Assessment of Attitudes and Practices of Solid Waste Management among Residents of the Water Village in the Sandakan District, Sabah, Malaysia

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ABSTRACT

Public attitudes and behaviors toward waste management vary. Although many people have a positive attitude, it does not necessarily translate into appropriate actions. In Malaysia, public awareness of systematic waste management is still low, leading to an increase in illegal waste disposal. This study used a questionnaire distributed both physically and online through Google Forms to gather residents' opinions on cleanliness and solid waste management. The findings of this study indicate that many residents still struggle with proper waste disposal, with a significant portion of the respondents preferring to dispose of waste in their home surroundings. However, there is also some awareness among respondents to maintain cleanliness by disposing of waste in the bins provided by the authorities. Recycling activities are often regarded as burdensome. Despite this perception, many respondents engage in collecting recyclable waste and bring reusable bags when shopping. Notably, those respondents who expressed discomfort with a polluted environment reported these issues to the authorities. The effectiveness of waste management still depends on a combination of attitudes and practices within the community. Water village areas require more systematic waste management compared to other formal settlements. Therefore, continuous support from the authorities is greatly needed to ensure more efficient and sustainable waste management.

Keywords: water village, attitude, public, practice, solid waste, sandakan

INTRODUCTION

The issues arising from solid waste management problems are increasingly attracting the attention of government officials. The increase in the amount of solid waste is due to demographic changes and rapid urbanization rates. According to Grove (2009), by 2030, it is estimated that approximately 80% of the global population will reside in urban areas, while the remaining will be in rural areas. However, it should be noted that the trend of urbanization varies significantly between countries and regions. Migration to cities results in increased population density in already densely populated urban areas, thereby reducing the available land and resources. As a result, some residents are forced to move to the outskirts of the city, including areas inhabited illegally, known as squatter settlements. These slum settlements exacerbate the issue of solid waste management because their residents tend not to pay taxes to the government. As a result, waste collection facilities were not extended to the area, leading to uncontrolled waste disposal and subsequently causing very serious environmental impacts.

Rural villages still face various issues, but the emphasis is on the need for better solid waste management, especially in informal settlements in most developing countries. However, solid waste management in these areas is still insufficient, contributing to illegal dumping. This problem has become more pronounced owing to the increase in informal settlements and the weaknesses in the waste management services provided by local authorities (Jakeni et al. 2024). Factors such as the availability of open spaces and road accessibility also play an important role in determining the location and density of illegal waste disposal in an area.

Water village settlements need to be managed in an integrated manner, considering the unique issues faced by the community. Integrated solid waste management is a holistic approach that combines various technologies and strategies to achieve sustainable waste management objectives. This approach encompasses strategies to reduce waste generation, optimize resource recovery, and minimize environmental impact by considering economic, social, and environmental factors according to the needs and conditions of a specific area. In addition, integrated solid waste management involves various stakeholders, including the government, private sector, community groups, informal sector, and non-governmental organizations (NGOs). The community also plays an important role in ensuring the success of integrated solid waste management. The implementation of effective management requires commitment from all levels of society, especially at the grassroots level. The commitment and active involvement of the community are the main factors that determine the success of solid waste management policies and programs organized by the government.

The increase in the amount of solid waste is one of the most pressing environmental issues that require serious attention from all parties. This increase occurs due to various factors such as urbanization, migration, and population growth. The process of urbanization shows that more than half of the population now resides in urban areas due to migration from rural to urban areas. Malaysia is not exempt from this trend, where approximately 14 million residents now inhabit urban areas, while the number of rural residents is decreasing. The existence of squatter settlements also contributes to the increase in waste. This happens because squatter settlements often do not receive waste collection services due to administrative factors such as land status and assessment taxes.

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As third-level stakeholders, the community plays a role in assisting government bodies in achieving better solid waste management. Community participation is crucial for local governments to achieve their goals in the hierarchy of solid waste management. Knowledge, attitudes, and practices of the community are important elements of an effective solid waste management strategy. According to Babaei et al. (2015), the provision of infrastructure and recycling programs are key steps that local governments need to take to raise public awareness about waste segregation.

This study aims to identify the attitudes and behaviors of residents in two water settlement areas in the Sandakan district towards solid waste management. In addition, a comparison will be made between the two study locations to determine whether there are differences in attitudes and behaviors towards solid waste management.

LITERATURE REVIEW

The practical term for municipal solid waste (MSW) encompasses daily items such as product packaging, grass clippings, furniture, clothing, bottles, food waste, newspapers, and other household items disposed of by their users (Nabavi-Pelesaraei et al., 2019). All forms of waste must be disposed of correctly and systematically to ensure environmental sustainability. Public perception of waste management varies according to location and environment. Most individuals have a positive attitude towards proper waste management, such as in the Owerri Municipality in Nigeria, where 97.5% of those interviewed had a positive attitude towards waste management (Adogu et al. 2015). However, this perception is not uniform everywhere. In Tacna, Peru, the community views

solid waste as a health risk, a visual disturbance, or even as a factor contributing to the spread of diseases (Drackner 2005).Although there is a positive attitude towards waste and waste disposal, the implementation is generally still weak due to various factors such as cost, lack of awareness, and socio-economic constraints. The contradiction between attitudes and practices serves as the basis for the need for an integrated strategy that not only raises awareness but also addresses functional barriers to ensure more effective waste disposal.

The attitude of Malaysian society towards waste segregation, recycling, waste management, and cleanliness is still at a low level despite the government implementing various efforts towards sustainable practices. Awareness and knowledge about the environment have a significant influence on shaping the public's attitude towards waste management. The public's attitude towards waste management in Malaysia could potentially improve through education and increased access to recycling facilities. The government, through the SWCorp Strategic Plan 2014-2020, aims to change the mindset, behavior, and culture of society in addressing waste management issues (Moh & Manaf, 2016).However, to achieve the recycling rate targets, continuous investment and involvement from the government, private sector, and society are essential.

Rural communities have diverse attitudes towards cleanliness, waste segregation, and waste management. Attitudes, personal norms, and perceived behavioural control are among the factors that play an important role in determining their intention to manage daily waste. Moreover, subjective norms indirectly influence the intention to separate waste through personal norms, perceived behavioural control, and attitudes towards the behaviour. Besides, structural factors have a significant impact on proper solid waste disposal behaviour. The availability of organised waste disposal facilities serves as a major catalyst for adherence to proper disposal practices, with compliance rates reaching 80% or more (Wang et al., 2018). Therefore, the waste management behaviour of the rural community is closely related to various dimensions, including individual, social, and structural factors.

The attitude of Malaysian society towards waste management and recycling is influenced by several factors. In general, Malaysian society is less responsible and less concerned about sustainable waste management (Moh & Manaf, 2016). As a result, issues such as open dumping, uncontrolled waste disposal, and weak waste segregation continue to proliferate, even though many discarded items can be recycled. Generally, Malaysia's recycling rate is only about 5% and still needs improvement. The government has implemented various initiatives, including mandatory source separation in the Solid Waste Management and Public Cleansing Corporation Act 672, to enhance sustainable solid waste management (Moh & Manaf, 2016). However, the main challenge still lies in changing the mindset of society and integrating waste separation and recycling into daily life. Therefore, continuous efforts and active participation from the government, private sector, and public are necessary to achieve Malaysia's recycling rate target of 22% by 2020 and to strive towards becoming a zero-waste country.

RESEARCH METHODOLOGY

Study Area

This study was conducted in the eastern coastal region of Sabah, specifically in the Sandakan area (Figure 1). Sandakan is the second largest division in Sabah after Kota Kinabalu, covering an area of approximately 2266.24 square kilometres and is under the administration of the Sandakan Municipal Council (MPS Officer, 2023). Kampung Tinusa 2 was chosen as the study location (Figure 1). Kampung Tinusa II is one of the villages located on water. According to Mr. Norshidi (Head of Kampung Tinusa II, 2023), this village has existed since 1992, and the most dominant ethnic group residing in this village is the Bugis tribe. According to the head of the Tinusa 2 village, this village is located 5.7 kilometers from the center of Sandakan. In this regard, the population residing in Kampung Tinusa II amounts to 9,395, with more than 7,000 people registered and the rest unregistered. A total of 5000 houses have been built in the area. However, the area of Kampung Tinusa II has not yet been determined due to the ongoing construction of houses. The second study area was Kampung Bokara. Kampung Bokara is one of the earliest water villages to exist in Sandakan, including Bambangan, Tanjung Aru, Piasau, and Lembaga. According to Haji Abdullah, the head of Kampung Bokara, the village originally covered an area of 25 acres, but after being taken over by the port authorities, the area of Kampung Bokara now only spans 5

acres from the port area to Bridge 6, with a total of 218 houses. The Bajau tribe is the most populous in the village, followed by other tribes such as Bugis, Chinese, and Malay.

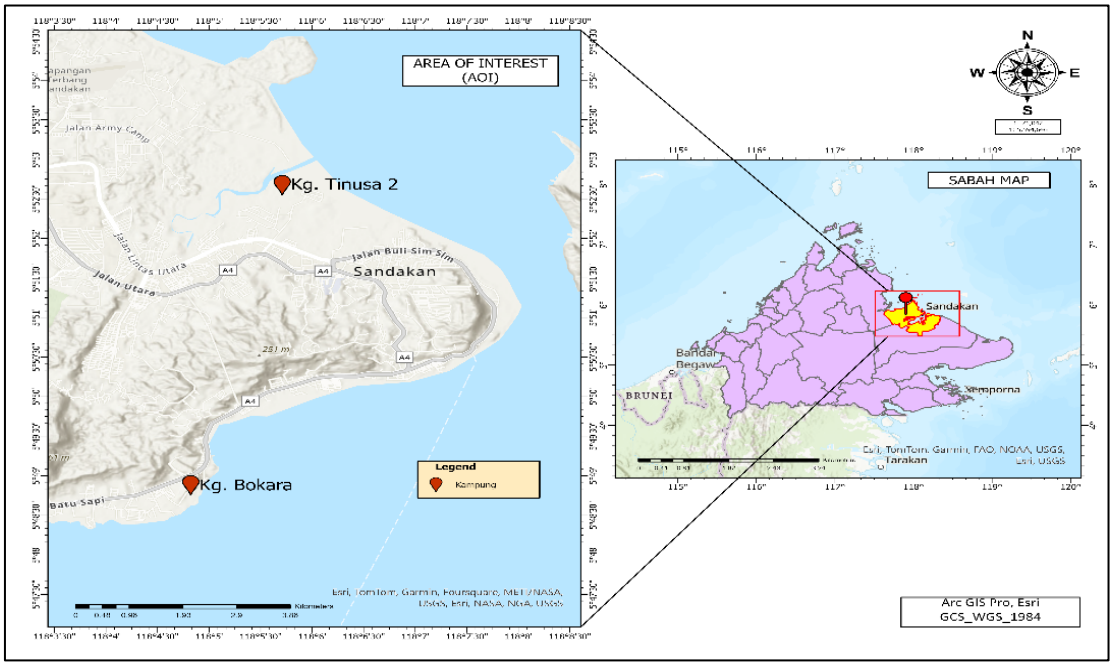


Figure 1: Study area

Research Design

Research methods in the social sciences encompass various qualitative and quantitative methods. Survey research is one of the quantitative techniques that is widely used in various fields of social sciences, especially to provide explanations about attitudes, behaviours, and other attributes (Cherney et al., 2013).In addition, surveys often utilize statistical techniques to draw conclusions from the collected data (Maravelakis, 2019). Although surveys remain the primary method for collecting data from large samples, there is a tendency among researchers to combine qualitative and quantitative approaches. This mixed approach is increasingly being adopted because it can provide a deeper understanding of the social phenomena being studied (Knoblauch et al., 2008; Leahey, 2008).

Data Collection and Analysis Methods

In this study, a survey method using questionnaires was employed to gather the genuine opinions of residents in the study area. Survey data were obtained through two methods: physically and via a link to a Google Form. Respondents were randomly selected, and representatives of the households involved filled out the questionnaire. After the data cleaning process was performed, 196 questionnaires were used for analysis purposes. The Google Forms link was provided to the village head to be distributed to the residents via the Whatsapp platform. The questionnaire had several sections: Section A, which pertains to the respondents' background; Section B, which addresses attitudes towards cleanliness; and Section C, which focuses on behavior in solid waste management. The Likert measurement scale was used for all questions, with scale 1 referring to strongly disagree and scale 5 to strongly agree. The average calculation of the Likert scale was determined based on the Pimentel (2019) formula using an interval of 0.8 (Table 1).This questionnaire was conducted over one day, specifically on November 16, 2023, from 10:00 AM to 4:00 PM with the assistance of ten research assistants.

Table 1: Interval scale

Item	Interval
Strongly disagree	1.00 - 1.79

Disagree	1.80 – 2.59
Not sure	2.60 – 3.39
Agree	3.40 – 4.19
Strongly agree	4.20 – 5.00

Source: Pimentel (2019)

Data obtained through the questionnaire were analyzed using the Statistical Package for the Social Sciences (SPSS) software. Subsequently, the data were analyzed descriptively (mean) and using the Mann-Whitney U analysis to determine whether there were statistically significant differences in the ordinal data (MacFarland & Yates, 2016).In this study, comparisons between locations will be analysed to identify differences in respondents' attitudes and behaviours towards solid waste management.

RESULTS AND DISCUSSION

Sociodemographic of Respondents

In this study, 196 respondents were selected as a sample consisting of 107 men (54.6%) and 89 women (45.4%).The respondents consisted of different age groups, with the largest being those aged 50 and above (32.7%).This was followed by the age group of 41–50 years (23.0%) and those aged 31–40 years (18.9%). There was variation among the respondents regarding their educational qualifications, with most having completed secondary school (SPM, 28.6%), while others held a diploma or STPM (12.8%) and a bachelor's degree (10.7%). There was also a significant portion (13.8%) who stated that they did not have formal education. In terms of employment, nearly half of the respondents (49.0%) were unemployed, 25.5% were self-employed, and the rest worked in the private (12.8 %) and government (12.8 %) sectors. The income distribution also shows that 54.6% of the respondents earned less than RM1000, and 24.5% earned between RM1001 and RM2000. An income of RM3000 and above was earned by only 10.2% of the total respondents. There were differences in household size, but generally, 36.7% had six or more members. Regarding marital status, 68.4% were married, and 27.6% were single. The main ethnic groups are Bajau 44.4% and Bugis 37.8%, followed by Suluk 5.6%, Malay 4.1%, and the rest are minority ethnic groups.

Respondents' Attitudes Towards Waste Management

The respondents' attitudes towards waste disposal practices revealed several important patterns (Table 2). .63.8% reported that it was easier to dispose of waste under their houses, while 29.1% preferred to adopt other disposal methods. A study by Alias et al. (2014) in three selected water villages located in three major towns in Sabah found that 48% of the 242 respondents in the water villages disposed of their solid waste directly into the sea. Troschinetz and Mihelcic (2009) stated that awareness significantly contributes to waste management behavior. Furthermore, 47.9% of the respondents stated that they do not experience disturbances from the waste piling up around their homes. These findings indicate that the current waste disposal system is inadequate and requires corrective measures.

From a positive perspective, 82.7% of respondents expressed their willingness to help maintain the cleanliness of their village by avoiding littering under their houses. This supports Ajzen's Theory of Planned Behavior (1991), which states that the intention to perform a behavior is a good predictor of practices such as waste management and demonstrates hope for efforts aimed at reducing waste generation.

In addition, 90.3% of respondents believed that the municipal authority (MPS) should provide regular advisory services aimed at maintaining cleanliness. This indicates a strong need for coordinated efforts at the institutional level to enhance public perception of cleanliness. According to Wilson et al. (2012), local government agencies play a crucial role in educating and providing relevant infrastructure for effective waste management.

Respondents also showed a strong commitment to the environment, with 94.9% stating that cleanliness around their homes is important to them, while only 3.6% disagreed. This shows that most respondents consider personal and communal cleanliness as a matter of concern. Obstacles such as limited waste disposal facilities and other logistical difficulties can cause the public to adopt behaviours that are contrary to the expected conduct. Regarding the issue of waste disposal, 43.4% of respondents reported that they found it difficult to use the trash bins provided by MPS, while 28.6% disagreed with this statement.

Additionally, 42.3% of respondents stated that they found recycling troublesome, while 60.2% expressed support for the community cleaning programs organized by the MPS. Overall, the respondents did not consider recycling to be a burdensome task. These findings reflect a positive perception of recycling efforts and can be further enhanced with appropriate facilities, greater educational investment, and active participation from the community (Chen et al., 2021).

To identify the differences between the two study locations regarding waste management attitudes and behaviours, Mann Whitney analysis was used. The test hypothesis is as follows:

H0 = there is no difference between the two locations regarding waste management behaviour

H1 = there is a difference between locations related to waste management behaviour

The Mann-Whitney U test results revealed significant differences in attitudes towards waste disposal and cleanliness across the study locations (Table 2).Respondents disposed of waste differently according to location (p = .020), indicating spatial differences in waste disposal attitudes. Residents of Kg. Bokara found it easier to take waste to the provided trash bins because they were located closer to their homes. Research indicates that densely populated areas are the most susceptible to illegal dumping (Jakeni et al., 2024).Similarly, there was a perception regarding the need for municipal services for cleanliness (p=.001).This is because there is a difference between the two study areas, with Kg Bokara being more easily accessible by MPS due to better heavy vehicle routes. However, for Kg. Tinosa 2, the vehicle route is one of the reasons why MPS services cannot be provided because it is too congested with residents' vehicles. The discomfort in using the municipal trash bins provided by MPS (p = .008) also shows a significant variation. For Kg. Tinosa 2, the RORO waste disposal facilities are only provided outside the village area, requiring residents to carry their waste over a considerable distance. Compared to the residents of Kg. Bokara, waste bins are provided at the end of the bridge, making them more accessible to the residents. Gomathy et al., (2022), state that rural areas may struggle with limited access to waste disposal facilities.

Table 2: Mann-Whitney U Test Results for Attitude Variables to Waste Management

	Kg.Bokara	Kg.Tinusa 2	Average Mean	Sig.	Results
I prefer to throw waste under the house	2.7683	2.2982	2.4949	.020	Reject null hypotheses.
I feel unbothered by the abundant waste in the home environment	2.6341	2.1842	2.3724	.151	Maintain the null hypotheses.
I am ready to keep the village clean by not throwing waste under the house	4.1341	4.2719	4.2143	.812	Maintain the null hypotheses.
MPS (Sandakan Municipal Council) must always provide advisory services on cleanliness	4.0732	4.7632	4.4745	.001	Reject null hypotheses.
The cleanliness of the home environment is important to me	4.5976	4.7982	4.7143	.775	Maintain the null hypothesis

I don't feel guilty if I throw waste under the house	3.0000	2.5526	2.7398	.060	Maintain the null hypotheses.
Throwing garbage into the waste cans provided by MPS is inconvenient	2.5366	3.2018	2.9235	.008	Reject null hypotheses.
The Gotong-royong programme should be held by the MPS	4.0732	4.6316	4.3980	.053	Maintain the null hypotheses.
Collecting recyclable waste is a hassle	2.5732	2.5439	2.5561	.924	Maintain the null hypotheses
Keeping the house away from litter is very important	4.4634	4.5351	4.5051	.265	Maintain the null hypotheses.

Respondents' Behaviour Towards Waste Management

Improper waste disposal can cause pollution and health problems, especially in densely populated areas. Therefore, sustainable waste management strategies are greatly needed in this field. This study analyses respondents' attitudes towards waste management based on their reported practices (Table 3).

Regarding waste management behavior, the study shows that 32.1% of respondents disposed of all types of waste under the house (agree), while 67.9% did not practice this. The average Likert scale analysis also shows that the practice is not supported by the respondents (2.374). This is consistent with previous studies that show that improper waste disposal is often influenced by a lack of enforcement and environmental awareness (Moh & Manaf, 2017). Therefore, stricter enforcement of waste management regulations and educational campaigns need to be emphasized to foster behavioral change.

Regarding the collection of recyclable items, some respondents had a more positive attitude. On average, respondents were more environmentally friendly by collecting recyclable items (3.6173). Only 24.5% of respondents did not do so, compared to 64.8% who stated that they kept old newspapers, glass bottles, and aluminum cans for recycling purposes. In a statement related to recycling, 78.5% of respondents expressed a desire to convince their families not to throw away recyclable waste. From this study, it was observed that 71.5% of respondents stated that they carried reusable bags when shopping, in contrast to 23.4% who did not. Other research shows that consumers are increasingly embracing sustainable consumption to contribute to environmental preservation (Mahadeva et al., 2024).

In a recent survey regarding cleanliness responsibilities, 65.9% of participants indicated that they would address the accumulation of waste under the house when it became excessive. This reflects a proactive approach to environmental management and a commitment to maintaining cleanliness. In addition, 89.8% of respondents are inclined to improve hygiene by supporting participation in cleaning programs. These findings demonstrate community-driven initiatives for reducing pollution. Community participation is one of the most significant elements in the success of waste management programs because group activities can result in better environmental interventions (Chen et al., 2021).

Despite being aware of the problem of garbage piles in their residential areas, only 42.3% of respondents admitted to reporting the concern to the local municipal authority (Sandakan Municipal Council). The possibility of a lack of communication between residents and local authorities should be addressed, and local government units should facilitate reporting, and communities should participate in these local government unit initiatives (Moh & Manaf, 2017).

The results of the Mann–Whitney U test used to assess waste management practices at the two study sites revealed significant differences in certain behaviors, as shown in Table 3. The habit of throwing waste under the house showed a significant difference ($p = .000$). This difference in behaviour is due to the availability of facilities and access to waste bins. For Kg Tinosa 2, the absence of waste bins at the exit is the cause of this

prevalent attitude. Previous studies have shown that the lack of suitable facilities for storage, collection, and disposal of waste leads to illegal dumping and open burning of waste (Mahajan, 2023).

The collection of recycled materials such as newspapers, aluminum cans, and glass bottles was significant (p = .017). This significant difference shows that the residents in Kg. Tinosa 2 are more concerned about the matter. This phenomenon may be influenced by awareness of hygiene rather than environmental care. This can be attributed to the findings of the analysis on cleaning activities in the area under the house when there is excess garbage (p = .004). Previous studies have shown that residents' participation in environmental activities is influenced by their attitudes towards environmental issues (Wu et al., 2024).

The use of reusable bags when shopping (p = .001) also showed significant results between the two areas. The significant differences reflect variations in attitudes toward the use of reusable bags that may correlate with differences in education, public awareness campaigns, or enforcement of regulations such as plastic bag bans. The public's attitude towards the use of reusable bags is influenced by various factors. Effective strategies to promote the use of reusable bags should incorporate economic, structural, and behavioral interventions (Neef et al., 2023).

Table 3: Average Mean Analysis and Results of the Mann-Whitney U Test for behavioral variables on waste management

Items	Kg. Bokara	Kg. Tinusa 2	Mean Average	Sig.	Results
I throw all kinds of waste under the house	2.9024	1.9912	2.3724	.000	Reject the null hypothesis
I collect recyclable items such as old newspapers, aluminum cans and glass bottles at home	3.2805	3.8596	3.6173	.017	Reject the null hypothesis
I will clean the area of the house (under the basement) if there is too much garbage	3.3293	3.9649	3.6990	.004	Reject the null hypothesis
I once informed MPS about the hygiene problem in my housing	3.0610	3.0439	3.0510	.913	Maintain the null hypothesis
I will bring a reusable bag with me when shopping	3.3415	4.0175	3.7347	.001	Reject the null hypothesis
I don't throw away recyclable materials	3.4390	3.6316	3.5510	.449	Maintain the null hypothesis
I will participate in the *gotong-royong* program if there is one	4.3659	4.4211	4.3980	.200	Maintain the null hypothesis
I would encourage my family not to throw away recyclable waste	3.7073	4.1491	3.9643	.103	Maintain the null hypothesis
I will bring waste from home to be disposed of in the garbage can provided by MPS	3.7195	3.9123	3.8316	.825	Maintain the null hypothesis

CONCLUSION

The study of attitudes and practices in solid waste management is important for devising more effective solutions. Such studies have been widely conducted in cities and rural areas. This study focused on water

villagers gazetted by the authorities, who should have better management than squatter areas. However, the results of this study show that the level of awareness and attitude of the population towards solid waste management is still at a low level. Although there are some positive practices to be proud of, there are still many aspects that need to be improved. The findings of the study also showed that an inattentive attitude towards littering was still considered a habit among respondents. However, in terms of behavior, there are some good practices practiced by the residents, such as carrying reusable bags when shopping and collecting recyclable items, which is a positive development. Therefore, it is important for the authorities to not only provide information and awareness to the population but also provide continuous support to ensure a more sustainable change in attitudes and practices in solid waste management.

REFERENCES

1. Adogu, P., Uwakwe, K., Egenti, B., Okwuoha, A., & Nkwocha, I. Assessment of Waste Management Practices among Residents of Owerri Municipal Imo State Nigeria. Journal of Environmental Protection, **06**, 446–456. https://doi.org/10.4236/jep.2015.65043(2015).
2. Alias, F. S., Manaf, L. A., Ho, M., Onn, N., & Abdullah, S. J. H. Knowledge and Attitude of Water Villagers' Towards Solid Waste Management. British Journal of Arts and Social Sciences II.(2014).
3. Ajzen, I. The theory of planned behavior. Organizational Behavior and Human Decision Processes, **50**(2), 179-211. https://doi.org/10.1016/0749-5978(91)90020-T(1991).
4. Babaei, A.A., Alavi, N., Goudarzi, G., Teymouri, P., Ahmadi, K.A., & Rafiee, M. Household recycling knowledge, attitudes and practices towards solid waste management. Resources Conservation and Recycling, **102**, 94-100.(2015).
5. Britten, N. Qualitative interviews in medical research. BMJ, **311**(6999), 251–253. https://doi.org/10.1136/bmj.311.6999.251(1995).
6. Broom, A., Hand, K., & Tovey, P. The role of gender, environment and Individual biography in shaping qualitative interview data. International Journal of Social Research Methodology, **12**(1), 51–65. https://doi.org/10.1080/13645570701606028 (2009).
7. Cherney, A., Povey, J., Ferguson, M., Boreham, P., & Head, B. Research Utilization in the Social Sciences. Science Communication, **35(**6), 780–809. https://doi.org/10.1177/1075547013491398 (2013).
8. Drackner, M. What is Waste? To Whom? – An Anthropological Perspective on Garbage. Waste Management & Research : The Journal of the International Solid Wastes and Public Cleansing Association, ISWA, **23,** 175–181. https://doi.org/10.1177/0734242X05054325 (2005).
9. Gomathy, G., Arul Kumar, D., P, A. T., Selvaraj, D., Dhinakaran, D., & Kalaiselvi, P. Automatic Waste Management based on IoT using a Wireless Sensor Network. 629–634. https://doi.org/10.1109/icecaa55415.2022.9936351(2022).
10. Grove, J. M. Cities: Managing Densely Settled Social-Ecological Systems (pp. 281–294). (springer new york. 2009). https://doi.org/10.1007/978-0-387-73033-2_13
11. Jakeni, Y., Madonsela, B. S., Malakane, K. C., & Maphanga, T. Identification of Illegal Dumping and Community Views in Informal Settlements, Cape Town: South Africa. Sustainability, **16**(4), 1429. https://doi.org/10.3390/su16041429 (2024).
12. Knoblauch, H., Baer, A., Petschke, S., Laurier, É., & Schnettler, B. Visual Analysis. New Developments in the Interpretative Analysis of Video and Photography. Forum Qualitative Social Research, **9**(3). https://doi.org/10.17169/fqs-9.3.1170 (2008).
13. Leahey, E. (2008). Methodological MemJemielniak, D. Thick Big Data. (Oxford University Press, Oxford 2020). https://doi.org/10.1093/oso/9780198839705.001.0001
14. Mahadeva, R., Ganji, E. N., & Shah, S. Sustainable Consumer Behaviours through Comparisons of Developed and Developing Nations. International Journal of Environmental Engineering and Development, **2,** 106–125. https://doi.org/10.37394/232033.2024.2.10 (2024).
15. Mahajan, R. Environment and Health Impact of Solid Waste Management in Developing Countries: A Review. Current World Environment, **18**(1), 18–29. https://doi.org/10.12944/cwe.18.1.3 (2023).
16. Maravelakis, P. The use of statistics in social sciences. Journal of Humanities and Applied Social Sciences, **1**(2), 87–97. https://doi.org/10.1108/jhass-08-2019-0038 (2019).
17. Moh, Y.C., & Manaf, L.A. Solid waste management transformation and future challenges of source separation and recycling practice in Malaysia. Resources Conservation and Recycling, 116, 1-14. (2017).

18. Nabavi-Pelesaraei, A., Chau, K.-W., Mostashari-Rad, F., Hosseini-Fashami, F., & Kaab, A. Life Cycle Assessment (LCA) Approach to Evaluate Different Waste Management Opportunities (pp. 195–216). crc. https://doi.org/10.1201/9780429423376-12 (2019).
19. Næss, P. Validating explanatory qualitative research: enhancing the interpretation of interviews in urban planning and transportation research. Applied Mobilities, **5**(2), 186–205. https://doi.org/10.1080/23800127.2018.1464814 (2018).
20. Neef, N. E., Richter, I., Shihepo, K., & Roos, C. Creating a shared vision by uniting local stakeholders to tackle plastic bag consumption. Frontiers in Communication, **8**. https://doi.org/10.3389/fcomm.2023.1177334 (2023).
21. Noor, K. B. M. Case Study: A Strategic Research Methodology. American Journal of Applied Sciences, **5**(11), 1602–1604. https://doi.org/10.3844/ajassp.2008.1602.1604 (2008).
22. Pegawai MPS (Sandakan Municipal Council Officer), Majlis Perbandaran Sandakan (Sandakan Municipal Council) (14 November 2023). Interview.(2023)
23. Pimentel, J. Some Biases in Likert Scaling Usage and its Correction. International Journal of Sciences: Basic and Applied Research (IJSBAR), **45**, 183–191. (2019).
24. Troschinetz, A. M., & Mihelcic, J. R. Sustainable recycling of municipal solid waste in developing countries. Waste Management, **29**(2), 915-923. https://doi.org/10.1016/j.wasman.2008.04.016 (2009).
25. Wang, W., Chu, Z., & Zhang, T. Synergy Degree Evaluation of stakeholder engagement in Integrated Municipal solid Waste Management: a case study in Harbin, China. Energies, **15**(14), 5000. https://doi.org/10.3390/en15145000. (2022).
26. Wilson, D. C., Velis, C., & Cheeseman, C. Role of informal sector recycling in waste management in developing countries. Habitat International, **30**(4), 797-808. https://doi.org/10.1016/j.habitatint.2005.09.005 (2006).
27. Wu, Z., Jin, M., & Cao, H. Residents' environmental behavior in eco-community development and its influencing factors: Evidence from Dongying City, Shandong Province in China. Sustainable Development, **32**(5), 4338–4353. https://doi.org/10.1002/sd.2915 (2024).