Topic:

Negatives Outcome of Food Waste in Restaurants in the UK

Abstract

Food waste has evolved as a recurring issue across the wide world that raises critical concerns about the environment. Nearly, 1.3 billion food is wasted on a global level each year which has raised alarming concerns on this problem. Despite the significance of this problem, there had been limited attention given to this topic in the research field. This particular research has undertaken a comprehensive and systematic assessment of the negative outcomes of food waste in restaurants and approaches to effective food waste management employed by restaurant owners/managers. While other parts of the food system have received significant attention, however the research focus on the consumption of food and waste treatment in the restaurant settings is lacking. Hence, the objective of this research study narrows down the knowledge gap on urban food strategies and food waste management particularly focusing on the UK. On critical review of the literature, it has been observed that prevention of food waste is the most preferred option, while recycling of wastes through anaerobic digestion and composting comes next, followed by the recovery phase of energy from the food wastes through the process of incineration and disposal is the final and least preferred option. The methodology followed in this research emphasized on a mixed method (i.e. both qualitative and quantitative) approach by conducting a close-ended Survey with the 50 customers of the London Stock and Kitchen Table restaurants of the UK. Conversely, qualitative findings are derived by conducting semi-structured interviews with 2 restaurant managers in the UK. The findings and results generated from this study are useful for raising awareness and improving waste management practices within the hospitality sector. The study finally concludes by linking the findings with the objectives in order to derive the success level of this research, followed by a set of recommendations and highlighting the scope for the final research.

Table of Contents

Keywords:

Food waste in restaurants, Food waste and the Environment, Food waste behaviour, Food Waste Hierarchy, Waste Management in the Food sector, Types of Food waste in Restaurants

Chapter 1. Introduction

1.1 Introduction

Globally, approximately one-third of the food is produced for human consumption ends up in landfills as waste (Karki, Bennett and Mishra, 2021). The increasing rate of food waste has raised significant concerns about the challenges of food security, environmental degradation, climatic changes, loss in biodiversity, air and water pollution, overharvesting, etc (de Visser-Amundson, 2022). Food waste is a global concern; particularly the rate of food waste generation in the hospitality sector has amplified unprecedentedly. Reports from Filimonau and Delysia (2019), have confirmed that food wastes generated in restaurants are inevitable. In the UK, approximately 42% of the food waste is generated at consumption which implies that the consumers are responsible for wasting large amount of edible food that resulted in the collection of 89 million tons of food waste each year (Filimonau and Sulyok, 2021). The food wastes generated in the restaurants generally have two phases i.e. food wasted at the time of preparation and food wasted at the time of consumption. In restaurants in the UK, approximately 34% of waste is generated from plate leftovers or uneaten food by the customers. According to de Visser-Amundson (2022), proper disposal of food waste through donation, composting, and recycling, can result in the reduction of food waste in landfills, which in turn can minimize the emission of carbon dioxide that is produced into the atmosphere. The implementation of a "weight-based system" could minimize the amount of food waste. In the "weight-based system", the food waste is weighed, while the restaurants are charged on the amount of waste produced (Filimonau et al 2020). This is an effective approach to motivate restaurants in reducing the production of food waste that could help in the easy and effective management of food disposal. Referring to the "waste management hierarchy" in the literature, the highest priority has been

given to waste prevention followed by the stages of reusing, recycling and recovery in the form of energy, and finally moving to waste disposal as the least preferable option. In The UK, the waste hierarchy is legally binding depending on the type of waste generation and its effect on society, environmental and financial aspects.

1.2 Research Problem

The agenda of appropriate food waste management is predominant in the rising concern of food waste in restaurants. Currently, the issue of food waste is under-researched. The recent surge in food waste has led to an increase in food insecurity and unpredictable effects on climatic conditions are a major cause of the global food system. However, it has been observed that the restaurants have no systematic interventions or suitable measures employed to reduce food waste. The restaurant managers have a low level of awareness of how critical food waste is and the severity of its impact (Giordano et al 2020). The causes of food waste generation in the plate leftovers of the customers are crucial to determine the percentage of food wasted each day and what measures can be employed to reduce it. The reports by Garske et al (2020) have shown the food wastes generated from the plate leftovers are disposed of in landfills, however, no strategic action plans have been devised to change this behaviour. Inappropriate disposal of food waste is another major concern that has resulted in environmental damage and significant climatic changes (Huang, Liu and Hsu, 2020). In addition, the restaurant employees are an essential factor in the effective management of food waste; however, the hotel managers/owners have lack of knowledge and low motivation to employ strategic measures to educate the employees, train them to improve their menu offerings and serve portions and improve their internal communications in effect to improve the food waste management.

1.3 Research Rationale

In response to the concerns highlighted which are significantly associated with the surge in food waste in the hospitality sector, this particular research will focus on assessing the major causes of food waste in urban restaurants. Moreover, the food system has gradually become a crucial part of the systematic and legitimate planning that must be employed by restaurants globally. Focusing on the part of the UK, this study has explored the key areas of concern and challenges in the effective management of food waste generated from restaurants. While the widespread research on food waste is still in its infancy, the data on the quantities of food waste generated and prevention measures and costs associated with it is uncertain and lacking. Hence, this particular research has focused on identifying the major causes of food waste and the amount of food waste generated or disposed of in landfills in an attempt to alleviate the food security problem.

1.4 Research Purpose

This research has highlighted the possibilities of minimizing food waste by drawing attention to the plate leftovers in restaurants in the UK. Hence, significant attention has been given to the consumers/ customers visiting the restaurants and strategic approaches to change their wasteful behaviour. In this study, the "waste management hierarchy" has been a major focus to evaluate the various phases of waste treatment in a hierarchical order. Furthermore, the benefits of various waste management approaches are thoroughly assessed along with the identification of several existing alternatives to handle the wastes effectively. This research objectively emphasizes on raising awareness and improving the waste management practices in restaurants which will help in creating new urban food strategies in the hospitality sector. On the basis of specific objectives established in this research study, this research has set specific research approaches to study food

waste management comprehensively, while highlighting adequate levels of possibilities for the restaurant owners/managers to strategically devise their food waste management planning.

1.5 Research Aim

The aim of this research is to raise awareness and improve food management practices within the hospitality sector to reduce food waste and establish sustainable systems within the hotel/restaurant businesses.

1.6 Research Objectives

- To observe the major causes of food wastes generation in restaurants of the UK
- To review the current procedures of food waste management and its effectiveness
- To research on new methods and approaches to overcome this crisis and ensure effective food waste management

1.7 Research Questions

- What practices can restaurants put in place to reduce or eliminate their food waste?
- What are the challenges in effective food waste management faced by restaurants?
- What are the effective food waste management approaches or measures that must be employed by the restaurants?

1.8 Research structure

This research is segregated into short divisions so that the topic and its associated perspectives are observed and assessed in a systematic manner. Hence, this dissertation is sub-divided into five main chapters and their respective content are discussed herein -

Chapter One: Introduction

This chapter of dissertation presents the theme of research with a precise description of the research aim, objectives and research questions. The introduction chapter highlights the research problem and illustrates the rationale for conducting this research. The topic is described briefly and it forms the foundation of devising the research objectives and questions. Moreover, the first chapter is useful for creating a mindmap and serves as the directional guideline of execution.

Chapter Two: Literature Review

This chapter emphasizes on secondary research through the assessment of existing literature sources on the chosen topic and problem statement as highlighted in the first chapter. This section of the dissertation critically evaluates the theories, concepts and facts in an attempt to evaluate the topic in a standardized pattern. Moreover, this chapter provides an overview of the existing knowledge and creates a foundation that serves to guide the primary research and evidence collection in order to meet the research objectives.

Chapter Three: Methodology

This chapter of the dissertation apparently describes how the research was conducted. The methodical approaches, selection of the correct research tools and accurate analytical approach are the main content of this section. Moreover, this information enables the readers to check if the tools and methods chosen for this study are dependable and accurate. An effectively strong methodology helps to improve the accuracy of findings and results.

Chapter Four: Data Analysis and Discussion

This chapter is one of the essential sections of the dissertation that typically presents the data findings, interpretations and critical discussion. The findings and results are derived by following

a specific analytical approach (i.e. thematic analysis and statistical analysis) to examine the research questions and reach the final conclusion.

Chapter Five: Conclusion, Recommendations and Scope of Future Research

The final chapter concludes the overall assessment based on the findings and resulting outcomes derived in the previous chapter. The conclusive parts will determine the success level of this research study by linking the results with the objectives. On identifying the key limitations of this research, a set of action recommendations are proposed to improve the areas of challenges along with the strategic direction provided on the scope of future research.

Chapter 2. Literature Review

2.1 The Alarming Food Waste Problem in the UK

The increasing food wastes have a significant impact on the people, planet and profits, which in turn raises alarming concerns about sustainability across the globe. Minimizing the alarming rate of food waste is crucial for reducing the environmental footprint and managing the rising population in a sustainable manner (Papargyropoulou et al 2019). Restaurants generate the highest percentage of food waste in the public sector, thus indicating significant room for improvement in this sector (Hennchen, 2019). Environmental beliefs and consumer attitude is considered the potential predator of food waste behaviours. Most of the consumers prefer eating out at restaurants, however not all of them clear their plates as a result of which much of the edible food gets wasted. The edible food undergoes a long transition from earth to the table through varying processing stages that involve farming, factories, transportation, retailing and cooking (Pirani and Arafat, 2016). In each of these stages, there are significant environmental impacts that make use of large amounts of resources such as oil, water, fuel, etc. In addition, Tong et al (2018) have asserted that food wastes generated high greenhouse effects and carbon dioxide emissions that have a major adverse impact on the environment. With the ever-growing global population, the demand for food and resources will be increasing exponentially. Hence, as the sustainable agenda is high in society, it is crucial to have a robust approach towards sustainable food waste management. Due to the rising concerns of food waste, the "EAT Foundation" implements the action taken by the service sector to implement sustainable changes in the mechanism of food consumption. With the aim of reducing the food waste, "EAT

Foundation" focuses on changing consumer behaviour by raising awareness on the negative impact of increasing food waste on the society, environment and climatic conditions.

2.2 Research Gap

Changing consumer behaviour is considered a promising way of minimising food waste. Research studies on food waste and consumer behaviour have primarily focussed on the food waste generated by households, however much recently the food service sector has received little attention. Conversely, most of the research studies focussed on the food service sectors have concentrated on the total amount of food wasted and food management techniques in restaurants; however, no attention is catered for consumer behaviour. Garcia-Garcia, Woolley and Rahimifard (2015) have pointed out that the key reasons of food waste in restaurants does not occur from food preparation; rather food waste is primarily generated from the food served to the consumers on the table. Moreover, 34% of the overall food prepared in restaurants is wasted by the consumers, and food waste in restaurants constitutes the highest waste generated in comparison to other public dinings such as workplaces, schools, canteens and day-care (Papargyropoulou et al 2019). Hence, there is a significant research gap on the food waste behaviour by consumers in restaurants.

2.3 Food Waste in the Hospitality and food sector

The food waste generated from the hospitality sector encompasses food preparation wastes, spoilage and plate waste during consumption. According to Xue et al (2017), approximately 30% of the total food waste generated from the hospitality sector is mainly the leftovers from customers' plates. It has been estimated that 1 in every 6 meals served in restaurants in the UK is wasted. A substantial proportion of the large size food portions have resulted in the food leftover

waste on the consumer's plates (de Visser-Amundson, 2022). The hospitality sector can take adequate measures in reducing the portion size at a slightly reduced price. The "Good to Go" initiative undertaken in Scotland has encouraged restaurants to offer take-home services for the plate leftovers. As a critic, Li, Mirosa and Bremer (2020) suggest that such initiatives would not be suitable for all business models. However, the food waste issues associated with the portion size will deliver dual outcomes for both the "improvement of environment and people's health outcomes". Improving awareness of the portion size of food will increase the competitive pricing of pack sizes to address the rising food waste and reduce the rate of obesity (Filimonau and Delysia, 2019). Hence, the government must work in collaboration with the hospitality and food sectors to assess the ways of preventing plate waste.

2.4 Theoretical framework

There has not been any specific definition of food waste, however, Betz et al (2015) defined food leftovers as the “edible food that diners have ordered but not consumed” whereas, Hennchen (2019) opined the occurrence of food loss when the food is edible, yet unconsumed. Focusing on the food consumption behaviour of the consumers, norms and attitudes, a combination of these factors helps in determining the driving aspects of food waste in the restaurant's settings. The reduction of food associates helps in determining the pro-environmental behaviour, hence the theory of planned is assessed here to make predictions on both consumer behaviour and pro-environmental behaviour at large.

2.4.1 Theory of Planned Behaviour and Perceived behaviour Control (PBC)

The theory of planned behaviour (TPB) is popularly used for evaluating consumer behaviour on food waste. The theory of TPB emphasizes the consumer belief, attitudes and intentions to

understand their pro-environmental behaviour such as minimising food waste, understanding the consequences of food waste on environmental degradation, and moral norms of food consumption (Ajzen, 2011). This draws attention to the perceived behaviour control (PBC) that encompasses the potential barriers (i.e. both external and personal barriers), perceived difficulty and ease of engaging in certain behaviour. For example, the consumers may have limited PBC within a restaurant setting and tend to have negligible control over the restaurant management. However, consumers can have control over their own plate waste behaviour (Sommer, 2011). On the contrary, situational factors can have a significant impact on consumers' behaviour towards food waste. For example, situational factors that include smell, desire, sight, and appetite for food have a major influence on the consumer waste consumption of food. In criticism, Sniehotta, Presseau and Araújo-Soares (2014) opine that tastes and hunger are the two dominant factors of plate waste behaviour. Another major factor that has a significant influence on food waste behaviour is income and the cost of food items. According to Filimonau, Krivcova and Pettit, (2019), low-cost items such as starch is more likely to be left on the plates than high-cost items such as proteins. In addition, the high income of consumers leads to an increased rate of eating in restaurants and more diverse food consumption leads to higher food waste.

Self-reported food waste behaviour – encompasses the avoidable leftover waste of food plates at restaurants. It mainly includes five key items i.e. protein (fish, meat), vegetables (fruits, sauces), and starches (pasta, rice, potatoes), which are wasted maximum in the restaurants (La Barbera, Riverso and Verneau, 2016). This part of the framework also suggests that consumers are more likely to have left food on their plates at a buffet table.

Intention to avoid food waste – This indicates the consumer attitude towards food waste which is measured through the four main items discussed above that correlate to the situational factors

containing five key items of hunger, appearance of food, taste, avoidance of food coma and stress.

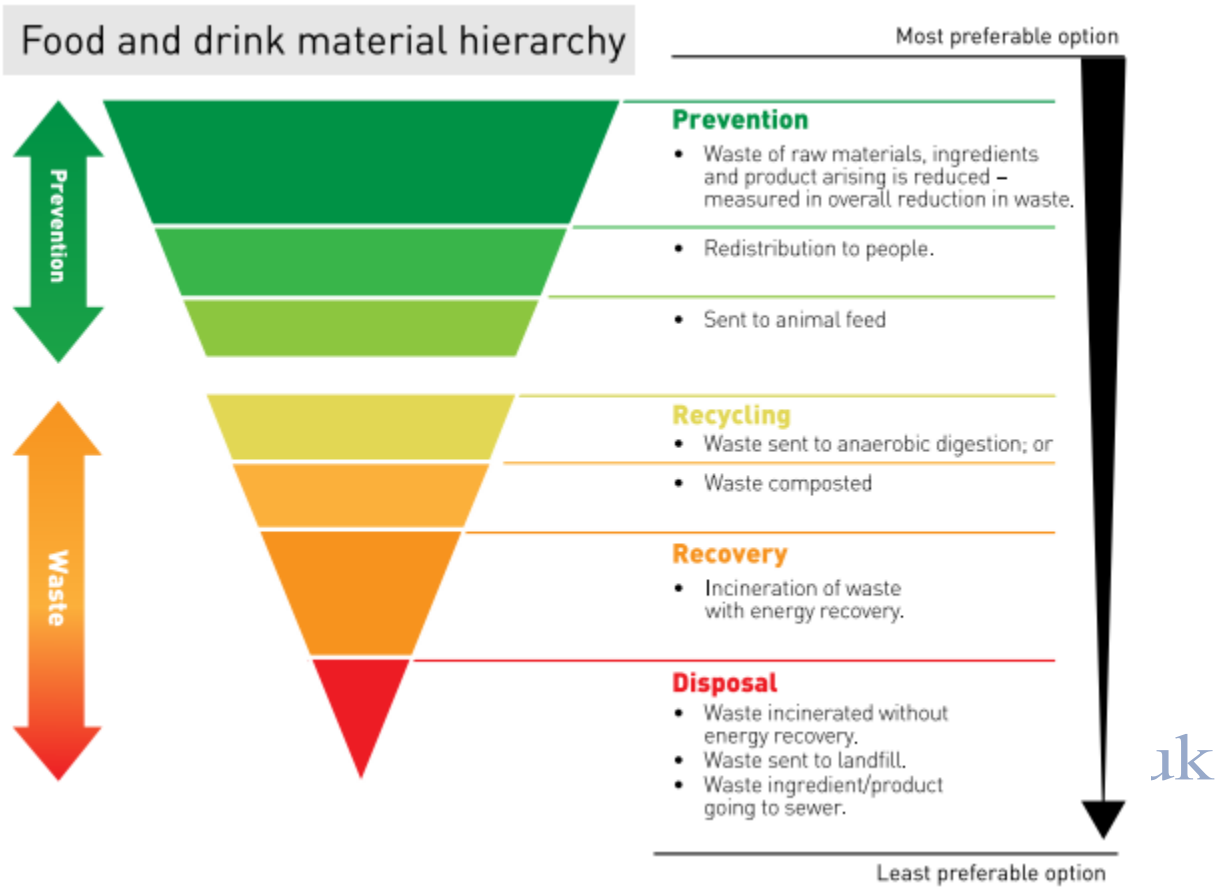
Criticism on TPB

According to the critics, the Theory of planned behaviour has certain limitations underlying the assumptions which say TPB are the way people act rationally, hence the emotional aspects of the food waste behaviour are not considered in this case. According to Ghani et al (2013), the TBP can predict food waste behaviour accurately but only when the conditions of the intention-behaviour relationship are stable. In addition, the subjective norms associated with food waste tend to have a weak component which is inadequate.

2.5 The UK and Food Waste Hierarchy

The European Union has enforced the legal policies and critical frameworks for food waste management in the UK that sets out five major steps in dealing with the waste and ranked with respect to its environmental impact (Giordano et al 2020). This framework is referred as Waste Hierarchy which is used in the food and drink sector.

Figure (1): Food Waste Hierarchy



(Ref: Papargyropoulou et al 2014)

Prevention - The food waste hierarchy depicted in Figure (1), indicates the effective management and prevention of food by preventing the ingredients and raw materials from becoming waste in the first place. The surplus food generation must be prevented throughout the food production system across the supply chain and consumption.

Reusing – The surplus food can be reused for human consumption by the under-privileged or poor people, or it can be reused as animal and bird feed, donated through the redistribution networks, charities and food banks(Papargyropoulou et al 2014).

Recycling - Food waste can be best treated by recycling it through anaerobic digestion or composition and animal feed.

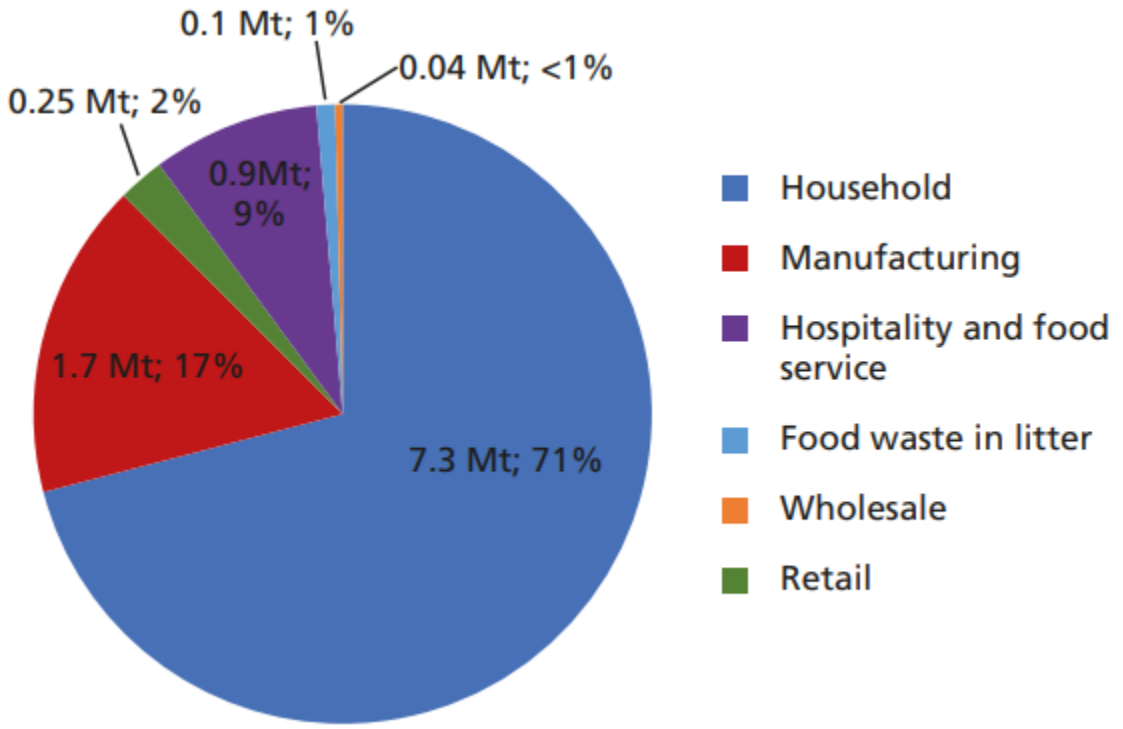
Recovery - Recovery of food wastes could be attained by the incineration of the wastes through the process of energy recovery via anaerobic digestion.

Disposal – The disposal of surplus food or food wastes can be engineered to the landfill along with the landfill gas utilisation systems in place (Teigiserova, Hamelin and Thomsen, 2020). This could be treated as the last option available.

The most desirable phase in the hierarchy appears to be the prevention that ensures edible food does not become waste. The Government emphasizes on voluntary initiatives for food waste management instead of imposing regulatory approaches to ensure the reduction in food waste (Filimonau and Sulyok, 2021). The voluntary initiatives for food waste management in the UK

are primarily driven by the WRAP with funding supported through Defra (Thyberg and Tonjes, 2016). The estimation made by WRAP on the rate of food waste from different sources is that household food makes up 71% of food waste, manufacturing contributes to 17% of the food waste, food services and hospitality serves 9% and retail only 2% to the food waste (Papargyropoulou et al 2014).

Figure (2): Food wastes arising from different sources in the UK



(Ref: Papargyropoulou et al 2014)

2.6 Waste Management in the Hospitality and Food Sector

The literature on food waste management across the hospitality and food sector is significantly limited. Also, the researches focussing on the reasons for food waste in restaurants are particularly scarce. The sources of food waste generated from the restaurants are subdivided on the basis of preparation wastes and leftover waste on the customer's plates (Truong et al 2019). The food waste generated during the preparation is mainly due to the peeling, cutting, spoilage, overproduction or overcooking which are relatively less in comparison to the customer plate leftovers. Moreover, Thi, Kumar and Lin (2015) suggested that several other reasons that have a significant contribution to food waste generation in the restaurants or hospitality sector are mainly the poor rotation of stocks, poor food quality, lack of techniques for portion control,

variation in the menu, inaccurate consumer demand forecast, large portion sizes, and frequency of ingredient delivery to the restaurants.

2.7 Types of Food Waste in Restaurants

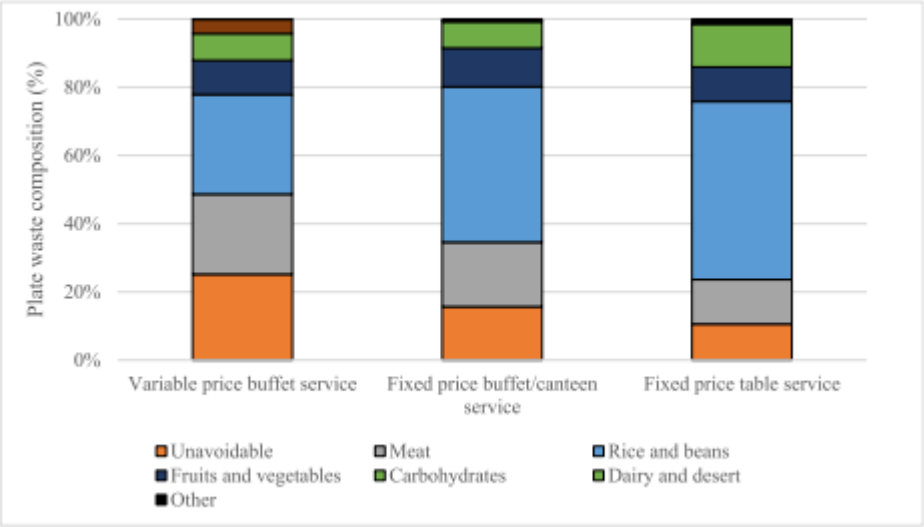
The food waste created by restaurants is alarmingly high in the UK, while each year, the costs of food waste incurred by restaurants are £682 million whereas overall restaurants produce approximately 915,400 tonnes of waste that constitutes 199,100 tonnes of food waste. The restaurants incur nearly, £1 loss on each meal served to the consumers which can have a major impact on the total profits (Filimonau et al 2020). For example, in a pub restaurant, the average expense made on a three-course pub meal is £14.48. From this amount, six percent is instantly stripped off from the total amount due to the unavoidable food waste alongside the utilities, maintenance and wages.

The first step towards the development of a workplace technique of minimising waste is about knowing the customers. Reports by Filimonau, Nghiem and Wang (2021) stated that more than one-quarter of the diners (i.e. nearly 28%) have leftover foods on their plates while they dine out. This implies that plate wastes are common for them, whereas three-fifths informed that they are not concerned with food waste leftovers. Approximately, 41 percent of the consumers have informed food leftovers are common for them due to the large portions of food served in restaurants (Huang, Liu and Hsu, 2020). The other key factors that have a potential influence on the food waste in restaurants are the number of courses ordered e.g. diners are found to leave more of their main if they have ordered starters and desserts with it. The diners suggest food waste also depends on the partner we dine with e.g. diners are found to eat more if they are comfortable with their company.

2.7.1 Carbon footprint

From the lifecycle assessment of a food plate, the estimated carbon footprint for the "variable size buffet service is 128 CO_2, for the “Fixed price buffet service” is 222 CO_2 and for the fixed price table services, the carbon footprint is estimated at 324 CO_2 respectively (Matzembacher et al 2020).

Figure (3): The composition of food wastes in %



(Ref: Matzembacher et al 2020)

From Figure (3) above, it can be estimated that the meat category food is the hotspot across all the restaurant's settings and it represents around 48%, 57% and 39% of the total carbon footprint generated in the fixed price buffet/canteen services, variable price buffet service and fixed price table services respectively (Matzembacher et al 2020).

The second category of food waste that contributes to the highest carbon footprint is beans and rice that accounts for 27%, 16% and 33% of the total carbon footprint of the variable price buffet

service, fixed price buffet/canteen services, and fixed price table services respectively (Matzembacher et al 2020).

2.8 Prevention measures of food waste in the restaurants

The eco-friendly approaches undertaken by the food industry have a noteworthy contribution to food waste management with potential recycling rates (Christ and Burritt, 2017). Approximately, 51 percent of all restaurant food wastes are recycled whereas 65 percent of the packaging and related wastes can also be recycled. Among the various other strategies, food waste in restaurants can be minimized by increasing the awareness of staff, menu engineering, tracking of daily consumer demands and food wastes, activity and consumption-based costing, reducing the plate size, fines levied on customers for food wastage, donation of the food leftovers, alternatives of bio-treatments such as composting and anaerobic digestion, expire date, effective storage practices FIFO approach applied to the inventory, avoiding over-trimming during the preparation and reducing the portions of starters.

The legislative policies and protocols play a major role in the reinforcement of successful and sustainable management of food waste (Teigiserova, Hamelin and Thomsen, 2020). The laws and regulations to be followed in the hospitality sectors and restaurants include stringent reporting on food waste, standardized food waste calculations, expiration date labels on foods, and conducting a waste audit.

The system of incentivizing food businesses or restaurants to compost food waste instead of disposing of it in landfills is a significant approach that could be taken by the government to minimize food waste (Garcia-Garcia, Woolley and Rahimifard, 2015). In addition, proactively

asking the customers in the restaurants to take away the leftover foods in the "doggy bags" could be the next common approach towards preventing the food waste.

As consumers are often found to be casual about the plate leftovers, hence minimizing the leftover food becomes a major responsibility of the restaurant owners. The following strategies could be devised to minimise food waste.

- ***Flexible menu*** – offering a combination of menus that comprises the signature dishes liked by the guests could be a better way to bring down the waste levels.
- ***Offering takeaways*** – The restaurant staff must be trained to offer takeaways who have an excess amount of food left on their plates.
- Creating meals to satisfy varying levels of hunger i.e. small meal or snack items, breakfast or dinner essentials can provide customized choices to the customers. In addition, the inclusion of lighter options on the menu will help in the automatic reduction of food waste and plate leftovers.

Food waste donations to charities is another prominent approach towards the effective management of food waste, however, Matzembacher et al (2020) argued the potential liability and uncertainties associated with this process have restricted them from donating the excess food. According to the study by Matzembacher et al (2020), 79% of restaurants do not have collaboration with NGOs and charities to make donations of the excess food. This is mainly because the stringent time frame stated by the charity organizations for the food pickups has been a major constraint for the restaurants, as the food leftovers in restaurants mainly occur during the evening. Consequently, not many volunteers are willing to pick up food during that time.

2.9 Legislative Implications

The redistribution/donation of surplus food is essential to reduce food wastes management; however, the implication of WRAP sets out a target for the retailers (food businesses and restaurants) to double the proportion of surplus food redistribution to voluntary organizations, charities and NGOs (de Visser-Amundson, 2022). This approach also specifies a timescale over which the redistribution of surplus food should be completed. The Government takes proactive steps to incentives for the companies to support their efforts in redistributing the surplus food and better communicate the current tax breaks.

For example, owing to these incentives offered by the government, a large number of food businesses dispose of even the edible surplus food via AD or convert it into animal feed because the costs are less than keeping it in the fit state for consumption. This is because, it may incur additional costs in the context of segregation, handling and storage, and sharing to the charities.

Hence, the FareShare as a renowned national network of charitable food redistributors in the UK that is made of 18 independent organizations suggests that the Government must provide adequate incentives to assist the redistribution (Garske et al 2020). This could be administered by an authorized organization in the food industry, such as WRAP or The Food and Drink Federation. Hence, on the basis of charity redistribution presently, an estimated investment of £1 million a year is required to cover the excess costs involved in maintaining food safety and transportation to the charities which can also rise upto £10 million a year if the food redistribution goals reach upto 100,000 tonnes a year.

2.10 Food waste collections

According to the estimation made, approximately 3,415,000 tonnes of food waste are disposed of in the food and drink sector each year. If this quantity of food waste is collected and moved to anaerobic digestion (AD), it can abate around 3.86 million tonnes of Carbon dioxide each year (Eriksson, Strid and Hansson, 2015). The provisions of food waste collection are variable for the different companies. For instance, 19 councils across England provide dedicated commercial food waste collections, whereas industrial food waste is mainly processed by private organizations (Karki, Bennett and Mishra, 2021). In addition, waste management contractors also offer commercial food waste collections. Focusing on the waste management strategy of "Towards zero waste", it sets out a coordinated approach to improve the food waste management across the supply chain in the food and drink sector (Filimonau et al 2023). The separation of food waste from mixed waste is a crucial approach to diverting food waste from its disposal. This is because the separate food waste collections from the food businesses tend to offer the opportunity for diverting the waste right from the bottom part of the waste hierarchy.

2.11 Integrated Sustainable Waste Management (ISWM)

According to Moustakas et al (2020), integrated waste management is defined as the purposeful management of all the waste flows from the municipality, having the goal of protecting the environment and human health. The wastes generated in the preparation and consumption of meals in restaurants mainly consist of inorganic and organic solid wastes. The ISWM system considers various types of waste generated during the restaurant activities (Mak et al 2020). In other words, the most effective methods for minimizing the environmental impact of restaurant waste can be achieved by the implementation of an integrated waste management system across all the stages of meal preparation and consumption in restaurants (Kibler et al 2018). However,

the failure to accurately conduct waste management operations leads to the excessive level of waste generation that reaches to a critical point. Hence, these critical points of waste generation must be addressed by the implication of corrective measures to minimize waste generation in restaurants.

Table (1): Critical points and corrective measures

Operational phases	Corrective actions
Planning menu	▪ The planned menus must include varieties of organic, fresh, seasonal, agroecological, and locally grown foods ▪ Implementing efficient cooking methods to reduce the food waste generation ▪ Estimate the acceptance of new dishes by analyzing the sales data and plate leftovers (Moustakas et al 2020).
Food purchase	▪ fresh and seasonal food items are ordered from the suppliers ▪ Suppliers must deliver food items with secondary packaging and delivery must be done in reusable boxes.
Receipt	▪ Organizing a specific area for the temporary storage of solid food wastes ▪ The inorganic food wastes must be discarded in the external or internal trash bins before disposal (Wang et al 2013)
Food storage	▪ Chilled, packed dry and frozen food products must be stored in the reusable or stainless steel containers

	▪ Foods must not be stored in the secondary packaging ▪ Specific areas must be arranged for the temporary storage of food waste (Zanella, 2020).

The corrective actions depicted in the above table (1), have specifically formulated waste management across the steps involved in meal preparation in restaurants which is mainly based on avoiding, reuse, reduce, recycle and disposition underlying waste management (Martin-Rios et al 2018). These action plans are proposed with the goal to minimize the volume of food waste disposed to landfills as a strategy towards reducing the environmental impact of meal preparation.

On analysing the waste management across the restaurants, the below flowchart has been developed to depict the seven key steps of food waste management in the restaurants that comprise of significant protocols as shown below –

STEP 1: Gravimetric analysis of food waste generated in the restaurants
STEP 2: Survey of the local associations and agencies that collects, sort out, measure and treat the restaurant wastes
STEP 3: Survey done on the restaurant infrastructure, and staff, analysing the equipment, used for the food preparation and food waste management
STEP 4: Observation of the waste flow across the operational areas during the meal preparation and meal consumption

STEP 5: Monitoring or auditing the food wastes generated during throughout the meal preparation and meal consumption in order to determine the critical points
STEP 6: development of the corrective measures for effective management of food waste and reducing the waste generation at each stage
STEP 7: Formulating recommendations for the consumers to minimize food waste during their meal

No restaurants can determine and exactly identify the critical points of food waste without following a systematic approach as discussed above. The baseline audit in the restaurants must focus on the following critical points –

- Highlight the largest sources of food waste generation internally in the restaurants
- Underscoring the areas where the staff can effectively reduce food waste by working as a team in collaboration with the consumers (restaurant guests)
- Revealing the scope and size of the "invisible problems of food waste" to make them more visible and manageable
- Indicate that reducing food waste can inevitably save a lot of money.

2.12 Adoption of technology in Restaurants – Food waste management systems

The emergence of advanced technologies can create an effective technological solution to minimize food waste in restaurants. For example, the world's leading hotel companies, InterContinental hotels group (IHG) have plans to reduce restaurant food waste by more than

30% using Artificial Intelligence (AI) technology (Wen et al 2018). This leading hotel chain has partnered with a renowned tech firm "Winnow" to facilitate the automatic measurement, tracking and minimizing the food waste in the restaurants and ensures highly standardized operations and efficient food waste management to improve sustainability (Sucheran and Olanrewaju, 2021). This advanced technology has been installed successfully across the seven big hotels of IHG globally, and future installations across the 30 new hotels of this group will happen soon. Winnow was established in London in 2013 as the solution provider for the reduction of food waste across restaurants. The operational model of Winnow was set on specific scales to reduce food wastage. They install a touchscreen system in which the kitchen staff informs the system of the amount of food disposed off. This digital scale is connected through a Tablet Bluetooth, which is further coupled to the cloud server. Once the waste is disposed of into the trash bin, the scale identifies the change in weight and relays this information to the cloud analytics of Winnow that estimates the accurate value of food waste and create daily reports highlighting the practices and measures undertaken by the restaurants that helps in saving both the food and money (Sucheran and Olanrewaju, 2021). The automation technology is further set to enhance food waste management i.e. the integration of a computer vision camera inbuilt with a motion sensor is useful as it automatically takes snaps of food images when it is disposed of, and identifies the waste item and amount of waste disposed.

The Unilever brand has created Wise up on Wastes which is based on the concept of data collection pertaining to the wastage of food, while the data findings and results lead them to devise a strong action plan for preventing food waste (Sucheran and Olanrewaju, 2021). The wise-up on the waste mostly includes reviews on the food delivery wastes and stock management to ensure the effective storage plan of the food in restaurants.

Tenzo is a popular software that is used in restaurants to help the prediction of regular food consumption and wastage accurately by using the AI sales forecasting algorithm. This forecasting makes use of growth trends and past data in restaurants that help in reducing food waste dramatically.

Chapter 3. Methodology

3.1 Introduction

The methodology is the systematic approach to conducting the research by the implication of appropriate tools and techniques in a sequential manner which will help in deriving the findings and results more accurately (Palinkas et al 2011). In reference to the chosen topic of "Negative outcome of Food waste in Restaurants in the UK", a standardized approach to secondary and primary data collection has been implemented to ensure a comprehensive evaluation and detailed analysis of the overall study.

3.2 Secondary Research

The secondary data is pertinent in this study which will be collected from the existing sources of literature (Johnston, 2017). The secondary data is effective for the purpose of developing a strong base of knowledge on the given topic and serve as the guidance to derive the primary data and empirical evidence (Johnston, 2017). Hence, the secondary research is conducted to critically review the existing theories and concepts based on the following keywords - *Food waste in restaurants, Food waste and the Environment, Food waste behaviour, Food Waste Hierarchy, Waste Management in the Food sector, and Types of Food waste in Restaurants.*

In precise, the sources of literature are obtained from academic articles, peer-reviewed journals, University web libraries, industry reports, company statistics, online sources, etc. Moreover, the secondary data is collected for the chosen topic is collected from credible publications and reliable databases which are mainly Scopus, ERIC, ScienceDirect, IEEE, JSTOR and Economist Intelligence Unit.

3.3 Primary Research

The primary data refers to the first-hand data collected from the human participants (research subjects) in an attempt to derive the potential knowledge about the facts and reality from the experiences and understanding of the research subjects. The primary research is undertaken through direct communication with the research subjects instead of relying on pre-existing data. The primary data in this study is collected by the integration of both the qualitative and quantitative techniques of data collection by involving the hotel owners and consumers who are selected as the research subjects for this chosen topic.

3.4 Research Philosophy

The research philosophy is significantly associated with the knowledge, assumptions and significant nature of the study. The two main philosophies applied in a research study are positivism and interpretivism philosophy that has their own specific ways to deal with a research problem under investigation (Saunders, Lewis and Adrian Thornhill, 2019). The positivism philosophy holds the belief that all genuine knowledge is either positive or true which is mainly derived from the logical reasoning from the sensory experience (Alharahsheh and Pius, 2020). With respect to the chosen topic "Negative outcome of Food waste in Restaurants in the UK", the qualitative and quantitative data collection is useful to comprehend the evidence and facts based on the experiences of reality which are shaped by the social constructs, perspectives and motivation of the research subjects involved in the primary data collection. Hence, interpretive philosophy is useful for deriving the facts through the comprehensive exploration of the objective reality that delves in-depth into the root cause of this problem by the correlation of both the primary and secondary information.

3.5 Research Approach

The two major approaches applied to a research study involve the inductive and deductive approach that has diverse forms of implications for a research problem. Deductive reasoning is the top-down approach that aims to test the existing theories and shift the focus from more generalized ideas to a specific conclusion (Armat et al 2018). Alternatively, inductive reasoning refers to the bottom-up approach that implies to the development of emerging theories while shifting the focus from specific observations to a broader generalization. Referring to the research problem, this study employs the combination of both primary and secondary data; hence deductive reasoning is suitably applicable to this particular study (Almalki, 2016). Furthermore, the deductive approach is useful for the critical assessment of the existing theories and the choice of concepts related to the topic of the Negative outcome of Food waste in Restaurants in the UK by the construction of a hypothesis which is further synthesized through the primary responses.

3.6 Research Design

The three main research designs that can be applied to academic research studies are exploratory, descriptive and explanatory. The descriptive design is useful to demonstrate the topic through the descriptive assessment of the research problem. The explanatory research study critically assesses the "why" and "how" questions to identify the root cause of the problem statement (Cole and Trinh, 2017). This particular research study seeks to comprehend the phenomenal instances by identifying the major events of the research problem through the integration of exploratory research design.

3.7 Data collection: Mixed method technique

The primary data collection is mainly obtained through the i.e. qualitative data (open-ended) and quantitative data (close-ended). Qualitative data collection is useful for recording the narrative and descriptive responses from a small sample (Schoonenboom and Johnson, 2017). Alternatively, quantitative tools are useful for deriving numerical data and statistics in the form of primary responses from a relatively large sample size (Palinkas et al 2015). In this particular research study, a mixed method technique of data collection is applied that implies both qualitative and quantitative data collection. The qualitative technique of data collection aims at deriving the subjective opinion of the sample (restaurant managers) based on their social perspectives, motivations and experiences which are essential for meeting the research objectives. On the other hand, the quantitative data collection is obtained through the survey questionnaire which is useful for underpinning the numerical data in order to quantify and calculate the responses obtained from consumers/customers of the restaurants in the UK. The survey questionnaire contains specific sets of questions to evaluate the responses in an objective manner.

3.8 Data collection tools: Survey questionnaire and semi-structured interviews

3.8.1 For qualitative data

The qualitative data is collected by employing the proficient tool of semi-structured interviews that primarily contains open-ended questions which are framed on the basis of the research problem and research objectives (Tran, 2019). During the session of semi-structured interviews, the research subjects/sample chosen for this study are allowed to present their ideas and viewpoints in a descriptive format (McGrath, Palmgren and Liljedahl, 2019). Also, the

researcher has the freedom to ask probing questions to the participants to derive insights and facts associated with the topic. The semi-structured interviews are feasible for this research study owing to their time efficiency and cost-effectiveness which helps in standardizing the results.

3.8.2 For quantitative data

The survey questionnaire is the primary tool used for the collection of quantitative data following a series of close-ended questions with a set of objective responses which are answered online by the sample (research subjects) (Haardörfer, 2019). The survey questionnaire is sent through the respective email ids of the individual participants who are requested to fill in the survey at their convenience within the given deadline. The survey questionnaire contains close-ended questions that allow collecting the statistical information from a large sample in order to assess the multiple responses seamlessly in the shortest span of time.

3.9 Sample Size and sampling strategy

The sample selected for qualitative semi-structured interviews is 2 restaurant managers from the UK, London, one from the London stock and another sample from the Kitchen Table. The sampling strategy for the selection of interview samples is a generic purposive sampling that enables the researcher to make selection of those participants who are primarily linked to the research objectives and questions directly, however, the final selection is made by the researcher without following any inclusion criteria for selection (Emmel, 2013). Alternatively, the sample size for the survey questionnaire involves 50 customers of the London Stock and Kitchen Table restaurants in London by using the sampling strategy of simple random probability that does not employ any specific criteria of selection. In this process, the researcher selects a subset of participants from a large population that provides equal opportunity for selection to each of the

participants. Consequently, approximately 80 members were approached, out of which only 50 participants have willfully participated in the survey.

3.10 Data Analysis

Thematic analysis – Thematic analysis is applicable to synthesize the interview responses followed by a systematic approach to underpin the factual themes (Neuendorf, 2018). The themes are established based on the recurring data patterns which are highlighted from the descriptive interview responses. The themes are cross-synthesized in respect to the literature findings for deriving the accurate results to the possible extent (Lawrence and Tar, 2013). The findings obtained from the thematic analysis are interpreted critically to derive the results and reach a conclusion that can successfully meet the research objectives.

Statistical analysis – this analytical approach applies the cross-tabulation synthesis of responses and data findings based on the visual and statistical bar graphs. The statistical analysis is scalable and measurable in nature which helps in deriving meaningful insights with more accurate results.

3.11 Ethical considerations

The researcher must follow a standard code of conduct in compliance with the ethical code of conduct outlined by the University. The researcher must ensure the chosen sample (i.e. restaurant managers and customers of the restaurants) must participate in the study willfully without any external compulsion. The participants are also given the liberty to quit from the interview/survey at any time. On the contrary, the researcher presents the aim, objectives, purpose, problem statement, duration of the interviews, survey procedures and other necessary details in the consent form and sends it through their email to obtain their informed consent before the commencement of research (Perera and Emmerich, 2018). The identity of the participants is

concealed to ensure their anonymous responses and protect them from any kind of threats. Also, the researcher has completed the ethical checklist presented by the University in order to get approval for initiating the data collection process.

3.12 Research Limitations

There are a few limitations faced while conducting this study which is described in detail below -

Time constraints – Owing to the cross-sectional nature of this academic research, hence the researcher is unable to delve in deep in several aspects of the topic due to the limited time period.

Reliability issues – The participants (i.e. the restaurant managers) are more likely to provide biased responses for their companies which can have a major influence on the research findings (Ploug and Holm, 2015). Also, the survey respondents (customers of restaurants) may not provide accurate and 100% honest answers to the questionnaire. Hence, reliability issues are pertinent in this study.

Chapter 4. Analysis and Discussion of Findings

4.1 Qualitative Data Analysis: Semi-structured interviews with 2 restaurant managers in the UK, London

Theme 1: Effective planning of Food waste management at the regional and national level

The prevention of food waste in restaurants could be made possible only if the restaurant owners, governments and social organizations join hands in collaboration to mitigate the issue. With the increasing trend of dine-out and the resulting amplification of restaurant food waste, the change in consumer behaviour is paramount along with the development of robust waste management and recycling strategies across the food chain and not just on the plate leftovers. The respondents asserted that the restaurants can create sustainable meal plans or urge the clients to order food as much as they can finish up the plate. In addition, the leftover foods in the restaurants can be packed in "doggy bags" as a takeaway in order to avoid the food being wasted and making its way to the trash bin.

Theme 2: Food waste mitigation strategies integrated by the Restaurants

The respondents emphasize on the implementation of sustainable development goals that aim at minimizing the per capita food waste at the global level to half by 2050. On the contrary, the respondents have also highlighted the key ways to reduce food waste in restaurants on the part of hotel managers and hotel owners by careful monitoring of the expiry dates, ensuring the usage of leftover peels as bird and animal feed, donation of the surplus food to the charity and NGOs, efficient menu planning, composting, portion planning, re-using the edible leftovers for the preparation of other dishes, and cost adjustment. The food waste can therefore be effectively

managed by taking into account the food waste both at the food service level and food consumption level.

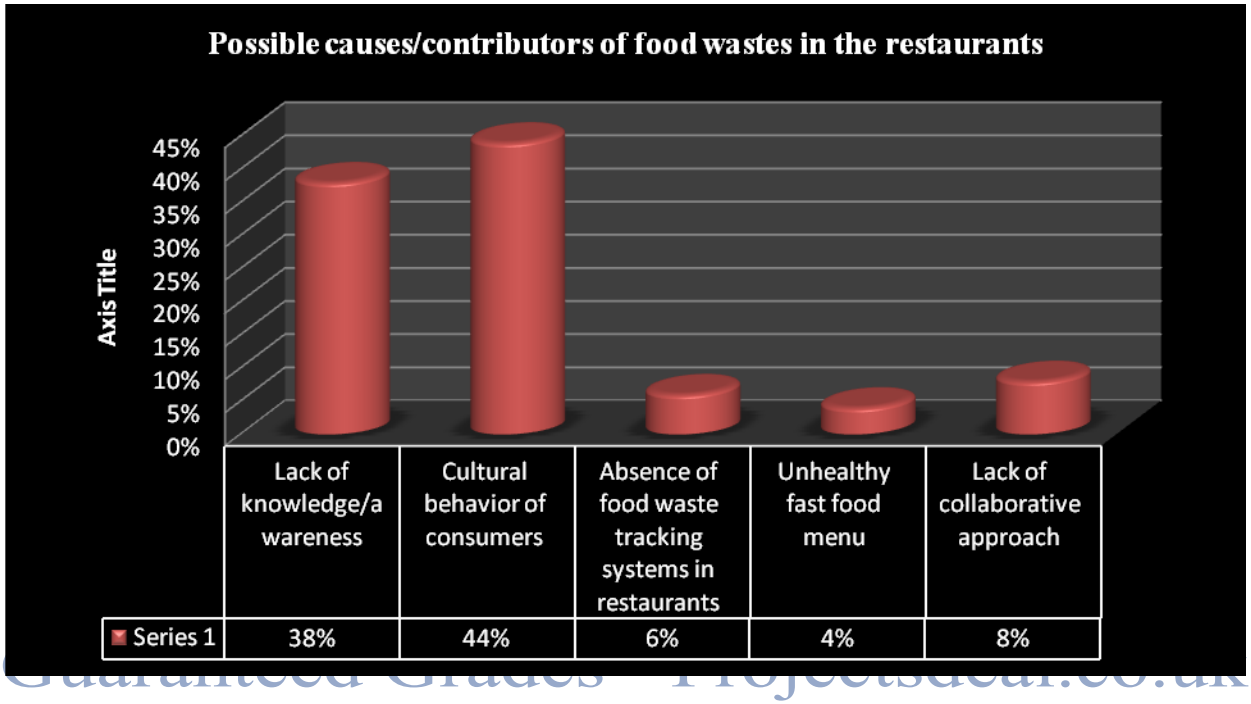
4.2 Quantitative Data Analysis: Survey Questionnaire with 50 customers of the London Stock and Kitchen Table restaurants in London

Q1.What are the possible causes/contributors of food waste in restaurants?

Table (1):

Options	**No of respondents**	**Total respondents**	**Response %**
Lack of knowledge/awareness	19	50	38%
Cultural behaviour of consumers	22	50	44%
Absence of food waste tracking systems in restaurants	3	50	6%
Unhealthy fast food menu	2	50	4%
Lack of collaborative approach	4	50	8%

Findings



Analysis

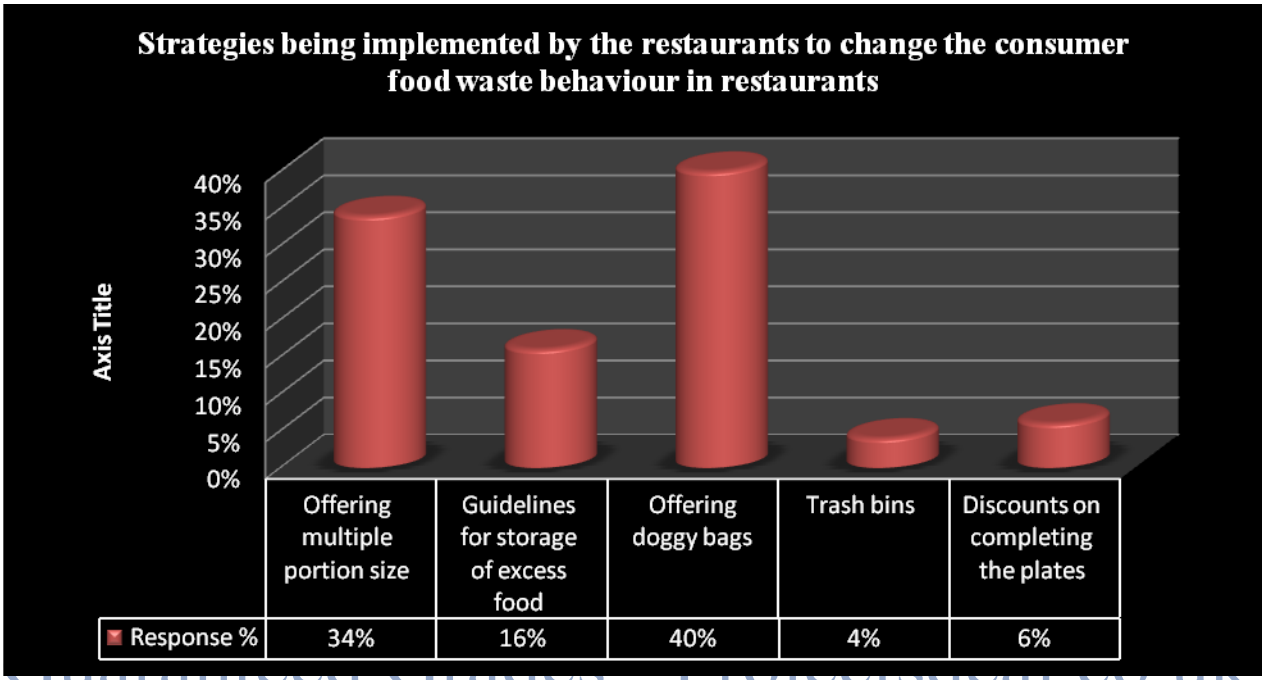
According to the statistics above, the majority of the responses emphasize on the possible contributors of food waste from the customers are mainly due to the lack of knowledge on portion sizes, consciousness of the amount of food they are capable of eating, and lack of awareness on the possible consequences of this rising food wastes. Moreover, there have been potential concerns raised on the cultural behaviour of the consumers where asking for a "doggy bag" to carry the plate leftovers to home is a reason of embarrassment or shame, hence this lack in consumer behaviour has led to the increase in food waste in restaurants. This cause of food waste is largely considered as the social constraint in which the customer's behaviour has significantly contributed to the food waste generation in restaurants.

Q2. What strategies are being implemented by restaurants to change consumer food waste behaviour in restaurants?

Table (2):

Options	**No of respondents**	**Total respondents**	**Response %**
Offering multiple portion size	17	50	34%
Guidelines for storage of excess food	8	50	16%
Offering doggy bags	20	50	40%
Trash bins	2	50	4%
Discounts on completing the plates	3	50	6%

Findings



Analysis

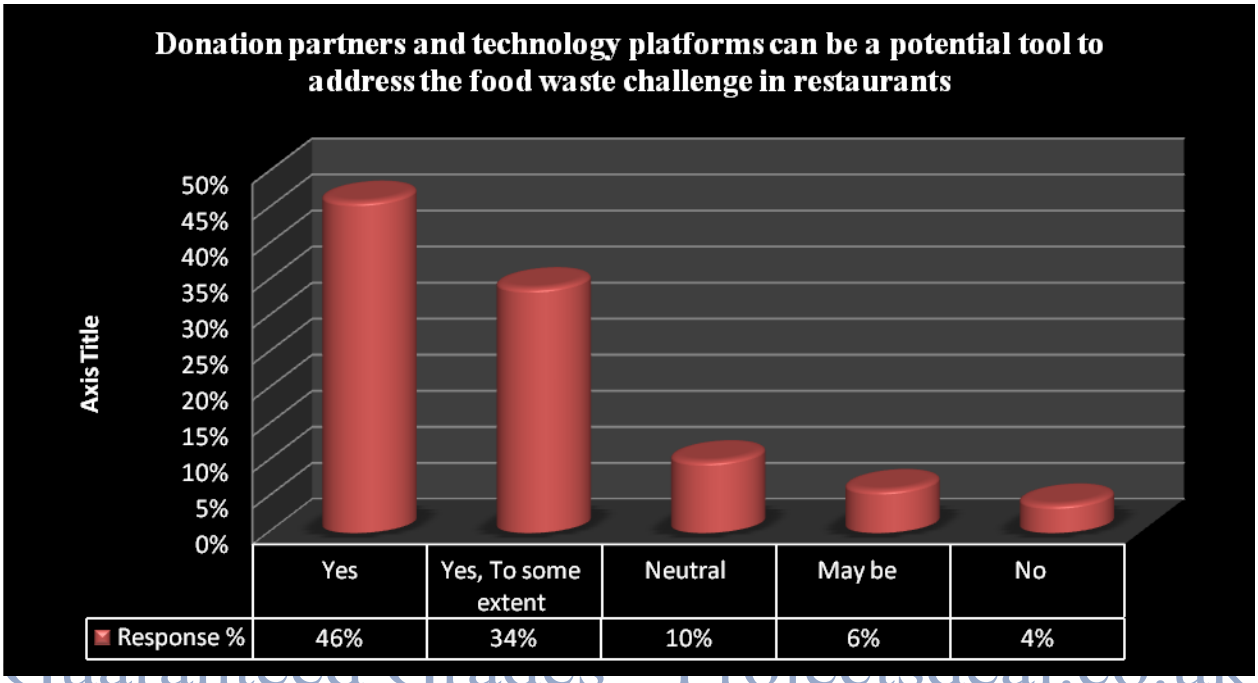
The Limited service restaurants have mastered the technique of right-sizing by offering their customers with the option of multiple portion sizes such as "half" and "full" so that the guests can customize the order based on their appetite. The restaurants often serve small portions along with the "refill" options and side dishes. They offer the customers to choose the side dishes and train the staff to ask for customer preferences. In addition, the restaurant's staff assists the customers immediately who ask for wrapping the plate leftovers. Furthermore, the "doggy bags" or the take-home containers are printed with re-heat and storage instructions to maintain the quality of leftover foods before it is consumed at home.

Q.3 Do you think donation partners and technology platforms can be a potential tool to address the rising challenge of food waste in restaurants?

Table (3):

Options	**No of respondents**	**Total respondents**	**Response %**
Yes	23	50	46%
Yes, To some extent	17	50	34%
Neutral	5	50	10%
May be	3	50	6%
No	2	50	4%

Findings



Analysis

Donation partners and technology platforms help the restaurants to redistribute or sell their daily surplus of prepared food and plate leftovers at a discounted price thereby creating a middle ground between the retail sale and donation to the charity. Such a form of food rescue may expand the market to a new audience with low budget i.e. struggling families, college students, unemployed people and many more. The restaurants can be suitable partners for the food donation programs. On the contrary, the technology solutions thus push out notifications to the food donation app users when the meals become available. They offer the users to purchase meals through the online apps and pick up the meals at a specific time. This is an effective

approach to food waste management on the contrary; the restaurants get some portions of their money invested for sourcing, procurement and preparation.

4.3 Discussion

The UK follows the legal framework or directive referred to as the "food waste hierarchy" having the aim to reduce food waste. This food waste hierarchy as the major framework demonstrates the actionable steps for dealing with food waste in the UK (Papargyropoulou et al 2014). Prevention of food waste is considered the most ideal of the four levels that emphasize on the redistribution of plate leftovers to the people or to the animals instead of trashing it into the waste bins. Consequently, restaurant managers and hotel owners are more focused on the prevention stage of the hierarchy and undertake a range of measures to reduce food waste at this point. The restaurant managers have adopted the practices of donating the leftovers to public workers, NGOs and charities, making alterations in the food procurement strategies by entering into agreements with the suppliers in terms of delivery frequency and ingredient quality, raising awareness campaigns on food waste, strategies to minimize surplus food preparations are the major initiatives that can lead to a significant reduction in the food wastes in restaurants (Filimonau et al 2023). On the contrary, recycling involves sending food wastes for anaerobic digestion and composting.

The rising level of food waste generated by the restaurants in UK thus leads to a critical problem in the country. Reportedly, the UK alone is estimated to generate nearly 9.5 million tonnes of food waste annually and a vast share of is trashed at landfill sites, which are already superfluous in nature (de Visser-Amundson, 2022). The large-scale generation of food waste has a significant contribution to global warming and the erosion of the ozone layer. In the context of the carbon footprint, the food waste in the UK emits more than 3.3 billion tonnes of carbon dioxide

annually which is equivalent to approximately 7% of the entire global emissions (Huang, Liu and Hsu, 2020).

4.4 Critical analysis

Even if the restaurants have incorporated all the best practices for minimizing food waste and developing robust donation programs, they still end up with food scraps and inedible parts that cannot be repurposed. Hence, it is essential to determine the best approach to food waste management in compliance with local regulations. The restaurants incorporate the strategies of food waste disposal system through anaerobic digestion, food recovery, proper treatment for bioenergy production, recycling food wastes through composting that results in the yield of organic fertilizers, reutilising food wastes as bird and animal feed, distribution and donation of foods to charities or food banks. Furthermore, changing customer behaviour towards food wastage and guidelines to "clean up their plates" is considered a primary approach to reduce the carbon footprint owing to the drastic climatic conditions and rising costs of energy. The financial incentives allocated by the government to the restaurants in order to motivate their more responsible behaviour who ensures to redistribute or donate the leftover foods to the charity. Despite the significant strategies and potential interventions fostered by the government to reduce food waste, however, there is still significant reluctance from the restaurant managers/owners to impose the interventions in fear of getting possible backfire effects on its customers.

Conversely, Karki, Bennett and Mishra (2021) pointed out that the amount of food waste and the type of food waste generated is different due to the differences in the location, customer demographic visiting the restaurants, size, service level (limited or full), and management styles in the restaurants. However, this research study has not focused on the different locations or

diverse demographic that have led to the significant research gap and created the scope for future research studies. On the other hand, it has been found that no restaurants can accurately identify the amount of food waste generated unless there is a fixed protocol to identify and weigh the restaurant food waste on a daily basis. This has been identified as the "invisible problem of food waste". Furthermore, the findings have identified the challenges to changing consumer behaviour towards their consumption habits and food waste behaviour online, however, it has been agreed that there was little awareness on this rising issue which is not currently being put into action by the restaurants. Switching to the recycling of food waste is a low-cost sustainable solution to effectively manage the unavoidable waste in restaurants (Mak et al 2020). It has been believed that zero food waste is an ideal solution; however, it is rarely achievable in practice. Hence, the restaurants must focus on the food waste hierarchy to prevent food wastage, redistribute the plate leftovers, and utilise the remainder as animal or bird feed and recycle the edible parts.

Chapter 5. Conclusion and Recommendations

5.1 Conclusion

The findings and analysis have shown that food waste in the restaurant sector is a significant challenge that makes up approximately 18% of the total national food waste. The reports from the restaurants have indicated a substantial amount of food waste arising from the customer plates as leftover food. This can be the cause of highly standardized procedures of food preparation, and serving procedures along with the irresponsible customer behaviour prompted by the relative affordability of the dishes. However, this challenge can be mitigated by effective waste management strategies that can even turn the constraints into opportunities by increasing the bottom line. Underpinned by the food waste hierarchy in the literature, the interventions that could be taken by the hotel managers/owners with the goal to prevent the occurrence of food waste would potentially depend on accurate forecasting of demand which will prevent the oversupply of food ingredients and over-production of meals in the restaurants with the subsequent reduction in the possibility of waste generation and leftovers in the customer plates.

The research findings have comprehensively discussed on the multiple techniques and tools available at the restaurants to improve their operating standards and engage the staff and consumers in the food waste reduction efforts. On critical analysis, it has been established that addressing these challenges would not be easier unless it engages the appropriate stakeholders, empower them to take suitable actions and incentivize them for their reduction efforts (Moustakas et al 2020). To create equilibrium, it can be concluded that the local authorities in coordination with the hotel owners/managers must remain responsible to address the specific challenges of food waste faced at the local levels in the restaurants. Hence, the best practices

must be followed to devise a more standardized approach and improve waste management activities. A larger portion of the food waste generated in the restaurants and hospitality sectors is the result of large portion sizes that leads to food waste left on the customer's plate. On the contrary, the government must leverage the existing opportunities to incentivise restaurants to encourage various ways of preventing plate waste, e.g. by offering small portions, offering the options of side dishes, and encouraging the consumers to take home the plate leftovers in the restaurants. Furthermore, the waste hierarchy that exists for the prevention and effective management of food waste is a constructive effort towards minimising the impact on the environment. However, it has been observed in the research that even though the waste hierarchy is widely acknowledged as necessary to reduce food waste, but it has not been apparently enforced in the system. Hence, it is recommended the governing authority in collaboration with the environmental agency must emphasize enforcing the waste hierarchy for the wider benefit of society. Moreover, there is an increasing need to improve public awareness and education on the major causes of food waste and its consequences on society (Mak et al 2020). It is an essential norm to educate the customers visiting restaurants about the negative consequences of food waste on society and trigger their perceived behavioural control (PBC) and intention to avoid food waste.

If the plate leftovers or surplus food could not be redistributed, then it has to be disposed of in the landfills. However, referring the food waste hierarchy studied in the literature, it apparently pinpoints that the disposal of food waste is the least preferred approach to mitigate food waste. Conversely, it is evident that if the food wastes are managed effectively, it has the potential to minimise the complete loss of natural resources which was invested in food production. For instance, the wasted food could be recycled through anaerobic digestion or composting for

material recovery (Wang et al 2013). It has been studied that the collections of commercial food waste are poorly organized, owing to the infrastructural and budgetary issues that may prevent the private companies and local authorities to collect and dispose the food waste from the restaurants effectively. It has been observed in the literature and in practice that restaurant owners are incentivized to compost the food waste instead of disposing it in landfills. The hauling costs for the compost bins were found to be 20% less in comparison to the hauling price for landfill bins. The local authority conducts regular checks on the landfill bins for determining the amount of compost done on the landfill bins (Filimonau, Zhang and Wang, 2020). Conversely, there is a common misconception that restaurants are potentially liable for donating food. The retailers/restaurants are dissuaded due to the fear of lawsuits because of the claims that donated food causes health problems to the consumers. Besides the misconception associated with the potential liability for food donation, one of the major hurdles for restaurants is the logistical constraints of food donation. The restaurants often have less storage space and a lack of transportation infrastructure that hinders the successful donation of leftover foods.

5.2 Recommendations

Based on the gaps identified in the research study, these recommendations can be applied to address the challenges of food waste management effectively-

(1) It could be asserted that the restaurant businesses alone may not be able to make decisions or foresee the potential consequences of food waste on a larger scale (Kibler et al 2018). Hence, the implication of education and improved exchange of knowledge help in the development of collaborative efforts to deal with food waste across the whole supply chain till its final consumption.

(2) Increased level of international collaboration, coordinated initiatives of waste prevention on the regional and national levels by the government, and private restaurant businesses and improved communication between the diverse stakeholders helps in creating a strong drive towards more integrated practices and efforts towards food waste prevention.

5.3 Future Scope of Research

The current tools employed for assessing food waste lack accuracy and are highly complex. Hence, there is a significant scope of research on the food waste tracking systems specifically in the dining facilities in the restaurants in order to determine the patterns of leftover food in customer plates which are not widely integrated by the restaurant managers/operators.

Reference List

Ajzen, I., 2011. The theory of planned behaviour: Reactions and reflections. *Psychology & Health*, *26*(9), pp.1113-1127.

Alharahsheh, H.H. and Pius, A., 2020. A review of key paradigms: Positivism VS interpretivism. *Global Academic Journal of Humanities and Social Sciences*, *2*(3), pp.39-43.

Almalki, S., 2016. Integrating Quantitative and Qualitative Data in Mixed Methods Research--Challenges and Benefits. *Journal of Education and Learning*, *5*(3), pp.288-296.

Armat, M.R., Assarroudi, A., Rad, M., Sharifi, H. and Heydari, A., 2018. Inductive and deductive: Ambiguous labels in qualitative content analysis. *The Qualitative Report*, *23*(1), pp.219-221.

Betz, A., Buchli, J., Göbel, C. and Müller, C., 2015. Food waste in the Swiss food service industry–Magnitude and potential for reduction. *Waste management*, *35*, pp.218-226.

Christ, K.L. and Burritt, R., 2017. Material flow cost accounting for food waste in the restaurant industry. *British Food Journal*, *119*(3), pp.600-612.

Cole, A.P. and Trinh, Q.D., 2017. Secondary data analysis: techniques for comparing interventions and their limitations. *Current opinion in urology*, *27*(4), pp.354-359.

de Visser-Amundson, A., 2022. A multi-stakeholder partnership to fight food waste in the hospitality industry: A contribution to the United Nations Sustainable Development Goals 12 and 17. *Journal of sustainable tourism*, *30*(10), pp.2448-2475.

Emmel, N., 2013. *Sampling and Choosing Cases in Qualitative Research: A Realist Approach* [online]. London: Sage Publications Ltd.

Eriksson, M., Strid, I. and Hansson, P.A., 2015. The carbon footprint of food waste management options in the waste hierarchy–a Swedish case study. *Journal of Cleaner Production*, *93*, pp.115-125.

Filimonau, V. and Delysia, A., 2019. Food waste management in hospitality operations: A critical review. *Tourism management*, *71*, pp.234-245.

Filimonau, V. and Sulyok, J., 2021. 'Bin it and forget it!': the challenges of food waste management in restaurants of a mid-sized Hungarian city. *Tourism Management Perspectives*, *37*, p.100759.

Filimonau, V., Chiang, C.C., Wang, L.E., Muhialdin, B.J. and Ermolaev, V.A., 2023. The resourcefulness of chefs and food waste prevention in fine dining restaurants. *International Journal of Hospitality Management*, *108*, p.103368.

Filimonau, V., Krivcova, M. and Pettit, F., 2019. An exploratory study of managerial approaches to food waste mitigation in coffee shops. *International Journal of Hospitality Management*, *76*, pp.48-57.

Filimonau, V., Nghiem, V.N. and Wang, L.E., 2021. Food waste management in ethnic food restaurants. *International Journal of Hospitality Management*, *92*, p.102731.

Filimonau, V., Todorova, E., Mzembe, A., Sauer, L. and Yankholmes, A., 2020. A comparative study of food waste management in full-service restaurants of the United Kingdom and the Netherlands. *Journal of Cleaner Production*, *258*, p.120775.

Garcia-Garcia, G., Woolley, E. and Rahimifard, S., 2015. A framework for a more efficient approach to food waste management. *International Journal of Food Engineering*, *1*(1), pp.65-72.

Garske, B., Heyl, K., Ekardt, F., Weber, L.M. and Gradzka, W., 2020. Challenges of food waste governance: An assessment of European legislation on food waste and recommendations for improvement by economic instruments. *Land*, *9*(7), p.231.

Ghani, W.A.W.A.K., Rusli, I.F., Biak, D.R.A. and Idris, A., 2013. An application of the theory of planned behaviour to study the influencing factors of participation in source separation of food waste. *Waste management*, *33*(5), pp.1276-1281.

Giordano, C., Falasconi, L., Cicatiello, C. and Pancino, B., 2020. The role of food waste hierarchy in addressing policy and research: A comparative analysis. *Journal of Cleaner Production*, *252*, p.119617.

Haardörfer, R., 2019. Taking quantitative data analysis out of the positivist era: Calling for theory-driven data-informed analysis. *Health Education & Behavior*, *46*(4), pp.537-540.

Hennchen, B., 2019. Knowing the kitchen: Applying practice theory to issues of food waste in the food service sector. *Journal of Cleaner Production*, *225*, pp.675-683.

Huang, C.H., Liu, S.M. and Hsu, N.Y., 2020. Understanding global food surplus and food waste to tackle economic and environmental sustainability. *Sustainability*, *12*(7), p.2892.

Johnston, M.P., 2017. Secondary data analysis: A method by which the time has come. *Qualitative and Quantitative Methods in Libraries*, *3*(3), pp.619-626.

Karki, S.T., Bennett, A.C. and Mishra, J.L., 2021. Reducing food waste and food insecurity in the UK: The architecture of surplus food distribution supply chain in addressing the sustainable development goals (Goal 2 and Goal 12.3) at a city level. *Industrial Marketing Management*, *93*, pp.563-577.

Kibler, K.M., Reinhart, D., Hawkins, C., Motlagh, A.M. and Wright, J., 2018. Food waste and the food-energy-water nexus: A review of food waste management alternatives. *Waste management*, *74*, pp.52-62.

La Barbera, F., Riverso, R. and Verneau, F., 2016. Understanding beliefs underpinning food waste in the framework of the theory of planned behaviour. *Calitatea*, *17*(S1), p.130.

Lawrence, J. and Tar, U., 2013. The use of Grounded Theory Technique as a Practical Tool for Qualitative Data Collection and Analysis. *Electronic Journal of Business Research Methods*, *11*(1).

Li, C., Mirosa, M. and Bremer, P., 2020. Review of online food delivery platforms and their impacts on sustainability. *Sustainability*, *12*(14), p.5528.

Mak, T.M., Xiong, X., Tsang, D.C., Iris, K.M. and Poon, C.S., 2020. Sustainable food waste management towards circular bioeconomy: Policy review, limitations and opportunities. *Bioresource Technology*, *297*, p.122497.

Martin-Rios, C., Demen-Meier, C., Gössling, S. and Cornuz, C., 2018. Food waste management innovations in the food service industry. *Waste management*, *79*, pp.196-206.

Matzembacher, D.E., Brancoli, P., Maia, L.M. and Eriksson, M., 2020. Consumer's food waste in different restaurants configuration: A comparison between different levels of incentive and interaction. *Waste Management*, *114*, pp.263-273.

McGrath, C., Palmgren, P.J. and Liljedahl, M., 2019. Twelve tips for conducting qualitative research interviews. *Medical teacher*, *41*(9), pp.1002-1006.

Moustakas, K., Rehan, M., Loizidou, M., Nizami, A.S. and Naqvi, M., 2020. Energy and resource recovery through integrated sustainable waste management. *Applied Energy*, *261*, p.114372.

Neuendorf, K.A., 2018. Content analysis and thematic analysis. In *Advanced research methods for applied psychology* (pp. 211-223). Routledge.

Palinkas L. A., Aarons, G. A., Horwitz, S., Chamberlain, P., Hurlburt, M., & Landsverk, J. (2011) Mixed methods designs in implementation research. *Adm Policy Ment Health*; 38 (1):44–53

Palinkas, L.A., Horwitz, S.M., Green, C.A., Wisdom, J.P., Duan, N. and Hoagwood, K., 2015. Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, *42*(5), pp.533-544.

Papargyropoulou, E., Lozano, R., Steinberger, J.K., Wright, N. and bin Ujang, Z., 2014. The food waste hierarchy as a framework for the management of food surplus and food waste. *Journal of cleaner production*, *76*, pp.106-115.

Papargyropoulou, E., Steinberger, J.K., Wright, N., Lozano, R., Padfield, R. and Ujang, Z., 2019. Patterns and causes of food waste in the hospitality and food service sector: Food waste prevention insights from Malaysia. *Sustainability*, *11*(21), p.6016.

Perera, K. and Emmerich, N., 2018. *The Ethical Concerns of Writing in Social Science Research*. SAGE Publications Ltd.

Pirani, S.I. and Arafat, H.A., 2016. Reduction of food waste generation in the hospitality industry. *Journal of cleaner production*, *132*, pp.129-145.

Ploug, T. and Holm, S., 2015. Meta consent: a flexible and autonomous way of obtaining informed consent for secondary research. *BMJ: British Medical Journal (Online)*, *350*.

Saunders, M., Lewis, P., & Adrian Thornhill, A. (2019). *Research Methods for Business Students.* Harlow: Pearson Education Limited. 8th ed.

Schoonenboom, J., and Johnson, R. B. (2017). How to Construct a Mixed Methods Research Design. *Kolner Zeitschrift fur Soziologie und Sozialpsychologie*, 69 (Suppl 2), 107–131. Retrieved on 2nd Dec. 2020, from https://doi.org/10.1007/s11577-017-0454-1

Sniehotta, F.F., Presseau, J. and Araújo-Soares, V., 2014. Time to retire the theory of planned behaviour. *Health psychology review*, *8*(1), pp.1-7.

Sommer, L., 2011. The theory of planned behaviour and the impact of past behaviour. *International Business & Economics Research Journal (IBER)*, *10*(1).

Sucheran, S. and Olanrewaju, O.A., 2021. Food waste management of restaurants in Kwazulu-Natal, South Africa. In *Proceedings of the International Conference on Industrial Engineering and Operations Management* (pp. 58-69).

Teigiserova, D.A., Hamelin, L. and Thomsen, M., 2020. Towards transparent valorization of food surplus, waste and loss: Clarifying definitions, food waste hierarchy, and role in the circular economy. *Science of the Total Environment*, *706*, p.136033.

Thi, N.B.D., Kumar, G. and Lin, C.Y., 2015. An overview of food waste management in developing countries: Current status and future perspective. *Journal of environmental management*, *157*, pp.220-229.

Thyberg, K.L. and Tonjes, D.J., 2016. Drivers of food waste and their implications for sustainable policy development. *Resources, Conservation and Recycling*, *106*, pp.110-123.

Tong, H., Shen, Y., Zhang, J., Wang, C.H., Ge, T.S. and Tong, Y.W., 2018. A comparative life cycle assessment on four waste-to-energy scenarios for food waste generated in eateries. *Applied Energy*, *225*, pp.1143-1157.

Tran, B., 2019. The Nature of Research Methodologies. In *Advanced Methodologies and Technologies in Library Science, Information Management, and Scholarly Inquiry* (pp. 552-563). IGI Global.

Truong, L., Morash, D., Liu, Y. and King, A., 2019. Food waste in animal feed with a focus on use for broilers. *International Journal of Recycling of Organic Waste in Agriculture*, *8*, pp.417-429.

Wang, Y.F., Chen, S.P., Lee, Y.C. and Tsai, C.T.S., 2013. Developing green management standards for restaurants: An application of green supply chain management. *International Journal of Hospitality Management*, *34*, pp.263-273.

Wen, Z., Hu, S., De Clercq, D., Beck, M.B., Zhang, H., Zhang, H., Fei, F. and Liu, J., 2018. Design, implementation, and evaluation of an Internet of Things (IoT) network system for restaurant food waste management. *Waste management*, *73*, pp.26-38.

Xue, L., Liu, G., Parfitt, J., Liu, X., Van Herpen, E., Stenmarck, Å., O'Connor, C., Östergren, K. and Cheng, S., 2017. Missing food, missing data? A critical review of global food losses and food waste data. *Environmental Science & Technology*, *51*(12), pp.6618-6633.

Zanella, M.A., 2020. On the challenges of making a sustainable kitchen: experimenting with sustainable food principles for restaurants. *Research in Hospitality Management*, *10*(1), pp.29-41.