Report – Survey To Understand Consumer Attitudes Toward Food Waste By F&B Companies In Singapore

Survey was conducted by the
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Abstract

This study aims to investigate consumer perceptions toward food waste generated by the food and beverage (F&B) sector in Singapore. A survey questionnaire was devised and 428 valid responses were obtained. The results were analysed using SPSS and are presented in the Results section. The key findings of the survey are summarised as follows:

1. More than 90% of the participants are concerned about the food waste generated in Singapore and more than 83% of participants found it unacceptable for F&B companies in Singapore to waste food.

2. Close to 50% of the participants named NTUC FairPrice as a company whose food waste reducing strategy will be of interest to them. The same question yielded approximately 38% of responses for BreadTalk.

3. Participants are most interested in how retail supermarkets handle food waste, with NTUC FairPrice, Cold Storage, Giant and Sheng Siong among the top 10 most named companies.

4. An overwhelming majority of the respondents stated that they want to see F&B companies 'donate unsold, excess and near-expiry food that is still safe for consumption to the charities' (91.1%) and 'sell unsold, excess and near-expiry food that is still safe for consumption at a discount' (83.6%) in their bid to curb food waste.

5. Participants are willing to support F&B companies which adopt strategies to reduce food waste by helping them spread the word for their efforts (>80%). In addition, about 70% of the respondents expressed that they will buy more of the company's food products or patronise the company's outlets again.

6. It was found that female (Mean Rank= 226.77) is likely to be more concerned than male (Mean Rank= 189.52) toward food waste, U=16711, p=0.001, r=-0.158.

Introduction

According to the National Environment Agency (NEA), 780,000 tonnes of food waste was produced in Singapore in 2014 and only 13% of this waste is recycled [1]. This amounts to approximately 160kg per capita per year in Singapore. We will find further cause of concern when our food waste is compared against Europe or United States, where per capita waste is estimated to be around 95 to 115 kg per year.

The large amount of food waste generated is seemingly contradictory to the expectation of Singapore's quest to be a truly 'green' city. In the Singapore Green Plan 2012 released by the Ministry of Environment and Water Resources (MEWR), the committee highlighted Singapore's aim in achieving 'sustainable development [by] maintain[ing] a quality living environment while pursuing economic prosperity' [2]. One important objective under this plan was to have up to 60% of the waste generated in Singapore to be recycled. While Singapore has achieved considerable success in the recycling of waste such as construction debris and metal waste, efforts at other fronts have been less encouraging. The recycling of food and plastic waste which account for the third and fourth largest sources of waste in Singapore, leave much to be desired. Only 13% of food waste and 9% of plastic waste are recycled annually [1]. Certainly, a lot more can be done to increase the amount of waste recycled in these sectors.

It is against this backdrop that we wish to investigate the perception of the public in Singapore towards food waste. In the chain of food production, the potential sources for food waste are from agricultural production, post-harvest handling, manufacturing, retail or wholesale and consumers [3]. Given that Singapore does not produce most of the food, food waste is mainly generated in the retail or wholesale and the consumer level. Therefore, to mitigate food waste in Singapore, it is imperative to study these sources to better understand and provide solutions to the issue.

To this end, consumers' perspectives play an important role in the mitigation of food waste. Besides the ability to reduce food waste by more responsible consumption, consumers can also play an important role in advocating for best practices by the Food and Beverage (F&B) sector. With this premise, this study aims to understand consumers' attitude toward food waste and how they hope corporations can contribute to the reduction of food waste. While there are some information available in the public domains and literature regarding food waste, little, if not no literature on Singaporeans' perspective towards food waste, this led to the decision to conduct a preliminary survey to understand generic trends on the subject matter.

This report will first outline the methodology and the design of the study. Following which, the results from the study will be presented and discussed. A copy of the survey designed for the study can be found in the appendix of this report.

Methodology

The survey questionnaire was designed with the objective of investigating participant's attitude towards food waste by corporations. The first part of the survey, as seen in Appendix 1.1 aims to collect independent variables for profiling the participants and for explaining the difference in response toward food waste. These independent variables are attributes, implying that only correlation, and not causal relationship can be established. It might also be the case that these attributes do not play a significant role in the difference in perception toward food waste. In which case, these variables can still be used to ensure that the samples obtained from the respondents are representative of the population in Singapore. It was postulated that gender, age, monthly income and residential status are suitable indicators to represent the population.

The second part of the survey, as seen in Appendix 1.2, aims to investigate respondent's attitude towards different types of food waste. The type of waste includes those generated from cosmetic filtering in supermarket to disposal of excess food in restaurants and food courts. While not exhaustive, these classifications are meant to give a representation on the fields deduced to be the main sources for food waste. Finally, the third part of the survey is targeted at participants who believe that corporations can do more to reduce food waste. This part outlines a series of suggestions that could potentially be taken by corporations to reduce food waste. Respondents who have indicated that they wish to see corporations do more in reducing food waste are prompted to select suggestions and select avenues in which they will support the corporations shall the corporation embark on efforts to reduce food waste.

The survey was hosted on the National University of Singapore online survey platform. No personal contact details were collected in the survey and all data were collected only for the purpose of this survey. Although the IP addresses of the respondents were collected to ensure that the origin of the data is reliable, the IP addresses were deleted once the responses were validated. The survey was then distributed through an online link and responses were captured on the NUS server. Unless otherwise stated, all data was analysed and illustrated with Statistical Package for Social Sciences (SPSS) [4] [5].

Results - Descriptive Statistics

Participants

Data from 500 respondents were gathered. Out of these respondents, 72 were incomplete or are deemed as possible duplications based on uncanny similarities in response or IP address. Most of the incomplete surveys can be attributed to the constraint that all questions in section 1 and 2 are mandatory and participants are free to leave the survey if they are unwilling to answer any questions. These responses were invalidated and the final count of respondents used for further analysis was reduced to the final count of 428. Out of the 428 respondents, 287 are female, while 141 are male. A large majority of the participants are Singaporean Citizens (81.3%) while the remainder is equally divided between Singapore Permanent Resident and individuals on Long Term Passes. Meanwhile the monthly per capita income represents a good spread across the 5 categories sampled. These attributes are summarized in Table 1. The participants are aged between 16-72 years old, with an average age of 30.1 and a standard deviation of 11.2. The age distribution is shown in Figure 1.

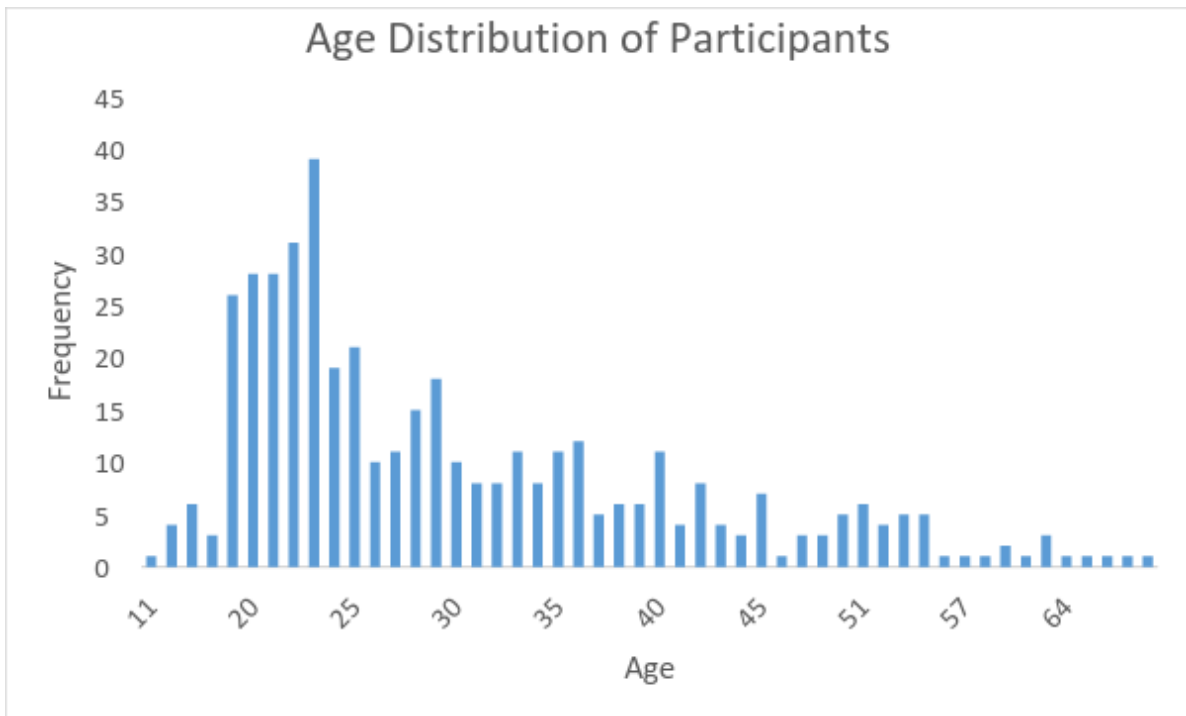| Attribute	Group	Frequency	Percentage (%)
Gender (n=428)	Male	141	33.0
	Female	287	67.0
Citizenship Status (n=428)	Singaporean Citizen	348	81.3
	Singaporean PR	38	8.9
	Long Term Pass	42	9.8
Monthly Household Income (n=428)	Below $3000	91	21.3
	$3001-$6000	142	33.2
	$6001-$9000	73	17.1
	$9001-$12000	55	12.9
	More than $12000	67	15.7

Table 1. Demographics of participants

Figure 1. Frequency distribution for age of participants

Results for Key Variables

Table 2 shows the responses for 10 dependent variables investigated in Section 2. These variables are measured on a Likert scale between 1 to 5. More than 90% of the participants expressed concern for the amount of waste generated by the F&B sector while more than 80% of the respondents found that the sources of food waste to be unacceptable.

Question	Percentage of Responses					Mean	SD
	SD	D	N	A	SA		
I am concerned about food waste generated in Singapore	1.2	1.9	6.5	39.5	50.9	4.37	0.786
I am concerned about food waste generated by F&B companies in Singapore	0.9	2.6	6.1	36	54.4	4.4	0.794
F&B companies need to do more to reduce food waste	2.6	0.2	1.9	34.8	60.5	4.5	0.782
It is acceptable for F&B companies to throw away unsold, excess and near-expiry food that is still safe for consumption	50.2	36.4	9.1	3	1.2	1.68	0.85
It is acceptable for bakeries to throw away unsold bread and pastries that are still safe for consumption	57.9	34.1	5.4	1.9	0.7	1.53	0.744
It is acceptable for supermarkets to throw away unsold and near-expiry food items that are still safe for consumption	56.1	36.2	5.4	1.6	0.7	1.55	0.734
It is acceptable for supermarkets to throw away vegetables and fruits that are "ugly" but still safe for consumption	58.4	30.4	7.5	3.3	0.5	1.57	0.805
It is acceptable for restaurants and cafes to throw away unsold and excess food that is still safe for consumption	52.8	37.9	6.5	2.1	0.7	1.6	0.763
It is acceptable for food courts to throw away unsold and excess food that is still safe for consumption	50	36	10.3	2.8	0.9	1.69	0.838
It is acceptable for caterers to throw away excess food that is still safe for consumption	50.5	32.7	13.1	3.3	0.5	1.71	0.851

Table 2. Responses to Perception of Food Waste on a Likert-type Scale

In the final section of the survey, only the first question is mandatory. The rest of the questions are conditional in that only a 'Yes' response to the first question will result in a trigger to answer the remaining questions.

It was found that 82% (n=351) of the participants are interested to find out more about efforts by F&B companies to reduce food waste. The participants who responded yes to this question were asked to name the companies which food waste reduction strategy they want to find out more. As seen in Table 3, NTUC FairPrice, BreadTalk and McDonald's were the most named companies whose food waste reduction strategy are of interest to the participants. Meanwhile, the retail supermarkets comprising Sheng Siong, NTUC FairPrice, Cold Storage and Giant made up the largest proportion of the named companies.

Company	Frequency	Frequency as Top Choice
NTUC FairPrice	200	101
BreadTalk	159	57
McDonald's	112	32
Cold Storage	95	21
Giant	61	4
Sheng Siong	58	5
Kopitiam	38	6
Starbucks	31	5
KFC	27	0
Four Leaves	23	0

Table 3. Top 10 companies named by participants' for interest towards their food waste reduction strategy (n=351)

A sizable amount of participants also indicated that they are willing to support these companies shall they pursue means to reduce food waste. The most popular avenue of showing their support is to either help the companies advertise their efforts, or to buy more of the companies' food product. These responses are captured in Tables 4 to 6.

Responses (n=428)	Frequency (%)
Donate unsold, excess and near-expiry food that is still safe for consumption to the charities and needy	91.1
Sell unsold, excess and near-expiry food that is still safe for consumption at a discount	83.6
Find ways to reduce food wastage during storage, transportation or cooking of food	71.4
Sell or serve food in smaller portions	47.7
None of the above	0.467

Table 4. Responses to "Which of the following strategy would you encourage companies to adopt?"

Responses (n=428)	Frequency (%)
Tell others about the company's efforts to reduce food waste	81.1
Buy more of the company's food products or patronise the company's outlets again	70.1
Continue to buy the company's food products or patronise the company's outlets, even if there are competitors	67.0
Continue to buy the company's food products or patronise the company's outlets, even if there are price increases	29.4
No difference in support	6.77

Table 5. Responses to "How would you support an F&B company if you know that it's taking steps to reduce food waste?"

Responses (n=428)	Frequency (%)
Tell others about the company's efforts to reduce food waste	85.5
Buy more of the company's food products or patronise the company's outlets again	69.8
Continue to buy the company's food products or patronise the company's outlets, even if there are competitors	66.3
Continue to buy the company's food products or patronise the company's outlets, even if there are price increases	34.1
No difference in support	4.91

Table 6. Responses to "How would you support an F&B company if you know that it donates unsold, excess and near expiry food that is still safe for consumption

Compounded Variables

Certain variables obtained directly from the survey were grouped according to categories for further analysis. This was done as these variables displayed a high degree of correlation and the questions were designed to test similar overarching attributes. The variable of 'acceptance towards food waste' was obtained by the averaging the responses to questions 8 to 14, where participants responded to a series of Likert-scaled statements on how far they accept each type of food waste. Meanwhile, the variables of 'support for managing food waste' and 'support for donating food', were obtained by summing up the responses that participants checked in questions 19 and 20 respectively. The descriptive statistics of these variables are shown in Table 7.

The attribute 'total household income' was also divided by 'number of person in household' to obtain 'per capita income', which gives a better basis for comparison. This is also reflected in Table 7.

Variable (n=428)	Mean	Standard Deviation
Acceptance towards Food Waste	1.62 (out of 5)	0.696
Support for Managing Food Waste	2.47	1.09
Support for Donating Food	2.94	1.14
Per Capita Income	$2094	$1826

Table 7. Compounded variables

Analysis and Discussion

The results obtained in the previous section were further analysed to investigate the relationships between the variables. The Spearman rho test, Mann Whitney U test and ANOVA were performed to test for inferential statistics. The attributes 'gender', 'age' and 'per capita income' were taken to be independent variables while the other variables are taken to be dependent variables. The results and the relevant analysis are reported in this section. Note that all discussions on effect size were based on Cohen [6].

Correlation between Variables

To investigate the correlations between the variables, the Spearman rho ordinal statistic method was employed. The nonparametric Spearman method was employed as the scores on the Likert scale are assumed to be ordinal and not normal. This is due to the skewed nature (|skewness|>1.0) of most of the responses obtained for the dependent variables. These outputs can be found in the output.spv file. The correlation coefficients and the significance of the statistically significant cases are reported in Table 8.

Variable 1	Variable 2	Correlation Value	Significance
Age	Concern towards Food Waste	0.266	<0.001
Age	Acceptance towards Food Waste	-0.164	0.001
Age	Support for Managing Food Waste	0.130	0.007
Age	Support for Donating Food Waste	0.131	0.007
Support for Managing Food Waste	Support for Donating Food Waste	0.764	<0.001
Support for Managing Food Waste	Acceptance towards Food Waste	-0.290	<0.001
Support for Managing Food Waste	Concern towards Food Waste	0.348	<0.001
Support for Donating Food Waste	Acceptance towards Food Waste	-0.231	<0.001
Support for Donating Food Waste	Concern towards Food Waste	0.282	<0.001
Concern towards Food Waste	Acceptance towards Food Waste	-0.395	<0.001

Table 8. Spearman correlation for statistically significant cases

The strongest positive correlation for independent to dependent variables, which would be considered as having a small to medium effect size, was between age and concern towards food waste, rho(426)=0.27, p<0.001. It is likely that participants who are more aged are more likely to be concerned about the amount of food waste generated in Singapore. While other listed variables were found to correlate to age, the effect size is smaller. No variables were found to possess statistically significant correlations with the income level of the participants.

The correlation between the dependent variables were found to be high, with the highest between support for donating food and support for managing food waste, rho(426)=0.764, p<0.001, which indicates a very large effect size. From this, it is likely that participants who support mitigating food waste by donating unconsumed food will also support companies having strategies to manage food waste. It was also found that participants who are concerned about food waste are unlikely to accept food waste in various sectors, rho(426)=-0.395, p<0.001, with a medium to large effect size.

Comparing Groups within Gender Variable

Given that the dependent variables in this study were ordinal and that the assumption of normality is markedly violated, Mann-Whitney U tests were performed to compare the dichotomous gender variable. The results of the tests between gender and the 4 key dependent variables are shown in Table 9.

Variable	Categories within Gender	N	Mean Rank	Z	Significance
Support for Donating Food	Female	287	222.70	-2.01	0.044
	Male	141	197.82		
Support for Managing Food Waste	Female	287	222.16	-1.89	0.058
	Male	141	198.91		
Acceptance Towards Food Waste	Female	287	208.26	-1.55	0.121
	Male	141	227.20		
Concern towards Food Waste	Female	287	226.77	-3.26	0.001
	Male	141	189.52		

Table 9. Mann Whitney U tests for gender variable

The 141 male participants have lower mean ranks than the 287 female participants in all variables except for acceptance towards food waste, where the mean rank is higher. A statistically significant correlation is observed between the concerns of the different genders towards food waste. It was found that female (226.77) is likely to be more concerned than male (189.52) toward food waste, U=16711, p=0.001, r=-0.158, which is considered a small to medium effect size. The effect size was estimated using the relation $r = Z/\sqrt{N}$.

It was also found that female (222.7) is more likely to support an F&B company in reducing food waste through donation than male (197.82), U=17881, p=0.044, r=-0.10.

Regression

The ordinal logistic regression was performed on the 4 main dependent variables using the attributes of gender and age. Statistically significant results were obtained for the variables of support for donate food and support for managing food waste. The results obtained are summarized in Table 10.

Dependent Variable	Model Fitting Significance	Goodness of Fit Significance	Test of Parallel Line Significance
Support for Managing Food Waste	0.002	0.753	0.93
Support for Donating Food	0.002	0.556	0.937
Acceptance to Food Waste	<0.001	<0.001	<0.001
Concern for Food Waste	<0.001	<0.001	0.341

Table 10. Key results from Ordinal Logistic Regression

From the results in Table 10, it can be seen that the final model gives a significant improvement over the intercept-only model with all the model fitting significance being statistically significant. However, only the first two variable displayed a good fit with the final model as seen the p>0.01 in the goodness of fit significance. Even when a conservative p=0.01 is chosen, the last two variables on Table 10 will still have to be rejected as the goodness of fit significance is less than 0.01. The proportional odds assumption was also found to be held valid for the first two variables as indicated by the high level of significance. Therefore, it is likely that the ordinal regression model provides a good fit for predicting the effects of age and gender on the support towards managing food waste and donating food to reduce food waste.

One sample T test

The one sample t test was also employed to investigate if the sample results differ significantly with the hypothesized population mean. Given the lack of previous data, the population mean of the individuals on the variables of concern towards food waste and acceptance towards food waste was taken to be 3 on the Likert Scale. This null hypothesis of indifference towards food waste was tested against the hypothesis that the population is not indifferent toward food waste. The results are summarized in Table 11.

Variable	Mean	95% confidence interval	Level of significance
Concern towards Food Waste	4.37	1.30 to 1.45	<0.001
Acceptance of Food Waste	1.62	-1.44 to -1.30	<0.001

Table 11: T test for testing against population mean

It is clear that in both cases, the null hypothesis of indifference towards these two issues has to be rejected and the alternative hypothesis should be accepted. In fact, examining the 95% confidence interval, it is likely that the new mean for concern towards food waste on a Likert scale of 5 should be between 4.30 to 4.45 and the new mean for acceptance towards food waste lies between 1.56 to 1.70.

Conclusion

From this study, it can be concluded that the population living in Singapore is concerned about food waste in Singapore and that they do not agree with all sources of food waste, with the strongest area of disagreement being from bakeries (Mean score=1.53). It was found that 82% of the participants will want to find out more about food reduction strategies by the F&B companies in Singapore and the top sector of interest is retail supermarket. Using various statistical tools, it was found that age is positively correlated with concern for food waste, $rho(426)=0.27$, $p<0.001$. Female was also found to be more likely to be concerned with food waste, $U=16711$, $p=0.001$, $r=-0.158$ and will most likely support initiatives to reduce food waste through donating unconsumed food still safe for consumption, $U=17881$, $p=0.044$, $r=-0.10$.

With these findings, it seems that more can be done to alleviate the concerns of the population towards the large amount of food waste generated in Singapore. While there have been encouraging initiatives from the government, including the recent introduction of the Mandatory Waste Reporting under the Environmental Public Health Act [7] and the introduction of various food waste recycling programmes [8], these efforts are still exploratory. Also, the greater concern is that efforts from corporations to tackle food waste are still limited. The lack of effort by corporations can possibly be attributed to a wide variety of reasons, and further study is required to understand the issue of food waste from the perspective of corporates. Only then can appropriate measures be recommended to both F&B companies and consumers for the mitigation and recycling of food waste in Singapore.

References

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[8] Z. Feng, "Singapore Budget 2015: Two trials to start this year to get people to recycle food waste," *The Straits Times,* 11 March 2015.

Appendix

Survey Questions

Part 1.1

1) What is your age?
_____

2) What is your gender?
Male/Female

3) What is the monthly average income of your household?
$3000 or below
$3001 to $6000
$6001 to $9000
$9001 to $12000
More than $12000

4) How many persons are there in your local household?
_____

5) What is your residential status in Singapore?
Singaporean citizen/ Permanent Resident/ Long Term Visit Pass

Part 1.2

F&B companies include retail shops selling food, bakeries, cafes, restaurants, food courts, canteens, hawker centres, markets, supermarkets, and caterers.

On a scale of 1 – 5 with 1 = Strongly Disagree and 5 = Strongly Agree, please rate statements 6 to 15:

6) I am concerned about food waste generated in Singapore.

7) I am concerned about food waste generated by F&B companies in Singapore.

8) It is acceptable for F&B companies to throw away unsold, excess and near-expiry food that is still safe for consumption.

9) It is acceptable for bakeries to throw away unsold bread and pastries that are still safe for consumption.

10) It is acceptable for supermarkets to throw away unsold and near-expiry food items that are still safe for consumption.

11) It is acceptable for supermarkets to throw away vegetables and fruits that are "ugly" but still safe for consumption.

12) It is acceptable for restaurants and cafes to throw away unsold and excess food that is still safe for consumption.

13) It is acceptable for food courts to throw away unsold and excess food that is still safe for consumption.

14) It is acceptable for caterers to throw away excess food that is still safe for consumption.

15) F&B companies need to do more to reduce food waste.

Part 1.3

16) Would you like to know what F&B companies are doing to reduce food wastage?

Yes/No

17) If your answer to Q16 is Yes, which F&B company's food waste reduction strategy would you most like to know? (Indicate the top 5 F&B companies, such as the names of bakeries, cafes, restaurants, supermarkets and retail shops selling food)

1. _____

2. _____

3. _____

4. _____

5. _____

18) Which of these food waste reduction strategies would you encourage F&B companies to adopt? (You may choose more than one option)

a) Donate unsold, excess and near-expiry food that is still safe for consumption to the charities and needy

b) Sell unsold, excess and near-expiry food that is still safe for consumption at a discount

c) Find ways to reduce food wastage during the storage, transportation or cooking of food

d) Sell or serve food in smaller portions

e) None of the above

19) How would you support an F&B company if you know that it is taking steps to reduce food waste? (You may choose more than one option)

a) Tell others about the company's efforts to reduce food waste

b) Buy more of the company's food products or patronise the company's outlets again

c) Continue to buy the company's food products or patronise the company's outlets, even if there are competitors

d) Continue to buy the company's food products or patronise the company's outlets, even if there are price increases

e) No difference in support

20) How would you support an F&B company if you know that it donates unsold, excess and near-expiry food that is still safe for consumption to the charities and needy? (You may choose more than one option)

a) Tell others about the company's efforts to reduce food waste

b) Buy more of the company's food products or patronise the company's outlets again

c) Continue to buy the company's food products or patronise the company's outlets, even if there are competitors

d) Continue to buy the company's food products or patronise the company's outlets, even if there are price increases

e) No difference in support

21) Any other comments?