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A Study on Incentive-Based Recycling Program in Residential Areas in Johor

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Abstract

The rise of solid waste production in Malaysia underscores the need for effective waste management strategies. To address this issue, the government introduced the Separation at Source initiative in 2015, which aims to enhance recycling rates and sustainability. This study evaluates the role of the KITARecycle application in improving knowledge and promoting waste segregation and 3R practice among Johor household residents. Data collection was conducted via a questionnaire survey embedded in the app, focusing on demographics, knowledge and attitude levels, the influence of recycling facilities, and feedback on app usability. The SPSS software, namely the descriptive statistics, frequency analysis, cross-tabulation, and correlation tests, were utilized to analyze the data. Findings indicate that the app improves users' knowledge and behavior toward waste separation and simplifies delivering recyclables by identifying nearby Drive-Thru Recycling Centers (DTRCs). Challenges of using the app include slow payment processing, a non-user-friendly interface, limited promotion, and insufficient access to DTRCs. Respondents suggested accelerating cash rewards, improving the interface, increasing app promotions, and enhancing DTRC facilities to improve the app. This study highlights the potential of KITARecycle in fostering sustainable waste management while emphasizing areas for improvement to achieve Malaysia's targeted national recycling rate target by 2025.

1. Introduction

In Malaysia, the waste generation rate has been steadily increasing over the years due to population growth and urbanization. Daily solid waste production rose from approximately 19,100 metric tons in 2007 to about 38,427 metric tons in 2021 and is projected to exceed 60,000 metric tons by 2050 [1][2][3]. Despite producing over 14 million metric tons of waste annually, the waste management system remains inefficient, with most waste being disposed of in landfills. This traditional method, though cost-effective, has led to diminishing landfill space, necessitating alternative waste management strategies [1].

To address the growing waste problem, Malaysia introduced the National Solid Waste Management Policy in 2002, followed by the concept of separation at source and 3R (Reduce, Reuse, Recycle) in 2005 [2]. Mandatory

separation at source regulations were later enforced in 2015 to improve recycling rates and reduce landfill dependency [4]. These regulations require residents to segregate their waste into recyclable and non-recyclable categories. However, despite efforts through campaigns, school programs, and community activities, Malaysia's recycling rate reached only 33.2% in 2022, highlighting the need for more innovative measures to achieve the national target of 40% by 2025 [5].

One of the measures taken to improve the waste separation and 3R practice is through the KITARecycle app, introduced by SWM Environment Sdn Bhd. Launched in 2018, this app rewards users with redeemable points for sending recyclable materials to designated locations. It aims to attract community participation in waste segregation and recycling by offering cash rewards and facilitating access to recycling centers. This study is interested in investigating the role of the app in improving knowledge and promoting waste separation and household practice among Johor household residents.

Previous studies have highlighted that knowledge and access to recycling facilities are crucial factors influencing waste separation behavior and the successful adoption of 3R practices. Nizam et al. [6] emphasized that a comprehensive understanding of waste separation processes and recycling benefits fosters proper waste management habits. Guo et al. [7] also found that individuals who perceive themselves as knowledgeable about waste separation are more inclined to engage in recycling activities. Additionally, research by Johnson et al. [8] and Williams & Taylor [9] showed that the availability, accessibility, and condition of recycling facilities significantly affect recycling participation rates.

Since knowledge and recycling facilities are crucial for effective waste segregation and 3R practices [10]–[12], this study examines the extent to which KITARecycle influences the knowledge and behavior of users. By investigating user experiences and challenges, the research aims to assess the app's potential to promote sustainable waste management practices in Malaysia.

2. Methodology

This study focused on individuals who actively use the KITARecycle application. Data collection was conducted through a questionnaire distributed to users via the application. A pop-up menu for the questionnaire appeared when users accessed the app, ensuring targeted data collection from active users. The questionnaire consisted of four sections. The first section gathered demographic information about the respondents, such as age, gender, and education level. The second section investigated the respondents' level of knowledge and the factors that motivated them to practice waste segregation and 3R (Reduce, Reuse, Recycle). The third section examined the influence of recycling facilities on the respondents' waste segregation and 3R practices in their daily lives. Lastly, the fourth section collected feedback on the functionality and effectiveness of the KITARecycle application as a tool for separating recyclable waste. A summary of the data collection process is illustrated in Figure 1.

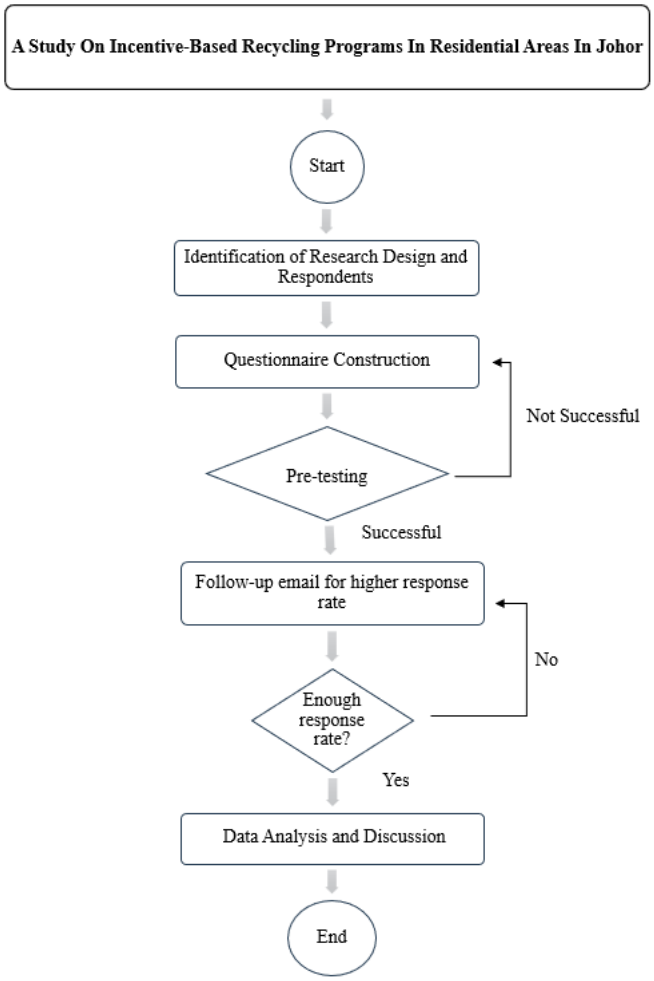

***Fig. 1*:** Flowchart of the research methodology of the research

3. Result and Discussion

The response rate for this study was 40, with a total of 40 participants completing the questionnaire. Despite follow-up reminders being sent five times via email, the response rate remained relatively low. Follow-up calls could not be conducted due to the unavailability of phone numbers within the KITARecycle application. While the sample size was limited, it aligns with the recommendations of [13][14], who suggest that a minimum of 40 respondents is sufficient to obtain a reasonable prediction of population behavior in studies of this nature. A summary of the respondents' demographic background is presented in Table 1. The demographic data provide an overview of the participants' characteristics, including age, gender, and education level, which are essential for understanding the diversity and representativeness of the sample.

***Table 1*:** Background of Respondent

Descriptions		Frequency (n)	Percentage (%)
Residential areas	Batu Pahat, Johor	17	42.5
	Johor Bahru	7	17.5
	Kluang, Johor	2	5.0
	Segamat, Johor	4	10.0
	Muar, Johor	9	22.5
	Tangkak, Johor	1	2.5
Gender	Male	18	45.0
	Female	22	55.0
Age	Below 25 years old	3	7.5

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	25 - 35 years old	13	32.5
	36 - 44 years old	15	37.5
	45 - 54 years old	7	17.5
	55 years old and above	2	5.0
Highest Level of Education	Secondary Level	14	35
	Tertiary Level	26	65.0
Occupation	Unemployed/Retired	4	10.0
	Students	2	5.0
	Government Sector	19	47.5
	Private Sector	11	27.5
	Self-employed	4	10.0
Monthly Income	Not applicable	4	10.0
	Less than RM2500	4	10.0
	RM2500 - RM4000	15	37.5
	RM4001 - RM5500	10	25.0
	RM5501 - RM7000	4	10.0
	More than RM7000	3	7.5
Household Size	Less than 3 people	10	25.0
	3 - 5 people	27	67.5
	6 - 8 people	3	7.5
Overall satisfaction	Unsatisfactory	17	42.5
	Satisfactory	23	57.5

Table 4.1 presents the demographic profile of the 40 respondents. Most respondents reside in Batu Pahat (42.5%), followed by Muar (22.5%), Johor Bahru (17.5%), Segamat (10.0%), Kluang (5.0%), and Tangkak (2.5%). In terms of gender, a higher proportion of respondents are female (55.0%) compared to male respondents (45.0%).

Regarding age, most respondents are in the 36–44 years old category (37.5%), followed by 25–35 years old (32.5%). Smaller groups are found among those aged 45–54 (17.5%), below 25 years old (7.5%), and 55 years old and above (5.0%).

In terms of education, most respondents hold a university degree (65.0%), followed by those with college/institute and secondary school education (17.5% each).

Occupationally, nearly half of the respondents are employed in the government sector (47.5%), followed by those in the private sector (27.5%). Smaller groups include unemployed/retired individuals (10.0%), self-employed individuals (10.0%), and students (5.0%).

In terms of monthly income, the largest group earns between RM2500 and RM4000 (37.5%), followed by those earning between RM4001 and RM5500 (25.0%). Smaller proportions earn less than RM2500 (10.0%), between RM5501 and RM7000 (10.0%), and more than RM7000 (7.5%). A minority of respondents (10.0%) indicated that income data was not applicable. Regarding household size, the majority of respondents live in households with 3–5 members (67.5%), while smaller groups reported household sizes of fewer than 3 members (25.0%) and 6–8 members (7.5%).

Overall satisfaction with the KITARecycle program revealed that 57.5% of respondents were satisfied, while 42.5% were unsatisfied. Among the satisfied respondents, 47.5% rated their experience as good, and 10.0% rated it as excellent. Conversely, of the unsatisfied respondents, 30.0% rated their experience as fair, and 12.5% rated it as poor. A correlation was observed between gender and overall satisfaction levels. The results are summarized in Table 2.

Table 2: Correlations between gender and overall satisfaction

		Gender	Overall satisfaction
Gender	Pearson Correlation	1	.137
	Sig. (2-tailed)		.398
	N	40	40
Overall satisfaction	Pearson Correlation	.137	1
	Sig. (2-tailed)	.398	
	N	40	40

The correlation test results indicated no significant relationship between gender and overall satisfaction (ρ = 0.398). This finding contrasts with previous studies, such as [15], which reported a significant relationship between satisfaction levels and mobile app usage, with women generally expressing higher satisfaction than men. Additionally, [16] found that women tend to use mobile apps more frequently than men.

Despite the lack of statistical significance in this study, a cross-tabulation analysis revealed that women were more satisfied with the app compared to men, as shown in Table 3. While the results do not establish a significant relationship, they suggest that women may derive greater satisfaction from using the app, indirectly supporting trends observed in prior research.

Table 3: Cross-tabulation between gender and overall satisfaction

			Unsatisfied	Satisficed	Total
Gender	Male	Count	9	9	18
		% within Gender Respondent	50.0%	50.0%	100.0%
	Female	Count	8	14	22
		% within Gender Respondent	36.4%	63.6%	100.0%
Total		Count	17	23	40
		% within Gender Respondent	42.5%	57.5%	100.0%

3.1 Respondent's Level of Agreement Between Knowledge, Behavior and KITARecycle Application

This section evaluates respondents' agreement on how the KITARecycle app improves their waste separation and 3R knowledge and behavior. Six statements were prepared for the respondents using a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree). The results are summarized in Fig. 2.

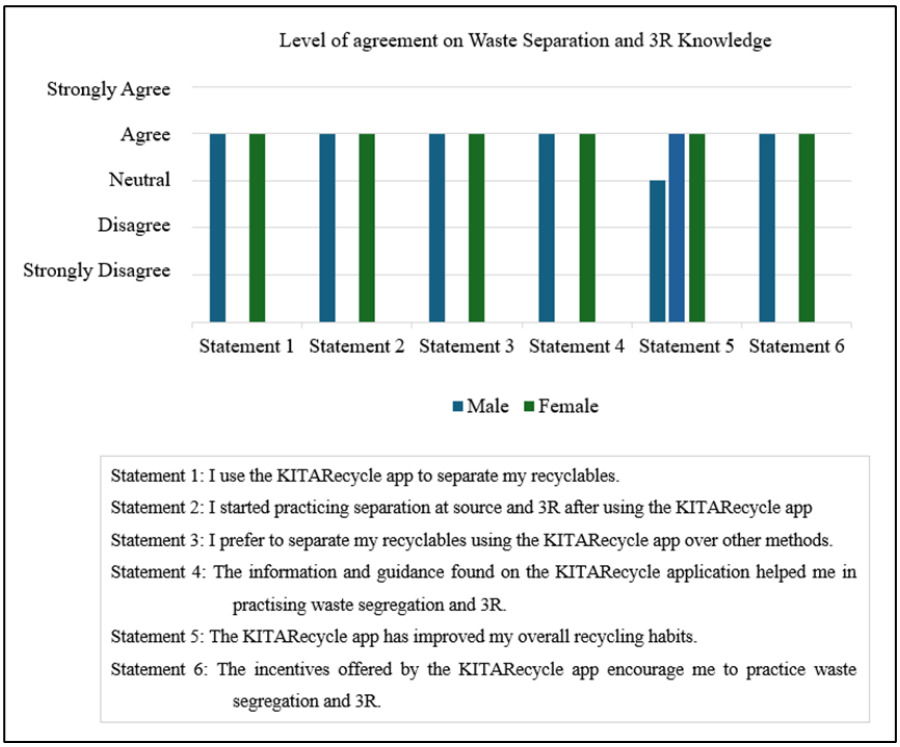

Fig. 2: Overall results on the level of agreement of how far the KITARecycle app improves the knowledge and behaviour on waste separation and 3R

The findings indicate that the KITARecycle app has positively influenced users' waste separation and 3R practices. Most male and female respondents agreed that the app encourages them to separate recyclables, with 50.0% of male and 45.5% of female respondents expressing agreement. Additionally, 38.9% of male and 45.5% of female respondents stated they began practising waste separation and 3R after using the app. The app's information and guidance were also found helpful, as 44.4% of male and 50.0% of female respondents agreed it assisted them in practising waste segregation. Moreover, the incentives offered by the app motivated 33.3% of male and 54.5% of female respondents to engage in recycling activities. Overall, all respondents agreed that the

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KITARecycle app has contributed to improving their knowledge of waste separation and 3R practices. In today's digital era, technology plays a crucial role in daily life by facilitating learning activities and providing easy access to reference materials and information. This convenience not only simplifies information retrieval but also saves time in the learning process. [17] highlighted that mobile applications significantly enhance knowledge and support educational practices in digital learning environments.

3.2 Respondent's Level of Agreement on 3R Facilities of KITARecycle Application

In this sub-section, respondents were asked to indicate their level of agreement regarding the availability of the KITARecycle recycling facilities. Six statements were presented, and respondents rated their responses on a 5-point Likert scale, where 1 indicated 'strongly disagree' and 5 indicated 'strongly agree.' The summarized results are presented in Fig. 3. For the statement, "There is a 'Drive-Thru Recycling Center' (DTRC) facility in my residential area," 38.9% of male and 50.0% of female respondents disagreed, indicating limited availability of DTRC facilities. In terms of ease of use, 50.0% of male respondents strongly disagreed that using the DTRC facility is easy and fast, while 36.4% of female respondents strongly agreed. This contrast highlights differing user experiences, possibly due to the varying availability and conditions of the facilities in different locations. Regarding the app's "recycling bin locator" feature, 38.9% of male respondents strongly disagreed that it makes finding DTRC locations easy, while 45.5% of female respondents agreed. This suggests that the locator feature may not be equally effective for all users, possibly due to navigation issues or outdated facility information.

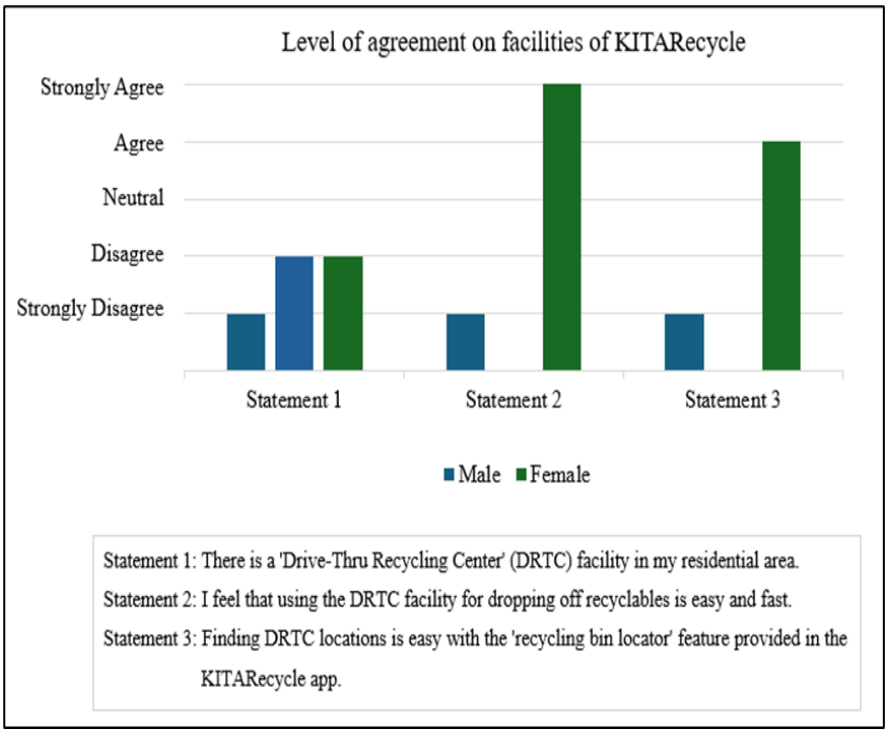

***Fig. 3*:** Overall result for the level of agreement towards facilities offered by the KITARecycle application

Overall, respondents in Johor generally agreed that the availability of a Drive-Thru Recycling Center (DTRC) in or near their residential areas significantly eases the process of delivering recyclable materials. This aligns with [14], who found that households with convenient access to recycling centers are more likely to engage consistently in recycling practices. However, knowledge of waste management and 3R practices alone is not enough to encourage participation. Well-maintained and user-friendly recycling facilities, such as accessible and convenient centers, increase public usage [19]. Similarly, [20] reported that participants emphasized the need for easily accessible recycling facilities to motivate people to recycle more actively.

3.3 Overall Feedback on The KITARecycle App

This section presents the feedback provided by respondents regarding the use of the KITARecycle application for waste separation and 3R practices. Respondents were asked to identify any challenges they faced while using the app and to suggest improvements for its effectiveness and broader usability. Since this section used an open-ended questionnaire, not all respondents provided feedback, and the analysis is based solely on the responses received.

***Table 4*:** Summary of feedback on the KITARecycle Application

Description	Frequency (n)	Percentage (%)
Slow payment process	15	37.5
Inconvenient for users / Not user-friendly	8	20.0
Less promotion	4	10.0
Far-off access to the 'Drive-Thru Recycling Center' (DRTC) facility	1	2.5

For Question 1, which asked about the problems and challenges encountered, the feedback revealed several issues with the app's functionality and accessibility. The most frequently reported issue was a slow payment process, mentioned by 15 respondents, accounting for 37.5% of the total feedback. Another concern was the app's inconvenience and lack of user-friendliness, with eight respondents (20.0%) dissatisfied with its interface and usability. Limited promotion was the third issue, with four respondents (10.0%) pointing out that there was insufficient effort to raise public awareness of the app. Lastly, one respondent (2.5%) mentioned difficulties accessing the 'Drive-Thru Recycling Center' (DTRC) facility, highlighting challenges with recycling infrastructure. The suggested improvements to the app are summarized in Table 5.

***Table 5*:** Summary of suggestions for further improvement on the application

Description	Frequency (n)	Percentage (%)
Accelerated cash rewards	7	17.5
More user-friendly	14	35.0
Increase KITARecycle application promotions	7	17.5
Increase the 'Drive-Thru Recycling Center' (DRTC) facility	1	2.5

Table 5 presents the respondents' suggestions for improving the KITARecycle application, identifying four key areas for enhancement to address user concerns and improve the app's effectiveness. The most common suggestion made by 14 respondents (35.0%) was to make the app more user-friendly, with a focus on improving the interface and usability. The second and third most frequent recommendations, each mentioned by seven respondents (17.5%), were to speed up cash rewards and to increase promotions for the app. These suggestions underscore the importance of incentivizing users and raising awareness. Lastly, one respondent (2.5%) suggested increasing the number of 'Drive-Thru Recycling Center' (DTRC) facilities, highlighting the need to improve access to recycling infrastructure. Overall, the feedback aligns with findings from previous studies. Research has shown that placing recycling facilities in strategic locations boosts recycling rates compared to areas without such facilities [21][22]. Despite understanding source separation and 3R practices, many individuals struggle to implement them due to a lack of accessible recycling facilities [24]. While some residents may be willing to travel further to dispose of recyclables, they often prefer to use nearby bins [24]. Therefore, to reduce plastic and solid waste, it is essential to expand the availability of clean, well-maintained, and user-friendly recycling facilities to encourage better waste separation and 3R practices within communities.

4. Conclusion

In conclusion, this study demonstrates that the KITARecycle application plays a significant role in enhancing knowledge and providing facilities for waste separation and 3R practices. However, the relatively low number of responses limits the ability to draw comprehensive conclusions. Therefore, it is recommended that future studies involve a larger sample size to obtain more in-depth insights into how the app influences user behavior and responses.

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