



Unlocking the Barriers of Household Waste Recycling in Seremban, Malaysia

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Abstract

This preliminary study investigates the barriers inhibiting effective household waste recycling in Seremban, Malaysia. Data was gathered from 101 households using a structured Google Form questionnaire over two months. Seven barriers were identified, with limited access to recycling facilities, lack of awareness, and inconvenient collection schedules among the most prominent. Quantitative statistical methods were employed to analyze the data, revealing mean scores and skewness for each barrier. The results of this initial investigation will serve as a foundation for a more comprehensive study employing the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method to analyze complex interrelationships between barriers.

Keywords: waste recycling; household; Seremban; Dematel;

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1.0 Introduction

Inadequate waste management practices can have noteworthy ecological consequences that may adversely affect human health and ecosystems (Ebadi et al., 2022). Household waste recycling is crucial to sustainable waste management strategies (Razali et al. 2019). However, several households encounter diverse obstacles that impede their involvement in recycling initiatives (Nguyen et al., 2022; Rodzi et al. 2023). This study aims to identify the impediments to household waste recycling in Seremban, Malaysia, to gain a deeper comprehension of these challenges. This study aims to investigate the following research inquiries: This inquiry seeks to identify the factors that impede household waste recycling in Seremban, Malaysia, and to propose potential solutions to surmount these obstacles.

The study will employ a quantitative research methodology to attain the research objectives. The research will entail surveying 101 households in Seremban, Malaysia, to collect information about their household waste recycling practices. The study will also identify the factors that impede their recycling endeavors. The survey will encompass inquiries about the availability and accessibility of recycling facilities and services, comprehension and recognition of the advantages of recycling, schedules for recycling collection, impetuses and stimuli for recycling, attitudes towards recycling, and the implementation of enforcement measures or penalties for non-adherence to recycling regulations. The research will additionally facilitate focus group deliberations with designated households to procure qualitative information regarding the obstacles they encounter in recycling and the feasible remedies they propose.

2.0 Literature Review

The Department of National Solid Waste Management (JPSPN) has reported that Malaysia's recycling rate for the year 2020 was 31.52%, which did not meet the government's objective of achieving a recycling rate of 40% by 2025. On the contrary, a notable percentage of developed nations have achieved a recycling rate of no less than 60%. The need to overcome obstacles that hinder

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recycling efforts in Malaysia and increase community participation in recycling initiatives is highly significant. Table 1 presents the results of a research study that provides insight into the obstacles hindering the waste recycling process.

Table 1. The barriers to waste recycling

Barriers	References
B1-Negative attitudes towards recycling	(Almasi et al. 2019; Ayeleru et al. 2023; Byrne and O'Regan 2014)
Limited storage space for recyclable materials at home	(Li et al. 2020; Lu et al. 2022; Luthra, Lowe, and Ochoa Berkley 2023)
B3-Inconvenient or inconsistent recycling collection schedules	(Clauciana Schmidt Bueno de Moraes et al. 2022; Dias et al. 2022; Shuvo 2023)
B4-Lack of awareness and understanding of the benefits of recycling	(Almulhim 2022; Chengqin et al. 2022; Fogt Jacobsen, Pedersen, and Thøgersen 2022)
B5-Limited access to recycling facilities and services	(Dutta and Goel 2021; Maiurova et al. 2022; Wang et al. 2020)
B6-Lack of motivation or incentive to recycle	(Chengqin et al. 2022; Li et al. 2022; Wang, Zhang, and Sun 2021)
B7-Lack of enforcement or penalties for non-compliance with recycling regulations	(Ayeleru et al. 2023; Favot et al. 2022; Ma et al. 2020; Woodard 2020)

Despite facing numerous challenges, Malaysia has implemented several measures to promote recycling and waste reduction. At the national level, the government initiated a program named "Kampungku Bersih" (My Clean Village) to foster communal responsibility towards waste management and promote the adoption of recycling practices.

The private sector has implemented various initiatives to promote recycling practices and minimize waste generation. For instance, IKEA Malaysia has introduced a take-back program for pre-owned furniture. At the same time, the Tzu Chi Foundation has established dispersed recycling centers that cater to a broad range of recyclable materials. The iCycle platform has been introduced in Malaysia as an additional measure to encourage household waste recycling. The Malaysian government has launched a "zero waste" campaign intending to promote sustainable practices and tackle the challenge of waste management. The recycling activities in Seremban are summarised in Table 2.

Table 2. Summary of Recycling Activities In Seremban

Year	Recycling Bank In School		Recycling Bank In Kindergarten		Recycling Bank In Community		Recycling Bank In Government Office		Recycling Bank At the University		Recycling Bank Industry	
	KG	RM	KG	RM	KG	RM	KG	RM	KG	RM	KG	RM
2017	45,608	9,488	8,803	2,213	2,522	576	41,127	12,899	6,262	1,249	224,767	17,647
2018	45,226	9,389	4,092	898	5,547	845	11,069	1,391	2,458	34	3,345	14
2019	74,048	16,154	4,042	1,015	7,001	1,306	5,385	1,455	1,171	144	2,417	5,123
2020	96,018	20,181	2,590	551	6,227	1,066	26,677	4,974	1,018	185	14,596	860
2021	52,279	12,974	1,242	320	38,001	13,307	39,851	3,620	2,229	437	4,272	568
Total	313,180	68,185	20,768	4,998	59,297	17,100	124,109	24,339	13,137	2,049	249,398	24,212

SOURCE : Swcorp Negeri Sembilan (2022)

3.0 Methodology

This study adopted a quantitative research methodology to investigate the barriers to household waste recycling in Seremban, Malaysia. Data was collected from a sample of 101 households, chosen through a random sampling strategy to capture a varied demographic background. The primary tool for data gathering was a structured questionnaire disseminated via Google Forms. The questionnaire was divided into sections, one capturing demographic information and another delving into specific hindrances to household waste recycling. Variables examined included age, household income, education level, key impediments like limited access to recycling facilities, and awareness or attitudes toward recycling. Data collection took place over two months and was facilitated through Google Forms. The questionnaire link was distributed through WhatsApp channels to target the sample population. A pilot test was conducted before the survey launch to ensure the clarity and appropriateness of the questions.

4.0 Findings

4.1 Demographics

Table 3. Demographic

Recycle	Gender		Status		Age (years old)		Income		
No	40.6%	Female	72.3%	Married	64.4%	19 -25	8.9%	64.4	29.7%
Yes	59.45	Male	27.7%	Single	35.6%	26 -35	50.5%	35.6	47.5%
						36 - 44	36.6%	RM5,001 - RM7,000	10.9%
						45 and above	4.0%	RM7,001 - RM10,000	6.9%
								RM10001 and above	5.0%

The research collected data on recycling habits from a cohort of 101 individuals, displayed in the accompanying table. The study's findings indicate that most participants, comprising 50.5%, belonged to the age bracket of 26-35 years. The subsequent largest cohort

was represented by respondents aged 36-44, accounting for 36.6% of the sample. A comparatively lesser proportion of respondents fell within the age brackets of 19-25 years (8.9%) and 45 years and above (4%). The gender distribution exhibited a predominant proportion of 72.3% female and a subordinate proportion of 27.7% male. The study's findings indicate that 64.4% of the participants were married, whereas 35.6% were single concerning their marital status.

Additionally, the investigation incorporated data on the income distribution of the participants. The results disclosed that the most substantial percentage of respondents (6.9%) belonged to the RM7,001-RM10,000 income category, while 10.9% of the participants were categorized under the RM5,001-RM7,000 income bracket. A small proportion of participants (constituting 5% of the sample) indicated a total income of RM10,001 or above.

4.2. The Barriers of Waste Recycling

The study uses a numerical rating scale from 1 to 5 to evaluate various barriers to effective waste recycling among households in Seremban, Malaysia. A score of 1 represents the least level of agreement or concern, while a score of 5 indicates the highest level. The mean scores for each barrier were calculated by summing up the individual ratings from respondents and dividing by the total number of respondents.

a) Limited access to recycling facilities and services

The calculated average score of 2.94 suggests that the accessibility of recycling bins in the locality is challenging for the residents. This implies a potential insufficiency of the necessary systems and facilities to facilitate and sustain recycling initiatives. Furthermore, the calculated average score of 3.20 suggests that the inhabitants express discontentment towards the recycling collection amenities furnished within their locality, plausibly due to irregular or inconvenient recycling collection timetables. The statistical mean value of 3.64 suggests insufficient recycling bins for residents in the area, potentially resulting in an upsurge of improperly disposed household waste. It can be inferred that there exists a necessity for enhanced infrastructure and services to facilitate the recycling of household waste in the Seremban locality.

Table 4. Limited access to recycling facilities and services

Limited access to recycling facilities and services	Mean	S.d	Skewness	Skewness s.d
It is difficult for me to access recycling bins in my area.	2.94	1.103	0.165	0.240
I am dissatisfied with the recycling collection services provided in my area.	3.20	1.020	0.283	0.240
I do not have enough recycling bins available to me in my area.	3.64	1.035	-0.063	0.240

b) Lack of awareness and understanding of the benefits of recycling

According to the study's findings, many respondents lack comprehension of the ecological advantages associated with recycling, as evidenced by an average rating of 3.67 for the corresponding statement. Additionally, the mean score of 3.19 obtained for the statement regarding confusion surrounding the recyclability of specific materials underscores the necessity for improved clarity and information on this topic. Furthermore, the statement on the economic benefits of recycling received a relatively low average score of 2.52, indicating a need for heightened cognizance regarding the monetary advantages of recycling. Therefore, it is imperative to execute focused educational and awareness programs that aim to improve households' understanding of the environmental, economic, and social benefits of recycling to foster increased engagement and compliance with recycling policies.

Table 5. Lack of awareness and understanding of the benefits of recycling

Lack of awareness and understanding of the benefits of recycling	Mean	S.d	Skewness	Skewness s.d
I am not aware of the environmental benefits of recycling.	3.67	1.087	-0.076	0.240
I am not knowledgeable about what materials can and cannot be recycled.	3.19	1.120	0.229	0.240
I do not understand the economic benefits of recycling for my community.	2.52	1.073	0.405	0.240

c) Limited storage space for recyclable materials at home

The survey results reveal moderate concurrence with the assertions concerning restricted storage capacity for recyclable substances in residential settings. The possible cause for this phenomenon may be attributed to the dimensions of living spaces and the number of individuals residing in smaller households. Moreover, the dearth of conveniently reachable recycling facilities in specific regions could lead to decreased involvement in recycling endeavors for households with restricted storage capacity. The consequences of restricted storage capacity encompass reduced engagement in recycling, amplified generation of waste, and probable psychological strain among households. The factors mentioned earlier could potentially be attributed to the degradation of the environment and raise concerns regarding sustainability.

Table 6. Limited storage space for recyclable materials at home

Limited storage space for recyclable materials at home	Mean	S.d	Skewness	Skewness s.d
I do not have enough storage space at home to store my recyclables.	3.01	1.100	0.026	0.240
I find it easy to dispose of recyclables because I don't have enough storage space.	3.08	1.055	0.048	0.240
I have had to throw away recyclables because I did not have enough storage space.	2.77	1.076	-0.022	0.240

d) Inconvenient or inconsistent recycling collection schedules

Table 5 presents the average scores derived from three statements on the recycling collection timetable in the region of the respondents. Based on the mean scores obtained, it can be inferred that households in Seremban face difficulties in complying with the recycling collection schedule owing to factors such as inconvenience and irregularities. The hindrance in question could stem from insufficient planning and implementation of recycling collection schedules by local governmental authorities. The obstacle in question has resulted in a reduction in participation in recycling programs and an increase in the disposal of recyclable materials. This is due to households being unable to consistently adhere to collection schedules.

Table 7. Inconvenient or inconsistent recycling collection schedules

Inconvenient or inconsistent recycling collection schedules	Mean	S.d	Skewness	Skewness s.d
The recycling collection schedule in my area is inconvenient for me.	2.79	1.003	0.189	0.240
I often miss recycling collection days because of the schedule.	2.91	1.096	0.226	0.240
I find the recycling collection schedule to be inconsistent and unpredictable.	3.56	1.081	-0.072	0.240

e) Lack of motivation or incentive to recycle

Table 6 reports the mean scores of three statements about the inconvenience, missed collection days, and inconsistency of the recycling collection schedule. Specifically, the mean score for the statement "The recycling collection schedule in my area is inconvenient for me" was 2.79. In contrast, the mean score for "I often miss recycling collection days because of the schedule" was 2.91. Finally, the mean score for "I find the recycling collection schedule inconsistent and unpredictable" was 3.56. The scores suggest that households residing in Seremban encounter challenges in adhering to the recycling collection timetable owing to inconveniences and irregularities. The potential reason for this impediment may be attributed to inadequate planning and execution of recycling collection timetables by the municipal administration. The ramifications of this obstacle encompass a decrease in engagement with recycling initiatives and a rise in discarding reusable materials as household waste. The absence of drive or inducement to engage in recycling constitutes a noteworthy obstacle to practicing recycling in numerous localities.

Table 8. Lack of motivation or incentive to recycle

Lack of motivation or incentive to recycle	Mean	S.d	Skewness	Skewness s.d
I am not motivated to recycle because there are no financial incentives.	3.51	1.092	-0.156	0.240
I would not participate in a recycling program even if it provided recognition for participation.	3.65	1.014	-0.253	0.240
I do not feel motivated to recycle because I do not believe in the environmental benefits.	2.49	0.996	0.568	0.240

f) Negative attitudes towards recycling

The lack of enthusiasm toward participating in recycling initiatives is attributed to unfavorable attitudes. According to the initial assertion, with an average value of 3.03, individuals tend to view recycling as a cumbersome undertaking. The second assertion, with an average score of 3.13, implies a deficiency in individuals' faith in the significance of recycling, indicating a perceived lack of motivation to participate in recycling endeavors. Based on the findings, it can be inferred that the third statement garnered the lowest average score of 2.31, suggesting that people perceive recycling as a wasteful employment of time and resources. The genesis of this impediment can be attributed to the notion held by individuals that recycling is a demanding and time-consuming endeavor. The existence of this hindrance may lead to reduced motivation and participation in recycling initiatives, which could have significant environmental ramifications. Adverse perceptions towards recycling can lead to decreased inclination to participate in recycling initiatives, consequently impeding recycling efforts in the community. Table 9. Negative attitudes towards recycling.

Negative attitudes towards recycling	Mean	S.d	Skewness	Skewness s.d
I find recycling to be a hassle.	3.03	1.014	-0.002	0.240
I believe recycling is not worth the effort.	3.13	1.092	-0.120	0.240
I think recycling is a waste of time and resources.	2.31	0.997	0.457	0.240

g) Lack of enforcement or penalties for non-compliance with recycling regulations

According to the survey findings, households in Seremban exhibit moderate agreement in their awareness of recycling policies. However, there seems to be a lack of motivation to comply with these policies and support for penalties in case of non-compliance. The statements' mean scores varied between 2.17 and 2.52, while the corresponding standard deviations ranged from 0.964 to 1.110. The results suggest a necessity for heightened educational and awareness initiatives to disseminate information to households regarding regulatory guidelines and the significance of adhering to them.

Table 10. Lack of enforcement or penalties for non-compliance with recycling regulations

Lack of enforcement or penalties for non-compliance with recycling regulations	Mean	S.d	Skewness	Skewness s.d
I am not aware of the recycling regulations in my area.	2.35	0.964	-0.066	0.240
I do not feel responsible for complying with recycling regulations.	2.52	1.110	0.272	0.240

I believe there should not be penalties for households not complying with recycling regulations.	2.17	0.991	0.472	0.240
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4.3 The overall barriers

This study has performed a statistical examination of seven variables that could potentially be associated with inadequate household waste recycling behaviors. The statistical measures of mean, standard deviation, skewness, and skewness deviation have been computed, indicating a degree of variability and deviation from the normal distribution. The research has identified primary hindrances to recycling household waste, including restricted availability of recycling amenities and services, inadequate awareness and comprehension of recycling advantages, insufficient storage capacity, inconvenient collection schedules, lack of motivation or incentives, unfavorable attitudes, and inadequate enforcement measures. The study indicates that certain factors impede the successful execution of household waste recycling initiatives in the region and suggests enhancing sustainable waste management methodologies.

Table 3. The barriers to households' waste recycling in Seremban, Malaysia

Barriers	Mean	S.d	Skewness	Skewness s.d
Limited access to recycling facilities and services	3.2607	0.8214	0.301	0.240
Lack of awareness and understanding of the benefits of recycling	3.1287	0.8406	0.232	0.240
Limited storage space for recyclable materials at home	2.9538	0.8769	-0.112	0.240
Inconvenient or inconsistent recycling collection schedules	3.0891	0.8767	0.167	0.240
Lack of motivation or incentive to recycle	3.2178	0.7866	0.006	0.240
Negative attitudes towards recycling	2.8218	0.8240	0.069	0.240
Lack of enforcement or penalties for non-compliance with recycling regulations	2.3927	0.9421	0.056	0.240

5.0 Discussions

Our study results provide useful insights into the challenges and motivators that influence home recycling habits in Seremban, Malaysia's specific context of waste management. We use several theoretical frameworks to elucidate and substantiate our findings. Our research provides empirical evidence in favor of Ajzen's (1991) Theory of Planned Behavior, which posits that an individual's beliefs, subjective standards, and perceived behavioral control play a significant role in shaping their decision-making process about certain activities, such as recycling. The study revealed that unfavorable attitudes towards recycling and a lack of information among the people were major barriers to implementing recycling behaviors. The observation enhances the theory's capacity for making accurate predictions and underscores the need for educational endeavors to enhance attitudes and subjective standards on waste management.

Furthermore, our findings align with the notion of "nudges" proposed by Thaler and Sunstein (2020). Our recommendation entails the implementation of conveniently located bins and collection sites, which may subtly influence consumers towards adopting more sustainable behaviors, ultimately leading to an enhancement in recycling rates. Finally, the present study additionally investigates the impact of financial incentives as substantiated by empirical findings from Gneezy and Rustichini's (2000) research. Based on our data analysis, it is evident that implementing monetary awards or fee reductions has the potential to significantly augment household motivation toward recycling.

6.0 Conclusion & Recommendations

The present study has identified various barriers to household waste recycling in Seremban, Malaysia. These include restricted availability of recycling facilities, insufficient awareness and motivation, inconvenient collection schedules, unfavorable attitudes, and inadequate enforcement measures. The research proposed remedies, including enhancing infrastructure, imparting education and incentives, and implementing regulations. Subsequent studies may assess the efficacy of the remedies mentioned above and explore the ramifications of incentives and disincentives on recycling conduct. It is recommended to investigate the recycling behaviors of households with low socioeconomic status and the perspectives and behaviors of various demographic cohorts concerning recycling. The study results can be utilized by waste management organizations and local governmental bodies to encourage the implementation of sustainable waste management strategies and enhance household waste recycling rates in Seremban, Malaysia.

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