



The Effect of Demographics on Food Waste Reduction at Food Stall In Banyumas, Indonesia

Fany Amelia Putri Simanungkalit

Industrial Engineering Department, Telkom University, Purwokerto Campus,
Banyumas, Indonesia

Fauzan Romadlon

Industrial Engineering Department, Telkom University, Purwokerto Campus,
Banyumas, Indonesia

Khikmatul Aliyah

Industrial Engineering Department, Telkom University, Purwokerto Campus,
Banyumas, Indonesia

Correspondence author: fauzanro@telkomuniversity.ac.id

Abstract. Food waste is still a significant problem, affecting food security, the environment, and the global economy. More than 53% of food produced becomes waste. Food waste worldwide totals 1.3 trillion annually. One of the districts with a high food waste rate is Banyumas. The most significant contributor to waste in the Banyumas region in 2021 was food waste, accounting for 39.85%, with much of it generated by restaurants. Restaurants play an essential role in managing food waste, as most food discarded at the preparation stage cannot be reused. This study aims to analyze the relationship between demographics and food waste reduction to support a digital technology approach from a restaurant perspective. This study used quantitative methods. The respondents of this study were 100 restaurants located in Banyumas, including A La Carte, Ramesan, Tegal, and Padang, and the data were analyzed using ANOVA. The results show that demographic factors, including income, age, restaurant opening hours, and the prices of best-selling foods, influence food waste in restaurants. The recommendation is for restaurants to prepare and plan menus. This will affect food prices, opening hours, and revenue. Some restaurants can increase their knowledge of handling food waste.

Keywords: Banyumas, Demographic, Food waste, Restaurant, Reduction

Abstrak. Sampah makanan masih menjadi masalah yang signifikan dan memengaruhi ketahanan pangan, lingkungan, serta perekonomian global. Lebih dari 53% makanan yang diproduksi menjadi limbah. Sampah makanan di seluruh dunia mencapai 1,3 triliun setiap tahun. Salah satu kabupaten yang memiliki persentase sampah makanan tertinggi adalah Banyumas. Komponen penyumbang sampah terbanyak di wilayah Banyumas pada tahun 2021 adalah sampah makanan dengan angka 39,85% dan sebagian berasal dari restoran. Restoran memiliki peran penting dalam mengelola sampah makanan karena sebagian besar makanan yang dibuang pada tahap persiapan tidak dapat dikonsumsi kembali. Penelitian ini bertujuan untuk menganalisis hubungan antara demografi dan pengurangan sampah makanan guna mendukung pendekatan teknologi digital dari perspektif restoran. Penelitian ini menggunakan metode kuantitatif. Responden penelitian

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*Fauzan Romadlon Fauzanro@telkomuniversity.ac.id

ini adalah 100 restoran di Banyumas, termasuk A La Carte, Ramesan, Tegal, dan Padang, dan data dianalisis menggunakan ANOVA. Hasil penelitian menunjukkan bahwa faktor demografi, termasuk pendapatan, usia, jam buka restoran, dan harga makanan terlaris, memengaruhi jumlah sampah makanan di restoran. Rekomendasi yang diberikan adalah agar restoran mempersiapkan dan merencanakan menu. Hal ini akan memengaruhi harga makanan, jam buka dan pendapatan. Beberapa restoran dapat meningkatkan pengetahuan mereka dalam menangani limbah makanan.

Kata kunci: Banyumas, Demografi, Limbah Makanan, Pengurangan, Restoran

INTRODUCTION

Food waste is food that is no longer consumed for specific reasons, such as being discarded, spoiled, rotten, or expired (FAO 2011, 2013). Food waste is still a severe problem today, as it can affect food security, the environment, and the global economy (Ibtiyah, Romadlon and Nurisusilawati, 2023). More than 53% of food produced is wasted. The food waste in all countries is approximately 1.3 trillion annually (Sukismanto and Artha, 2021). Almost one-eighth of the human population experiences food shortages due to food waste. Food waste is one problem that has yet to be resolved in many parts of the world. Indonesia is the world's second-highest producer of food waste after Saudi Arabia (Saputra and Asih, 2017). Food waste problems in developed and developing countries differ in severity. Developed countries have high levels of food waste, but it can still be tolerated. In contrast to developing countries with a high level of hunger, this is very concerning (Mulyana, Gunawan and Tamara, 2019).

Food waste remains a severe problem because it affects food security, the environment, and the global and national economies. It is dominated by household waste at 41%, followed by trade (18%) and markets (17%). It makes the trade sector (business and markets) the second-largest contributor to waste in Indonesia (Wulansari, Ekayani and Karlinasari, 2019). One of the regencies with a high food waste rate is Banyumas. The most significant contributor to waste in the Banyumas area in 2021 was food waste, accounting for 39.85%. The percentage is considered relatively high. Businesses are the most significant contributors to food waste in Central Java Province. The large number of businesses in Central Java Province may lead to increased waste generation, especially in the Banyumas Regency. One of the businesses established is a food business, such as a restaurant (Andriani *et al.*, 2021).

Restaurants are commercial businesses that serve a variety of food ready for consumption. Restaurants produce food waste, such as fruit, vegetables, and ready-to-eat food, as well as non-food waste, such as plastic, wood, and packaging. The number of Restaurants in the Banyumas area, such as *Tegal*, *Padang*, Sundanese, and *à la carte restaurants*, is relatively high. Restaurants provide food every day, which can lead to food waste. Thus, food service providers (restaurants) play an essential role in tackling food waste because most food is wasted at the preparation stage, and food that cannot be reused is wasted at the serving stage (Wulansari, Ekayani,).

Restaurants play an essential role in managing food waste, as most food discarded at the preparation stage cannot be consumed again. Food waste in restaurants consists of three components: rice, vegetables, and seafood. Restaurant food waste generates around 6,383 tons/year (Wulansari, Ekayani and Karlinasari, 2019). The causes of food waste in restaurants are poor food quality and service. Service quality is a priority in customer satisfaction. Restaurants must pay more attention to customer needs and desires to meet customer expectations by providing better service than competitors. In addition, the lack of knowledge regarding the importance of using technology in preventing and processing is one of the contributors to food waste (Aït-Kaddour *et al.*, 2024). Factors that affect customer satisfaction with service in restaurants or food stalls are price and value (Dagiliūtė and Musteikytė, 2019).

Based on this explanation, research focusing on analyzing food waste reduction initiatives is needed for restaurant or food stall food waste management. This study aims to analyze the relationship between demographics and food waste reduction from a food stall perspective. This research was conducted in the Banyumas Regency, Central Java Province, Indonesia. The benefit of this study for food stalls in Banyumas is that it provides knowledge and improvement recommendations to reduce food waste.

METHODS

This research used quantitative methods. The respondents of this research were 100 food stalls in Banyumas, including *A La Carte*, *Ramesan*, *Tegal*, and *Padang*. The questionnaire consisted of two parts: demographic and food choice attributes. Demographics included gender, age, type of food stalls, revenue, price of the best-selling food, and having a refrigerator. The food choice attributes were measured using the Likert Scale. The Likert scale ranges from 1 (strongly disagree) to 5 (strongly agree), and the attributes used in the questionnaire are shown in Table 1.

Table 1. Food waste reduction attributes

Variable	Code	Indicator
Storage (Magalhães <i>et al.</i> , 2021)	P1	Refrigerator facilities
	P2	Food loss with adequate storage
Procurement (Tamara, Mulyana and Gunawan, 2020)	P3	Purchasing raw materials
	P4	Planning provided a menu.
	P5	Preparing selling food
Cooking and Serving (Ciutra, 2018)	P6	Good cooking skills
	P7	The cleanliness of the food and the place affects the buyer's interest
	P8	Excessive ordering from the menu leads to food waste.
Food selection (Chen and Antonelli, 2020)	P9	Food processing method
	P10	High food prices will discourage shoppers
Marketing (Saputra and Asih, 2017)	P11	Good food quality makes buyers interested.
	P12	The increase in raw materials affects the menu
Food waste handling (Miratania and Rahmalia, 2019)	P13	Providing discounts or low prices affects buyer interest.
	P14	Knowledge about food waste
	P15	Efforts to reduce food waste

According to Table 1, the storage attribute has two variables: storage facilities (P1) and (P2). Food stalls that have adequate storage can reduce food waste. In the procurement attribute, there are four variables: P3, P4, P5, and P6. P3 is the purchase of overstock raw materials to increase the types of food sold. P4 is the wrong planning when preparing a menu for sale, leading to food waste. P5 is the preparation of the type of food to be sold, which can reduce leftover food. P6, namely good cooking skills, will attract customers.

The cooking and serving attribute has three variables: P7, P8, and P9. Where P7, the cleanliness of food and places, affects buyer interest. P8 is the excessive presentation of the food menu, which causes food waste. P9 is when the food processing process has been wasted. There are two variables, P10 and P11, that influence food selection. P10, namely high food prices, will reduce buyer interest, and P11, namely good food quality, will increase buyer interest. In the marketing attribute, there are two variables: P12 and

P13. P12 is the increase in raw materials that affects the menu to be served, and P13 is the provision of low prices to attract customers.

Regarding food stall food waste handling, there are two variables: P14 and P15. Where P14 is that food stalls know about food waste, and P15 is that restaurants have efforts to reduce food waste. After collecting the data, the next step was conducting a statistical analysis. The data were analyzed using ANOVA to test the influence of demographics on food choice at food stalls regarding food waste management initiatives. The hypothesis was set as follows:

H1: Demographics affect food waste reduction at food stalls in Banyumas

RESULT AND DISCUSSION

Demographics Result

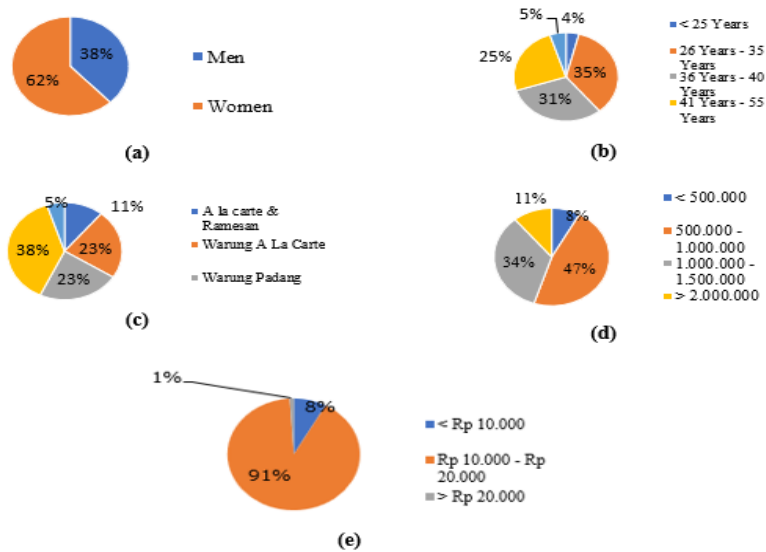


Fig. 1. Demographics of restaurants, including gender (a), age (b), type of restaurant (c), revenue (d), and best-selling food price (e)

The demographic of the food stalls is shown in Figure 1. Figure 1(a) shows that most food stall owners are women, with 62% of them. Figure 1(b) shows that most food stall owners are 26-35 years old, accounting for 35%. Figure 1(c) shows that the most common type of food stall is a group restaurant, with 38% of respondents reporting this type. Figure 1(d) shows that most restaurants' revenue is between IDR 500,000 and IDR 1,000,000, accounting for 47%. Figure 1(e) shows that the most in-demand food prices are between IDR 10,000 and IDR 20,000 (91%), followed by food priced below IDR 10,000 (8%) and food priced above IDR 20,000 (1%).

ANOVA Results

Before conducting the ANOVA, the researcher employed an instrument. The instrument's test consisted of validity, reliability, and normality tests. The tests were conducted using Minitab 19 with a 95% confidence level. The validity test showed a p-value of less than 0.05, indicating that the data were valid. The reliability test results showed a Cronbach's Alpha value of 0.6855, indicating the data were reliable (greater than the Cronbach's alpha table value of 0.06). In the normality test using the Kolmogorov-Smirnov statistic, the null hypothesis is rejected if the p-value is less than 0.05. The results indicate that the data are normally distributed, with a p-value of 0.126.

The validity test results show that all data are valid except P6 and P7. Codes P6 and P7 are invalid because the p-value is above 0.05. P6 and P7 are not included in the following testing stage. The reliability test shows a Cronbach's Alpha value of 0.6855. The data are deemed reliable because Cronbach's Alpha is greater than 0.60. The normality test obtained a p-value of 0.126. The data are distributed, as indicated by the p-value > 0.05. According to ANOVA results, there are significant differences in the demographics of the 15 factors given to food stalls in the Banyumas. Based on the processed data, the essential demographics are best-selling price, revenue, having a refrigerator, and age.

Table 2. ANOVA results

Code	Gender	Age range	Types of food stalls	Revenue	The price of the best-selling food	Having Refrigerator
P1	0.023*	0.038	0.744	0.288	0.837	0.340
P2	0.033*	0.010*	0.994	0.053	0.315	0.212
P3	0.520	0.189	0.497	0.297	0.013*	0.601
P4	0.086	0.023*	0.975	0.206	0.324	0.605
P5	0.253	0.001*	0.138	0.004*	0.477	0.670
P8	0.797	0.354	0.044*	0.357	0.470	0.272
P10	0.515	0.002*	0.000*	0.000*	0.138	0.173
P11	0.105	0.191	0.386	0.036*	0.461	0.134
P12	0.583	0.428	0.008*	0.073	0.004*	0.947
P13	0.376	0.735	0.305	0.349	0.919	0.370
P14	0.845	0.081	0.061	0.120	0.282	0.245
P15	0.768	0.325	0.059	0.672	0.263	0.032*

*p-value less than 0.05

Table 2 shows that gender is significant in questions P1 (refrigerator facilities) and P2 (adequate storage). Within the age range, there are four significant critical factors: P2 (adequate storage), P4 (planning for the provided menu), P5 (preparing and selling food), and P10 (high food prices). Three types of food stalls have significant values: P8 (Excessive serving), P10 (High food price), and P12 (High cost of raw materials). There are three essential values in revenue: P5 (preparing food for sale), P10 (high food prices), and P11 (good food quality). At the price of the best-selling food, there are two significant values: P3 (Raw material purchasing) and P12 (high cost of raw material). Finally, there are two essential values in the demographics of having a cooler, namely in P14 (knowledge about food waste) and P15 (efforts to reduce food waste).

At P1, having a cooler significantly affects gender (p-value = 0.023). At P2, food stalls with cooling facilities have a substantial effect on gender (0.033) and age (0.010). It shows that different genders and ages have different perspectives on cooling facilities. P3, or the purchase of overstock raw materials, has a significant weight on the best-selling food, with a value of 0.013. It means that purchasing too much raw material affects the price of the best-selling food. P4, or wrong planning, has a significant value on age, with a value of 0.023. This means relatively old-age food stalls can make plans better than those considered young. In P5, food type and preparation have significant effects on age (0.001) and revenue (0.004). This means older food stalls usually have better food preparation than younger ones. Good food preparation can also affect turnover, as it can prevent revenue from decreasing or even increase it.

P8, or excessive menu presentation, has a significant value against the type of food stalls, with a value of 0.044. This means that the food menu production depends on the type of restaurant. The types of food stalls, *Padang* and *Tegal*, usually serve a reasonably extensive menu, in contrast to *Ramesan* and *à la carte* restaurants, which only offer a limited selection. It causes differences in food waste: most is generated by Padang and Tegal food stalls, while *à la carte* food stalls generate the least. P10, or high food prices, has three significant values: age (0.002), revenue (0.000), and type of restaurant (0.000). At P11, good food quality significantly affects revenue with a value of 0.036. In P12 or food, hygiene has a substantial weight on the type of restaurant, with a value of 0.008, and the best-selling price, with a discount of 0.004. At P13, low prices are not significant for the given demographics. In P14, where restaurants know about food waste, there is no

meaningful value in the respondents' demographics. P15 has considerable value compared to a cooler, with a value of 0.022.

Finding implications

Food waste is food that humans cannot consume due to several factors, such as being stolen, rotten, or expired (Ortiz-Gonzalo *et al.*, 2021). Food waste can occur for several reasons, including being unable to choose which menu to serve for sale. Therefore, the food provided is unsold due to a lack of customer interest (Redlingshöfer, Coudurier and Georget, 2017). Some food stalls can plan their menu selection based on consumer preferences and market segments to increase sales. After all, food preparation affects turnover or revenue. Poor food preparation can reduce customer interest, affecting the revenue of food stalls. In addition, food stalls must maintain food quality and make promo prices to attract customers (Wijaya *et al.*, 2022), such as offering low prices or promos for food that is still left over or leftover from yesterday. Some food stalls must also have an attitude toward food waste and consider their customers' food choices.

Furthermore, food choice is crucial for product development, marketing, and reducing food waste (Aschemann-Witzel, de Hooge and Almlı, 2021). Food choice is often influenced by the customer, who determines it based on feelings, mood, health, taste, and price. Therefore, food choice can be one factor in reducing food waste in restaurants (Chen and Antonelli, 2020).

The presentation of food varies across different types of restaurants. *Padang* and *Tegal* food stalls offer a wide range of menu options, leading to food waste. *A la carte* food stalls offer a somewhat limited menu because they usually serve only items on the menu and cook them when ordered. Therefore, *a la carte* food stalls do not cause much food waste. *Rames* food stalls offer menus that are not too long, as their operating hours are not extended. Restaurants can pay attention to food presentation by looking at consumer interest, so they can estimate what to serve and ensure they don't sell out. Food stalls can make recommendations by maintaining high standards of taste and quality. Food stalls can make notes related to the food menu. The notes include the composition and dosage of the food menu. This is to maintain the quality of the food menu for sale and keep it stable.

Cooling facilities, such as refrigerators, play a crucial role in maintaining the quality and freshness of food in restaurants (Wijaya *et al.*, 2022). Unfortunately, not all

restaurants have these facilities, so unsold food becomes stale and is wasted. This is not only an economic loss for the restaurant or food stall, but also an ethical and environmental issue related to food wastage. Furthermore, the lack of refrigeration facilities hinders the food stall's ability to keep food stocks fresh, which, in turn, can reduce the quality of the dishes served. If this situation persists, the restaurant or food stall will not only lose revenue but also potentially lose customers due to declining food quality (Filimonau *et al.*, 2019).

In the procurement variable, menu preparation and planning affect food prices, food stall opening hours, and turnover. When managing food, the cooking and serving variables will affect turnover and the type of restaurant. Some restaurants do not have the knowledge to handle existing food waste, which becomes food waste (Yu and Li, 2021). It is also considered to be detrimental to food stalls. Recommendations for food stalls to minimize food waste include careful planning, starting with the menu to be sold, and working with raw material suppliers to obtain cheap, fresh, and high-quality raw materials quickly. Other alternatives include providing discounts or low prices for food that has not been sold out at night (Wongprawmas *et al.*, 2021).

Furthermore, the technology can reduce food waste, such as waste treatment using drying technologies, such as solar cabinet dryers, halogen ovens, and conventional ovens (Pinto *et al.*, 2022). Investment in the right technology helps food stalls reduce economic losses and contributes to global efforts to reduce food waste and its environmental impact. Therefore, investing in adequate refrigeration facilities is an essential step for food stalls to sustain their businesses, reduce food waste and losses, and ensure customer satisfaction.

CONCLUSION

This research explores the influence of demographics on food waste reduction initiatives in food stalls in Banyumas. The results showed that demographics influence food choices. The demographic factors include income, age, food stall opening hours, and the prices of best-selling foods. Food waste in food stalls involves six variables: storage, procurement, cooking and serving, marketing, food selection, and food waste handling. Some food stalls have cooling facilities such as refrigerators. Its function is to store leftover food that is not sold. This causes the food stall to experience losses if this continues. In food procurement, food stalls can plan and prepare their menus. This will affect food prices, food stall opening hours, and revenue.

In addition, the lack of knowledge about handling food waste also contributes to food waste. To solve the problem, food stalls can plan more effectively, work closely with ingredient suppliers, offer discounts on unsold food, and use technology such as advanced refrigeration, inventory management software, and digital apps to sell excess food. Investing in the right technology helps reduce economic losses and contributes to global efforts to reduce food waste and its environmental impact. Further research can be conducted to map the roles of each stakeholder in managing food waste, supporting a food waste management approach from a food stall perspective. These stakeholders include the government, suppliers, and customers. Demographics is the only perspective for mapping the extent of food waste in the selected small-scale restaurants or food stalls. Therefore, future research could focus on larger-scale restaurants, such as hotels and exclusive restaurants, where more significant food waste is likely to occur, and examine customers while dining. The research could also continue to explore the role of stakeholders in food waste management initiatives.

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