

Original Research Article

Consumer Behavioural Insights for AI-Enabled Personalized Food Waste Reduction in Restaurants

Ms. Anjali Ved,¹ Dr. Parag Ajgaonkar²

¹Research Scholar, University of Mumbai; Assistant Professor, SVKM's Narsee Monjee College of Commerce and Economics (Empowered Autonomous)

²Research Guide and Principal, SVKM's Narsee Monjee College of Commerce and Economics (Empowered Autonomous)

Corresponding author E-mail: anjalived1106@gmail.com

Received: 10 September, 2026 | Accepted: 24 September, 2026 | Published: 13 October, 2026

Abstract:

Artificial Intelligence (AI) is increasingly enabling restaurants to deliver personalized customer experiences while supporting sustainable business practices. However, the effectiveness of AI-enabled interventions depends on understanding the behavioural factors that influence consumer food waste. This study examines consumer behaviour related to restaurant food waste and explores how behavioural insights can inform AI-driven personalization strategies for food waste reduction. The research is grounded in the Theory of Planned Behaviour (TPB) and is based on primary data collected from 100 restaurant consumers in the Mumbai Suburban region using a structured questionnaire. The study assessed six behavioural constructs: awareness, attitude, behavioural factors, psychological factors, social factors, and willingness to act towards food waste reduction. Descriptive analysis revealed that respondents demonstrated relatively high levels of awareness (Mean = 3.89) and positive attitudes (Mean = 3.92) towards reducing food waste. Psychological factors (Mean = 3.81) and social factors (Mean = 3.64) also indicated favourable behavioural orientations. However, behavioural practices recorded comparatively lower scores (Mean = 3.45), suggesting an attitude-behaviour gap in responsible food consumption. Respondents also expressed a positive

willingness to adopt food waste reduction practices (Mean = 3.76), indicating the potential for targeted behavioural interventions. Based on these findings, the study proposes an AI-driven consumer insight framework that can support restaurants in designing personalized food waste reduction strategies, including portion-size recommendations, smart menu suggestions, and digital nudges. Rather than positioning AI as a replacement for managerial decision-making, the framework demonstrates how consumer behavioural data can be leveraged to enhance AI-enabled customer engagement and sustainability initiatives. The study contributes to the growing discourse on AI in Business and Marketing by illustrating the role of behavioural insights in developing customer-centric and sustainable restaurant practices. The findings offer practical implications for restaurant managers seeking to integrate AI-enabled personalization with food waste reduction initiatives in the HORECA sector.

Keywords: Artificial Intelligence, Consumer Behaviour, Food Waste, Restaurant Management, Theory of Planned Behaviour, Sustainability, HORECA.

1. Introduction

Food waste is a major sustainability issue facing the global hospitality and restaurant sector. It is estimated that approximately one-third of all food produced for human consumption is lost or wasted throughout the food supply chain, and out-of-home dining is a significant contributor to food waste (Etim, Choedron, Ajai, Duke, & Jijingi, 2025). In the Indian context, the problem of plate waste has been a persistent issue in the HORECA (Hotel, Restaurant and Catering) industry, as the sector has witnessed rapid growth in urban dining, rising disposable income, and culturally embedded norms of consuming large portions of food. Consumer plate waste is behavioural in nature, as it is related to ordering behaviour, social interactions, and psychological attitudes developed at the point of consumption, and is not a direct result of purchasing, storage, and preparation choices, as is the case with kitchen-side waste.

Meanwhile, Artificial Intelligence (AI) is revolutionizing the way restaurants interact with their customers. AI-powered solutions are already being used in the hospitality industry for demand forecasting, inventory management, and waste tracking, with some commercial AI platforms claiming to have achieved measurable results in reducing food waste in their kitchens (Sigala, Gerwin, Chroni, Abeliotis, Strotmann, & Lasaridi, 2025). But most of this technological progress has been directed at operational and back-of-house waste, and there is a lack of understanding of how AI can be applied to understand and shape consumer-facing waste, where a significant portion of restaurant food waste actually occurs. In theory, the same personalisation technologies used for recommending menu items, loyalty programmes, and dynamic pricing could be applied to encourage consumers to order and eat more mindfully, as long as restaurants have a clear understanding of the behaviours that underlie over-ordering and under-filling their orders.

This study aims to fill that gap by applying the Theory of Planned Behaviour (TPB) to understand consumer attitudes and behaviours regarding food waste in restaurants, and to suggest a framework for personalization via AI in reducing food waste. The specific objectives of the study are: (1) to evaluate consumer awareness, attitude, behavioural tendencies, psychological orientation, social influence and willingness to act in relation to restaurant food waste; (2) to identify the degree of gap between attitude and actual ordering and consumption behaviour; and (3) to convert the behavioural insights into a practical, AI-driven personalization framework that restaurant managers can use for designing targeted interventions.

2. Literature Review

2.1 Food Waste in the HORECA Sector

The issue of food waste in the hospitality industry has been gaining traction in the academic and policy worlds as part of the broader SDG 12.3. In restaurants, waste occurs at various stages, including kitchen waste, over-portioning, and consumer waste from plates, with the latter being the most challenging due to its reliance on the consumer's decision to waste in the context of social eating (Wani et al., 2025). The findings of the study on Indian restaurant consumers suggest that while the classic TPB constructs are important, there are also culturally specific factors like religiosity and food preference which also influence intention to reduce food waste, highlighting the need for context-specific behavioural research in the Indian context.

2.2 Theory of Planned Behaviour and Food Waste

Theory of Planned Behaviour (TPB) of Ajzen (1991) continues to be the most widely used theory to explain pro-environmental and food-related behaviour, which is explained as a function of intention, which is mediated by attitude, subjective norm, and perceived behavioural control. Attitude and perceived control have been found to be strong predictors of intention in systematic reviews that use TPB to explain household and restaurant food waste, and intention does not always predict actual food waste-reducing behaviour, which is often referred to as the attitude-behaviour gap or intention-behaviour gap (Etim et al., 2025). The model's explanatory power has been enhanced by the inclusion of contextual constructs in extensions of the TPB that include food-related involvement and food literacy (Adaryani et al., 2025). Instead of the three classical constructs, this study takes a more extended, practice-oriented approach to TPB by evaluating six behavioural dimensions (awareness, attitude, behavioural practice, psychological orientation, social influence, and willingness to act) to gain insights that can be more directly translated into actionable, personalisable interventions.

2.3 Artificial Intelligence and Food Waste Management

The use of AI in the hospitality sector for managing food waste has grown significantly. AI-based waste-tracking systems have been shown to cut food waste by as much as 50% in hotels and restaurants, primarily by providing kitchen staff with real-time insights into what and how much is being wasted (Sigala et al., 2025). A study on structural equation modelling in the hospitality sector in Serbia and Montenegro also revealed that the use of AI in inventory management, process automation, and waste tracking significantly enhanced the efficiency of the operations and decreased food waste (Vukolić, Gajić, Cabral, Veljović, & Knežević, 2025). In addition to kitchen applications, researchers have started to investigate the potential for applying AI-based approaches from commercial hospitality applications to consumer-facing and even domestic applications, including the use of centralized dashboards, consumption pattern analysis, and personalized notifications (Clark, Kanavikar, Clark, & Donnelly, 2025). In a broader sense, AI is known as a game-changer in the food sector, influencing a variety of aspects such as supply chain forecasting and customized customer interactions (Zatsu et al., 2024).

What remains comparatively underexplored is the integration of consumer behavioural insight of the kind generated through TPB-based survey research with AI-enabled personalization at the point of ordering. Most existing AI food waste literature is operationally focused on the kitchen or supply side; comparatively little work connects psychographic consumer segmentation to design choices such as portion customization, smart menu nudges, or personalized doggy-bag prompts. This study seeks to help close that gap by using primary consumer behavioural data to inform the design logic of such an AI-enabled personalization framework.

3. Research Methodology

The study was descriptive, cross sectional in nature and questionnaire was used as the research instrument which was structured and administered to the consumers of restaurants in Mumbai Suburban area. Convenience sampling was used and 100 valid responses were obtained, which is exploratory. The questionnaire collected demographic data (age, gender, eating frequency) and 34 behavioural items organised into six constructs of the Theory of Planned Behaviour: Awareness (5 items), Attitude (5 items), Behavioural Factors (6 items), Psychological Factors (6 items), Social Factors (6 items) and Willingness to Act (6 items).

Hypothesis

H0₁: There is no significant difference between consumer attitude and behavioural practice toward food waste reduction (no attitude–behaviour gap).

H0₂: There is no significant association between consumer awareness of food waste and willingness to act toward food waste reduction.

4. Results

4.1 Construct-wise Descriptive Statistics

Table 1 shows the mean scores for the six constructs. Attitude (M = 3.92) and Awareness (M = 3.89) scored highest, showing consumers are aware of food waste and hold positive attitudes toward reducing it. Psychological Factors (M = 3.81) and Willingness to Act (M = 3.76) were also favourable. Social Factors were moderate (M = 3.64). Behavioural Factors recorded the lowest mean (M = 3.45) actual ordering practices lag behind attitudes and awareness.

Construct	Items	Mean	SD	Interpretation
Awareness (B)	5	3.89	0.46	Moderate–High
Attitude (C)	5	3.92	0.47	Moderate–High
Behavioural Factors (D)	6	3.45	0.47	Moderate
Psychological Factors (E)	6	3.81	0.37	Moderate–High
Social Factors (F)	6	3.64	0.48	Moderate
Willingness to Act (G)	6	3.76	0.45	Moderate–High

Table 1: Construct-wise Descriptive Statistics

4.2 The Attitude–Behaviour Gap

The near half-point gap between Attitude (3.92) and Behavioural Factors (3.45) is consistent with the intention–behaviour gap widely reported in TPB food waste literature (Etim et al., 2025). Respondents agreed strongly that waste reduction is a shared responsibility, but scored lower on concrete actions like requesting smaller portions or leftover packing pointing to situational and social friction rather than a lack of concern.

4.3 Social and Psychological Drivers

The higher scores for celebratory over-ordering (M = 3.90) and social pressure to order generously (M = 3.81) compared to discomfort requesting smaller portions (M = 3.50) and a parcel (M = 3.33) within Social Factors indicate that group norms are more likely to encourage over-ordering than individual indifference. The Psychological Factors had consistently high scores of guilt (M = 3.81) and personal responsibility (M = 3.92), which suggest that the

consumers are emotionally involved. The highest willingness to act was observed for choosing a sustainable restaurant ($M = 4.10$), while the lowest was for concrete actions such as joining awareness campaigns ($M = 3.57$) again indicating that convenience, rather than motivation, is the obstacle.

4.4 Hypothesis Testing

A paired t-test comparing Attitude and Behavioural Factors confirmed a statistically significant difference ($t(99) = 7.406, p < .001$), so H_{01} is rejected the attitude-behaviour gap is statistically real, not just descriptive.

A Pearson correlation between Awareness and Willingness to Act showed a significant positive association ($r = .241, p = .016$), so H_{02} is rejected greater awareness is linked to greater willingness to act.

Both results confirm the study's core argument: consumer readiness to reduce food waste already exists, but requires interventions such as AI-enabled personalization to convert that readiness into consistent behaviour.

5. Findings

The results indicate that the consumers of restaurants in Mumbai are not apathetic towards food waste, they have a classic attitude-behaviour gap in which positive attitudes and awareness are not always reflected in their ordering and consumption patterns. This is similar to the results of the TPB-based research in other Indian and international restaurant settings (Wani et al., 2025; Adaryani et al., 2025), suggesting that interventions that rely on awareness alone are not likely to be sufficient to close the gap. Rather, the findings suggest interventions that decrease the social and situational conflict around mindful ordering, such as simplifying and normalizing ordering smaller portions, sharing food, and asking for packaging.

AI-powered personalization is just the sort of friction that can be solved with it. A customized digital menu interface can make recommendations about portion sizes on a regular basis, without the social stigma of the human waiter doing so, because it can be based on a guest's past order history, party size, and preferences. Likewise, AI systems that are already able to monitor kitchen side waste patterns (Sigala et al., 2025; Vukolić et al., 2025) could be expanded to correlate certain dish combinations or portion sizes with plate waste, providing recommendations for consumers as well as operational suggestions for the kitchen. The behaviourally defined segments suggested by the constructs measured here (e.g. high on Awareness and Attitude, low on Behavioural practice) provide a basis for restaurants to adjust the strength and message of nudges delivered digitally.

6. Proposed AI-Enabled Consumer Insight Framework

Based on the behavioural results, this study suggests a three-layered approach to help restaurants leverage consumer behaviour data for AI-driven personalisation strategies for food waste reduction, while maintaining managerial discretion.

Layer 1 — Behavioural Data Capture: Restaurants gather structured and passive signals similar to the six constructs in this study, such as order history, portion adjustments, leftover requests, and straightforward post-meal feedback prompts to create a lightweight behavioural profile of each patron or table.

Layer 2 — AI-Driven Segmentation and Prediction: Machine learning models, akin to those already employed to predict waste in the kitchen, categorise customers or dining occasions into behavioural segments (high-awareness/low-action; socially influenced group diners; habitually accurate orderers) and predict the probability of over-ordering for a given ongoing order.

Layer 3 — Personalised Nudges and Manager Dashboards: The system presents low friction, non-judgemental

nudges at the point of ordering (e.g., 'popular portion for two' suggestions, opt-in for smaller plates, a one-tap request for a leftover-pack), and feeds aggregated, anonymised behavioural insights into a manager dashboard for menu redesign, portion standardisation, and staff training, similar to the centralized-dashboard approach already in use for AI-powered hospitality waste systems (Clark et al., 2025).

Since Behavioural Factors came out as the weakest construct, but with high scores of Attitude and Awareness, the framework intentionally focuses on the ordering moment and minimizing friction rather than additional attitude-change messaging. Social Factors showed a meaningful group-dining influence, and the framework suggests that personalization should work at the table/party level, rather than just the individual level, to consider other factors that affect ordering, like celebrations or group meals.

7. Limitations

The study's findings are limited by a small and self-reported data that may be affected by social desirability bias. The proposed AI framework is also conceptual and requires real-world testing before its impact can be confirmed.

8. Conclusion and Managerial Implications

The aim of this study was to explore the drivers of consumer behaviour that contribute to food waste in restaurants in the Mumbai Suburban region and to develop an AI-based personalization framework based on these insights. The findings show that customers' awareness and attitudes towards food waste reduction are favourable, but they do not necessarily correspond to their ordering and consumption behaviour, highlighting an attitude-behaviour gap. The barriers to more sustainable ordering behaviour seem to be related to social dynamics and situational friction, rather than to a lack of concern. For restaurant managers, this means that AI-powered personalisation is most effective not when it tries to convince customers that food waste matters since they are already aware of this but when it removes the friction that stops that awareness from becoming action, such as making it easier and less awkward to request a smaller portion or a leftover parcel. The study demonstrates that consumer behavioural insight, as derived from well-established theoretical models like TPB, can and should be used to inform the design logic of AI systems applied in customer-facing settings in the HORECA sector, with AI serving as a complement to rather than a replacement for managerial understanding of consumer psychology.

References

- Adaryani, R. L., Palouj, M., Gholami, H., Baghestany, A. A., Damirchi, M. J., Dadar, M., & Seifollahi, N. (2025). Predicting household food waste behavior: Bringing food literacy and purchasing power into the theory of planned behavior. *Journal of Retailing and Consumer Services*, 82, 104119.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
- Clark, Q. M., Kanavikar, D. B., Clark, J., & Donnelly, P. J. (2025). Exploring the potential of AI-driven food waste management strategies used in the hospitality industry for application in household settings. *Frontiers in Artificial Intelligence*, 7, 1429477.
- Etim, E., Choedron, K. T., Ajai, O., Duke, O., & Jijingi, H. E. (2025). Systematic review of factors influencing household food waste behaviour: Applying the theory of planned behaviour. *Waste Management & Research*.

- Sigala, E. G., Gerwin, P., Chroni, C., Abeliotis, K., Strotmann, C., & Lasaridi, K. (2025). Reducing food waste in the HORECA sector using AI-based waste-tracking devices. *Waste Management*, 198, 77–86.
- Vukolić, D., Gajić, T., Cabral, Ó., Veljović, S., & Knežević, S. (2025). Revolutionizing the hospitality industry: The impact of AI technologies on efficient food management and reduction of food waste. *Journal of Tourism Futures*, ahead-of-print.
- Wani, M. D., Dada, Z. A., & Shah, S. A. (2025). What factors influence consumers' intention and food waste reduction perceptions in Indian restaurants? *British Food Journal*, 127(2), 569–587.
- Zatsu, V., Shine, A. E., Tharakan, J. M., Peter, D., Ranganathan, T. V., Alotaibi, S. S., Mugabi, R., Muhsinah, B., Waseem, M., & Nayik, G. A. (2024). Revolutionizing the food industry: The transformative power of artificial intelligence — a review. *Food Chemistry: X*, 24, 101867.