Volume 25 Issue 6
Originally issued as A3



Global Journal of Management and Business Research: A Administration and Management
Volume 25 Issue 3 Version 1.0 Year 2025
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4588 & Print ISSN: 0975-5853

Reducing Food Waste in College Cafeterias through Design Thinking Process

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Chapter 1- Introduction- Food waste has emerged as a pressing global problem with significant repercussions for the environment, economy, and society. Due to the high volume of meals served daily and the prevalence of buffet-style or all-you-care-to-eat dining models, college and university campuses, particularly their dining facilities, significantly contribute to this issue. In such settings, large quantities of unfinished food are thrown away due to inconsistencies in meal preferences, a lack of awareness, and excessive portion sizes. According to the Food and Agriculture Organization, approximately one-third of all food produced globally is wasted, with institutional settings like universities being key contributors. Food waste occurs at multiple stages-during preparation, consumption, and servicein college cafeterias. Food waste disposal also strains natural resources and contributes to greenhouse gas emissions through landfills, in addition to raising ethical questions about throwing away food that can be eaten while millions of people suffer from hunger. Addressing food waste in college dining systems requires a multi-faceted approach involving behavior change, improved food service management, technology integration, and awareness campaigns.

GJMBR-A Classification: *JEL Code: Q53*



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Reducing Food Waste in College Cafeterias through Design Thinking Process

Mahesh MV [α], Nishanth AN [σ], Sai Vihar KS [ρ] & Vaishnavi K [ω]

Chapter 1- Introduction

Food waste has emerged as a pressing global problem with significant repercussions for the environment, economy, and society. Due to the high volume of meals served daily and the prevalence of buffet-style or all-you-care-to-eat dining models, college and university campuses, particularly their dining facilities, significantly contribute to this issue. In such settings, large quantities of unfinished food are thrown away due to inconsistencies in meal preferences, a lack of awareness, and excessive portion sizes. According to the Food and Agriculture Organization, approximately one-third of all food produced globally is wasted, with institutional settings like universities being key contributors. Food waste occurs at multiple stages- during preparation, consumption, and servicein college cafeterias. Food waste disposal also strains natural resources and contributes to greenhouse gas emissions through landfills, in addition to raising ethical questions about throwing away food that can be eaten while millions of people suffer from hunger. Addressing food waste in college dining systems requires a multi-faceted approach involving behavior change, improved food service management, technology integration, and awareness campaigns.

Chapter 2- Review of Literature

1. *Whitehair, K. J., C. Shanklin W., and L. Brannon A. (2013)*

Title: Written Messages Improve Edible Food Waste Behaviors in a University Dining Facility

Summary:

This study explored the impact of behavioral nudges (e.g., signage with written messages) on food waste in a college dining hall. Post-consumer food waste was found to be significantly reduced by strategically placed signs reminding students to only take what they could eat. The intervention was low-cost but had a meaningful influence on student behavior, highlighting the effectiveness of simple awareness techniques.

2. *K. Thiagarajah & Getty, V. M. (2013)*

Title: The Effect of Moving from a Tray to a Trayless Delivery System in a University Dining Hall on Plate Waste and How Employees Reacted to the Change

Summary:

This research evaluated the effect of removing trays in college dining halls. Students tended to eat less at a time, which resulted in a significant reduction in plate waste when trays were removed. Additionally, the study gathered feedback from dining staff, which revealed minimal opposition to the change and operational benefits.

3. *F. Marra, et al. (2018)*

Title: The Use of Nudging and Other Behavioral Interventions to Reduce Food Waste in Self-Service Environments

Summary:

This paper reviewed multiple behavioral interventions, including nudging, pre-portioning, and menu design, in self-service environments like cafeterias. It came to the conclusion that by influencing consumer decisions at the point of selection, interventions tailored to specific dining settings, such as restricting choices or providing smaller plates, could reduce waste.

4. *Kim, K., & Morawski, S. (2012)*

Title: Quantifying the Effects of Going Trayless in a Dining Hall at a University.

Summary:

Using pre- and post-intervention data collection, this study quantified the effect of a trayless policy in a large U.S. university. It found that each student's volume of food waste decreased by 25-30%. Changes in administrative policy that do not necessitate technological investment were supported by the study.

5. *Kallbekken, S., & Sælen, H. (2013)*

Title: An environmental win-win by "nudging" hotel guests to reduce food waste Despite the fact that it was carried out in a hotel buffet setting, the results are highly applicable to college cafeterias.

Summary:

This research demonstrated that placing signs encouraging guests to reduce waste and take smaller portions led to significant decreases in food waste. Although the buffet-style setting is not unique to

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universities, it makes the findings applicable to college dining halls and makes them applicable.

6. *Food Waste Audit in Selected Hostels of Rajasthan University, Jaipur*

Authors: Sunita Agarwal, Kamlesh Haritwal, Jyoti Meena

- Submitted to the Asian Journal of Food Research and Nutrition in the year 2023
- In summary, the 70-day audit of two girls' hostels revealed significant daily food waste at breakfast, lunch, and dinner in this study. The study emphasizes the significance of raising staff and student awareness of the need to reduce food waste.

7. *Food waste reduction at Chitkara University in Punjab*

- The organization is Chitkara University.
- In conclusion, Chitkara University was able to reduce food waste by 40% by implementing strategies like color-coded bins for tracking waste, adjusting food preparation based on student attendance, offering smaller portion sizes, implementing educational programs, and training staff members who serve food.

8. *Management of food waste at Lovely Professional University (LPU) in Punjab*

- *Institution:* Lovely Professional University
- *Summary:* LPU has implemented a structured system for tracking and managing food waste, including encouraging students to pre-subscribe to meal services, using 200-liter bins for collecting leftovers, and daily tracking of food waste. In the 2022-23 academic year, LPU recorded food wastage of less than 1 metric ton, showcasing its commitment to sustainable practices.

9. *Addressing Malnutrition and Reducing Campus Food Waste at Centurion University, Odisha*

- Centurion University is the organization.
- *Summary:* With a campus population of approximately 12,000, Centurion University produced around 751 kg of food waste per day in 2023. The university implemented awareness campaigns, efficient menu planning based on ICMR guidelines, composting through bio-digesters, and regular monitoring to reduce per capita food waste from 0.21 kg in 2020 to 0.13 kg in 2023.

10. *Study on Food Wastage in BIT-Patna College Campus Hostel Mess*

- *Author:* Mohit Raj
- *Summary:* This study explores the reasons behind food wastage in the boys' hostel mess at BIT-Patna, managed by Sodexo Food Solutions India Pvt. Ltd. The study identifies factors that contribute to food waste and offers effective solutions to the issue through interviews, observations, and a literature review.

Chapter 3-Research Design

Research Methodology and Data Collection:

This study followed a Design Thinking approach, a user-centered problem-solving framework that emphasizes empathy, ideation, prototyping, and testing. This objective is to reduce food waste in college cafeterias.

Stage 1: Empathy:

To understand the food waste in college cafeterias, a structured Google Forms questionnaire was distributed among students. The survey included both open-ended and multiple-choice questions covering:

- Explore behaviours like skipping meals, disposing of leftovers, over-ordering.
- Include quotes or anecdotes that reflect common attitudes (e.g., "I take more food just in case, but I can't finish it").
- Investigate pain points such as rigid portion sizes, unappealing menu options, or lack of time.

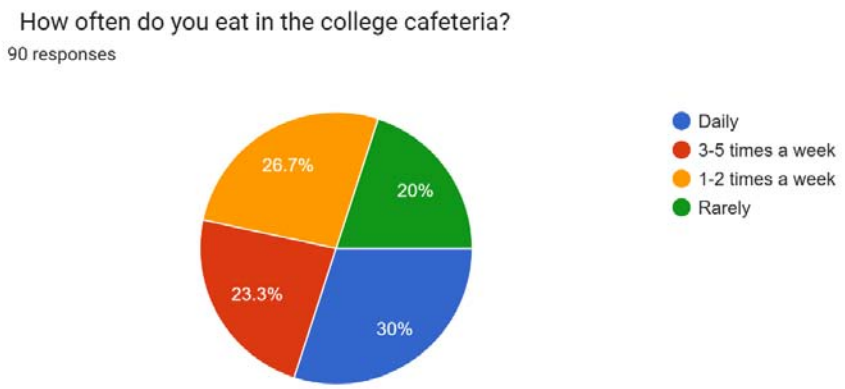


Figure 1

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From this pie chart illustrates how often students eat in the college cafeteria, based on 90 responses. According to the data, 30% of students eat in the cafeteria on a daily basis, and 23.3 percent go there 3–5 times per week. This suggests that the cafeteria is frequented by more than half of respondents (53.3%). However, only 26.7% of students eat there more than once per week, and 20% of students rarely make use of the cafeteria's services. Based on this distribution, it would appear that the students the cafeteria serves are a mix of regular and occasional diners. Meal planning and demand forecasting become more difficult as a result of this variation in usage, which can lead to food overproduction and waste if not carefully managed.

Stage 2: Define:

The college cafeteria faces high food waste due to inflexible portion sizes, rushed meal selection, and inconsistent food quality. Students often discard food because of taste issues, large servings, and time constraints. How might we improve meal selection, portion customization, and food quality to minimize waste and enhance student satisfaction?

Stage 3: Idea Pitching:

The team conducted brainstorming sessions to generate possible solutions. The most promising ideas were grouped into four categories:

- Discounts for Smaller Portions
- Food Donation Program
- Customizable portion sizes
- Food Waste Awareness Campaign

Final Recommendation idea: *Customizable portion sizes*

Pros:

- Reduces over-serving.
- Meets individual preferences and increases student satisfaction.
- Reduces post-meal waste.

Cons:

- May slow down service lines.
- Requires operational changes.
- Potential inventory management challenges.

Stage 4: Prototype

A low fidelity prototype of the chosen idea was developed using a visual website.

1. This website helps the students to customize their food portions and combos.
2. Students can pre order their meals where can reduce the time in cafeterias.
3. Helps kitchen plan and reduce overproduction.

Sample website Screen shots:

Below are sample UI screenshots of the food ordering website prototype:

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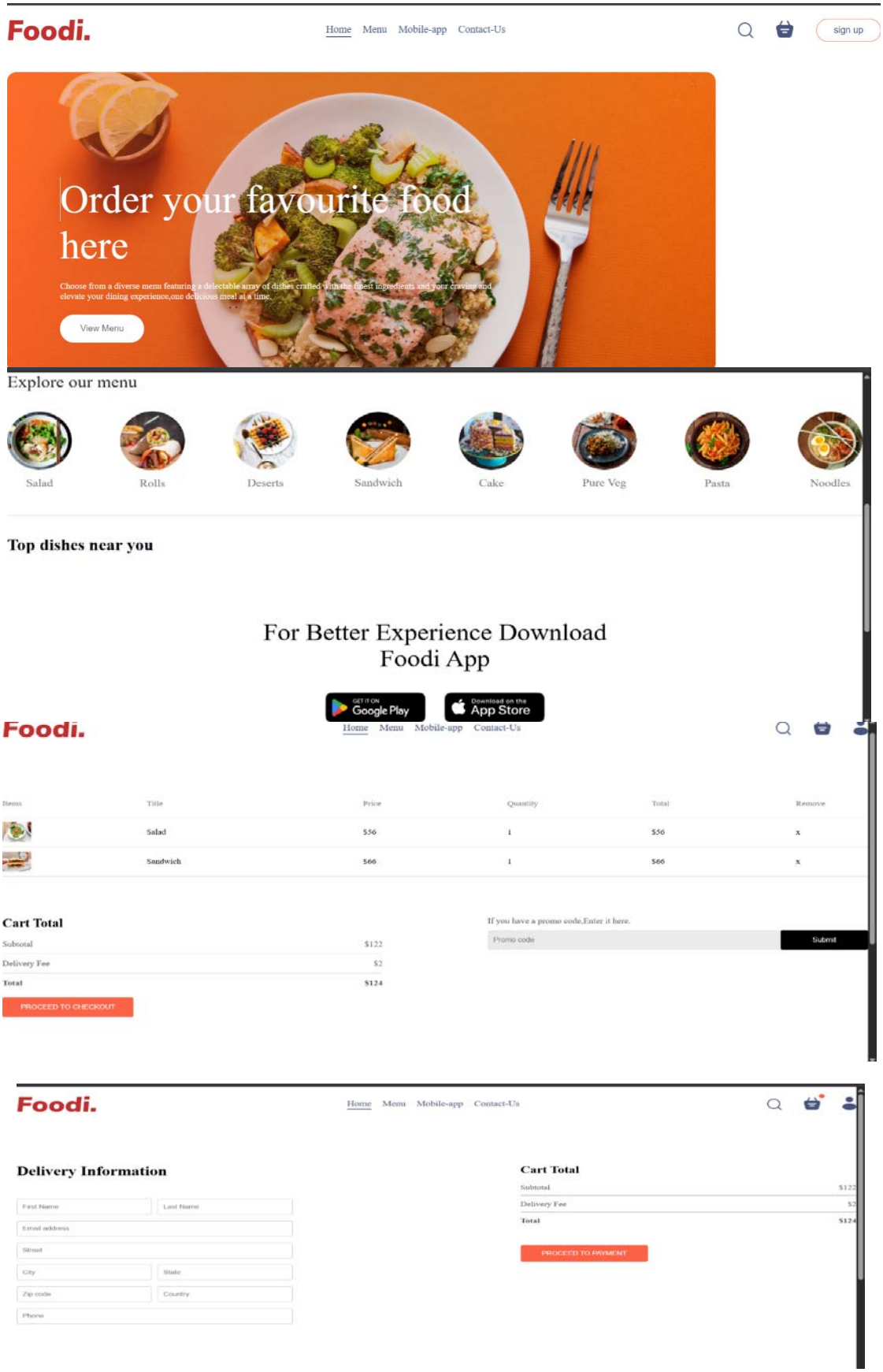


Figure 2

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Stage 5: Testing

Conducted usability testing with 20 users over 1 week. Feedback gathered on:

- Ease of use
- Ease to access
- We can pre-order

In the Test phase, users interacted with the prototype of the food ordering website designed to reduce the food waste. Feedback was collected through surveys.

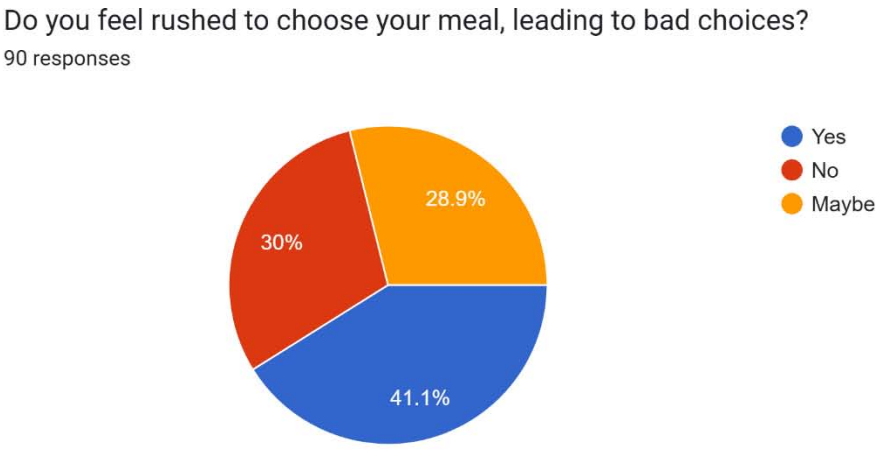


Figure 3

Interpretation:

The second pie chart addresses whether students feel rushed when selecting their meals, potentially leading to poor choices. Out of 90 respondents, 41.1% reported feeling rushed, 30% said they did not, and 28.9% were unsure. This means that nearly 70% of students experience at least some level of uncertainty or pressure when deciding what to eat. This behavior can result in students selecting meals they may not truly want or enjoy, which increases the likelihood of uneaten food being discarded. Such a pattern highlights a critical issue: the lack of time or clarity during meal selection contributes directly to food waste, emphasizing the need for improved systems that support more thoughtful and informed meal choices.

Chapter 4– Summary of Findings, Suggestions and Conclusion

Findings:

1.

- A significant portion of students (53.3%) eat in the cafeteria frequently (daily or 3–5 times a week).
- Nearly 47% of respondents use the cafeteria only occasionally or infrequently.
- The cafeteria must accommodate both frequent and occasional visitors because of this variation in usage, making demand forecasting and portion planning more difficult.

2.

- A combined 70% (Yes + Maybe) of students feel some level of pressure or indecision while selecting meals.
- Impatient decisions may result in:
  - Unwanted food selections
  - More food goes to waste (if students throw away food they didn't really want) o A lower level of contentment with cafeteria meals

Suggestions:

1. *Introduce Digital Pre-ordering:*

- Make it possible for students to choose their meals in advance through an app or website.
- This can reduce last-minute decisions and help the kitchen prepare accurate quantities.

2. *Implement Customizable Portion Sizes:*

- Enable students to choose smaller, medium, or large portions based on hunger levels.
- This can directly reduce uneaten food waste.

3. *Display Menus with Nutritional Info & Photos:*

- Waste and poor meal choices can be reduced by making informed decisions easier.

4. *Train Staff on Predictive Serving:*

- To avoid over-preparation, adjust cooking quantities based on meal timing and popularity trends.

5. *System for Student Feedback:*

- To learn about shifting preferences and levels of satisfaction, conduct feedback kiosks or surveys on a regular basis.

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Conclusion

The analysis reveals that while over half the student body regularly uses the college cafeteria, a large portion also experiences rushed meal decisions. This frequently leads to poor food choices, which may increase food waste. Implementing digital pre-selection tools, portion customization, and better meal presentation strategies can significantly enhance meal satisfaction and reduce food wastage. Addressing these concerns not only improves operational efficiency but also supports a sustainable campus dining environment.

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