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Investigation of Human Awareness on Solid Waste Management at Taman Seroja and Data Collection in Sik, Kedah

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Abstract: Nowadays, solid waste generated in Malaysia is increasing in line with urbanization and population growth. The increasing population and the increase in economic status have led to an increase in solid waste generation in Sik, Kedah. A typical problem occurred in most residential areas when they could not effectively manage the solid waste by practicing the separation method. Therefore, the objectives of this study are to review and identify the effect of improper solid waste management in Malaysia, to identify the human awareness on waste separation in a residential area and to analyze the changes rate of solid waste before and during Movement Control Order (MCO) in Sik, Kedah. It has been identified that from the previous studies, improper management could impact two main issues: the environment, such as water and air pollution, and flood due to clogging, while the impact on humans will cause diseases such as *dengue*, *leptospirosis* and *salmonella*. In order to understand human awareness, based on the survey conducted, 32 respondents (58%) of the 50 respondents (100%) did not agree to participate in recycling activities due to the time-consuming to separate the wastes. In addition, it is found that when comparing the changes rate of solid waste due to MCO, 10% of solid waste increment during MCO compared to the year before MCO in 2019 with the highest increment differences in April and May at 15% and 23%, respectively. This result shows that each resident produced more waste when they worked from home and could only litter from home. In conclusion, this study indicates that solid waste management can be effectively executed when all parties play their roles to achieve better control.

Keywords: Change Rate of Solid Waste, Human Awareness, Solid Waste Management

1. Introduction

Solid waste can be defined as waste material that is no longer needed. This waste can be categorized into three classes such as solid, liquid and gaseous waste. Solid waste production contributes to industrial areas, residential areas, construction activities, and commercial activity centers such as shopping malls. Each category of solid waste should be disposed of according to the method for each category of waste. In addition, to ensure the smooth management of solid waste, the solid waste collection should be done according to the schedule set by the Municipal Council or District of a place. The Local Authority will appoint a contractor who manages waste collection for each area. This can make it easier for residents to plan waste disposal activities so that waste does not escape the collection if the type of waste, such as food waste that is not collected and left in the bin for a long time, will give an unpleasant smell to the surrounding area and will cause odor pollution. If not appropriately managed, other solid wastes will disrupt the environmental balance and be detrimental to human health.

The objectives of the study are to review and identify the effect of improper solid waste management, to identify the human awareness on waste separation in a residential area and, to identify the changes rate of solid waste before and during movement control order (MCO) in Sik, Kedah and. Questionnaires were sent to ±50 residents of the selected residential area at Taman Seroja, Sik Kedah, to understand the human awareness on waste separation and management. Daily data were also obtained from the District Council and Idaman Bersih Sdn. Bhd. and were analyzed. Based on the study, the residential area is the major contributor to solid waste for Sik District. The greater the number of households, the more solid waste generated. Community participation plays an important role in the success of planned activity in reducing solid waste generation. Residents are unable to manage their solid wastes using segregation methods effectively. This can be observed when all types of solid waste are mixed and thrown into the trash collected by Idaman Bersih Sdn. Bhd.

The importance of this study is to identify the solid waste management by the residents themselves where the solid waste production for each household should be well coordinated by implementing waste segregation practices. In addition, results from this study can potentially identify residents' attitudes about solid waste segregation practices for this residential area.

2. Reviews on the challenges and effects of solid waste management

2.1 Challenges of solid waste management

2.1.1 Landfill constraints

Society is producing an increasing amount of solid waste. This challenges the authorities, as Malaysia lacks suitable land for a landfill. This is because landfills should be away from residential areas. Housing development in the area is dangerous, disrupting soil structure, fauna growth, toxic gases, and groundwater pollution and polluted basic human food sources. This is also because landfills are used in Malaysia to handle solid waste. As a result, nearly 95% of waste is disposed of in landfills, and current disposal is rapidly approaching the end of its useful life. Fast development requires a developing country like Malaysia to effectively manage its domestic solid waste disposal system. The government is very committed to this aspect. The Ministry of Energy evidences this, Green Technology and Water and agencies such as the National Solid Waste Management Department and the Solid Waste Management and Public Cleansing Corporation (PPSPPA). There is also the formulation of the National Green Technology Policy. At the international level, Malaysia signed the 1997 Kyoto Protocol to address climate change and global warming due to the greenhouse effect [2].

However, only seven of the 289 landfills in the country are environmentally friendly sanitary landfills. That is, less than 2.5 percent of the entire landfill is well managed, with the rest operating on an open dumping or open-dumping basis. Moreover, in Malaysia, with an

estimated population growth of 2.4 percent or 600,000 people per year (since 1994), more waste will be generated, further reducing the lifespan of landfills. The situation is exacerbated by the latest statistics showing 113 out of 289 landfills in the country are no longer operating and awaiting closure. Some have extended their lives to cover the existing garbage. Sadly, many of the 113 landfills that have been closed are not sanitary landfills. But what is more interesting; most of the landfills are managed by local authorities (PBT) or private parties appointed by PBT. According to PPSPPA statistics, 114 landfills are operated by local authorities, covering 58 landfills in Peninsular Malaysia and the Federal Territory of Labuan, Sarawak (41) and Sabah (15).

2.1.2 Rapid Urbanization & Industrialization Process

The amount of solid waste produced in a given area is comparable to the total population. Solid waste generation and waste composition have increased due to high population growth combined with rapid urban population growth. In Malaysia's urban areas, 760,000 tonnes of solid waste are produced every day, compared to 1.8 million tonnes per year [2]. As countries go from low to middle to high-income status, their waste management issues alter. Rising affluence and migration to urban areas are linked to increasing per capita waste production.

Furthermore, as cities and populations develop, more people congregate in metropolitan areas, making waste collection and site acquisition for treatment and disposal more difficult. For developing local policy and planning, data on waste management is critical. Local governments can choose appropriate treatment procedures and plan for future needs by assessing how much rubbish is generated and the types of waste generated, especially in light of rapid urbanization and population growth. Using this data, the government can design systems with the correct number of trucks, construct efficient routes, set waste diversion goals, track progress, and adapt when garbage generation trends change.

2.1.3 Constraints of financial resources

In the excellent management of solid waste, the cost factor is significant. Local governments are finding it difficult to improve the quality of services to the community, owing to a shortage of resources, personnel, operations, vehicles, and facilities. The excessive expense begins with the quotation, collection, and waste transportation to the breakout site. Transport of remaining solids accounts for roughly 60% of the overall money spent on remaining solids management. Cities have high costs for waste management. In low-income countries, waste management is frequently the most expensive budget item, accounting for roughly 20% of municipal budgets on average. Solid waste management accounts for more than 10% of municipal budgets in middle-income countries, while in high-income countries, it accounts for around 4%. Budget allocations for waste management can be much more significant in some cases. Waste management is costly and complex, and it competes for money with other priorities such as clean water and other utilities, education, and health care. Local governments typically handle waste management with limited resources and capacity for planning, contract administration, and operational monitoring. Sustainable waste management is a challenging prospect on the road to economic development because of these variables. Most low- and middle-income countries and their cities fail to meet the demands. Poor waste management has disastrous repercussions for the poor, who are usually overlooked or have no control over the trash disposed of legally or informally near their houses.

2.1.4 Inefficiency of the Concession Company

The community often talks about the inefficiency of the concession company on both social media and the mass media. This is because the collection time is not according to the set schedule. This interferes with the activities of the residents in planning activities if this happens often. Garbage waste in the bins too will emit an odor around the neighborhood and encourage wild animals such as dogs to litter the residential area. In addition, leachate seeped along the road during transportation and litter was scattered. The lack of transportation facilities causes the Lorries to transport garbage beyond the proper limits. The use of vehicles that are not suitable for solid waste collection causes garbage to be scattered on the streets [2].

2.2 Factors of solid waste generation

2.2.1 Population Growth

According to [2], based on the 2002 annual report of the Ministry of Housing and Local Government (MHLG), the expanding MSW production is significantly connected to population growth, with a record of 13, 068, 97 tonnes per day for 1996 compared to 16, 247, 93 tonnes per day in 2001, corresponding to an increase from 15,146,236 to 17,136,575 at the same time of population. Over six years, the total MSW generation has grown by much than 20% or 3.3% a year. These events illustrate clearly that the increase in the production of MSW is closely linked to population expansion in Malaysia. Like other emerging countries, Malaysia saw rapid population growth from 1970 to 2005. Over ten years, the overall population grew by 13.8%, from 23.49 million in 2000 to 26.75 million in 2005 [2].

2.2.2 Education Level

Awareness and attitudes towards public waste can affect the whole municipal solid waste management system. All processes in municipal waste management depend on public awareness and engagement, from domestic waste storage through the segregation, recycling, frequency of collection, willingness to pay for waste management services and opposition to the location of waste treatment and waste disposal facilities. Therefore, a lack of public awareness and educational knowledge of the importance for people's health and well-being of efficient waste management seriously restrain the growth of community-based techniques in developing nations [4]. People's attitudes determine the features of waste generation and the effective demand for services for waste collection. In addition, awareness campaigns and education efforts can affect attitudes favorably and improve the negative impact on public health and environmental circumstances of poor waste handling. Some campaigns should be integrated with waste collection, reuse, recycling, and composting improvements.

2.2.3 Culture and lifestyle

Today's world creates a lot of solid waste, making it less environmentally friendly. Many people are also unconcerned about emissions in the atmosphere. Lifestyle changes can be seen when people start making dining out instead of home-cooking as a medium in daily affairs with the Food panda or Grab food application. This contributes to an increase in the addition of food packaging waste. The amount of solid waste generated can be decreased if people change their attitudes and lifestyles to be more environmentally conscious and the cost of solid waste management systems. Various leftovers and packages are visible throughout the festival season. There are vast amounts of paper, bottles, cans, glass, plastic, and decorative packaging in the trash bin during festival season. All of this is solid waste that must be discarded in improper ways [5].

2.3 Effects resulting from solid waste

2.3.1 Water pollution

Waste runoff from the landfill will flow into nearby rivers, especially through groundwater. This runoff contains various heavy metal pollutants such as Cd, Cr, Cu, Pb, Mg, Zn and Fe. For example, the quality index of the Pajam River recorded is polluted, which is in the range below 60 percent, 32 percent to 51 percent [3]. Water pollution is defined as a change in the content or color of water and its chemical characteristics induced by different pollutants in the form of solids, liquids, or gases. The untreated discharge of sewage frequently causes water pollution into a body of water. Water pollution impacts the entire biosphere of plants and organisms that dwell in a body of water, as well as organisms and plants that may come into contact with it. Native plants and natural biological communities may be harmed as a result of the consequences. A wide range of chemicals, pathogens, and physical changes, such as high temperatures, contribute to water pollution.

2.3.2 Air pollution

Open burning is also a result of poor waste management. The flora that used to be green will wither and die because of the toxic effects of open burning. In addition, air pollution through the smell of garbage left too long in the bins and irregular collection schedules because the neighborhood is polluted with foul-smelling air. Rubbish cultivation is involved in dumping waste into landfills, and this approach is still widely used in most nations. Filled soils are frequently used in abandoned quarries, mine voids, and loan pits [5]. Landfills that are well-designed and well-managed can provide a safe and relatively economical way to dispose of rubbish. Older and poorly planned and maintained landfills, on the other hand, can have negative environmental consequences such as wind-borne trash, flea luring, and the development of liquid leachate. Another typical result of packed soils is gas, primarily made up of methanol and carbon dioxide created by the anaerobic decomposition of organic waste. This gas is a plant house gas that can cause odor problems and destroy plants.

2.3.4 Flood

Each construction project for a residential area is the responsibility of the developer. To ensure that the construction project gets approval from the authorities, the developer will ensure that all infrastructures have the standards set by the government, including the housing drainage system. If the residents still throw garbage in the drain and the assigned contractor does not go through the cleaning work with garbage traps not maintained properly will cause the drainage system to be full of garbage. When the drainage system is filled with garbage, it will block the flow of water and cause stagnant water, which causes floods in the area. The dumping of rubbish and industrial waste into rivers and ditches causes flash floods, most common in cities. To remedy this issue, the community must be aware of the situation so that harmful practices, such as staging campaigns to love the river, do not persist. Certain bodies should also keep the river clean and not be utilized as a waste dump.

2.3.5 Diseases

Solid waste is human waste that has a dirty nature. This will attract the attention of disease-carrying vectors when solid waste is not maintained correctly. Insects and disease-carrying animals such as rats, mosquitoes and cockroaches will make solid waste disposal areas a breeding ground. This will give the disease to humans through the vector of carriers of this disease, namely dengue (Aedes mosquito), leptospirosis and salmonella (Rat). In addition, cockroach-bite diseases are salmonella and poliomyelitis. Our society still has a terrible practice of discarding rubbish in the incorrect area, which will result in the existence of pests such as rats and flies, which will be agents in the spread of illnesses such as cholera and diarrhea, affecting human health. According to Associate Professor Dr. Hamah Abdullah, an uncontrolled

garbage disposal can result in overflow water flowing into nearby rivers, a foul odor enveloping the surrounding area, polluted air due to the release of toxic gases, pollution that seeps into the soil, and many other negative consequences. Residents living near landfills may face severe consequences due to chemical reactions that release harmful particles such as heavy metals and organic pollutants (POPs) into the air. According to previous scientific research, the population residing near the waste disposal region suffers from health issues such as cancer, respiratory disorders, and birth control issues.

3. Materials and Methods

This is a descriptive and quantitative research study. Primary data collection is through survey forms to respondents in the study area. To obtain the objectives of the study, several instruments were used to collect data. Criteria for selecting respondents based on several principal characteristics: the respondent is a permanent resident in the study area. The questionnaire is divided into four sections, namely sections A, B, C and D. Section A contains the socio-demographic related of the respondents. Section B contains knowledge and community practices related to solid waste management, while section C contains questions factor respondents are not involved with waste management practices. Finally, section D includes questions about suggestions or opinions of the community in further increasing the level of awareness in solid waste management. The primary sources of information and data related to solid waste were obtained through the Majlis Daerah Sik and Idaman Bersih Sdn Bhd. Data information on the types of solid waste and the amount of solid waste collection was obtained through a meeting with officials from the Majlis Daerah Sik and Idaman Bersih Sdn Bhd.

3.1 Questionnaire

A survey (the questionnaire) was conducted to obtain more primary data to complete the secondary data. The questionnaire was distributed to 50 respondents of Taman Seroja, Sik Kedah. Questionnaires were conducted to obtain the objectives of the study to identify human awareness in managing solid waste. From this questionnaire, will be able to know each solution to a problem. Respondents are essential to obtain information or direct feedback so that the research process runs smoothly.

3.2 Data collection of total daily waste

Data collection is the most important phase in conducting any study. This aims to achieve the objectives and goals of the study. Information was collected based on data obtained from Majlis Daerah Sik and Idaman Bersih Sdn Bhd.

4. Results and Discussion

4.1 Questionnaire Analysis

In this questionnaire, several questions were asked to the respondents to answer the level of solid waste management for the residents of Taman Seroja. This questionnaire consists of 4 questions. In addition, to understand the human awareness of waste separation, a survey using Google form was conducted on 50 residents of Taman Seroja Sik, Kedah.

4.1.2 Demographic respondent

Of the 50 respondents who answered this questionnaire, 58% were male, and 42% were female. Overall, 100% of the respondents are of Malay descent and Muslim. Most respondents aged 20-25 years and 56-60 years and above were in the highest percentage of 20%. The rest of the respondents were aged 26-30 years (10%), 31-35 years (6%), 36-40 years (8%), 41-45 years (14%), 46-50 years (8%), and 51-55 years (14%). Respondents were found to have an educational background with a Degree 48%, Diploma 30%, Sijil Pelajaran Malaysia 16%, Penilaian Menengah Rendah 2% and Ujian Penilaian Sekolah Rendah 4%. The majority of respondents' income is in the highest percentage of RM 4000, above 34%. Respondents' income is RM0-RM1000 (28%), RM1100-RM2000 (16%), RM2100-RM3000 (12%), and RM3100-RM4000 (10%). 42% of respondents work in the government sector, 8% work in the private sector, 8% are self-employed, 16% are retirees, 22% are students, and 4% are housewives. Respondents in this area are more likely to adopt a home-cooking lifestyle with 84%, and only 16% adopt an outdoor eating lifestyle.

4.1.3   Knowledge and community practices related to solid waste management.

Solid waste management requires an integrated approach so that the neighborhood environment is in a clean, beautiful and prosperous condition can be achieved. A clean environment and a prosperous population are good and successful solid waste management indicators. Based on community knowledge and practices related to solid waste management, 80 % of respondents know that Environment Idaman Sdn Bhd. is a contractor company that collects solid waste in the respondents' neighborhood and 20 % vice versa. The majority of respondents understand what solid waste management means, with a percentage of 90% and 10% of respondents still do not understand what solid waste management means. In addition, 98% of respondents have heard of solid waste management, and the rest still have never heard of solid waste management. As respondents who live in residential areas, this gives a good response when almost 98% of respondents understand the concept of recycling. Furthermore, most respondents know that 90% can distinguish plastic, glass, paper, and organic waste as solid waste. Furthermore, 94% of respondents know that solid waste segregation can generate income. Thus, almost 50% of respondents have participated in solid waste management campaigns in the neighborhood, and 50% still do not participate in the activities carried out. Household waste segregation activities are always a burden for the community in the housing residential area. Still, as many as 76% of respondents in this neighborhood practice household waste segregation activities, and only 24% have not yet practiced this method. On the other hand, 66% of respondents are responsible for practicing recycling activities, and 24% have not yet made this activity a practice.

4.1.4   Factor residents are not involved with waste management practices

Out of the 50 respondents who answered the questionnaire, it was found that 18 people equivalent to 36% of respondents, said they disagreed and were neutral that solid waste management activities take a long time. The majority of respondents of 58%, disagreed, saying this activity took a long time. Some respondents are neutral towards time-consuming factors that hinder this activity. This is because recycled materials need to be separated by category. The absence of recycled materials at one time causes them to have to be collected in large quantities and then sent to recycling centers. Respondents also disagreed with making recycling centers too remote to engage in solid waste management. According to 20 respondents, 40% consider that recycling activities do not generate a lucrative income. The majority of respondents were 32 people, with 64% disagreeing that there are no items to be recycled.

4.1.5 Community suggestion in further increasing awareness in Solid Waste Management.

One of the steps that can be taken is to provide recycling facilities to encourage recycling activities. The majority of respondents suggested providing more recycling bins in each of the

alleys of residential areas. This makes it easier for them to segregate solid waste by type. In addition, the respondents also hoped that the authorities would conduct more frequent awareness campaigns on solid waste segregation in residential areas and impose fines on individuals involved in dumping solid waste in inappropriate bins. Therefore, by increasing the number of recycling centers and recycling bins, it is hoped that it will nurture the community to practice more recycling. The position of the recycling center and the three colour bins should be more strategic to make it easier for them to carry recycled materials. It should be placed close to residential areas, schools and surau.

4.2   Data collection solid waste rate in 2019 – 2020

Table 1 shows the percentage changes in total solid waste (in kg) for the whole year of 2019 and 2020. It indicates that January 2020 had increased by 10% compared to January 2019 (no MCO in both years). In February 2020 (still no MCO), there was a decrease of 11%, and the pattern of changes began to increase between April and October. Table 2 shows the percentage changes of total solid waste (in kg) months before and during the Movement Control Order (MCO). The comparison was made only between April and November. Full MCO has started for four months, between March and June 2020. Note that there was no data in Mac 2020 because all related staff for waste management also work from home in Mac 2020. April and May 2020 show relatively high increments at 15% and 23%, respectively (Table 2). This may be because all residents have started working from home (WFH) entirely; hence, more waste productions were generated. In June 2020, no changes can be observed since there were no data in June 2019, total waste in June 2020 was quite impressively higher than the other months in 2019 and 2020 July 2%, August 6%, September 13%, and October 16%. In November there was a decrease of 4%. No data was found to be compared in December 2020 as well. Overall, total solid waste between the two years of 2019 and 2020 was increased by almost 17%, while between entire months of MCO also grew by 10%. It can be seen that during the movement control order, the local community produced lots of solid wastes because many activities were done at home.

Table 1: The monthly and annual percentage differences of solid waste rate in 2019 and 2020

Month	A monthly collection of solid waste (kg)		Percentage differences (%)
	2019	2020	
January	401350	443870	10
February	347262	312640	11
March	480754	No data	-
April	363110	426560	15
May	434080	566780	23
June	No data	621280	-
July	587430	594630	2
August	498540	528040	6
September	465200	532110	13
October	453400	535420	16

November	552030	531400	4
December	No data	540490	-
Annual total	**4690526**	**5633220**	**17**

Table 2: The difference percentage solid waste rate before and during Movement Control Order (MCO)

Month in 2019	Before MCO	Month in 2020	During MCO	Percentage differences (%)
April	363110	April	426560	15 (increased)
May	434080	May	566780	23 (increased)
July	587430	July	594630	2 (increased)
August	498540	August	528040	6 (increased)
September	465200	September	532110	13 (increased)
October	453400	October	535420	16 (increased)
November	552030	November	531400	4 (decreased)
Total	**3353790**	**Total**	**3714940**	**10 (increased)**

5. Conclusions

Through the questionnaires, it can be preliminary observed that most such housing communities are concerned with solid waste management. Most of the residents know about solid waste recycling and have initiated a start on their recycling activities of solid waste. This may be because most residents are highly educated, and most are employed. Moreover, from the data collection of monthly and annual total waste (in kg) both for comparison between 2019 and 2020; and before and during the MCO, the increment of solid waste production during the MCO was observed. Work from home during MCO has shot up the waste produced during MCO in 2020. In terms of awareness, the Sik community has a basic understanding of solid waste management, but there are still more residents who lack awareness about solid waste management.

Acknowledgement

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