

# Food waste prevention in the hospitality sector: prospects and challenges

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## Abstract

Food wastage is an issue that affects everyone. It is of particular concern for businesses in the hospitality and food service sector, which in Greece dispose of an estimated 300,000 tonnes of wasted food every year. According to the United Nations Food and Agriculture Organization, almost one third of food, i.e. around 1.3 billion tonnes per year, produced all over the world for human consumption is spoiled or wasted. Food loss and waste cost the world about \$1 trillion a year. In addition to food waste, water, soil, and energy resources are also wasted. Food loss and waste generates 8% of global GHGs emissions and consumes 30% of all water used by agriculture, which makes this issue a priority concern for all countries.

Food waste management is an important issue for the establishments of the hospitality sector (i.e. restaurants, hotels, canteens and catering). The aim of the present paper is to summarise published international research on food waste prevention of the hospitality sector- mainly hotels and restaurants. The current status of food waste management were reviewed for best practices, prospects and challenges, with focus on the Greek hospitality sector and what strategies may be used to prevent food wastage.

## Keywords

Prevention, waste management, food consumption hotels, Food waste, hospitality sector.

## Introduction

Food waste has a detrimental impact on the environment. If disposed to landfill, decomposing food gives off methane, a greenhouse gas twenty six times more potent than carbon dioxide. If unavoidable food waste is collected separately and sent for appropriate treatment it can be turned into valuable end products such as compost, fertiliser and renewable energy, but still the environmental and financial costs of food production are considerably higher than the value of the recovered products.

Food wastage is an issue that affects everyone. It is of particular concern for businesses in the hospitality and food service sector, which in Greece dispose of an estimated 300,000 tonnes of wasted food every year [1].

The United Nations Food and Agriculture Organization, has estimated that one third of food, i.e. around 1.3 billion tonnes per year, produced all over the world for human consumption is spoiled or wasted. Food loss and waste cost the world about \$1 trillion a year [2]. In addition to food waste, water, soil, and energy resources are also wasted. Food loss and waste generates 8% of global GHGs emissions and consumes 30% of all water used by agriculture, which makes this issue a priority concern for all countries.

Although hotels do not create huge amount of wastes and consume huge amount of resources individually, collectively they cause substantial impacts on the environment [3, 4]. It has been

estimated 75% of hotels' environmental impacts are directly associated with excessive consumption [5]. This is wasteful in terms of resources and it increases operational costs unnecessarily. It is economically beneficial for hotels to pursue "green practices" in three areas, namely energy saving, water conservation, and recycling and waste management [3, 6]. Public awareness of environmental issues is growing around the world, and the environmental profile of a hotel or a restaurant forms an increasingly important part of its overall reputation.

Environmental improvement is an increasingly important factor for businesses to stay competitive and manage their supply chain risks. Increasing resource scarcity; rising raw material, transport and utility costs; and pressure from legislation, customers and society to reduce environmental damage, are combining to drive businesses to improve their performance and become more sustainable. Hotels and restaurants which incorporate environmental considerations into their business operations will benefit from better corporate image which helps distinguish them in the marketplace as forward - Looking and responsible service providers who are sensitive to environmental issues.

### Literature review

International studies and publications on food waste prevention of the hospitality sector, mainly hotels and restaurants, were analysed. The current status of food waste management in the hospitality sector was reviewed and best practices, prospects and challenges were identified, with focus on the Greek hospitality sector and what strategies may be used to prevent food wastage.

Generation of avoidable food waste means that for a percentage of their products, the hospitality and food service companies are losing not only the purchase cost of food, but are also unable to recover the add-on operational costs associated with labour, water, energy and waste disposal.

Food waste<sup>1</sup> is defined as organic waste, which has its origin in food. It can be divide between avoidable and unavoidable food waste. Avoidable food waste was edible at some point prior to disposal (e.g. slice of bread, plate residues etc.). The avoidable food waste from the hospitality sector could be further divided in waste from the kitchen (e.g. preparation of meals) and waste from the guests (plate residue). Unavoidable food waste is not-edible food waste from the preparation and consumption of food (e.g. bones, egg shells, coffee grounds etc.). The terms of avoidable food waste and edible food waste are used as synonyms [7].

### Food Waste Prevention Measures

This study reviewed the literature currently available on waste management in the hospitality sector. In general, there are not many scholarly publications on this area of research, with many references being in the form of practical reports published by different organisations. This paper focused on the hospitality sector, comprising primarily of hotels and restaurants.

The literature that can be found with respect to food waste research and prevention measures for the hospitality sector are presented in Table 1. Owing to the increasing number of reports and papers, as well as the multilingual nature of the available literature, a complete list is not feasible. The overview mentions the most important papers and studies dealing specifically with the hospitality sector, especially with recommendation of prevention measures. In addition publications and studies of special topics or including a good literature summary of a region are included.

Table 1. Overview of selected food waste studies in the hospitality sector from various regions and countries

Source	Year	Country/ Region	Content
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<sup>1</sup> There has been no commonly accepted definition of the terms "food loss" and "food waste", neither in European and national legal frameworks nor in the scientific literature. The main differences is where the border between "avoidable" and "unavoidable" food waste lays, whether non-edible parts of foodstuff belong to food waste and whether food that was originally dedicated to human consumption, but gets out of the supply chain, is considered as food waste, even if it is brought to a non-food use.

Source	Year	Country/ Region	Content
[8] El-Mobaidh <i>et al.</i>	2006	Egypt	Food waste from in-flight catering of Egypt air flights, in g/meal, in % per meal, in tn/year
[9] Kandiah <i>et al.</i>	2006	Richmond, IN, USA	Plate waste from 346 patients testing influences (diet order, sex, length of stay, diagnosis), in %
[10] Soares <i>et al.</i>	2011	Brazil	Generation and costs of food waste in cafeterias of a Brazilian company, prevention measures suggested in g/ca., kg/month, % of food purchase cost
[11] Ling <i>et al.</i>	2017	China	Characterisation of restaurant food waste
[12] Li <i>et al.</i>	2003	Asia-Pacific flights	Generation of food waste from airline catering sorted by flight, classes, distances and food type (total mass in kg, %), lost nutrient value
[13] Lily Zakiah <i>et al.</i>	2005	Malaysia	Quantity generated, product type and causes for plate waste from a Malaysian district hospital, in % of served food
[14] Engström <i>et al.</i>	2004	Sweden	Food losses from two schools plus two restaurants, in % food delivered, g/portion, monetary loss in Swedish krona
[15] Marthinsen <i>et al.</i>	2012	Denmark, Finland, Norway, Sweden	Summary of the quantities, initiatives and instruments to reduce the quantity of avoidable food waste within hospitality sector, practical guidelines highlighted, in t, kg/ca./year
[16] Kallbekken and Sælen	2013	Norway	Reducing plate size and providing social reminders, the amount of food waste in hotel restaurants was reduced by around 20%.
[17] Betza, <i>et al.</i>	2015	Switzerland	Detailed analysis of food losses (location, type, quantity and avoidance). Consideration of mass modification of food during preparation process (MFA). Novel and detailed calculation of monetary losses based on cost prices (MFA). Determination of reasons and relevance of food waste through a consumer survey. Reveal of high savings potential and development of concrete, effective measures
[18] Beretta <i>et al.</i>	2013	Switzerland	Quantifies food losses along food supply chain, hotspots, reasons, in TJ, % of total calories, t
[19] Lazel I, J.	2014	United Kingdom	Discuss organisational barriers in the lack of accountability in auditing and disposing of food waste with health and safety procedures. Recommendations for future behaviour change and food waste prevention projects.
[20] Hallorana <i>et al.</i>	2014	Denmark	Suggest sustainable solutions to the reduction of food waste in Denmark
[21] Kranert <i>et al.</i>	2012	Germany	Summary and extrapolation of international food waste data for case of Germany, reasons, prevention measures, in t, % mass
[22] Schneider F. and Lebersorger S.	2011	Austria	Discussion of methodological issues, analyses share of packaging mass included in food waste category on household level using Austrian case study, in mass-%, kg/cap year
[23] Schneider F.	2011	World	Reviews the development of human attitudes concerning food over the different ages from ancient times to World War II; describes history of food wastage and early prevention actions during crises

Source	Year	Country/ Region	Content
[24] Schneider F.	2013	USA, Austria	Summary of development for food donation activities including political, legal, social, logistical barriers and incentives; introduces concept for a food donation network; discusses impact on ecology, economy and society
[25] Von Normann	2009	Germany	Reasons for food wastage, Presents German 'Die Tafeln' organisations with respect to demand and structure, success factors and suggestions for improvement
[26] WRAP	2011	United Kingdom	Quantifies amount and composition of food waste at UK schools, reasons, prevention alternatives, toolkit development, in t, g/schoolkid per day, %
[27] WRAP [28] WRAP	2011 2013	United Kingdom	Tests method to quantify food waste from UK hospitality sector, provides estimates on amount, in t, %, GBP
[29] WRAP [30] WRAP	2012 2015	United Kingdom	Summary of the Courtauld Commitment 2 results. Introducing of measures for food waste reduction at distribution, retail and household level, in %
[31] Brochado and Freedman	2009	USA	The study has shown that portion size can be reduced by 33% before it's noticed, and that reducing portion size reduces overall plate waste.

There are significant publications that review the literature available on food waste prevention [32] or waste management practices of the hospitality sector [33, 34]. The strategies of the hospitality sector are underlined in terms of initiatives and practices, which are already being implemented around the world, to facilitate sustainable waste management.

Several international organisations, initiatives, and national legislation aiming at prevention of food wastage in the hospitality industry have been summarized in this paper. The majority of such actions is being implemented in Europe and the United States. These initiatives are mentioned along with general waste minimization strategies which have been implemented in various parts of the world.

A general waste management procedure that has demonstrated a significant potential to reduce the food waste production of a hotel or a restaurant is the mere recording of flows and waste production. An important component of any waste management strategy is to identify quantities and sources of waste. Waste mapping [35, 36] is a relatively new approach which is being used by organisations to facilitate more effective waste management and consequently food waste minimisation. It helps the establishments "understand where and how waste occurs, and how much it is really costing" them [35, 36]. With respect to the hospitality sector, waste mapping involves monitoring waste generation at a property in terms of which types of waste are generated, in what quantities, and in which locations of the property. A waste map is subsequently created to reflect this data. The establishment can subsequently plan its waste management operations in a more efficient manner.

In Europe, the efforts of the European Union has resulted in an advanced waste management policy and legislation (despite any national variations in actual implementation). The EU Waste Framework Directive (directive 2008/98/EU) provides the legislative framework for the collection, transport, recovery and disposal of waste, and includes a common definition of waste. The directive requires all member states to take the necessary measures to ensure waste is recovered or disposed of without endangering human health or causing harm to the environment and includes permitting, registration and inspection requirements. The directive also requires member states to take appropriate measures to encourage firstly, the prevention or reduction of waste production and its harmfulness and secondly the recovery of waste by means of recycling, re-use or reclamation or any other process

with a view to extracting secondary raw materials, or the use of waste as a source of energy. The directive's requirements are supplemented by other directives for specific waste streams. An important requirement of the directive is that recyclable materials should be collected separately. The separate collection of biowaste (food and "green" waste) is strongly encouraged. In addition, the older directive 1999/31/EC *on the landfill of waste*, requires EU member states to divert biodegradable waste, which are consisted predominately of food waste, from disposal to landfills.

The United Kingdom is quite ahead when it comes to waste management and a noteworthy factor contributing to this is WRAP (Waste and Resources Action Programme). WRAP's objective is the sustainable use of resources. WRAP works with businesses, individuals and communities to help them realise the benefits of reducing waste, developing sustainable products and using resources efficiently.

WRAP publishes statistics related to the hospitality sector in the UK. Its 2011 study established that in the area of on-site treatment of waste, the most common technology used by hospitality establishments in the UK was the macerator, which is an "in-sink grinder that enables food waste to be flushed away to the sewer" [27], though even this was only used by 7% of businesses. The next most common technologies were balers (4%), compactors (2%) and glass crushers (1%). All of these technologies help reduce the volume of the waste, which helps the businesses by potentially reducing the amount they need to spend on waste disposal. It also helps ensure maximum return on recyclables and raises the number of vendors willing to accept the materials [37]. The 2011 WRAP UK study also found that a number of UK businesses actually claimed having policies in place which addressed waste minimisation. These policies were most commonly in the form of an informal commitment to reducing waste (27%), followed by an environmental policy statement (25%), supplier take back programs (11%), targets for recycling (3%), and finally a waste management strategy (3%). Therefore, relatively speaking, the UK has demonstrated significant achievements insofar as the waste management of the hospitality industry is concerned. Indeed, as part of a study which screened 42 hotels in London [38] ascertained that 94% of the hotels indicated implementing some sustainable strategies. Nevertheless, the actual adoption of these strategies was noticeably lower; for example, only 67% of the respondent hotels recycled their waste [39].

The majority of the prevention measures, not applying solely to the hospitality sector, implemented by governments up to now are soft instruments like awareness campaigns, round tables and information platforms. This is, firstly, because such measures are easy to implement and, secondly, because it is obvious that the exchange of information can contribute considerably to reduce food wastage.

Awareness campaigns like the British "Love food hate waste", the French "Qui jette un œuf, jette un bœuf" and the German "Zu gut für die Tonne", to name just a few, aim to draw consumers' attention to the issue of food wastage and to increase their regard for food. They instruct consumers on the proper handling of food by providing tips on shopping, shelf life, storage, preparation, and recovery of leftovers. Awareness campaigns should be directed to different target groups, in close cooperation with retailers and the hospitality sector, using various approaches. WRAP UK estimated that avoidable food waste in British households was reduced by 18 percent within five years primarily due to public awareness campaigns [40].

Legal requirements for the prevention of risks to consumers' life and health, which are related to various EU regulations, may conflict with the ambition to avoid food waste. Strict norms for the tolerable contamination of food, Maximum Residual Levels for pesticides and veterinarian medicines as well as hygienic rules concerning the packaging and storage of easily perishing goods are seen as significant drivers promoting the discarding of edible food [41, 42]. Thus, the current regime of food safety regulations should be reviewed in order to identify provisions that are not mandatory to protect human life, but lead to unnecessary food waste. Further research is required to decide where limits may be revised without decreasing food safety. The current system of food labelling is

regarded as another legal barrier to a responsible handling of food. Consumer surveys in various Member States revealed that there is considerable confusion about expiry dates and the differences between “best before” and “use by” dates. Thus, the revision of existing regulations on food labelling should be considered in order to improve the definiteness and visual presentation of expiry dates. In addition, European legislation should set new “best before dates” according to the true *shelf life* of products. The initiative of the Netherlands and Sweden [43] to abolish the expiration dates for stable food is a first step in this direction.

Effective environmental management in the hospitality industry is not easily achieved. The hospitality industry does not cause wide-scale environmental pollution such as harming the ozone layer or significantly contaminating natural resources. It also does not consume vast amounts of non-renewable resources and, in that respect, it is not ordinarily in the front line of environmental concern as are other industries such as manufacturing. Nevertheless, it has the potential for considerably reducing environmental pollution and unnecessary consumption. Although it is possible for hotels to provide more environmentally friendly services, they may fear that doing so runs the risk of losing customers due to a perceived degradation of service. In this regard, it is quite a challenge for hotel managers to come up with plans that successfully integrate environmental practices without compromising service. Clearly, it is almost impossible for hotels alone to implement such measures without cooperation from customers. In this regard, hotels should encourage environmentally responsible behaviours among its customers and help them believe that the collective efforts in which they are participating are good for everybody. Further research that identifies the balance between consumer expectations and green practices could prove highly beneficial.

## **Conclusions**

The literature on food waste prevention for the hospitality sector is limited when it comes to hospitals and even more for in-flight catering, schools, the military, prisons, catering at events, and many assumptions have to be made when estimating waste from different types of restaurants. Although during recent years some findings have been published concerning retail food waste, facts about wholesale are not common. There is also scarce information about the redistribution sector – that is, the distribution of donated surplus food to people in need. Although a considerable number of publications are dealing with food waste of the hospitality sector, some issues still remained basically unexplored. One example is the proportion of different disposal paths for food waste, since some of them are very difficult to determine objectively. In the meantime, there are also some life-cycle assessment studies of different food commodities which include the additional burdens of food waste. Research publications introducing evaluation methodology or presenting reliable results of evaluating implemented food waste prevention measures are limited.

Generally, the scientific literature and reports studying food waste generation and prevention practices in the hospitality sector is still very limited and specifically for non-existent for Greece. More studies, in different geographic regions and on different hospitality types, need to be carried out for the investigation of food waste production and good practices to move food waste management up in the waste management hierarchy.

Hotels that perceive higher economic benefits are likely to adopt an innovation. Potential benefits that could be derived include savings in operational costs, reduced waste and pollution and enhance reputation [44, 45]. Consequently, it is predictable that perceived characteristics of innovation positively affect the adoption of green practices for hotels in Greece. This can be measure as social or economic benefits.

The instruments for sustainable waste management exist and have implemented in various degrees in the hospitality sector worldwide. The challenge for the Greek hospitality sector is to creatively adopt them and become increasingly effective, maximising the value of the resources used. This requires changing the way it thinks about products, the way it manages finite resources and the way

it assesses and considers waste. This study, hopefully, makes a contribution towards a more sustainable approach to the food waste issue in the “heavy industry” of Greece, hospitality sector.

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