

The Sustainability of Solid Waste Management on Kapas Island, Terengganu, Malaysia

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Solid waste management is a serious environmental issue for marine park islands, especially in Malaysia. The amount of waste generated by visitors is usually produced within a short period of time and adds to existing waste management problems. The purpose of this study is to identify the sustainability level of solid waste management on Kapas Island, Terengganu. Inefficient solid waste control not only triggers a reduction in tourism, but also provides a negative impact on environmental management. This qualitative study uses primary data collected via in-depth interviews with chalet operators and Marang district Council officials responsible for solid waste management on the island. The result of this study shows that an integrated recycling program and composting methods were seen to be more efficient in solid waste management on Kapas Island.

Key words: *Sustainability, solid waste, Small Island, management, recycling, composting.*

Introduction

Solid waste management has been identified as one of the main issues faced by local authorities on Kapas Island in Malaysia. Increasing tourist numbers affect the ecosystem, habitat, and marine life. The challenge for authorities is that they need to tackle this problem in a sustainable manner. This study focuses the role of Local Authorities in establishing cooperation from stakeholders, such as resort operators, resort staff, tourist, and contract staff, towards sustainability of solid waste management. The involvement such stakeholders is important in reducing environmental pollution. In addition, tourist participation contributes to the preservation of the marine park.

Issues of Solid Waste Management in Small Island

Studies conducted on solid waste management on Malaysian islands found an increase of solid waste generation. Table 1 below shows four Malaysian islands where solid waste levels are produced. Langkawi produces more solid waste compared to Redang and Tioman Islands. Ironically, Langkawi is larger in area and size and, in terms of solid waste generation, is superior to other islands.

Table 1: Solid Waste Generation in Small Island in Malaysia

	Redang	Tioman	Pangkor	Langkawi
Size (km ²)	10.7	131	8	478.5
Population	1,400	3,400	26,000	79,000
Waste generated (metric ton/day)	2.7	6.95	13	85
Waste generation rate (kg per person per day)	0.86	0.87	0.48	1.08

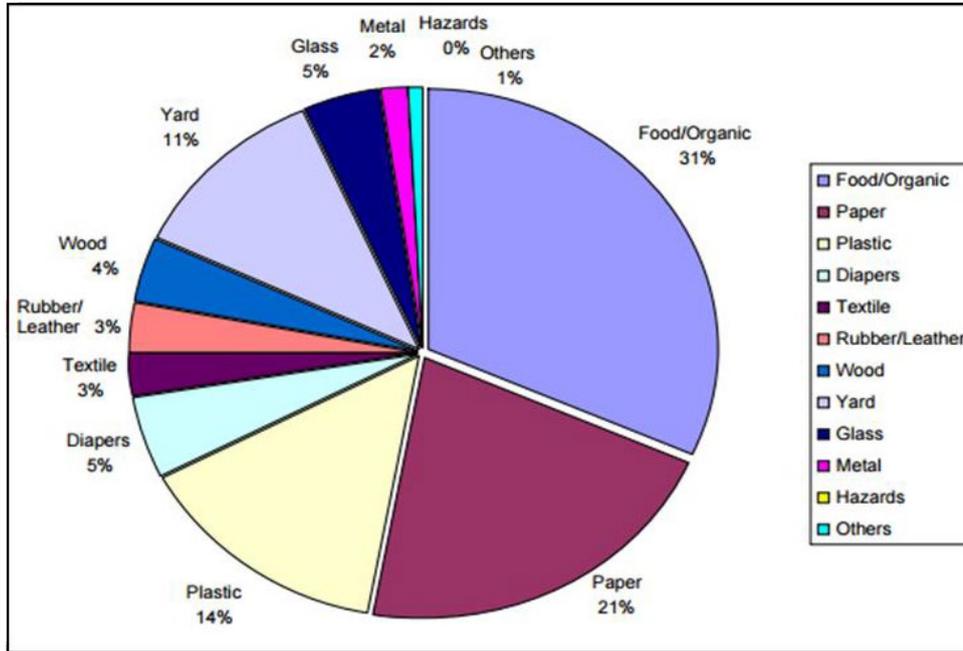
Source: Agamuthu, Nagendran (2010)

Irresponsible solid waste disposal by individuals impacts the environment and affects the quality of land, water and air due to chemicals that react with natural resources. Most of resorts in Malaysia, such as Perhentian and Redang Islands, are preferred choices of domestic and foreign tourists. Despite this, a constraint in the eradication of solid waste management afflicts the the resort islands. Inefficient solid waste management on Perhentian Island is also a major threat to coral reef ecosystems (Tourism Research, 2015). Additionally, studies on heavy metal contamination in groundwater have been conducted on Kapas Island.

Such studies assess the extent of heavy metals in groundwater and subsequently determine the impact on residents. According to Nouri et al, 2006; 'small islands are generally formed with highly permeable soil, which, with enough recharge water, easily transports the heavy metals at the surface area into the ground water.' This is not the exception for Kapas Island which sees heavy metals affecting water quality for the purpose of community needs, especially those living on the Kapas Island. The island is entirely dependent on groundwater resources and the removal of solid waste into the sea changes the quality of the water for both daily and domestic needs.

The study of "Waste Management Challenges in Sustainable Development of Islands" conducted by Agamuthu P and Nagendran P. (2010) describes the composition of waste on islands by showing a high percentage of organic waste (31%), followed by paper waste (22%) and; 14% for plastic and other compositions of solid waste. Figure 2 below shows the percentage of each solid waste composition obtained through research.

Table 2: Solid waste composition in Small Island in Malaysia



Source: Agamuthu & Nagendran (2010)

Methodology

This study involved in-depth interviews with resort operators, cleaning contract staff and Marang District Council officers who are involved directly in the management of waste on Kapas Island. Secondary data was obtained from Marang District Council Annual reports as well as journals related to solid waste management. Information and data obtained from interviews was analysed and coded according to the study's themes.

Results and Discussion

Table 3 below shows various types of solid waste composition generated on Kapas Island. The results of this study indicated that food waste represents the highest percentage of solid waste generated. Food waste was ranked and comprised almost 40% of the solid waste. This was followed by 30% of garden waste and has no negative impact on the environment. However, the problem of resorts undertaking dry waste burning of bulky wastepaper stands at 10%. Total daily solid waste generation on Kapas is approximately 1 tonne (100kg / day), (Assistant Environmental Health Officer of Marang District Council, 2017).

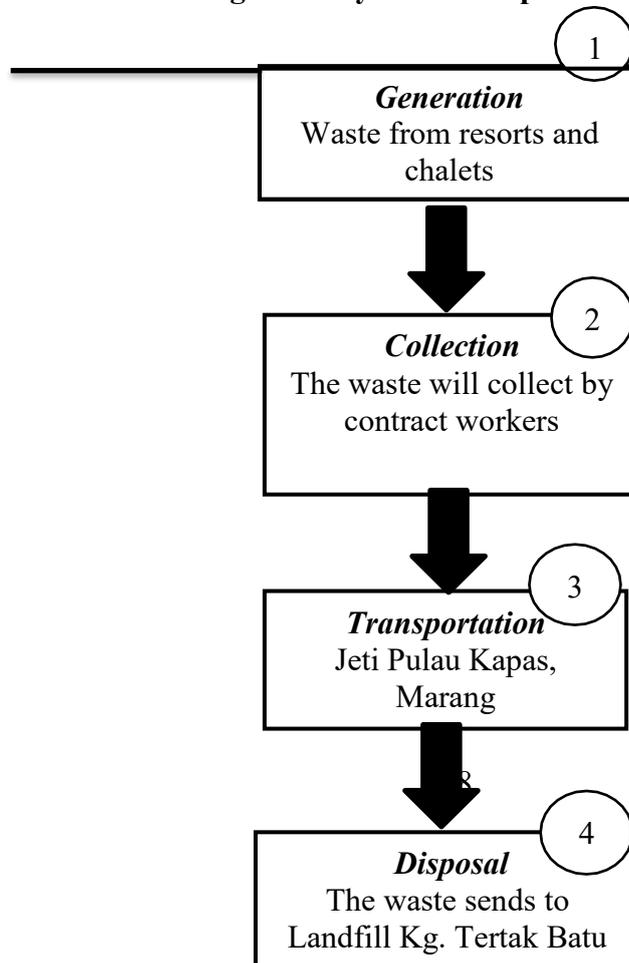
Table 3: Waste Composition in Kapas Island

Types of waste	Average weight (Kg/Day)	Average weight (%)
Food waste	400	40
paper	100	10
Aluminium	30	0.3
Plastic	30	0.3
Glass	40	0.4
Garden waste	300	30
Bulky waste	100	10

Source : Marang Local District, (2017)

The study found that there are several stages of solid waste management. The results show that resort management, contract worker staff and the Marang District Council work together to ensure that garbage collection and transport management is done well on a daily basis. The solid waste management process is set out in Figure 1 below:

Figure 1: Solid Waste Management System in Kapas Island



Source: Fieldwork (2017)

With regards to Figure 1 above:

a) Solid Waste Generation

Most waste is generated by resort operations and chalets. The highest type of solid waste is organic waste (food) totalling almost 40% and followed by 30% of garden waste. However, plastic bottles, paper, and aluminium are further examples of waste.

b) Collection System

Garbage collection is undertaken daily by contract workers appointed by the Marang District Council. Isolating and separating waste is not done by the resort owner and is mixed in a black plastic bag and tied before placed on the beachfront for collection for transport to the mainland.

c) Transportation and Disposal

Waste collected from shore is transported by boat and sent to landfills. There are two types of transport: used speedboats and small boats. Both boats are used according to the type and amount of solid waste generated by each resort. Speedboats ferry garbage to the mainland and small boats carry trash around the island. Traveling from Kapas Island to the jetty takes between 25-30 minutes and garbage trucks wait at the jetty to transport the landfill. Distance from the jetty to the landfill is 11 kilometres. In the monsoon season, any collection and disposal activities are not permitted by the Marang District Council. This is because turbulent seas threaten workers themselves. For three months (October to December), contract workers are not directly involved in waste collection. Therefore, resort management either transports the waste to the mainland or burns it.

The study found that Kapas island also faced challenges in addressing large and heavy sized bulky items. Bulk waste is group or domestic waste that is no longer used and includes furniture, mattresses, washing machines and refrigerators. Most of these items are from resorts, garbage disposed by tourists or upgrade work. This is a challenge because 'bulky waste' is lumped and left unattended without taking appropriate action. However, other issues arise when there is no suitable way to transport solid waste to the mainland from the Marang District landfill site. Solid waste falls into the sea and costs are high to secure the load safely. High cost and relatively expensive transport costs cause the 'bulky waste' to be left behind at the resort or in the interior of the island (Department of Solid Waste Management, Ministry of Housing and Local Government, Danida, 2009).

Solid waste management involves the organisation of aspects of generation, grouping, collection, separation and disposal at landfills. Solid waste management facilities also play an



important role in that they enhance the effectiveness and efficacy of its management. In addition, the involvement of various parties, both the authorities and the people, play a more important role in safeguarding the environment. Therefore, this study addresses and makes, several recommendations in order to strengthen and improve waste management on Kapas island for the future.

In terms of policy implementation, local authorities' involvement through the Marang District Council serves to provide effective plans and strategies to ensure solid waste management provides environmental balance and socio-economic well-being. Additionally, rigorous planning to provide more efficient services and cost-effective allocation assists in management efficiency. The National Solid Waste Management Policy and the Waste Disposal Policy are aimed at reducing the dangers faced by the environment and human beings. However, in achieving its objectives and goals, policy enforcement needs to be undertaken to ensure the established policies are capable of safeguarding social wellbeing and sustainability. Rules and regulations embedded in policies and laws need to be tightened by authorities to avoid misuse or complete neglect..

Comprehensive policy implementation should be emphasized in covering various aspects of solid waste management as well as ensuring that services provided are more integrated, cost effective and achieve maximum efficiency. For example, the establishment of the Solid Waste Policy on Cults which began September 1, 2015 should continue to be enforced within the country to achieve the objective of reducing waste generation at the landfill and to raise awareness among the people to preserve and value the environment. Residual separation in Kapas Island should be carried out by local authorities to ensure sustainable solid waste management systems on the island. Continuous enforcement and monitoring should be undertaken by local authorities to monitor and take unauthorized action against illegal dumps behind the resorts and chalets and in public places, as well as on open burning practices.

As an island recognised by the government as a National Marine Park, environmental habitats and ecosystems need to be maintained. A recycling campaign will create social, economic and environmental awareness. Public involvement is extremely important in raising awareness of care through such a campaign. Environmental campaigns provide informal education and knowledge to all people about the need and priority to preserve the natural environment. Through a targeted and savvy recycling campaign, waste reduction will be achieved. Local authorities, NGOs and other agencies need to further enhance recycling awareness campaigns on the island and involve tourists as part of the program to do so. The study also suggests that an integrated recycling centre should be set up on Kapas Island and managed by resort operators and local tourist associations through Marang District Council. This integrated recycling centre will reduce management and potential clean-up costs incurred by authorities.



Conclusion and Recommendations

This study found that solid waste management on Kapas Island was moderate but required improvement in terms of collection and transport disposal methods. Governments have very clear roles and responsibilities in caring and safeguarding the environment. Any policies and guidelines established by government must be implemented at a local authority level to ensure sustainability of the marine park islands. The government should always evaluate and monitor management of solid waste and seek feedback from resort staff and chalets, as well as tourists. Gaining insights and suggestions contributes to the improvement of waste disposal on the island.

Additionally, authorities handling waste management activities need to have in place robust, effective management plans to ensure the efficient waste management procedures. Placing recycling bins in strategic areas is one such example. Under the jurisdiction of the Marang District Council, the role of solid waste management agencies such as the Solid Waste Management and Public Cleansing Corporation should also assume the role of controlling and monitoring solid waste. Targeted efforts need to be improved to ensure that solid waste management is manageable, integrated and sustainable. Planning for solid waste management needs to be systematic by using sustainable approaches that do not harm the environment and ecosystems. It is evident that the involvement of all stakeholders, whether the authorities or the public, should work together to protect the environmental cleanliness for present and future generations.

Solid waste management services need to be reviewed and upgraded from time to time so as to monitor the levels and impact of waste on the island. Proposed models such as integrated recycling centres and composts can help refine and improve solid waste management systems. Although numerous proposals and solutions to mitigate waste management problems have been proposed, enforcement and prosecution needs to be improved in order to reduce waste disposal landfills. In addition, the implementation of policies to manage solid waste should be increased so that national development and social well-being goals are achieved.



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