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Exploring Food Waste Management Practices: Insights from a Coastal Hotel in Sri Lanka

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Abstract

Background: Food waste is immense, accounting for over one-third of worldwide food production for human consumption, totalling 1.3 billion tons annually. Additionally, Sri Lanka's estimated daily food waste is 4000 tons, with the hotel and hospitality sector responsible for a notable percentage. Therefore, it is essential to understand how this amount of waste is generated and what strategies are being employed to manage it.

Objective: The research intends to identify the causes of food waste and understand the main waste generation points and food waste mitigation techniques employed within the hotel.

Methodology: This exploratory study employs a qualitative approach to examine food waste management practices at a coastal hotel in Sri Lanka's western province. Researchers used purposive sampling, semi-structured interviews with four key informants, and participant and non-participant observations. Thematic analysis was used to analyse the data.

Results: The findings demonstrate that the hotel implements various food waste management techniques, including operational, quality, and standards elements. These techniques vary from internal initiatives to external measures.

Conclusion: Effective practices can reduce the waste generated throughout the hotel's food supply chain. This will ultimately result in better economic, environmental, and societal outcomes.

Unique Contribution: This research provides useful insights and lays the groundwork for future research by addressing this timely issue prevailing within both the local and global hotel industry. These findings can be applied to other settings, such as households, retail, and emerging hotels and resorts.

Keywords: Food Waste, Waste Management, Sustainability, Waste Hierarchy Model, Hospitality, Hotel industry

Introduction

Food waste is a significant sustainability challenge, costing about $2.6 trillion annually, with environmental and social costs estimated at $700–900 billion (FAO, 2014). This issue worsens environmental degradation, releasing greenhouse gases like carbon dioxide (CO_2) and methane (CH_4), further exacerbating global warming. The issue is driven by population growth, demand for convenience, overproduction, and the decreasing cost of food. Most retailers and consumers often discard leftovers for convenience. In business, it is often more cost-effective to dispose of excess food than to manage it responsibly (Srijuntrapun et al., 2022). Approximately one-third of the food produced for human consumption, around 1.3 billion metric tons annually, is lost or wasted globally (Cederberg & Sonesson, 2011). This food waste coincides with rising global hunger, with 720 and 811 million undernourished people reported in 2020 (FAO, 2021). To address this issue, the United Nations' Agenda 2030 highlights two key Sustainable Development Goals (SDG): SDG #12 (Responsible Consumption and Production) and SDG #2 (Zero Hunger), both aimed at reducing food waste and promoting global food security.

Food waste is a significant sustainability concern in the tourism and hospitality sector, particularly impacting SDG #12 in developed nations and SDG #2 in developing countries (Srijuntrapun et al., 2022). Hotels and restaurants, as major players in the global food supply chain, contribute notably to food procurement and waste. According to the International Hotel Environmental Initiative (2002), hotels generate between 0.8 and 1.2 kg of waste per guest daily, doubling on checkout days. Therefore, hotels must reconsider their approach to food waste to address this pressing issue, enhance their public image and elevate the industry's sustainability standards.

In Sri Lanka, the issue of food waste management remains critical, exacerbated by inefficient waste management practices. This was tragically highlighted by the 2017 collapse of the "Meethotamulla" garbage dump in Colombo, which brought national attention to the country's waste management challenges and spurred collaboration between the government and local authorities to initiate public awareness campaigns. According to recent research, 65% to 66% of Sri Lanka's solid waste comprises perishable organic material, amounting to approximately 3,963 tons of food waste generated daily (FAO, 2023). This alarming situation underscores the urgent need for effective waste management solutions across all sectors, from households to large-scale businesses like hotels, as explored in this study.

This study is based on the belief that effective food waste management extends beyond environmental sustainability, it encompasses economic and social sustainability as well. By thoroughly examining the food waste management practices of selected hotels, the researchers aim to provide valuable insights that foster awareness and establish a foundation for future

research. This study aims to mitigate food waste issues locally and globally across all sectors, particularly within the tourism and hospitality industry. The intended objectives of this study are the following:

1. To identify the causes of food waste in hotels in Sri Lanka.
2. To understand the main waste generation points in hotels in Sri Lanka.
3. To determine food waste mitigation techniques employed in hotels in Sri Lanka.

This study offers a unique contribution by exploring food waste management practices in a coastal hotel in Sri Lanka, utilising data triangulation for a more comprehensive understanding of the research objectives. As Heesen et al. (2019) highlighted, combining multiple data collection methods strengthens conclusions more effectively than relying on a single method. To support the study's findings, we employed both participatory and non-participatory observations throughout the hotel's food supply chain. Four semi-structured interviews with field experts were conducted to provide a holistic perspective. The study's significance lies in its context-specific insights into food waste mitigation techniques applicable to households, retail, and emerging hospitality sectors.

Literature Review

Food Waste

The combined effects of this waste on the environment and economy would rank it as the third-largest greenhouse gas emitter in the world (Bhatia et al., 2023). The food services industry is largely responsible for this waste, which is mostly produced in developed nations during the consumption phase (Dhir et al., 2020). Nonetheless, research indicates that roughly 75% of this waste can be avoided, highlighting the possibility of significant financial savings and environmental advantages.

The Sri Lankan context provides a case study of the prevalence of food waste in the country. A striking 50% to 76% of its total municipal waste is solid waste, which is composed of food waste of 4000 tons per day, posing a significant challenge for waste management and the pursuit of sustainability (FAO, 2021).

A popular concept in food waste management is source reduction, which refers to making informed decisions about food at every stage of preparation and consumption. The United Nations has set a goal called Sustainable Development Goal 12, aiming to cut in half the amount of wasted food per person globally by 2030 (Garcia-Garcia et al., 2017). Redistributing surplus food is another vital concept that addresses hunger by diverting edible excess food from various sources to areas where there is a food shortage in communities (Patel et al., 2021).

Waste Hierarchy Model (WHM)

The waste hierarchy model, as stated by Cristóbal et al. (2018) prioritizes waste management strategies according to their capacity to divert landfill waste alongside reducing the adverse environmental impacts. WHM is employed as a method for prevention focusing on the impact on the environment rather than the minimization of food waste generation.

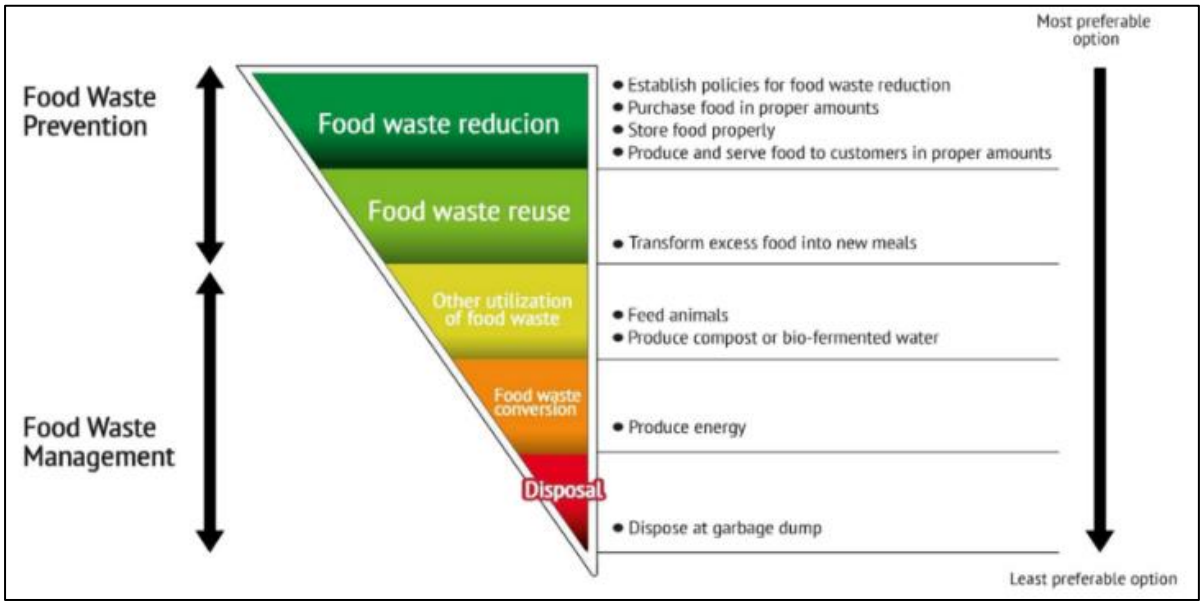

Figure 1 : Food Waste Hierarchy Model
Source: (Srijuntrapun et al., 2022)

Srijuntrapun et al. (2022) mentioned that WHM (Figure 1), reducing the food waste from the source is recommended while landfill disposal is identified as the least favourable option. The findings show that the WHM is an effective approach to minimising food waste in operational integrated hotels, highlighting waste reduction at all levels of food distribution.

Kattiyapornpong et al. (2023), explored sustainable food waste management methods within five-star hotels, especially in developing countries incorporating the Food Waste Hierarchy (FWH), in promoting the UN SDGs. In contrast, Parsa et al. (2023) argue that traditional FWH tries to oversimplify the dynamics of urban food waste, reducing the accuracy and adaptability to ensure effective environmental policies. Thereby, it concludes by suggesting an improved hierarchy.

More recently, Chawla et al. (2024) examined how luxury hotels understand and apply the FWH principles to their waste management processes to evaluate its impact. The study findings highlighted potential conflicts across levels of the FWH, implying the lack of proper understanding within hospitality workers. Therefore, the study suggests that the waste hierarchy principles are beneficial, but there are constraints to applying them due to staff perceptions and operational complexity.

Food Waste Management in Hospitality

The hospitality industry significantly contributes to food waste in the national food supply chain, yet there is comparatively little focus on waste generated in the pre-consumer stages. While food waste management is increasingly examined in grocery stores and agriculture, the hotel industry has received limited attention (Griffin et al., 2009). This food waste negatively affects long-term global socioeconomic and environmental sustainability (Garrone et al., 2014). Consumers create most food waste in the supply chain, so researchers focus a lot on managing this waste (Graham-Rowe et al., 2014). Hotels and restaurants can greatly encourage customers to be more responsible with food waste (Filimonau & De Coteau, 2019).

During the procurement stage, hoteliers return damaged goods to suppliers to maintain the quality of the raw materials (Kasavan et al., 2019). As noted by several authors, motivating food and beverage employees is crucial for proper food storage, including labelling items with

expiration dates and storage guidelines (Okumus, 2020). Additionally, controlling menu options and offering dishes that meet the expectations of both local and international guests can help reduce food waste. Designing economically sustainable menu cycles, such as using the same ingredients in multiple recipes, is essential for implementing effective food waste reduction strategies (Okumus et al., 2020).

A study in a Malta-based five-star hotel found that plate waste averaged 0.21kg and 0.16 kg per person at lunch and dinner, respectively. Furthermore, it will rise to 0.48 kg per person at a buffet supper (Camilleri-Fenech et al., 2020). Apart from that, to preserve food for a longer period without compromising its quality, any excess food ingredients will be frozen by hoteliers in Veszprem for later use. It implies methodical internal management to reduce food waste and hotel operating expenses and protect the environment (Filimonau & Sulyok, 2021).

Methodology

Research Design

This study used an exploratory research approach to explore the current food waste management practices implemented within the selected hotel. Firsthand experience on the field was required to capture the true picture of the ground-level operations. Therefore, the authors engaged in two data collection methods, mainly semi-structured interviews and observations.

Sampling and Data collection

This study used purposive sampling to select participants with relevant characteristics or experiences. Semi-structured interviews were conducted with four key informants selected from the member-checking criteria as follows.

1. Level of engagement in terms of mitigating food waste
2. Level of administrative authorisation in terms of mitigating food waste
3. Level of guest interactions at the buffet area
4. Level of authorisation in the waste disposal process

These criteria were established from a pilot study conducted at another hotel in Sri Lanka in January 2024. In February 2024, semi-structured interviews were conducted with the selected informants. The interview questions were developed using existing literature and insights from the pilot study. In summary, four key informants were selected to represent the entire hotel's food supply chain. Table 1 shows the demographic details and selection criteria.

Table 1 : Respondent Profile

Respondent	Main area of work	Experience	Criteria
Sous Chef	Food preparation	15	1
Compliance Executive	Ensuring overall health, hygiene and safety	2	2
F&B Executive	Preparing buffet arrangements	4	3
Stewarding Supervisor	Ensuring proper waste disposal	12	4

Additionally, the observation method was employed, utilising both participative and non-participative approaches to capture a holistic view of food waste management in the hotel. This study's target population includes key stakeholders directly involved in food waste management in the hotel industry.

Data Analysis

Thematic analysis was utilised to analyse the gathered data. Braun and Clarke (2006) state that thematic analysis involves six phases, each yielding a different outcome. It is not linear; we have moved back and forth between phases as needed, making it a recursive process.

Results And Discussion

The hotel discussed in this study is a five-star establishment situated on 11.7 acres, with 199 rooms and a staff of 384.

Objective 01: To identify the causes of food waste in hotels in Sri Lanka.

Our research identified several key causes for food waste, including guest behaviour, overproduction, operational inefficiencies, and storage issues. A major contributor is guest behaviour, particularly in buffet settings, where cultural and consumption patterns significantly influence waste. Reitemeier et al. (2021), also emphasised that raising guest awareness about food waste reduction remains a challenge for hotels, as it may affect guest satisfaction, which is beyond the hotel's direct control.

Overproduction, driven by the need to maintain high standards and specific buffet presentations, such as offering four appetizers, nine main dishes and seven Sri Lankan dishes, regardless of guest numbers or preferences. This often leads to spoilage. Operational inefficiencies, such as procurement and kitchen processes during busy shifts, contribute to waste, often due to inadequate training in food waste management. Additionally, storage issues, including supplier malpractices, improper temperature control, and poor rotation of short shelf-life items, exacerbate food waste in inventory management.

Objective 02: To understand the main waste generation points in hotels in Sri Lanka.

The process begins with procurement, where food purchases are coordinated based on each property's needs, generating no waste due to efficient practices. Minimal waste may occur during transport due to logistical challenges, but the hotel is not accountable for supplier malpractices. In the storage unit, meticulous procedures minimise waste, though overstocking and expiration can occasionally occur. Overall, food waste at this stage remains minimal.

If you ask me the points where waste is generated it's the main restaurant, A la carte restaurant, staff cafeteria, drivers' meal room, and kitchen preparation - **Compliance Executive.**

Food waste is generated across various kitchen sections, including the hot, cold, pastry, and staff kitchens. Extra peeling due to discolouration and trimming of pre-peeled onions contribute to waste. Peels and skins from fruits like pineapples and papayas are discarded to avoid contamination. Pastry production generates significant waste due to the limited shelf life of dough off-cuts. Interestingly, the cold kitchen, where salads, cold appetisers, dressings, and plated desserts are prepared, produces the least food waste.

Usually, there is nothing that gets wasted from the cold kitchen after breakfast, after lunch there is a very small quantity - **Stewarding Supervisor.**

While the hotel chain effectively regulates food waste up to this point, waste generated during consumption remains largely uncontrollable. A key area of concern is the buffet, where a wide variety of food options is presented, regardless of guest consumption. Despite efforts to predict demand and forecast food preparation needs, accurately estimating consumption levels remain challenging, leading to unavoidable waste.

When we take the buffet, irrespective of whether the guest consumes the food or not, we have to arrange it - **F & B Executive.**

As a result, whatever is left on the guests' plates ends up as waste. Furthermore, some buffet products, such as salads, cannot be repurposed and must be destroyed because they can only be fresh for three to four hours and might not be ideal for consumption after that. In addition to the buffet area, the staff cafeteria and driver meal room are the other identified food waste generation points across the hotel chain.

Objective 03: To determine food waste mitigation techniques employed in hotels in Sri Lanka.

Five key themes were identified under objective three based on the data gathered through the interviews and observations.

Operational Strategies

The hotel adopts a batch cooking strategy to reduce waste and optimise resources by preparing staples like rice in small quantities, preventing overproduction and minimising spoilage. Buffet portion estimations are used to further limit waste, though predicting exact consumption is challenging. The kitchen staff prepares a standard amount of food per item based on the number of guests, helping to control waste at buffets.

The First-in-First-out (FIFO) inventory control method helps minimise food waste by using older inventory before newer stock, preventing spoilage. Additionally, portion control techniques, such as serving food in shooters and ramekins, help limit serving sizes and reduce excess food waste. A study by Reynolds et al. (2019) found that changing plate sizes and portions can reduce food waste by 57%. Observations indicate that guests often take only one portion when food is served in ramekins, making this an effective strategy for waste reduction.

The hotel has also introduced action stations for salads and meats, allowing guests to customise their meals. This ensures food is prepared only upon request, reducing surplus. Additionally, timely food refill management is employed, where kitchen staff monitor food consumption and restock only as needed during service hours. This approach prevents overproduction, minimises food spoilage, and helps maintain optimal stock levels while ensuring guests are adequately served.

Food Waste Prevention

The hotel's internal strategies for preventing food waste include using whiteboards in the kitchen to track guest counts and demographics for the three main meals. This helps adjust food preparation and menu options to avoid excess production and plate waste. The interview findings detailed below further validated these practices.

A Chef is usually armed with this knowledge and experience, and he is able to ascertain how much to cater for the different clientele - **F & B Executive.**

According to Amicarelli et al. (2022), key challenges in reducing food waste include uncertainty in guest profiles and inadequate forecasting. To address this, chefs rely on their expertise to understand guest preferences based on demographics and make informed menu planning and portion control decisions. The hotel also prioritises employee training, equipping staff with skills in purchasing order control to prevent waste. Regular training sessions are held to raise awareness about food waste reduction, waste segregation, and proper storage practices. To prevent food surplus, the hotel ensures buffet quantities match expected demand, reducing

excess waste. Goods are carefully inspected for quality, with only premium materials accepted, and orders are placed timely to minimise excess inventory and wastage.

The 3Rs approach

The 3R (Reduce, Reuse, and Recycle) waste management strategy has been successful in many countries (Mohammed et al., 2021). Ioannidis et al. (2021) found that employing 3R techniques can improve corporate performance, measured by operational profits and the ratio of a physical asset's market value to its replacement cost. To reduce food waste, the hotel allows executive-level employees to access buffets after guests, minimising waste. The hotel also targets staff cafeteria waste by implementing a weekly "no-bin day", encouraging complete consumption of available food. They reduce plate waste by using small bowls in buffet areas and adjusting the menu based on short-expiry products. Strict procurement standards further help minimise food waste from the start. To extend the shelf life of unused milk, the hotel stores it in airtight containers, reducing the need for disposal and enabling reuse. Leftover bones are reused for flavouring before being sent to piggeries, demonstrating internal food reuse. Non-edible waste, such as oil, is refined and reused according to quality standards. However, some reuse strategies are limited by strict hotel hygienic policies, which prevent the reuse of cooked food (Sandaruwani & Gnanapala, 2016). While the hotel currently lacks recycling strategies, they are exploring sustainable solutions. Though reduction, recycling, and reuse are common in hospitality, research suggests there is room for innovation in redesigning and rethinking strategies (Rodríguez-Antón & Alonso-Almeida, 2019).

Waste Segregation

Waste segregation is fundamental to food waste management (Kattiyapornpong et al., 2023). This hotel segregates waste into four types: dry garbage, wet garbage, tins and cans, and glass bottles. A standardised approach with colour-coded bins (green for wet garbage and grey for dry garbage) is employed throughout the kitchen, especially when cutting food. This systematic method streamlines operations and reduces confusion among kitchen staff.

Figure 2 : Misclassification of wet garbage

Figure 2 shows that plastic and polythene materials were placed in the wet garbage bins despite the colour-coded bins intended to facilitate the segregation process. However, instances of misclassification by kitchen staff underscore the need for increased awareness regarding waste segregation practices.

In the garbage room, waste undergoes secondary sorting before wet garbage is dispatched to piggeries. However, the garbage room is only limited to wet and dry garbage, and tins, cans, and glass bottles are excluded.

This wet garbage is sent to piggeries. They also segregate the wet garbage before collecting - **Stewarding Supervisor.**

The hotel follows hygienic waste segregation procedures, with the garbage room cleaned twice daily. Despite these measures, continuous improvement remains a focus for the hotel, particularly in the segregation of edible and non-edible waste.

Waste Disposal

The hotel employs various waste management strategies to ensure environmental sustainability and social well-being. Instead of internal composting, the hotel pays pig farmers to collect and transport waste to their piggeries. Salemdeeb et al. (2017) found that wet pig feed has the most beneficial environmental and health impacts.

We don't use the waste to make compost internally. We try to dispose of our waste in a manner which does not harm the environment, so the best practice we can implement is to hand over the waste to the piggery - **Compliance Executive.**

The management of non-edible food waste presents certain challenges that require proper disposal procedures. Non-edible items, such as bones from the buffet, are segregated from the food waste and disposed of separately.

If we take the buffet, if there is a bone, that is non-edible, so that needs to be thrown away - **Compliance Executive.**

Additionally, the disposal of used cooking oil is done systematically by having specific collection days and precise measurements.

There is a day to dispose of cooking oil. On the 5th we have disposed of 36 Liters of cooking oil. The collection is for a month - **Stewarding Supervisor.**

Conclusion

This research explores the food waste management practices of a hotel chain in the coastal area of Western Province, Sri Lanka, a key tourist destination in South Asia. The hospitality industry is crucial in promoting sustainability, but food waste management remains a significant challenge. This study explores how a typical Sri Lankan hotel handles food waste. Findings reveal that food waste originates from kitchens, buffets, and restaurants. Despite efforts like portion control and employee training, waste continues to be an issue due to guest preferences and food contamination.

Operational strategies like batch cooking and FIFO inventory control help reduce waste. The hotel applies the 3Rs method, including composting and sending waste to pig farms, alongside strict segregation practices. The hotel can enhance its waste management using the waste hierarchy model by analysing current practices. Continuous staff training and awareness are key to achieving successful waste reduction. This study offers valuable insights for hotel practitioners to act sustainably, cutting costs and enhancing brand image through SDG-aligned practices. It emphasises the importance of preventing and reducing food waste, from receiving goods to guest consumption and addressing gaps in food waste management within the hospitality sector.

While this study offers valuable insights into current food waste management practices, it also highlights several limitations. First, its scope is restricted to a single coastal hotel in Sri Lanka, overlooking the geographical diversity. Second, it focuses solely on food waste, excluding other types of solid waste. The findings cannot be generalised to other hotels. While the hotel generates various types of waste, this study specifically focuses on food waste, so it does not provide insights into the total solid waste produced by this hotel. Future research should expand to other industries generating food waste in developing countries to address research gaps in these contexts.

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