The Wastage of Golden grains-the Food: A Case Study of Service Sector

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Abstract:

Food is wasted at many points along the food supply chain, from farm production to processing, distribution, and consumption. It is a significant global issue with costs on the social, environmental, ethical, and financial fronts. The goal of the current work is to discuss the differences between waste produced from surpluses or leftovers, food waste monitoring systems in public food services, and best practices for reducing food waste. In addition to the readily available information on waste reduction, tons of foods were wasted each day. Food waste must be drastically reduced if a sustainable food system is to be achieved. For SDG 12.3 in public food services to be achieved, significant reductions in food waste must be attained through collaborative efforts. Therefore, policies that encourage or mandate more extensive implementation of enabling customers to share meals or order smaller portions; offering packaging so that customers can take leftovers home for later consumption. The policies that public food services will follow should offer suggestions for the kinds of goods that can be donated. However, it is important to adhere to the specific temperature requirements that vary depending on the food category. In order to reduce food waste, this paper expands on our understanding of surpluses, leftovers, and best practices that could be used in public food services.

Keywords: leftovers, public foodservices, surpluses, best practices, food waste

Introduction

Food waste occurs at every stage of the food supply chain, from farming to processing to distribution to final consumption. The daily discard of tons of food intended for human consumption points to the food system's unavailability, which has negative effects on the environment, society, ethics, and the economy [1]. Food waste has many different global causes that are closely related to local conditions [2]. Except for the stages where losses are more significant, developed countries' waste is greater in the final stages of consumption, while underdeveloped countries' waste is more common in the production and transport stages [3]. It has been shown that the 1/3 ratio between waste and production remains the same between developed and underdeveloped countries [4].

According to the Food and Agriculture Organization of the United Nations (FAO), approximately 1.3 billion tonnes of the food produced for human consumption are wasted annually worldwide [1]. Around 131 kilograms (kg) of food waste per person were produced in the EU in 2020, the first year of the COVID-19 pandemic [4]. Of this amount, 53%—or 70 kg—were produced by households. According to data gathered by the European Commission, restaurants and food services (such as canteens at schools and workplaces, hospitals, etc.) account for 9% of food waste, while wholesale and retail produce about 7%. Primary production (11%) and food processing and manufacturing (20%) are additional industries that contribute to food waste in the EU [4]. There is a lot of food waste.

Food waste causes the food chain to emit millions of tons of CO2 equivalents or greenhouse gases, which is extremely harmful to the environment. In addition to harming the environment and wasting limited natural resources like land and water, food waste has negative effects on society in the nutritional, social, and economic spheres as well [5]. Food waste seems contradictory when 8.3% of people in Europe couldn't afford

a full dinner every second day that included meat, fish, or a vegetarian alternative [6]. In the European Union, 95,3 million people, or 21.6% of the populace, faced the threat of poverty or social exclusion in 2022 [7]. The United Nations member states decided to include food waste in one sustainable development goal of "ensuring sustainable consumption and production" in 2015 as the solution to this global issue has become more political and social.(SDG 12) "Patterns" Half of per capita food waste at retail and consumer levels is the goal of target 12.3.by the year 2030, and decrease food losses throughout the food supply and production chains, including losses following harvest [8]. Reduced food loss and waste is therefore widely regarded as a crucial With a focus on the public food service sector (meals provided for schools, hospitals, prisons, universities, etc.), catering services are at the very end of the food supply chain. Reducing food waste can have significant positive effects on both the economy and the environment [9]. Public catering services are available to people of all ages, and they are the locations where many people choose to eat and consume meals [10]. The significance of recently, difficulties with the investigation of food waste in the public food service was identified. authored by the United Nations [11].

2. Definition of Food Waste

Food waste is characterized as the use of food intended for human consumption for non-human consumption, the rerouting of food for animal consumption, or the disposal of edible food [12]. In catering services, three types of food waste that result from various stages of meal production can be seen. In the beginning, waste can happen during storage and preparation and includes excessive quantities of purchased ingredients, spoiled food, inedible portions of food, and parts not typically consumed, like peels and stalks of fruit and vegetables. Food that is prepared but not served in the second phase due to insufficient planning of the required quantities is known as surpluses.

increases the overall food waste. Finally, portions of food served but not eaten significantly increase food waste [13]. The term "food waste" has no precise definition, and different authors may use different terms. The definition of food waste varies depending on what is wasted, how it is wasted, where it comes from, and the cultural constraints involved [14]. For example, food that is deemed waste in one country might be considered edible in another.

Food waste has been classified into three categories: "avoidable," "not avoidable," and "partially avoidable." Food that is thrown away but is still suitable for human consumption, such as a piece of bread, an apple, or leftovers from a meal, is referred to as avoidable food waste. Food that some people eat but not others makes up partially avoidable food waste, as do waste products from various consumption patterns (like bread crusts). The portions of food that are inedible to humans under normal circumstances, such as bones and eggshells, are referred to as non-avoidable food waste [15]. Additionally, academics contend that these three broad categories of food waste may vary depending on the cultural context [16].

Food waste is defined by the European Parliament as any food product that is removed from the agri-food chain due to aesthetic, economic, or time constraints but which is still perfectly edible and fit for human consumption and which, in the absence of a potential alternative use, is intended to be disposed of and thrown away. The food supply chain is typically thought to experience "food loss" at the harvest, slaughter, and catch levels up to, but excluding, the retail level, and "food waste" at the retail and consumption levels [2].Results for food waste are typically displayed as the proportion

of food served but not eaten. The results can also be presented in other ways, such as in terms of [17,18].

The inorganic portion of fish by-products has undoubtedly been shown to be a rich source of nutrition, but there are still questions about the availability of nutrients as well as the presence of other ingredients (such as starch, other proteins, phenolic compounds, and lipid profile). The bioavailability of nutrients in the finished product can be increased or decreased by the addition of fish waste. The use of calcium from fish bones to make up for calcium deficiencies has drawn a lot of attention [19].

In public food services, food waste can happen during food preparation or storage, for instance, losses related to product expiration dates and ignorance of label information, the aesthetic qualities of the product that are a selection criterion, in which defective products and products damaged by handling are rejected, and insufficient food storage conditions. However, a significant portion of waste is caused by food that was produced and ready to serve but was wasted due to excesses or by consumers (leftovers) (Figure 1).

Figure 1 shows food waste from surpluses, leftovers, and food produced in food services.

Foods cooked in excess for specific amounts or portions are referred to as surpluses. These foods are typically suitable for hygienic conditions or unaffected by bacterial development. Surpluses may be consumed later on up to 48 hours after preparation if they are properly packaged and kept at refrigeration temperatures and are not contaminated by pollutants or kept in good, safe conditions. As prepared food that has been overproduced but not distributed or consumed makes up surpluses, they can be categorized as unused food waste [20]. Foods that have been cooked and kept under strict time and temperature controls that ensure their nutritional value and sensory quality without being exposed during distribution are considered surpluses, allowing for proper storage [21].

The policies that public food services will follow should offer suggestions for the kinds of goods that can be donated. For instance, since they adhere to hygiene standards, products that are left in the kitchen can be donated. a few Member States, Trade associations have produced detailed regulations for the industry [22].

Public food services typically cater to a defined clientele that is more or less homogeneous when taking into account the age group and level of activity. These services are also typically regulated, allowing for better quantitative planning of meals. By default, meals are planned and prepared, with production done in accordance with the average intake for each unit's population. Average dietary intake. even when there is preparation for the quantity of meals served in each establishment, mass catering frequently produces surpluses of food that is wasted.units, primarily because it was difficult to predict demand.

It is possible to calculate the surpluses index as follows:

Surpluses index (%) = (kg of food surpluses)/(kg of food produced) 100

Among catering units, the rate of surpluses varies greatly. Though some authors claimed that values greater than 7% or 25 g per person shouldn't be allowed [21], others disagreed.

The facilitation of food is necessary because surpluses are food that is suitable for human consumption. In Europe, donation is a top priority area of work [22], and the ideal location might beAccording to some authors [23], make it accessible to those in need and help institutions.as steps to make food services more socially and environmentally sustainable.

By using food that is no longer fit for human consumption as animal feed, these EU regulations aim to encourage sustainable food production systems, reduce food waste, and promote the circular economy [22].

According to the recommendations, this use as feed must adhere to all applicable EU laws, including feed hygiene and safety requirements, to prevent any risks to the environment or animal health. In terms of composition and potential contaminants, the food intended for animal feed should be secure [22].

Toachieve this, it is crucial to implement sound agricultural techniques and create the necessary infrastructures for the collection, transportation, and storage of food waste for use as animal feed.

To ensure the security and effective valorisation of food waste, cooperation between operators of food businesses, feed manufacturers, and competent authorities should be encouraged. Implementing a risk assessment and suitable control measures should be done throughout thefood chain to prevent any possible dangers.

2.2. Remaining's

Unfinished meals that have been cooked and distributed safely are referred to as leftovers. Due to the risk of spreading infectious diseases, such as hepatitis B, leftovers should never be used in human food. This is because they are bacteriologically contaminated by those who have partially consumed them. The ratio between the quantity served and the amount of food that was left over and placed back on the consumer's plate is used to calculate the leftover index. It has a direct impact on how well-received menus are, how well-prepared the food is on the palate, and how satisfied a customer is with the meal they received. Even when customers are happy with the meal service, according to a 2015 investigation, there is still significant average food waste.

It is necessary to improve the planning of the quantities produced and plated as well as the suitability of the menus in relation to customer preferences considering the literature's rejection of this value. Given that the food was properly prepared,

There shouldn't be many leftovers. However, the food has a responsibility as well.service to keep track of the leftover index's values over time and set a cap for theunit based on the population type inherent in its use and the resulting adaptation and planning. A high rate of leftovers is thought to indicate dissatisfaction with theunit in accordance with the population type that it is designed to serve, with appropriate adaptation, and with advance planning. A high percentage of leftovers is thought to indicate poor planning and/or dissatisfaction with the meal or service [24].

The following formula can be used to determine the leftovers index: Leftovers index (%) = (kg of leftovers)/(kg of food served) 100

In university canteens, waste rates from leftovers could range from 7.5 to 16.8% and depend on the meal type, from vegetarian to meat dishes [23]. Food waste from leftovers can reach a value of 72.6% in the hospital setting [26]. The principal causes of Customers' preferences for leftovers are not being met, and the food service does not permitnot being accommodating in providing varying portion sizes in accordance withclient requirements.

3. Monitoring Systems for Food Waste

It is essential to measure food waste in order to provide data on which to base prevention strategies. To measure food waste at each stage of the food supply chain, the EU Commission adopted a common methodology in 2019 as a result [27]. According to a 2018 report by the Food and Agriculture Organization (FAO), 20 MT of fisheries byproducts (head, skin, fins, bone, red meat, viscera, trimmings, and scale) are produced each year. Numerous initiatives have been made to recover more of these by-products for use as human food, as well as to use them in feed, food packaging, fish silage, fertilizer, and biofuels [18,28].

By direct measurement (weighing or volumetric assessment), waste composition analysis, counting/scanning, and diaries, food waste in food services can be quantified [27]. In direct measurement, the mass of samples of food waste or fractions of the total waste is ascertained directly or based on volume, and collected food waste can be broken down into its component parts. The process of counting or scanning involves estimating the number of components that make up food waste and using the results to calculate the mass. The physical separation of food waste from other fractions is done as part of the waste composition analysis to calculate the mass of the fractions sorted out. Finally, the diaries include the realization of a record or log of foodIn order to calculate the mass of the fractions as part of the waste is physically separated from other fractions as part of the waste composition analysis. The diaries also reveal the realization of a regular log or record of information regarding food wastea person or group of people's assertions [27].

The definition of an acceptable level of food waste in catering services varies depending on the characteristics of the food unit and the population it serves and does not meet the consensus among different authors. The standard value should be determined by some authors contend that rates of less than based on values established in the food unit itself [29];Less than 5% is ideal, and 10% food waste from leftovers is acceptable [30,31].

The number of days used for measuring food waste can affect how reliable the results are; for instance, if only a few days are used for measuring, the results will be very dependent on the dishes served during the evaluation period.can be anticipated to generate waste with varying levels and compositions, making theresults that are ambiguous or hard to interpret. Evaluation times differ significantly betweenstudies ranged in length from one to thirty days, with the average evaluation period lasting two weeks [33].

Several authors have identified the problematic areas and used reduction strategies after realizing the significance of using precise continuous measurement methods for measuring food and waste related to food [33,34]. By way of illustration, the method of assessment used in public food services

for schools weighs the waste by aggregatedVisual estimation and components appear to be the methods with the best performance [34].appears to be a less effective approach.

Most studies weigh leftover food waste in accordance with its components to be more informative, for example, soup, plate components (garnish, conduct, salads), bread, and desserts [23,26,34]. This measurement is crucial to assess the effectiveness of food service and identify areas for process improvement, such asthe redesign of the menu [23, 35].

4. Recommendations

The reduction of food loss and waste was placed on the global agenda after the United Nations General Assembly formally adopted the 2030 Agenda for Sustainable Development in September 2015, which included 17 Sustainable Development Goals (SDGs) as part of the Post-2015 Development Agenda—universal goals to end poverty, protect the planet, and ensure prosperity for all. SDG 12 aims to "ensure sustainable patterns of consumption and production."

At every point in the food supply chain, efforts can be made to reduce food waste. This entails enhancing farming practices to reduce production-related losses, putting in place better storage and transportation systems, and developing efficient distribution networks. By implementing stock management systems, giving away unsold food to charities, and taking part in initiatives to reduce food waste, businesses can also play a significant role [36].Several laws can enforce and support the widespread application of best practices.practices to decrease food waste in the food services industry, such as promoting awareness.; to put inventory management systems into place; to donate extra food by working with food banks and charities; to standardize date labeling by creating distinct and standardized date labelling ;legislation to stop needless food waste. This may entail the use of words like "best."Implementing national guidelines to determine food safety and using "before"instead of "use by"based on data from science.

To achieve global food loss and waste targets, a set of recommendations from the EU Platform on Food Losses and Food Waste (FLW) [37] is put forth. These recommendations are common at different points along the food value chain, involve numerous actors, and are essential. Some guidelines to put food donation into practice were presented in May 2019 [37] with the intention of The publication "Redistribution of Surplus Food: Examples of Practices in the Member States"

With the implementation of some measures [37], Public Food Services should actively participate in the Prevention and Reduction of Food Waste and subsequently contribute to sustainable patterns of consumption and production.

-Train employees on the value of minimizing food waste and practical advice for doing so in their specific jobs; Ensure that the front-of

-house staff is able to interact with customers on specific issues; in terms of the selection of dishes, serving sizes, etc.;

- Develop modular or customizable menu options that let customers select thechosen portion size and type.

-Reduce the likelihood of customers leaving food on their plates by optimizing portion sizes, making sure they are manageable and adequate; Adopt payment policies that are in line with operations and business profiles (for example, payment terms that are flexible); in all-you-can-eat buffets, charging for dishes that go uneaten by weight of food.

- Enable customers to share meals or order smaller portions.

- Donate unused food that is still fit for human consumption to your neighbourhood food banks or charities.

- Examine menu items' popularity and profitability, eliminating underperforming or unprofitable ones that increase waste and promoting popular ones that produce less waste.

- Regularly review efforts to reduce food waste and evaluate them for improvement.data, paying attention to customer comments, and changing procedures as necessary.

- Run publicity campaigns to let clients know that the catering service isdevoted to reducing food waste.

Other best practices include:

- Simplify inventory and cut down on the number of items on hand; - Modify menus to avoid overbuying; - Adopt better food safety and storage practices to reduce the need for waste.

- Assess stock surpluses on a regular basis and modify inventory control to reduce surpluses.

-To comprehend overrun outlines, conduct waste audits.

To "enjoy meals without wasting," the European Citizens' Panel on Food Waste Final Recommendations (2023) urges food establishments to reduce food waste. The requirements for quality should all be met.

The recommendations can also be applied to Public Food Services and include:

- Display a (EU-wide standardized) logo indicating that leftovers may be taken home and add additional text to menus or walls indicating that leftovers may be taken home.

- On request, offer packaging so that customers can take their leftovers home;offer "le Gourmet Bag" or "doggy bags" for plate leftovers so that customerstake leftovers home to enjoy later.

- Employees should be provided with prepared food leftovers.

- Food that is not edible should be used for other projects, such as the production of renewable energy or animal feed, provided that it complies with health and safety regulations; - Raw food leftover from the kitchen should be donated to food banks or other charities;

- A composting system or cooperation with regional food-focused organizationsRecovery needs to be enhanced.

- To plan a week of food waste awareness using a "Stop food waste" or similar campaign.Food waste will be the focus of a "thematic week" to increase customer awareness.

Food donation must adhere to EU regulations on food hygiene and the General Food Law. Every restaurant must comply with Regulation (EC) No. 852/2004 on Food Hygiene [38]. The groups, working together with theAuthorities should create policies regarding the transport's hygienic conditions.and storage of the goods used in food services. There are certain temperature ranges.requirements for the various redistribution stages (storage, transport, etc.)based on the type of food and its nutritional makeup.

General hygiene standards that apply to all food donation activities purport to prevent food contamination to protect human health and help reduce food waste. EU food safety regulations provide a great deal of flexibility to meetthe unique requirements of various establishment types, and some Member States have alsoadopted national regulations or measures [22]. An investigation conducted in the Swedish. The public catering industry investigated the benefits of implementing the Environmental Code.

Composting bio-waste reduces greenhouse gas emissions from organic materials decomposing in landfills, lessens the environmental impact of waste disposal, and creates a useful resource in the form of nutrient-rich compost. [40]

5. Conclusions

Understanding food waste is crucial for altering attitudes and behaviors toward leftovers and surplus food, as well as for achieving SDG 12.3 in regard to public food services. This industry can help prevent food waste by utilizing sustainable practices.of ingredients, environmentally friendly cooking methods, and consumer education about sustainablecollaboration. Several regulations that can enforce and support the widespread implementation ofFood waste can also occur at another step of the supply chain if best practices are not properly implemented, such as when leftovers or donated food are not properly disposed. Food waste can also occur at another step of the supply chain if best practices are not properly implemented, such as when leftovers or donated food are not properly implemented, such as when leftovers or donated food are not properly implemented, such as when leftovers or donated food are not properly implemented, such as when leftovers or donated food are not properly implemented, such as when leftovers or donated food are not properly implemented, such as when leftovers or donated food are not properly disposed. When portions are adjusted using various sized containers after being brought home in a doggie bagKitchen waste increases because of plates. When assessing how effective food waste issuch indirect effects should be considered when reducing involvements.

In conclusion, a multifaceted strategy must be implemented to address food waste, involving all stakeholders, including governmental entities, private companies, and individuals.

Efforts must be made to reduce food waste along the entire food supply chain. This entails enhancing farming practices to reduce production-related losses, putting into practice.

better methods for transportation and storage, as well as building efficient distribution networks. Businesses can also play a significant part by putting in place stock management systems, giving, and donating unsold food to charities and taking part in programs to reduce food waste.

By planning their meals, buying only what they need, properly storing their food, and finding creative ways to use leftovers, consumers can reduce food waste at the individual level. Moreover, promoting sustainable consumption habits and increasing awareness of food wastecan assist in

altering consumer behaviour. Composting of biowaste in home composters or inAdditionally, community composters can help reduce food waste.

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