

Predictors of food waste management practices in the foodservice sector: a latent profile analysis of businesses in Japan

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Abstract

Purpose – This study explores how different foodservice organisations vary in their food waste management (FWM) practices throughout the value chain (procurement, stock management and storage; menu and product design; staff and customer engagement and leftover handling) and develops a theory-driven understanding of how business characteristics, managerial capabilities and social-capital resources shape FWM.

Design/methodology/approach – A latent profile analysis of data from surveys of 260 foodservice business managers in Japan identified four profiles of businesses based on their FWM practices. The study also explores the demographic and business characteristics and social capital resources that influence the various FWM practices using multinomial logistic regression.

Findings – Consistent with social capital theory, social and professional connections are critical in facilitating access to resources integral to adopting FWM. Furthermore, business location, operating in a franchise format and staffing levels influence food service businesses' ability to practice FWM.

Originality/value – New theoretical and practical implications are presented for the FWM practices of foodservice organisations, highlighting the importance of multiple internal and external stakeholders in the adoption of FWM practices. It also explicates measures to support and overcome barriers to implementing FWM practices through various phases of business operations.

Keywords Foodservice, Food waste management, Social capital theory, Hospitality, Japan, Latent profile analysis

Paper type Research article

1. Introduction

The Food and Agriculture Organization (FAO) of the United Nations estimates that the quantity of food production worldwide is sufficient to feed the global population (FAO, 2016). However, approximately one-third of food produced for human consumption is lost or wasted, amounting to 1.3 billion tons globally each year (FAO, 2011). "Food waste", referring to the food produced for human consumption that goes unconsumed, can be categorised into: (1) avoidable waste – edible food that has spoilt and become inedible, (2) unavoidable waste – including eggshells, animal bones, fish scales, etc., that are generally inedible, and (3) potentially avoidable waste – edible food that is disposed of during the production process, such as carrot peels, apple cores, potato skins, etc. (Dhir *et al.*, 2020). Discarded food carries with it the squandered energy, water, land, and capital invested in cultivating, processing, and distributing it, thereby depleting natural resources and releasing greenhouse gases at every step of the supply chain (Project Drawdown, n.d.). Life cycle analyses show that the carbon footprint of global food waste exceeds the emissions generated by commercial aviation,



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primary plastics production, and crude oil extraction (World Resources Institute, 2016). Beyond these environmental externalities, food waste worsens food insecurity by diverting edible food from human consumption (Hao *et al.*, 2022) and places upward pressure on the cost of food (Lei *et al.*, 2024).

Within this issue, the European Union (EU) has identified the food-service sector as the third-largest source of avoidable food waste after households and agri-food processing (Katsarova, 2016). There are calls for the industry to take greater responsibility for its waste management and its impacts on consumers, society, and the environment (Strotmann *et al.*, 2017). For example, HOTREC – the Association of Hotels, Restaurants, and Cafes in Europe, developed the European Hospitality Industry Guidelines to Reduce Food Waste Management (HOTREC, 2017). The guidelines recommend a multifaceted approach to reducing food waste, including menu design, storage of stock, cooking and preparation, customer engagement in food waste, managing leftovers and unsold products, and re-using and recycling residual food.

It is estimated that 75% of the food waste generated by the foodservice industry can be managed through business strategies, policies, and operations designed to control and minimise wastage (Oliveira *et al.*, 2016). Food waste is also generated through various stages of the value chain, including procurement, inventory control, storage, product development, and consumption, thus requiring a multifaceted strategy to tackle the issue (Dolnicar *et al.*, 2020). The extant research on food waste management (FWM) in the foodservice industry has explored the composition of waste, waste handling, government initiatives and regulations, interventions, and nudging consumer behaviours (Dhir *et al.*, 2020). Despite these advancements, a broad and multidisciplinary approach to exploring FWM remains fragmented and disparate. Specifically, two critical limitations emerge from recent syntheses (Lei *et al.*, 2024). First, most investigations remain exploratory and context-specific, relying on small interview samples that limit generalisability (e.g. Bharucha, 2018). Second, research attention tends to gravitate towards diners' motivations and attitudes as causes of food waste (e.g. Long *et al.*, 2024), leaving the managerial and organisational drivers of waste largely unexplored. Therefore, despite growing attention on the issue of food waste, and recognition of the United Nations Sustainable Development Goals (UNSDG) of “zero hunger” and “responsible consumption and production”, the underlying factors related to FWM in the context of foodservice organisations remain unclear (Lei *et al.*, 2024).

Equally under-developed is a theory-driven understanding of how business characteristics, managerial capabilities, and social-capital resources shape FWM. For example, foodservice business are typically owner-managed small- and medium-sized enterprises, whose generalist managers juggle day-to-day survival pressures. Some struggle to manage everyday operations and have limited capabilities or capacities to implement waste management practices (Strotmann *et al.*, 2017). Moreover, foodservice managers often lack the skills to identify, analyse, and control the food waste occurring throughout the value chain, including procurement, inventory control, storage, product development, and consumption (Filimonau *et al.*, 2020).

There are also considerable variances within the foodservices sector in terms of business operations and strategies, as well as the managers' social and professional networks that form social capital resources (Lee and Hallak, 2020). Foodservice businesses do not operate in a vacuum, rather, management of these businesses is a dynamic process involving relationships with a network of external actors including customers, suppliers, government and local councils, competing businesses, etc. Network-based social capital – access to expert advice, peer learning, and financial knowledge – has proven pivotal for other dimensions of foodservice performance such as increased innovation and improved sales (Lee and Hallak, 2020).

However, how such intangible business resources translate into effective FWM remains unexplored. Thus, a clear theoretical and empirical gap exists at the intersection of operations

management and social capital theory in foodservice contexts. Thus, there is a critical need for research to better understand practices in this sector and to implement effective resources, policies, and initiatives that support foodservice operators in managing food waste throughout the value chain. Responding to this knowledge gap, this study pursues an empirical examination of FWM in foodservice organisations and addresses three main research objectives. Specifically.

Objective 1: To map and profile the FWM practices (procurement and storage; menu and product design; staff and customer engagement; leftover handling) currently adopted by foodservice organisations;

Objective 2: To examine how diverse business owner demographics (age, experience, education) and firm characteristics (business type, location, size etc) influence the breadth and depth of those FWM practices; and

Objective 3: To investigate whether the firm's networks and social capital resources shapes these key FWM practices.

We pursue these objectives through a quantitative study that conducts Latent Profile Analysis and multinomial logistic regression using data from surveys of 260 foodservice business managers in Japan in 2023. The findings of the study contribute to the body of knowledge concerning foodservice FWM in two ways. Theoretically, it extends FWM research from single stage analyses to a multidimensional framework that recognises organisational heterogeneity as a central explanatory factor. The study is examined through Social Capital Theory (SCT) – defined by Bourdieu (1985, p. 248) as “the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition”. Social capital is a valuable resource for small- and medium-sized enterprises. For example, connections with institutional networks such as banks and financial institutions facilitates the attainment of financial resources, which may be necessary to develop new FWM practices (Hernandez-Carrion *et al.*, 2017). Foodservice firms with strong connections to associative networks such as local or national restaurant associations can source new information leading to the adoption of innovative business practices (Lee and Hallak, 2020), including innovation designed to minimise food wastage.

This study also contributes to FWM knowledge by providing practical directions on where interventions and support are needed to effectively control food waste throughout business operations, reducing costs and addressing the barriers experienced by these organisations. This research is undertaken in Japan, a country where reduction of waste is a key government priority (Cabinet of Japan, 2020). Government policies and organisations such as the Sustainable Restaurant Association (SRA) have been established to reduce waste and promote sustainability in the foodservice value chain. Thus, the present study informs government policy and the SRA whose objectives include (1) providing training and education for organisations to understand food sustainability, (2) using a rating system to certify business sustainability through the “Food Made Good Standard”, and (3) supporting businesses’ social capital through an online community platform (Sustainable Restaurant Association Japan, 2023).

2. Foodwaste management in the foodservice sector

Significant progress has been made by governmental bodies and industry associations in promoting sustainable practices within the foodservice sector. Notable initiatives include Japan's Basic Policy under the [Act on Promotion of Recycling and Related Activities for Treatment of Cyclical Food Resources \(2019\)](#) and the European Hospitality Industry Guidelines to Reduce Food Waste Management (HOTREC, 2017). However, despite these advancements, empirical research identifies persistent barriers hindering effective FWM.

These include incomplete or ineffective legislation, irresponsible consumer behaviour, and resource constraints, all of which significantly impede the capabilities of foodservice managers to implement sustainable waste-reduction practices. Additionally, negative perceptions surrounding health and safety regulations, concerns about potential food poisoning from unsold products, and environmental apathy further discourage foodservice operators from investing in FWM initiatives (Filimonau *et al.*, 2020, 2022). Practical limitations such as heavy workloads, staffing shortages, and limited financial resources compound these challenges, reducing managerial willingness and capacity to engage in proactive waste management strategies (Filimonau *et al.*, 2020).

Previous literature demonstrates that food wastage in commercial and institutional kitchens is both substantial and largely preventable. In a multi-site investigation of banquet operations, food courts, Chinese restaurants, and hotel dining rooms, Papargyropoulou *et al.* (2019) found that roughly one-third of purchased food ended up as waste and almost one-half of that discarded fraction could have been avoided. Preparation trimmings were the single largest component, followed by buffet leftovers and, finally, plate waste. The financial toll amounts to about 23% of the value of all ingredients procured. Papargyropoulou *et al.* (2019) attributed these losses partly to internal operating policies and partly to the social norms that shape diners' expectations. For example, restaurants routinely over-produce by about 30% to project variety and abundance. Therefore, they call for a twin-track strategy that tackles both back-of-house processes and customer behaviour, reinforced by clearer communication and closer collaboration along the supply chain to promote avoidance and donation initiatives (Papargyropoulou *et al.*, 2019).

Research in Nordic contexts supports the view that waste reduction depends on a constellation of interacting factors rather than a single intervention. Drawing on participatory action research with 34 practitioners, Heikkilä *et al.* (2016) identified eight drivers of waste in catering: societal norms, the business concept itself, product development and purchasing practices, management routines, employee skill levels, diner behaviour, competitive pressures and communication. They emphasise that avoidable waste arises at every stage of the food chain and that meaningful progress hinges on integrated management systems, continuous monitoring of portion sizes and thorough documentation of activities. Thus, controlling food waste demands a holistic, organisation-wide approach in which everyday leadership and a skilled workforce play pivotal roles (Heikkilä *et al.*, 2016).

Likewise, quantitative evidence from 51 Finnish schools, day-care centres, and restaurants underscores the importance of systematic oversight. Silvennoinen *et al.* (2015) measured kitchen waste, serving waste, and plate waste over one-day or one-week periods and concluded that meticulous planning, strong managerial commitment, and routine documentation are the cornerstones of effective waste prevention. Recording data not only reveals where waste originates, but also sets the baseline needed to design targeted solutions. A broad synthesis of academic and grey literature by Vizzoto *et al.* (2021) catalogued 30 food-waste-reduction measures, clustering them into managerial, supply-chain, preparation-and-serving, consumer-behaviour, information-exchange, and alternative-destination strategies. While this taxonomy supports food-waste management (FWM) being inherently multi-faceted, the review also highlights persistent blind spots. Little is known about why some establishments adopt a wide array of practices whereas others engage only superficially, and the influence of business owner and firm characteristics remain under explored.

Thus, waste generation predominantly occurs during food preparation, driven by operational inefficiencies and managerial policies. Consequently, targeted interventions addressing internal business operations and consumer engagement could substantially mitigate food wastage. For instance, research by Hao *et al.* (2022) emphasises the significant share of waste originating from customer leftovers, noting a prevalent lack of consumer awareness regarding the environmental and economic impacts of their food wastage behaviours. In sum, prior scholarship has quantified waste volumes, mapped the stages at

which losses occur and proposed a broad menu of remedial actions. What remains under-explored is how the demographic profile of business owners—age, educational attainment, entrepreneurial experience—and the structural attributes of their firms—format, size, location, market segment—shape both the breadth and the depth of FWM implementation. Addressing this gap will sharpen our understanding of why similar operations exhibit divergent waste outcomes and will inform more finely tuned interventions that recognise the heterogeneous realities of the food-service sector.

3. Social capital and food waste management

A growing body of literature also underscores the importance of business and owner characteristics as predictors of effective FWM (Principato *et al.*, 2018; Filimonau *et al.*, 2022). Central to this discourse is Social Capital Theory, articulated by Bourdieu (1985), which posits that enterprises endowed with robust professional and social networks have superior access to essential intangible resources. Social capital comprises both tangible and intangible assets accessible through an individual's network of social and professional relationships (Stam *et al.*, 2014). Such networks include both direct contacts and indirect acquaintances – connections to individuals who themselves are linked to other influential figures (Greve and Salaff, 2003). These relational assets provide strategic resources that significantly enhance business capabilities, facilitating opportunity recognition (Anderson and Miller, 2003), fostering inter-firm alliances (BarNir and Smith, 2002), accessing funding (Honig, 1998), recruiting skilled employees (Bosma *et al.*, 2004), obtaining business advice (Zhou *et al.*, 2007), and stimulating innovative ideas (Hughes *et al.*, 2007).

Social capital theory holds that business decisions and actions spring from the resources and opportunities accessed through networks, relationships, memberships, and broader social structures (Zhao *et al.*, 2011; Ceci *et al.*, 2020). Since social capital is built on the ties among actors, those ties naturally differ in form, depending on how familiar the actors are with one another and how strong their connection is (Lee *et al.*, 2024). Social capital, as a firm level resource, varies among organisations, as well as the strength (or weaknesses) of the network ties that constitute the social capital. Networking ties have been categorised as “weak” and “strong” (Granovetter, 1973). Weak ties refer to loose connections among people who are not closely acquainted. By linking a broad array of dispersed, unfamiliar contacts, these ties open access to a wider pool of expertise and information. Conversely, strong ties refer to strong relationships between individuals who know each other intimately, such as family bonds. Individuals with strong ties are often usually like each other, are in constant contact, and are more likely to exchange similar information (Lee *et al.*, 2024).

Foodservice enterprises are predominantly independently owned small- and medium-sized firms, operating within intricate networks of relationships involving suppliers, customers, employees, government institutions, trade associations, and even familial ties. When strategically leveraged, this network portfolio encompasses four overlapping dimensions: personal networks (family and close friends), professional networks (partners, staff, suppliers, and customers), associative networks (industry bodies and chambers of commerce), and institutional networks (financial institutions and government agencies) (Lee and Hallak, 2020; Hernández-Carrión *et al.*, 2017). The depth and quality of these relationships constitute a strategic resource vital to acquiring essential inputs such as finance, market intelligence, skilled labour, and raw materials (Lee and Hallak, 2020).

Franchising, a popular foodservice business format, can also be thought of as a network-based resource, in which a contractually formalised network of franchisees and franchisors cooperate to achieve mutual goals (Yakimova *et al.*, 2021). This includes franchisees complying with the terms of their contract with the franchisor (e.g. using specific business models, brand positioning, etc.), communication between the franchisor and franchisee to share managerial and market information, and knowledge and information sharing between

franchisees themselves (Yakimova *et al.*, 2021). Collectively, these networks fundamentally influence the enterprise's capacity for innovation, competitiveness, and sustainability (Hallak and Lee, 2023).

Networks facilitate the transfer of technology and innovation into firms, while simultaneously providing a continuous stream of market intelligence. This information, disseminated through industry organisations, online platforms, and peer networks, has the potential to alert managers to evolving consumer preferences, competitor strategies, and emerging distribution channels. However, what remains largely unexplored is how variations in social capital translates into diverse FWM outcomes. Despite the evidence that social capital can drive business innovation practices (Ceci *et al.*, 2020), there is limited knowledge on how social capital in foodservice organisation can facilitate the knowledge exchange, opportunity recognition, and consequently business decision specific toward food waste management operations. This remains a major oversight as networks encompassing mentors, consultants, and industry forums further sharpen managerial decisions, expedite organisational learning, and enhance responsiveness to market shocks. Thus, there is need to explore how the strength of social capital, driven through collaboration among stakeholders across the food supply chain, enables coordinated and strategic approaches to food waste reduction. This includes optimised procurement, efficient distribution, proactive customer engagement, and the redistribution of surplus food to vulnerable communities (Riches and Silvasti, 2014; Chowdhury *et al.*, 2020).

Thus, a thorough review of the existing literature underscores the complexities and nuanced interplay of factors influencing food waste in the foodservice industry. These factors encompass establishment type, menu design, managerial attitudes and behaviours, operational strategies, and customer consumption patterns. Responding to existing calls for greater academic and practical attention, this study seeks to advance the current understanding of food waste within the foodservice sector. Building upon previous research that highlights food waste occurring across multiple stages of the value chain, and research that identifies critical operational and managerial influences, the study empirically investigates FWM practices across four primary phases: (1) procurement, stock management, and storage; (2) menu and product design; (3) staff and customer engagement; and (4) leftover handling. Additionally, the research categorises foodservice establishments based on distinct combinations of FWM practices across these phases, further analysing how different profiles correlate with auxiliary predictors – specifically business and managerial characteristics and the influence of social capital – in explaining variations in food waste management behaviours.

4. Method

The study is based on data from foodservice establishments operating in major urban centres of Japan. Food waste is a major issue for Japan, as outlined in two key policies: the Act on Promotion of Recycling and Related Activities for Treatment of Cyclical Food Resources and the Act on Promotion of Reduction of Food Waste, both enacted in 2019. The amount of food waste in Japan is estimated to be 5.23 million tons a year, with 2.79 million tons being classified as “business-related” food waste. Recognition of Japan's food waste problem has prompted the Japanese government's target to halve its annual food waste by 2030 (Cabinet of Japan, 2020). These national efforts are underpinned by the UNSDGs, which were adopted in 2015 by 193 member states of the United Nations. SDG 12 (Responsible consumption and production) explicitly calls for halving global food waste by 2030, which has accelerated initiatives related to FWM in Japan. Following the adoption of the SDGs, Japan enacted food waste related legislation, encouraging action from the private sector toward achieving these goals. As of the most recent global assessment, Japan ranks 18th out of 167 countries in overall SDG performance, placing it within the top 10% (Sachs *et al.*, 2024). Therefore, understanding the current state of FWM practices in Japan may provide valuable insights for other countries seeking to address similar challenges.

An online survey was conducted in February 2023 using panel data from Neo Marketing Inc., a Japanese market research company. The questionnaire was completed by a manager/representative of the foodservice business who was knowledgeable and could answer questions about the business's food procurement, storage, processing, and discarding processes. The final number of valid responses was 260, with the following regional breakdown: 158 (60.8%) from the Tokyo area, 29 (11.2%) from the Nagoya area, and 73 (28.1%) from the Osaka area. The characteristics of the sample respondents are shown in [Table 1](#).

4.1 Method of analysis

Data was analysed using latent profile analysis (LPA) and multinomial logistic regression (MLR). LPA was combined with MLR to examine how each profile was associated with the

Table 1. Sample characteristics ($n = 260$)

Managers' characteristics	No.	%	Business characteristics	No.	%
<i>(1) Gender of manager</i>			<i>(5) Type of business</i>		
Male	209	80.4	<i>(1 = Serving mainly alcoholic beverages, 0 = others)</i>		
Female	51	19.6	Serving mainly food	148	55.8
<i>(2) Age of manager</i>			Serving mainly non-alcohol beverages	27	10.2
<i>(1 = over 45 years, 0 = 18–45 years)</i>			Serving mainly alcoholic beverages	76	28.7
18–25	6	2.3	<i>(6) Location of business^a</i>		
26–35	25	9.6	Urban	221	85.0
36–45	68	26.2	Rural	39	15.0
46–55	90	34.6	<i>(7) Age of business</i>		
56 and above	71	27.3	<i>(1 = Over 30 years, 0 = 30 years or less)</i>		
<i>(3) Highest level of education</i>			10 years or less	50	18.9
<i>(1 = completed higher education, 0 = completed high school or less)</i>			<i>(8) Franchise business or not</i>		
Did not complete high school	14	5.4	Yes	65	24.5
Completed high school	83	31.9	No	200	75.5
Certificate/Diploma	62	23.8	<i>(9) Family-owned business or not</i>		
Bachelor's Degree	97	37.3	Yes	89	33.6
Post-Graduate Degree	4	1.5	No	176	66.4
<i>(4) Years of experience in hospitality/restaurant</i>			<i>(10) Number of full-time staff</i>		
<i>(1 = Over 10 years, 0 = 10 years or less)</i>			<i>(1 = Over 5, 0 = 5 or less)</i>		
10 years or less	40	15.4	1	55	20.8
11–20 years	75	28.8	2	56	21.1
21–30 years	79	30.4	3–5	75	28.3
31 years or more	66	25.4	6 or more	79	29.8
			<i>(11) Seating capacity</i>		
			<i>(1 = Over 100 seats, 0 = 100 seats or less)</i>		
			Less than 25 seats	117	44.2
			25–50 seats	83	31.3
			51–100 seats	39	14.7
			Over 100 seats	26	9.8

^aBusinesses operating in a municipality with a population of 100,000 or more are counted as *urban*, less than 100,000 are categorised as *rural*

Source(s): Authors' work

characteristics of managers and businesses. The three-step approach (Vermunt, 2010) included: (1) identifying the optimal number of profiles without auxiliary variables; (2) introducing auxiliary variables based on the selected model; and (3) examining associations while correcting the classification errors (Vermunt and Magidson, 2020).

The MLR analysis included 12 predictors. Unlike hypothesis testing research, this study took an exploratory approach with less requirements to control numerous factors to avoid spurious correlations. The analysis adopted backward elimination (Derksen and Keselman, 1992; Smith, 2018). This process first carries out an analysis using all predictor variables. Subsequently, predictors with *p*-values exceeding the threshold (0.05 in this study) are identified from the initial results, and an analysis excluding the predictor with the largest *p*-value is conducted, reducing the predictors iteratively. The variable reduction procedure finishes when predictors with *p*-values below the threshold remain.

4.2 Measures of variables

4.2.1 Measures for classifying profiles. To develop the questionnaire, prior research on FWM practices in restaurant contexts were consulted. First, Papargyropoulou *et al.* (2014), based on interviews with food waste experts in the United Kingdom, introduced the Food Waste Hierarchy (FWH) measure, which categorises FWM practices into five levels: prevention, re-use, recycling, recovery, and disposal. Utilising this conceptual framework, Stürnimann and Zizka (2022) conducted interviews with restaurant managers in Switzerland and identified a range of practical implementations. Their findings revealed that prevention and re-use constituted most practices in restaurants, whereas recycling (e.g. use as animal feed or compost), recovery (e.g. biogas collection), and disposal (e.g. landfill) were much less commonly applied.

Next, Filimonau and De Coteau (2019), referring to the same framework, noted the absence of established methods for quantifying, characterising, and reducing food waste in hospitality operations. Through a literature-based analysis, they proposed a managerial framework encompassing three stages of FWM practices: pre-kitchen (e.g. demand forecasting, procurement, stock management, and menu design), kitchen (e.g. storage, preparation, plating, and serving), and post-kitchen (e.g. customer service and post-service actions). Dhir *et al.* (2020) further emphasised that managerial involvement is more prominent in upstream practices, staff engagement more prominent in central midstream, and consumer influence is predominant downstream.

Finally, in Japan, the Basic Policy for the Promotion of Food Loss Reduction was adopted as a Cabinet Decision in 2022 and subsequently revised in 2025 (Cabinet of Japan, 2025). The policy outlines concrete FWM practices. These include procurement and storage adjustments based on weather and calendar events, menu and product design strategies such as smaller portion sizes and customisable serving options, staff and customer engagement initiatives encouraging customers to finish meals or take leftovers home, and leftover handling measures such as food donation and recycling.

Based on the previous studies explained above, a comprehensive set of 25 questions about FWM practices were devised, categorised into four classifications: (1) procurement, stock management and storage, (2) menu and product design, (3) staff and customer engagement, and (4) leftover handling, drawn from the empirical literature and industry guidelines (see HOTREC, 2017; Dhir *et al.*, 2020; Filimonau *et al.*, 2019; Principato *et al.*, 2018; Appendix B). Table 2 shows the means and standard deviations of the 25 items related to FWM practices. The survey items were developed with reference to specific FWM practices identified in prior studies (Table 2). All items were measured on a 7-point Likert scale, assessing the frequency of implementation from 1 = Never to 7 = Very Often (see Appendix B for the full questionnaire).

All Cronbach's alphas were >0.6 (Table 2), indicating sufficient internal consistency (Nunnally and Bernstein, 1994). Therefore, mean scores of the related items for each factor were computed to create subscale scores.

Table 2. Means and standard deviations of FWM practices

Item	Alpha	Mean	S.D.	Source
(1) <i>Procurement, stock management and storage</i>	0.725	4.532	1.055	
1 We use frozen foods with longer storage time		4.123	2.072	Filimonau and Sulyok (2021) and Stirnimann and Zizka (2022)
2 Purchasing supplies from local businesses		4.035	2.089	Filimonau and De Coteau (2019)
3 Forecasting customer demand to ensure we do not over purchase stock		5.142	1.674	Filimonau and De Coteau (2019) and Stirnimann and Zizka (2022)
4 Forecasting and planning ingredients required		5.342	1.555	Dhir <i>et al.</i> (2020), Filimonau <i>et al.</i> (2019), and Stirnimann and Zizka (2022)
5 Having proper storage facilities and processes		5.588	1.493	Dhir <i>et al.</i> (2020) and Filimonau and De Coteau (2019)
6 Managing kitchen errors, mishandlings, and lack of balance in ingredients		5.058	1.599	Dhir <i>et al.</i> (2020)
7 Ordering on daily basis		4.738	2.029	Stirnimann and Zizka (2022)
8 Collaborating with other restaurants in sharing and redistributing our stock		2.231	1.814	Filimonau and De Coteau (2019) and Stirnimann and Zizka (2022)
(2) <i>Menu and product design</i>	0.773	3.895	1.244	
9 We use seasonal ingredients in our menu items		4.496	2.06	Filimonau and De Coteau (2019) and Filimonau and Sulyok (2021)
10 Changing menu items to control the use of our stock		4.3	1.934	Filimonau and De Coteau (2019), Principato <i>et al.</i> (2018), and Stirnimann and Zizka (2022)
11 Shortening the menu		3.123	1.792	Filimonau and Sulyok (2021), Stirnimann and Zizka (2022)
12 Cooking on demand		5.042	2.056	Filimonau and Sulyok (2021)
13 Including smaller portions on the menu		3.508	2.039	Filimonau and De Coteau (2019), Filimonau and Sulyok (2021), Principato <i>et al.</i> (2018), Stirnimann and Zizka (2022)
14 Changing the menu items to ensure stock can be utilised		4.138	1.904	Filimonau and De Coteau (2019), Principato <i>et al.</i> (2018), Stirnimann and Zizka (2022)
15 Changing prices of menu items to help them to sell quickly		3.038	1.941	Filimonau and De Coteau (2019) and Stirnimann and Zizka (2022)
16 Implementing flexible daily menus		3.512	2.248	Stirnimann and Zizka (2022)
(3) <i>Staff and customer engagement</i>	0.659	3.427	1.202	
17 Donating any excess food to staff		3.146	2.076	Dhir <i>et al.</i> (2020), Filimonau and Sulyok (2021) and Stirnimann and Zizka (2022)
18 Increasing staff awareness, commitment, and involvement in food waste management		5	1.613	Filimonau and De Coteau (2019) and Stirnimann and Zizka (2022)
19 Encouraging cooperation between staff and the customers about food waste		3.942	1.837	Filimonau and De Coteau (2019)
20 Encouraging customers to take leftovers home		2.762	1.978	Filimonau and De Coteau (2019) and Stirnimann and Zizka (2022)
21 Encouraging customers to finish their food- e.g. having signs on the restaurant walls about food waste		2.285	1.698	Filimonau and De Coteau (2019) and Stirnimann and Zizka (2022)

(continued)

Table 2. Continued

Item	Alpha	Mean	S.D.	Source
(4) Leftover handling	0.724	2.381	1.223	
22 Donating any excess food to charity		1.604	1.277	Dhir <i>et al.</i> (2020), Principato <i>et al.</i> (2018), and Stirnimann and Zizka (2022)
23 Separating food waste		3.658	1.883	Filimonau and De Coteau (2019)
24 Composting food waste		2.588	1.964	Filimonau and De Coteau (2019), Principato <i>et al.</i> (2018), and Stirnimann and Zizka (2022)
25 Using leftover stock to feed animals		1.673	1.383	Stirnimann and Zizka (2022)

Source(s): Authors' work

4.2.2 Predictors. The predictors of latent profiles were *managers' social capital and networks*, and the 11 managers and business characteristics (Table 1). Social capital was operationalised with a six-item scale adapted from Lee and Hallak (2020). Food-service operators rated the strength of their relationships with key stakeholder groups—local businesses and suppliers, customers, local government and industry associations, business networking groups, and universities and research centres—on a seven-point Likert scale (1 = very weak, 7 = very strong). Cronbach's alpha for the scale was 0.805, indicating sufficient internal consistency (Nunnally and Bernstein, 1994).

The 11 characteristics were categorical variables. Four variables had only two levels and were incorporated into the analysis as dummy variables. Of the remaining variables, four had four levels each ([4] years of experience in hospitality/restaurant, [5] type of business, [10] number of full-time staff, and [11] seating capacity), and three had five levels each ([2] age of manager, [3] highest level of education, and [7] age of business). The conversion of these into dummy variables (excluding the reference variables) resulted in 24 variables ($4 \times [4-1] + 3 \times [5-1]$). To improve estimation stability given the modest sample size, variables with four or five levels were recoded into binary form. This also helped to avoid the instability that can arise from different outcomes depending on the choice of reference category in multi-level dummy coding.

The reduction of levels was conducted through the following procedure. First, LPA was conducted to determine the optimal number of profiles. Each respondent was then assigned to the profile with the highest probability, and a nominal variable ($\mathcal{N}$) was created to represent that classification [1]. For each multi-level categorical variable, dummy variables (D_h) were created by dichotomizing at all possible thresholds of h . For each D_h , a chi-square statistic χ^2_h was calculated based on a cross-tabulation with $\mathcal{N}$. The threshold h that produced the highest χ^2_h was selected, and the corresponding D_h was used in the analysis. For example, the manager age variable with five categories (18–25, 26–35, 36–45, 46–55, and 56 and above) was converted into a binary variable using the third level as the threshold: 18–45 years = 0, and over 45 = 1. This procedure was applied to other variables as well (see Table 1). These, plus the four original binary variables, comprised the final set of 11 predictors [2].

5. Results and discussion

5.1 Step 1: determining the optimal number of profiles

Bayesian information criterion (BIC) and bootstrapped loglikelihood ratio test (BLRT) criteria were used to determine the optimal profile number (Nylund *et al.*, 2007). Table 3 shows the BIC and BLRT as the number of profiles increased from 1. The BIC continued to decrease up to six profiles (BIC = 2987.803), and then started to increase. Therefore, the BIC suggested seven profiles. Table 3 also shows the entropy, an indicator of the accuracy of the posterior

Table 3. BICs, BLRT, and entropy for different profile solutions

No. of latent profiles	BIC	BLRT: <i>p</i> -value	Entropy
1	3333.723	n/a	n/a
2	3160.761	0.000	0.679
3	3036.888	0.000	0.864
4	3022.523	0.000	0.896
5	2998.430	0.000	0.826
6	2983.867	0.000	0.836
7	2987.803	0.008	0.815
8	2995.050	0.010	0.834
9	2999.641	0.006	0.845
10	3008.724	0.034	0.872
11	3024.258	0.295	0.843
12	3031.782	0.176	0.865

Note(s): BIC = Bayesian Information Criterion; BLRT = Bootstrapped loglikelihood ratio test

Source(s): Authors' work

classification (Ramaswamy *et al.*, 1993). Entropy values above 0.8 indicate good separation, while values above 0.7 indicate sufficient separation (Blömeke and Kaiser, 2011). The entropy for the 6-profile solution was 0.836. Thus, the 6-profile solution was adopted for further analysis.

5.2 Step 2: classifying cases into profiles

Next, individual respondents were assigned to the profile with the highest probability of membership. The frequency and composition ratio of the six profiles are shown in Table 4. The composition ratio of Profile 5 was only 0.8% and the composition ratio of Profile 6 was low at 7.3% compared to other profiles, and was only half of Profile 3, the next smallest profile (14.6%). Table 4 also shows the FWM scores for each profile. While Profile 5 indicates that all FWM practices are at a very high level, Profile 6 hardly practices any FWM. Because of low frequencies and extreme FWM practices, Profiles 5 and 6 can be considered outliers which may distort results in step 3 (i.e. multinomial logistic analysis). Therefore, these outliers (21 cases) were subsequently excluded from the data.

Table 5 shows the results of the profile analysis (Step 1) minus outlier cases. The BIC continued to decrease up to four profiles (BIC = 2665.522), and then started to increase. The

Table 4. Description of the six latent profiles on FWM

Profile	Frequency	%	Procurement, stock management and storage	Menu and product design	Staff and customer engagement	Leftover handling
1	43	16.5	5.114	4.958	4.471	4.259
2	38	14.6	4.184	3.694	3.397	3.206
3	58	22.3	5.203	4.772	3.977	2.103
4	100	38.5	4.385	3.273	2.882	1.545
5	2	0.8	6.500	6.937	7.000	6.625
6	19	7.3	2.049	1.607	1.519	1.066

Source(s): Authors' work

Table 5. BICs, BLRT, and entropy for different profile solutions without outlier-profiles

No. of latent profiles	BIC	BLRT: <i>p</i> -value	Entropy
1	2804.526	–	–
2	2686.542	0.000	0.694
3	2674.203	0.000	0.740
4	2665.522	0.000	0.776
5	2671.338	0.010	0.772
6	2681.662	0.046	0.797
7	2699.045	0.508	0.798
8	2715.426	0.513	0.798

Source(s): Authors' work

entropy for the 4-profile solution was 0.776 indicating sufficient separation (Blömeke and Kaiser, 2011). Thus, the 4-profile model based on the BIC was adopted (Table 6).

The composition ratio of the four profiles is at least 15.1%, showing that each profile had a relatively large group. The frequency of Profiles 1 to 4 was 41, 36, 59, and 103, respectively. Figure 1 illustrates the FWM scores of the four profiles from the revised analysis.

The results suggest that all profiles implement a relatively high level of internal FWM practices, with the key differentiating factor being the level of external FWM practices (staff and customer engagement and leftover handling). This trend is consistent with the findings of Stirmmann and Zizka (2022), who investigated FWM practices in the German-speaking region of Switzerland. Their study showed that while various measures were implemented for food waste prevention (i.e. internal FWM), relatively fewer efforts were made in the areas of re-use, recycle, recovery, and disposal (i.e. external FWM). In line with this distinction, the present analysis identified two main FWM strategies among foodservice establishments: a holistic approach (Profiles 1 and 2) and an internal approach (Profiles 3 and 4). Both Profiles 1 and 2 practice FWM in full, but the former has higher FWM scores in all aspects than the latter. Both Profiles 3 and 4 practice partial FWM, but again the former has higher FWM scores in all aspects than the latter. Thus, based on the slope of the trends and the height of the intercepts, the FWM practice patterns of the four profiles were labelled as follows.

- (1) Profile 1: *Full-High FWM*
- (2) Profile 2: *Full-Low FWM*
- (3) Profile 3: *Partial-High FWM*
- (4) Profile 4: *Partial-Low FWM*

Table 6. Description of the four latent profiles on food FWM

Profile No.	Profile name	Frequency	%	Procurement, stock management and storage	Menu and product design	Staff and customer engagement	Leftover handling
1	Full-High FWM	41	17.2	5.139	4.988	4.478	4.253
2	Full-Low FWM	36	15.1	4.189	3.741	3.427	3.283
3	Partial-High FWM	59	24.7	5.252	4.812	3.973	2.119
4	Partial-Low FWM	103	43.1	4.409	3.321	2.931	1.588

Source(s): Authors' work

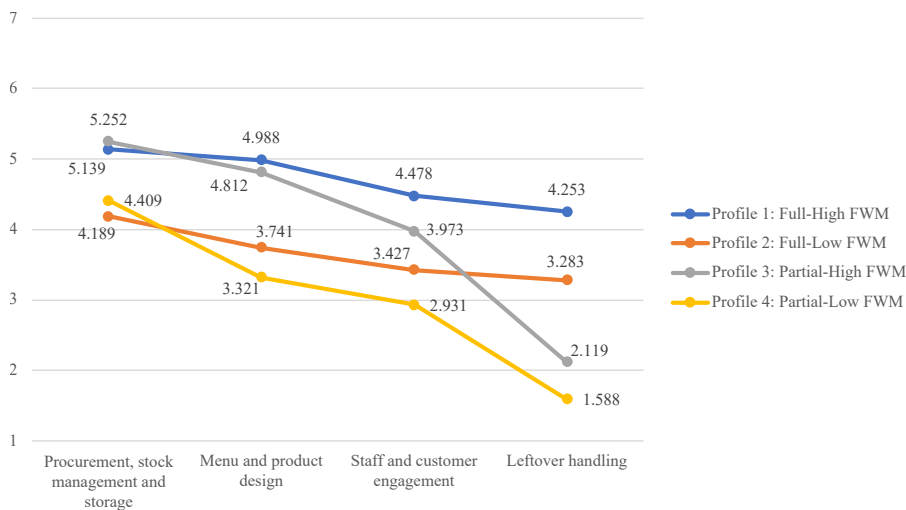


Figure 1. Food waste management profiles for the 4-profile model. Source: Authors' work

The existence of groups with low levels of external FWM practices – namely, the Partial-High and Partial-Low FWM profiles – aligns with the broader context surrounding Japanese FWM practices. Compared to countries that are more advanced in food waste management, such as the UK and France, Japan has made less progress in developing public awareness. One possible reason is its relatively low ethnic diversity, which may have limited the development of broad and easily understandable public campaigns (Watanabe, 2018). These campaigns are often needed to help consumers understand food waste issues, particularly those related to staff and customer engagement. Furthermore, according to the Japanese Ministry of Agriculture, Forestry and Fisheries (2022), the reuse of leftovers has been notably slower to develop in Japan's foodservice sector. This slow progress can be attributed to practical challenges. The Japan Foodservice Association (2017) notes that restaurants in Japan are widely dispersed and that each outlet generates only a small amount of food waste, making collection economically inefficient and costly. It also explains that the wide variety of food waste types makes recycling itself more complicated. Nevertheless, some groups in Japan appear to have overcome these external FWM barriers. Specifically, the Full-High FWM profile (17.2%) and the Full-Low FWM profile (15.1%) together account for 32.3% of the sample. The following step investigates the factors that explain the differences between these profiles.

5.3 Step 3: associations of profiles with auxiliary predictors

The study discovered four significant predictors of profile membership: social capital and networks, location, franchise business, and number of full-time employees. Table 7 presents the results of the MLR analysis. Based on four profiles extracted, there are six possible combinations (${}_4C_2$). Table 7 shows the average marginal effects (AME), which indicate the impact of a 1-point increase in each predictor on the occurrence probability (see Appendix A: Average marginal effects).

Social capital and networks were significantly associated with membership of a particular profile in five of the six comparisons (Table 7). Thus, the study supports the importance of Social Capital Theory in explaining the propensity to adopt FWM practices. In past studies, the influence of social and professional connections has been largely ignored, with a highly internal focus on the types of establishment and menu items (Principato et al., 2018), managers' attitudes and behaviours (Filimonau et al., 2019), or an external focus solely on

Table 7. Results of multinomial logistic regression analysis

	High-low comparisons			Partial-Low FWM → partial-high FWM		
	Full-Low FWM → full-high FWM β	SE	AME	β	SE	AME
Intercept	−5.025	1.916		−1.626	1.044	
Location ^a	0.124	0.748**	0.022	−1.286	0.642*	−0.251
Franchise ^b	0.372	0.605	0.066	−1.010	0.693	−0.197
No. of fulltime employees ^c	−0.295	0.592	−0.052	0.864	0.586	0.169
Social capital and networks	1.227	0.432**	0.218	0.703	0.273*	0.137
	Full-partial comparisons Partial-high FWM → full-high FWM			Partial-low FWM → full-low FWM		
	β	SE	AME	β	SE	AME
Intercept	−6.948	1.877**		−3.550	1.295**	
Location ^a	0.503	0.641	0.072	−0.908	0.770	−0.154
Franchise ^b	1.639	0.688*	0.234	0.257	0.592	0.044
No. of fulltime employees ^c	0.107	0.547	0.015	1.266	0.610*	0.215
Social capital and networks	1.423	0.424**	0.203	0.898	0.313**	0.152
	Crossed comparisons			Full-low FWM → partial-high FWM		
	Partial-low FWM → full-high FWM β	SE	AME	β	SE	AME
Intercept	−8.574	1.855**		1.923	1.358	
Location ^a	−0.784	0.744	−0.093	−0.378	0.671	−0.080
Franchise ^b	0.629	0.578	0.074	−1.266	0.712	−0.269
No. of fulltime employees ^c	0.971	0.583	0.115	−0.402	0.579	−0.085
Social capital and networks	2.126	0.424**	0.252	−0.196	0.334	−0.042
Note(s): ** $p < 0.01$, * $p < 0.05$, ^a 1 = urban, 0 = rural, ^b 1 = franchise, 0 = not franchise, ^c 1 = 6 or more, 0 = 5 or less						
Source(s): Authors' work						

customer behaviours (Hao *et al.*, 2022). We extend knowledge on FWM adoption by showing that foodservice businesses do not operate in a vacuum, rather, FWM is a dynamic process involving relationships with a network of actors including customers, suppliers, government and local councils, competing businesses, etc.

Critically, the study finds that social capital and networks are strongly associated with the “best” FWM profiles (Full-High) compared to the “worst” FWM profiles (Partial-Low). Social capital and networks had a positive association with a case being in the Full-High FWM profile compared to the Full-Low FWM profile ($\beta = 1.227$, $p < 0.01$). The AME implied that a 1-point increase in social capital and networks increased the probability of a case being associated with the Full-High FWM profile compared to the Full-Low FWM profile by 21.8%. Social capital and networks also had a positive association with a case being in the Partial-High FWM profile compared to the Partial-Low FWM profile ($\beta = 0.703$, $p < 0.05$). A 1-point increase in social capital and networks increased the probability of a case being in the Partial-High FWM profile compared to the Partial-Low FWM profile by 13.7%

Next, social capital and networks had a positive association with a case being in the Full-High FWM profile compared to the Partial-High FWM profile ($\beta = 1.423$, $p < 0.01$). A 1-point

increase in social capital and networks increased the probability of a case being in the Full-High FWM profile compared to the Partial High FWM profile by 20.3%. Social capital and networks also had a positive association with a case being in the Full-Low FWM profile compared to the Partial-Low FWM profile ($\beta = 0.898, p < 0.01$). A 1-point increase in social capital and networks increased the probability of a case being associated with the Full-Low FWM profile compared to the Partial-Low FWM profile by 15.2%. Finally, the crossed comparisons showed that social capital and networks had a positive association with a case being in the Full-High FWM profile compared to the Partial-Low FWM profile ($\beta = 2.126, p < 0.01$). A 1-point increase in social capital and networks increased the probability of a case being associated the Full-High FWM profile compared to the Partial-Low FWM profile by 25.2%.

Consistent with Social Capital Theory (Bourdieu, 1985), our results imply that the depth and quality of professional and social relationships constitute the firm's social capital, a strategic resource vital to acquiring essential inputs such as finance, market intelligence, skilled labour, and raw materials to facilitate the adoption of FWM practices. Close connections with associative networks such as local or national restaurant associations (Lee and Hallak, 2020) can give restaurant owners market intelligence relating to the latest FWM practices available. Connections with institutional networks such as banks (Hernandez-Carrion *et al.*, 2017) facilitates the attainment of the financial resources necessary to fund the adoption of new FWM practices. Finally, communication and collaboration with staff can facilitate an exchange of information and awareness relating the importance of FWM practices. This ensures sufficient buy-in from staff towards implementing new FWM practices, overcoming potential apathy and negative attitudes towards reducing food waste, which was shown by Filimonau *et al.* (2022) as being a significant barrier to implementing FWM practices.

The study also theorised that franchising, as a formalised network-based resource, may increase the propensity for a foodservice business to adopt FWM practices. The franchising structure itself, with a large network of franchisors and franchisees, encourages social exchanges through franchisee training, intranets, and regional and national meetings (Yakimova *et al.*, 2021). This alerts managers to evolving consumer preferences, competitor strategies, and emerging distribution channels, all of which may significantly influence strategic decision-making and operational effectiveness in FWM practices. The results supported this notion, as the full-partial comparisons showed that being a franchise business had a positive association with a case being in the Full-High FWM profile compared to the Partial-High FWM profile ($\beta = 1.639, p < 0.05$). Being in a franchise format increased the probability of a case being in the Full-High FWM profile compared to the Partial-High FWM profile by 23.4%. In addition, the number of full-time employees had a positive association with a case being in the Full-Low FWM profile compared to the Partial-Low FWM profile ($\beta = 1.266, p < 0.05$). When the number of employees increased to six or more, this increased the probability of a case being associated with the Full-Low FWM profile compared to the Partial-low FWM by 21.5%.

This finding may reflect the Japanese government's efforts to raise public awareness of FWM (Kobayashi, 2020). In Japan, many restaurants had previously not allowed customers to take home leftovers due to concerns over food safety, such as the risk of food poisoning. However, since 2017, the Japanese Ministry of Agriculture, Forestry and Fisheries has issued guidelines titled "Points to Consider When Addressing 'Leftovers' in Food Service Establishments". The guidelines state that the safety of leftovers brought home is the responsibility of the consumer. With the introduction of these guidelines, and as public awareness of food waste reduction has increased, more restaurants have begun allowing customers to take home uneaten food. Capitalising on this trend, initiatives to reduce food waste at individual outlets are likely to be viewed positively by franchise businesses, as they may enhance the brand image of the entire chain. This may encourage more proactive engagement by franchisees in such efforts. This type of government intervention can directly

alleviate the problems associated with FWM uptake. For example, [Filimonau et al. \(2020, 2022\)](#) demonstrated that negative perceptions surrounding health and safety regulations and concerns about potential food poisoning from unsold products discouraged foodservice operators from investing in FWM initiatives.

Additionally, [Perrigot et al. \(2021\)](#) suggest that franchisors can codify their FWM knowledge into operation manuals and enact compliance through franchising agreements and training sessions. Thus, a franchising format forces a commitment from restaurant owners to enact FWM practices, overcoming internal barriers commonly associated with non-adoption of FWM practices such as poor food preparation procedures ([Principato et al., 2018](#); [Papargyropoulou et al., 2019](#)) and manager apathy towards managing food waste ([Filimonau et al., 2022](#)). This codification also means that staff have more opportunities for formal training. This increases their levels of work engagement, contributing to better compliance with FWM policies and procedures, resulting in a higher propensity to engage with customers in leftover handling.

Finally, an emergent finding from the results indicated that location had a negative association with a case being in the Partial-High FWM profile compared to the Partial-Low FWM profile ($\beta = -1.286, p < 0.05$). Businesses in rural locations had a higher probability of being in the Partial-High FWM profile compared to the Partial-Low FWM profile by 25.1%. This indicates rural businesses are likely to do “more of the same” by “doubling down” on an internally focused FWM approach. Rural locations are relatively remote, meaning, the depth and breadth of rural businesses’ social networks may be limited to their local surroundings. Comparatively, businesses located in major cities will have access to a vast network of information and resources. Thus, for rural businesses in such “closed” eco-systems, the ability to gain new knowledge from “outside the system”, such as through inter-firm alliances ([BarNir and Smith, 2002](#)), is reduced, leading to the propensity of taking a “more of the same” approach to FWM. Furthermore, being distant from major cities presents operational challenges, such as longer stock delivery times, higher supplier power, and selling to smaller markets. Thus, to enable resources to last longer between stock deliveries and to increase profitability by increasing efficiency, foodservice operations in rural areas may be more inclined to intensify their current FWM practices related to procurement, stock management, and storage, and menu and product design.

6. Conclusion and implications

This study aimed to address three main research objectives: (1) To map and profile the FWM practices (procurement and storage; menu and product design; staff and customer engagement; leftover handling) currently adopted by food-service organisations; (2) To examine how diverse business owner demographics (age, experience, education) and firm characteristics (business type, location, size etc) influence the breadth and depth of those FWM practices; and (3) To investigate whether the firm’s networks and social capital resources shapes these key FWM practices. The fulfilment of these objectives provides several theoretical and practical implications.

This study argued that a broad and multidisciplinary approach to exploring FWM remains fragmented and disparate. Specifically, two critical limitations emerge from recent syntheses ([Lei et al., 2024](#)). First, most investigations remain exploratory and context-specific, relying on small interview samples that limit generalisability (e.g. [Bharucha, 2018](#)). Second, research attention tends to gravitate towards diners’ motivations and attitudes as causes of food waste (e.g. [Long et al., 2024](#)), leaving the managerial and organisational drivers of waste largely unexplored. In response, our supply-side perspective provides new knowledge based on empirical quantitative evidence, to better understand FWM practices throughout the foodservice value chain. The study reveals that FWM practices occur throughout the service value chain (procurement, stock management and storage; menu and product design; staff and customer engagement; and leftover handling). The study shows the existence of

distinct FWM profiles within foodservice businesses, with the key differentiating factor being the level of external FWM practices. The study finds that foodservice businesses have a propensity to take an internal approach (i.e. high levels of procurement, stock management and storage and menu and product design, representing 67.8% of our study sample). However, there is also a population of businesses who adopt a holistic approach to FWM (i.e. high levels of procurement, stock management and storage; menu and product design; staff and customer engagement; and leftover handling). Going forward, the challenge for the food-service industry is to move beyond internally focused food-waste management (FWM) and adopt practices that also address waste generated outside the kitchen. This shift is critical because managers' priorities and customers' behaviour are often misaligned. [Hao et al. \(2022\)](#) show that a large share of food waste comes from customer leftovers, yet many diners remain unaware of the environmental and economic consequences of their actions. Despite customers being a major source of waste, many businesses have yet to tackle this external dimension. The gap between customer-driven waste and managerial attention therefore merits deeper investigation.

This study's theoretical basis was Social Capital Theory, which emphasised the importance of robust professional and social networks to gain superior access to essential intangible resources. The study argued that prior studies of FWM focused solely on internal factors, such as staff behaviours and attitudes (e.g. [Principato et al., 2018](#); [Filimonau et al., 2020, 2022](#)). While useful, a more holistic perspective should also include the influence of the managers' social and professional networks that form social capital resources ([Lee and Hallak, 2020](#)). Foodservice businesses do not operate in a vacuum, rather, management of these businesses is a dynamic process involving relationships with a network of external actors including customers, suppliers, government and local councils, competing businesses, etc. The study's findings provide novel insights into the intersection of operations management and social capital theory in foodservice contexts, as the study finds that social capital and networks are strongly associated with the "best" FWM profiles (Full-High) compared to the "worst" FWM profiles (Partial-Low). Consistent with Social Capital Theory ([Bourdieu, 1985](#)), our results imply that the depth and quality of professional and social relationships constitute the firm's social capital, a strategic resource vital to acquiring essential inputs such as finance, market intelligence, skilled labour, and raw materials to facilitate the adoption of FWM practices.

The findings have several practical implications for the foodservice industry. The study results demonstrate that a holistic approach to FWM includes *both* internal and external practices. The business case of such a strategy is evident, as prior studies show that businesses lose approximately 23% of the total value of purchased food, and approximately one-third of food produced is ultimately wasted, half of which is classified as avoidable ([Papargyropoulou et al., 2019](#)). However, in this study's sample, 67.8% of businesses adopt what is categorised as a partial approach, focusing only on managing food waste in procurement, stock management and storage, and menu and product design. We encourage foodservice businesses to put efforts into externally focused FWM practices, such as staff and customer engagement and leftover handling, to maximise the benefits of FWM practices. One practical strategy can be to encourage customers to finish their food or take home their leftovers. While such strategies are seemingly simple, one must be aware that the practice of taking away leftovers is almost non-existent in Japan due to concerns of food safety. Such a move would also be timely in this study's context, as Japan's Ministry of Health, Labour and Welfare has recently initiated the creation of guidelines for taking home leftovers as part of Japan's efforts to reduce food waste and change societal norms around taking away leftovers ([News On Japan, 2025](#)). Restaurants can include messages on menus, posters, or table cards that encourage taking away leftovers, as prior studies (see [Stöckli et al., 2018](#)) demonstrate experimentally that informational and normative prompts in the form of place cards are able to reduce consumer food waste in a restaurant by encouraging diners to take away their leftovers. Ultimately, this functions to reduce waste disposal costs for foodservice businesses, which can be a significant expense item for restaurant operations.

The results underline the importance of social capital as a vital resource for expanding FWM practices. Foodservice managers should not operate as isolated silos and are advised to work on cultivating relationships with external parties. One practical way could be to join foodservice industry associations, which can provide access to the latest information and business support services that can assist in implementing FWM practices. This reduces the need for time and resource poor foodservice businesses to invest in extensive research and development to implement FWM practices. For example, in the context of this study's location (Japan), the [Japanese Restaurant Association \(n.d.\)](#) provides opportunities for members to engage in knowledge exchanges through business networking events and participation in restaurant industry conventions that showcase the latest food and beverage trends. Looking more globally, the National Restaurant Association in the U.S., in association with the World Wildlife Fund (WWF), provides resources and training to members on practical steps to reduce food waste ([National Restaurant Association, 2021](#)). Similarly, UKHospitality, the leading trade body for the U.K.'s hospitality industry, provides online courses and guides to foodservice managers to reduce food waste ([UKHospitality, 2024](#)). This demonstrates the utility of foodservice industry associations in being rich sources of information for the implementation of contemporary FWM practices.

7. Limitations and directions for future research

While all efforts to increase the rigour of the research were taken, the study is not without limitations. As the sample was extracted from Japan, there could be country-specific factors unique to this setting which influence these foodservice firms differently compared to other countries. For example, as discussed in [Section 1](#), reducing food waste is a key government priority in Japan, with policies put in place to accelerate initiatives related to FWM in Japan, which would have influenced the FWM practices of firms in our sample. Thus, further research in a broader national context is warranted. For example, in countries where taking home leftovers is the norm or encouraged, the emergent FWM profiles could be different compared to this study, especially with regards to leftover handling practices. Also, with Japan considered a developed country, one might surmise that foodservice firms in this study's sample to have the access and means to seek and implement relatively advanced FWM practices, such as restaurant management software to forecast customer demand, advanced storage and cooking equipment, and robust waste disposal systems with recycling and composting options. In contrast, countries which are less developed may not have the technology or infrastructure to support advanced FWM practices, which could influence the kinds of FWM practices that emerge from such datasets.

A supplementary qualitative approach would also be useful to provide additional insights to the quantitative results. For example, interviewing managers in the partial FWM group to understand their lack of engagement with leftover handling practices could be illuminating, as this could help identify strategies to overcome potential barriers to managing leftovers for foodservice operations. Finally, the results also find that business owner demographics (e.g. age, experience, education) do not influence the adoption of FWM practices. This suggests that future studies should focus on managers' psychographic characteristics instead, which may have more explanatory power to predict the adoption of FWM practices. For example, the concept of creative self-efficacy, referring to an individual's beliefs in their ability to generate creative outcomes ([Tierney and Farmer, 2002](#)), may be especially relevant towards the implementation of FWM practices. Implementing new FWM techniques involves looking at new ways of doing things, and creative self-efficacy can influence dynamic capability enactment – “the capacity of an organisation to purposefully create, extend, or modify its resource base” ([Helfat et al., 2007](#), p. 4) – which can facilitate change orientation actions in an organisation ([Kevill et al., 2017](#)). Thus, investigating the role creative self-efficacy plays in the implementation of novel FWM practices is a promising avenue.

Ethics statement

The study was reviewed and approved by the Human Subject Research Review Committee at Tohoku Gakuin University. The approval number is 2023-028.

Notes

1. The results of the first and second steps can be found in [sections 4.1](#) to 4.4.
2. Some levels presented difficulties for proper estimation in the multinomial logistic regression analysis due to a small number of respondents. For example, the threshold at which the chi-square (χ^2) was maximised in the ‘highest level of education’ was between ‘less than high school graduates’ and ‘high school graduates or higher’, but there were only 14 respondents who were ‘less than high school graduates’. In such cases, we used the level with the second-largest chi-square as the threshold. For instance, for ‘highest level of education’, we divided it into ‘less than a university degree’ and ‘university degree or higher’.

Supplementary material

The supplementary material for this article can be found online.

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