ASSESSING FOOD WASTE BEHAVIOUR AMONG THE COMMUNITY OF PULAU TUBA, LANGKAWI

ISSA, Z. M.[1*] – MUSTAKIM, M.[2] – ZAMLI, M. I.[1] – ZAHA, Z. B. M.[1] – AHMAD, N.[1] – MAJID, M. A. A.[1]

[1] *Faculty of Hotel and Tourism Management, Universiti Teknologi MARA, Selangor, Malaysia.*

[2] *Faculty of Health Sciences, Universiti Teknologi MARA, Selangor, Malaysia.*

**Corresponding author*
e-mail: zurainim[at]uitm.edu.my

(Received 18th October 2025; revised 28th November 2025; accepted 05th December 2025)

Abstract. It has been acknowledged that tourist destinations worldwide face significant issues related to food waste, which comes most from the hospitality sector. Meanwhile, Pulau Tuba, a small island located off the west coast of Langkawi, is a relatively lesser-known destination renowned for its natural beauty and might face a similar issue when the industrial players start to come in. Thus, this study aims to investigate the food waste behaviour of its community by applying the Theory of Planned Behaviour (TPB) prior to any future developments to accommodate the needs of the tourism industry in Pulau Tuba. A self-administered questionnaire was conveniently distributed to respondents at four identified locations in Pulau Tuba. The data were then analysed using SPSS (ver. 26) software. The findings reveal no significant correlation between subjective norms and perceived behavioural control towards food waste behaviour. On the other hand, Pearson correlation analysis shows that attitude has a significant positive correlation towards food waste behaviour. Consequently, attitude is shown to be the only predictor that influences food waste behaviour. The findings of this study can benefit the local authority in monitoring and conducting food waste awareness among the Pulau Tuba community. In addition, the outcome of the study can help the authorities and the community prepares the necessary measures to receive the influx of tourists whilst ensuring the sustainability of Pulau Tuba as one of Malaysia's tourist attractions.
Keywords: *food waste behaviour, langkawi, theory of planned behaviour, tourism*

Introduction

Pulau Tuba is one of the islands in Langkawi; a hilly, small island offs the west coast of Langkawi. Pulau Tuba is approximately 6.5 kilometres from Kuah, the main town on Langkawi Island, and it is known for its natural beauty, including pristine beaches, lush forests, and scenic views. It is also home to a small fishing village where visitors can experience the traditional lifestyle of the locals. Pulau Tuba is a relatively lesser-known destination, but it is popular for ecotourism activities such as hiking, bird watching, and snorkeling. In a press release dated 31st May 2020, the Langkawi Development Authority (LADA) announced six strategies to recover Langkawi's economy post-COVID-19 pandemic (LADA, 2020). One of the strategies is to promote Langkawi tourism, which would eventually include the tourism industry in Pulau Tuba. The strategies include further development and promotions, resulting in an influx of tourists. Later, more accommodations will be built, and more hospitality industry players will reside in Pulau Tuba. This development would enhance the socioeconomic status of the respective communities. The development of tourism is related to perceived trust among tourists, which can be gained through factors such as infrastructure, heritage, education, local community-consumer/customer engagement and cleanliness (Sharma and Sarmah, 2019). However, as tourism development is enhanced, the negative aspects can pose

some challenges (Ibrahim et al., 2019), including producing more food waste (Raihan, 2023; Raihan et al., 2023).

Adhikari et al. (2006) predicted that Asia will experience the largest increase in food waste in 2025 due to economic development. Hence, proper planning and monitoring are important in ensuring the sustainability of Pulau Tuba as one of Malaysia's tourist attractions. As De Visser-Amundson (2022) recommended, the hospitality industry must develop and implement multifaceted solutions from various stakeholders to tackle the food waste issue. On the same note, waste management is very much related to governance effectiveness, where clear policies and strategies are very important in ensuring the sustainability of waste management in small islands. This should include investigating the community's behaviour towards food waste as they are one of the stakeholders involved in the hospitality industry. Therefore, this study aims to identify food waste behaviour among the communities of Pulau Tuba by utilising the TPB model.

Literature review

Food waste and its implications

Food waste has become a critical global problem that has a substantial impact on the environment as well as the economic and social aspects. One of the most significant environmental impacts of food waste is greenhouse gas emissions produced by rotting food in landfills (Sharma et al., 2020; Themelis and Ulloa, 2007). When food waste decomposes, it releases methane, a potent greenhouse gas that is 25 times more effective at trapping heat in the atmosphere than carbon dioxide (USEPA, 2023). Greenhouse gas emissions can harm the environment, which can negatively impact tourism destinations that rely on the natural environment to attract visitors. Consumers are increasingly aware of environmental issues and may choose to avoid destinations or businesses seen as wasteful (Raihan, 2023; Ibnou-Laaroussi et al., 2020; Khatter et al., 2019). As a result, the reputation of tourism destinations and businesses will be negatively affected. In addition, food waste also wastes the resources that go into producing food, such as water, land, and energy, which can result in economic impact (Raihan et al., 2023). Similarly, when the additional cost of purchasing and preparing food is involved, there is also the cost of disposing waste (Xiong et al., 2023).

It is reported that large quantities of wholesome edible food are often unused or left over and discarded from household kitchens (Fadhullah et al., 2022; Amirudin and Gim, 2019; Zainal and Hassan, 2019) and eating establishments (Xiong et al., 2023; Papargyropoulou et al., 2019), which results in greenhouse gas emission. In the year 2020 and 2021, the Solid Waste Management and Public Cleansing Corporation (SWCorp) reported that Malaysians wasted approximately more than 17,000 tonnes of food daily, where 24 per cent of the food wasted is regarded as "avoidable food waste" (Yuen, 2022). "Avoidable food waste" refers to food that can be eaten but is discarded because the food either does not fulfil personal preference or due to other factors such as health concerns (WRAP, 2020). It can occur at any point in the food chain where people are negligent or consciously decide to throw the food away.

Sadly, the amount of food wasted since 2019 is more than 4,000 tonnes, which is sufficient to feed three million people three meals per day (Yuen, 2022). Hence, a conclusion can be made that food waste can result in social impact as it can contribute to food insecurity and poverty (Fami et al., 2021). Food insecurity among Malaysians

has been reported to worsen, especially after the COVID-19 pandemic (Ahmad et al., 2022; Tan et al., 2022). The COVID-19 pandemic has disrupted supply chains, led to restrictions on foodservice establishments, and caused changes in consumer behaviour (Barman et al., 2021), all of which can contribute to increased food waste. The issue of food waste in Malaysia, exacerbated by the COVID-19 pandemic, can be related to both the COVID-19 crisis and multiple Sustainable Development Goals (SDGs) such as Zero Hunger (SDG2), Sustainable Cities and Communities (SDG11), and Responsible Consumption and Production (SDG12).

Food waste in community and island settings

Similar to other tourist destinations in many parts of the world (Elnasr et al., 2021; Wang et al., 2021; Li and Wang, 2020; Goh and Jie, 2019), food waste is a significant issue in Langkawi. As a popular tourist destination, Langkawi generates a large amount of food waste from hotels, restaurants, and cafes (Kasavan et al., 2022, 2019; Shamshiry et al., 2011). Currently, there is no organized system for managing food waste in Langkawi. Municipal waste collectors collect most food waste for disposal in landfills (Kasavan et al., 2022), which can contribute to environmental problems such as greenhouse gas emissions and soil pollution (Sharma et al., 2020). Some efforts have been taken to address the issue of food waste in Langkawi, where some hotels have started to implement composting (Ahmad et al., 2023; Kasavan et al., 2022). While food waste remains a challenge in Langkawi, positive steps are taken to address the issue and promote sustainable practices. The local government has begun to act on the issue by introducing policies and programs to promote sustainable waste management practices. For example, Langkawi has launched a "Zero Waste Island" campaign to encourage residents and businesses to reduce waste and recycle more. However, this campaign can be challenging (Wang et al., 2021) since Pulau Langkawi has many small islands. Island communities such as Pulau Tuba in Langkawi, Kedah, encounter distinct risks stemming from their physical seclusion, dependence on tourism, and inadequate waste management systems. Food waste on islands not only exacerbates environmental deterioration, but also jeopardises the viability of fisheries, agriculture, and eco-tourism. Understanding food waste behaviour in these communities is therefore essential for developing sustainable measures that correspond with environmental and socio-cultural circumstances.

Theory of Planned Behaviour (TPB) and food waste

The Theory of Planned Behaviour (TPB) introduced by Ajzen (1991) posits that behaviour is shaped by three main predictors, that are attitude, subjective norms and perceived behavioural control (PBC). Although TPB generally positions intention as a mediator between predictors and behaviour, numerous scholars contend that in context characterised by habitual, situational, or culturally influenced behaviour, it is meaningful to examine the direct influence of TPB variables on behaviour (Stancu et al., 2016; Conner and Armitage, 1998). According to Stancu et al. (2016), food waste is frequently routine and contingent upon context. Therefore, in communities such as Pulau Tuba, where food-related behaviours are intertwined with cultural, religious, and environmental contexts, the direct influence of attitude, subjective norms and perceived control on behaviour may be more significant that the indirect route through intention.

Attitude towards food waste

Ajzen (1991) defines attitude as the extent of positive or negative assessment an individual associates with a specific behaviour. Those with positive attitudes towards waste reduction (such as perceiving it as a means to conserve finances, safeguard the environment, and uphold religious principles) exhibit a lower tendency to waste food (Akhter et al., 2024; Blešić et al., 2021). Muslims in Malaysia uphold Islamic principles against mubazir (wastefulness), hence may enhance favourable attitudes towards food waste reduction. Nonetheless, conventional customs of providing excessive food for guests during celebrations may lead to waste (Abdul Wahab et al., 2023; Phooi et al., 2022). Hence, it can be proposed that attitude towards food waste has a negative effect on food waste behaviour among the Pulau Tuba community (H1).

Subjective norms and social influence

Subjective norms encompass the felt social pressure to engage or refrain from specific behaviours (Ajzen, 1991). In tightly-knit communities like Pulau Tuba, family members, neighbours, and local leaders can significantly influence dietary practices. Ariyani and Ririh (2020) and Jereme et al. (2016) highlighted that individuals are less inclined to waste food when they believe their social group prioritises food conservation. However, the research is inconclusive. A study conducted by Akhter et al. (2024) concluded that subjective norms were not important predictors among students, but Nazli et al. (2024) emphasized their significance, particularly the cultural norms, in Malaysian households. Nonetheless, in a setting of a small island community, norms may exert a particularly significance due to communal living and a shared cultural identity. Thus, a hypothesis can be proposed that subjective norms exert a detrimental influence on food waste behaviour among the Pulau Tuba community (H2).

Perceived Behaviour Control (PBC) and food waste

Perceived behavioural comtrol (PBC) denotes the degree to which individuals believe that they can manage their food waste (Ajzen, 1991). Individuals who perceived they possess authority over meal preparation food storage and leftover utilisation typically exhibit reduced food waste (Aydin and Aydin, 2022; Stancu et al., 2016). In contrast, restricted access to food storage facilities, inadequate waste management systems , and cultural norms of food sharing may reduce perceived control in rural island environments. In Pulau Tuba, PBC is probably affected by both individual ability (e.g. skills in food preservation) and structural factors (e.g. access to refrigeration, waste management services). A heightened sense of control is anticipated to directly result in less food waste behaviour. Therefore, it is hypothesised that PBC negatively influences food waste behaviour within the Pulau Tuba community (H3).

Research framework and hypotheses

The theoretical framework is shown in *Figure 1*. The hypotheses are as follows: (H1): Attitude towards food waste has a negative effect on food waste behaviour among the Pulau Tuba community; (H2): Subjective norms a negative effect on food waste behaviour among the Pulau Tuba community; (H3): PBC negatively influences food waste behaviour within the Pulau Tuba community.

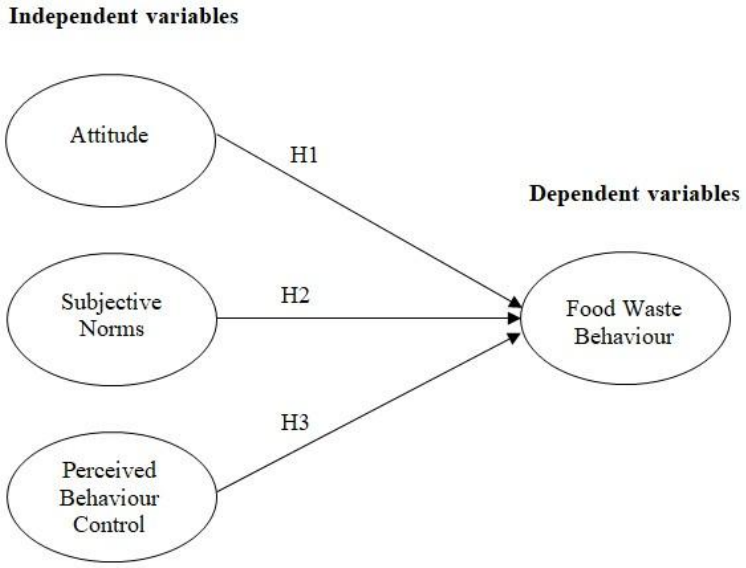

Figure 1. *Theoretical framework.*

Materials and Methods

A quantitative cross-sectional survey was conducted to determine the correlations between the TPB attributes (namely perceived behaviour control, attitude and subjective norms) and food waste behaviour among Pulau Tuba, Langkawi communities. A cluster sampling technique was adopted where Pulau Tuba communities were segmented according to their living areas: Kuala Sungai, Bukit Batu Licin, Teluk Karam, and Selat Bagan Nyior. However, respondents were conveniently approached at their respective living areas. The data were collected for five days in September 2022 using a validated questionnaire set. The questionnaire was divided into five sections. Section A consisted of the demographic profiles of the respondents, which included age, gender, marital status, highest education level, employment, income level, and household numbers. Sections B and C consisted of five items related to subjective norms and attitudes related to food waste, respectively. Meanwhile, Section D consisted of four items on perceived behavioural control, and Section E consisted of five items related to behaviour towards food waste. The respondents expressed agreement or disagreement on a five-point Likert scale ranging from “strongly agree” to “strongly disagree”).

The data were subjected to SPSS version 28 (SPSS, Inc.) software for statistical analyses. Prior to analyses, data gathered were evaluated for completeness and its normality. Descriptive analysis was employed to summarise the demographic profiles of the respondents using frequencies and percentages. In addition, associations between respondents’ demographic characteristics and the dependent variable were examined. However, before assessing the relationship between demographic profiles and the dependent variable, normality tests were performed to ensure appropriate analysis. Besides that, mean scores and standard deviations were calculated to examine respondents’ agreement levels on each item across all variables. Additionally, Multiple Linear Regression (MLR) was performed to examine the influence of attitude, subjective norms and perceived behavioural control on food waste behaviour among the Pulau Tuba community. Prior to the analysis, assumptions of multiple linear regression

were assessed using scatterplots and residual plots for linearity and homoscedasticity, the Durbin-Watson statistic for independence of errors, histograms and Q-Q plots for normality of residuals, and variance inflation factor (VIF) values for multicollinearity. All assumptions were satisfactorily met. This study and its consent procedure were reviewed and approved by the Faculty Ethics Review Committee (FERC), Universiti Teknologi MARA [Reference no. FPHP/FREC/239/2022].

Results and Discussion

Demographic characteristics and their associations with food waste behaviour

Table 1 shows the demographic profile of the respondents and their association with food waste behaviour. Most respondents are female (68.3%), aged between 26 and 35 years old (31.7%), and married (70.0%). More than half of the respondents' highest educational level is secondary school (61.7%), and approximately only 20% of the respondents had tertiary education. More than 90% of the respondents were employed and earned RM3000 or less monthly. Almost 80% of the respondents had a household size of four and above. As shown in *Table 1*, non-parametric analyses were conducted since the data did not meet normality assumptions. The Kruskall-Wallis test confirmed that the age group ($H = 13.612$, $df = 5$, $p < 0.05$) and education level ($H = 23.246$, $df = 4$, $p < 0.001$) of the respondents are significantly associated with food waste behaviour. In contrast, no significant associations were found for gender, marital status, employment status, income level, and household size. The significant association between age and food waste behaviour supports previous research indicating that food waste decreases as individuals grow older (Haque et al., 2022; Theodoridis and Zacharatos, 2022; Grasso et al., 2019; Secondi et al., 2015). Older adults are often more mindful of food use, Theodoridis and Zacharatos (2022) identifying those above 40 years old as food waste fighters. However, in relation to the association between education and food waste behaviour, the findings of this study align with Secondi et al. (2015) but contradicts the findings of Ananda et al. (2021) and Grasso et al. (2019), suggesting that education may exert different effects depending on cultural or contextual factors. Besides that, this study has not found any association between gender, marital status, employment status, income level and household size, and food waste behaviour among Pulau Tuba community. These findings are consistent with the previous studies (Ananda et al., 2021; Grasso et al., 2019; Secondi et al., 2015). However, other research conducted in different contexts, such as Japan during the COVID-19 pandemic (Qian et al., 2020) and Canada (Van Der Werf et al., 2019), reported significant effects for these demographic variables, highlighting how situational and cultural factors may shape food waste behaviour differently across population.

***Table 1**. Demographic profile and their association with food waste behaviour (N = 120).*

Characteristic	Frequency	Percentage	Association with food waste behaviour
Gender			p = .225 > 0.05
Male	38	31.7	
Female	82	68.3	
Age			p = .018 < 0.05*
18–25 years	14	11.7	
26–35 years	38	31.7	
36–45 years	27	22.5	
46–55 years	26	21.7	
56–65 years	8	6.7	

66 years and above	7	5.8	
Marital Status			p = .297 > 0.05
Single	35	29.2	
Married	84	70.0	
Others	1	0.8	
Highest Educational Level			p = .000 < 0.001*
Primary School	22	18.3	
Secondary School	74	61.7	
Pre-University	18	15.0	
Undergraduate	4	3.3	
Postgraduate	2	1.7	
Employment			p = .331 > 0.05
Employed	111	92.5	
Unemployed	7	5.8	
Students	2	1.7	
Household Income			p = .321 > 0.05
Below RM1,500	59	49.2	
RM1,501 to RM3,000	53	44.2	
RM3,001 to RM5,000	6	5.0	
RM5,001 to RM7,000	2	1.7	
RM7,001 to RM9,000	0	0	
RM9,001 and above	0	0	
Number of Household Members			p = .484 > 0.05
2 and below	6	5.0	
3 people	20	16.7	
4 people	24	20.0	
5 people	49	40.8	
6 people and above	21	17.5	

*Note: *significant relationship at $p < 0.05$; **significant relationship at $p < 0.001$.*

Descriptive analyses of food waste behaviour

The overall mean (± SD) obtained demonstrates that the community agreed on food waste behaviour (4.034 ± 0.517). As shown in *Figure 2*, more than 70% of the community agreed with all the statements related to food waste behaviour. Statements "I feel guilty when throwing away food" and "I always try to eat all purchased foods" have approximately 90% agreement. However, the respondents had a stronger agreement to consume all purchased foods (64.2%) than the guilt of throwing away food (61.7%). A study conducted by Theodoridis and Zacharatos (2022) among consumers in Greece during the COVID-19 lockdown revealed that the consumers can be grouped into seven clusters reflecting food waste behaviour: (1) 20s-40s food waste fighters, (2) 20s-40s Food Wasters, (3) Unaware consumers-Food Wasters, (4) Total food waste fighters, (5) young female Food Wasters, (6) aware consumers-food waste fighters, and (7) young male food wasters, hence leading to less agreement towards feeling guilty of throwing food. The findings found that food waste fighters aged 40 and above always feel guilty in throwing away food. Younger generations aged 40 and below who were clustered as food waste unaware or food wasters (Theodoridis and Zacharatos, 2022) need to have more awareness related to food waste behaviour (Haque et al., 2022). These may explain some of the differences in the findings related to age and food waste behaviour. In addition, according to Haque et al. (2022), among the reasons that lead to food waste are the inability of the household's family members to finish food, especially among household with children under 6 years old, and with teenagers above 16 years old, and the preparation of too much food. To ensure the food is not simply thrown away, most households would store leftover food either for later consumption or reuse it to create new recipes (Annunziata et al., 2022). However, the leftover food would still be thrown away if it has been stored for too long in the fridge (Haque et al., 2022). The uncertainty about the safety of the leftover food for consumption or the inability to determine its safety results in it being thrown away to avoid food poisoning potential

(Annunziata et al., 2022; Haque et al., 2022). Unfortunately, the behaviour of not wasting food does not tally with the statement that they would use all leftovers (74.2%), where this statement scored the lowest. This is further supported by the PBC statement, "I find it difficult to prepare food from leftovers". Previous studies have reported that difficulty in preparing food has been one of the barriers to reducing food waste (Kawasaki et al., 2023), especially among the younger generations (Karunasena et al., 2021). Another study identified the unwillingness to reheat leftover food as another contributor to food waste (Porpino et al., 2015). Despite high agreement level towards all food waste behaviour statements, Malaysian households are still lacking in action in reducing food waste (Phooi et al., 2022). As stated by Shamshiry et al. (2011), raw materials and food waste from the household are the main contributors of waste sent to landfills in Langkawi.

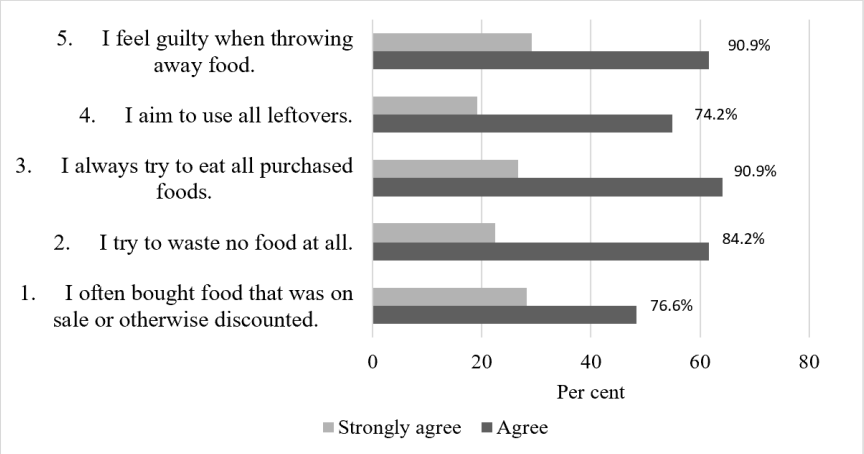

Figure 2. *Agreement with statements related to food waste behaviour among the community in Pulau Tuba.*

Descriptive analyses of attitude towards food waste

The respondents showed a positive attitude towards food waste, with an overall mean and SD of 4.125 ± 0.503, respectively. As shown in *Figure 3*, the community had the highest attitude level of agreement towards the statement "I strongly believe that wasting food is a waste of money" (96.7%), where more than 50% of the community strongly agreed with the statement. About 40% of the community also strongly agreed that it is immoral to discard food while other people in the world are starving (89.2%), followed by the statement, "It upsets me when unused food products end up in the waste bin" (85%). The above findings are consistent with a study by Falasconi et al. (2019) among households in Italy where they perceive food waste as a waste of money, can result in economic loss, and the wasted food could be valuable to others such as those in need of food. Accordingly, almost 80% of the community agreed that leftover food can always be reused. Comparing the results with Grasso et al. (2019), the community of Pula Tuba had a more positive attitude toward reusing leftover food compared to the community in Spain and Denmark; approximately 40% of the respondents in Spain and Denmark would reuse the leftovers. However, according to Annunziata et al. (2022), the attitude in reusing leftover food would depend on whether the food is home-cooked or from outside the home. The attitude of reusing leftover food can help reduce discarded food that would end up in landfills, which can result in undesirable environmental

consequences. This statement is further agreed by the community that by reducing food waste, less food will be dumped at the landfills. Unfortunately, this statement on environmental consequences had the lowest agreement among the community of Pulau Tuba. Similarly, Falasconi et al. (2019) also reported that the consequences of food waste on the environment were considered the least important by their respondents. Conversely, in another study by Qi and Roe (2016), respondents' attitudes towards food waste could be segmented into three groups: (1) one that represents perceived practical benefits households may lose if food waste were reduced, (2) one that represents the guilt associated with food waste, and (3) one that represents whether households feel they could be doing more to reduce food waste.

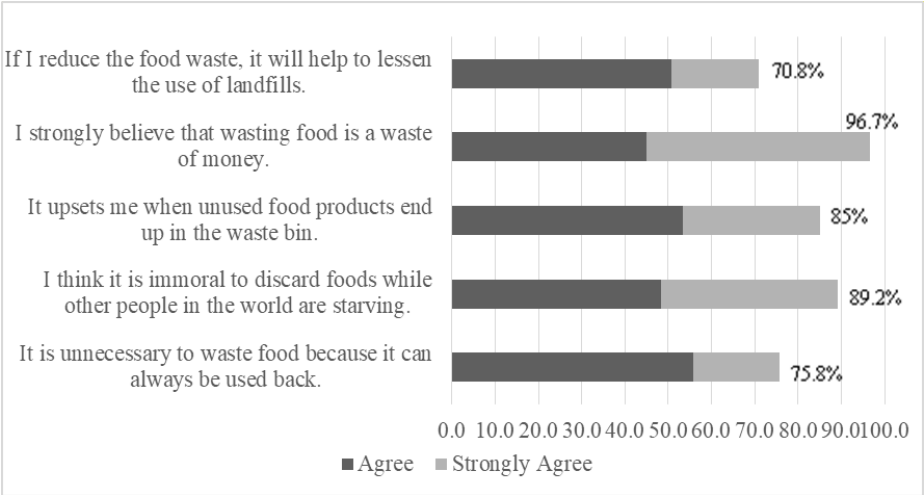

Figure 3. *Agreement with statements on attitudes to food waste among the community in Pulau Tuba.*

Descriptive analyses of subjective norms

The subjective norm variable's overall mean (± SD) is 3.742 (± 0.601). *Figure 4* represents the agreement level on the subjective norms of the community towards food waste. The statement "I have been raised not to waste food that I took" had the highest total agreement among the community (80.8%), followed by the statement that they did not waste food when they went for an outing with their friends (73.3%), and with family members (72.5%). Hence, in terms of the strength of the agreement level, slightly more than 20% of the community strongly agreed that they were raised not to waste food and would not waste food when they went out with their family. Studies conducted by Burlea-Schiopoiu et al. (2021) and Qian et al. (2020) during the pandemic of Covid-19 pointed out that family and friends were shown to influence the behaviour of households and young adults not to waste food. The way a person is brought up (Trubnikova et al., 2021) and the people they mingle with will influence their behaviour (Laursen and Veenstra, 2021). Similarly, it is common among Malay parents to consume their children's leftover food. Hence, the thought that food is not meant to be wasted, or that they need to finish up all the food taken, has been embedded since their early life. On the other hand, the statement "I believe that I can do something about food waste" had the lowest agreement level, indicating that the community was less innovative in finding ways to utilise leftover food. Hence, more programs are needed to

educate the community in utilising the leftover food into new servable recipes (Madanaguli et al., 2022).

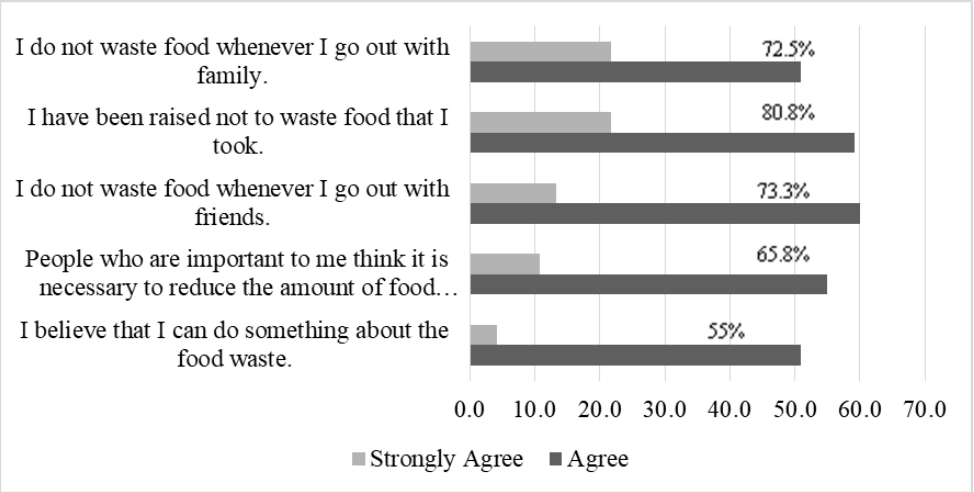

Figure 4. *Agreement with statements on subjective norms related to food waste among the community in Pulau Tuba.*

Descriptive analyses of perceived behaviour control

In this study, it was shown that the overall mean and SD for PBC variables related to food waste were considered neutral (2.788 ± 0.751). Interestingly, all PBC statements had low agreement, which is less than 30% by the community of Pulau Tuba. Similar findings were reported by Ismail and Azeman (2021) among the community of Kuantan, Pahang, where the overall score for PBC statements was the lowest compared to other TPB attributes. As can be seen in *Figure 5*, the statement "I find it difficult not to have any food wastage in my household" has the highest agreement level (30%), followed by the statement "I find it difficult to prepare food from leftovers" (27.5%). Meanwhile, "I find it difficult to plan my shopping that will guarantee no food waste" has the lowest agreement level (16.7%). All these statements indicate that the majority of the community of Pulau Tuba had a good perception related to controlling food wastage at home (70%), preparing new recipes from leftovers (72.5%), and ensuring that they shop as per planning (83.3%). As stated by Fami et al. (2019), knowledge is one of the indicators that can result in the motivation to control and reduce food waste. In addition, improving skills (Kasavan et al., 2019) and obtaining information about food consumption and management (Principato et al., 2022; Roe et al., 2021) can help the community manage food at home, reducing food waste.

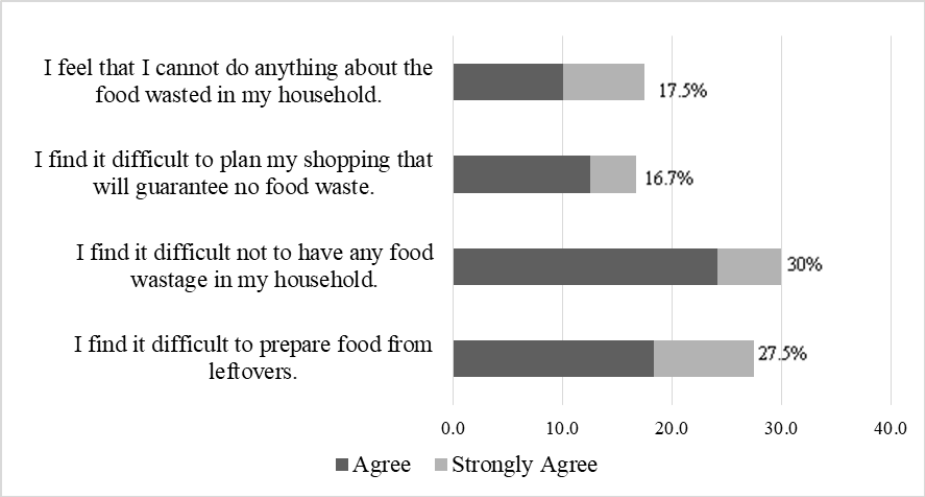

Figure 5. *Agreement with statements on perceived behaviour control related to food waste among the community in Pulau Tuba.*

Predictive role of attitude, subjective norms, and PBC in food waste behaviour

The multiple linear regression (MLR) analysis showed that the combined predictors, namely PBC, subjective norms and attitude towards food waste, significantly explained 10.4% of the variance in food waste behaviour ($R2 = 0.104$, $F(3, 116) = 4.509$, $p = 0.005$). This indicates a modest but statistically significant relationship between the predictors and the dependent variable. The MLR analysis showed that among the predictors, only attitude significantly predicted food waste behaviour ($\beta = 0.359$, $p < 0.05$), suggesting attitude plays a central role in influencing food waste behaviour. This supports H1, suggesting that individuals with more negative attitudes towards food waste are less likely to engage in wasteful behaviour, aligning with the hypothesis that attitude negatively influences food waste behaviour. Meanwhile, subjective norms ($\beta = -0.102$, $p > 0.05$) and PBC ($\beta = -0.003$, $p > 0.05$) were not significant predictors in the regression model. These findings indicate that perceived social pressure and individual's perceived control over reducing food waste do not significantly affect their actual behaviour in this study. Thus, H2 and H3 are not supported.

However, the Durbin-Watson statistic was below the acceptable threshold ($DW = 0.773$), suggesting potential positive autocorrelation in the residuals, which may violate the assumption of independence or errors. This issue could affect the reliability of the regression estimates and should be addressed in future research. The sample size, although adequate, may limit the generalizability of the findings. Furthermore, this cross-sectional design restricts causal interpretations. Hence, future research should consider including additional relevant predictors to improve model fit and explanatory power. Longitudinal data collection is recommended to address autocorrelation and better assess causal relationships. Increasing the sample size and ensuring data meet regression assumptions, such as independence of residuals, would enhance the robustness of the findings. Employing alternative statistical techniques, such as time-series analysis, might be appropriate if data are collected over time. The findings are comparable to prior Malaysian studies. Zainal and Hassan (2019) found that PBC significantly predicted the intention of not waste food, which in turn predicted actual food waste behaviour, a result also supported by Teoh et al. (2022). Similarly, Chun T'ing et al. (2021) and Nair (2021) also reported that both attitude and PBC were

significantly associated with the intention to reduce food waste. Nair (2021) further demonstrated that PBC not only predicted intention but also was directly influenced food waste behaviour. These findings suggest that incorporating behavioural intention as a mediating variable could strengthen future investigations into food waste behaviour among the communities in Malaysia.

Conclusion

The sustainability of tourist destinations and its close connection to future development has prompted a rethinking regarding food waste, specifically regarding the current awareness among Pulau Tuba, Langkawi community. The findings demonstrate that attitude towards food waste is a significant negative predictor of food waste behaviour among the community, confirming the relevance of psychological factors in influencing waste reduction practices. Furthermore, demographic variables, specifically age and education level were found to have significant associations with food waste behaviour, suggesting older and more educated individuals tend to engage in more sustainable food consumption practices. These results underscore the multifaceted nature of food waste behaviour, influenced by both cognitive and sociodemographic factors.

For the tourism industry, these insights highlight the need for tailored interventions that account for demographic differences. Targeted educational campaigns that address younger and less-educated populations could enhance awareness and promote responsible food waste behaviours among both residents and visitors. Additionally, leveraging the influence of community members with higher education and mature age groups may facilitate peer-led initiatives that reinforce positive attitudes.

For a policy perspective, government strategies aimed at food waste management should integrate demographic considerations into program design to increase effectiveness. Incorporating food waste education into formal and informal settings and focusing on age- and education-specific approaches, can enhance community engagement and contribute to sustainable tourism development. Overall, this study provides empirical evidence supporting the development of comprehensive, context-specific interventions that combine attitudinal and demographic insights to mitigate food waste in tourism-dependent communities.

The originality of our work is captured in the research model that shows the strong impact of TPB in assessing food waste behaviour among the small island community. It is interesting to note that the findings are unique and different from previous studies, which are worth exploring further. Thus, our findings and conclusions would inform and impact the future development of Pulau Tuba as a tourist destination and further strengthen the existing food waste management policy. Moreover, addressing food waste in Langkawi can contribute to multiple SDGs, including zero hunger, responsible consumption and production, and sustainable cities and communities. By aligning with the SDGs, Langkawi can work towards a more sustainable and inclusive future.

Acknowledgement

This research was supported by Universiti Teknologi MARA (Ref. No. 600-RMC/LESTARI SDG-T 5/3 (160/2019) and 600-UITMSEL (PI. 5/4) (103/2022)).

Conflict of interest

The authors confirm that there is no conflict of interest involved with any parties in this research study.

REFERENCES

[1] Abdul Wahab, M.F., Talhah, H.F., Zamry, N.N. (2023): Religion, culture and food waste behavior among Muslim consumers in Selangor. – ESTEEM Journal of Social Sciences and Humanities 7(SI Oct): 157-171.

[2] Adhikari, B.K., Barrington, S., Martinez, J. (2006): Predicted growth of world urban food waste and methane production. – Waste Management & Research 24(5): 421-433.

[3] Ahmad, A., Shahril, M.R., Wan-Arfah, N., Mohd Abu Bakar, W.A., Piernas, C., Lua, P.L. (2022): Changes in health-related lifestyles and food insecurity and its association with quality of life during the COVID-19 lockdown in Malaysia. – BMC Public Health 22: 1-9.

[4] Ahmad, R., Abdullah, J.E., Zainol, N.A., Ramely, A. (2023): Attracting customers using sustainability: a look at the Datai, Langkawi. – Journal of Business Management and Accounting 13(1): 57-78.

[5] Ajzen, I. (1991): The theory of planned behavior. – Organizational Behavior and Human Decision Processes 50(2): 179-211.

[6] Akhter, S., Rather, M.I., Zargar, U.R. (2024): Understanding the food waste behaviour in university students: An application of the theory of planned behaviour. – Journal of Cleaner Production 437: 11p.

[7] Amirudin, N., Gim, T.H.T. (2019): Impact of perceived food accessibility on household food waste behaviors: A case of the Klang Valley, Malaysia. – Resources, Conservation and Recycling 151: 9p.

[8] Ananda, J., Karunasena, G.G., Mitsis, A., Kansal, M., Pearson, D. (2021): Analysing behavioural and socio-demographic factors and practices influencing Australian household food waste. – Journal of Cleaner Production 306: 12p.

[9] Annunziata, A., Muca, F.L., Mariani, A. (2022): Preventing household food waste in Italy: A segmentation of the population and suggestions for action. – Sustainability 14(12): 17p.

[10] Ariyani, L., Ririh, K.R. (2020): Understanding behavior of household food waste management: Food waste hierarchy context. – Jurnal Ilmiah Teknik Industri 19(2): 142-154.

[11] Aydin, H., Aydin, C. (2022): Investigating consumers' food waste behaviours: An extended theory of planned behaviour of Turkey sample. – Cleaner Waste Systems 3: 9p.

[12] Barman, A., Das, R., De, P.K. (2021): Impact of COVID-19 in food supply chain: Disruptions and recovery strategy. – Current Research in Behavioral Sciences 2: 8p.

[13] Blešić, I., Petrović, M.D., Gajić, T., Tretiakova, T.N., Syromiatnikova, J.A., Radovanović, M., Popov-Raljić, J., Yakovenko, N.V. (2021): How the extended theory of planned behavior can be applied in the research of the influencing factors of food waste in restaurants: Learning from Serbian urban centers. – Sustainability 13(16): 17p.

[14] Burlea-Schiopoiu, A., Ogarca, R.F., Barbu, C.M., Craciun, L., Baloi, I.C., Mihai, L.S. (2021): The impact of COVID-19 pandemic on food waste behaviour of young people. – Journal of Cleaner Production 294: 10p.

[15] Chun T'ing, L., Moorthy, K., Gunasaygaran, N., Sek Li, C., Omapathi, D., Jia Yi, H., Sivakumar, K. (2021): Intention to reduce food waste: A study among Malaysians. – Journal of the Air & Waste Management Association 71(7): 890-905.

[16] Conner, M., Armitage, C.J. (1998): Extending the theory of planned behavior: A review and avenues for further research. – Journal of Applied Social Psychology 28(15): 1429-1464.
[17] De Visser-Amundson, A. (2022): A multi-stakeholder partnership to fight food waste in the hospitality industry: A contribution to the United Nations Sustainable Development Goals 12 and 17. – Journal of Sustainable Tourism 30(10): 2448-2475.
[18] Elnasr, A.E.A., Aliane, N., Agina, M.F. (2021): Tackling food waste in all-inclusive resort hotels in Egypt. – Processes 9(11): 15p.
[19] Fadhullah, W., Imran, N.I.N., Ismail, S.N.S., Jaafar, M.H., Abdullah, H. (2022): Household solid waste management practices and perceptions among residents in the East Coast of Malaysia. – BMC Public Health 22: 1-20.
[20] Falasconi, L., Cicatiello, C., Franco, S., Segrè, A., Setti, M., Vittuari, M. (2019): Such a shame! A study on self-perception of household food waste. – Sustainability 11(1): 13p.
[21] Fami, H.S., Aramyan, L.H., Sijtsema, S.J., Alambaigi, A. (2019): Determinants of household food waste behavior in Tehran city: A structural model. – Resources, Conservation and Recycling 143: 154-166.
[22] Fami, H.S., Aramyan, L.H., Sijtsema, S.J., Alambaigi, A. (2021): The relationship between household food waste and food security in Tehran city: The role of urban women in household management. – Industrial Marketing Management 97: 71-83.
[23] Goh, E., Jie, F. (2019): To waste or not to waste: Exploring motivational factors of Generation Z hospitality employees towards food wastage in the hospitality industry. – International Journal of Hospitality Management 80: 126-135.
[24] Grasso, A.C., Olthof, M.R., Boevé, A.J., van Dooren, C., Lähteenmäki, L., Brouwer, I.A. (2019): Socio-demographic predictors of food waste behavior in Denmark and Spain. – Sustainability 11(12): 16p.
[25] Haque, A., Karunasena, G.G., Pearson, D. (2022): Household food waste and pathways to responsible consumer behaviour: evidence from Australia. – British Food Journal 124(11): 3783-3802.
[26] Ibnou-Laaroussi, S., Rjoub, H., Wong, W.K. (2020): Sustainability of green tourism among international tourists and its influence on the achievement of green environment: Evidence from North Cyprus. – Sustainability 12(14): 21p.
[27] Ibrahim, M.S.N., Halim, S.A., Ishak, M.Y. (2019): The impacts of tourism development on community well-being in Langkawi: The case of Kampung Padang Puteh, Mukim Kedawang. – Journal of Marine and Island Cultures 8(2): 61-88.
[28] Ismail, S.N., Azeman, A.S. (2021): Assessing consumers' behavior towards food waste in Pahang, Malaysia. – Jurnal Intelek 16(2): 48-59.
[29] Jereme, I.A., Siwar, C., Begum, R.A., Talib, B.A. (2016): Addressing the problems of food waste generation in Malaysia. – International Journal of Advanced and Applied Sciences 3(8): 68-77.
[30] Karunasena, G.G., Ananda, J., Pearson, D. (2021): Generational differences in food management skills and their impact on food waste in households. – Resources, Conservation and Recycling 175: 10p.
[31] Kasavan, S., Mohamed, A.F., Halim, S.A. (2019): Drivers of food waste generation: Case study of island-based hotels in Langkawi, Malaysia. – Waste Management 91: 72-79.
[32] Kasavan, S., Mohamed, A.F., Halim, S.A., Yusof, S., Siron, R. (2022): Challenges for source separation of food waste and turning waste into compost for island-based hotels. – Akademika 92(3): 39-49.
[33] Kawasaki, Y., Nagao-Sato, S., Yoshii, E., Akamatsu, R. (2023): Integrated consumers' sustainable and healthy dietary behavior patterns: Associations between demographics, psychological factors, and meal preparation habits among Japanese adults. – Appetite 180: 11p.
[34] Khatter, A., McGrath, M., Pyke, J., White, L., Lockstone-Binney, L. (2019): Analysis of hotels' environmentally sustainable policies and practices: Sustainability and corporate

social responsibility in hospitality and tourism. – International Journal of Contemporary Hospitality Management 31(6): 2394-2410.
[35] Langkawi Development Authority (LADA) (2020): Development and implementation of Langkawi economic recovery action plan (PTPEL). – Langkawi Development Authority 6p.
[36] Laursen, B., Veenstra, R. (2021): Toward understanding the functions of peer influence: A summary and synthesis of recent empirical research. – Journal of Research on Adolescence 31(4): 889-907.
[37] Li, N., Wang, J. (2020): Food waste of Chinese cruise passengers. – Journal of Sustainable Tourism 28(11): 1825-1840.
[38] Madanaguli, A., Dhir, A., Kaur, P., Srivastava, S., Singh, G. (2022): Environmental sustainability in restaurants. A systematic review and future research agenda on restaurant adoption of green practices. – Scandinavian Journal of Hospitality and Tourism 22(4-5): 303-330.
[39] Nair, G. (2021): The food we waste: antecedents of food wastage management behaviour. – International Journal of Social Economics 48(6): 826-842.
[40] Nazli, N.A.A., Hapiz, H.Y., Ghazali, M.S. (2024): Determinants of consumer food waste behaviour in Malaysia based on the theory of planned behaviour. – BIO Web of Conferences 131: 14p.
[41] Papargyropoulou, E., Steinberger, J.K., Wright, N., Lozano, R., Padfield, R., Ujang, Z. (2019): Patterns and causes of food waste in the hospitality and food service sector: Food waste prevention insights from Malaysia. – Sustainability 11(21): 21p.
[42] Phooi, C.L., Azman, E.A., Ismail, R., Arif Shah, J., Koay, E.S.R. (2022): Food waste behaviour and awareness of Malaysian. – Scientifica 11p.
[43] Porpino, G., Parente, J., Wansink, B. (2015): Food waste paradox: antecedents of food disposal in low income households. – International Journal of Consumer Studies 39(6): 619-629.
[44] Principato, L., Secondi, L., Cicatiello, C., Mattia, G. (2022): Caring more about food: The unexpected positive effect of the Covid-19 lockdown on household food management and waste. – Socio-Economic Planning Sciences 82: 10p.
[45] Qi, D., Roe, B.E. (2016): Household food waste: Multivariate regression and principal components analyses of awareness and attitudes among US consumers. – PLoS One 11(7): 19p.
[46] Qian, K., Javadi, F., Hiramatsu, M. (2020): Influence of the COVID-19 pandemic on household food waste behavior in Japan. – Sustainability 12(23): 14p.
[47] Raihan, A. (2023): The dynamic nexus between economic growth, renewable energy use, urbanization, industrialization, tourism, agricultural productivity, forest area, and carbon dioxide emissions in the Philippines. – Energy Nexus 9: 11p.
[48] Raihan, A., Ibrahim, S., Muhtasim, D.A. (2023): Dynamic impacts of economic growth, energy use, tourism, and agricultural productivity on carbon dioxide emissions in Egypt. – World Development Sustainability 2: 10p.
[49] Roe, B.E., Bender, K., Qi, D. (2021): The impact of COVID-19 on consumer food waste. – Applied Economic Perspectives and Policy 43(1): 401-411.
[50] Secondi, L., Principato, L., Laureti, T. (2015): Household food waste behaviour in EU-27 countries: A multilevel analysis. – Food Policy 56: 25-40.
[51] Shamshiry, E., Nadi, B., Bin Mokhtar, M., Komoo, I., Hashim, H.S., Yahaya, N. (2011): Integrated models for solid waste management in tourism regions: Langkawi Island, Malaysia. – Journal of Environmental and Public Health 8p.
[52] Sharma, N., Sarmah, B. (2019): Consumer engagement in village eco-tourism: A case of the cleanest village in Asia – Mawlynnong. – Journal of Global Scholars of Marketing Science 29(2): 248-265.
[53] Sharma, P., Gaur, V.K., Kim, S.H., Pandey, A. (2020): Microbial strategies for bio-transforming food waste into resources. – Bioresource Technology 299: 12p.

[54] Stancu, V., Haugaard, P., Lähteenmäki, L. (2016): Determinants of consumer food waste behaviour: Two routes to food waste. – Appetite 96: 7-17.
[55] Tan, S.T., Tan, C.X., Tan, S.S. (2022): Food security during the COVID-19 home confinement: A cross-sectional study focusing on adults in Malaysia. – Human Nutrition & Metabolism 27: 8p.
[56] Teoh, C.W., Koay, K.Y., Chai, P.S. (2022): The role of social media in food waste prevention behaviour. – British Food Journal 124(5): 1680-1696.
[57] Themelis, N.J., Ulloa, P.A. (2007): Methane generation in landfills. – Renewable Energy 32(7): 1243-1257.
[58] Theodoridis, P.K., Zacharatos, T.V. (2022): Food waste during Covid-19 lockdown period and consumer behaviour-The case of Greece. – Socio-Economic Planning Sciences 83: 10p.
[59] Trubnikova, E., Malysheva, A., Elkin, S. (2021): Attitude of high school and university students to family values. – European Proceedings of Social and Behavioural Sciences EpSBS 107: 429-438.
[60] United States Environmental Protection Agency (USEPA) (2023): Global Methane Initiative. – United States Environmental Protection Agency 3p.
[61] Van Der Werf, P., Seabrook, J.A., Gilliland, J.A. (2019): Food for naught: Using the theory of planned behaviour to better understand household food wasting behaviour. – Canadian Geographer 63(3): 478-493.
[62] Wang, K.C.M., Lee, K.E., Mokhtar, M. (2021): Solid waste management in small tourism islands: An evolutionary governance approach. – Sustainability 13(11): 23p.
[63] Waste and Resources Action Programme (WRAP) (2020): Household Waste Prevention Hub: Waste prevention activities-Food. – Waste and Resources Action Programme 3p.
[64] Xiong, C., Khan, A., Bibi, S., Hayat, H., Jiang, S. (2023): Tourism subindustry level environmental impacts in the US. – Current Issues in Tourism 26(6): 903-921.
[65] Yuen, M. (2022): M'sians continue to waste food. – The Star Online 6p.
[66] Zainal, D., Hassan, K.A. (2019): Factors influencing household food waste behaviour in Malaysia. – International Journal of Research in Business, Economics and Management 3: 56-71.