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Emphasizing Food Expenditure as a Food Waste Mitigation Initiative at Restaurants in Banyumas, Indonesia

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ABSTRACT

Food waste can be defined as waste at the final stage of the food supply chain related to retailers and consumer behavior (distribution and market, consumption). The population expected to increase over the years, will also affect food availability and consumption. The problem can be solved by increasing food production, but it does not help much if the quantity of loss and waste is not minimized. In Indonesia, consumption activities are not only to fulfill hunger but also become a lifestyle such as visiting restaurants. Restaurants have a high potential to create food waste and in Banyumas the restaurant contribute more waste after households. the study aims to find the role of food expenditure at restaurant to reach food waste management initiatives. It relates to how restaurants see food expenditures as a strategy to procure and sell the menu based on portion adjustment. The method used was quantitative and obtained data by distributing questionnaires to 103 restaurants in Banyumas using ANOVA. The result showed the demographics affect food expenditure at restaurants in Banyumas. The restaurants can conduct food waste mitigation initiatives by enhancing restaurant services, adjusting the meal menu with consumers, forecasting procurement quantity, considering storage for raw material, and focusing on food consumption. Furthermore, the restaurant shall consider to manage menu to avoid food waste by adding more refrigerator or utilizing the waste.

Keywords: banyumas; food expenditure; food waste; restaurant

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1. Introduction

Food waste is one of the global problems related to world hunger or food resources (Irianto & Giyatmi, 2021). Food waste is from intentional human behavior resulting in a decrease in the quantity or quality of food caused by retailers, food services, and consumers (Akamatsu et al., 2022). Food waste can be defined as waste at the final stage of the food supply chain related to retailers and consumer behavior (distribution and market, consumption) (Ishangulyyev et al., 2019) (Nainggolan et al., 2023). The population expected to increase over the years, will also affect food availability and consumption. The problem can be solved by increasing food production, but it does not help much if the quantity of loss and waste is not minimized (Wang et al., 2022).

Food waste also negatively impacts the environment, such as high greenhouse gas emissions (Afifah, 2018). Food waste will have an impact on environmental pollution this is because food waste can produce methane which is a compound of the formation of greenhouse gas emissions. Greenhouse gases caused by the accumulation of organic waste generated from the food life cycle will produce a carbon footprint equivalent to carbon dioxide (CO_2) which can affect the global climate. According to the Food Agriculture Organization (FAO) (2013) food loss and food waste are responsible for greenhouse gas emissions equivalent to 3.3 billion tons of carbon dioxide (Wulandari & Asih, 2020). Based on

EUROSTAT study data, it is stated that considering the entire product life cycle in the creation of food waste for one year will be equivalent to being responsible for the creation of 170 million tons of carbon dioxide (CO_2) (Nicastro and Carillo, 2021). In addition, food waste disposal can produce polluting gases and heavy metals that will remain in the environment for up to 100 years afterward (Lins et al., 2021).

Based on National Waste Management Information System (SIPSN) data in 2022, Indonesia has a waste generation of 35.1 tons every year (Ministry of Environment and Forestry, 2022). The most common type of waste generation in Indonesia in 2022 based on SIPSN data is food waste with a percentage of 40.7%. In Indonesia, consumption activities are not only to fulfil hunger but also become a lifestyle and making eating out as a habit. Eating out impacts the increasing number of restaurants with various characteristics ranging from taste, interior design, food type, and serving (Anriany & Martianto, 2013). However, the restaurants have a high potential to create food waste, which is as much as 37%, and 10 % waste before reaching the consumers (Sakaguchi et al., 2018).

One of the Regency that has high food waste is Banyumas Regency. Data from the Banyumas SIPSN had a daily waste generation 2022 of 536.29 tons. The type of waste is dominated by food (36%). For restaurants, it contributes 25.99%, the second largest contributor after households (Ministry of Environment and Forestry, 2020). Restaurants are one of the places that produce food waste (Wulansari et al., 2019). The Waste and Resources Action Program (WARP) states that restaurants do not believe that food waste is their responsibility, resulting in a lack of effort to shift to sustainable practices. Common causes of food waste in restaurants include improper inventory, improper food material handling and over-preparation, excessive plate portions and leftovers, over-expenditure of food, lack of prediction of client numbers, forgotten and spoiled food, lack of awareness of food waste data (Sakaguchi et al., 2018). Restaurant managers or chefs, staff, and clients are the stakeholders involved and responsible for restaurant food waste (Principato et al., 2021).

Therefore, a food waste management initiative is needed to reduce food waste in restaurants, and one of the causes of high food waste is consumer expenditure. Consumer food expenditure means the quantity or amount of food consumers spend from several categories such as vegetables and fruits (Valluri et al., 2020). Food expenditure is influenced by customer behavior factor. The factor is food choice which means affecting the portion and type of food consumers want (Filimonau, Algboory et al., 2023).

Moreover, the study aims to find the role of food expenditure at restaurants to initiate food waste management. It relates to how restaurants see food expenditures as a strategy to procure and sell the menu based on portion adjustment. The study adds a new approach to food waste mitigation efforts in restaurants and it will give some benefits to mitigate the food waste. Meanwhile, regarding the environment, food waste mitigation through food expenditure can help the government reduce food waste at the retail level in Banyumas Regency.

2. Theoretical Underpinning

2.1. Restaurant

A restaurant is a small business in the form of a restaurant, small shop, kiosk, or simple restaurant. The term restaurant in Indonesia is also called a *warung*. A restaurant is a place that serves or sells various food dishes (Nuada, 2018). Food restaurants in Indonesia consist of several types, such as Padang restaurants, Sundanese restaurants, Tegal restaurants, and *A La Carte*. Padang restaurants provide Padang specialties with a mandatory menu of rice, young jackfruit vegetables, and cassava leaves accompanied by various side dishes such as rendang, fish, tempeh, and others. Tegal restaurants are restaurants that provide traditional home cooking. Sundanese restaurants is a restaurant that offers Sundanese cuisine, which consists of fresh vegetables and chili sauce. *A La Carte* means a restaurant that presents the menu, and then consumers can determine their orders (Wulansari et al., 2019).

2.2. Food Waste at Restaurant

Food waste is a threat to food security, the economy, and the environment. According to the Food Agriculture Organization (FAO), food waste is defined as food fit for human consumption that is discarded, either because it is allowed to spoil or stored beyond its expiration date. Most food waste is created due to food spoilage, oversupply, market conditions, and individual eating and spending habits. Food waste can be defined as waste at the final stage of the food supply chain related to retailers and consumer behavior (Ishangulyyev et al., 2019).

Food waste occurs at the retail and consumer levels. Restaurants are one of the places that account for most food waste. Research in the US estimates that as much as 40% of eligible food is unconsumed. According to the Food Waste Reduction Alliance, 37% of food waste comes from retail stores and food services. Restaurants waste as much as 10% before food reaches consumers. The US Department of Agriculture (USDA) study in 2014 stated that as much as 21% of food in restaurants is uneaten and wasted. From a financial perspective, this amounts to USD 9 to 23 billion in restaurant food waste annually. Restaurants that pay attention to or track the amount of food waste generated can reduce food waste by 7% and save USD 1.3 billion annually for food businesses (Sakaguchi et al., 2018).

The stakeholders involved and responsible for the incidence of food waste in restaurants are the managers or chefs, staff, and clients. The three phases of the food waste phenomenon in restaurants are during kitchen food preparation or kitchen food waste, food service and staff activities, and customer consumption activities. Kitchen food waste is waste generated due to food wasted during preparation caused by overproduction, chipping, cutting, expiration, spoilage, overcooking, and others. Restaurant managers or chefs are responsible for creating kitchen food waste. The following phenomenon is food waste in food service or commonly referred to as service food waste, which is food discarded by staff under the control of food service operators (Principato et al., 2021).

2.3. Food Expenditure

Food expenditure is purchasing or spending behavior influenced by complex interactions between individual, social, and environmental factors. Food purchase is an intermediary of food intake, which can be affected by food preparation and food waste factors (Danger et al., 2020). Food choices are influenced by various factors such as price and income, time constraints, environmental factors (distance to restaurants or retailers), community characteristics, family structure, psychological invoices, and nutritional food information (Carpio et al., 2020).

3. Research Methods

This method used quantitative and obtained data by distributing questionnaires. The questionnaires answers were recorded using Google form and data processing used Minitab 19 software. Data were collected from 103 restaurants in Banyumas. The kind of restaurant menu can be seen in Figure 1 and restaurant in Banyumas can be seen in Figure 2.

Figure 1. Restaurant Menu

Figure 2. Restaurant in Banyumas

The questionnaire consisted of restaurants' demographic factors and food expenditure attributes. The demogrpahic factors consisted of restaurant owner gender, age, type of restaurant, restaurant operating hours, income, food prices, and consumer profession. The food expenditure attributes can be seen in Table 1.

Table 1. Food Expenditure Attributes

Atribut	Code	Question
Restaurant Concept (Vanhatalo et al., 2022) (Matzembacher et al., 2020)	Q1	Foodservice and presentation by employees
	Q2	Restaurant atmosphere
Consumption Behavior (Attiq et al., 2021) (Wang et al., 2022) (Mumtaz et al., 2022) (Yazdankhah et al., 2020)	Q3	Customer loyalty
	Q4	Consumer awareness to reduce plate waste
	Q5	Take away
Food Consumption (Valluri et al., 2020) (Danger et al., 2020) (García & Grande, 2010) (Oostenbach et al., 2021), (Principato et al., 2021)	Q6	Food taste/menu adjustment
	Q7	food menu quantity
	Q8	Serving portion
	Q9	excess food expenditure
Procurement (Akamatsu et al., 2022) (Lins et al., 2021)	Q10	storage
	Q11	Adjustments in stock procurement
Food waste management (Sakaguchi et al., 2018) (Liang et al., 2021), (Vizzoto et al., 2020) (Hidayat et al., 2020)	Q12	Efforts to reduce leftovers and spoiled raw materials
	Q13	Restaurant owners' concern about the creation of food waste
	Q14	Utilization of food waste
	Q15	Recycling efforts

Table 1 shows impact of food expenditure on restaurant food waste management has five attributes. These attributes are restaurant concept, consumption behavior, food expenditure, procurement, and food waste management. Restaurant concept attributes include food service and presentation (Q1) and restaurant atmosphere (Q2). Consumption behavior attributes include consumer loyalty (Q3), consumer awareness of reducing plate waste (Q4), and takeaway (Q5). Food consumption attributes include food taste adjustment (Q6), food menu quantity (Q7), serving portion (Q8), and excess food expenditure (Q9). Procurement attributes include storage of raw materials and leftovers (Q10) and adjustments in stock procurement (Q11). Food waste management attributes include efforts to reduce food waste and damaged raw materials (Q12), seller concern for the creation of food waste (Q13), utilization of food waste (Q14), and recycling efforts (Q15).

The Likert scale was conducted to measure food expenditure attributes. The value is from 1 to 5 and the description can be seen in Table 2.

Table 2. Likert scale

Scale	Descriptions
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

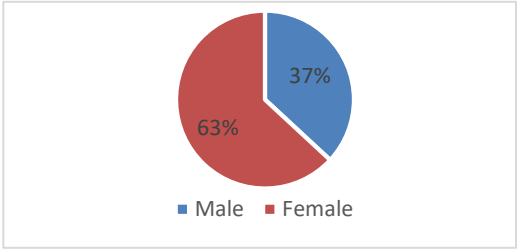
Based on Table 2, scale one means strongly disagree, scale two means disagree, scale three is neutral, scale four is agreed, and scale five means strongly agree. Then, a statistical analysis was conducted to test the influence between demographic and food expenditure attributes. The test used is an ANOVA test. Before conducting ANOVA, The instrument test was done to test validity, reliability, and normality using Minitab 19 software with confidence level is 95%. The hypothesis was set as follows.

H_1 = Demographics affect food expenditure affects at restaurant in Banyumas.

4. Results and Discussion

4.1. Demographics of Restaurants in Banyumas

The respondent demographic was obtained from 103 restaurants in Banyumas. The result can be seen in Figure 3.



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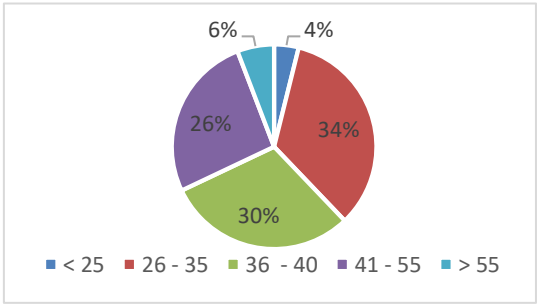

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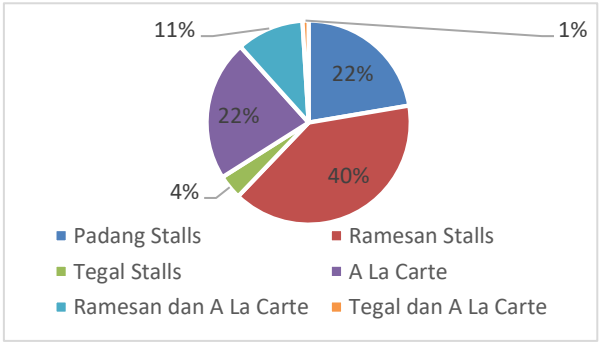

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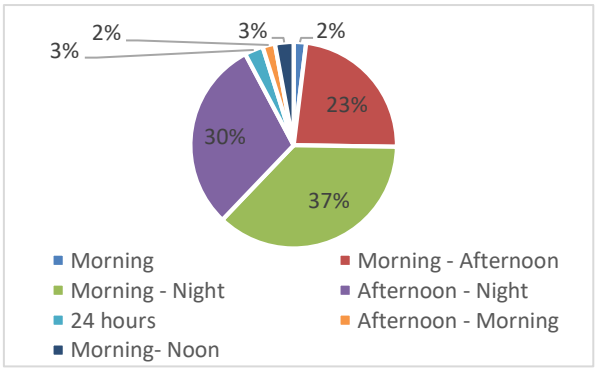

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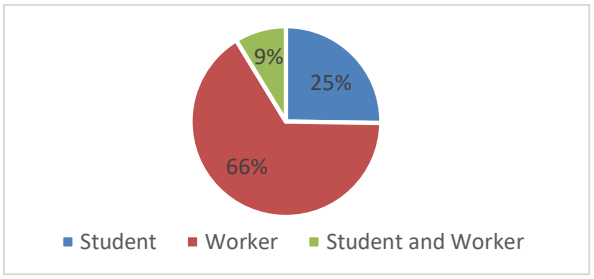

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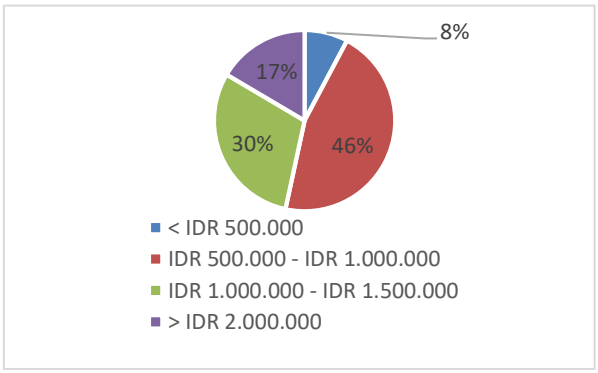

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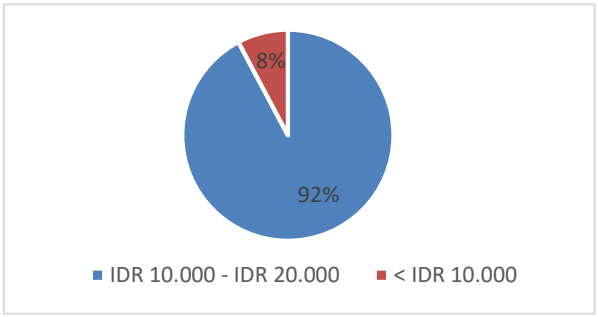

(g)

Figure 3. Demographics of Restaurants in Banyumas including Gender of Restaurant Owner (a), Age (b), Restaurant Type (c), Operating Hours (d), Consumer Profession (e), Income (f), Dominant Food Price (g).

Based on Figure 3, it can be seen that most restaurant owners are women, with a percentage of 63%, while male restaurant owners are only 37% (Figure 3 (a)). The age ratio of the restaurant owners is dominated by the age of 26 years to 35 years with a percentage of 34%, followed by the age range of 36 to 40 years, which is 30% (Figure 3 (b)). Regarding the type of restaurant, *Ramesan* restaurant is dominated by 40%, Padang by 22%, and *A La Carte* by 22% (Figure 3 (c)). Then the operating hours of restaurants are dominated by restaurants opening from morning to night, which is 37% (Figure 3 (d)). Restaurant consumers are dominated by workers at 66%, followed by students, 25%, and the rest are workers and students (Figure 3 (e)). Furthermore, a restaurant's income is dominated by IDR 500,000 to IDR 1,000,000 with a percentage of 46%, followed by restaurants with income of IDR 1,000,000 to IDR 1,500,000 with a portion of 30% (Figure 3 (f)). Most menu prices sold by restaurants are IDR 10,000 to IDR 20,000 with a percentage of 92% (Figure 3 (g)).

4.2. Instrument Test Result

The instrument test in this study was conducted until it met the criteria for further analysis. The instrument test consisted of a validity, reliability, and normality test. The test was conducted using Minitab 19 software. The confidence level used was 95%. The results of the validity test, reliability test, and normality test can be seen in Table 3.

Table 3. Results of Validity, Reliability, Normality Test

Activity	Code	Validity	Reliability	Normality	
		Pearson Correlation	Cronbach' Alpha	Skewness	Kurtosis
Restaurant Concept	P1	0.016	0.6077	-0,02	-0,67
	P2	0.164			
Consumption Behavior	P3	0.000			
	P4	0.521			
	P5	0.232			
Food Consumption	P6	0.000			
	P7	0.001			
	P8	0.004			
	P9	0.000			
Procurement	P10	0.000			
	P11	0.005			
Food Waste Management	P12	0.000			
	P13	0.000			
	P14	0.000			
	P15	0.000			

According to Table 3, the validity test showed some invalid data such as P2, P4, and P5. The attributes were caused greater than p-value (0.05). Then, the reliability test was not included P2, P4, and P5 and it showed 0.607, which means the data was reliable because the minimum value was 0.6. The following instrument test is the normality test. The normality test used Skewness and Kurtosis, and the results showed a Skewness value of -0.02 and a Kurtosis value of -0.67. These results were normal because they are included in the Skewness value criteria, which is between -2 and +2, and the Kurtosis value is between -7 and +7.

4.3. ANOVA Test Results

ANOVA test aims to determine the significance value between responses and factors. The factors include restaurants' demographic and the responses are food expenditure attributes. The results can be seen in Table 4.

Table 4. ANOVA Results

Significance Factor	Code	P-Value
Type of Restaurant	P1	0.000
	P9	0.000
	P10	0.037
	P14	0.000
	P6	0.000
Food Prices	P6	0.010
	P13	0.042
Gender	P6	0.022
Consumer Profession	P7	0.000
	P9	0.018
Income	P10	0.044
	P13	0.023
Operating Hours	P13	0.007

According to Table 4, the type of restaurant has significance in the response of restaurant presentation by employees (P1), food menu expenditure tailored to consumer tastes (P6), excess food expenditure (P9), storage of raw materials and food waste (P10), and food utilization (P14). The type of

restaurant is dominated by *ramesan* restaurants, with a percentage of 40%. In P1, regarding the concept of restaurants with serving done by employees can reduce food waste because employees must determine and understand the consumer needs (Filimonau, Chiang, et al., 2023). It can be compared to self-service. The practice can produce excess plate waste because consumers take extra portions to meet their satisfaction. Excessive quantities can lead to food waste due to uneaten food (Filimonau, Algboory, et al., 2023).

In P6, food expenditure at *ramesan* restaurants is a type of home cooking, but it still requires determining a food menu that is tailored to consumer tastes. Menu design and portion size are the responsibility of the chef or restaurant owner (Filimonau, Algboory et al., 2023). Determining food expenditures are tailored to consumer tastes and will affect the sale of food and food waste. The restaurant has a diverse food menu. In this case, the restaurant owner must determine what menu and how much will be presented to consumers. Therefore, the restaurant shall estimate demand and distribute food optimally. It can be done by utilizing advances in online delivery technology so that restaurants can access new and broad customer markets (Filimonau, Algboory et al., 2023).

In P9, excessive food expenditure will result in the creation of food waste. Therefore, food expenditure must be adjusted to the type of menu that is in great demand by consumers. In P10, the storage of raw materials and the utilization of food waste carried out by restaurants also affect the formation of food waste. Food waste can occur at the storage and food preparation stages. The food waste at the storage stage is due to spoilage due to improper storage, technological errors (cooling damage and inappropriate cooling capacity), and overstocking of raw materials or food, which is triggered by errors in demand forecasting (Filimonau, Chiang et al., 2023). The storage of raw materials must be done appropriately and correctly so that the condition of the raw materials can be kept. In this case, storing food waste and excess raw materials in a suitable container and cold storage is a step to reduce food waste (Aloysius et al., 2023). In P14, food waste no longer suitable for consumption can be used for animal feed or given to farmers for composting. However, food waste that is still suitable for consumption can be given to employees or people in need to reduce food waste rather than directly disposing of food waste (Filimonau, Algboory et al., 2023). Therefore, the restaurant shall separate the types of food waste so that food waste can be utilized properly.

Food prices have significance for P6 regarding food expenditures tailored to consumer tastes and P13 regarding the sellers' concern for the creation of food waste. The menu that is tailored to consumer tastes has a dominant price of IDR 10,000 to IDR 20,000, with a percentage of 92%. In P6, food expenditure is adjusted to consumer tastes, in this case, setting attractive food prices by promising superior value and setting attractive prices to appeal to consumers (Ikhsan et al., 2020). The cost and the food obtained must be appropriate and feasible. If the selling price is too high, it can reduce consumer interest and impact food waste. Dynamic prices can be used to compete with other restaurants (Filimonau, Algboory et al., 2023). In P13, the seller's concern about food waste can impact the size of the profit the seller earns. If there is no effort to mitigate food waste, it will impact the economic value due to food waste (Aloysius et al., 2023), affecting the selling price of food.

In this study, the type of consumer is dominated by workers, with a percentage of 66%. Then the dominant consumer has significance for P7 and P9. In P7, the difference in consumer professions between workers and students can affect food expenditures from the type of menu issued and the quantity of each menu. The amount of the food menu will be adjusted to the level of success of the menu. The more popular the menu is, the more portions will be increased than other less attractive menus. In P9, excess food expenditure can be mitigated by knowing the pattern of consumers (workers), and they can predict the number of food types by looking at the level of demand for each menu served.

Gender is dominated by women, with a percentage of 63%. Gender has significance for P6. The food expenditure is measured to consumer tastes that are related to the taste and type of menu served. Female restaurant owners can create more flavor meals than males to serve their consumers. Furthermore, most restaurants have an income of around IDR 500,000 to IDR 1,000,000, with a percentage of 46%. Income has significance in P10 and P13. In P10, good storage treatment of excess raw materials and food waste will reduce food waste and losses for restaurant owners, affecting income (Filimonau, Chiang et al., 2023). In P13, The restaurant owner's concern about the creation of food waste will also affect the restaurant's income. The more food waste generated, the smaller the profit earned. In this case, there is an effort to reuse food waste worthy of consumption, significantly mitigating food waste (Aloysius et al., 2023).

The restaurant's operating hours are dominated from morning to night with a percentage of 37%. Operating hours have significance for P13. In this case, operational hours will have an impact on the expenditure of the served menu. For example, restaurants only open in the morning dominate breakfast menus such as chicken porridge, *uduk* rice, and yellow rice. At the same time, restaurants operating hours from morning to night have several group menus. Therefore, it needs a restaurant owner concerned with developing food waste management by serving the proper menus.

Food expenditure can contribute to better food waste management at restaurants. It can help in reducing restaurant losses on wasted food. In addition, it can also help local governments reduce food waste from retail, especially in restaurants, and it can create a healthier environment.

4.4. Implications and Recommendations

This study aims to determine the impact of the demographic on food expenditure at restaurants in Banyumas. The vast problem of food waste requires a solution to reduce food waste. FAO explains that food waste occurs in every country in the world. Limited natural resources make waste suppression an effective method to increase food availability (Ariani et al., 2022). Reducing food waste in sustainable development is one of the goals of the Sustainable Development Goals (SDGs) declared by the United Nations (UN) in New York in 2015. The target of the SDGs by 2030 is to halve global food waste per capita at the retail and consumer levels (Li et al., 2022).

The cause of wastage is poor inventory management and planning. Planning is done to set food expenditure proportionally to meet consumer desires and prevent food waste. In addition, poor stock planning can lead to food overstock followed by consumer appetite and large food portions that can lead to food waste (Wani et al., 2023). Food expenditure must be applied proportionally to fulfill consumer desires and prevent food waste. In this study, food expenditure is related to restaurant services, meal menu adjustments with consumers, menu procurement quantities, food type expenditures, storage of raw materials and food waste, restaurant owners' concern, and utilize of food waste (Vanhatalo et al., 2022). Poor procurement planning can be caused by inaccurate sales forecasts. Conducting accurate sales forecasts can reduce food waste because procurement is done correctly so as to avoid overstock (Wani et al., 2023).

The restaurant concept applied to the restaurant is part of the planning related to the restaurant atmosphere that can affect the creation of food waste (Vanhatalo et al., 2022). The Restaurant Food Waste Management (RFWM) map identifies the mitigation of food waste and its causes along with relevant actors. The three phases of the food waste phenomenon in restaurants are food preparation in the kitchen, food service, and client consumption (Principato et al., 2021). The concept of a restaurant serving its food by employees can reduce food waste because employees already understand the portion sizes their consumers need compared to self-service, which can produce excess plate waste. In addition, consumers do not want to feel lost, and they take extra portions to meet their satisfaction. Efforts are made to reduce food waste by implementing food serving according to the amount desired by consumers (Matzembacher et al., 2020).

Food expenditure related to food preparation can be done by storing raw materials and leftovers properly to reduce food waste. Poor cold chain management methodologies for products that require freezing to increase shelf life can result in significant food waste. Recording the arrival of raw materials can be done to know the shelf life that is about to expire so as to reduce food waste. Adjusting the type of food and the portion consumers need will be very essential in reducing food waste. Therefore, employees who are trained in food dispensing, raw material procurement and storage can contribute to reducing food waste (Wani et al., 2023). In addition, restaurant owners shall concern to implement food waste management initiatives. Controlling food waste in restaurants will help food waste management in mitigating food waste that can have an impact on environmental damage. Redistribution of food to the needy will help in providing food to the underprivileged and socio-economic groups. Furthermore, food waste that is still suitable for consumption can also be re-managed. Re-management can include freezing and heating food. Managing leftover food into other meals is also an effort to reduce food waste. The next step is to utilize food waste as animal feed and composting (Wani et al., 2023). Prevention of food waste through food expenditure is expected to help reduce carbon dioxide generation and greenhouse gas emissions.

5. Conclusion

This study was conducted to determine the effect of demographics on food expenditure at restaurants in Banyumas. The result showed the demographic factors significance affect to food expenditure responses. The demographic included, gender of the restaurant owner, type of restaurant, operating hours, dominant consumers, income, and food prices. The food expenditures responses consisted of restaurant concept, consumption behavior, food expenditure, procurement, and food waste management.

The restaurants can conduct food waste mitigation initiatives by enhancing restaurant services, adjusting the meal menu with consumers, forecasting procurement quantity, considering storage for raw material, and focusing on food consumption. In addition, the restaurant shall consider to manage menu that influence food waste by adding more refrigerator or utilizing the waste. This research has limitation for small-scale restaurant and specific types of menu. Therefore, future research can expand to more big-scale restaurant such as hotel restaurants and adding more complexity in restaurant type such as café, dine-in, and fast food.

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Declaration of Competing Interest: We declare that we have no competing financial interests or personal relationships that could have appeared to influence the work reported in this manuscript.

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