Food waste management in restaurants: A case study of H.N. Vietnamese restaurant in Budapest

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ABSTRACT

The global problem of environmental degradation necessitates full assessment across all sectors, encompassing food waste, which involves multifaceted environmental, economic, and social consequences. This study examines the significant issue that concerns food waste management in the restaurant sector, with a case study on H.N. Vietnamese restaurant located in Budapest. It provides insight into the factors that influence food waste generation and handling among employees and the customers, as well as the effectiveness of current food waste control approaches and expose difficulties and challenges during the management process. After a two-week measuring and monitoring period the volume of H.N.'s food waste was calculated, which was roughly 1157 kg, with an average of 82 kg per day including food waste is explicitly classified. The survey answers and collected data of the measurement help the restaurant comprehend the cause and impacts of the food waste production, which stems from awareness, understanding of menus and dishes, eating and ordering habits as well as how customers handle leftovers, while from the staffs, in addition to lack of awareness and proactive in management, practical measures lack feasibility and are hindered by cost, fixed cooking recipes, cultural and technological barriers. Simultaneously, the study revealed positive associations between awareness and concern regarding food waste and both age and education level. The interview also suggested the information about existed methodology and modified the management in the stages of inventory, menu and portion planning, staffs and customer's engagement, and composting with some specific food waste. The recommendations can reduce costs and human resources, increase operational efficiency, and improve the position of the business, bringing a good image to the brand, especially in the context of the environment and sustainability, which are top priorities in every sector.

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1. Introduction

Resource conservation and environmental challenges are currently the top concerns for the worldwide society. Rapid growth in industrialization and urbanization lead to increased resource exploitation, environmental destruction, amplification of the greenhouse effect, and detrimental effects on human health. As a result, waste management and treatment are two essential components of environmental preservation that demand more attention in relation to an upsurge in production and consumption.

The most recent available reference year, 2010, generated estimates of 7 to 10 billion tons of solid waste from homes, businesses, industries, and construction. Of this total, half was composed of waste produced in industrialized and high-income countries such as Western Europe, America, Japan, Oceania, and so forth. (GWMO, 2015). The EU as a whole produced 2.3 billion tonnes of garbage in 2018, comprising waste from residences and all forms of industrial activity. In the EU, this equates to roughly 5.2 tons per person (Eurostat, 2018).

There are numerous ways to produce food waste, and because of the interplay of various variables such consumer behaviours, food production and distribution methods, and national waste management policies, it can be difficult to identify the primary source. However, the food service sector in Europe produces 14% of the total food waste of the whole continent, which can be attributed to left-over packaging policies, client demand variations, and portion limitations in restaurants, hotels, and other food service enterprises (European Environment Agency, 2020).

It is apparent that the service industry, which primarily consists of hotels and restaurants, is one of the major contributors to food waste. This holds especially true in the context of the flourishing growth of the food service, tourism, and other related industries. The hospitality sector in the European Union generated more than 12 million tonnes of food waste in 2010 (Oliveira et al., 2016). Plus, there is a direct correlation between the growth of tourism and the quantity of food waste produced by the hospitality industry (Manomaivibool, 2015). In the instance of Mallorca, a 1% increase in visitor arrivals results in a 1.25% increase in trash creation, of which food waste makes up the majority (Arbulu et al., 2016).

In this case, the region under study is Budapest, the capital of Hungary, a country in Central Europe experiencing an economic transition. Being an intersection of culture and politics, Budapest is also a desirable travel destination with extraordinary resources available for tourists (Vedran Milojica et al., 2022). However, statistics and reports about food waste of the Hungarian hospitality sector are incredibly scarce. The Wasteless Project, run by The National Food Chain Safety Office (Nébih), provides compensation for food consumption, management, and use. With this information, one may somewhat assess how customers generally behave when it comes to food consumption in restaurants and lodging establishments. The results of a 2016 study show that the average Hungarian wastes 68.04 kg of food annually, of which 48.70 percent (or 33.14 kg/capita/year) might have been avoided (Szabó-Bódi et al., 2016). Comparable statistics were also investigated in Finland and Greece, where it was found that each country could cut its annual food waste per capita by 23 kg (Koivupuro et al., 2012) and 25.9 kg (Abeliotis et al., 2019).

Rich and diverse culinary scene is being enhanced by an increasing number of new firms from different areas bringing new ideas to the table. Therefore, H.N. - a Vietnamese restaurant in Budapest is the subject of this study. In contrast to other European restaurants, it features a menu that is designed differently, and the foods it offers have distinct portions and food ratios that may impact how much food is wasted as a result of customers' eating habits.

This study will clarify the problem of food waste at a Vietnamese restaurant in Budapest by analysing the current situation, significant contributing factors, and measures for mitigation. Restaurant operations involve intricate supply networks, complex culinary processes, interactions with customers, and an in-depth understanding of their demands and behaviours. The specific way in which these habits result in food waste is still unclear, which makes developing efficient intervention strategies more challenging.

A thorough evaluation of the wider economic effects is also required, covering the processing, storage, and possible cash gains from food waste management initiatives. Food waste causes financial difficulty for H.N. given that it involves costs for purchasing, storing, processing, and discarding leftovers and misplaced food. Due to differences in meal amount distribution and nutritional value, patrons of Vietnamese restaurants will be influenced by how they are perceived as general Asian restaurants in terms of food waste.

The impact of H.N.'s business model on food waste management initiatives and their efficacy will also be examined in this article from the viewpoint of restaurant employees at all levels. The elements will be examined within the context of Hungary and Europe as a whole. For the purpose of trying to determine the most multifaceted viewpoint and the source of the issue, there will also be a comparison with data on food waste and food waste management in Vietnam. Understanding and eradicating food waste in this context provides benefits not only for H.N.'s operations but also for other food and beverage businesses in Budapest, particularly Asian restaurants. The knowledge gathered from this study will help establish sustainable practices that benefit the industry and are adopted by companies operating in the same sector.

With the goal of developing a multifaceted protocol to better understand the elements that lead to the production of food waste, the primary analytical components that were chosen for the study include the measurement of the amount of food that is wasted, along with the surveying of customers and restaurant employees. In the concluding stages, there is an in-depth interview with the proprietor of the company, during which the company will analyse and assess the efficiency of the management strategies that are now in place, aside from learn about the challenges that the restaurant is currently facing and make recommendations for the future.

2. Literature review

This literature review aims to give a concise overview of the condition of food waste today and the wide range of research that has been done on the subject. Under the research object of an H.N. restaurant, a Vietnamese restaurant in Budapest, Hungary, the literature will examine the environmental, human health, and monetary consequences of food waste, as well as the methods for managing and treating food waste in the hospitality industry. Additionally, this study will look at the deeper impacts on food waste generation, unsolved issues with food waste treatment, their practical applications, and their solutions. This review of the literature will involve three main topics addressed. This is a brief overview of the challenge of sustainable development and the situation of environmental impacts in the food service industry today. The management of food waste in restaurants and Hungarian context are the next discussed. Finally, an examination and study of food waste in restaurants within H.N. case study.

2.1. Key definition

FAO (2014) introduced the definition of food loss as "a decrease in quantity or quality of food," whereas food waste is a component of it. Food waste has unique motivations and solutions that

differ from food losses. Food waste can occur at all stages of the food supply chain, from manufacturing to consumption. Food waste refers to food that passes safety and nutrition requirements but is wasted or alternatively used. The GMA/FMI effort, established by the Grocery Manufacturers Association (GMA) and Food Marketing Institute in 2012, has provided a clear definition of food waste as "Any solid or liquid food substance, whether in its raw or cooked form, that is discarded or intended to be discarded." Food wastes refer to the organic leftovers that are produced during the many stages as in Figure 1, each stages including many specific steps of food processing, handling, storage, sale, preparation, cooking, and serving.

Figure 1*: Food supply chain*

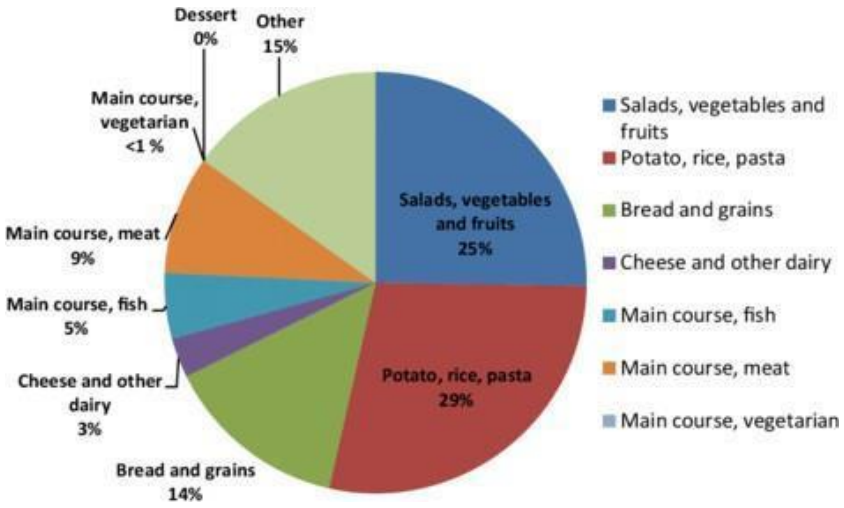
Source: Environmental Protection Agency

In their 2013 research on the US's food waste, BSR defined food waste as the quantity of food that is "disposed of, whether intentionally or out of necessity," regardless of whether it is in solid or liquid form, or whether it is raw or cooked. Food waste encompasses the organic remnants, such as vegetable roots or peels, that are produced during food production, handling, storage, sale, preparation, etc. Food loss and waste occur throughout the consuming period as a result of the surplus of food purchased by customers, restaurants, and caterers that remains uneaten (Brian Lipinski et al., 2013).

The concept of total food waste represents both preventable and inevitable food waste, also the portion of food waste that is nutritionally deficient and inedible (Peter Lee et al., 2013). Conforming to WRAP, reversible food waste refers to the amount of food that is discarded and continued to be edible before getting tossed away. These waste of food can be diminished by implementing more accurate portioning, effective management, appropriate storage, and meticulous preparation. Edible food items such as crusts and skins from baked potatoes and bread are discarded and end up in the waste bin due to their undesirability (Peter Lee et al., 2013). Food waste often includes inedible components, such as meat bones, egg shells, and used tea bags. An analysis conducted in Finland by Silvennoinen and colleagues in 2015,

illustrated in Figure 2 revealed that the largest portion of unconsumed food items falls under the carbohydrate-rich classification, specifically potatoes, rice, and pasta (29%). Furthermore, salads and vegetables constitute a major share (25%), indicating a trend among diners to leave behind huge amounts of these essential components of a healthy diet.

Figure 2: *Contribution of the customer plate leftovers in restaurants and diners in the context of Finnish food service sector*



Source: Silvennoinen et al., 2015

As stated by the BSR (Grocery Manufacturers Association and Food Marketing, 2013), any food that has been taken out of the main distribution route and may or may not have been processed through product reclamation centres is classified as unsalable.Unmarketable food can be produced throughout the manufacturing and distribution process. For instance, errors made during the manufacturing process can lead to food that is completely safe and fit for consumption, but cannot be marketed due to concerns related to its quality, excessive production, or labelling problems. Donations of raw materials and incomplete goods that are still safe for human use but do not meet retail standards are another good example. In the course of delivery and retail operations, the exterior packaging of food products might get damaged, making them unsellable but perfectly edible. You can still eat food that is not fit for sale because it is either too old, has defects, or is nearing its expiration date (Le Lan Phuong, 2017).

In terms of food leftovers and food waste in general, institutions can be approached to process them through recycling or composting if they are eligible. The Food Bank in Hungary,

established in 2016, has disseminated 340,000 metric tonnes of food, amounting to a total worth of $67.4 million (equivalent to 20.3 billion HUF). The project has successfully offered aid to over 340,000 individuals through collaborations with 325 non-governmental organisations and municipalities. The organisation distributed 4,800 metric tonnes of donated food in 2016. Food waste reuse or recycling include the procedures of composting, transforming waste into animal feed, and repurposing waste oils for fuel generation. From 2017, Tesco in Hungary contributes to animal shelters with a combined total of 45 hypermarkets and 11 smaller outlets. Since 2013, these enterprises have provided animal shelters and wildlife parks with meat, dairy products, eggs, baked goods, and vegetables.

2.2. Food waste and environmental management in food service sector

In 2019, SOFA provided a definition for the concept of food waste as the decrease in the quantity or quality of food resulting from the choices and behaviors of suppliers, food service providers, and consumers. In particular, the amount of food waste can be influenced by consumer culture, waste management strategies, and the economic composition of each region. However, it frequently accounts for a significant portion of garbage generated by both enterprises and households. The processes of producing, manufacturing, distributing, and retailing food all result in greenhouse gas emissions. Greenhouse gas emissions are also produced by food that is disposed of in landfills. The decomposition of the buried food releases methane into the atmosphere, a greenhouse gas 28 times more potent than CO2 (European Commission)

Food waste is turning into a worldwide issue that affects natural resources, contributes to pollution, complicates climate change, and has major socioeconomic and environmental ramifications (Batool et al.,2024). In 2021, the United Nations Environment Programme (UNEP) identified that a significant amount of food waste is generated by the food service industry (approximately 244 million tons). This waste is largely attributed to the diverse settings in which food is consumed away from home, making it prone to waste (Heikkilä et al., 2016). The scope of food services extends beyond traditional venues like restaurants, hotels, and cafes (Wang et al., 2018), encompassing cruise ships (Li & Wang, 2020), various events (Pirani & Arafat, 2016), and street food vendors (Alfiero et al., 2020). Additionally, food services are provided in educational and workplace environments, where food is served in their canteens and cafeterias, often managed by external contractors (Derqui et al., 2018). Despite ongoing efforts to quantify food waste, comprehensive data collection remains a challenge,

with many areas still underexplored (Dhir et al., 2020). Notably, data on waste from street food vendors is scarce, despite its considerable contribution to the food market in several countries, particularly in Asia and Africa (Filimonau et al., 2023). Following the Covid pandemic, food delivery services have seen robust growth, yet data on food waste within this specific sector remains notably limited. Filimonau and colleagues pointed out that this gap in research hinders the establishment of food waste benchmarks, making the issue increasingly challenging and problematic to address.

Multiple associations are involved in the production and reduction of food waste (Filimonau et al., 2023). To make food waste reduction a reality, these stakeholders may be involved in the stages of food service provision, transportation, or waste treatment that result in the generation of food waste, but their involvement is also intimate and active (Bhattacharya & Fayezi, 2021). The most effective approach for addressing the issue is stakeholder participation (De Visser-Amundson, 2022). To address food waste more successfully and optimally, the previously mentioned cooperation contributes to the professionalization and improvement of the food supply chain's responsiveness and resilience (Filimonau, 2021).

In 2019, approximately 931 million tons of food, which represents 17% of the total food available to consumers, was discarded by households, retailers, restaurants, and other food service providers (UNEP, 2021) while at least 238 million people experience severe food insecurity as a result of food shortages that follow. According to the European Civil Protection and Humanitarian Aid Operations (2023), this number has increased by 10% from 2022. The amount of food produced in Sub-Saharan Africa (230 million tons) is almost equivalent to the amount of food wasted by industrialized regions in North America, Europe, and Asia (222 million tons), based to a concerning UNEP analysis. While other environmental issues are constantly being highlighted, this contrast raises concerns about the deteriorating condition of food waste and has not received much public attention.

Food waste has had significant environmental impacts, both directly and indirectly, such as contributing to the release of greenhouse gases, causing deforestation, soil erosion, and polluting the air and water (Schanes et al., 2018). Food waste not only takes up space in landfills, as is evident, but it additionally emits methane, a greenhouse gas that contributes considerably to global warming (Swinburne and Sandson, 2019). Reducing the quantity of food waste produced while properly applying the concepts of reduce, reuse, recycle, and recover is

key considering good food waste management is a prerequisite for enhancing environmental protection (Ahamed et al., 2016). Food waste recycling, which is most commonly used to reduce environmental impact, primarily through anaerobic digestion and composting of organic waste (Lin et al., 2018), facilitates the development of a complete circular food system and, more scientifically, results in less waste output and fewer inputs into the food production system. Regardless of efforts to implement recycling techniques, the United States' municipal solid waste in 2017 had over 41 million tons of food waste, of which only 6.3% were thought to have been composted (US EPA, 2019). Food waste recycling offers multiple benefits, yet the process may not be practical or safe until waste classification is ensured to occur in an absolutely accurate manner, meaning the input does not consist of hazardous materials or other sorts of material (Thakali et al., 2022). Strict adherence appears to be challenging because environmental contaminants can readily infiltrate the food chain, resulting in food waste during manufacturing, processing, packaging, distribution, and retail, or by consumers during disposal or as a result of inadequate separation from other wastes, consisting of foodservice and packaging items (Thakali and MacRae, 2021).

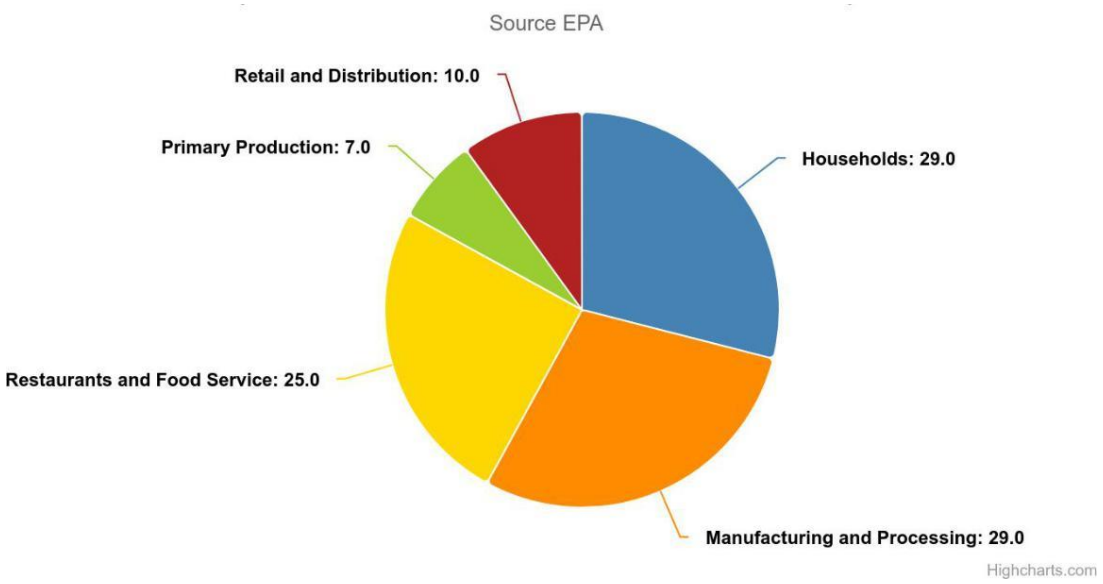
According to World Food Program USA (2021), the quantity of water lost throughout the food manufacturing process is sufficient to fill Lake Geneva thrice. Meanwhile, cereals account for the majority of the water used and produced in the agricultural sector (Mekonnen and Hoekstra, 2011). Results of a worldwide study carried out by FAO in 2011 that investigated the food production and consumption cycle from post-harvest to consumption were released in 2013. 81% of food is estimated to be lost or squandered. This amount of food accounts for 23% of global fertilizer consumption and 250 x 109 m3/year of water resources (52% of which are used for cereal cultivation) (FAO, 2013). Along with fruit and vegetables, which account for 75% of recorded water loss, grains comprise 57% of overall food wastege generated (Kummu et al., 2012).

2.3. Hotels and restaurant’s food waste and its management

Food waste has not received as much attention or concern as the other waste categories we have examined and learned about thus far, even though the United Nations Environment Program (UNEP) Food Waste Index Report 2021 states that a billion tons of food are wasted globally each year. The stages of food supply chains that involve consumption in middle-class and high-income countries, production in industrialized countries, and production, storage, and transportation in low-income nations are where a large proportion of food waste happens (Gustavsson et al., 2011). It is astounding to learn that one-third of the food produced worldwide

is wasted or lost. The global challenges of pollution, waste, loss of nature and biodiversity, and climate change must all be addressed by reforming the food system (UNEP, 2022).

Figure 3: *Estimated Food Waste Generated in Ireland in 2021 (percentage/food supply chain stage)*



Source: Environmental Protection Agency

Figure 3 illustrates the percentage of food waste produced in the food service industry in Ireland in 2021. Restaurants and food services account for 25% of the nation's food waste, which is extremely high, following behind food waste generated by households, highlighting their substantial contribution to food waste metrics. It is known for a fact that the food service industry's internal structure and complexity intensify the seriousness and complexity of the food waste problem (Filimonau et al., 2023). Fine dining, casual dining, and fast service businesses are the restaurant subsector's main contributors of food waste (McAdams, von Massow, Gallant, & Hayhoe, 2019). Filimonau et al.'s 2023 discussion of the variations between the aforementioned business strategies also reveals an effect on the reason beyond food waste. More precisely, food waste occurs primarily at the consumption stage in quick-service restaurants, but it frequently occurs in the kitchen of high-end or hotel restaurants (Charlebois, Creedy, & Massow, 2015). Due to the sensitive specifications of the meals, which only allow for the finest ingredients to be taken, dishes that are exquisitely made and come from upscale hotels or catering services frequently result in waste during the preparation and processing stages. ingredients, but food services in the bottom segment will concentrate on using ingredients to minimize costs. On the contrary, the two groups' diets differ significantly in terms

of quantity, which results in a different amount of food waste being produced during the consumption stage. This is especially true for low-cost restaurants and food services where customers are more likely to leave leftovers because of the larger portion sizes, common ingredients, and flavors.

Moreover, there are notable distinctions in the motivations behind food waste between large, professionally run, chain-linked businesses and small, independently owned or family-run firms (Filimonau et al., 2023). When considered on an equivalent size, the resources, management effectiveness, and utilization of chain branches can vastly surpass those of standalone, non-specialized business models, resulting in distinct food waste production and approaches to the issue (Ritzer, 2018). For the purpose of to get more accurate and thorough data, Betz et al. (2015) divided trash from two businesses (in the business and education sectors) into seven categories and four categories (storage losses, preparation losses, serving losses, and plate waste). food and measured over a duration of five days. The analysis revealed that 7.69% of the volume of all meals served was lost in the process chain in company B (commercial sector) and 10.73% in company A (educational sector). Consequently, waste that might have been avoided is categorized as 91.98% in company A and 78.14% in company B. Serving leftovers, mostly carbohydrates and veggies, results in the highest rate of waste.

The main factor driving wasted food in storage from the kitchen, suppliers, food management organizations, and staff members who produce food is food deterioration (Tomaszewska, Kołożyn-Krajewska, and Bilska, 2020). From an economic standpoint, food suppliers are incentivized to overorder due to bargaining power and negotiation disparities, particularly for small-scale enterprises and partners of a similar size (Krivcova, Pettit, & Florinau, 2019). When food is kept in excess and not eaten before its expiration date, it deteriorates (Filimonau et al., 2023).

The hotel and restaurant industries have long been important to modern society's socioeconomic structure since they provide the eating needs of those who are out-of-home (Filimonau et al., 2021). Multiple studies have demonstrated that the hospitality industry produces a considerable quantity of environmental pollution and excessive utilisation of natural resources (Chou et al., 2012). The hotel and restaurant industry generates approximately 12 million tons of food waste annually, accounting for almost 12% of the total; residences and the food industry follow in second and third place, respectively (Oliveira et al., 2016).

In the 2019 study, Filimonau and de Coteau identified the main obstacle to the wider adoption of environmental management concepts in hotel operations as the relatively small to medium size of many hotel businesses.The same year, study by Filimonau et al. confirmed that managers are reluctant to actively participate in environmental conservation and doubtful about its necessity due to the hospitality industry's lack of hospitality and limited resources. The flow and exchange of knowledge might be restricted by improperly formed management networks (Shaw & Williams, 2009). Hotel firms operating in the service industry are disadvantaged by their low understanding of environmental management strategies (Legrand et al., 2017). Managers find it challenging to emphasis the areas that need intervention in order to mitigate the increasing environmental effect of hotel enterprises (Filimonau et al., 2019). This makes it more difficult for managers to prioritize and transfer internal resources as efficiently as possible while minimizing negative environmental effects, according to Tzschentke et al. (2008).

According to Heikkilä et al. (2016), there are a variety of internal and external elements that might contribute to food waste and loss during various phases of restaurant operations. These factors include processes and operational procedures that take place prior to, during, and after the kitchen (Filimonau & de Coteau, 2019). There are notable distinctions and impact from national markets. A study of casual dining restaurants in Brazil indicated that reducing food waste worked best when food had been offered by a particular weight (Matzembacher, Brancoli, Maia, & Eriksson, 2020). When applying to a different nation, this cannot be applied entirely. For instance, despite being specialized by big enterprises, hot pot is a common meal custom in Asia that is particularly prone to waste because of its ingredient-rich nature (Filimonau, Zhang, & Wang, 2020). As a result, each market requires a different application and strategy to the problem, and cultural considerations related to cuisine are exceptionally important. Carefully evaluating specificity from a market, economic, and cultural standpoint is necessary for an accurate analysis of food waste (Dhir et al., 2020). As indicated by Papagyropoulou et al. (2016), comparative studies must thus concentrate on a variety of markets in order to identify the most appropriate approaches and define the scope of application. However, the existing shortage of such research and its lack of updates make this process highly ambiguous.

As a result of not adopting comprehensive measures to address sustainability, Robinson et al. (2023) revealed that the hospitality industry has also been accused of greenwashing. Furthermore, a lack of assistance and additional funding has historically made it difficult for

independent restaurants and small and medium-sized businesses (SMEs) to adopt programs that offer comprehensive sustainability value (Chan, 2011; Meager et al., 2021). Although Alcorn's 2014 study demonstrated that applying green practices in restaurants has the potential for positive effects for both employees and consumers., the pressure to increase the sustainable impact contributed by the restaurant industry is remained an unanswered question (Maichum et al., 2016). Basic methods first concentrate on handling food waste, extra ingredients, or rotten food. The government or other parties are then responsible for managing this food waste.

Food waste in the foodservice industry worldwide has long been thought to be substantial, but its precise amount has remained unknown (Parfitt, Barthel, & Macnaughton, 2010). Food service companies neglect to concentrate on tracking the quantity of food that is wasted with diligence (Filimonau, Krivcova, & Pettit, 2019). Food waste is an operational concern that has not received enough attention from management and executives (Principato, Pratesi, & Secondi, 2018). This is also due to the fact that food waste computation techniques are not scientific or provide unreliable results, and quantifying food waste in practice is still difficult (Papargyropoulou et al., 2019). For example, during 'peak' season in a busy restaurant kitchen, quantifying food waste and its major streams can be challenging, if not impossible. Additionally, the layout and design of the restaurant have an impact on how much food waste is calculated. For instance, a buffet or hot pot restaurant's kitchen will be more complex than a traditional restaurant with a simple menu.

Research on consumer attitudes and behavior would have a greater impact, according to other studies, since suppliers can encourage their customers to act in more environmentally friendly ways by offering them financial and ethical incentives (Kallbekken and Sælen, 2013). These studies also suggest that customer plate waste makes up a larger portion of all food waste. Furthermore, several other reasons, including individual tastes (Wang et al., 2018), portion control issues, and overordering (Kallbekken & Sælen, 2013), also contribute significantly to the decision made by customers to cause food waste. Following WRAP (Jayne Cox and Phil Downing, 2006), customers fall into three categories of wasting food: high (30%), middle (27%), and low (43%). After conducting 1,862 interviews, Jayne and Phil identified three key food waste groups: young professionals (16-34), full-time workers (42%), young families (25-44), parents (45%), and social renters (typically those in social class DE) (35%). The report identified four primary conclusions as follows. Firstly, those who exhibit indifference towards food waste may do so due to their minimal disposal of food, their perception that food waste is

not a significant issue, their belief that it is an unavoidable occurrence, or their aversion to the risk of illnesses related to food. Secondly, the group that is troubled by this issue might attribute their concerns to three main factors: the waste of financial resources, the feeling of wasting "quality food," and a general sense of shame. Thirdly, the issue of food wastage cost does not significantly worry the responders. Finally, It is notable that the relationship between environmental concern and behaviour change remains uncertain.

Currently, the most common approaches to mitigate food waste consist of the following: modifying on the quantity and the ratio of ingredient and portion, reusing ingredients in a safe and reasonable form in accordance with food safety regulations, actively recycling or collaborating with other organizations, and apply composting technology in solid food waste treatment. However, the implementation of compost technology necessitates substantial investments in infrastructure, advanced technology, and standardized processes, in addition to physical space and adequate area. According to Papagyropoulou et al. (2016), a cleaning firm or a private rubbish collection service would be examples of the third. Food waste separation from ordinary landfills should therefore be prioritized (Sakaguchi et al., 2018). Focusing on strictly controlling supply and predicting sales volume to serve the import of goods is one of the measures that brings long-term efficiency and is a premise for subsequent operating stages. Besides, the significance of individual actions in positively influencing food waste management is emphasised, as well as their responsibility and value. By highlighting and promoting responsible food consumption and shopping, Filimonau & de Coteau additionally make reference to the instruments of behavioral economics and consumer psychology in addition to the two methods already discussed. Local government support and company readiness are two intimate elements that are challenging to balance to ensure that actions are implemented effectively (Filimonau et al., 2019; Heikkilä et al., 2019; Heikkilä et al., 2016; Tatano et al., 2017).

2.4. Hungarian & Vietnamese context

2.4.1. Food waste management in Hungary

Measuring food waste will necessitate more effort and professionalism from larger, chain-connected food service firms. The explanation for this is the fact that when it comes to environmental protection, they frequently create rigid organizational goals (Filimonau, Todorova, Mzembe, Sauer, & Yankholmes, 2020). Nonetheless, small, independent, or family-run foodservice firms make up the majority of the industry (Camillieri, 2018). These companies'

owners are unlikely to invest in environmental advances like measuring and managing food waste unless they are devoted to environmental conservation (Filimonau, Todorova, et al., 2020). Certain estimates of food waste (FW) in the global foodservice industry are derived from country- and regional-specific reports published by different government agencies and industry associations, such as WRAP (2020) for the UK, Sustainable Restaurant Association SRA (2010), and ReFED (2018) for the US. Regardless, the accuracy of these reports has been undermined due to the fact these analysis often rely on self-reported methods for assessing food waste announced by WRAP in 2015. Estimates of FW produced by "independent companies," such as family-run restaurants and small- to medium-sized dining establishments, are uncommon. This is a significant omission given that these companies dominate the worldwide foodservice industry (Filimonau, Todorova et al., 2020).

The food and beverage industry is a substantial sector of the Hungarian economy, according to EMIS (A Euromoney Institutional Investor, 2015). It ranks third in manufacturing sector production and second in terms of employment size. Its share of the overall industrial output was 10.3% in 2014. From starting point of the pandemic in 2019 until 2022, when it was contained, a total of 4,382 establishments in the food service sector ceased operations. This represents a decrease from the initial count of 51,329 catering units (2019) in the industry to the latest figure of 46,947 (2022).

Table 1: *The total amount of catering units in Hungary from 2019 to 2022*

Year	Restaurants and buffets	Confectionaries	Taverns and music club	Public catering units	Workplace, even and mass catering unit	Total catering units
2019	25.325	4013	15.688	45.026	6303	51.329
2020	25.065	4037	14.659	43.761	6429	50.19
2021	23.792	4016	13.385	41.193	6731	47.924
2022	23.181	3949	12.618	39.748	7199	46.947

Source: KSH - Hungarian Central Statistical Office

The World Athletics Championship, which was held in Budapest in 2023, attracted more than half of the approximately 230,000 foreign overnight reservations (Hungary Today, 2023). This represents the most remarkable development since the conclusion of the Covid-19 pandemic, and economy, tourism, and service sector repercussions are beginning to gradually improve. This phenomenon yields substantial advantages for the tourism sector as a whole and the restaurant industry specifically, which shows promising future expansion as demand for dining and travel progressively regains popularity.

Likewise to other European nations, Hungary faces a significant difficulty with food waste, which has not been fully addressed despite the FUSION project's establishment to investigate the phenomena of FW in the EU-28. The evidence is that, despite being one of Europe's unique cultural and tourism hubs, Hungary is among the ten EU-28 nations that do not provide any information on food waste. With the tourism industry booming in the wake of the pandemic, the economy is drastically changing. Similarly, a more recent investigation carried out by Bori (2018) revealed that Hungary wastes nearly 2 million tonnes of food each year, although it was unable to accurately quantify the portion attributed to food services.

52% of the companies in Hungary that responded to the study stated that they kept track of food loss measurements; 9.7% of them said they could calculate the losses, and 20% said they could specifically calculate the amount of damages; however, 8.6% of respondents gave a completely negative response, indicating that there is no way to estimate the damages and that it is impossible to determine the data from the records (Kurthy et al., 2021). According to data from the Hungarian National Tax Office in 2016, another study was also carried out with a focus on businesses in the food industry; however, it is thought that this study does not accurately

represent reality, as small and micro enterprises make up a significantly smaller proportion of the business sector than large and medium-sized businesses, which account for a proportion that is quite high (Kurthy et al., 2021). This makes sense because big businesses can more readily communicate their ideas with the public and have greater access to surveys. Larger businesses are also more interested in this topic, seeking knowledge and solutions as well as gaining more expertise in waste management, since they deal with the issue of food loss and its harm more than small and micro businesses do.

In 2021, Filimonau and Sulyok conducted a study in Veszprem, Hungary, and the majority of the participants confirmed that the primary factor causing a significant amount of food waste to be generated is consumer behavior. The relationship between this component and variables like eating habits, portion sizes, and individual preferences (Filimonau, Todorova, et al., 2020). On the other hand reparing more food than needed is the result of errors in demand planning leading to food waste, which was recognized by Pirani & Arafat in 2014. Seasonality should be taken very seriously for this driver, particularly as the two places under discussion - Budapest and Hanoi, are both well-known travel destinations with distinct high and low visitor seasons. Cooking becomes a priority when traveling when you want to save money, nevertheless, as self-sufficient low-cost travel with an emphasis on budget tightness is becoming a global trend and even surpassing package tours (Günter Spreitzhofer, 2010). This implies that dining out will not be the best option for this particular set of travelers. Since eating out is no longer the favored option for tourists—at least not in the recent past—restaurants and food service organizations must modify their food budgets to prevent food waste or excess, even during the busiest travel seasons. Furthermore, most food is left over from dinner service during the low season, especially at restaurants that serve a la carte menus, as contrast to lunch, which has a set menu and clientele. (Sulyok & Florinau, 2021). The À la carte menu format is widely acknowledged to be a contributing factor to food waste, and it makes perfect sense in the Hungarian setting (Filimonau, Fidan, et al., 2019). The same exists for Vietnam, a country well-known for its diverse cuisine that includes a lot of foods that travelers find challenging to eat. With the case study of the H.N. restaurant, the research object possesses all the previously described attributes, including a fixed lunch menu, plus à la carte menu, and Vietnamese foods. The primary target audience for this research is Hungarian, main customer segment that the case study serves.

2.4.2. Food waste management in Vietnam

In the first quarter of 2018, approximately 25% of the food produced in Vietnam was lost before it could reach processing factories or distribution sites. The total estimated losses amounted to 8.8 million tonnes or US$ 3.9 billion, which is equivalent to 2% of Vietnam's GDP and 12% of its Agriculture GDP, according to CEL Consulting (2018). It is a frequent occurrence to observe individuals at food and beverage establishments disposing of leftover food into containers that have covers, while wastewater is carelessly poured down the drain or discarded on the roadside, resulting in the degradation of Hanoi's aesthetic appeal. Urban management has led to environmental degradation and public outcry. Hoi An, Vietnam's preeminent tourist destination, documented a total of 1500 kg of waste, with restaurants accounting for 46% and hotels accounting for 22%. Approximately 46.79% of the garbage consists of kitchen waste. Based on an analysis of collected data and surveys, CEL Consulting concluded in 2018 that the fruit and vegetable industry experienced the most significant rate of loss, equivalent to 32% or 7.3 million tonnes annually. Generally, the meat statistics indicate a quantity of 694,000 tonnes per year, which accounts for 14% of the total. Similarly, fish statistics show a quantity of 804,000 tonnes per year, equivalent to 12% of the total.

Another large-scale metropolis in Vietnam is Ho Chi Minh city, which has the per capita food waste rate ranges from 0.9 to 1.38 kg/person/day, with food waste accounting for approximately 50% to 55% (approximately 0.5 to 0.76 kg /person/day) (Thi, 2015), and about 83–88.9% of Ho Chi Minh City's food waste was ended up in landfills. Out of the substantial quantity of food waste, only 10% is utilized for compost manufacturing. Currently, waste classifying in Ho Chi Minh is primarily ignored. The complexity of everyday activities, paired with the frequent occurrence of these activities, along with the inadequate distribution of infrastructure and the absence of proper waste treatment procedures, present challenges in organising waste storage and containment for separating food waste from other types of solid waste (Ngoc Bao Dung Thi et al., 2017).

Table 2: *Volume of municipal solid waste, composition, and ratio of food waste generation per capitain selected cities in Southeast Asia*

City	Da Nang	Hanoi	Ho Chi Minh City	Bangkok	Phnom Penh
Year	2018	2015	2018	2016	2015
Population (1000 persons)	1080	4371	8100	9166	1446
Food waste fraction (%)	57.3	57.3	65.7	47.6	51.9
Collected/landfilled municipal solid waste (tons/day)	994	4980	9400	10,130	1121
Food waste generation rate (kg/day.cap)	0.52	0.65	0.76	0.53	0.40

Source: Ngoc Bao Pham et al., 2021

When comparing the rate of food waste generation in Da Nang, a famous tourist destination in Vietnam with 7.94 million visitors in 2023 (Ngo Anh Van, 2024), to other big urban areas in Vietnam (Hanoi, Ho Chi Minh City) and other developing country's cities in Southeast Asia (Bangkok, Phnom Penh), it is evident that Da Nang has an immensely high level of food waste generation (Ngoc Bao Pham et al., 2021). In 2016, despite Bangkok having a population nine times larger than Da Nang, both cities had a similar amount of food waste per person. Despite Ho Chi Minh City having a population eight times larger than Da Nang, its per capita food waste generation rate was just 48% higher.

The variation in lifestyle, solid waste management practices (including the handling and disposal of food waste), as well as the attitudes and understanding of the local population in Da Nang, may account for this discrepancy when compared to other cities. Simultaneously, the tourism sector in Da Nang is experiencing rapid growth and faces the potential danger of becoming unmanageable due to an anticipated surge in tourist numbers, projected to reach 8.4 million individuals by 2024 (People's Newspaper, 2024).

The pre-recycling procedure has either not been implemented or has not been implemented comprehensively from the initial phase, leading to inadequate food processing and preparation in restaurant and hotel kitchens. Uyen Vu's 2022 study has demonstrated that it is possible to fully utilise all components of food, including those that are considered unhealthy. However, the majority of individuals choose to opt for discarding such

components. Hotel restaurant operators are sometimes criticised for neglecting to prioritise food optimisation due to the low food prices in Vietnam, despite the fact that the food service industry yields very large profits. Hence, it is comprehensible to discard a withered vegetable, a damaged piece of fruit, and similar items.

The highly competitive nature of the out-of-home food consumption market, especially at the local scale, makes it impossible to control portion sizes, design portions for different subjects, and cook on demand. effective. The example of Veszprem is a testament because of the small city size, most food service operators are located close to each other, the customer base is long-standing and the majority are local regulars (Filimonau & Sulyok, 2021).

Certain enterprises that impose certain conditions, such as IHG Hotels & Resorts, have undertaken initiatives and launched campaigns to provide sustenance to the most impoverished communities in Vietnam. Their charitable network ensures that food from community hotels is not wasted and is instead utilised to sustain a variety of individuals. When businesses in the hospitality industry initiate efforts to address the critical matter of surplus food, educate communities about food security and sustainability, and donate meals to underserved individuals in Vietnam, this is a positive sign, particularly when these initiatives originate from large, influential, and widespread enterprises. Such initiatives set a positive example for other businesses to emulate.

The literature described above discusses a number of comprehensive research on food waste management in the restaurant industry. However, it indicates that there is still a lack of thorough study. Given the unique characteristics of a Vietnamese restaurant in terms of food preparation, cultural significance, and the consumer and staff behaviour, it is necessary to adopt specific food waste minimization measures for this particular case study in Budapest. This literature review emphasises the necessity for a more profound comprehension of these distinct circumstances in order to develop more efficient, considerate, and multifaceted strategies for managing food waste. This study aims to fill the existing knowledge vacuum by conducting a comparative examination of the factors that impact food waste in this varied culinary environment.

3. Methodology

3.1. Goal and scope of the study

As stated in the literature review, food waste in the food service sector may originate from two sources: consumers and food suppliers, particularly in hotels and restaurants. For this study, the research will examine both the perspectives of customers and the restaurant, including staff and owners.

A study was conducted to analyze the food waste and food waste management practices of H.N. restaurant, with four primary objectives. Initially, the project will clarify the level of food waste at H.N. restaurant by manual monitoring, classification, and measuring techniques. Secondly, the study will investigate the factors and incentives behind the generation of food waste by both customers and restaurants. It will focus on the relationship between customers' consumerism and the amount of leftover they generate and their attitudes toward it. Also, it will explore the connection between work habits, recipes, culinary methods, and employee culture in relation to food waste creation and management. Thirdly, the research will review the efficacy of H.N.'s existing food waste management procedures and identify the challenges encountered by restaurants, along with the constraints limiting their food waste management efforts. Eventually, the research will include the assessment of both customers and restaurant employees, and ultimately suggest practical and most effective approaches for H.N. to mitigate food waste, multidimensionally.

With the intention to achieve the goals listed above, the research will apply qualitative methodologies and quantitative analyses parallelly. This study has been limited to the geographical area of H.N. restaurant. The data in this study were obtained by the administration of questionnaire surveys, personally online interviews with one of two business owners, and manual measurements.

3.2. Data sample and data collection

3.2.1. Data sample

The interview with Mr. Vo Hai, the owner of the restaurant, was conducted online and complied with a predetermined set of questions. On March 27, 2024, the interview was conducted out, and a voice recording was made afterward. In compliance with the proprietor's desire, certain

information concerning the restaurant's suppliers, imports and exports, and profits is kept confidential.

Food waste of H.N. was carefully observed and documented from February 12 to February 25, 2024. Food waste was retrieved from the food waste containers in two cooking zones, two dishwashing zones, and two preparation zones. In addition, the number of items with leftovers on the plate is recorded and counted as well as classified as vegetarian and non-vegetarian. The restaurant's ordering system also tracks and approximates the number of clients served each day during the period of measurement.

The targeted sample size of the customer survey was 100, while the actual sample size consisted of 111 responses. The customer survey (called Survey 1) is participated in by customers who have visited the restaurant within 1 week and are between the ages of under 18 and over 65 years old. Significant variations exist in food waste behaviors among different generations. A study conducted by T.E. Quested and colleagues in 2013, titled "Spaghetti Soup: The Complex World of Food Waste Behaviors" revealed that individuals aged 65 and above who suffered food shortages during or after World War II waste approximately 25% less food compared to the rest of the population. As a result of limitations related to language and time, the survey received a limited number of replies from participants aged 65 and older, accounting for only 3.6% (4 responses). Despite its favorable position, H.N. is rarely frequented by visitors. Thus, many poll respondents were local residents and regular guests.

The employee survey (Survey 2) obtained responses from a total of 22 restaurant employees across several departments, including the kitchen area (cooking and preparation), dishwashing area, service area (front of the house), and the managers. The difference in age and awareness between restaurant staffs reveals valuable insights into their work ethics and perspectives on the issue of food waste.

3.2.2. Data collection

Primary data of this study includes two questionnaire surveys, one in-depth interview and food waste measure data.

The survey data was collected and determination followed by data collection analyzed in two distinct steps: preliminary and analysis. The questionnaire has been developed using the author's direct observations as a supervisor of service staff during a position of internship.

This experience involved observing customer behavior regarding leftover food on their plates, as well as monitoring the generation of food waste by staff members and their preferred ways of handling this food waste. The questionnaire is organized into three sections, which include demographic information, awareness and perception of the environment and food waste, and habits related to consuming and handling food waste/leftovers.

The fundamental objective of the initial part of Survey 1 involves identifying key variables associated with the influence of customer behavior, habits, and perceptions on the generation of food waste, particularly in relation to leftovers. Leftovers are recognized as a major contributor to food waste, accounting for a substantial portion, with a significant amount of it being edible. For the identification step of Survey 2, the purpose remained identical. It is important to acknowledge that the creation of food waste during food handling, which includes storage, processing, cooking, and serving, is unavoidable. Although these losses may not be clearly visible as production from customers, they still need to be taken into account. An evaluation will be conducted on the causes of food waste in restaurants, focusing on the employees' level of consciousness and work practices, as well as the cultural elements, rules, and recipes followed by the establishment. The pilot-testing procedure was conducted by distributing the task to ten participants. Once the feedback on the questionnaire, confusing questions, and definitions were gathered, all necessary modifications were implemented.

Firstly, from March 18 to March 24, Survey 1 was conducted using a Google form and distributed to H.N. after they order food using a tablet with the form interface enabled and ready to fill out. The form is specifically created to be completed within a time frame of 5 to 7 minutes, matching with the time frame for waiting for the customer's food. This ensures that time is not wasted and the customer does not experience any discomfort. Additionally, the completion of the form is based on a voluntary spirit. In the meantime, Survey 2 was administered by distributing it to employees through text messages within the internal program Base. Employees who are elderly or have difficulty with language will be provided with a tablet or phone. This device will contain a pre-prepared form that they can easily fill out. Alternatively, an interpreter will be available to explain the questions in the survey form and record their replies.

Secondly, on March 26, 2024, the compilation of interview questions was finalized for the first time and discussed through email correspondence with Mr. Vo Hai. The interview was conducted on March 28, 2024 at 5:30 pm in Budapest via Google Meet, after obtaining consent

for the list of questions. The entire conversation was videotaped. Further discussion was held regarding some additional side questions.

Finally, the data collected on the actual amount of food waste of H.N.. Between February 12 and 25, 2024, monitoring and measurement were used to uncover the quantitative data regarding H.N.'s food waste scenario. The number of customers served each day within 2 weeks of measurement is also monitored and estimated by the restaurant's ordering system. As an intern shift supervisor, the author was granted access to H.N.'s waste management area, specifically the section dedicated to handling food waste. H.N. categorizes and separates food waste into three specific areas: the cooking area, preparation area, and dishwashing area. There are a total of two cooking areas, with two trash bins allocated to each area for the purpose of storing food waste while cooking. Similarly, two trash bins are positioned in each of the two preparation areas. In regards to the dishwashing section, there are two designated locations. Apart from the two standard bins, a smaller bin is utilized specifically for storing leftover vegetarian dishes. In addition, a fixed amount of food waste every day based on the restaurant's recipes and principles is transferred directly to the general trash bin at the end of each day. In a further step, the author records and categorizes the specific amount of items that leftovers exsited (excluding packaged ones) using vegetarian and non-vegetarian labels, with the help of two dishwashers. At end of each day during the experiment period, with assistance from fellow staff members, the weight of every garbage bin is measured manually using a 30kg scale. On the other hand, there were a few situations where the amount of waste surpasses the capacity of the scale and cannot be subdivided into smaller portions for weighing (despite the oversight being minor), the measurements obtained are considered relative. The collected food waste components include: two types of vegetarian and non-vegetarian leftovers, food waste generated during the cooking process, food waste generated during the preparation process and fixed food waste including bones and vegetables used to make broth for noodle soup and other dishes. Cooking oil is changed every two days, transferred to another area and handed over to another partner for processing.

3.3. Data analysis

The volume data obtained from the measurement provides insights into the food waste situation in H.N., including the specific volume of each type of food waste. This allows for comparisons to be made, such as identifying which ingredients are most commonly left over and comparing the leftovers of vegetarian and non-vegetarian foods. This outcome enables the computation of

the mean quantity of food waste per day for a single guest (with the number of guests per day recorded by the ordering system). Furthermore, the act of observing and documenting leftovers from both vegetarian and non-vegetarian groups aids in determining the rate at which leftovers are left behind for these two dietary categories. Answers from the interview are typed in writing as well as taken notes during the interview process. Missing or confusing information is updated and discussed via internal software Base (already included in the interview text).

Data from the questionnaire was analyzed using SPSS 26 software. Three stages of data solving were involved: identifying unreliable surveys, coding and processing data, and analyzing the data. The study applied statistical analysis techniques such as frequency analysis, descriptive analysis, mean and standard deviation calculation to achieve its objectives. Aside analysis from sociodemographic information, the causes of food waste also consider customers' eating and ordering habits, as well as the working habits and perception of restaurant staffs. Additionally, attitudes towards and management of leftovers, as well as the frequency and description of food waste, are considered to assess the influence of various factors.

Demographic data of Survey 1 includes age, gender, education level, employment status and income. Demographic data of Survey 2 includes age, gender and work position. Survey 1 includes a section on eating and ordering patterns, which provides details on the frequency of dining at the restaurant, preferred meal times, ordering preferences, frequency of leaving food uneaten, eating preferences, and factors influencing the decision not to consume food that remains. The following section of Survey 2 comprises an evaluation of team members' awareness and working habits, as well as an assessment of the restaurant's food waste situation and its management. Finally, a section asking about potential food waste treatment and reduction methods was included at the end of the form in both surveys, contributing to the evaluation and discussion of the recommendation.

3.4. Research questions

Five research questions will need to be answered by the collected data:

RQ1: What is the magnitude of H.N.’s food waste?

RQ2: What are the primary sources of food waste and specific key drivers?

RQ3: How does H.N. manage their food waste and how effective are the current practices?

RQ4: What challenges and limitations does the restaurant encounter in managing food waste?

RQ5: Which feasible measures can be applied to enhance food waste management in H.N.?

4. Results and discussion

4.1. Introduction about the H.N. case study

The case study revolves around H.N. restaurant, a Vietnamese restaurant situated in District 11. One notable advantage is the restaurant's strategic location in a bustling region that is home to various universities, offices, and the Allee shopping centre. In addition, it is also surrounded by conveniently located traffic crossings leading to the city centre and bustling areas. The restaurant was founded in 2013 and has since been recognised as one of the top Vietnamese restaurants in Budapest, Hungary. It is highly favoured by both locals and visitors and has received high ratings on Trip Advisor (4.5 out of 5 stars) and Google (4.75 out of 5 stars).

The restaurant runs from 10:00 to 21:00, offering a selection of authentic Vietnamese cuisine and meals prepared in the traditional Vietnamese cooking style. During weekdays, specifically from Monday to Friday, between the hours of 11:00 and 15:00, clients are provided with an expanded selection for their office lunch. In addition to the regular a la carte menu, customers can choose from a variety of reasonably priced lunch options. These options include a package of dishes accompanied with soup. The costs for these lunch menus, along with a drink, range from under 4000 HUF per meal.

The capacity of the restaurant is 105, which may be expanded to handle up to 110 seats by adding extra chairs. The restaurant undergoes its highest levels of activity during the time period between 11:00 and 14:00, and between 18:00 and 20:00. The restaurant personnel presently engages a total of 22 people, consisting of 2 co-owners and managers, 9 service team members, and 11 people working in various roles within the kitchen, including preparation, cooking, and dishwashing sections.

The Pho noodle soup, which is the most renowned Vietnamese cuisine, is available in two sizes: medium and big, and remains the top-selling item. Once customers have specific requests, the restaurant consistently attempts to accommodate them. This includes providing smaller portions for children or preparing dishes without certain ingredients that the customer prefers not to have. Nevertheless, there are still several issues with the volume and size of food that H.N. presently offers to customers. The restaurant prioritises cost minimization and optimisation, as well as striving to best utilise materials in the process of cooking and food preparation. Their menu went through multiple revisions and redesigns. However, the business owners

acknowledge the need for more cautious adjustments due to unresolved issues which will be further examined in the following section.

4.2. Food waste measurement

4.2.1. Volume of food waste (FW)

Table 3*: Types of food waste*

Type of FW	Quantity (kg)	Percentage
Leftover	544.8	47%
FW cooking	50.8	4.4%
FW preparation	81.1	7.0%
Fixed FW	420	36.3%
Cooking oil	60	5.2%
Total	1156.7	100%
Average FW/day	82.6	Total guests in two
Average FW/guest/day	0.22	weeks: 5198 people

Source: from findings of the study

The data acquired from the 2-week measuring experiment indicates that the volume of food waste accumulated is 1156.7 kg. The primary category of food waste is leftovers, which amount to 544.8 kg, constituting 47% overall. The cooking procedure generates a total of 50.8 kg of food waste, representing 4.4%. This food waste can be attributed to either overcooked or burnt food, or faults committed during the cooking process. The preparation process leaves 81.1 kg of waste, which accounts for 7% of the overall volume containing the peels, trimmings, inedible or unused parts, and others food that is discarded during the preparation phase. The quantity of garbage generated by cooking oil is 60 kg, corresponding for 5.2% of the overall waste. This is most referring to the disposal of used frying oil or extra grease. Furthermore, a substantial proportion of the trash is categorized as 'Fixed FW', totaling 420 kg, representing 36.3%. This category is referred to unavoidable waste, includeing bones and vegetables that are boiled to create the broth for Pho soup and other dishes, considered the indispensable part of H.N. and the core of the menu. The restaurant generates an average of 82.6 kg of food waste (FW) per day, providing a quantitative measure and an indication of the daily scale of waste. Considering the total of 5198 guests in two weeks, the waste created by each individual guest is relatively small, 0.2kg per guest. Nevertheless, when combined, these individual contributions result in a substantial amount of food waste. The per guest waste metric is essential for directing waste reduction efforts towards consumers, particularly through initiatives aimed at adjusting portion sizes.

4.2.2. Leftover classification and the ratios

The table in the previous section clearly demonstrates that leftovers constitute the largest share of overall food waste, reaching to 544.8kg. The implementation of separate waste containers in the dishwashing area allows for the collection of more precise data regarding leftovers, categorized according to vegetarian and non-vegetarian labels.

Table 4: *Types of leftover*

Type of leftover	Quantity (kg)	Percentage
Vegan leftover	93.9	17.2%
Non-vegan leftover	450.9	82.8%
Total	544.8	100%

Source: from findings of the study

The amount of leftover food from two varieties of vegetarian food and non-vegetarian food is 93.9 kg and 450.9 kg, respectively. However, to determine the further details, the total items sold, the total items with leftovers, and the classification of each of those items.

Table 5: *Total sold items*

Items	Quantity (kg)	Percentage
Vegan items	1039	8.1%
Non-vegan items	11388	88.4%
Lunch menu items	459	3.6%
Total	12886	100.0%

Source: from findings of the study

The restaurant sold 1,039 vegan items, which makes up 8% of the total items. This relatively low percentage might reflect a smaller demand for vegan options. It is comprehensible that just 1% among those questioned in Hungary adhere to vegan dietary guidelines, as indicated by the statistical data released by Nils-Gerrit Wunsch on Statista in 2023. On the other hand, a recent survey conducted by the University of Nyíregyháza in 2022 reveals that between 4% to 6% of Hungary's population currently follows to a vegetarian diet. An additional study published in World Population Review estimated that vegetarianism comprises approximately 5% of Hungary's population, or approximately 450,000 people (2024).

In relation to the lunch menu, a handful of three meal sets is available to accommodate students, office workers, and other laborers in District 11 to provide guests with a diversity of options

and a quick and convenient lunch . Each set contains a starch-based option (such as noodles or rice), a main dish, and an adequate serving of soup. Basic meals averaging between 2,000 and 4,000 HUF, comprising either a single dish and a beverage or a single dish and a main course. Even though the lunch menu is available from 1:00 pm to 3:00 pm, the standard menu is still offered during that time. The lunch menu is accessible Monday through Friday. Each day, there are three alternatives to choose from. One of these options is unique to that day and is only served once a week. The other two options are repeated twice during the week, appearing on another day of the week and this menu is fixed every week. There were 459 items sold from the lunch menu during the 2-week experiment, which is an average of approximately 46 lunch sets sold.

The non-vegan items had the highest sales position, with a total of 11,388 items sold, representing an astounding 88.4% of the total purchases. This indicates a significant customer inclination towards H.N.'s non-vegan cuisine and these are the primary choice for the restaurant's customers. Nonetheless, the ratio of uneaten food among those mentioned food categories provides new insights on the tendency to leave leftover food based on menu choices.

Table 6: *Items with leftovers and ratio on creating leftovers*

Items with leftover	Quantity	Ratio of leftovers created by type of food (items with leftover/total items)
Vegan	295	28.40%
Non-vegan (lunch not included)	1512	13.30%
Lunch	112	24.40%
Total	1919	15%

Source: from the findings of the study

Due to the given table, it is evident that non-vegan foods at H.N. Vietnamese restaurant contribute to a substantial quantity of leftovers, accounting for 1512 items, which is equivalent to 78.8% of the total items with uneaten food left. Remarkably, the proportion of leftovers for vegan foods has a higher percentage (28.4%) compared to non-vegan items (13.3%). This implies that although non-vegan items constitute the majority of leftovers in terms of amount, vegan items are more prone to being left over relative to their sales frequency. An empirical study was done to emphasize the most commonly neglected components of vegetarian cuisine. It is compared before and after being given to the customer's table. These parts are side dishes consisting of rice and noodles, stir-fried vegetables, and braised tofu. While another type of tofu served which is fried tofu, is not commonly found in post-consumer portions that reach the dishwashing area.

This suggests that the portion size of vegetarian dishes sets barriers either in terms of quantity or taste. One possible explanation could be that Vietnamese-style vegetarian foods contain flavors that are not as familiar to local diners. Also, the portion size may be substantial in relation to the customer's appetite level. The implicit recognition of the diminished starvation among those adhering to a vegetarian diet may contribute to the higher occurrence of leftovers in vegetarian dishes. In 2005, Karen Collins and R.D reported that vegetarians generally have a lower body weight compared to meat-eaters. Furthermore, the calorie intake of these individuals decreased by approximately 200 calories per day upon adopting a vegetarian diet.

Recently, there has been an increasing trend towards vegetarianism and the consumption of plant-based goods. This shift is driven by a heightened awareness of the need to protect the environment and ecosystem, as well as a recognition of the potential health benefits for humans (A.Saari et al., 2021). Yet, ultimately, not everyone chooses to adopt a vegan lifestyle. Non-

vegan diners may occasionally order vegan foods out of curiosity, but they may not always find them as enjoyable as their usual selections.

The lunch items exhibit a significant leftover ratio of 24.4%, despite the sale of only 459 meals. This implies that, on average, 11 lunch items remain unconsumed completely per workday. A study conducted by Le Lan Phuong in 2017 revealed that customers have a propensity to discard between 10% and 20% of their meals when they are presented with a set menu. The menu varies between different days of the week and avoids repeating meals, however it remains consistent on a weekly basis. The fixed menu may become repetitive for customers who visit frequently during lunchtime, resulting in a decline in their motivation to complete their meals. The lunch consumer base primarily consists of office workers, university students, and a certain number of manual workers, resulting in potential variations in their appetite. Due to limited time, customers frequently desire a meal that is convenient, compact, and time-saving. The lunch menu is a good choice for this reason. However, the portion sizes provided are considered generous by H.N. for lunch can be perceived to be excessively large.

4.3. Results from the surveys

4.3.1. Sociodemographic characteristics

Two Google forms were administered, resulting in 111 responses for Survey 1 (Customer Survey) and 22 responses for Survey 2 (Employees Survey). All the answers are acceptable and none of the responses needed to be excluded.

Regarding the nationality component of Survey 1, it was stated in the introduction that a majority of responses would be from frequent customers and local individuals. However, due to the diverse and multi-ethnic composition of the citizens, the collected answers are varied and distinct. Particularly, 69.3% of the participants hold Hungarian nationality, while the remaining 30.7% are from various European, Asian, and African nations.

Table 7: *Socio-Demographic data of Survey 1 (Customer Survey)*

Age	Frequency	Percent	Cumulative Percent
Under 18	7	6.3%	6.3%
18-24	35	31.5%	37.8%
25-34	29	26.1%	64.0%
35-44	16	14.4%	78.4%
45-54	12	10.8%	89.2%
55-64	8	7.2%	96.4%
Above 65	4	3.6%	100.0%
Gender			
Female	60	54.1%	54.1%
Male	46	41.4%	95.5%
Prefer not to say	5	4.5%	100.0%
Nationality			
Hungary	77	69.4%	69.4%
Other Europeans countries	7	6.3%	75.7%
Asian countries	25	22.5%	98.2%
African countries	2	1.8%	100.0%
Employment Status			
Full-time	60	54.1%	54.1%
Part-time	9	8.1%	62.2%
Self-employed	17	15.3%	77.5%
Unemployed	2	1.8%	79.3%
Student	20	18.0%	97.3%
Retired	3	2.7%	100.0%
Monthly Income			
Below average	22	19.8%	19.8%
Average	36	32.4%	52.3%
Above average	53	47.7%	100.0%
Level of education			
Highschool	40	36.0%	36.0%
College or Vocational Traning	12	10.8%	46.8%
Bachelor's Degree	51	45.9%	92.8%
Higher Education	8	7.2%	100.0%
Frequency of dining			
Multiple times a week	39	35.1%	35.1%
Once a week	35	31.5%	66.7%
A few times a month	23	20.7%	87.4%
Once a month	2	1.8%	89.2%
Less than once a month	4	3.6%	92.8%
This is my first time	8	7.2%	100.0%

Source: from findings of the study

In relation to Survey 2, there is a significant disparity in the nationalities of the restaurant's staff, with 77.3% being Vietnamese and only 22.7% having Hungarian nationality. Hence, cultural and identity issues might influence the outcomes of a survey, leading to discrepancies in responses when individuals are asked about the same matter.

Table 8: *Socio-Demographic data of Survey 2 (Employee Survey)*

Age	Frequency	Percentage	Cumulative Percent
18-24	9	40.9%	40.9%
25-34	7	31.8%	72.7%
35-44	3	13.6%	86.4%
45-55	2	9.1%	95.5%
Above 55	1	4.5%	100.0%
Nationality			
Vietnamese	17	77.3%	77.3%
Hungarian	5	22.7%	100.0%
Work Position			
Manager	2	9.1%	9.1%
Kitchen area	6	27.3%	36.4%
Service area	9	40.9%	77.3%
Preparation area	3	13.6%	90.9%
Dishwashing area	2	9.1%	100.0%

Source: from findings of the study

4.3.2. Impacts of customers on food waste generation

All responses obtained from Survey 1 will be analyzed in this section including data tables designed to facilitate the discussion.

- *Frequency of the food waste generation by customers*

In an attempt to obtain comparative data and establish correlations, the primary focus of analysis will be on the frequency of leftover food when dining at H.N. This will allow us to draw implications and identify the factors that influence customers' food waste production. This data will be juxtaposed with other influential elements listed in the findings section throughout this results and discussion section.

Table 9: *African: Frequency of leaving food uneaten at H.N.*

Frequency of leaving food uneaten	Frequency	Percent	Cumulative Percent
Always	21	18.9%	18.9%
Often	49	44.1%	63.1%
Rarely	30	27.0%	90.1%
Never	11	9.9%	100.0%
Total	111	100.0%	
Mean value	2.721		

Source: from findings of the study

The mean score of 2.72 on a scale ranging from 1 (indicating 'Never' leaving food uneaten) to 4 (indicating 'Always' leaving food uneaten), meaning 4 is the maximum value, implies that the guests tend to occasionally leave food uneaten. The value is closer to 3 ('Often') rather than 2 ('Rarely'), suggesting that a substantial proportion of customers consistently fail to complete their meals.

- *Comparison between demographic information and food waste generation*

The acquired demographic information is used to make comparisons of food waste generation among consumers based on age, gender, nationality, income, education level, and labour status for a preliminary assessment.

Table 10: *Comparison on age and frequency of leaving food uneaten*

Age	Frequency of leaving food uneaten				Total	Mean value
	1	2	3	4		
	Never	Rarely	Often	Always		
Under 18	0	1	2	4	7	3.43
18-24	1	12	20	2	35	2.66
25-34	3	8	10	8	29	2.79
35-44	3	5	6	2	16	3.17
45-54	0	2	6	4	12	2.38
55-64	2	2	3	1	8	2.00
Above 65	2	0	2	0	4	2.69
Total	11	30	49	21	111	2.72

Source: from findings of the study

The data suggests that younger customers, particularly those under 18, are more likely to leave food uneaten, as evidenced by the highest average value of 3.43. In contrast, the 18-24 and 25-34 age group demonstrates a higher level of awareness regarding food waste, as indicated by the lower average score of 2.66. Diners in the middle age range, specifically for the people aged

45 and over, exhibit a more diverse range of reactions, with a higher level of awareness and consideration towards waste, even though there are some fluctuations, but the gaps are not significant. Interestingly, those between the ages of 35-44 exhibit a greater inclination to leave food uneaten, with an average value of 3.17, which is somewhat lower than the youngest age group, under 18, who had the highest average of 3.43.

Table 11: *Comparison on gender and frequency of leaving food uneaten*

Gender	Frequency of leaving food uneaten				Total	Mean value
	1	2	3	4		
	Never	Rarely	Often	Always		
Female	2	19	24	15	60	2.87
Male	8	9	23	6	46	2.59
Prefer not to say	1	2	2	0	5	2.20
Total	11	30	49	21	111	2.72

Source: from findings of the study

The data illustrates that there are variations by gender in the frequency of leaving uneaten food, with women exhibiting a higher tendency to leave more food compared to males, as well as people who choose not to disclose their gender in the restaurant. It is potential that the portion amounts are more appropriate for male participants or those who chose not to disclose their gender than women.

Table 12: *Comparison on nationality and frequency of leaving food uneaten*

Nationality	Frequency of leaving food uneaten				Total	Mean value
	Never	Rarely	Often	Always		
Hungary	7	24	32	14	77	2.69
Other European countries	0	2	5	0	7	2.71
Asian countries	3	4	11	7	25	2.88
Afican countries	1	0	1	0	2	2.00
Total	11	30	49	21	111	2.72

Source: from findings of the study

There are slight variations in food wastage behaviours among different nationalities. Asian customers tend to leave more uneaten food than others, while African customers leave the least amount of food uneaten, with the small sample size. Hungarian and other European citizens have wastage levels that are close to the overall average (2.72), with mean values of 2.69 and 2.71, respectively. These insights could be used to measure culturally appropriate modifications to portion sizes, flavor adjustment and menu choices.

Table 13: *Comparison on employment status and frequency of leaving food uneaten*

Employment Status	Frequency of leaving food uneaten				Total	Mean value
	1	2	3	4		
	Never	Rarely	Often	Always		
Full-time	4	19	25	12	60	2.75
Part-time	2	3	4	0	9	2.22
Self-employed	3	3	8	3	17	2.65
Unemployed	0	0	2	0	2	3.00
Student	1	5	8	6	20	2.95
Retired	1	0	2	0	3	2.33
Total	11	30	49	21	111	2.72

Source: from findings of the study

The mean values for students and the unemployed who leave a significant amount of food uneaten are 2.95 and 3.00, respectively. In contrast, part-time workers have the lowest mean value of 2.22 for food uneaten, followed by retirees at 2.33.

Table 14: *Comparison on monthly income and frequency of leaving food uneaten*

Monthly Income	Frequency of leaving food uneaten				Total	Mean value
	1	2	3	4		
	Never	Rarely	Often	Always		
Below average	3	5	9	5	22	2.73
Average	2	8	21	5	36	2.81
Above average	6	17	19	11	53	2.66
Total	11	30	49	21	111	2.72

Source: from findings of the study

In brief, people earning higher monthly incomes appear to be marginally less likely to leave food uneaten, whereas those earning lower incomes are slightly more likely not to finish their meals. Nevertheless, the differences are negligible, indicating that income does not significantly distinguish this conduct.

Table 15: *Comparison on educational level and frequency of leaving food uneaten*

Level of education	Frequency of leaving food uneaten				Total	Mean value
	1	2	3	4		
	Never	Rarely	Often	Always		
Highschool	3	8	18	11	40	2.93
College or Vocational Training	2	5	3	2	12	2.42
Bachelor's Degree	3	14	26	8	51	2.76
Higher Education	3	3	2	0	8	1.88
Total	11	30	49	21	111	2.72

Source: from findings of the study

Those with an education in high school exhibit the highest frequency of consistently leaving food uneaten, with a mean value of 2.93. This finding implies a lower degree of involvement in addressing concerns related to food waste among individuals at this educational level. Individuals who have received college or vocational training have a lower mean score of 2.42, which suggests that they leave uneaten food less frequently. Individuals with a Bachelor's degree exhibit a mean value of 2.76, indicating a modest tendency to leave meals uneaten. Participants with higher education exhibit a lower frequency of leaving food uneaten, as indicated by a mean value of 1.88. This suggests that this group possesses a greater awareness or employs more effective food management strategies. Compared to the average value of 2.72, it can be deduced that educational attainment influences food waste behaviour, with greater levels of education being associated with less frequent food waste.

- *Food waste perception and awareness*

The level of awareness and comprehension of the food waste issue among H.N.'s customers is assessed through the administration of a series of fundamental inquiries.

Table 16: *Findings on customer's food waste perception*

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total	Mean value
	1	2	3	4	5		
Level of agreement of the FW is needed more attentions	0	5	22	46	38	111	4.05
Level of concern on FW (From Not concerned at all to Extremely concerned)	4	8	21	51	27	111	3.80
Level of agreement on complying future measures	1	4	20	34	52	111	4.19

Source: from findings of the study

Customers strongly agree or generally agree with the opinion that food waste requires additional research and attention, as indicated by the mean value of 4.05. A mean score of 3.80 shows a significant degree of concern with food waste, although slightly less prominent than the first group. The statement reveals a responsible group of customers who are probably knowledgeable about the broader consequences of food waste, this might include its environmental and economic effects. The question on agreement to comply with future sustainability measures has the highest mean value of 4.19. This suggests a significant willingness among customers to support and adhere to such measures implemented by the restaurant in the future. The considerable degree of support confirms that the restaurant possesses a strong foundation upon which they can develop and execute food waste-reducing and managing methods.

Nevertheless, there may be a discrepancy between worry and perception and the real action. The initial cross-comparison table examined the relationship between the survey respondents' level of concern regarding food waste and their frequency of leaving uneaten food at H.N.

Table 17: *Comparison on level of concern and frequency of leaving food uneaten*

Level of concern		Frequency of leaving food uneaten				Total	Mean value
		1	2	3	4		
		Never	Rarely	Often	Always		
Not concerned at all	1	0	0	2	2	4	3.50
Slightly concerned	2	1	2	1	4	8	3.00
Moderately concerned	3	2	6	9	4	21	2.71
Very concerned	4	4	15	25	7	51	2.69
Extremely concerned	5	4	7	12	4	27	2.59

Source: from findings of the study

The numbers ranging from 1 to 5 is reffered from Not concerned at all to Extremely concerned. The inverse relationship between mean values and the amount of concern implies those who express higher levels of precaution regarding food waste are less inclined to leave food on their plates, though the gap is not significant between each level. The group that responded "not at all concerned" about food waste leaves food uneaten "often" and "always," reflected by their mean value of 3.50. This aligns with their low level of concern regarding food waste. Conversely, the customer who responded "extremely concerned" about food waste leaves food uneaten "rarely," as stated by their mean value of 2.59. On the other hand, customers who claim to have a high level of concern (level 4) still leave behind more food than expected, even more so than those with lower levels of awareness. This inconsistency between their perception and their actual behaviour suggests that they might be influenced by external factors when it comes to leaving food uneaten.

Table 18*: Awareness of the food waste issue categorized by the respondent's countries*

Nationality	Level of concern on food waste					Total	Mean value
	1	2	3	4	5		
	Not concerned at all	Slightly concerned	Moderately concerned	Very concerned	Extremely concerned		
Hungary	4	7	17	36	13	77	3.61
Other European countries	0	0	0	5	2	7	4.29
Asian countries	1	1	4	9	10	25	4.04
Afican countries	0	0	0	0	2	2	5.00

Source: from findings of the study

In comparison to the overall mean of 3.80, Hungarians exhibit a slightly below-average level of concern regarding food waste, as evidenced by their mean value of 3.61. The '4' rating for concern by the majority of Hungarians indicates that they are concerned but not the most so, and the issue may not be considered urgent in Hungary. With mean values of 4.29 and 4.04, respectively, other European and Asian customers at the restaurant demonstrate a heightened awareness of the issue of food waste. Notably, the group representing European countries provides the highest value, which implies that these demographics might be especially receptive to initiatives aimed at reducing food waste.

- *Ordering and eating habits*

This section aims to gather data on eating and ordering habits to gain insights into consumer behaviour patterns that may impact the amount and variety of food that is wasted. By recognising these characteristics, H.N. can analyse and address these issues thoroughly, leading to improved techniques, better assistance to consumers, more informed decisions, decreased the amount of avoidable food waste, and increased customer satisfaction.

The initial characteristic identified is the frequency with which the client visits the H.N. the author has categorised the responses into six distinct answers, each with its own frequency, in order to distinguish between frequent and infrequent consumers, as well as to determine the regularity at which consumers return.

Table 19: *Comparison on guest's frequency of dining in H.N.*

		Frequency of leaving food uneaten				Total	Mean value
		1	2	3	4		
		Never	Rarely	Often	Always		
Frequency of dining	Multiple times a week	4	15	15	5	39	2.54
		3.60%	13.50%	13.50%	4.50%	35.10%	
	Once a week	4	9	15	7	35	2.71
		3.60%	8.10%	13.50%	6.30%	31.50%	
	A few times a month	3	4	13	3	23	2.30
		2.70%	3.60%	11.70%	2.70%	20.70%	
	Once a month	0	0	1	1	2	3.50
		0.00%	0.00%	0.90%	0.90%	1.80%	
	Less than once a month	0	1	2	1	4	3.00
		0.00%	0.90%	1.80%	0.90%	3.60%	
	This is my first time	0	1	3	4	8	3.38
		0.00%	0.90%	2.70%	3.60%	7.20%	
Total		11	30	49	21	111	2.72

Source: from findings of the study

The largest segment, at 35.1%, represents customers who dine multiple times a week and 31.5% represents customers who visit once a week, indicating a strong regular customer base with cumulative percent of these two groups are 66.6%. The next significant segment, hose visiting a few times a month account for 20.7% of visits, suggesting moderate regularity. The smaller categories show 5.4% of customers dine once or less than once a month, which is a smaller number compared to first-time visitors, who account for 7.2%.

Customers who visit the restaurant consistently consume a reduced quantity of food, as evidenced by the score of 2.54, which is below the calculated midpoint of the scale. Conversely, people who come infrequently (customers who come once a month, less than once a month and new guests), including those who are visiting for the first time, exhibit a higher propensity to depart with their food, as indicated by their scores getting closer to the maximal value of 4. It

shows that customers who are acquainted with H.N. exhibit a positive correlation with reduced food waste. This can be attributed to their familiarity with the menu and accurate prediction of their consumption, characteristics that might not be available to less frequent customers or new visitors. Despite small sample of those who visit once a month and less than once a month, it is still possible to observe that out of the six people who responded in these two groups, the majority indicated that they frequently leave food behind, with only one respondent indicating rare occurrences.

Table 20: *Comparison on order styles*

Order style	Frequency of leaving food uneaten				Total	Mean value
	1	2	3	4		
	Never	Rarely	Often	Always		
Order from basic courses in a meal (Starter, Main course, Dessert)	2	5	28	16	51	3.14
Only soup or main dish	4	3	4	0	11	2.00
Soup/main dish and dessert	1	7	2	0	10	2.10
Soup and main dish	0	4	2	0	6	2.33
Starter and soup/main dish	3	10	10	4	27	2.56
Others (all are more than two courses)	1	1	3	1	6	2.67
Total	11	30	49	21	111	2.72

Source: from findings of the study

The research suggests a positive correlation among the number of courses ordered and the likelihood of food being left uneaten. Based on the comparison table, it is visible that customers who primarily order main dishes and soups (which are considered main dishes) tend to waste less food. This is particularly true for customers who exclusively choose only soup or main dishes for their meal, as their average waste value is only 2.0, which is significantly lower than the overall average waste value of 2.72. Beyond that, consumers that purchase a substantial number of courses in a single meal, notably three or more courses, have a significantly high average value. Customers who opted for all three standard courses of appetisers, main dishes,

and desserts were the most prone to leaving food uneaten, with an average value of 3.14 out of 4. Responses categorised as "Other" and all involving the selection of more than two courses in a meal likewise exhibit a mean value of 2.67. This indicates that consumers in this group frequently abandon uneaten food. Certain customers may be unfamiliar with Pho soup, which happens to be the top-selling and most renowned dish in H.N. Besides, they may have a limited understanding of the portion size, leading to a propensity for ordering excessive amounts. Pho, a type of soup, is commonly served as a main dish. However, cultural and culinary influences can affect the way customers perceive it, as some may not consider soup to be the main dish in a meal. This is particularly apparent when 27% of individuals explicitly stated that they do not regard Pho as a primary course, as indicated by the study's findings.

Table 21: *Comparison on time of dining*

Time of dining		Frequency of leaving food uneaten				Total	Mean value
		Never	Rarely	Often	Always		
		1	2	3	4		
Weekday (from Monday to Friday)	Lunch time (from 11am to 3am)	3	8	16	10	37	2.89
	Dinner time (from 6pm to 9pm)	6	11	10	3	30	2.33
	Between lunch and dinner time (from 3pm to 6pm)	0	2	4	2	8	3
Weekend (Saturday and Sunday)	Lunch time (from 11am to 3am)	1	5	9	2	17	2.71
	Dinner time (from 6pm to 9pm)	1	4	10	3	18	2.83
	Between lunch and dinner time (from 3pm to 6pm)	0	0	0	1	1	4
Total		11	30	49	21	111	2.72

Source: from findings of the study

Customers have a higher tendency to leave a greater amount of uneaten food during lunchtime on weekdays, but they prefer to leave a lesser amount after dinner on weekdays. This might be affected by the lunch menus offered during lunch time can lead to the greater inclination to

create food waste, correlated with the high ratio of food waste generated by type on the previous section. The intervals between meals over weekends display a significantly greater inclination towards wastage. However, the validity of this outcome may be compromised by the limited size of the sample. This also suggests that the timing of meals may affect how people behave in terms of wasting food, and that there may be a connection between specific consumer segments and their frequent visits during certain time periods. This information might be valuable for H.N. when they are planning the portion sizes for their menu.

Table 22*: Popular food that being left on plate post-consumption*

Type of food	N	Mean	Std. Deviation	Minimum	Maximum
Vegetable	111	3.23	0.904	1	5
Side dishes (Rice/Noodle)	111	4.03	0.919	1	5
Garnishes	111	4.44	0.86	1	5
Special flavor ingredients	111	3.04	0.673	1	5

Source: from findings of the study

The author categorises the most frequently found leftovers on customers' plates into six groups: vegetables, side dishes (rice and noodles), garnishes, starters, desserts, and meat, food items with distinct flavours or ingredients, and inedible parts such as bones, fatty portions, and animal skin. However, ongoing research is focused exclusively on vegetables, side dishes, garnishes, and food that contains unique flavours or ingredients. Other types of food are consistently found to be either never or rarely left behind, and inedible food items are similarly discarded which is obvious. Garnishes and side dishes are the most commonly left out, according to the data, which has exceptionally high mean values of 4.44 and 4.03, correspondingly, with the highest value being 5 (always leave leftovers). This suggests that the quantity of food offered by restaurants in these two categories exceeds the the amount required to satisfy consumers. Subsequently, vegetables receive an average score of 3.23, while foods containing special ingredients or flavours receive an average score of 3.04, considerably marginalised. While the standard deviation indices are comparable, they continue to indicate fluctuations in the number of consumers who leave food behind.

Table 23: *Factors that influence on guest's leaving leftovers*

	Level of agreement			

Influence on wasting food	1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly agree	Total	Mean	Std. Deviation
Large portion size	1	16	10	61	23	111	3.80	0.961
Personal taste	0	3	11	72	25	111	4.07	0.657
Overorder	8	26	28	38	11	111	3.16	1.116

Source: from findings of the study

In the same method as the preceding section, three of the six reasons investigated regarding the reasons that impact on discarding leftovers were eliminated by the author: social norms (mean value of 1.42), dietary restrictions and allergies (mean value of 1.86), and food quality (mean value of 2.92), which, while near the midpoint of the scale, was not a strong or dominant factor. Three influencing factors remain, as shown in the table above. In general, personal taste is identified as the primary factor resulting in the greatest number of participants leaving food uneaten (mean value: 4.07). This is entirely rational and the most challenging aspect to regulate due to the inherent variability in flavours. Le Lan Phuong's (2017) research on food waste revealed that the tasting experience of food exerts the most significant impact on consumers discarding their food, with an exceptionally high mean value of 4.46. The subsequent factor is the large portion size factor, which has a mean value of 3.8 and a standard deviation of 0.961. Despite some variability, this value is sufficient to demonstrate that large portions are a significant factor. Although overordering is of lesser concern, it exhibits the greatest degree of variability in the responses, as shown by the mean score of 3.16 and standard deviation of 1.116, which is the lowest mean score but carries highest variability. It is apparent that this factor does contribute, yet not significantly; it is more likely to occur with a small number of customers who are unfamiliar with the menu and serving sizes offered by H.N. or who are visiting less frequently or visiting for the first time.

Table 24: *Agreement on type of food is served in excessively large quantities by customers*

		Rice	Noodle	Vegetable	Meat/Poultry/Seafood	Garnishes
N	Valid	111	111	111	111	111
	Missing	0	0	0	0	0
Mean		2.76	3.34	3.04	2.58	3.77
Median		3.00	3.00	3.00	3.00	3.00
Mode		3	3	3	3	3
Std. Deviation		0.43	0.86	0.49	0.51	0.99

Source: from findings of the study

To reinforce the findings of H.N.'s issue with portion size, customers were also surveyed regarding their views on specific food portions that they believed were excessively large and not appropriate for their personal appetite. This survey utilised a 5-level scale ranging from Strongly Disagree to Strongly Agree. Based on the median and mode values of 3, the majority of customers believe that the portion sizes for all items, except meat, are significantly larger than their preference. Meat, poultry and seafood are considered closer to the ideal portion size. Rice has a mean value of 2.76, indicating it is slightly larger than preferred but still acceptable, while vegetables have a little higher mean value of 3.04. Noodles and garnishes are currently agreed to have the largest serving size and exceed customers' consumption needs with mean scores of 3.34 and 3.77, respectively, along with the two highest standard deviations of 0.858 and 0.99.

- *Customers' handling and attitudes toward leftovers*

In relation to the matter of remaining food, survey participants were also inquired about their decision to either package or not package the leftover food. Among the 111 respondents, 82 people indicated their intention to pack leftover food for takeaway, whereas the remaining 29 people expressed their refusal to do so, irrespective of the quantity of leftover food. Consequently, the author persists in evaluating 82 responses featuring the provision to take home leftover food, in an effort to determine the actual consumption of these wrapped leftovers.

Table 25*: Likelihood of leftover consumption of customers choosing to package leftover home*

Customers choose to package leftover home	Likelihood of consuming leftover after packing home					Total	Mean value
	Very unlikely	Unlikely	Neutral	Likely	Very likely		
	1	2	3	4	5		
	0	16	11	29	26	82	
	0.0%	19.5%	13.4%	35.4%	31.7%	100%	3.79

Source: from findings of the study

On average, customers have a higher probability of consuming their leftovers with the mean value at 3.79 out of 5, which is a positive result. This demonstrates a favourable disposition towards avoiding the unnecessary disposal of leftover food brought home. While 19.5% of respondents reported to unlikely continuing to consume wrapped leftovers, and 13.4% replied neutrally, it remains uncertain whether there was a clear intention to continue consuming it or not.

H.N. offers a range of, tools, and plastic containers of different sizes to cater to both take-away clients and those who buy meals through the delivery app. This makes it highly handy for consumers who wish to wrap their food home in the case that customers do not consume all of it. The food cleanliness, safety, and quality of H.N. are ensured and monitored by Nébih (Nemzeti Élelmiszerlánc-biztonsági Hivatal – National Food Chain Safety Office), making it perfectly safe to pack leftover food from a health perspective. Therefore, the survey continues to study how customers handle their leftovers, specifically packaging to take home from a cultural and social perspective. Hence, the survey aims to explore the manner in which customers manage their remaining food, particularly bringing unfinished food home, from both a cultural and social standpoint. It also seeks to understand how customer's cultural background and societal norms influence their decision to bring home leftovers or not, at the moment when they need to make this decision.

Table 26: *Level of agreement that taking leftover home are influenced by cultural background and social norms*

	Level of agreement					Total	Mean value
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree		
	1	2	3	4	5		
Impact of cultural background	1	7	19	57	27	111	3.92
Impact of social norms	11	29	30	28	13	111	3.03

Source: from findings of the study

It is widely recognized that both elements have an impact, but the average value of 3.92 clearly shows that cultural background is a more influential component than social norms. The mean score for social norms is significantly lower, close to the midpoint of 3.03 with the spread across different levels of agreement is broader suggesting a more varied perception of the impact.

4.3.3. Impacts of the employees on the food waste generation

- *Food waste perception and awareness*

The personnel's collective consciousness of and dedication to environmental values in general and to food waste problem in particular play a crucial role in determining the extent to which the restaurant adheres to sustainable practices. The employees' perspectives on food waste provide valuable insights into their awareness and willingness to initiate and support change. This, in turn, plays a crucial role in reducing, effectively managing food waste, and developing suitable methods. The following analysis seeks to extract the core of these views, outlining a range of consciousness that impacts each food item offered and every morsel discarded.

Table 27: *Perception of H.N.'s employees on environmental problem and food waste*

	Not concerned at all	Slightly concerned	Moderately concerned	Very concerned	Extremely concerned	Total	Mean value
	1	2	3	4	5		
Level of concern about environment and sustainability	3	10	2	3	4	22	2.77
Level of concern about food waste	2	3	5	5	7	22	3.55

Source: from findings of the study

According to the table, employees display a greater level of concern for food waste issues that are directly linked to their job with the high mean value at 3.55, as opposed to more general environmental concerns when the calculated mean value was 2.77, under the mid-point of the scale. This suggests a divergence between personal values and actual execution of those beliefs in the workplace. Additionally, employees may perceive that their individual actions have less influence on more expansive environmental concerns. Employees are more aware of and connected to issues that they can immediately see and affect in their immediate work environment. The impact of food waste is more noticeable and real in this context, making it a more urgent concern.

Table 28*: Self-evaluation of employees on the severity of food waste*

Evaluation on H.N.'s food waste severity by their employees	Not serious at all	Slightly serious	Moderately serious	Very serious	Extremely serious	Total	Mean value
	1	2	3	4	5		
	1	7	5	8	1	22	3.05

Source: from the findings of the study

The average result of 3.05 indicates an elementary level of concern generally, suggesting that although employees are aware of the problem of food waste, there may not be a connected feeling of urgency to address it. This perception can be juxtaposed with the concrete statistics gathered on the restaurant's factual food waste, totaling 1156.7 kg over a span of two weeks. The average daily waste of 82.62 kg is quite considerable and highlights a major possibility for improvement. The inconsistency between the mild perception of the problem's severity and the

actual food waste statistics suggests a possible gap in employees' understanding of the extent of waste produced, or a difference in how waste levels are communicated and handled internally.

However, when surveyed about the ability to accept improvements and new methods, the results were considered relatively positive.

Table 29: *Agreement on the need of training about environmental problems and food waste and agreement on complying with the management*

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total	Mean value
	1	2	3	4	5		
Agreement on receiving more training about environment and food waste	1	2	2	8	9	22	4.00
Agreement on complying future measures	1	1	6	9	5	22	3.73

Source: from findings of the study

The first component is shown by a high mean score of 4.00 out of 5, which shows a solid consensus among employees regarding the necessity for additional training on environmental issues and food waste. This indicates that the staffs are receptive and acknowledge that acquiring more knowledge and skills could be beneficial in tackling the issue of food waste. It is in line with the previously data moderate concern over food waste, suggesting that employees are not only aware of the problem but also prepared to participate in finding solutions. The second factor has a lower mean score of 3.73, compared to a mean of 4 out of 5 for the first factor, but still indicates a positive index . This difference suggests that employees acknowledge the significance of additional training on environmental and food waste issues. However, they may have slightly less dedication or confidence in implementing these measures. It is also possible that they already feel well-informed.

- *Internal factors*

In this section, factors that considered internal and examined include the influence of food processing and recipes on dishes, the amount prescribed by the restaurant, and an assessment of current food waste management methods.

Table 30: *Agreement on the impact of recipes and process that cause food waste*

Level of agreement on H.N.'s food processing and recipes causing food waste	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total	Mean value
	1	2	3	4	5		
	0	3	4	8	7	22	3.86

Source: from findings of the study

According to the data collected from employees' opinions, there is moderate agreement that food processing and recipes are a considerable factor in food waste, with an average rating of 3.86 out of 5. A significant percentage of employees appear to concur or strongly concur with this assertion, which could be indicative of their observations regarding the generation of food waste during the preparation of specific dishes, particularly Pho soup – the restaurant's top-selling item, with a total of 2070 units sold over a two-week observation period covering both medium and large sizes. Pho broth necessitates a substantial quantity of bones, resulting in a significant amount of fixed food waste (30kg a day). Although bones are crucial for enhancing the broth's taste, they are not meant to be ingested, even after long hours boiling. Similarly, the inclusion of vegetables in vegan broths also adds to the amount of waste generated. The high mean score indicates their awareness of the waste produced by these processes and highlights potential opportunities for enhancing waste reduction strategies. This could involve optimizing recipe proportions or finding alternative uses for typically discarded remains. However, it should be noted that addressing waste reduction in recipes and adhering to cooking rules can be challenging, especially to the dishes that require us to follow certain recipes.

Table 31*: Agreement on type of food is served in excessively large quantities by employees*

		Noodles	Vegetable	Meat/Poultry/Sea food	Garnishes
N	Valid	22	22	22	22
	Missing	0	0	0	0
Mean		3.32	3.05	2.36	3.45
Median		3.50	3.00	2.00	4.00
Mode		4	3	2	4
Std. Deviation		0.995	0.722	0.902	1.011

Source: from findings of the study

According to the employee responses, garnishes have the highest mean score of 3.45, which aligns with customer perceptions. This indicates a widespread consensus that garnish portions are more than necessary. The higher standard deviation in the garnishes option, as observed in both the customer (0.99) and employee (1.011) responses, suggests that there is greater variability in how respondents perceive the size of garnishes. This implies that both customers and employees hold diverse viewpoints regarding what qualifies as an excessive serving of garnish. Opinions may vary regarding the abundance of garnishes, with some individuals perceiving them as excessive and potentially resulting in wastage, while others may consider the quantities appropriate or insufficient, depending on personal preferences or cultural norms regarding meal aesthetics. Noodle is also regarded as somewhat extravagant, with an average rating of 3.32, slightly lower than customers' perception of noodles (3.34), along with the diversity in opinion which illustrated by a high standard deviation value 0.995. Vegetables have a mean score of 3.05, with a median of 3 and a mode of 3, implying a consensus that vegetables are often served in excess, but to a lesser extent than noodles, as shown by the lower mean score and the smaller standard deviation of 0.722. The employees share a similar viewpoint to customers, perceiving meat, poultry, and seafood to be the least excessive. This is indicated by the lowest mean score of 2.36, which reflects their agreement that these items are served in an ideal amount.

Table 32*: H.N.'s employees rate the effectiveness of current FW management*

Evaluation on current FW management by employees	Not effective at all	Slightly effective	Moderately effective	Very effective	Extremely effective	Total	Mean value
	1	2	3	4	5		
	4	10	4	4	0	22	2.36

Source: from findings of the study

The employees' assessment of the food waste management techniques at H.N., with an average score of 2.36, indicates that the existing strategies are considered inadequate. The absence of any answer rating the management as 'Extremely effective' and only four employees perceiving it as 'Very effective' highlights the urgent requirement for reevaluation and improvement of existing practices to reduce food wastage. This indicates an undeniable gap between awareness and action among both employees and owners.

- *Self-assessment and conscious efforts*

The employees' acknowledgment and active measures to minimize and decrease food waste throughout their work are of utmost significance. It measures the extent to which employees are involved in sustainable practices and their willingness to actively contribute to lowering the environmental footprint of the company. When questioned about this topic, precisely 50% of the employees surveyed, 11 out of 22, acknowledge being aware of and actively attempting to minimize and decrease food waste throughout their duties, while the remaining 50% do not verify this, still may suggest an uncertain commitment to environmental conservation among the restaurants' staff. This equitable division emphasizes a potential opportunity for the employer to enhance education or offer supplementary resources, implement incentive programs, promote shared collaboration among staff members, and establish particular goals to create more effective sustainable practices.

Table 33*: Employees' self evaluation on their contribution in reducing FW*

Evaluate on the contribution in reducing FW	Not helpful at all	Slightly helpful	Moderately helpful	Very helpful	Extremely helpful	Total	Mean value
	1	2	3	4	5		
	5	5	4	5	3	22	2.82

Source: from the findings of the study

The average score of the employees' self-evaluation of their effort in food waste practices is 2.82, suggesting a moderate opinion of their contributions. The average result is 2.82, suggesting that although employees are conscious and moderately engaged in decreasing food waste, they may not feel completely empowered or equipped to make a significant difference. The range of responses, ranging from employees perceiving their contribution as 'not helpful at all' to others perceiving it as 'extremely helpful', underscores the diversity in perceptions and experiences. Similarly, the analysis of their concern regarding the problem reveals that 7 participants expressed a high level of concern ('Very concerned' and 'Extremely concerned'), while 13 people displayed indifference by selecting "Not concerned at all" and "Slightly concerned". It implies that certain people may possess the appropriate knowledge and access to resources to efficiently minimize food waste, while others may not, which may stem from differences in age and uneven educational levels of employees.

4.4. Result from the interview

When identifying the success of H.N. restaurant's present procedures in managing food waste, it is crucial to take into account the viewpoints of the owner and also the general manager, who is responsible for setting and implementing the establishment's policies and operations. The managerial interview offers a thorough comprehension of the internal mechanisms implemented to tackle food waste, the effectiveness of these measures, and the obstacles the restaurant faces in reducing waste. This assessment not only demonstrates the restaurant's dedication to sustainability but also highlights the intricate challenges that the food service industry faces in its efforts to combat waste. The data obtained in this part will serve as the primary information for answering RQ3 and RQ4.

Mr. Vo Hai is the person in charge of monitoring and executing all activities occurring in H.N. The interview with him focused on the restaurant's current food waste control procedures, evaluating its operations and addressing the problems and obstacles they are encountering.

H.N. argues that sustainable growth is essential for the restaurant industry and for the restaurant itself, as it involves satisfying current demands without jeopardizing the well-being of future generations. Hai also acknowledged the enduring benefits that sustainable development delivers to enterprises, like increased operational efficiency and cost optimization for restaurants by leveraging human resources effectively although the restaurant is currently in the process of attempting to shift its company towards a more sustainable route. Concerning the matter of food waste, the restaurant acknowledges that it is a serious issue, both in terms of its environmental impact and its cost consequences. However, achieving zero-waste goal is currently a challenging objective. “We think it is challenging to match the balance of the quantity of the food and try to minimize it by meeting the need of offered services considering the cost and the profit. We assure you that we have never engaged in wasteful practices. However, due to the structure of our cuisine and recipes, there is a certain amount of waste that is unavoidable. We recognize the need of managing this waste effectively and make efforts to do so.” (Vo Hai, 2024)

After evaluating the food waste situation in H.N., management acknowledges that it is not yet at an alarming stage compared to other restaurants of similar size. However, they do recognize that the situation is still quite serious and there is a potential for it to escalate to a very serious level. Due to inherent constraints and complexities in measurement and computation, as well

as the intricate and interdependent nature of H.N.'s operating processes, making it impossible to quantify the financial impact for each individual step, therefore, providing an exact figure for the total quantity and monetary value of food waste is exceedingly challenging. Nevertheless, it is widely acknowledged to be of considerable magnitude, albeit with some progress observed since the latest estimate in 2017, which was approximately 100kg per day food waste in general. The restaurant also modifies its prices in accordance with the inflation rate and economic climate, in comparison to the cost of sale. Nevertheless, both expenses—converting costs from the quantity of food waste and the quantity of surplus food that the restaurant receives—are on the rise, and Hai accepts the possibility that the resulting costs are likely to surpass the restaurant's initial projections.

The main contributors to food waste are categorized into two primary sources: leftover food abandoned by customers and food waste generated within the restaurant. The latter includes food waste resulting from activities such as importing, storing, preparing, processing, and cooking food, as well as the consistent amount of food waste produced daily due to specific standards and regulations outlined in the restaurant's recipes. The restaurant recorded the data collected by the author while measuring food waste over a two-week span and verified its relative accuracy and also expressed concern about this issue. In terms of the quantity of food waste, both the author and the restaurant side concur that, excluding fixed food waste, leftovers constitute the bulk of the overall food waste. Therefore, consumers play a crucial part in generating this amount of food waste. The information regarding the issue of excessive food waste from customers is also received and in response, and the restaurant conducted inquiries and observations with selected certain consumers to understand why they did not finish their meals. It recorded that the majority of customers cited personal taste preferences, larger portion sizes than expected, and over-ordering, when some customers order too many dishes compared to their appetite and are not familiar with the flavors of Vietnamese dishes and the restaurant's menu. Additionally, Hai acknowledged that the restaurant's concentration on food waste is still inadequate and that the staff lacks sufficient attention and awareness regarding this issue. Restaurant employees are generally not aware of limiting and reducing waste and food waste and most of them only work as instructed by management.

When questioned about portion sizes, despite substantial evidence indicating that the quantity of food provided by H.N. for certain dishes surpasses the optimal level in comparison to the consumption patterns of survey participants, the restaurant maintains that there are no issues

with their portions. However, when questioned about Pho soup, the most popular dish, Hai acknowledged that customers had expressed dissatisfaction with the amount of pho noodles served per portion. As a result, the restaurant adjusted in 2021, reducing the quantity from 220g per large portion and 180g per medium portion to 190g and 150g respectively. The restaurant is confident that this modification has been successful. Hai said that "We check if the amount of food is too much or not, probably I would rate it like 40% of the guests say it is still too much and the rest 60% say the ratio is just right enough for them, we are trying to find the balance point in the menu planning but we think this result is not too negative". Hai also emphasized that the garnishes is crucial to include in every single dish. The portion sizes are considered generous, yet not overly excessive. While some customers greatly enjoy it, others may not, but it remains an essential component of the dish. Regarding the personal preference, H.N. believes that they have made appropriate modifications to the flavors of their dishes in order to satisfy customers from all continents with diverse cuisines. Additionally, customers have the option to personalize their orders and have the seasoning served according to their tastes. For customers who are new or unfamiliar with the store, H.N. always encourages servers and all front of the house staff to provide clear introductions and explanations of dishes. They also advise staff to offer reasonable recommendations to ensure a quick and suitable ordering process that matches the customers' appetite and consuming ability. Additionally, if a customer is unable to finish their meal, H.N. offers full support in packaging the remaining food items for take-home, if desired.

In response to the remaining issues, several practices have been implemented to address them. Classifying food waste to monitor and control the final treatment process by the collection partner is taken place in the first stage, certain distinct categories of food waste are categorized and subsequently acquired by a third party. For instance, cooking oil utilized in frying is relinquished to Biofilter, the company responsible for both collecting food waste for H.N. and managing its disposal. In addition, the restaurant emphasis on managing supplies and optimizing the sourcing of raw materials. These measures aim to make the most efficient use of available resources, excluding any elements that are completely inedible. Furthermore, the restaurant has demonstrated a keen interest in exploring and applying management techniques that prioritize biological recycling, particularly composting and to learn about new means and technology that facilitate composting which might be an ideal solution to deal with the fixed food waste including bones and vegetable generated by the broth making process. Hai declared that the restaurant takes great pride and has full confidence in efficiently managing supplies and imports through a rigorous and systematic approach. The POS system is used to accurately

forecast the required amount of food and ensure regular operations for imports to maintain the highest quality of food. Additionally, they strive to minimize food loss during import and storage, aiming for the lowest possible rate. “Overall, our proactive and systematic efforts have been moderately effective up to this point. On a scale of 5, I would rate it as 3.5. Nevertheless, we totally understand that there are certain aspects in which we do not meet expectations, and we are continuously attempting to discover methods to enhance and introduce new ideas to decrease food waste, especially aiding customers to reduce leaving and wasting leftover food.” Hai shared. Thus, it is visible that the effectiveness of current food waste management measures is considered by restaurants to be at a reasonable level and certain positive effects are recorded.

Undoubtedly, when implementing food waste approaches, there will inevitably be certain obstacles, and the long-term aspect of food waste management acts as a significant challenge, as it complicates the task of ensuring sustained effectiveness in managing and maintaining it. Initially, it is important to mention that the restaurant aims to explore and adopt the composting technique. Nevertheless, it suffers from a shortage of adequate physical space and the necessary technology and procedures to put it into practice. Furthermore, the insufficient awareness and knowledge among restaurant staffs impedes the smooth operation and optimal efficiency of food waste management. If employees have no proactivity and self-awareness regarding the significance and purpose of these tasks, and do not willingly engage in them, management's effectiveness is compromised. Their staffs receive training and are encouraged to focus on efficient utilization of resources and avoiding wastage to reduce costs. However, they have little familiarity with environmental concerns and sustainable development. Conversely, the work cycle consists of multiple stages, each comprising many different steps. If employees are conscious and proactive in reducing and minimizing food waste starting from the smallest steps, it will facilitate more efficient and tight management. The restaurant has informed us that they are currently in the process of finalizing procedures and sorting perishable food waste in order to collaborate with the Food Bank project. Yet, at present, the food waste from H.N. does not meet the necessary requirements to be included in this program.

The inevitability of generating a significant quantity of food waste daily is supported by the unalterable nature of Vietnamese recipes, where this waste is utilized for the preparation of bone and vegetable stew for Pho soup and other dishes, making it a crucial and indispensable ingredient. However, the restaurant firmly believes that the substantial quantity of bones and vegetables, estimated at 30kg per day, has been efficiently utilized and cannot be repurposed,

but entirely organic. As previously stated, the restaurant has a strong emphasis on conserving and optimizing the utilization of all ingredients, which has been a consistent part of the restaurant's culture. In addition to the previously justified fixed waste section, Hai believes that they are effectively managing costs and materials. Thus, apart from the fixed food waste in making broth, the quantity of food waste generated during other stages, while still being addressed, is inherently negligible.

In the future, H.N. will strive to implement a compost testing plan for planning and implementation purposes. Despite the time and cost involved, this method, by far, is the most effective solution for managing organic food waste. While it may not be suitable for leftovers, the restaurant think it is highly beneficial for solid food waste, particularly fixed food waste which including long-cooked bones and vegetables, although other processing steps still need to be modified afterwards. The restaurant also continues to work on adjusting the size and quantity of food to create the most ideal portions and aims to limit leftover as much as possible, while encouraging customers to wrap their food home in case there is leftovers to avoid wasting food while it can still be consumed, thus prevent the avoidable food waste. Simultaneously, the restaurant additionally encourages the promotion of employee awareness regarding the significance of effectively managing food waste, as well as other sustainable environmental principles. Hai commits to improving the staff's knowledge to be able to ensure the comprehensive implementation of management measures. With the forthcoming backing or sanctions from the government or local committee, the restaurant anticipates significant financial, operational, and moral advantages in its efforts to minimize and handle food waste in the region, as well as support small and medium-sized eateries and food enterprises like H.N. Nevertheless, Hai stated that thus far they have not encountered any legislation or regulations of such kind, or they were unaware of these sanctions previously, or these regulations have had barely any effect on the restaurant.

4.5. Feasible improvement options

The subsequent step in enhancing food waste management at H.N. involves examining viable options for improvement. Creating strong food waste reduction frameworks is essential for identifying and incorporating more efficient and inventive strategies. This section explores potential modifications and approaches that the restaurant could implement to further minimize waste, optimize resource efficiency, and strengthen its dedication to environmental stewardship. Valuable insights have been obtained from both customers and employees by asking specific questions about the most efficient strategies they propose for minimizing food

waste. This section assesses the proposed improvements put forward by the main stakeholders, in addition to the opinions provided by the restaurant manager during a recent interview. The goal is to combine these different perspectives to identify the most practical and creative methods that can be implemented to improve resource efficiency and maintain the restaurant's dedication to proper food waste management.

Based on the literature review and an understanding of H.N.'s situation, the survey included five improvement options for customers and employees to evaluate their agreement on the conformity and feasibility of these options, on the scale from 1 to 5 (1-Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree)

Table 34*: Customers evaluate the improvement options*

	The evaluation of improvement options by customers				
	Adjust dish ratio and size	Interpret specific dish information on menu	Encourage customer to take leftover home	Reuse in case safe and reasonable	Composting
N	111	111	111	111	111
Mean	4.22	4.33	4.04	3.03	3.04
Std. Dev	0.68	0.68	0.86	1.10	0.93
Minimum	2	2	1	1	1
Maximum	5	5	5	5	5

Source: from findings of the study

From Table 34, the average score of 4.33 indicates that customers place a high importance on having precise information about dishes on menus. Additionally, they have a strong tendency to the option of adjusting the portion sizes, as evidenced by their average rating of 4.22. In addition, they strongly support the practice of taking leftover food home, giving it a rating of 4.04. However, their inclination to reuse items when it is both safe and reasonable, as well as their interest in composting, is relatively low, with average scores of 3.03 and 3.04, respectively. The customers at H.N. restaurant display a notable tendency towards receiving comprehensive information for the dishes on the menu, as evidenced by the exceptionally high average score of 4.33. This preference may stem from the fact that such detailed information aids in developing a thorough comprehension of the menu and dishes, enabling customers to make well-informed choices that can potentially minimize food wastage. Furthermore, they exhibited a pronounced inclination towards modifying portion sizes and ingredient quantities in dishes, particularly when it related to noodles and garnishes that were perceived to be excessively

provided through the findings above. The average scores for this preference were 4.22, indicating a desire to order food that aligns with their consumption capacity which has huge potential for reducing food waste. The practice of bringing home uneaten food was also highly valued, receiving a score of 4.04. This indicates a proactive and responsible approach to finishing the meals that were ordered, thus reducing the amount of unnecessary leftover food for customers. Conversely, the comparatively lower scores for reuse (3.03) and composting (3.04) show that while customers are receptive to these approaches, they might not consider them as immediately or practically beneficial as the other available options. It is understandable that customers have concerns about the safety and quality when discussing reusing. Also, composting is a concept that is not widely known to customers, and they often lack confidence in its effectiveness and the outcomes it produces, or simply view it as unpopular.

Table 35: *Employees evaluate the improvement options*

	The evaluation of improvement options by employees				
	Adjust dish ratio and size	Interpret specific dish information on menu	Encourage customer to take leftover home	Reuse in case safe and reasonable	Recycle and compost
N	22	22	22	22	22
Mean	3.68	4.18	4.23	2.5	2.95
Std. Dev	0.72	0.66	0.43	0.96	0.95
Minimum	2	3	4	1	2
Maximum	5	5	5	4	5

Source: from findings of the study

Meanwhile, as indicated in Table 35, the employees' strong endorsement for customers to take leftovers home as the most effective measure to reduce food waste is reflected in the highest mean score of 4.23. The employees' level of support for details on menus is quantified by a mean score of 4.18 reflects a recognition of the positive impact it can bring on customer understanding of the menu. The adjustment of dish portions receives a lower yet high level of support, as indicated by an average rating of 3.68. Composting is assigned the lower priority, with a rating of 2.95, which is less favorable compared to all other options. The lowest rate belongs to the option of reusing food and ingredient. The restaurant regards promoting customers to take home leftovers as the most effective measure to minimize food waste, rating it 4.23. This shows their belief in individual accountability for reducing food waste and the immediate impact of this approach, without requiring significant changes or extra effort from the restaurant. Additionally, they recognize the importance of repurposing food in a cautious

and logical manner, demonstrating a proactive stance towards minimizing waste. The staff considered the amount of support for the details interpretation menu options, scoring it at 4.18, still a high index yet slightly less immediate solution compared to the ratings given by customers. It is widely acknowledged that can enhance the efficiency of the ordering process and improve customer satisfaction by providing clear menu descriptions. This, in turn, reduces the likelihood of incorrect orders and customer dissatisfaction, ultimately minimizing food waste resulting from unmet expectations food, despite the complexity and time-consuming nature of changing the menu design. Employees moderately supported the idea of adjusting food portions, with a score of 3.68. This suggests that they viewed it as a practical measure. However, implementing this change may require significant operational adjustments and testing time, which could hinder its quick effectiveness. Composting was calculated to have the fairly low mean value at 2.95. This discrepancy may be attributed to concerns about the feasibility, additional workload, or effectiveness of implementing composting programs in a restaurant setting, which only the restaurant staff fully understand. Lastly, reusing is not considered as a appropriate approach (mean value 2.5) despite its convenience and simplicity, prioritising food cleanliness and safety, as well as following health regulations, remains a top concern. In addition, there are still parts of food that can be reused, but the quantity is very small, leading to insignificant effectiveness. The disparity in viewpoints regarding the influence of information and customization in waste management is underscored by this comparison between employees and customers.

In general, customers, restaurant staff members, and management concur that the most efficient strategies presently involve enhancing the comprehension of menu in details, encouraging customers to bring home uneaten food, and adjusting the quantity and size of food portions. Although composting demonstrates promising utility, it remains currently unattainable.

5. Conclusion and recommendations

5.1. Conclusion

5.1.1. Correlations between customer's socio-demographic data & food waste awareness

By conducting a dependency test on the demographic information and food waste awareness and perception responses of 111 customers, multiple links were identified.

After coding 5 level of agreement (there was no response for "Strongly disagee") and calculate the dependency, an association was discovered between the age of customers and their level of awareness regarding food waste issues. The results indicate that the question regarding the under-researched nature of the food waste problem and the need for more attention has a p value of 0.044. Additionally, the question regarding the level of concern about food waste has a p value of 0.007. These findings suggest that younger individuals, particularly those aged 18 to 34, are more likely to possess greater awareness and interest in the issue.

Figure 4*: Crosstabulation between the statement "Food waste is under-researched and needs more attention" and age group*

Source: from findings of the study

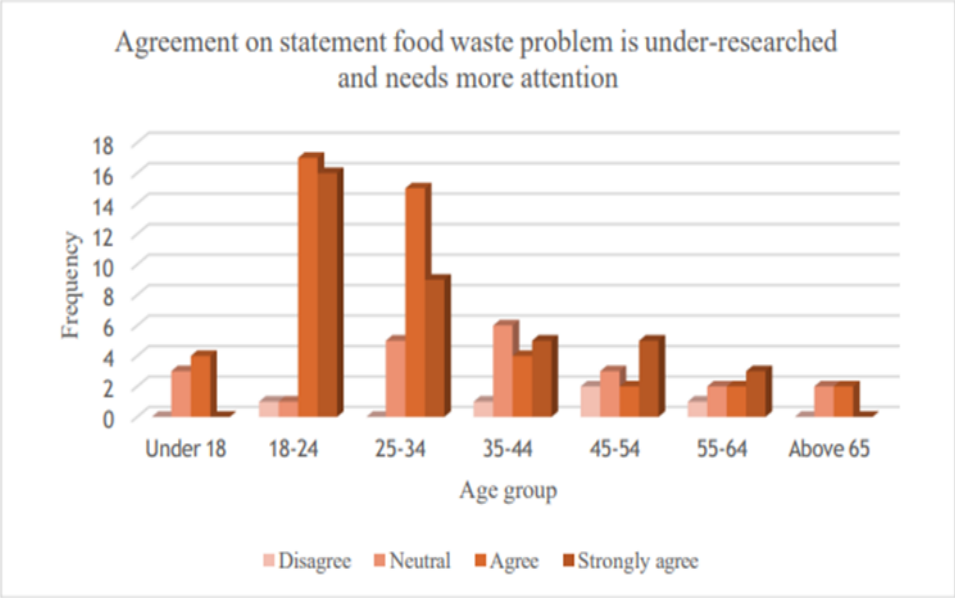
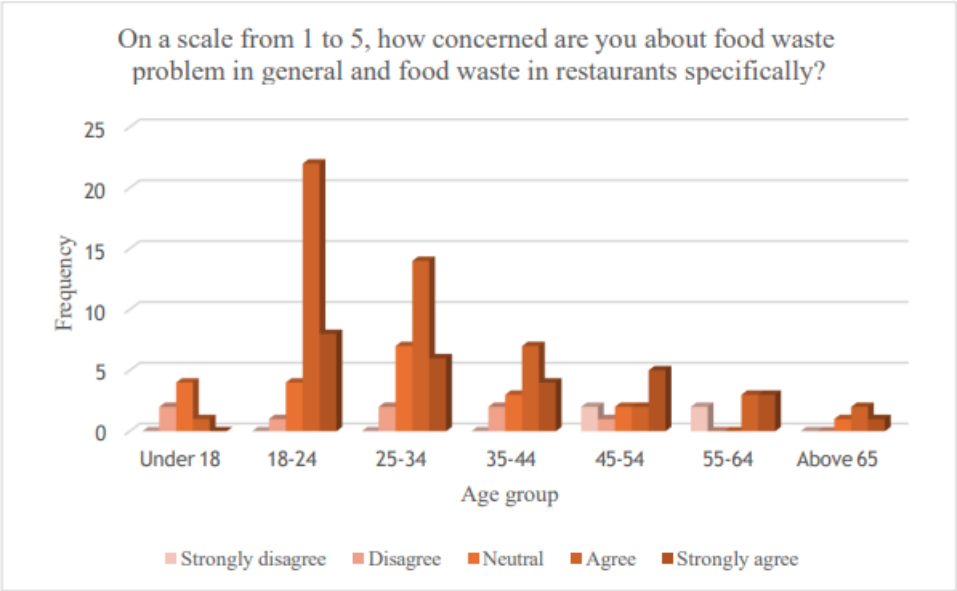


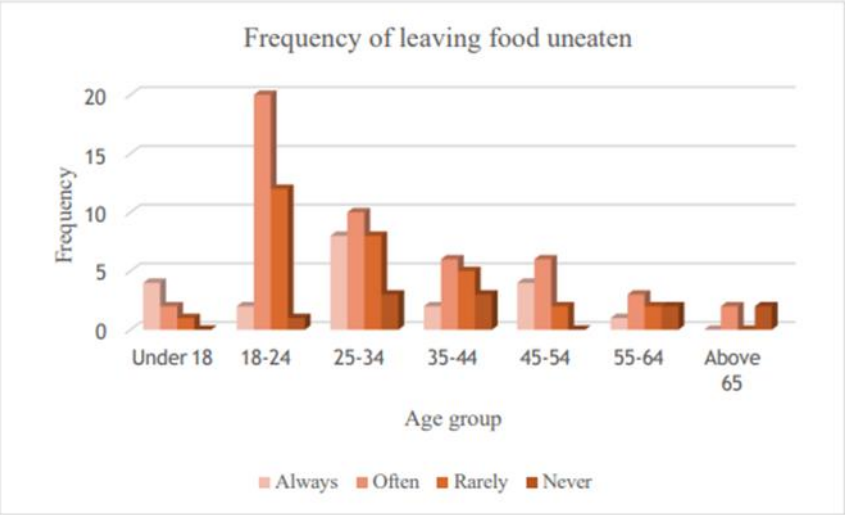
Figure 5: *Crosstabulation between the level of concern and the age group*



Source: from findings of the study

Nevertheless, when examining the relationship between participants' age and frequency of leaving leftovers, a statistical test for independence yielded a p value of 0.028, indicating a significant correlation between these two variables (the four sections 1, 2, 3, 4 are similar to the 4 levels of leaving leftovers: Always, Often, Rarely and Never respectively; and values from 1 to 7 correspond to age groups as mentioned above).

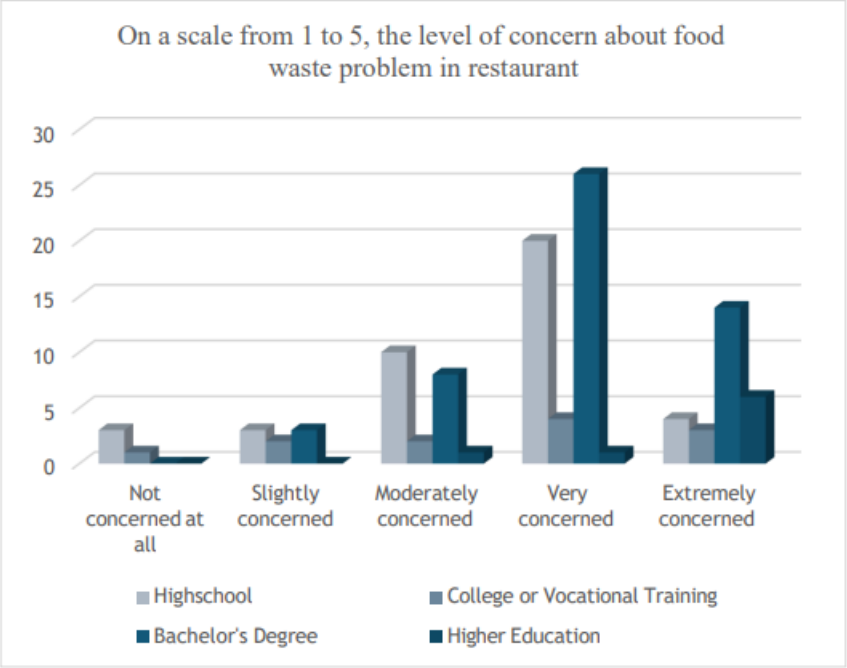
Figure 6: *Crosstabulation between the frequency of leaving food uneaten and age group*



Source: from findings of the study

Despite showing greater awareness and concern about the issue, this age group is also the most likely to leave food behind (Figure 6), with frequency decreasing towards older age groups (the four sections 1, 2, 3, 4 are similar to the 4 levels of leaving leftovers: Always, Often, Rarely and Never respectively; and values from 1 to 7 correspond to age groups as mentioned above). There is a possibility that the environmental consciousness of young people, particularly with regard to food waste, is expanding. However, a lack of comprehension regarding personal responsibility or the impact of individual liberalism may account for this awareness. Consequently, younger consumers are more likely than older consumers to abandon uneaten food, whereas the latter are more cognizant of personal accountability and the value of food.

Figure 7: *Crosstabulation between customer's level of education and level of concern*



Source: from findings of the study

An additional correlation was discovered between participants' level of education and their awareness and perception of food waste. According to Figure 7, there is a positive correlation between education level and awareness and concern regarding the issue at hand. This correlation can aid restaurants in providing customised approaches for each customer based on their educational attainment, and utilising education to involve customers in their food waste management efforts to achieve favourable outcomes, particularly considering that 53.1% of restaurant patrons possess a bachelor's degree or higher (as indicated in the study's findings, Table 7).

5.1.2. Summary

In conclusion, the study achieved the four primary objectives and provided answers to five research inquiries. First, the author had access to specific estimates of the level of food waste in H.N. Initially, the author had access to precise estimates regarding the extent of food waste in H.N. The total amount of food waste is estimated approxmately 1156.7kg over two weeks with daily outflow of food waste averages 82.6kg. In this section, the leftovers have been categorised according to the original food type. Leftovers from vegetarian dinners make up 17.2% of the total, while the remaining 82.8% consists of non-vegetarian foods.

Furthermore, by monitoring the sales of items categorised as vegan, non-vegan, and lunch menu, as well as tracking the amount of leftover food for each item, we can determine the rate at which food waste is generated for each label. While vegetarian food comprises only 8.1% of the total items sold, it has the greatest proportion of leftovers at 28.4%, indicates that the rate of food waste generation is also higher than the other two classifications. Lunch menu offers follow with a leftovers percentage of 24.4%, despite accounting for only 3.6% of the total lunch offers sold. The food waste generation rate for the leftover food is 13.3%, and the total number of sold goods accounts for 88.4%. By comprehending the rate at which food waste is generated, restaurants can gain a more comprehensive understanding of the consumption and eating patterns of different customer groups. This knowledge enables them to enhance portion sizes and make necessary modifications to flavours and ingredients in order to cater to customers' dietary requirements.

Second, the two primary causes of food waste were found to be leftover and fixed food waste from cooking, accounting for 47% and 36.3% respectively. The residual quantity of food waste is present in various stages of restaurant operations, such as preparation, processing, and cooking oil is redirected to Biofilter for treatment. The author's evaluation of the causes of food waste includes customers and restaurant staffs, based on the quantity and types of food waste observed. The perspective and influence of the two mentioned subjects on food waste production have been elucidated through two surveys. Customers' decisions are influenced by their awareness, familiarity with the restaurant, understanding of menus and dishes, quantity of the food, personal preference, eating and ordering habits, as well as their cultural background and social norms (although the latter is not highly significant). Simultaneously, demographic factors also impact the generation of food waste. Specifically, individuals who are younger and possess higher levels of education tend to exhibit greater awareness and concern regarding the discussed problem. On the other hand, restaurant employees demonstrate a noticeable impact on the generation of food waste due to their limited awareness and proactive management, the shortage of practical measures, hindered by cost, cultural, and technological barriers, further exacerbates the issue. Additionally, employees exhibit a lack of personal responsibility and initiative in contributing to waste management. Plus, it is imperative to acknowledge that recipes, which necessitate strict adherence and prohibit alterations, have played a substantial role in generating a predetermined quantity of food waste, thereby complicating the management of food waste.

Third, by amalgamating the evaluations of both restaurant staff and managers, it can be deduced that the food waste management in H.N. exhibited a moderately satisfactory level of effectiveness, yet there were several areas that were constrained and necessitated enhancement. Restaurants presently prioritise the categorization of food waste to oversee and regulate the ultimate disposal procedure. They also aim to prompt customers to order according to their level of consumption when placing orders and to consult the food base on customer's ability to consume their entire meal. The restaurant is currently highly confident in effectively managing supplies and optimising the sourcing of raw materials through the use of a POS system to forecast sales. In addition, it is important to make suitable adjustments to the taste of the dishes to meet customers' individual preferences and to encourage them to take home any uneaten portions if they are unable to finish their ordered meals. Ultimately, the restaurant is conducting ongoing research to enhance the accuracy of food quantification in order to determine the optimal portion size, yet not effective. The main obstacle are encoutering is the lack of awareness and knowledge among restaurant staff, which impairs the effective implementation of food waste management. Meanwhile, barriers such as cost, time, cultural differences, and cognitive limitations limit the ability to involve customers in activities aimed at reducing food waste and leftovers. Additionally, there are uncontrollable factors, such as customer personal preferences, that contribute to the likelihood of generating leftovers. The restaurant has expressed its intention to evaluate and implement the composting technique, highlighting its efficacy in managing fixed food waste. However, due to constraints such as insufficient physical space, lack of necessary technology, and absence of proper procedures, the implementation of composting is currently not feasible.

Lastly, after collecting and calculating data about the responses, there are three options that both customers, restaurant staff and management agree are the most feasible and predicted to bring high efficiency. The three most immediate measures are to improve the interpretation of menu details, encourage customers to take leftovers home, and adjust the quantity and portion size of food. Composting shows potential usefulness, it is not yet possible.

5.2. Recommendations

Based on the study findings, a number of approaches have been proposed. However, currently, three methods are considered the most practical for reducing food waste generation:

Enhancing menu details helps customers have a more in-depth view of the dishes, size and flavor information helps improve the efficiency of the ordering process and improve customer satisfaction, reduces the likelihood of incorrect orders and ultimately minimizes food waste

Encouraging customers to pack leftovers is a measure that does not require substantial alterations or additional exertion from the restaurant customers while are equipped with appropriate amenities, such as reusable plastic containers and utensils, to pack their leftovers. This method is also recorded to bring positive signals when customers have a higher probability of consuming their leftovers (from findings of the study, Table 25)

Considering the research findings, it is necessary to modify the portion size and quantity of ingredients. The restaurant has acknowledged that they are currently working on designing optimal portion sizes, although their previous attempts have not been particularly successful. If implemented correctly, this method has the potential to align with the customer's consumption level, enhance customer satisfaction in terms of appetite, and reduce food waste. However, it will require time for testing and significant operational resources, which may impede its immediate effectiveness.

While the remaining two proposed methods are not completely ineffective, their overall effectiveness and feasibility are relatively low. Due to concerns regarding food safety and health regulations, as well as the restaurant's existing emphasis on efficiently using raw ingredients from the start, there is limited room for implementation and the resulting effectiveness is not significant. Furthermore, the foods utilised by H.N. are characterised by their freshness, perishability, and limited shelf life, making reuse challenging. Composting is a viable approach for managing solid food waste, which constitutes a substantial portion of the overall waste produced. Nevertheless, the current unavailability of adequate physical space, appropriate treatment technologies, and sufficient testing time pose financial obstacles that hinder the implementation of this method. H.N. also expressed their desire to promptly integrate this method into existing management and eagerly anticipate its promising outcomes.

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Appendix

I. Questionnaires survey for customers (Survey 1)

Dear Participants,

I am conducting a Bachelor thesis to examine the Food Waste Management in Restaurants, the case study will be H.N. restaurant - a Vietnamese restaurant with Vietnamese cuisine in Budapest, Hungary. The aim of this survey is to get an in-depth knowledge of the viewpoints, needs, and practices of the customers in relation to the production and management of food waste. This information will help improve and refine waste management strategies, which will ultimately result in less food waste and better food waste management. These enhancements will increase client satisfaction while also optimizing resource utilization.

The survey should take about 5 - 7 minutes to complete, and all responses will remain anonymous. I sincerely appreciate your time and effort in filling this research. Your responses are invaluable and will contribute to a deeper understanding of food waste issues from the viewpoint of customers.

Thank you and best regards,

Tran Thu Phuong

- *Demographic section*

1. Your age group:
    - Under 18
    - 18-24
    - 25-34
    - 34-44

- 45-54
- 55-64
- Above 65

2. Your gender:
    - Female
    - Male
    - Prefer not to say

3. Your country of citizenship

4. Your employment status
    - Full-time
    - Part-time
    - Self-employed o Unemployed
    - Student
    - Retired

5. Your monthly income range (The average range is based on Hungary's average income level of about 200,000 HUF - 400,000 HUF ≈ 550 USD - 1100 USD)
    - Below average
    - Average
    - Above average

6. Your level of education
    - Highschool
    - College or Vocational Training
    - Bachelor’s Degree
    - Higher Education

- *Perception and Awareness About Food Waste*

1. Do you think the food waste problem is under-researched and needs more attention (than other environmental issues)? (1 - Strongly disagree, 2 - Disagree, 3 - Neutral, 4 - Agree 5 - Strongly agree)

2. On a scale from 1 to 5, how concerned are you about food waste problem in general and food waste in restaurants specifically? (1 – Not concerned at all. 2 – Slightly concerned, 3 – Moderately concerned, 4 – Very concerned, 5 – Extremely concerned)

3. Would you agree and be willing to comply if the restaurant takes measures to reduce food waste? (1 - Strongly disagree, 2 - Disagree, 3 - Neutral, 4 - Agree 5 - Strongly agree)

- *Specific survey questions*

1. Your frequency of dining in H.N.
    - Multiple times a week
    - Once a week
    - A few times a month
    - Less than once a month
    - This is my first time

2. If this is your first time, have you known about Vietnamese food and Pho soup before?
    - Yes
    - No

3. What time of day do you usually come to H.N. to eat?
    - Lunch time (from 11am to 3pm)
    - Dinner time (from 6pm to 9pm)
    - Between lunch and dinner time (from 3pm to 6pm)

4. What time of the week do you usually come to H.N. to eat?
    - Weekday (from Monday to Friday)
    - Weeken (Saturday and Sunday)

5. In what order do you usually order food?
    - Order from basic course in a meal (Starter, Main course/Soup, Dessert)
    - Only soup or main dish

- Soup/main dish and dessert
- Soup and main dish
- Starter and soup/main dish
- Other

6. Do you consider a Pho soup as a main dish?
    - Yes
    - No
    - Maybe

7. How often do you leave food uneaten?
    - Always
    - Often
    - Rarely
    - Never

8. In case you leave leftovers when eating out, what parts of food are usually left behind?
    - Vegetable
    - Side dish (rice/noodle)
    - Garnishes (item or substance used as a decoration or embellishment such as pickles, sauce, herbs, etc.)
    - Starter
    - Dessert
    - Meat
    - Inedible parts (skins, bones, fatty parts, etc.)
    - Food that are flavored or contain special ingredients

9. What influences your decision to leave food uneaten at restaurant?
    - Large portion size
    - Quality of food
    - Dietary restrictions or allergies
    - Personal taste (The dishes are not my preference or contain ingredients that are not in my preference)
    - Over-order
    - Social norms

10. In case you have leftover, do you pack it home?
    - Yes
    - No

11. On a scale of 1 to 5, rate your likelihood of consuming leftover food after packing it to take home (1- Very unlikely, 2 - Unlikely, 3 - Neutral, 4 - Likely, 5 - Very likely)

12. On a scale of 1 to 5, how do you evaluate the opinion that leaving leftovers and wrapping leftovers to take home is influenced by cultural background factors? (1 - Strongly disagree, 2 - Disagree, 3 - Neutral, 4 - Agree 5 - Strongly agree)

13. On a scale of 1 to 5, how do you evaluate the opinion that leaving leftovers and wrapping leftovers to take home is influenced by social norms? (1 - Strongly disagree, 2 - Disagree, 3 - Neutral, 4 - Agree 5 - Strongly agree)

14. Do you think that a certain amount of food in a dish is being served too much compared to other ingredients of the dish? (1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly agree)
    - Rice
    - Noodle
    - Vegetable
    - Meat/Poultry/Seafood
    - Garnish

15. On a scale of 1 to 5, would it be easier for you if the sizes and portions were clearly illustrated and explained on the menu? (1 - Strongly disagree, 2 - Disagree, 3 - Neutral, 4 - Agree 5 - Strongly agree)

16. Of the methods below, evaluate relevance and applicability to reduce food waste in the restaurant?
    - Adjust quantity and ratio of ingredients and dishes
    - Reuse in case safe and reasonable
    - Encourage customer to bring left-over home
    - Enhance menu details interpretation
    - Compost

17. On a scale of 1 to 5, would it be easier for you if the sizes and portions were clearly illustrated and explained on the menu? (1 - Strongly disagree, 2 - Disagree, 3 - Neutral, 4 - Agree 5 - Strongly agree)

18. Do you have any suggestion for the restaurant to reduce food waste?

II. Questionnaires survey for employees (Survey 2)

The purpose of this survey was to gain in-depth knowledge of the attitudes, behaviors and perceptions of restaurant staff regarding the production and management of food waste. This information will help improve and refine food waste management strategies, which will ultimately lead to less food waste and better food waste management. The survey will take approximately 5 minutes to complete and all responses will be anonymous. I sincerely appreciate your time and effort in answering these survey questions honestly.

Thank you and best regards!

Tran Thu Phuong

- *Demographic section*

1. Your age group
    - 18-24
    - 25-34
    - 35-44
    - 45-55
    - Above 55

2. Your nationality

3. Your work position
    - Service area
    - Kitchen area
    - Dishwashing area
    - Preparation area
    - Manager

- *Food waste perception and awareness & specific questions*

1. Are you aware and concerned about protecting sustainable values, the environment and the ecosystem? (1 - Not concerned at all, 2 - Slightly concerned, 3 - Moderately concerned, 4 - Concerned, 5 - Very concerned)

2. Do you think that food waste awareness and food waste reduction is a necessary and obligation for restaurant employees? (1 - Not necessary at all, 2 - Slightly necessary, 3 - Moderately necessary, 4 - Necessary, 5 - Very necessary)

3. How do you assess the severity of the food waste problem in H.N? (1 - Not serious at all, 2 - Slightly serious, 3 - Moderately serious, 4 - Serious, 5 - Very serious)

4. Do you think that a certain amount of food in a dish is being served too much compared to other ingredients of the dish?
    - Noodle
    - Vegetable
    - Meat/Poultry/Seafood
    - Garnish

5. Do you think the food processing and recipes in H.N. causing food waste? (1 - Strongly disagree, 2 - Disagree, 3 - Neutral, 4 - Agree 5 - Strongly agree)

6. How effective do you feel are the current food waste management measures in H.N.? (1 - Not effective at all, 2 - Slightly effective, 3 - Moderately effective, 4 - Effective, 5 - Very effective)

7. Are you conscious and trying to limit the creation and reduce food waste during work?

    - Yes
    - No

8. Do you find your contributions very helpful in reducing restaurant food waste? (1 - Not helpful at all, 2 - Slightly helpful, 3 - Moderately helpful, 4 - Helpful, 5 - Very helpful)

9. How do you feel it is necessary to receive more training or information about food waste management? (1 - Not necessary at all, 2 - Slightly necessary, 3 - Moderately necessary, 4 - Necessary, 5 - Very necessary)

10. How willing are you to participate in food waste reduction programs or initiatives at H.N? (1 - Very unwilling, 2 - Slightly willing, 3 - Moderately willing, 4 - Willing, 5 - Very willing)

11. Of the methods below, evaluate relevance and applicability to reduce food waste in the restaurant?
    - Adjust quantity and ratio of ingredients and dishes
    - Reuse in case safe and reasonable
    - Encourage customer to bring left-over home
    - Enhance menu details interpretation
    - Compost

III. Questions for the interview

1. What is the significance and relevance of sustainable development for the restaurant sector as a whole and specifically for your business?

2. Regarding the issue of food waste in particular, do you think this is a prominent issue in your business?

3. What is your evaluation of the present food waste situation in your restaurant? Can you estimate a number that represents the damage and costs of food waste generated by the restaurant?

4. From your perspective, what do you believe are the primary sources of the restaurant's food waste?

5. What measures are restaurants currently taking to reduce and manage food waste? Can you further evaluate its effectiveness?

6. Based on observations and tracking, the quantity of unconsumed food left by guests is substantial. What are your opinions regarding this issue, and have you ever discovered the reason behind guests leaving uneaten food?

7. Are there any challenges and limitations that restaurants face when it comes to managing food waste?

8. Does the restaurant cooperate with any partners to support food waste treatment?

9. Does the fact that a restaurant specializes in Vietnamese cuisine, with its specialized recipes and cooking methods, address a challenge in terms of minimizing food waste?

10. How does the cultural background of restaurant employees and the culture of the business in general affect the restaurant's food waste management?

11. Based on survey responses and customer opinions, there is currently an inconsistency in the portion size and ingredient ratio of the dish, specifically the Pho soup - the restaurant's best-selling dish. Specifically, there have been complaints about excessive servings of pho noodles. Do you believe this is an issue that should be addressed?

12. Does your business prioritize the education and involvement of employees in subjects connected to environmental responsibility and sustainability? If yes, how did you reach that goal and keep that commitment between the circle of the restaurant?

13. Do you believe it is necessary for restaurant staff to receive education regarding awareness and the significance of food waste management, along with other environmental principles?

14. Do regulations influence your approach to controlling food waste at H.N.? How valuable do you consider the government's efforts in decreasing and managing food waste in the restaurant industry?

15. What are your future plans or goals for enhancing food waste management in your restaurant?