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Determinants of Urban Recycling Behaviour: Evidence from Seremban, Malaysia

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Abstract
Rapid urban growth creates environmental challenges, making effective waste management crucial for sustainable cities. This study examines recycling intention among urban communities in Seremban, focusing on attitudes, subjective norms, and perceived behavioural control. A survey of 110 residents revealed that all three factors positively influence recycling intention, with subjective norms being the strongest predictor. This suggests that social expectations and community influence play a significant role in promoting recycling practices. The findings emphasise the importance of community engagement and social support, offering practical insights for policymakers to design strategies that promote sustainable waste management and urban sustainability.

Keywords: Recycling intention; attitudes; subjective norms; perceived behavioural control

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1.0 Introduction

Recycling is a sustainable and practical approach to managing household waste, offering environmental benefits such as reducing pollution and conserving natural resources. Household waste, also known as municipal solid waste, comprises the waste generated daily by communities (Schuster et al., 2019). Rapid urbanisation and population growth have significantly increased the volume of municipal solid waste, making effective waste management increasingly critical. In 2016, cities worldwide generated over 2.01 billion tonnes of solid waste, with an average per capita generation of approximately 740 grams per day. East Asia and the Pacific accounted for the largest share (23%), followed by Europe and Central Asia (20%) and South Asia (17%). The World Bank projects that global waste generation will increase from 2.01 billion tonnes in 2016 to 3.40 billion tonnes by 2050, with at least 33% currently mismanaged through open dumping or burning. In this context, household waste recycling is crucial for enhancing waste management efficiency and minimising environmental impacts

Recycling is a key component of sustainability, particularly in waste management and environmental health. Globally, the increasing generation of waste without effective disposal solutions poses serious environmental and public health risks (Osama & Lamma, 2021). The adoption of the 3Rs (reduce, reuse and recycle) supports resource conservation and reduces dependence on virgin materials

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(Crunden, 2022). In Malaysia, the concept of a Material Cycle Society was introduced in the early 2000s to enhance resource use efficiency, minimise waste generation at the source, and reduce landfill dependency. This initiative aligns with the Sustainable Development Goals, particularly SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action) (Tiew et al., 2019). Despite these efforts, public participation in recycling remains limited. Although many Malaysians exhibit positive attitudes and basic awareness of recycling, these intentions are often not translated into actual recycling behaviour. The heterogeneous nature of municipal solid waste, coupled with the complexity of waste segregation and limited knowledge of electronic waste management, continues to hinder effective recycling practices (Hunn, 2022; Tiew et al., 2019).

In Malaysia, recycling culture remains weak, particularly among communities residing in rural areas, where inadequate facilities, poor waste management practices, and low environmental awareness often limit pro-environmental behaviour. In contrast, urban communities generally demonstrate a stronger commitment to pro-environmental behaviour. According to environmental deprivation theory, urban residents tend to exhibit greater concern for their local environment and engage in a broader range of pro-environmental activities (Dąbrowski et al., 2022). However, despite various community-based collective initiatives aimed at enhancing waste management awareness in urban settings, recycling practices among Malaysians have shown limited improvement.

The Malaysian government has introduced several initiatives to promote recycling, including the Separation at Source Initiative (SSI), which is supported by awareness campaigns and enforcement measures, such as fines imposed on households and businesses that fail to separate recyclable and non-recyclable waste. Nevertheless, these enforcement mechanisms have not been consistently or effectively implemented, undermining the overall effectiveness of the programme (Razi et al., 2022).

Although urban communities display relatively stronger pro-environmental orientations, weak enforcement and inconsistent implementation have contributed to low levels of recycling awareness and practice. These challenges suggest that insufficient knowledge and awareness negatively influence attitudes towards recycling, while inadequate enforcement reduces public engagement with recycling initiatives. Accordingly, this study aims to examine the factors influencing recycling intentions, focusing on attitudes, subjective norms, and perceived behavioural control, as proposed by the Theory of Planned Behaviour (TPB), to better understand the barriers to effective recycling behaviour.

2.0 Literature Review

Recycling is recognised as an environmentally responsible practice; individuals may refrain from engaging in proper recycling due to time constraints or perceived efforts (Steg et al., 2014). This suggests that recycling behaviour can be conceptualised as a form of planned behaviour influenced by social cognitive factors (Ajzen, 1991). In this regard, the Theory of Planned Behavior (TPB) provides an appropriate theoretical framework for the present study.

According to TPB, an individual's intention to perform a specific behavior is determined by three key factors: attitude, subjective norms, and perceived behavioral control. Behavioral intention, in turn is strongly associated with actual behavior (Conner & Armitage, 1998). TPB has been widely applied to explain various pro-environmental behaviours, including the adoption of green transportation (de Groot & Steg, 2007), water conservation (Lam, 2006), and household recycling (Mannetti et al., 2004).

However, behavioral formation is a complex process and may be influenced by contextual factors beyond core social cognitive variables. Consequently, an increasing number of studies have extended the TPB by incorporating additional determinants (e.g., Perugini & Bagozzi, 2001; Sabbir & Taufique, 2021). In the context of recycling, knowledge plays a significant role as effective recycling requires an understanding of appropriate practices (Rosenthal & Leung, 2020). Previous research has shown that individuals who recycle are generally better informed about recycling processes than those who do not (Vining & Ebreo, 1990). Accordingly, this study adopts the TPB framework to examine recycling intentions in shaping pro-environmental behaviour.

2.1 Recycling Intention

According to the United States Environmental Protection Agency (2023), recycling involves collecting, processing, and transforming materials that would otherwise be discarded as waste. The practice of recycling offers numerous benefits; for instance, the EPA projects that recycling 37% of generated waste could lead to a 65% reduction in landfill usage. This significant decrease has led to fewer waste materials being directed to landfills because of the recycling process. Recent years have seen an increased awareness of environmental issues, leading to a rise in recycling activities from various initiatives and programs implemented by governments and non-governmental organisations (NGOs).

Recycling intention refers to an individual's willingness to engage in recycling behaviours (Mamun et al., 2018). For instance, a person with a strong sense of responsibility or conviction regarding the importance of recycling is likely to actively promote recycling efforts and tackle environmental challenges, thereby contributing to a healthier planet. Consequently, recycling intention plays a vital role in addressing issues related to waste management. Additionally, Liu and Yang (2022) provide a further definition, highlighting that personal norms, behavioural skills, social motivation, ascription of responsibility, and indirect personal motivation influence recycling intention. This underscores the various internal and external factors that affect an individual's intention to recycle. Furthermore, recycling intention is closely aligned with prominent behavioural theories, such as the TPB, which emphasises pro-environmental intentions and actions like those associated with recycling (Mamun et al., 2018).

2.2 Attitude

One key factor influencing recycling intention is an individual's attitude. A person with a strong sense of discipline and a positive attitude is more likely to recognise the importance of recycling and commit to it (Izagirre Olaizola et al., 2014). According to the TPB, attitude

refers to an individual's positive or negative evaluations of their own ability to perform a specific behaviour. This concept is particularly relevant to recycling intention, which is influenced by various aspects of an individual's beliefs, opinions, and values regarding the necessity of participating in recycling efforts. A strong sense of moral obligation is a significant factor influencing their personal beliefs and perceptions. For instance, a person with a strong moral obligation or ethical values related to recycling is likely to engage in behaviours that support environmental sustainability and to perceive recycling positively (Jia et al., 2017). This indicates that attitude plays a significant role in promoting environmental sustainability and can influence an individual's mindset and actions, encouraging positive and effective recycling behaviours. Individuals with greater eco-centric environmental concerns tend to have more positive attitudes towards recycling (Jain et al., 2020). In summary, an individual's personal attitude plays a crucial role in shaping their perceptions, behaviours, and moral and ethical values related to recycling. When someone fosters strong beliefs that align with positive values, such as a commitment to recycling, they can make a significant contribution to initiatives aimed at promoting a sustainable environment and building a better future. These attitudes will later influence their intention to recycle. Based on the theoretical arguments and empirical evidence reviewed above, the proposed hypothesis is:
H1: There is a significant relationship between attitudes towards recycling intention.

2.3 Subjective Norms

In the TPB, subjective norms refer to an individual's perception of how important people in their lives, such as friends, family, and society at large, view certain behaviours (Fan, 2021). Essentially, a person's actions are significantly shaped by the reactions and approval of those around them. When individuals receive positive responses from their social circles, they are more inclined to engage in certain behaviours. In contrast, negative feedback tends to discourage those actions. This emphasises that the level of approval, disapproval, or encouragement from important figures can significantly influence the likelihood of a person performing a particular behaviour (Alhamad & Donyai, 2021). Sulaiman and Chan (2019) define subjective norms as the ways in which individuals align their behaviour with societal expectations and pressures. People often feel anxious about how others perceive them and what is expected of them, which in turn influences their actions. This dynamic is usually referred to as "social pressure" or "peer pressure" in contemporary discussions. Subjective norms bear a strong resemblance to the concept of peer pressure, as individuals are influenced by the opinions and reactions of those around them. Farooq et al. (2020) further explore the relationship between social pressure and subjective norms, emphasising that both are shaped by the influences of close acquaintances, friends, and family. Individuals influenced by subjective norms tend to act in accordance with the reactions and approval of those around them. Consequently, it is essential for them to receive positive reinforcement to support their intention to recycle. When household members in Seremban actively support and endorse recycling efforts, this encouragement can significantly enhance an individual's commitment, ultimately leading to meaningful recycling actions. Therefore, the proposed hypothesis is as follows:
H2: There is a significant relationship between subjective norms and recycling intention.

2.4 Perceived Behavioural Control

According to Ajzen (1991), a fundamental concept from the TPB is perceived behavioural control (PBC). This concept focuses on an individual's belief in their capacity to execute a specific behaviour. Essentially, PBC reflects the extent to which a person feels confident and capable of taking the necessary actions to achieve a desired outcome. It is important that individuals with high PBC generally show strong confidence in their ability to engage in certain behaviours, whereas those with low PBC may struggle with this confidence (Conner, 2020). In investigating recycling intentions, perceived behavioural control (PBC) plays a vital role in shaping these intentions among the communities of Seremban, Negeri Sembilan. According to the TPB proposed by Ajzen (1991), urban residents in Seremban are more likely to develop strong recycling intentions when they feel confident in their ability to manage the recycling process effectively. Consequently, when these communities demonstrate a high level of perceived behavioural control, they are more inclined to recognise a moral obligation to recycle. This positive outlook on recycling as a possible practice motivates them to invest greater effort in adopting recycling behaviours (Sudin et al., 2023). Therefore, the hypothesis proposed is as follows:
H3: There is a significant relationship between perceived behavioural control and recycling intention.

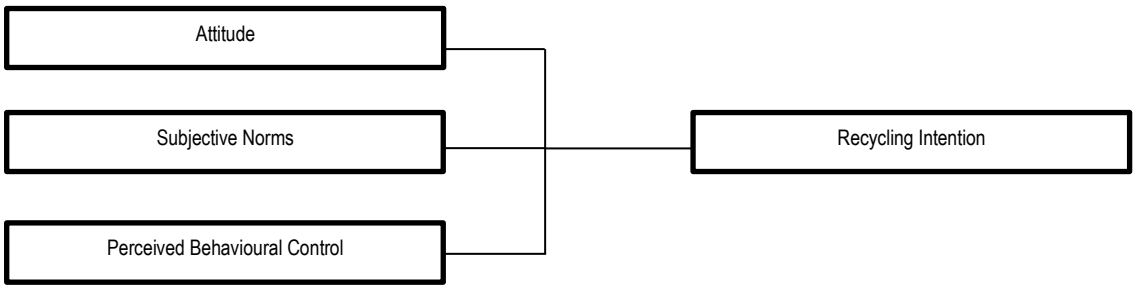

Fig. 1: Conceptual Framework

In conclusion, the effectiveness of recycling is influenced by various factors, including attitudes, subjective norms, and perceived behavioural control. It is important to emphasise that fostering strong beliefs and a sense of moral responsibility, along with boosting confidence in one's ability to act, such as committing to responsible waste management practices, can significantly encourage collective

efforts to promote a healthier environment. Figure 1 represents the conceptual framework that highlights the factors influencing recycling intention.

3.0 Methodology

This study employed a cross-sectional design using a quantitative approach. The target population consisted of urban communities in Seremban, Negeri Sembilan, with an estimated population of 713,000 as of 2024 (Department of Statistics Malaysia, 2024). According to Dumas (2022), an urban area is defined as having at least 2,000 housing units or a minimum population of 5,000 residents; thus, Seremban meets these criteria and qualifies as an urban area.

The required sample size was determined using Green's (1991) formula, commonly applied in survey-based research involving regression analysis. For multiple regression, the minimum sample size is defined as $N \geq 50 + 8m$, where m represents the number of predictors. With three predictors included, the minimum required sample size was 74 respondents. To improve the reliability and robustness of the analysis, data were collected from 110 respondents, exceeding the minimum requirement.

Purposive sampling was employed because Seremban participated in the KITARecycle drive-thru recycling initiative, which provides accessible recycling facilities at the Seremban Municipal Council. Participants were selected based on two criteria: (1) residence in Seremban and (2) prior engagement in recycling activities. Data were collected using a structured questionnaire distributed through both online (Google Forms) and printed formats.

All variables were measured using a 21-item instrument adapted from Ioannou et al. (2013), assessed on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Before analysis, data reliability and normality were evaluated internal consistency was assessed using Cronbach's alpha (Sekaran & Bougie, 2016), while normality was examined based on skewness and kurtosis values (Kline, 2005). This study conducted Pearson correlation and multiple regression analyses to examine the relationships between the predictor variables and recycling intention.

4.0 Findings

4.1 Demographic Profile

Based on the demographic profile of the respondents, the findings reveal that the sample was predominantly female (57.3%), with male respondents comprising 42.7%. In terms of age distribution, almost half of the respondents (49.1%) were between 18 and 24 years old, followed by those between 25 and 34 years (24.5%) and those between 35 and 44 years (16.4%), indicating that the majority were young adults under 35 years old (73.6%). This is further reflected in their marital status, where most were single (72.7%), while only 27.3% were married. Regarding educational background, many respondents held a degree qualification (66.4%), followed by diploma holders (24.5%), with a small proportion possessing postgraduate qualifications (3.6% master's and 0.9% PhD) or other forms of education (4.5%). Overall, these findings suggested that the study sample was composed mainly of young, single, and highly educated individuals, with a greater representation of females. Examining recycling intentions in Seremban is significant, as younger and more educated individuals tend to be more aware of environmental issues and are therefore more likely to adopt sustainable practices, such as recycling.

4.2 Normality and Reliability Results

Table 1. Normality and Reliability Results

Variables	Skewness	Kurtosis	Cronbach's Alpha
Attitude	-.033	-.361	0.547
Subjective Norms	-.550	.299	0.888
Perceived Behavioral Control	-.430	-.196	0.843
Recycling Intention	-.530	-.058	0.876

Kline (2005) states that to evaluate the normality of the data, the skewness value should range from -3 to +3, and the kurtosis value should sit between -10 and +10 to signify normal distributions. As shown in Table 1, both the skewness and kurtosis for the research model were confirmed to be normally distributed. Consequently, the study aligns well with the assumptions of normality. Cronbach's Alpha values for attitude (0.47), subjective norms (0.888), perceived behavioural control (0.843) and recycling intention (0.876). According to Sekaran and Bougie (2016), reliability scores below 0.60 are categorised as poor, scores in the 0.70 range are regarded as acceptable, and scores exceeding 0.80 are classified as very good. Pallant (2020) further emphasises that a Cronbach's Alpha reliability score above 0.50 is acceptable for scales with fewer than 10 items. As indicated in Table 1, the Cronbach's Alpha for recycling intention (0.876), attitude (0.547), subjective norms (0.888), and perceived behavioural control (0.843). Considering these reliability scores, we can confidently assert that all the variables are deemed very good and reliable.

4.3 Mean Result for Recycling Intention

Table 2. Mean Results of Recycling Intentions

Items	Mean	Standard Deviation
I am willing to participate in the recycling scheme in the future	4.009	0.840
I plan to reuse recyclable material in my daily life	3.946	0.876
I plan to reduce the purchase of disposable products	4.027	0.962
I plan to recycle my plastic waste	4.218	0.734
I plan to categories my recycle waste before properly dispose to recycling facilities	3.946	0.822

*Mean: very low (1-1.50), low (1.51-2.50), medium (2.51-3.50), high (3.51-4.50), and very high (>4.50)

The findings indicate that respondents in Seremban demonstrated a high level of recycling intention across all items. The strongest intention was to recycle plastic waste (M = 4.218, SD = 0.734), reflecting high awareness of plastic pollution. This was followed by reducing the use of disposable products (M = 4.027, SD = 0.962) and willingness to join recycling schemes (M = 4.009, SD = 0.840). Respondents indicated a readiness to adopt sustainable behaviours. Slightly lower, but still high, mean was recorded for reusing materials and categorising waste, suggesting some challenges. Overall, participants demonstrate strong recycling intentions, with improvements needed in the systematic separation and reuse of waste.

4.4 Correlation Results

Table 3. Correlation Results

Variables		Result	Hypotheses
Attitude	Pearson Correlation	0.508	
	Sig. (2-tailed)	0.000	H1 accepted
	N	110	
Subjective Norms	Pearson Correlation	0.662	
	Sig. (2-tailed)	0.000	H2 accepted
	N	110	
Perceived Behavioral Control	Pearson Correlation	0.560	
	Sig. (2-tailed)	0.000	H3 accepted
	N	110	

Table 3 shows that the Pearson correlation analysis confirmed significant positive relationships between attitude, subjective norms, and perceived behavioral control with recycling intention among urban communities in Seremban. Attitude ($r = 0.508$, $p < 0.05$) indicates that respondents perceive recycling as a means of reducing landfill use, conserving resources, and engaging in a meaningful household activity. Subjective norms ($r = 0.662$, $p < 0.05$) indicate a strong social influence, with family, peers, community, and government all encouraging recycling practices. Perceived behavioral control ($r = 0.560$, $p < 0.05$) indicates respondents' confidence, availability of facilities, and convenience in recycling. These results validate and accept H1, H2, and H3.

4.5 Multiple Regression Results

Table 4. Multiple Regression Results

Variables	Beta	Sig
Attitude	0.344	0.000
Subjective Norms	0.486	0.000
Perceived Behavioral Control	0.095	0.378
R^2	0.550	
Adjusted R^2	0.537	
F Change	43.127	
Sig.	0.000	

Based on Table 4, the results of regression analysis demonstrate that attitude, subjective norms, and perceived behavioral control collectively account for 55% of the variance in recycling intention among urban communities in Seremban ($R^2 = 0.550$, Adjusted $R^2 = 0.537$, $F = 43.127$, $p < 0.001$). Among the predictors, subjective norms ($\beta = 0.486$, $p < 0.001$) exerted the strongest influence, highlighting the key role of social expectations in shaping recycling behaviour.

5.0 Discussions

The research's objective is to examine whether attitudes, subjective norms, and perceived behavioural control significantly contribute to recycling intention. Surprisingly, all three 3 employed factors significantly influence the recycling intention among Seremban urban communities. The main findings also discovered that attitude, subjective norms and perceived behavioural control have a significant positive relationship with recycling intention. This finding was consistent with those of empirical studies in related areas, as reported in previous studies (Chen and Tung, 2010; Oom Do Valle et al., 2005; Cheung et al., 1999; Wan et al., 2012; and Arli et al., 2020).

This study reveals that subjective norms are the most influential factor in shaping recycling intentions among urban groups in Seremban. This conclusion is consistent with findings from Liu et al. (2022) in New York City, where social expectations significantly impacted recycling behaviour, and Wan et al. (2012) in Hong Kong, who identified subjective norms as the primary motivational force for recycling. Furthermore, Botetzagias (2024) found that subjective norms were more dominant than other components of the Theory of Planned Behaviour in predicting recycling intentions among Greek citizens. Similarly, the current findings affirm that in Seremban,

Negeri Sembilan, the social influences of family, peers, and the community play an important role in driving recycling intentions, compared to attitude and perceived behavioural control.

6.0 Conclusion

This study revealed that urban communities in Seremban exhibit a strong intention to recycle. It identified that attitudes, subjective norms, and perceived behavioural control significantly influenced the recycling intentions of these communities. The decisions related to recycling behaviour were framed by the Theory of Planned Behaviour (TPB), which offers a comprehensive framework for understanding decision-making processes and predicting behavioural intentions. Although this study contributes to and identifies important factors influencing behavioural intentions regarding recycling, it has some limitations. This study focused on a limited sample size, which may limit the generalizability of the findings. Future studies are encouraged to expand the study to rural areas to understand how to increase recycling intentions among rural communities. Finally, future studies should expand upon the current research model by including a broader range of variables, such as mediating or moderating factors, demographic influences, and recycling experiences.

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Paper Contribution to Related Field of Study

The results of this study, which involved participants from urban communities, addressed existing gaps in the literature, particularly in the realm of environmental management. These findings will contribute to future research on the significance of recycling initiatives in promoting behaviours that support a sustainable environment.

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