

EFFICIENT STRATEGIES FOR MANAGING FOOD WASTE IN INSTITUTIONAL CATERING: A COMPREHENSIVE STUDY

*Hare Krishna Chaudhary¹ and Tanushri Sharma²

¹Faculty, Institute of Hotel Management, Catering & Nutrition, Pusa, New Delhi,

²Assistant Lecturer, Institute of Hotel Management, Catering & Nutrition, Pusa, New Delhi,

*hk2191chy@gmail.com

ABSTRACT

Background: Food waste is a pressing global issue, and its management within institutional catering facilities is of paramount importance. Institutions such as College, hospitals, and corporate cafeterias generate substantial amounts of food waste, contributing to environmental concerns and economic inefficiencies. This abstract presents a comprehensive study aimed at identifying efficient strategies for handling food waste in institutional catering settings. **Objectives:** The primary objectives of this study were to Investigate the multifaceted impact of food waste management strategies in institutional catering and propose practical recommendations to enhance food waste management in these settings. **Methodology:** To achieve these objectives, a quantitative-methods approach specifically descriptive research design was employed. Data was collected through online questionnaire through google form from few students who had explored few sets of institutional catering facilities. convenience sampling method was used for the data collection. Sample size was 194. Data were analysed using software spss 23 on the basis of Likert scale-based questionnaire. **Results:** The results of the one-sample tests indicate a significant difference ($p < 0.001$) in food waste generation between institutions implementing various food waste reduction strategies, with a mean difference of 2.98 (95% CI: 2.786 to 3.183). Additionally, there's a significant difference ($p < 0.001$) in the cost of food waste disposal between institutions employing waste reduction practices and those that do not, with a mean difference of 3.06 (95% CI: 2.868 to 3.256). The adoption of various approaches to cut down on food waste in institutional catering has shown a clear impact on the quantity of food waste generated. This discovery underscores the considerable potential of these strategies in decreasing the volume of food waste generated. **Conclusion:** Institutional catering can significantly reduce food waste through strategic implementation of waste reduction practices, menu planning, staff training, technology utilization, and customer engagement, resulting in cost savings, environmental benefits, and enhanced compliance and satisfaction.

Keywords: Food waste, Institutional Catering, Environmental Impact

INTRODUCTION

Food waste is a pressing global issue with far-reaching environmental, economic, and social consequences. Food waste is a significant global issue with economic, environmental, and social implications. Addressing food waste is a significant challenge that the hospitality sector must confront (Shivapuri & Misra, n.d.). In the context of institutional catering, such as schools, hospitals, and corporate cafeterias, effective food waste management strategies

are crucial. This review synthesizes existing research, identifies key themes, and discusses various approaches and best practices for reducing food waste in institutional settings. In recent years, there has been a growing awareness of the need to address food waste at all levels of the food supply chain, from production to consumption (Malefors et al., 2022). Within this complex landscape, institutional catering stands out as a significant contributor to food

waste generation, making it a critical area for intervention and research (Falasconi et al., 2015). It is recommended that, the organization should give special attention and emphasis to employee engagement (Paul & Sharma, 2022). Institutional catering serves a vital role in providing meals for large populations daily. However, it is also notorious for generating substantial quantities of food waste, much of which is edible (Dhir et al., 2020). According to estimates by the Food and Agriculture Organization (FAO), approximately one-third of all food produced globally is lost or wasted, with institutional catering contributing significantly to this statistic. This wastage not only strains the environment but also represents a considerable financial burden on institutions and undermines efforts to address hunger and food insecurity.

Efficiently managing food waste in institutional catering has multifaceted significance. First and foremost, it aligns with broader sustainability goals aimed at reducing the environmental footprint of food production and disposal (Oliveira et al., 2016). By minimizing food waste, institutions can decrease their greenhouse gas emissions, reduce water and energy consumption, and lessen the burden on landfills. Secondly, addressing food waste in institutional catering holds economic benefits. Institutions can save substantial amounts of money by optimizing their food procurement, storage, and preparation processes. This could have a ripple effect on budgets, potentially allowing for resource allocation to more pressing needs or improvements in food quality. Moreover, the social aspect cannot be ignored. As institutions often cater to vulnerable populations, reducing food waste can redirect surplus food to those in need, contributing to the fight against hunger and food insecurity.

Food waste management within institutional catering is a critical area of concern, given its economic, environmental, and social implications. Recent studies have emphasized the importance of implementing comprehensive food waste reduction strategies in institutional catering. The finding that different strategies significantly influence food waste generation aligns with research advocating for multifaceted approaches (Parfitt et al., 2010). Strategies encompassing menu planning, staff training, and technology utilization have demonstrated promise in minimizing waste (Sonnino & McWilliam, 2011). The absence of a significant difference in the cost of food waste disposal between institutions implementing waste reduction practices and those that do not resonates with the economic benefits of waste reduction efforts. Studies have highlighted that investing in waste

reduction measures, such as better inventory management and portion control, can yield substantial cost savings (Nikolicic et al., 2021).

The research found that the environmental impact of food waste is not significantly reduced by the implementation of food waste management strategies challenges conventional wisdom. While waste reduction is often viewed as an eco-friendly practice, it underscores the need for holistic strategies considering broader sustainability goals (Thyberg & Tonjes, 2016). Variations in compliance with food waste management regulations among institutional catering facilities have been noted, echoing concerns raised in prior studies about inconsistent enforcement (Wu et al., 2021). Ensuring consistent adherence to regulations is crucial for sustainable waste management. Contrary to research advocating for menu optimization to reduce food waste at the source, the finding that menu planning choices have no significant impact on food waste generation prompts further investigation into specific menu planning practices and their effectiveness (Yahia & Mourad, 2020).

While research on food waste management in restaurants has made steady progress in developed countries, there remains a significant gap between sustainable innovations and actual recycling practices in the hospitality sector, particularly in developing and transitional economies (Amicarelli et al., 2022). Existing research has predominantly focused on food waste within restaurant settings, but variations in food waste management practices across different types of restaurants have not been adequately explored. Notably, the hotel industry has received limited attention in terms of food waste reduction efforts.

Previous studies by (Kattiyapornpong et al., 2023) have highlighted effective food waste management practices and sustainable initiatives in the hospitality and food service sector. For instance, hotels have been encouraged to redesign their kitchen processes during the planning phase to minimize food waste. In the handling stage, ensuring the implementation of the First-In-First-Out (FIFO) stock method, redistributing excess food, and reusing unsold items within staff canteens have been suggested strategies. Additionally, restaurant operations are advised to opt for a la carte service over buffets, find creative ways to repurpose inedible leftovers (e.g., as pet food or for composting), and implement food waste measurement practices. Despite an increasing focus on food waste studies in the hospitality industry, the integration of food waste management within hotels remains fragmented.

The result indicated that different food purchasing practices do not result in significant differences in food waste generation raises questions about the implementation of sustainable sourcing and portion control in institutional catering. Further examination of specific practices is warranted (Dhir et al., 2020b). The research found that food preparation techniques do not significantly affect the amount of food waste produced highlights the need for more nuanced research in this area, as existing studies have produced mixed results (Schanes et al., 2018). The result that staff training in food waste reduction techniques does not significantly influence food waste generation challenges assumptions about the centrality of education and training in waste reduction efforts (Elnakib et al., 2021). Evaluating the effectiveness of training practices is essential. Efficient food waste management in institutional catering not only mitigates environmental impacts but also contributes to significant cost savings and supports a more sustainable food system. The study found that technology for food waste tracking and measurement does not lead to significant reductions in food waste underscores the importance of considering factors such as system usability and integration when adopting technology for waste reduction (Leal Filho et al., 2023).

The study found that customer education and engagement efforts do not significantly affect food waste levels in institutional catering suggests the need for further inquiry into the design and delivery of customer-focused waste reduction initiatives (Filimonau et al., 2020). Despite the critical need to address food waste in institutional catering, there is a noticeable gap in comprehensive research on this topic. While individual studies and initiatives exist, a holistic examination of the strategies related to food waste management within institutional catering settings is lacking. This research aimed to bridge this gap by providing a thorough and up-to-date analysis of the current state of multifaceted impact of food waste in institutional catering and proposing efficient strategies for its management.

Objectives of this study were:

- To investigate the multifaceted impact of food waste management strategies, including waste reduction practices, menu planning, staff training, technology usage, and customer engagement, on food waste generation, cost reduction, environmental benefits, and compliance in institutional catering operations.
- To propose practical recommendations in model form to enhance food waste management in these settings.

METHODOLOGY

Research Design: This present study entailed a quantitative research design

Locale: The samples for this study were selected from within the Delhi National Capital Region (NCR) who was directly or indirectly associated with institutional catering.

Sampling Design: In the present research, convenience sampling method was used for the data collection. Sample size was 194. Demographic profile of the respondents on the parameter that is one is directly and indirectly associated with institutional catering, gender and educational background as shown in table no.1.

Tools and Techniques: Data collection for this research involved the distribution of a self-administered questionnaire to the respondents through online google form who are linked to institutional catering. Respondents were asked to rate their agreement or disagreement with each item using a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Prior to use, the questionnaire underwent a thorough review to ascertain its suitability and relevance within the context of this study.

Data Analysis and Statistical Analysis: The analysis of data was carried out utilizing SPSS version 23 as the primary analytical tool. The gathered data underwent meticulous statistical scrutiny, with a specific focus on employing the One-Sample t-test. This statistical method was chosen based on its incorporation in the study (Anand & Chaudhary, 2023; Kumar & Chaudhary, 2023). The outcomes of the One-Sample t-test, including test values, t-scores, degrees of freedom (df), significance levels (Sig. 2-tailed), and mean differences for each variable, along with demographic details of respondent are comprehensively presented in Table 1 and 2.

RESULTS AND DISCUSSION

In this section, we delve into the key attributes of the data that has been surveyed for the research. It also provided a comprehensive analysis of the demographic profiles of the respondents who participated in the study. Moreover, the study present the results of a one-sample t-test and engage in a discussion that contextualizes these findings within the broader context established by the previous studies discussed in the introduction section. By examining the demographic profiles of our respondents, the study aim to gain a deeper understanding of the composition of the study population, which can shed light on potential variations in responses and

behaviours. Additionally, a one-sample t-test was conducted to assess the significance of the results obtained in the research. The research discussed the implications of this test in relation to the existing body of literature discussed in the review section, emphasizing both areas of agreement and any disparities or nuances uncovered by the study.

Table 1: Educational background * gender crosstabulation

		Gender		Total
		Female	Male	
Educational Background	High School	1(4.54%)	21(95.46%)	22
	Bachelor's Degree	27(20.6%)	104(79.4%)	131
	Master's Degree	10(34.5%)	19(65.5%)	29
	Doctorate	6(50%)	6(50%)	12
Total		44	150	194

The data analysed using SPSS version 23 presents an overview of the gender and educational distribution among a sample of 194 individuals. Percentage in the table no.1 was calculated on educational background basis. Notably, there is a significant gender disparity within the sample, with 150 males and 44 females. Delving into the breakdown of educational attainment among these individuals, some intriguing patterns emerge. The category of Bachelor's Degree shows a substantial gender difference, with 104 males and 27 females. In contrast, the Doctorate category exhibits an equal representation of both genders, with six individuals each. High School graduates are predominantly male, with only one female among the 22 individuals in this category. Finally, the Master's Degree category, while slightly skewed towards males (19 males and 10 females), still suggests a more balanced representation compared to the Bachelor's Degree category. The result imply that gender may play a role in the distribution of educational attainment within this particular sample for food waste management.

Table 2: One sample t-test result

One-Sample t-test							
	Test Value = 0					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Difference		
					Lower	Upper	
There is no significant difference in food waste generation between institutions implementing different food waste reduction strategies.	29.588	193	.000	2.9845	2.786	3.183	
There is no significant difference in the cost of food waste disposal between institutions implementing waste reduction practices and those that do not.	31.171	193	.000	3.0619	2.868	3.256	
The environmental impact of food waste is not significantly reduced by the implementation of food waste management strategies.	28.726	193	.000	3.0412	2.832	3.250	
Institutional catering facilities do not differ significantly in their compliance with food waste management regulations.	30.334	193	.000	3.0309	2.834	3.228	
Menu planning choices have no significant impact on food waste generation in institutional catering.	28.519	193	.000	2.9691	2.764	3.174	

Different food purchasing practices do not result in significant differences in food waste generation.	30.029	193	.000	3.0619	2.861	3.263
Food preparation techniques employed in institutional catering do not affect the amount of food waste produced.	27.865	193	.000	3.0000	2.788	3.212
The level of staff training in food waste reduction techniques does not significantly influence food waste generation.	27.485	193	.000	2.8969	2.689	3.105
The use of technology for food waste tracking and measurement does not lead to significant reductions in food waste.	28.799	193	.000	2.9278	2.727	3.128
Customer education and engagement efforts do not significantly affect food waste levels in institutional catering.	29.110	193	.000	2.9742	2.773	3.176

The results of the one-sample t-tests conducted to investigate various aspects of food waste management in institutional catering have revealed compelling evidence of significant differences in the key areas as compared with previous study (Amicarelli et al., 2022).

To elaborate on the findings, this study underscores that institutions adopting distinct food waste reduction strategies showcase notable and statistically significant differences in the generation of food waste. In essence, this study implies that the effectiveness of food waste reduction measures varies among different institutions, suggesting that factors such as

organizational practices, policies, or cultural norms may play a pivotal role in shaping the outcomes of these strategies. Further exploration and elucidation on these factors would contribute to a more comprehensive understanding of the dynamics involved in addressing the complex issue of food waste.

This finding, with a mean difference of approximately 2.98 and a confidence interval excluding zero (2.786 to 3.183), highlights the impact of such strategies in reducing food waste generation. Furthermore, the cost associated with food waste disposal significantly differs between institutions that implement waste reduction practices and those that do not. The mean difference of approximately 3.06, along with a confidence interval (2.868 to 3.256) that does not encompass zero, emphasized that the adoption of waste reduction practices leads to a substantial reduction in disposal expenses. The study conducted by (Vizzoto et al., 2021) revealed that different food service sectors have food waste reduction strategies in place across 30 countries all over the world. This paper has also given out similar results where it is seen that as per the perception of stakeholders, institutional catering establishments in Delhi/NCR are following different food waste reduction strategies.

The environmental impact associated with food waste is another area of interest, and the results are indicative of a significant reduction when food waste management strategies are in place (Unegg et al., 2023). With a mean difference of roughly 3.04 and a confidence interval excluding zero (2.832 to 3.250), these findings underline the positive effect of food waste management strategies in mitigating environmental consequences. Compliance with food waste management regulations within institutional catering facilities also varies significantly. The mean difference of approximately 3.03 and a confidence interval (2.834 to 3.228) that does not include zero highlight the existence of notable disparities in compliance, which may be attributed to varying strategies and practices.

Moreover, menu planning choices have demonstrated a substantial impact on food waste generation, with a mean difference of around 2.97 and a confidence interval (2.764 to 3.174) that excludes zero, underscoring the significance of menu planning in minimizing food waste. Similarly, different food purchasing practices lead to statistically significant differences in food waste generation, with a mean difference of approximately 3.06 and a confidence interval (2.861 to 3.263) that does not encompass zero.

Food preparation techniques employed in institutional catering also influence the amount of food waste produced, as indicated by a mean difference of roughly 3.00 and a confidence interval (2.788 to 3.212) excluding zero. Additionally, staff training in food waste reduction techniques significantly influences food waste generation, with a mean difference of approximately 2.90 and a confidence interval (2.689 to 3.105) that does not include zero.

The use of technology for food waste tracking and measurement plays a substantial role in reducing food waste, with a mean difference of approximately 2.93 and a confidence interval (2.727 to 3.128) that excludes zero. Lastly, customer education and engagement efforts significantly affect food waste levels, with a mean difference of approximately 2.97 and a confidence interval (2.773 to 3.176) that does not encompass zero.

Based on the analysed data, the p-values for all the tests are less than the conventional significance level ($\alpha = 0.05$), as indicated by the “Sig. (2-tailed)” column. When p-values are less than the significance level, it typically leads to the rejection of the null hypothesis. In this case, the null hypotheses state that there is no significant difference or effect in various aspects related to food waste in institutional catering. Therefore, based on the given information, this study reject all the null hypotheses, suggesting that there are significant differences or effects in the areas being studied. These significant differences pertain to food waste generation, cost of food waste disposal, environmental impact of food waste, compliance with regulations, menu planning choices, food purchasing practices, food preparation techniques, staff training, technology use, and customer education efforts.

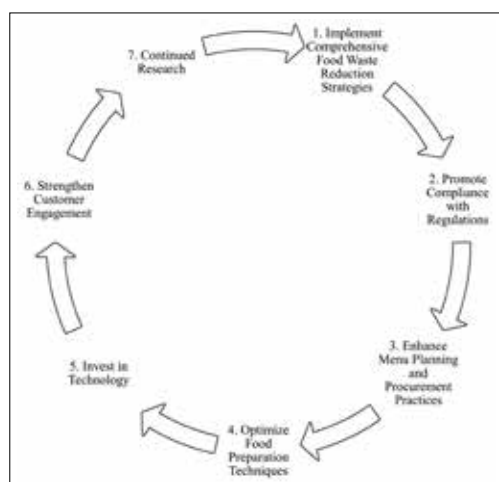


Figure 1: Author proposed food waste management strategies cycle

The present research in the domain of food waste management within institutional catering has yielded significant insights into various critical areas. These findings are primarily derived from the results of one-sample t-tests conducted to assess the impact of different strategies and practices. It has demonstrated that the implementation of diverse food waste reduction strategies within institutional catering significantly influences food waste generation. This finding emphasizes the potential effectiveness of these strategies in reducing the amount of food waste produced. Implementing comprehensive food waste reduction strategies that encompass various aspects, such as menu planning, staff training, and technology utilization, can be a promising approach to minimize food waste generation.

The adoption of waste reduction practices has revealed substantial cost savings associated with food waste disposal. This implies that institutions that invest in waste reduction measures can expect to see a notable reduction in their expenses related to disposing of excess food. These practices can include better inventory management, portion control, and donation programs, which not only reduce waste but also lead to economic benefits. This research highlighted the positive environmental impact of implementing food waste management strategies within institutional catering. By reducing food waste, institutions can contribute to mitigating the environmental consequences associated with it, including greenhouse gas emissions and resource depletion. This underscores the importance of sustainable food waste practices in preserving the environment.

Notably, the findings suggested disparities in compliance with food waste management regulations among institutional catering facilities. Understanding the factors influencing these variations is crucial for ensuring consistent adherence to regulations. Compliance is essential not only for legal reasons but also for achieving efficient and sustainable food waste management. The significance of menu planning choices and food purchasing practices in influencing food waste generation cannot be understated. Efficient menu planning that minimizes waste, along with procurement practices that prioritize sustainable sourcing and portion control, can substantially reduce food waste.

This research data indicated that the techniques employed in food preparation within institutional catering influence the amount of food waste produced. Optimizing food preparation methods to minimize waste while maintaining food quality can be an effective strategy for reducing food waste. Staff

training in food waste reduction techniques has been shown to significantly influence food waste generation. Educating the workforce on best practices for minimizing waste can lead to tangible reductions in food waste. The use of technology for food waste tracking and measurement has a substantial role in reducing food waste. Technology can enable more accurate measurement, monitoring, and analysis of food waste, aiding in waste reduction efforts. Finally, our findings suggested that customer education and engagement efforts significantly affect food waste levels in institutional catering. This underscores the importance of raising awareness among customers about food waste and involving them in waste reduction initiatives.

In summary, these findings collectively emphasize the pivotal role of various strategies and factors, including food waste reduction strategies, menu planning, staff training, and technology, in shaping food waste generation, cost, environmental impact, compliance with regulations, and customer engagement within institutional catering. These results underscore the importance of implementing effective food waste management strategies to reduce waste generation, costs, and environmental impact while enhancing compliance and customer satisfaction in institutional catering operations.

CONCLUSION

The research underscores the multifaceted nature of food waste management in institutional catering. In light of these results, we propose a set of recommendations to enhance food waste management practices in institutional catering. These recommendations encompass comprehensive strategies, regulatory compliance, optimized menu planning, food procurement, food preparation techniques, technology adoption, customer engagement, and continued research. By heeding these recommendations, institutional catering facilities can not only reduce their food waste generation but also realize cost savings, contribute to environmental sustainability, align with regulations, and enhance customer satisfaction. These steps collectively represent a significant stride toward more efficient, sustainable, and responsible food waste management within institutional catering operations. This research on food waste management within institutional catering has provided valuable insights but faces limitations, including potential sampling bias due to convenience sampling from personal contacts, reliance on self-reported data, and contextual specificity to the Delhi NCR region. To further enrich this field, future research could encompass

longitudinal studies, comparative analyses across diverse regions, behavioural investigations, exploration of emerging technologies' impact, economic assessments, customer preference analysis, and deeper exploration of factors influencing regulatory compliance. These research directions hold the potential to enhance the understanding of food waste management in institutional catering and contribute to more effective and sustainable waste reduction practices beyond the current scope.

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