and incineration, which is not a sustainable solution in terms of reducing airline food waste. Overall, there is still little known about the relationship between airline food wastage and passengers' behaviour, which is regarded as a critical action in generating food waste in the cabin service sector.

The overlooked issues of passengers' food wasting behaviour can be inferred by the following three reasons.

Firstly, airlines were more conscious of branding and customer than cabin waste management. In many cases, unrecyclable materials, such as food scraps, were sent to incineration or landfill as the major waste management solutions when these items could not be prevented, reused or recycled. Moreover, cabin waste cleaning and disposal usually are undertaken by cleaning and waste contractors.

Secondly, restrictive regulations discouraged airlines and other stakeholders to proactively look for solutions to prevent excessive food waste. Regulations indicate that International catering waste (ICW) should be disposed of using controlled measures, such as incinerating or deep burial in an authorised landfill ^[21]. Therefore, various food wastes from the ICW are regarded as the risky animal by products that are required to be disposed of by waste contractors. Food waste is unable to be reused and recycled once it has been produced during the airline cabin service.

Thirdly, awareness of food waste issues has not been raised among the airline food consumers—passengers. As the service receivers, passengers play an important role in the cabin service sector. Their airline food consumption behaviour potentially influences the airline food generation.

3. Design for Sustainable Behaviour as the Solution

To reduce environmental and social impacts produced by consumer behaviour, Design for Sustainable Behaviour (DfSB) has emerged in sustainable design aiming to promote behavioural change through design innovations ^[22]. DfSB centres on human behaviour in everyday life and finds solutions that reduce negative environmental and social impacts through the interaction between users and products, services and systems. Lilley and Wilson ^[23] have stressed the definition of sustainable behaviour as not only protecting the natural but also the

social environments. To tackle the issues caused by human behaviour, a key step is to find drivers that lead to the behaviour.

In recent years, psychological theories regarding behaviour change haven been applied in the field of DfSB, which supports finding and selecting the potential design solutions to alleviate the sustainability crisis [24]. Empirical studies applied those psychological models to explore the opportunities that contribute to energy-saving in household [25][26]; water-saving [27][28]; eco-commuting; [29][30] and stove-using [31]. As of 2019, DfSB has been applied into various types of behaviour and contexts, ranging from energy consumption behaviour from waste consumption behaviour [28][32][33][34][35]. The use of psychological models centres on the exploration of factors associated with the unsustainable behaviour. Focusing on either internal or external factors helps designers propose solutions for behaviour change.

Zachrisson and Boks [24] have indicated that a thorough investigation of various factors influencing behaviour can develop the useful design strategies. DfSB provides a framework to understand consumer behaviours and potential opportunities to intervene unsustainable behaviours from an environmental perspective [36]. The first step in the DfSB framework is to understand consumer behaviours in context. Lilley [37] has stressed that the context in which the consumer–products/services/systems interaction takes place is important to understand.

Klößner and Blöbaum [38] have proposed a Comprehensive Action Determination Model (CADM) as a useful tool for understanding individual's behaviour from normative, habitual, intentional and situational perspectives, which becomes the latest behavioural model applied in the sustainable field. Even though the CADM is a relatively new model in the field of behavioural research, it incorporates many key factors explored in the other classic theories, such as The Planned Behaviour theory [39]. Therefore, the CADM is believed to better explain variations in human behaviour. By addressing behavioural theories from the CADM combined with the DfSB framework, a number of principles from various factors affecting behaviour have been derived [24] (p. 50). The CADM not only helps with behavioural analysis, but also enables responsible factors and influences to be identified in the context. These findings potentially contribute to choosing appropriate strategies for designing behaviour change interventions.

Returning to consumer's food wasting behaviour, Ukar et al. [40] have underlined the significance of changing consumer behaviour to reduce the food wastage. Hebrok [41] conducted a comprehensive study of household food wasting drives and proposed different approaches to reduce household food waste through design. She also emphasized that collaboration between important stakeholders is needed when introducing behaviour change interventions.

According to IATA's suggestions to tackle food waste issues, passengers, as one of the key stakeholders in the cabin service system, should commit to reducing the environmental impact of food waste production. In recent years, airlines have neglected to deliver messages to raise passengers' awareness of food waste prevention or develop passenger-facing-waste communications [13].

There is limited research focused on interventions particularly aiming at food wasting behaviour in the aviation context. To select the effective behavioural interventions, factors associated with passenger's food wasting behaviour need to be comprehensively studied.

It was identified that food wasting behaviour was less addressed in the in-flight catering service and needed to be studied in order to prevent passengers' food wasting behaviour in the near future. The research scope focused on the in-flight catering service on full-service airlines where the food wasting behaviour happened. Consequently, the research question proposed based on the literature review is: what are the factors determining passengers' food wasting behaviour in the in-flight catering service? Therefore, this research underlined the issue mentioned above by investigating passengers' onboard behaviour through the whole in-flight catering process. The overarching aim is to understand what the key factors are and how they influence passengers' food wasting behaviour through the in-flight catering service and to understand the behaviour pattern of passengers who generated food waste, in support of the future study of behaviour change interventions. The findings helped propose possible intervention strategies to inducing sustainable behaviour in air travellers. The in-depth analysis of the mechanism of passengers' food wasting behaviour would ultimately offer a remedy to reduce food loss and food waste in the aviation industry. To address these research gaps and answer this question, this study sought to obtain data concerning passengers' food wasting behaviour in the in-flight catering service. It is time to take further step to scrutinise passenger behaviours and to understand why they wasted airline food. Passengers' behaviour should be studied in this context because their behaviours are closely associated with airline food consumption in the cabin service sector.

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