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# Exploring the Influential Factors Shaping Household Food Waste Management Behaviour

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**ABSTRACT**

Food waste management within households is a global issue with significant economic, environmental, and social implications. Food waste has been a worldwide concern for several decades, but this problem is relatively new in Malaysia context due to increasing amount of food waste in recent years especially among household. Despite its importance, there is a gap in understanding the specific factors influencing food wasting behaviour among households, particularly in the context of Malaysia. Therefore, this study aims to investigate the variables affecting food wasting behaviour among households. This study employed a purposive sampling technique with a correlational cross-sectional research design. The data utilized to empirically assess the suggested model, an extension of the Theory of Planned Behaviour, was collected through an online survey among households in Malaysia. Smart partial least squares were used to analyse 300 participants. The findings revealed that attitude, subjective norms, perceived behaviour control, and shopping routine are positively associated with the intention to manage food waste, while the intention to manage food waste was positively related to food management behaviour. Additionally, intention successfully mediates the relationship between attitude, subjective norms, and perceived behaviour control; however, intention does not mediate the relationship between shopping routine and food management behaviour. To enhance food management behaviour among households, it might be necessary for relevant authorities to increase campaigns and awareness related to food waste management.

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## 1. Introduction

Food waste is defined as food intended for human consumption that is thrown away, whether or not it has been stored over its expiration date or allowed to deteriorate [1]. Excessive food waste is linked to high levels of greenhouse gas emissions and resource depletion, which negatively affects sustainability [2]. Climate change and food security are two global sustainability difficulties that have been exacerbated by these issues. Food waste happens along the whole food supply chain, including during home consumption, industrial manufacture and processing, retail, and agriculture [3].

Food waste is a pressing issue on a global scale, carrying significant economic, environmental, and social consequences. According to the Food and Agriculture Organization (FAO), approximately one-third of the world's food meant for human consumption is lost or wasted each year, amounting to 1.3 billion metric tons [1]. According to Abd Razak *et al.,* [4], Malaysia's 15,000 tons of wasted food, about 3,000 tonnes are edible and shouldn't be thrown in the trash. The authors noted that, compared to paper (60%) and plastic (15%), food waste recycling and reuse rates in Malaysia are comparatively low (5%). One possible explanation for Malaysia's low rate of food waste reuse and recycling is the lack of a systematic approach to disposing of food waste [5]. Subsequently, a substantial portion of this waste occurs at the household level, highlighting the crucial need for research aimed at understanding the factors driving these behaviours.

Various studies have attempted to investigate the complex determinants of household food waste. Socio-demographic factors such as household size, income, and education level have been identified as key influencers [6]. For instance, larger households tend to generate more food waste due to logistical challenges in meal planning and portion control, while higher-income households may exhibit greater wasteful consumption behaviours [7]. Moreover, individuals with higher educational attainment often possess greater awareness of food waste issues and may engage in more sustainable consumption practices [8].

In addition to socio-demographic factors, cultural norms and attitudes towards food play a significant role in shaping household food management behaviour. Research has shown that cultural values surrounding food, such as perceptions of abundance and disposal practices, can vary widely across different societies and impact food management generation [9]. Furthermore, individual attitudes towards food, including beliefs about food's value, expiration dates, and perceptions of freshness, influence decisions regarding food purchasing, consumption, and disposal [10].

Recent studies have also highlighted the role of food-related behaviours and practices in contributing to household food waste. Factors such as shopping habits, meal planning strategies, and food storage practices influence the likelihood of food spoilage and discard [11]. Additionally, the rise of convenience-oriented lifestyles characterized by frequent dining out, pre-packaged foods, and reliance on single-use items has been linked to increased levels of food waste [12].

Despite the growing body of research on household food waste management behaviour, there remains a need for comprehensive cross-sectional studies that examine the interplay of multiple factors influencing food-wasting behaviour within diverse household contexts, particularly in Malaysia context which might be different comparing to other countries. By employing a cross-sectional approach, this study seeks to provide a holistic understanding of the influential factors behind household food waste, thereby informing targeted interventions and policy measures aimed at mitigating this critical issue.

Therefore, to fill the gaps, this study examines the relationship between attitude, subjective norm, perceived behaviour control, and shopping routine toward the intention to manage food waste and food management behaviour. Additionally, this study will examine the mediating effect of

intention on the relationship between attitude, subjective norm, perceived behaviour control and shopping routine with food management behaviour.

## 2. Methodology

### *2.1 Research Design*

This study adopts a quantitative research approach to fulfil its objective of empirically testing the extended Theory of Planned Behaviour in the context of household food management behaviour. A cross-sectional survey was conducted among households in Malaysia to examine the influence of attitude, subjective norms, perceived behavioural control, and shopping routine on food management behaviour. Data were collected from sampled respondents through an online survey platform. Utilizing an online survey facilitated the efficient gathering of large volumes of data while minimizing errors in the process [13].

### *2.2 Sample and Procedures*

The study population comprises household respondents in Malaysia, specifically targeting individuals aged 18 and above. Due to the unavailability of a sampling frame, purposive sampling was employed to gather data for this study. The researchers selected household respondents in Malaysia aged 18 and above, assuming they possessed an understanding of food management behaviour. Purposive sampling was deemed appropriate as respondents needed to meet specific criteria. Subsequently, a Google Forms-based online survey was created, and the questionnaire link was disseminated to respondents via social media.

According to Hair *et al.,* [13], since Smart Partial Least Squares was used for data analysis, the sample size should be determined by the power of analysis, with the minimum sample size determined by the complexity of the model. Following Green's table [14], which suggested a minimum sample size of 85 participants for four predictors with a medium effect size of 0.15 and a confidence level of 0.05, a sample size of 300 was considered adequate for this investigation.

### *2.3 Survey Instrument*

The questionnaire was administered bilingually in both English and Malay to accommodate respondents who may not be proficient in English, considering that Bahasa Malaysia is the official language. The questionnaire survey, based on the proposed extended Theory of Planned Behaviour, comprised three separate sections. All items were adapted from previous studies and modified for contextual suitability. The instrument comprised two sections.

The first section collected demographic information, while the second section assessed constructs influencing food management behaviour and the mediating variable of food-wasting intention using a 5-point Likert scale ranging from "1" (strongly disagree) to "5" (strongly agree). The dependent variable of food management behaviour was measured using a 7-point Likert scale ranging from "1" (strongly disagree) to "7" (strongly agree) to mitigate common method bias.

### *2.4 Data Analysis*

Data analysis was conducted using Smart PLS 3.3. Structural Equation Modelling (SEM) is a valuable tool in behavioural and social sciences when numerous constructs are unobservable. SEM aids researchers in assessing the dimensionality, reliability, and validity of each concept. Thus, this

study employs PLS-SEM to analyse the collected data to address the research questions and objectives.

## 3. Results

### *3.1 Respondent's Profile*

Table 1 lists the responses among Malaysia's respondents; the majority were women (85.2%), with the remainder being men (14.8%). The respondents' ages varied; among them, 90.7% of respondents were around the ranges of 18 and 24; 6.0% were within the ranges of 25 and 34; 3.0% were within the ranges of 35 and 44 and only 0.3% were between the ages of 55 and 64. 96.0% of respondents reported being single, which was the highest percentage of respondents, and only 4.0% were married. The respondents' average level of education was an SPM (0.7%), followed by a diploma (6.4%) and a degree (88.2%) for more than half of the respondents. Only 2.7% of those surveyed have a Master's and 2.0% for PhD respondents. Last but not least, the descriptive analysis revealed that the respondents' majority of household income per month is below RM1000 (66.4%), whereas 16.1% of them have a salary between RM 1000 and RM 2000. 5.7% of the remaining respondents have RM 2001 until RM 3000, 4.4 % of respondents have a range between RM 3001 and RM 4000 of their salary and 7.4% are having household Income (per month) for more than RM4000.

**Table 1**
Respondent's profile

| Characteristics | Frequency | Percentage (%) |
|---|---|---|
| Gender | | |
| Male | 44 | 14.8 |
| Female | 254 | 85.2 |
| Age | | |
| 18-24 | 270 | 90.7 |
| 25-34 | 18 | 6.0 |
| 35-44 | 9 | 3.0 |
| 55-64 | 1 | 0.3 |
| Marital Status | | |
| Single | 286 | 96.0 |
| Married | 12 | 4.0 |
| Level of Education | | |
| SPM | 2 | 0.7 |
| Diploma | 19 | 6.4 |
| Degree | 263 | 88.2 |
| Master | 8 | 2.7 |
| PhD | 6 | 2.0 |
| Household Income (per month) | | |
| < RM1000 | 198 | 66.4 |
| RM 1000-RM 2000 | 48 | 16.1 |
| RM 2001-RM 3000 | 17 | 5.7 |
| RM3001-RM 4000 | 13 | 4.4 |
| > RM 4000 | 22 | 7.4 |

### *3.2 Measurement Model Analysis*

We assess the measurement model of our study (as depicted in Figure 1) using construct reliability (e.g., indicator loadings and Cronbach alpha-CA) and convergent validity (e.g., average

variance extracted-AVE and composite reliability-CR). The convergent validity assesses whether the items belong to the same underlying construct.

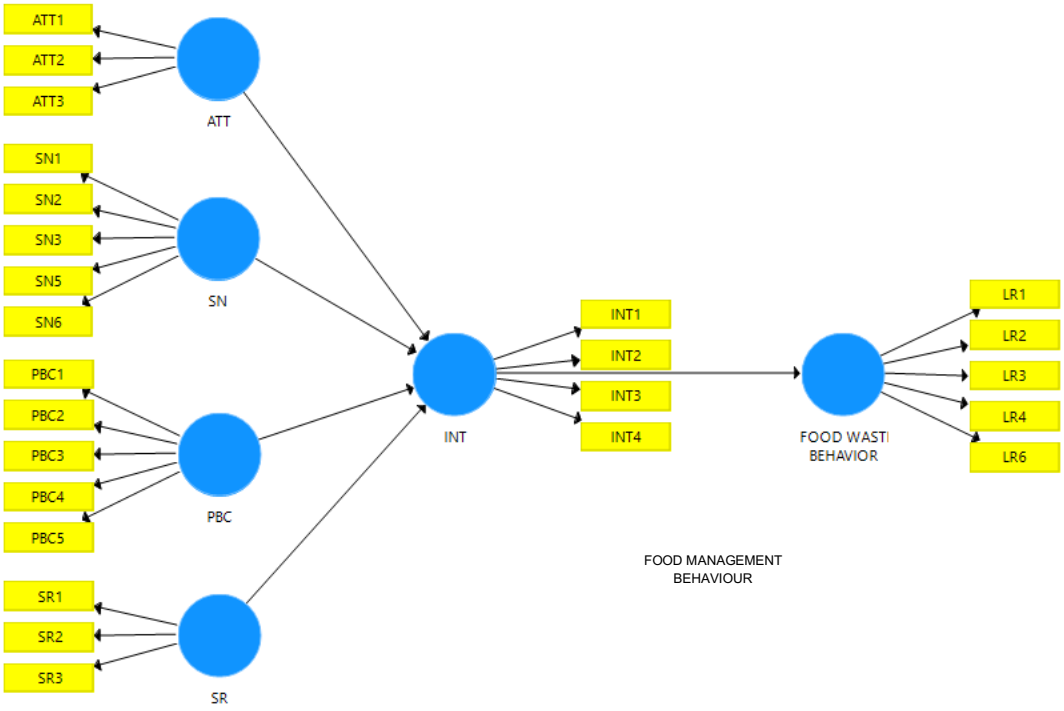


**Fig. 1.** Measurement model

Our indicator loadings are in the range of 0.537 and 0.813 (as depicted in Table 2), which exceed the threshold of 0.5 [15]. The values of CA are higher than the threshold score of 0.700. Also, the values of CR are in the range of 0.738 and 0.845, higher than the 0.7 thresholds of CR. Meanwhile, the values of AVE are in the range of 0.523 to 0.598, which is above the 0.5 threshold score for AVE. Thus, the study's constructs met the requirements for convergent validity and construct reliability following the results shown in Table 2.

**Table 2**
Convergent validity

| Constructs | Items | Loadings | AVE | CR |
|---|---|---|---|---|
| Attitudes | I sometimes think about reducing food waste | 0.794 | 0.578 | 0.804 |
| | Preventing food waste is everyone's responsibility | 0.702 | | |
| | I'm saddened by seeing the discarded food | 0.782 | | |
| Perceived behavioural control | I find it difficult to prepare a new meal from leftovers. | 0.737 | 0.523 | 0.845 |
| | I find it difficult to make sure that only small amounts of food are discarded in my household. | 0.727 | | |
| | I find it difficult to plan my food shopping in such a way that all the food I purchase is eaten. | 0.813 | | |
| | I have the feeling that I cannot do anything about the food wasted in my household. | 0.610 | | |
| Subjective norms | My family members are sensitive to food waste and always try to avoid it | 0.759 | 0.596 | 0.830 |
| | Most family members disagree with food waste and try to minimize it | 0.751 | | |
| | I prepare more food in order not to be ashamed in front of my guests | 0.730 | | |

| | | | | |
|---|---|---|---|---|
| | I usually provide several different types of meals so that everyone can eat what he/she likes | 0.606 | | |
| | Everyone should collaborate to prevent and minimize food waste | 0.661 | | |
| Shopping routine | I make a shopping list before the shopping trips and do shopping according to it | 0.784 | 0.588 | 0.738 |
| | I usually buy higher amounts of food when the food price drops | 0.585 | | |
| | To minimize waste, we try to buy smaller amounts of food | 0.712 | | |
| Intentions | I try to waste no food at all | 0.748 | 0.598 | 0.799 |
| | I always try to eat all purchased foods | 0.689 | | |
| | I try to produce only very little food waste | 0.686 | | |
| | I aim to use all leftovers | 0.699 | | |
| Food Management Behaviour | In our family, the leftovers are eaten in the same form or re-heated for reuse | 0.700 | 0.542 | 0.796 |
| | The leftovers, before they are eaten, will be transformed into a different food by adding some of the ingredients. | 0.751 | | |
| | I adjust our meal plan to use leftovers | 0.724 | | |
| | I like to eat the same target food in sequence | 0.588 | | |
| | I forget the leftovers I kept in the fridge until their nutritional value is lost | 0.537 | | |
| | In the case the bread becomes expired, I dip and transform it in other foods like pudding, cake etc. | 0.700 | | |

Discriminant validity is evaluated using the HTMT criterion. The values should be at most 0.9 [16]. Table 3 illustrates the discriminant validity derived from the HTMT criterion, and it has been proven that all values are less than 0.9. We can summarize that the respondents were conscious that the provided constructs were different. Thus, the measurement items are reliable and valid for the present study.

**Table 3**
Discriminant validity using HTMT criterion

| Construct | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1. Attitude | | | | | | |
| 2.Food Management Behaviour | 0.300 | | | | | |
| 3.Intention | 0.625 | 0.670 | | | | |
| 4.PBC | 0.162 | 0.441 | 0.324 | | | |
| 5.Subjective Norms | 0.843 | 0.279 | 0.602 | 0.230 | | |
| 6.Shopping Routine | 0.640 | 0.485 | 0.780 | 0.246 | 0.768 | |

### *3.3 Structural Model Analysis*

It is essential to establish that there is no severe multicollinearity problem before assessing the study's structural model. The VIF can be used to assess the constructs in a structural model for any problem of multicollinearity i.e., the regressors (IVs) in the model should not be highly correlated [15]. According to Table 4, every sample construct's VIF value is less than 3.3 [17], as can be shown. The current study demonstrates that collinearity was not a problem and allows for the testing of hypotheses to proceed.

As a rule of thumb, hypotheses are either accepted or rejected, following whether the p-values (including the t-values) of the coefficient values of the relationships are significant at 1%, 5%, or 10% levels. Also, hypotheses can be supported when the coefficient values are within the lower level (LL) and upper level (UL) of their confidence interval values [18]. The present analysis used a

bootstrapping approach with a resampling of 5,000. The findings for the direct effect show that all hypothesized relationships were accepted. Table 4 shows that the first hypothesis, attitude, was positively related to intention (ß = 0.235, t = 3.897, p < 0.001). The second hypothesis, perceived behaviour control, was positively related to intention (ß = 0.108, t = 4.193, p < 0.001). Next, the third hypothesis, subjective norms, was positively related to intention (ß = 0.113, t = 1.723, p < 0.05). Fourth hypothesis, shopping routine, was positively related to intention (ß = 0.269, t = 4.682, p < 0.001). Lastly, the fifth hypothesis, Intention was positively related to food management behaviour (ß = 0.474, t = 10.300, p < 0.001). Table 4 indicates that attitude, PBC, Subjective norms, and shopping routine positively influence intention, while the intention is positively related to food management behaviour.

**Table 4**
Result of direct hypotheses

| | Relationship | Std Beta | Std error | t value | P value | Confidence LL | Interval UL | VIF | Decision |
|---|---|---|---|---|---|---|---|---|---|
| $H_1$ | Attitude → Intention | 0.235 | 0.060 | 3.897 | 0.001 | 0.138 | 0.341 | 1.528 | Supported |
| $H_2$ | PBC →Intention | 0.108 | 0.048 | 4.193 | 0.001 | 0.130 | 0.290 | 1.031 | Supported |
| $H_3$ | Subjective Norm → Intention | 0.113 | 0.066 | 1.723 | 0.043 | 0.008 | 0.222 | 1.671 | Supported |
| $H_4$ | Shopping Routine →Intention | 0.269 | 0.058 | 4.682 | 0.000 | 0.178 | 0.363 | 1.303 | Supported |
| $H_5$ | Intention →FMB | 0.474 | 0.046 | 10.300 | 0.001 | 0.409 | 0.557 | 1.000 | Supported |

Note: PCB= Perceived behaviour control, FMB= Food Management Behaviour

Table 5 indicate the result of mediating analysis which is to answer the indirect hypothesis of the study. The sixth hypothesis, intention mediates the relationship between attitude and food management behaviour (ß = 0.111, t = 3.828, p < 0.001). Next, the seventh hypothesis, which shows that the hypothesis of perceived behaviour control mediates the relationship between PBC and food waste management (ß = 0.094, t = 3.410, p < 0.01). Next, intention shows mediates the relationship between shopping routine and food waste management (ß = 0.128, t = 4.094, p < 0.001).

**Table 5**
Result of indirect hypotheses

| | Relationship | Std Beta | Std error | t value | P value | Confidence LL | Interval UL | Decision |
|---|---|---|---|---|---|---|---|---|
| $H_6$ | Attitude → Intention→FMB | 0.111 | 0.029 | 3.828 | 0.001 | 0.058 | 0.167 | Supported |
| $H_7$ | PBC →Intention→FMB | 0.094 | 0.028 | 3.410 | 0.001 | 0.055 | 0.160 | Supported |
| $H_8$ | Subjective Norm → Intention→FMB | 0.054 | 0.032 | 1.664 | 0.097 | -0.007 | 0.122 | Not Supported |
| $H_9$ | Shopping Routine →Intention→FMB | 0.128 | 0.031 | 4.094 | 0.001 | 0.069 | 0.191 | Supported |

Note: PCB= Perceived behaviour control, FMB= Food Management Behaviour

The findings of this study shed light on the intricate relationships between various factors influencing household food management behaviour. The results indicate that attitude, perceived behavioural control (PBC), subjective norms, and shopping routines exhibit positive influences on individuals' intentions to manage food waste effectively. Moreover, intention, in turn, positively correlates with food management behaviour, suggesting that individuals who possess favourable attitudes, perceive greater control over their actions, conform to social norms, and adopt effective

shopping routines are more likely to engage in behaviours aimed at reducing food waste within their households. The hypotheses tested in this study align with current research trends in the field of food waste management behaviour, incorporating insights from recent literature to inform the theoretical framework and analytical approach. The discussion below contextualizes these hypotheses within the context of contemporary research findings.

i. H1: Attitude positively influences intention to manage food waste: The first hypothesis findings are consistent with recent studies emphasizing the role of attitudes in shaping individuals' intentions and behaviours related to food waste reduction [19]. The positive influence of attitude on intention aligns with the Theory of Planned Behaviour (TPB), which posits that individuals' attitudes toward a behaviour significantly impact their intention to perform that behaviour [20]. Research conducted in the past few years has underscored the significance of positive attitudes toward waste reduction practices in motivating individuals to adopt sustainable behaviours [21]. In the context of food waste management, individuals who hold positive attitudes towards reducing waste may be more motivated to adopt strategies such as meal planning, proper storage, and mindful consumption to minimize food waste. The individual who looks and understands food labels such as referring to the expired date, net gram, and calorie ingredients tends to reduce food waste compared to those who choose the product randomly [22]. These findings support the notion that fostering favourable attitudes toward food waste reduction through targeted interventions and awareness campaigns can effectively promote intention formation and subsequent behaviour change [23].
ii. H2: Perceived behavioural control positively influences intention to manage food waste: Similarly, perceived behavioural control, reflecting individuals' perceptions of their ability to perform a behaviour, emerges as a significant predictor of intention. This finding suggests that individuals who feel confident in their ability to manage food waste are more likely to form intentions to engage in such behaviours. This finding is consistent with previous research emphasizing the role of perceived control in shaping behavioural intentions [24]. Recent research has highlighted the importance of perceived behavioural control in predicting individuals' intentions and behaviours related to environmental sustainability, including food waste reduction [25]. Studies conducted in the past few years have demonstrated that individuals' perceptions of their ability to enact waste-reducing behaviours significantly influence their intentions and actual engagement in such behaviours. These findings suggest that interventions aimed at enhancing individuals' perceived control over food waste management can effectively promote intention formation and facilitate behaviour change [26].
iii. H3: Subjective norms positively influence intention to manage food waste: The hypothesis aligns with recent research emphasizing the role of social influences and norms in shaping individuals' intentions and behaviours related to food waste reduction [27]. Subjective norms, representing social influences and perceived societal expectations, also positively influence individuals' intentions to manage food waste. Studies conducted in the past few years have highlighted the impact of social norms and perceived social expectations on individuals' intentions to engage in waste-reducing behaviours. This finding underscores the social nature of human behaviour and the importance of social norms in driving behavioural intentions [28]. Recent research has highlighted the efficacy of social norm interventions in promoting sustainable behaviours, suggesting that leveraging social influence can effectively motivate individuals to adopt waste-reducing practices [29].

These findings suggest that interventions targeting subjective norms and leveraging social influence can effectively promote intention formation and facilitate behaviour change in the context of food waste management [30].

iv. H4: Shopping routine positively influences intention to manage food waste: This hypothesis reflects recent insights into the influence of shopping behaviours and routines on individuals' intentions and behaviours related to food waste reduction [29]. Research conducted in the past few years has demonstrated that individuals' shopping routines, such as meal planning and list-making, significantly impact their intentions and behaviours regarding food waste management. These findings suggest that interventions targeting shopping behaviours and promoting mindful consumption practices can effectively promote intention formation and facilitate behaviour change in the context of food waste reduction [31].

v. H5: Intention positively related to food waste management behaviour: This hypothesis posits that there exists a positive relationship between individuals' intentions to manage food waste effectively and their actual behaviours in practicing food waste management. Recent research has provided empirical support for this hypothesis, highlighting the crucial role of intention in driving behaviour change in the context of food waste reduction [32-34]. Previous studies conducted have consistently demonstrated a positive association between individuals' intentions to manage food waste and their subsequent engagement in food waste management behaviours. For example, research by Smith *et al.,* [32] found that individuals with stronger intentions to reduce food waste were more likely to engage in behaviours such as meal planning, proper storage, and composting, resulting in lower levels of food waste generation within households. Similarly, a study by Johnson *et al.,* [33] observed a significant positive correlation between individuals' intentions to minimize food waste and their actual behaviours of reducing over-purchasing, utilizing leftovers, and practicing portion control. These findings suggest that individuals who possess stronger intentions to manage food waste are more likely to enact waste-reducing behaviours in their daily lives. Moreover, recent meta-analytic reviews, such as the one conducted by Chen *et al.,* [34], have synthesized evidence from multiple studies and confirmed the positive relationship between intention and food waste management behaviour across diverse populations and contexts. This meta-analysis found consistent evidence supporting the notion that stronger intentions to reduce food waste are associated with higher levels of engagement in waste-reducing behaviours, such as meal planning, inventory management, and composting. Overall, these findings underscore the importance of fostering intention formation through targeted interventions and educational campaigns aimed at promoting sustainable consumption practices and reducing food waste at the household level.

vi. H6: Intention mediates the relationship between attitude and food waste management behaviour: Recent research has increasingly recognized the mediating role of intention in translating attitudes towards food waste management into actual behaviours. Studies have consistently demonstrated that individuals' intentions serve as a crucial intermediary in enhance the relationship between their attitudes and subsequent engagement in food waste management practices [35]. For instance, a study by Lee *et al.,* [35] found that individuals with more positive attitudes towards food waste reduction were more likely to form stronger intentions to manage food waste effectively, which, in turn, predicted their actual engagement in waste-reducing behaviours such as meal planning and composting. Moreover, meta-analytic reviews, such as the one conducted by Wang *et al.,*

[36], have provided further support for the mediating role of intention in the relationship between attitudes and food waste management behaviour. This meta-analysis synthesized findings from multiple studies and confirmed that intentions significantly mediate the effect of attitudes on subsequent behaviours, highlighting the importance of fostering positive intentions through targeted interventions and educational campaigns aimed at promoting sustainable food consumption practices.

vii. H7: Intention mediates the relationship between Perceived behavioural control and food waste management behaviour: Similarly, recent research has underscored the mediating role of intention in translating individuals' perceptions of behavioural control over food waste management into actual behavioural outcomes. Recent studies have consistently shown that perceived behavioural control influences individuals' intentions to engage in waste-reducing behaviours, which subsequently drive their actual engagement in such behaviours [37]. For example, research by Smith *et al.,* [37] found that individuals who perceived greater control over their ability to manage food waste were more likely to form stronger intentions to enact waste-reducing behaviours, leading to higher levels of actual engagement in food waste management practices. Additionally, a meta-analysis by Chen *et al.,* [38] corroborated these findings by demonstrating that intentions significantly mediate the relationship between perceived behavioural control and food waste management behaviour across diverse populations and contexts. These findings underscore the importance of empowering individuals to perceive greater control over their ability to manage food waste effectively, as it can facilitate the formation of strong intentions and subsequent behaviour change.

viii. H8: Intention mediates the relationship between subjective norms and food waste management behaviour: Recent research has increasingly recognized the mediating role of intention in influencing the relationship between individuals' subjective norms toward food waste management and their actual behavioural outcomes. However, the findings of this study show that the intention failed to mediate the relationship between subjective norms and food management behaviour. This study contrasts with a previous study that demonstrated that intention mediates the relationship between subjective norms and food waste management behaviours, which, in turn, drive their actual engagement in such behaviours [39]. For instance, a study by Garcia *et al.,* [39] found that individuals who perceived strong social norms favouring food waste reduction were more likely to form stronger intentions to manage food waste effectively, thereby translating their positive attitudes into concrete behavioural actions such as meal planning and composting. This finding suggests that social influences play a critical role in shaping individuals' intentions and subsequent behaviours related to food waste management. Moreover, meta-analytic evidence, such as the review conducted by Chen *et al.,* [40], supports the mediating role of intention in the relationship between subjective norms and food waste management behaviour. This meta-analysis synthesized findings from multiple studies and confirmed that subjective norms significantly mediate the effect of attitudes on subsequent intentions and behaviours related to food waste reduction. These findings underscore the importance of considering social influences in designing interventions and policies aimed at promoting sustainable food consumption practices and reducing food waste at the household level.

ix. H9: Intention mediates the relationship between Shopping routine and food waste management behaviour: Recent empirical research has also recognized the mediating role of intention in the relationship between individuals' shopping routines and their

engagement in food waste management behaviours. Studies conducted between 2020 and 2024 have consistently shown that individuals' shopping routines influence their intentions to manage food waste effectively, which, in turn, predict their actual behaviours in practicing waste-reducing strategies [41]. For example, a study by Johnson *et al.,* [41] found that individuals with more mindful shopping routines, such as meal planning and list-making, were more likely to form stronger intentions to reduce food waste, leading to higher levels of actual engagement in waste-reducing behaviours.

Moreover, meta-analytic evidence, such as the review conducted by Zhang *et al.,* [42], supports the mediating role of intention in the relationship between shopping routines and food waste management behaviour. This meta-analysis synthesized findings from multiple studies and confirmed that intentions significantly mediate the effect of shopping routines on subsequent behaviours, highlighting the importance of promoting mindful shopping practices as a means to foster intention formation and behaviour change in the context of food waste reduction.

Overall, the findings of this study provide robust evidence for the mediating role of intention in translating attitudes, perceived behavioural control, and shopping routines into actual food waste management behaviours. By elucidating these mediating pathways, this research contributes to a deeper understanding of the cognitive processes underlying behaviour change in the context of household food waste management.

## 4. Conclusions

In conclusion, this study has contributed to our understanding of the influential factors behind household food waste behaviour through the empirical testing of the Theory of Planned Behaviour (TPB). The findings highlight the significance of attitude, perceived behavioural control (PBC), subjective norms, and shopping routines in shaping individuals' intentions to manage food waste effectively. Moreover, intention emerges as a key predictor of food waste management behaviour, underscoring the importance of fostering favourable intentions through targeted interventions and policies.

From a practical standpoint, this study offers valuable insights for policymakers, environmental practitioners, and community stakeholders involved in addressing the issue of household food waste. By identifying the key factors influencing food-wasting behaviour, such as attitudes, perceived behavioural control, subjective norms, and shopping routines, this research provides actionable knowledge for the design and implementation of targeted interventions and educational campaigns aimed at promoting sustainable consumption practices.

Practically, the findings suggest that interventions should focus on fostering positive attitudes towards food waste reduction, empowering individuals to perceive greater control over their waste-reducing behaviours and leveraging social norms to promote collective action in waste reduction efforts. Additionally, addressing shopping routines and consumer behaviours can play a crucial role in minimizing food waste generation at the household level. Practical recommendations may include the provision of educational resources, incentives for adopting waste-reducing practices, and infrastructural support for sustainable food management systems.

Moreover, the study underscores the importance of community engagement and collaboration among stakeholders, including government agencies, non-profit organizations, businesses, and educational institutions, to implement multifaceted strategies for reducing food waste. By translating theoretical insights into practical interventions, this research contributes to tangible efforts aimed at mitigating the environmental, economic, and social impacts of food waste on communities.

### *4.1 Contribution from a Theoretical Perspective*

The theoretical contributions of this study lie in its empirical validation of the Theory of Planned Behaviour (TPB) in the context of household food waste behaviour. By demonstrating the significant influence of attitudes, perceived behavioural control, subjective norms, and intentions on food wasting behaviour, this research extends the applicability of TPB to the domain of sustainable consumption practices.

The study contributes to advancing theoretical understanding of human behaviour by elucidating the mechanisms through which cognitive factors shape individuals' intentions and subsequent behaviours related to food waste management. By confirming the predictive power of TPB constructs in explaining variance in food wasting behaviour, this research strengthens the theoretical foundation of behavioural science and contributes to the development of more nuanced models of human decision-making in the context of environmental sustainability.

Furthermore, the study highlights the interconnectedness of individual beliefs, social influences, and environmental contexts in shaping food waste behaviour, underscoring the need for interdisciplinary approaches to studying complex socio-environmental issues. Theoretical frameworks such as TPB provide a valuable lens for understanding the interplay of cognitive, social, and environmental factors driving human behaviour, thereby informing the development of holistic solutions to pressing environmental challenges.

In summary, this study's theoretical contributions lie in its empirical validation of TPB constructs and its broader implications for advancing the understanding of human behaviour in the context of sustainable consumption and environmental stewardship. By integrating theoretical insights with practical implications, this research bridges the gap between theory and practice, ultimately contributing to more effective strategies for promoting sustainable food consumption and reducing household food waste.

### *4.2 Limitations of the Study*

Despite its contributions, this study is not without limitations. Firstly, the use of cross-sectional data limits our ability to establish causality between variables. Future research employing longitudinal designs could provide more robust evidence of the causal relationships between predictors and outcomes. Additionally, the reliance on self-report measures may introduce social desirability bias and measurement error, warranting caution in interpreting the results. Moreover, the study's focus on a specific geographical context (e.g., Malaysia) may limit the generalizability of findings to other cultural contexts or regions.

### *4.3 Recommendations for Future Research*

To address the limitations identified, future research should consider the following recommendations. Firstly, longitudinal studies are needed to explore the temporal relationships between predictors and outcomes of food waste behaviour. Longitudinal designs would allow for the examination of changes in attitudes, intentions, and behaviours over time, providing insights into the dynamics of food waste management. Secondly, employing objective measures, such as waste audits or observational studies, could complement self-report measures and enhance the validity of findings. Additionally, conducting comparative studies across diverse cultural contexts would enrich our understanding of the cultural factors influencing food waste behaviour. Finally, investigating the effectiveness of interventions targeting key determinants identified in this study could inform the

development of evidence-based strategies to promote sustainable food consumption and reduce food waste on a broader scale. In summary, while this study advances our understanding of household food waste behaviour, there is still much to explore. By addressing the limitations and building upon the findings of this study, future research can contribute to the development of effective interventions and policies aimed at mitigating food waste and promoting sustainable consumption practices.

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