

ICMC 2023

The 3rd International Conference on Management and Communication

**FOOD INNOVATION PRODUCTS POTENTIAL FROM FOOD
WASTE FOR BUSINESS OPPORTUNITY IN TERENGGANU**

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Abstract

This study aims for a potential solution to retail food waste based on the circular economy, which encourages the modification of waste as a resource. Given this potential, researchers should suggest the types of food waste that can be innovated and used as a local business opportunity. Therefore, the objective is to identify the trends and patterns of food surplus that can be used as a new business opportunity and to identify residents' knowledge, attitude, and practices on innovative products from food surplus in Terengganu. A self-administered questionnaire was used to determine the types of wasted food surplus. Two hundred responses were analysed with descriptive statistical and one-way ANOVA. The findings showed that the animal parts, namely fish and chicken bones, were the highest rate with 21%, while durian rind was the highest with 11% for the fruit peels. Furthermore, the findings revealed a significant positive response among Terengganu residents regarding knowledge, attitude, and awareness of food surplus as a new business opportunity. Thus, it is essential for the local authorities (PBT) to be equipped with information regarding the advantages of using products derived from surplus food to share the message to the community or public in Malaysia. A lab test on the product invented from food waste as a commercialisation procedure may be conducted in the future. This study may contribute to the literature and provide meaningful input for prospective business ideas based on food surplus, particularly in Terengganu.

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Keywords: Business Opportunity, Food Surplus, Food Waste, Foodservice Providers, Innovative Products



1. Introduction

The population in Malaysia is expected to continue to grow linearly and is expected to reach around 43 million people by 2050. The increase in population will further increase the rate of food waste disposal (Phooi et al., 2022). Food waste is food that completes the supply chain until the final product is of good quality and fit for consumption. However, some are unusable because it is discarded after being spoiled, expired, or with excess ingredients. Furthermore, food waste is high among consumers from an economic perspective. The data shown by (Jarjusey, 2017) has stressed that Malaysian households of five have to spend an average of RM900 a month on food only. Meanwhile, a quarter of that food is wasted during preparation, cooking, and consumption. This point indicates that about RM225 goes into the bin every month, which works out to RM2,700 a year per household. The data found in 2016 showed that food waste contributes to wastage. The Food Aid Foundation (Food Aid) documented that Malaysian food wastes almost 15,000 tonnes daily, including 3,000 tonnes of edible food every day (Sulaiman & Ahmad, 2018). Besides, food waste impacts social perspectives, whereby it cannot be accepted when many people still live in hunger. Statistics show that food waste contributes to chronic malnutrition. An estimated 795 million hungry people out of 7.5 billion worldwide suffer from starvation and chronic malnutrition (Juliana et al., 2020). Moreover, food security issues arise with the losses related to food access, such as food prices and purchasing power (Stangherlin & de Barcellos, 2018). Gupta (2022) has stated that socio-demographic and socio-cultural profiles with eating trends or food preparation practices are the probable influencers of the quantity of food discarded. Recycling food waste is one of the solutions society can accept because of the flow of garbage that turns food waste into a reusable commodity (Ramli et al., 2022). Recycling through food waste and surplus as feed resources and further processing to extract or generate value-added goods could be alternatives to such disposal methods. This technique will convert "waste to possibilities for development" while contributing to the sustainable intensification of the food service industry.

Consumers largely cause food waste at unexpected percentages and rates. Food waste can be recycled from household and commercial businesses such as restaurants, institutions, industries, school cafeterias, hospitals, and manufacturers (Ramli et al., 2020). In line with the above idea, some researchers are already investigating the possibilities of using food waste to generate new value-added goods that can be used to reduce food waste. Likewise, the significance of novel advancements in preventing or reducing food waste has been emphasised. Food innovation from food surplus, which converts food waste into a reusable product, is one solution society can create and approve due to the garbage flow. The massive volume of garbage has piqued the interest of experts looking for a way to use food waste by-products (Lau et al., 2021). Innovative businesses apply this approach and sell surplus food from retailers and restaurants to consumers. As a result, employing innovative food waste products benefits residential and community economics and may promote food sustainability and minimise food insecurity, particularly in developing countries (Bashir et al., 2018; Torres-León et al., 2018). Looking at this potential, it is desirable for researchers to suggest the types of food wasted that can be innovated to be utilised as a business opportunity in this area. Therefore, the objective of this study is to identify the trends and patterns of food surplus that can be used as a new business opportunity and to identify Terengganu residents' knowledge, attitude, and practices on innovative products from surplus.

2. Method

The convenience sampling approach was used in this study using the self-administered questionnaire. This study aims to identify the trends and patterns of food surplus wasted as well as the KAP on food innovative products of food surplus of residential homes, commercial and non-commercial establishments such as hotels, restaurants, night markets, stalls, factories, institutions, school canteens, and hospitals. All respondents are classed as local residents since they are assumed to reside in Terengganu and produce municipal solid waste. The total population of Terengganu is estimated to be around 1,149,440 people with a land area of 13,035 km² (Department of Statistics Malaysia, n.d.). Due to time constraints and based on the rule of thumb, 250 questionnaires were distributed to respondents living in 8 districts of Terengganu. However, out of 250 questionnaires, only 200 surveys were completed and returned with accurate and significant results. The questionnaire used in the study had four sections: Section (A) demographic characteristics of respondents, Section (B) type of food surplus, Section (C) KAP on food innovation goods, and Section (D) Surplus Food as a New Business Opportunity in Terengganu. A 5-point Likert scale was used to assess questionnaire items that showed strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), and strongly agree (5). The questionnaire was subjected to a pre-test for content validity by experts prior to data collection. This test included three experts who assessed the clarity of the claims, the presentation of the questionnaire, and the respondents' acceptance of the assertions. Upon expert feedback, changes were made. Following the revision of the questionnaire, data for the research were collected using scaling survey questions and conducted by trained research assistants under the supervision of the researchers. The researchers analysed the information using IBM SPSS Statistics for Windows, version 26.

3. Results and Analysis

3.1. Demographic characteristics of respondents

This study revealed that the number of female respondents (62.5%) is higher than that of male respondents (37.5%). Most respondents in this study were between the age of 18 to 29 years old (50%), followed by those from 30 to 39 years old (29.0%), 50 to 59 years old (11%), 40 to 49 years old (9.5%) and 60 years old and above (0.5%). From a district point of view, most respondents lived in Kuala Nerus (67%), followed by those from Dungun (12.5%), Kuala Terengganu (10%), Besut (5.5%), Hulu Terengganu (2%), Marang (2%), and Setiu (1%). The highest educational level of respondents was from secondary school (43%), bachelor's degree (27%), master and above (9.5%), primary school and below (9%), diploma (7.5%) and certificate (4%). Based on these findings, it is observed that most of the respondents in this study were secondary school leavers. All respondents were found to be literate and received an education. Most respondents were in food businesses and enterprises (60.5%) compared to 39.5% of household respondents. It was found that most respondents in this study were young adults aged between 18 to 29 years old. From the perspective of respondents' type of businesses, they were discovered to be largely others (47%), hawkers/food stalls/kiosks (35.5%), cafeteria/school canteen, university or college (8%), and catering (1.5%). From the year of operation point of view, they were

found to be largely others (37%), less than three years (22.5%), 3-7 years old (20.5%), 8-10 years (16%) and more than ten years (4%). The highest position of respondents was others (74%), followed by cook (11.5%), server (7.5%), and manager (7%). It was observed that in terms of the type of business, year of operation and position, most respondents were found to answer 'Others' options. It is important to remember that this study involved 200 respondents, so its findings did not reflect the general population in Terengganu.

3.2. Surplus food and food waste that often generated at respondents' home or workplaces

The frequency of surplus food and food waste that is often generated at respondents' homes or workplaces is shown in Table 1.

Table 1. Surplus food and food waste that is often generated at respondents' home or workplaces

Answer options	Percentage, n = 200 (%)	
Less than 5 kilogram	134	67%
5-10 kilogram	62	31%
More than 10 kilogram	4	2%

As shown in Table 1, the highest surplus food and food waste that often generated at respondents' homes or workplaces were less than five kilograms (67%), followed by 5-10 kilograms (31%) and more than 10 kilograms (2%). Most respondents in this study generated less than five kilograms of surplus food and food waste, indicating they were less wasteful. The result concurs with Sirola et al. (2019), who stated that consumers' better awareness of food waste, managing surplus food efficiently, and reducing food waste will contribute to better consumer behaviour toward minimising waste and surplus food in households and workplaces. Dhir et al. (2020) also agreed and implied that environmentally conscious consumers know the effects and consequences of surplus food and food waste on sustainability issues. Clarification behind these studies' statements is that surplus food and food waste is linked to a lack of food spending control, which results in consumers' unsustainable overconsumption of food (Horton et al., 2019). The categories of surplus food and food waste that are often generated at respondents' homes or workplaces are shown in Table 2.

Table 2. Surplus food and food waste that is often generated at respondents' home or workplaces

Answer options	Percentage, n = 200 (%)	
Fruit peel (example: mango, watermelon, banana and others)	28	14%
Vegetable (example: carrot, mustard green, water spinach and others)	3	1.5%
Eggshell	4	2.0%
Surplus of animal parts (example: fish bone, chicken, meat and others)	81	40.5%
Shell	0	0%
Others (apart from fruit peel, vegetable, eggshell, surplus of animal parts & shell)	26	13.0%
Fruit peel and vegetable	11	5.5%
Fruit peel, vegetable, egg shell and surplus of animal parts	8	4.0%
Fruit peel and surplus of animal parts	2	1.0%
Vegetable, eggshell and surplus of animal parts	5	2.5%
Vegetable, eggshell, surplus of animal parts and shell	1	0.5%

Fruit peel, eggshell and surplus of animal parts	2	1.0%
Vegetable and others	1	0.5%
Vegetable, eggshell, surplus of animal parts and others	1	0.5%
Vegetable and eggshell	1	0.5%
Fruit peel, vegetable and eggshell	2	1.0%
Fruit peel, vegetable, eggshell, surplus of animal parts, shell and others	1	0.5%
Eggshell and others	2	1.0%
Surplus of animal parts and shell	1	0.5%
Vegetable and surplus of animal parts	1	0.5%
Fruit peel, vegetable, eggshell, surplus of animal parts and others	5	2.5%
Fruit peel, vegetable, surplus of animal parts and others	6	3.0%
Vegetable, surplus of animal parts and others	6	3.0%
Surplus of animal parts and others	1	0.5%

From a surplus of animal parts' point of view, Figure 1 depicts that most respondents provided examples of 'fish and chicken bones' (21%), followed by 'chicken bone' (5%), 'chicken skin' (0.5%), 'fish stomach, chicken skin, and bone' (0.5%) and, 'fish head, stomach, and bone' (0.5%). It indicates that respondents named 'fish and chicken bones' as the surplus and waste products most frequently generated under a surplus of animal parts category, concurring with Foroutan et al. (2021), who implied that bones (such as fish and chicken bones) are substantial parts of kitchen waste. Thus, using bone waste is imperative to reduce the volume of waste generated.

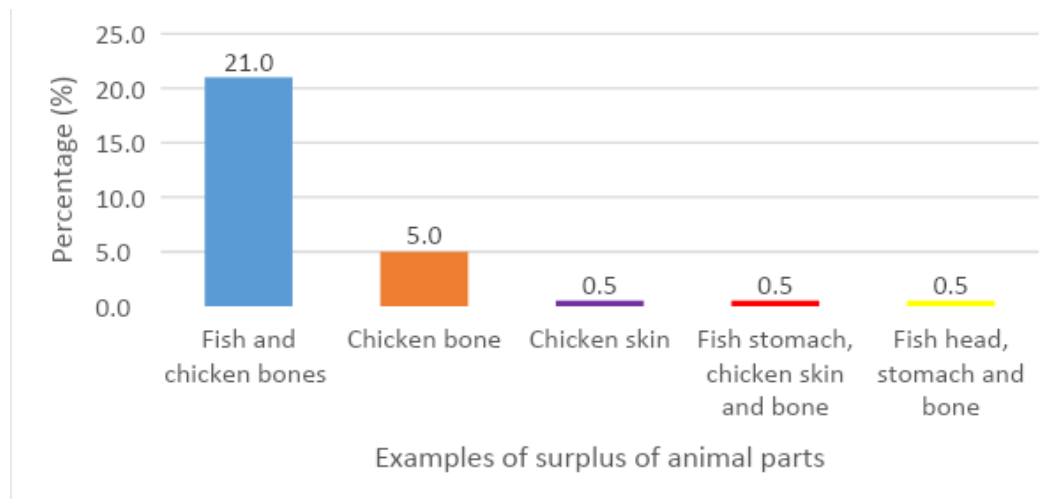


Figure 1. Respondents' responses to the examples of the surplus of animal parts

From the fruit peel perspective, Figure 2 depicts that most respondents provided examples of 'durian rind' (11%), followed by 'banana' (2%), 'mango and dragon fruit' (1%), 'mango, watermelon, banana and orange' (1%), 'watermelon' (1%), 'mango' (1%), 'mango and banana' (1%), 'guava' (0.5%), 'grape' (0.5%), and 'orange' (0.5%). It indicates that respondents named 'durian rind' as the surplus and waste products most frequently generated under the 'fruit peel' category. Although the result is only a small percentage (11%), this finding highlights the urgency to overcome durian dumping (lambakan durian) issues that occur each year in Malaysia (Anuar et al., 2021). Despite having a pungent smell, durian is a favourite fruit in Southeast Asia, including Malaysia (Muhammad et al., 2021). Thus, durian

dumping issues are considered as a crucial problem in this country because, as implied by Jong et al. (2021) in their studies, the durian rinds generate massive waste to the environment, especially during their peak season. As stated previously, 4% (3.5%) of the respondents gave examples of ‘chicken eggshell’ under the ‘eggshell’ category, and 1% of the respondents gave examples of ‘water spinach’ (0.5%) and ‘onion peel’ (0.5%) under the ‘vegetable’ category. The percentages in both categories were slightly lower than those in other categories due to the lack of examples given by respondents in the ‘eggshell’ and ‘vegetable’ categories, as depicted in Figure 2 below.

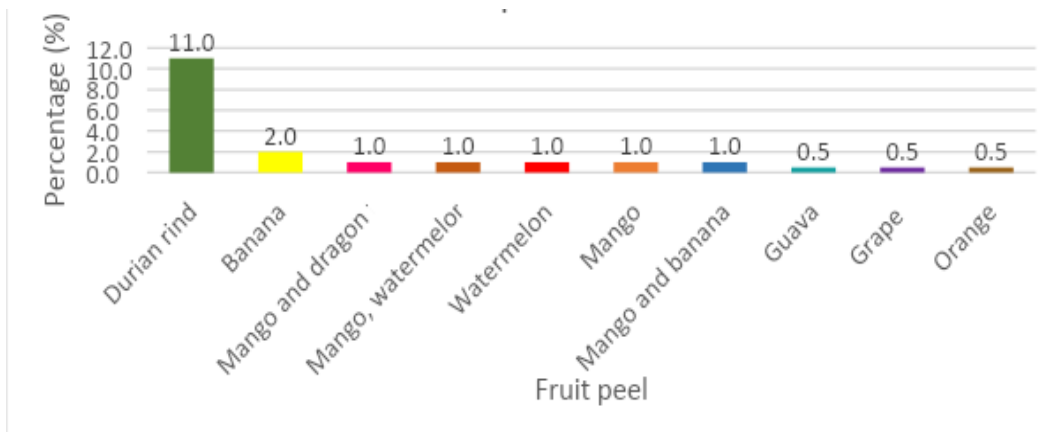


Figure 2. Respondents’ responses to the examples of fruit peel

3.3. Knowledge, attitudes and practice of innovative products from surplus food in Terengganu

The mean scores of respondents’ knowledge, attitudes and practice of innovative products from surplus food in Terengganu are shown in Table 3.

Table 3. Mean scores of respondents’ knowledge, attitudes and practice of innovative products from surplus food in Terengganu (n=200)

No.	Items	Mean ± SD
1.	Surplus food can be made into new products in our country.	4.58(0.69)
2.	Surplus food management can help reduce food waste disposal in the state of Terengganu.	4.66(0.55)
3.	Surplus food can be made into compost fertilizer.	4.70 (0.51)
4.	Surplus food can be made into animal feed.	4.71 (0.48)
5.	Products produced from surplus food can benefit entrepreneurs or the people of Terengganu.	4.64 (0.61)
6.	Compost fertilizer produced from food waste can generate income for entrepreneurs or the people of Terengganu.	4.68(0.51)
7.	I immediately discard the surplus food into the dustbin every time after eating.	4.59(0.73)
8.	I need enough time to separate the food waste that can be reused and cannot be reused.	4.51(0.79)
9.	I will separate the surplus food if I feel comfortable doing so.	4.63(0.62)
10.	I’m concerned about the way surplus food is collected, transported and distributed.	4.58(0.66)
11.	I will use leftovers from yesterday’s meal.	4.27(1.16)
12.	I will make an estimation of food portions that can be eaten for a week.	4.42(0.97)

13.	I believe that meal planning is necessary in saving household and restaurant budgets.	4.66(0.55)
14.	I will do food waste separation activities at my home/workplace.	4.52(0.73)
15.	We will participate in innovation/recycling activities of food waste if facilities for that purpose are available in our community.	4.60(0.61)
16.	I will engage in innovation/recycling activities of surplus food if I'm given remuneration, reward or payment.	4.56(0.69)
17.	I will carry out surplus food management activities at home/workplace.	4.55(0.69)
18.	I believe that surplus food at home/workplace can be converted into animal feed.	4.64(0.59)
19.	I often use surplus food for other and more beneficial purposes.	4.53(0.71)
20.	I believe cooperation with external parties is very important in dealing with surplus food issues.	4.59(0.65)
21.	I discard more than 1 bin of food waste every day.	4.26 (1.1)

Note: SD- Standard deviation

*Mean score ranged from 1 to 5, 1= Strongly disagree, 5= Strongly agree

The findings show that respondents agreed with every item asked in this section, implying that respondents portrayed positive responses regarding recycling, reusing, or creating innovative products from surplus food and the necessity to save and reduce food waste produced. However, there is a possibility that respondents demonstrated positive responses because they are expected to show good answers, or because they are not willing to give negative answers. Satisfactory KAP levels of respondents are essential to improve the utilisation of surplus and wasted food (Limon & Villarino, 2020). Adequate KAP levels are important for promoting and sustaining positive behaviour that prevents surplus food and food waste (Mohamed Hussein & Rosta, 2020). As shown in Table 3, respondents show positive responses towards all asked items, i.e. surplus food can be made into new products in our country; surplus food management can help reduce food waste disposal in the state of Terengganu; surplus food can be made into compost fertilizer; surplus food can be made into animal feed; products produced from surplus food can benefit entrepreneurs or the people of Terengganu; compost fertiliser produced from food waste can generate income for entrepreneurs or the people of Terengganu; I immediately discard the surplus food into the dustbin every time after eating; I need enough time to separate the food waste that can be reused and cannot be reused; I will separate the surplus food if I feel comfortable doing so; I'm concerned about the way surplus food is collected, transported and distributed; I will use leftovers from yesterday's meal; I will make an estimation of food portions that can be eaten for a week; I believe that meal planning is necessary in saving household and restaurant budgets; I will do food waste separation activities at my home/workplace; we will participate in innovation/recycling activities of food waste if facilities for that purpose are available in our community; I will engage in innovation/recycling activities of surplus food if I'm given remuneration, reward or payment; I will carry out surplus food management activities at home/workplace; I believe that surplus food at home/workplace can be converted into animal feed; I often use surplus food for other and more beneficial purposes; I believe cooperation with external parties is very important in dealing with surplus food issues; I discard more than 1 bin of food waste every day. It is also highlighted in Table 3 that respondents' mean scores on 'surplus food can be made into animal feed' and 'surplus food can be made into compost fertiliser' are higher than other items' mean scores. These findings indicate that respondents had higher awareness of surplus food processed into animal feed and compost fertilizer. It is supported by Pham et al. (2021) and Muth et al. (2019) that consumers are aware that animal feed and compost fertiliser are among the products derived from surplus food. Camilleri

(2021) stated that consumers knew that surplus food could be processed into animal feed and compost fertiliser. Consumers comprehend processing, recycling, or reusing surplus food because they are familiar with certain surplus food-derived products.

The mean scores of respondents' responses in terms of surplus food as a new business opportunity in Terengganu are shown in Table 4.

Table 4. Mean scores of respondents' responses in terms of surplus food as a new business opportunity in Terengganu (n=200)

No.	Items	Mean ± SD
1.	Consumers need detail plans to reduce the rate of surplus food disposal.	4.68(0.50)
2.	Terengganu state government should focus on the rising issue of surplus food disposal.	4.70(0.50)
3.	The community or the public should be educated regarding the benefits of managing surplus food properly.	4.71 (0.48)
4.	Local authorities (PBT) need to provide information to the people regarding the benefits of using compost fertiliser produced from food waste.	4.71 (0.49)
5.	Promotion of innovation activities/recycling surplus food should be done through mass media (e.g.: radio, television, internet), or print (e.g.: magazines, newspapers)	4.69 (0.50)
6.	Local authorities (PBT) need to provide incentives to individuals or entrepreneurs who manage surplus food.	4.68(0.52)
7.	The in-charged authorities need to increase their efforts or aid parties interested in cultivating fertiliser from surplus food in Terengganu.	4.69(0.51)
8.	Products produced from surplus food can provide business opportunities to the people of Terengganu.	4.69(0.53)

Note: SD- Standard deviation

*Mean score ranged from 1 to 5, 1= Strongly disagree, 5= Strongly agree

The findings depict those respondents agreed to every item asked in this section, indicating that respondents portrayed positive answers regarding surplus food as a new business opportunity in Terengganu. As stated before, respondents provided proper responses due to their expectations or unwillingness to show negative responses. As shown in Table 4, respondents show positive responses towards all asked items, i.e. consumers need detail plans to reduce the rate of surplus food disposal; Terengganu state government should focus on the rising issue of surplus food disposal; the community or the public should be educated regarding the benefits of managing surplus food properly; local authorities (PBT) need to provide information to the people regarding the benefits of using compost fertilizer produced from food waste; promotion of innovation activities/recycling surplus food should be done through mass media (e.g.: radio, television, internet), or print (e.g.: magazines, newspapers); local authorities (PBT) need to provide incentives to individuals or entrepreneurs who manage surplus food; the in-charged authorities need to increase their efforts or provide assistance to parties interested in cultivating fertilizer from surplus food in the state of Terengganu; products produced from surplus food can provide business opportunities to the people of Terengganu. Respondents were aware that surplus food could be a new business opportunity in Terengganu, concurring with Bhatt et al. (2018), who implied that surplus food has a strong potential to be commercialised as a new category of foods that is distinct from conventional and organic foods.

This finding is consistent with Veleva (2021), who implied that innovative food products produced from surplus food (leftover edible food fit for human consumption) present new opportunities for food

sector businesses and entrepreneurial companies. It helps minimize day-to-day household and workplace food waste and reduces environmental pollution. It is also highlighted in Table 4 that respondents' mean scores on 'the community or the public should be educated regarding the benefits of managing surplus food properly' and 'local authorities (PBT) need to provide information to the people regarding the benefits of using compost fertilizer produced from food waste' are higher than other items' mean scores. These findings indicate respondents' willingness to learn and be educated on the importance of proper surplus food management. They emphasised that the local authorities (PBT) should inform the community or the public about the significance of utilising compost fertilisers generated from food waste. It shows that respondents in this study were interested in receiving information about surplus food prevention and management because they knew particular surplus food-derived products, likely animal feed and compost fertiliser. Hence the respondents required input from the local authorities to know the benefits of using surplus food-derived products. Thus, the local authorities (PBT) must be equipped with information regarding the advantages of using products derived from surplus food in sharing the message to the community or public in Malaysia.

Based on the findings in Table 5, a significant association was found between these socio-demographic characteristics (i.e., district; type of business; year of operation; position) and respondents' level of KAP ($p < 0.01$). It indicates that the stated socio-demographic characteristics affect respondents' level of KAP regarding innovative products from surplus food in Terengganu. However, no significant association was found between these socio-demographic characteristics (i.e., gender; age; education level; category) and respondents' level of KAP ($p > 0.05$). This finding indicates that the stated socio-demographic characteristics did not affect the KAP level of respondents. Furthermore, it shows that respondents' KAP levels were affected by district, type of business, year of operation, and position factors, but not gender, age, education level, and category factors. Naim and Abdul Rahman (2020) disclosed in their research that a significant association was found between age and respondents' practice level, but no significant association was found between these factors (i.e., gender; educational level) and respondents' level of KAP ($p > 0.05$). It is important to remember that the present study and Naim and Abdul Rahman (2020) did not study similar factors. Hence, the effect of the district, type of business, year of operation, position, and category factors on respondents' KAP level were unclear.

Table 5. The association between socio-demographic profiles and respondents' level of KAP of innovative products from surplus food in Terengganu (n=200)

Criteria	n=200 (%)	Positive	Negative	P-value	Status of association
Gender					
Male	75 (37.5%)	69 (34.5%)	6 (3.0%)	0.575	Not significant
Female	125 (62.5%)	112 (56.0%)	13 (6.5%)		
Age					
18-29 years old	100 (50.0%)	92 (46.0%)	8 (4.0%)	0.602	Not significant
30-39 years old	58 (29.0%)	52 (26.0%)	6 (3.0%)		
40-49 years old	19 (9.5%)	18 (9.0%)	1 (0.5%)		
50-59 years old	22 (11.0%)	18 (9.0%)	4 (2.0%)		
60 years old and above	1 (0.5%)	1 (0.5%)	0(0%)		

District					
Besut	11 (5.5%)	11 (5.5%)	0 (0%)	0.000**	Significant
Setiu	2 (1.0%)	1 (0.5%)	1 (0.5%)		
Hulu Terengganu	4 (2.0%)	4 (2.0%)	0 (0%)		
Marang	4 (2.0%)	3 (1.5%)	1 (0.5%)		
Dungun	25 (12.5%)	17 (8.5%)	8 (4.0%)		
Kuala Nerus	134 (67.0%)	128 (64%)	6 (3.0%)		
Kuala Terengganu	20 (10.0%)	181 (90.5%)	19 (9.5%)		
Education level					
Primary school and below	18 (9.0%)	16 (8.0%)	2 (1.0%)	0.690	Not significant
Secondary school	86 (43.0%)	78 (39.0%)	8 (4.0%)		
Certificate	8 (4.0%)	7 (3.5%)	1 (0.5%)		
Diploma	15 (7.5%)	12 (6.0%)	3 (1.5%)		
Bachelor's degree	54 (27.0%)	51 (25.5%)	3 (1.5%)		
Master and above	19 (9.5%)	17 (8.5%)	2 (1.0%)		
Category					
Home	79 (39.5%)	72 (36.0%)	7 (3.5%)	0.803	Not significant
Food businesses and enterprises	121 (60.5%)	109 (54.5%)	12 (6.0%)		
Type of business					
Restaurant	16 (8.0%)	10 (5.0%)	6 (3.0%)	0.004**	Significant
Hawkers/Food stalls/Kiosks	71 (35.5%)	65 (32.5%)	6 (3.0%)		
Catering	3 (1.5%)	3 (1.5%)	0 (0%)		
Hotel/Resort/Golf club	0 (0%)	0	0 (0%)		
Cafeteria/school canteen, university or college	16 (8.0%)	16 (8.0%)	0 (0%)		
Others	94 (47.0%)	87 (43.5%)	7 (3.5%)		
Year of Operation					
Less than 3 years	45 (22.5%)	39 (19.5%)	6 (3.0%)	0.001**	Significant
3-7 years	41 (20.5%)	39 (19.5%)	2 (1.0%)		
8-10 years	32 (16.0%)	32 (16.0%)	0 (0%)		
More than 10 years	8 (4.0%)	4 (2.0%)	4 (2.0%)		
Others	74 (37.0%)	67 (33.5%)	7 (3.5%)		
Position					
Manager	14 (7.0%)	10 (5.0%)	4 (2.0%)	0.001**	Significant
Cook	23 (11.5%)	19 (9.5%)	4 (2.0%)		
Server	15 (7.5%)	11 (5.5%)	4 (2.0%)		
Supervisor	0 (0%)	0 (0%)	0 (0%)		
Financial officer	0 (0%)	0 (0%)	0 (0%)		
Others	148 (74.0%)	141 (70.5%)	7 (3.5%)		

Note: Positive: 4-5 (Agree-Strongly Agree), Negative: 1-3(Strongly disagree-Neutral)

**Chi square test: $p < 0.01$ is statistically significant

It was found that most respondents in this study came from Kuala Nerus district (67.0%), which could influence the association between the district and respondents' level of KAP. This study also shows that no significant association was found between educational level and respondents' level of KAP, indicating that the educational background of respondents did not affect their level of KAP. Hence, there was no difference between respondents with higher education and lower education in managing surplus food and food waste, as Gupta (2022) implied. Educated consumers with attractive, informative, and innovative communication tools are required to improve respondents' KAP levels to save surplus food and reduce food waste from excess purchasing and consumption (Okumus, 2020). This finding concurs with Goodman-Smith et al. (2020), who indicated that one of the effective ways to save surplus food and minimise food waste is by educating consumers on the importance of sustainability and environmental awareness. Another finding from this study is that there was a significant association between these socio-demographic characteristics (i.e., type of business; year of operation; position) and respondents' level of KAP, implying these factors lead to an increase in the respondents' KAP level. Possible clarification is that most respondents answered 'Others' for the type of business, year of operation, and position answers that lead to the significant association between those factors and respondents' KAP level.

4. Discussion and Conclusion

This study focused on identifying the trends and patterns of food surplus that can be used as a new business opportunity and identifying residents' knowledge, attitude, and practices on innovative products from food surplus in Terengganu. Throughout the study, the researchers discovered that the residents of Terengganu have significant knowledge, attitude, and practices on food waste innovation products. The local government already has a waste management system; however, it must address how to systematically manage the food waste recycling system, which the local government must adopt. It was discovered that the Terengganu municipalities do not currently use a food waste recycling system dedicated to residents but instead handle trash through a basic collect-and-dump approach. Local governments need a dedicated campaign to minimise the volume of home and commercial food waste generated within the context, which is unsettling given that the amount of food waste produced in the above community increases yearly. As a result, it is critical to build and implement a domestic food waste recycling system, which is a long-term solution to the ongoing food waste problem. Due to this fact, food waste can present various business opportunities. Food waste can be a profitable business for local Terengganu residents in a few ways. The innovative food waste can be composted, turned into nutrient-rich soil, and sold to local gardeners and farmers. The finding shows the urgency to overcome the yearly durian dumping issues as the durian rinds generate massive waste to the environment, especially during their peak season. Durian waste, including the husk and seeds, can be composted to create nutrient-rich fertiliser, which can nourish plants and crops. Furthermore, the local authorities could implement a systematic approach implementing a food recovery system to recover edible food that would otherwise go to waste and distribute it to those in need, specifically among B40 groups. This initiative can be accomplished through partnerships with food banks, food service, industry players, and local communities, which help reduce food insecurity in the Terengganu community. The food waste and surplus residents generate can also be upcycled into new food products or ingredients. The fibres in the

fruit waste, such as durian husks, watermelon and mango skins, and banana peels, can be used to make paper, textiles, and other industrial products. It can provide an alternative source of raw materials and reduce the environmental impact of traditional manufacturing methods. This initiative not only helps to reduce waste but can also create new revenue streams. Proposed food innovation courses or workshops can educate the community and entrepreneurs of Small and Medium Enterprises (SMEs) to generate income through used food waste. Furthermore, based on the results, it was found that the animal parts produced as kitchen waste can be turned into animal feed. This initiative can be accomplished by partnering with local farmers, i.e., Pertubuhan Peladang Negeri Terengganu (PPNT), to supply them with food waste to feed their livestock. In summary, food waste presents various business opportunities, from composting and food recovery to upcycling and anaerobic digestion. Finding ways to reduce food waste and repurpose it can generate revenue and contribute to a more sustainable and environmentally friendly food system.

The current study has broadened our understanding, which leads to food waste innovation products, particularly among Terengganu's residents. In building a sustainable-oriented food waste by-products and innovation goods plan, the new study has significant implications for various stakeholders, including entrepreneurs, society, and governments. It may also provide more information on food waste prevention and methods. Furthermore, with increased environmental concerns, much research is needed to identify how food waste might be developed for value addition and reuse. A lab test on the product invented from food waste as a commercialisation procedure may be conducted in the future. The qualitative study also allows future researchers to propose food innovation items from food surplus that can be used as a new business opportunity in Terengganu.

Acknowledgments

The authors would like to thank UiTM for encouraging the research and publication. This research was funded by Research Collaboration Fund (RCF) 2021/1, RMU, PJI UiTM Cawangan Terengganu. We also like to share our gratitude of collaboration with the members of Universiti Putra Malaysia (UPM) and the Malaysian Agricultural Research & Development Centre (MARDI).

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