

Challenges for Source Separation of Food Waste and Turning Waste into Compost for Island-Based Hotels

Cabaran untuk Pengasingan Sumber Sisa Makanan dan Perubahan Sisa kepada Kompos bagi Hotel

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ABSTRACT

The practice of turning food waste into compost among hoteliers in Malaysian islands is still far behind compared to the government's target of 8% by 2020. This paper aims to identify challenges associated with implementing sources of separation of food waste, turning waste into compost, and proposing relevant actions using island-based hotels on Langkawi Island as a case study. This study adopted the mixed-method approach. The researcher distributed sets of questionnaire surveys to 42 hoteliers, followed by observation and interviews with 23 hoteliers. This study identified the lack of space, existing facilities, expertise, funding, adequate knowledge and support from the hotel management affected the activities separation and composting of food waste at their hotel. The study also suggested five key actions for achieving sustainable food waste management for the hotel sector in Langkawi via separate and compost food waste strategies. Those actions are (1) monitor by establishing a unique team of the hotel staff; (2) cooperation with the contractor of taking waste hotel; (3) systematic waste collection with fixed schedule; (4) waste audit and waste mapping; and (5) adequate infrastructure. This study provides information and guidelines to help hoteliers reduce food waste, save hotel operation costs, and maintain the hotel's focus on environmentally friendly practices.

Keywords: Composting food waste; food waste; hotel sector; island; separating waste

ABSTRAK

Perubahan sisa kepada kompos dalam kalangan pihak pengurusan hotel di pulau Malaysia masih sederhana berbanding dengan sasaran kerajaan sebanyak 8% menjelang tahun 2020. Tujuan kajian ini adalah untuk mengenal pasti cabaran yang berkaitan dengan pelaksanaan pengasingan sisa makanan dan berubah sisa kepada pengkomposan serta mencadangkan tindakan yang relevan dengan menggunakan perhotelan di Pulau Langkawi sebagai kajian kes. Pendekatan kaedah gabungan dilaksanakan melalui tinjauan soal selidik dengan 42 pihak pengurusan hotel, diikuti dengan pemerhatian dan temu duga dengan 23 pihak pengurusan hotel. Kajian ini mengenalpasti kekurangan dari segi ruang, kemudahan sedia ada, kepakaran, pembiayaan, pengetahuan dan sokongan dari pengurusan hotel mempengaruhi aktiviti pengasingan dan pengkomposan sisa makanan di hotel mereka. Kajian ini juga mencadangkan lima tindakan utama untuk mencapai kelestarian pengurusan sisa makanan untuk sektor hotel di Langkawi melalui strategi pengasingan sisa makanan dan kompos. Tindakan tersebut adalah (1) dipantau dengan menubuhkan pasukan khas hotel; (2) kerjasama dengan kontraktor pengambilan sisa di hotel; (3) pengumpulan sisa secara sistematik dengan jadual tetap; (4) audit sisa dan pemetaan sisa; dan (5) infrastruktur yang mencukupi. Kajian ini memberikan maklumat dan idea kepada organisasi perhotelan dalam mengurangkan penghasilan sisa makanan dan pada masa yang sama dapat menjimatkan kos operasi hotel serta mengekalkan aspirasi hotel ke arah amalan mesra alam.

Kata kunci: Kompos sisa makanan; sisa makanan; sektor hotel; pulau; pengasingan sisa

INTRODUCTION

Currently, landfills have become the prime location for waste disposal in Malaysia. It was reported that the landfills in Malaysia had reached nearly 85% of their capacity (Moh & Abd Manaf, 2017; Zamhari & Ali 2014). Most of the other solid wastes

(such as paper, plastic, glass, rubber, metal) are usually only separated by waste collection workers and workers at the landfills (Hassan et al. 2000; Kasavan et al. 2022). Various cultural factors, infrastructure, management systems, economic support, technological inputs, human resources, and even awareness have created a barrier to

developing effective solid waste management and recycling systems in Malaysia (Ahmad Fariz, Samad Abdul Hadi, Shaharudin Idrus, 2011). In European countries, landfilling has become the least preferable option and waste that cannot be recycled are dumped into the landfills (Ghafar 2017). Developed Asian countries such as Korea and Japan use incineration as a waste recovery treatment. However, developing Asian countries (such as Malaysia, Indonesia, Thailand, Vietnam, and India) dispose of 70% to 90% of their waste into the landfills. Those waste disposal activities are done without proper treatments, such as gas venting, leachate treatment and lining systems (Ismail, 2013).

Disposal of waste at the landfills is cost-effective (Lim et al. 2016). However, it builds various negative impacts on environment such as toxic gas emissions, groundwater pollution, odour, and climate change (Khan & Nopiah, 2019; Mohamad Ridzuan Mohamad Salleh et al. 2020; Shamshiry et al. 2012). According to SWCorp (2014), 5,000 tons of food are wasted daily in Malaysia. This quantity of food is enough to provide three times meals weighing 0.5 kg per meal to 10 million people per day. A considerable amount of food waste ends up in landfills where it causes decreased landfills capacity and needs the government to build a new landfill by spending high cost. At present, the rate of reuse and recycling of food waste in Malaysia is relatively low at only 5% compared with paper (60%) and plastic (15%) (Moh & Abd Manaf, 2017). Apart from paper and plastic waste, there is limited waste recovery treatment for food waste in Malaysia, although 45% of food waste could be potentially composted (Noor et al. 2013). Composting food waste is common practice in Malaysia, and there is a limited separation of food waste sources. According to Vani, (2020), 90% of food waste is biodegradable and easy to compost, but awareness about food waste composting is still low among Malaysians.

Disposal of odd waste in the landfill is not sustainable, particularly on islands like Langkawi, a highly vulnerable ecosystem (Saraswathy Kasavan et al. 2017). Waste management at landfills on the island is more challenging than on the mainland, mainly due to insufficient alternative treatment strategies and land space constraints (Nor Fatimah Ibrahim et al. 2016). Moreover, it is not easy to find suitable sites to build new landfills. Food waste contributes to 32% of generation waste for Malaysia's tourist islands (Agamuthu Pariatamby and Nagendran Periaiah, 2007; Kasavan et al. 2019). As

a significant player in the growing tourism industry in island destinations, hotel operators should take relevant actions to minimise the generation of food waste to maintain sustainability on the island. In this light, it was reported that separation of food waste and composting is not a common practice by hoteliers in Malaysian islands, and it is yet to reach the government's target of 8% by 2020 (Agamuthu Pariatamby & Periaiah, 2007).

According to Singh, Cranage, & Lee (2014), food waste from the hospitality industry is also a contributor to greenhouse gas emissions in landfills. There is an urgent need for strategies for separating and composting food waste at the island-based hotel operations. However, there are limited studies conducted on food waste separation and composting in the hotel sector (Ibrahim 2017; Wong 2016). Therefore, this paper aims to identify challenges associated with implementing sources of separation food waste and turning waste into compost and propose relevant actions based on island-based hotels in Langkawi as a case study. A good food waste management in the hotel sector, comprising of separating food waste and composting, will help reduce the food waste dumped into at the landfill, cut down hotel operation cost, and maintain the hotels' environmentally friendly practices.

RESEARCH APPROACH

STUDY AREA

Langkawi island is located in Kedah, which is located at the northwestern coast of Peninsular Malaysia. Langkawi island is a popular tourist destination for nature-lovers because it was blessed with unique geological features, rich biodiversity and cultural heritage of the Malays, Chinese, Indians and Siamese people living there (Sharina Abdul Halim et al. 2011). Langkawi experienced a tourism boom after it was announced as a duty-free island in 1987. Subsequently, the island's economy has transformed from being reliant on agriculture (paddy and rubber) to reliance on tourism (Halimatun Saadiah Hashim, Sarah Aziz, 2011). Langkawi island was also certified as one of "UNESCO Global Geopark" in June 2007. This recognition is the first in Malaysia, and Southeast Asia and Langkawi are now the 52nd Global Geopark in the world, as shown by GGN (Ong et al. 2010).

METHOD

This study's data were not only based on what was reported by the food waste disposal through questionnaire (quantitative) but also collected through observation and individual interviews (qualitative), as shown in Figure 1. Questionnaires were distributed to selected hotels (ranging from 1 star to 5-star hotels) that provide in-house food and beverage services together with accommodation. A survey questionnaire was deployed to collect descriptive data for identifying current and future food waste disposal methods applied among 42 hoteliers (from 42 hotels) in Langkawi. The study also used a Guttman scale questionnaire which seeks either a 'yes' or 'no' answer and contains questions that allow respondents to give more than one answer. The most copies of the questionnaire completed have been personally collected through the researchers, while remain copies of questionnaires were collected via the online survey.

Furthermore, semi-structured interviews were also conducted with 23 hoteliers to examine the hotels' challenges in separating food waste and

turning waste into compost. The researchers also observed the food waste disposal method at the hotels in Langkawi. Each observation was carried out with a specific focus and was recorded with note-taking. All observations were carried out in the main places that generate the highest food waste, such as waste storage, food raw material stores, kitchens, and food distribution location. The qualitative study was conducted based on qualitative content analysis, which systematically describes the meaning of data from the interviews and the observations. The questionnaire survey and interview are mainly conducted with the operational level staff (chefs and stewards) and management staff (operations managers, general managers and F&B managers). According to Johnson & Onwuegbuzie (2004), the combined use of quantitative and qualitative approaches can create a more in-depth understanding of the study problem than other methods. The researcher summarised the qualitative and quantitative results to propose relevant actions towards implementing effective strategies separating and composting food waste in Langkawi hotels.

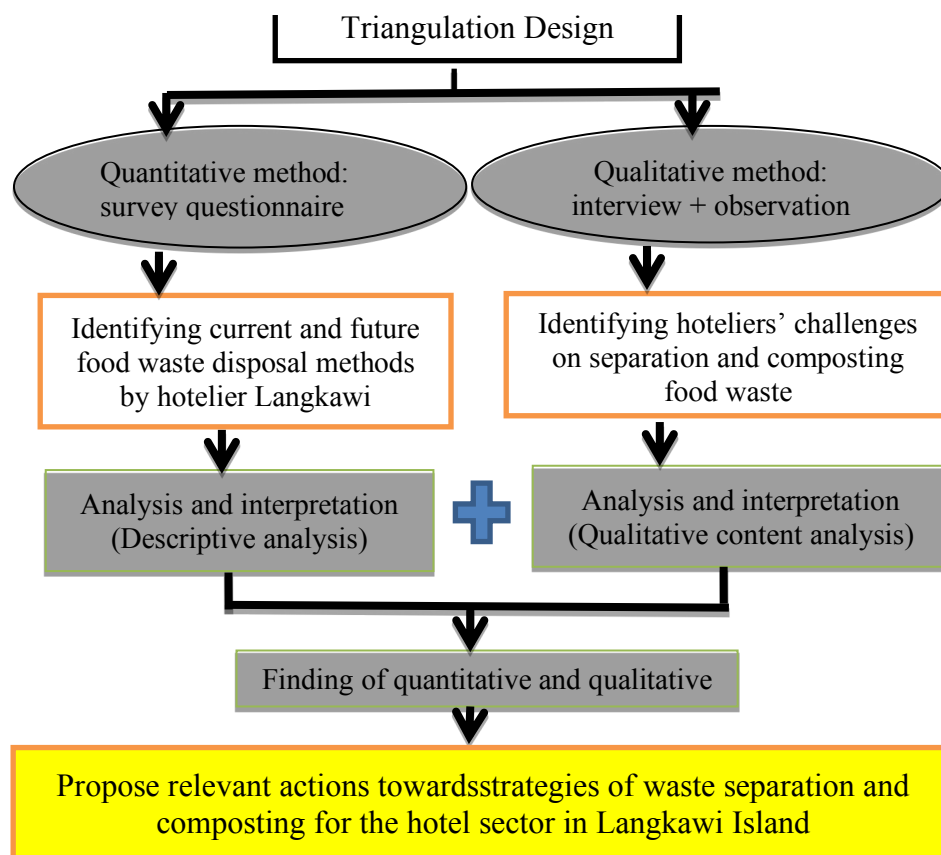


FIGURE 1. Triangulation design of the study

RESULTS AND DISCUSSION

CURRENT AND FUTURE FOOD WASTE DISPOSAL METHODS ADOPTED BY HOTELIERS

Around 66.7% of Langkawi hoteliers stated that they currently dispose of their food waste into landfills using the municipal council’s service (see Figure 2). In comparison, 23.8% of the hoteliers stated that they dispose of their food waste in landfills by hiring their own contractors. There are three main reasons for the hoteliers to hire their own contractor to collect their hotel waste such as (1) to clean up the boundary of storage waste at the prescribed time each day; (2) the hotel has limited space for storage waste; (3) to unpleasant smell and sight that could be generated by excessive waste. Currently, around 66.7 % of hoteliers use the municipal council’s services to dispose of food waste (Figure 3). However, hotelier intent to use the municipal council’s services to

dispose of food waste decrease by 42.9 % in future. In contrast, hotelier intent to dispose of food waste via hiring their own contractors’ increase by 35.7%.

Besides that, it was found that only 14.3% of the hotels practice composting, as shown in figure 2. Most hoteliers practice composting on a small scale (on-site composting) via traditional methods. They do not use any machines or specific infrastructure for composting. Around 23.8% of hoteliers stated that they have intended to dispose of their food waste via composting in future, as shown in figure 3. Around 9.5% of the hoteliers reported that they practice open dumping at present, and 7.1% of the hoteliers said they plan to use open dumping in future. Around 2.4% of the hoteliers practice open burning, and the same number of hoteliers also planned to use open burning in the future. 35.7% of the hoteliers intend to be zero- waste in the future, and around 7.5% intend to dispose of their food waste by using incinerators.

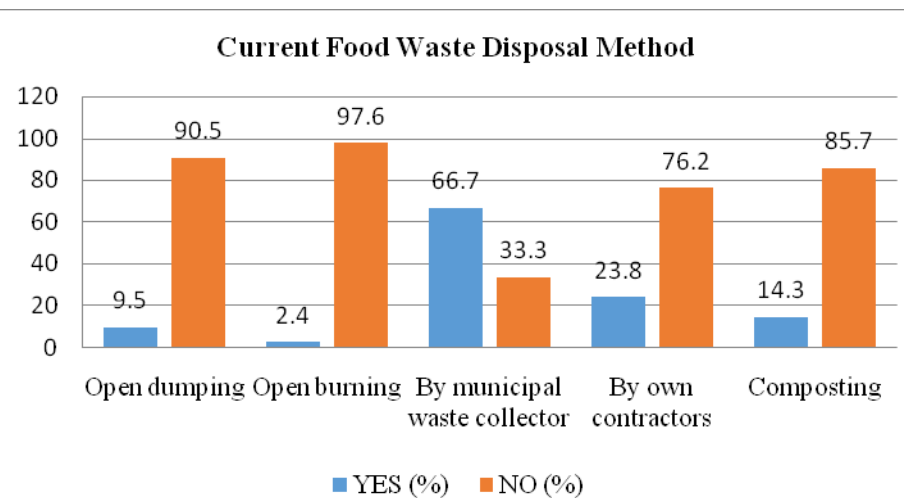


FIGURE 2. Current food waste disposal method in Langkawi hotels (N=42)

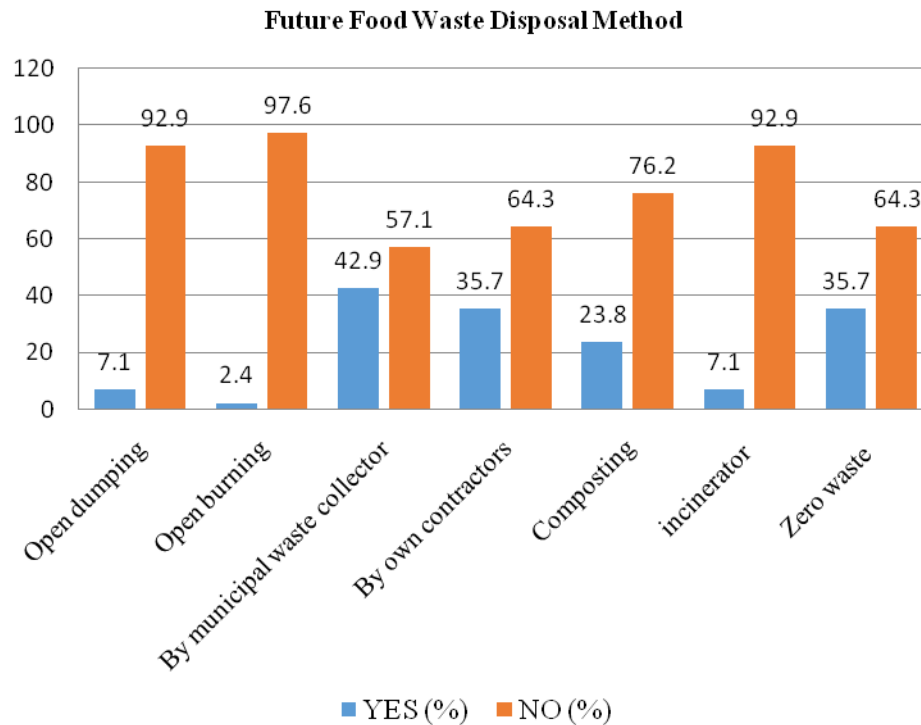


FIGURE 3. Future food waste disposal method in Langkawi hotels (N=42)

CHALLENGES FOR SOURCES SEPARATION OF FOOD WASTE AND TURNING WASTE INTO COMPOST

The hotel management is also responsible for providing adequate infrastructure and human resources to cultivate a culture that encourages reducing food waste. In other words, the hotel management system could determine how food waste is controlled and thus plan strategies to encourage sustainable food waste management. Besides that, food waste management is also influenced by decisions and actions made at different hotel's organisation levels. For example, the hotelier in Coral Bay Hotel on Phuket Island, Thailand, successfully reduced food waste from 300kg to 175kg by implementing effective and efficient food waste management through separation food waste at source and composting (Khun N.,2011). Similarly, this study's results indicate that managers' decisions influence food waste generated in hotels. Hence, the hotel's management efficiency is linked to how managers proper manage their food waste; managers can improve their employees' skills by establishing an effective management system to reduce food waste. However, a group of key informants expressed their views that food waste management is not an easy task, there are still hotel managers who resist change and still clinging to the

existing culture, business concepts and practices at their hotels. The researchers also observed that the hotel manager would emphasise separating waste and composting if the hotel business concept as part of the hotel's green practices for waste management to attract more tourists. However, hotel managers are less likely to emphasise green practices for waste management if the hotel focuses on improving services' quality by offering adequate facilities to customers.

In this study, most hoteliers agreed that they have insufficient human resources for food waste management in their hotel. This finding is consistent with the findings of the past study by Mak et al. (2018) that reported insufficient human resources is the biggest challenge in encouraging food waste composting in the commercial and industrial sectors. Meanwhile, perhaps the most striking result to emerge from the data is that the lack of hotelier commitment is mainly due to their lack of awareness on benefits of reducing food waste to the business operation and how it could promote sustainability. Implementing food waste in a sustainable manner will may create more burden for the hotel staff due to needing more systematic workforce, such as separating the waste properly and making compost and record food waste generated (audit waste) and conducting waste mapping. However, despite the need for extra human resources, composting and

waste separation has direct economic benefits to the hotels (e.g., reducing tangible and intangible cost for waste management from purchase until disposal), as well as indirect benefits (e.g., better corporate image and getting positive customer response) for long-term sustainability.

One of the key informants feels that the lack of monitoring and enforcement is another reason for the lack of waste separation and composting practices in Langkawi hotels. The researcher also observed that most smaller hotels do not practice separation and composting as they lack the awareness of the benefits of waste separation and composting. In this study, 90% of the key informants agreed that there is a lack of education and awareness on the benefits of separating food waste and composting. Most of the key informants stated that they only attended a brief program on food handling for newly appointed F&B staff and never attended any composting and waste management program. Based on the interviews, most of the key informants agreed that they intend to adopt green initiatives in their hotel, including food waste management. However, they feel it should be made compulsory for all staff from every hotel department, leading to environmental sustainability awareness.

Adequate equipment and infrastructure are crucial for the hoteliers' battle against food waste. Around 30% of the smaller hotels of 1 to 3 star-

ratings that have been interviewed have kept their large amount of various types of waste into a limited waste storage space, as shown in Picture 1. Moreover, some key informants also admitted that inadequate bins for waste disposal led to avoiding separating or composting food waste before disposal. Indeed, hoteliers throw their all types of waste into similar bins without practising separation waste at the source. Hoteliers also request their contractor to dispose of their mixed waste to the landfill immediately to prevent viewing customers on unnecessary visual, odour or noise nuisance from the hotel waste and maintain the comfort of the surrounding customers. However, this practice avoids separation of waste before disposal to the landfills (as shown in Picture 2).

Meanwhile, around 40% of larger-sized hotels of 4 or 5-star ratings that have been interviewed have their waste inventory of storage to mainly keep the food waste in air-conditioned chambers or under refrigeration to avoid the bad odours in the hotel. Such a practice would help store the different types of recyclable material and food waste separately within one site and reduce the space and bins requirement substantially for every hotel department. However, keep the food waste in air-conditioned chambers or under refrigeration need the additional cost of storing the waste inventory, especially during the summer season.



PICTURE 1. Limited waste storage space and inadequate bins



PICTURE 2. Waste disposed without waste separation

Furthermore, this study found that waste management contractors (hired by the hotels) practice inefficient waste collection system. It has brought challenges for the practice of waste separation before they are disposed into the landfills. Most of the time, the contractors collect all kinds of waste, including cooking oil, without a fixed schedule. Consequently, this creates a significant challenge for the hotels, particularly those with limited waste storage space, as they need to collect the waste separately until the waste collectors arrive. Briefly, waste collection without a fixed schedule by private or government contractor causes the increasing amount of decomposing waste in the hotels. At times, this causes a bad odour in the hotel's vicinity.

Composting activities can also help island-based hotels to reduce various environmental problems at the landfills. Food waste can be made into cheap fertiliser for hotel landscaping and to grow healthy vegetables and fruits for consumption. However, the study results found that more than 40% of hoteliers agreed that the lack of trash bins, space, existing facilities, technology, and expertise affected their hotel's composting practices. It was also observed that most food waste from the hotels goes to the landfill without recovery treatment. Mainly food waste is disposed of together with other solid waste material like aluminium, plastic, glass, rubber and metal. The lack of commitment for waste separation at the source is the main reason for the increasing number of wastes dumped into landfills in Langkawi Island. Some hoteliers believed that waste separation and composting create a burden task for the staff members. Most F&B staff must prepare food for the customers within a limited time, particularly when preparing the breakfast buffet. They feel that they do not have enough time to separate waste and compost food waste. Overall, these results indicate that apart from contextual factors (such as technical facilities, physical infrastructure and availability

training program), intra-personal factors (such as habits, attitudes and norms) are also required to sustain hoteliers' intentions towards separating and composting food waste in the hotel sector.

ACTIONS TOWARDS IMPLEMENTING STRATEGIES OF SEPARATING WASTE AND COMPOSTING

According to Quested et al. (2013), households generate a significant food waste component for developing countries. Meanwhile, in the context of tourism islands like Langkawi, the largest contributor to food waste is the hospitality sector, especially the hotel sector (Majid 2007; Noor Khafazilah 2015). The number of new hotels in Langkawi has increased in line with the increased number of tourist arrivals, and hotels play a critical role in providing economic opportunities. At the same time, they are responsible for ensuring sustainable practices to preserve the unique environment (Saraswathy Kasavan et al. 2018). Agamuthu et al. (2007) found that Langkawi has generated the highest food wastage volume compared to other tourism islands in Malaysia. Therefore, Langkawi Island urgently needs systematic efforts to reduce food waste generation.

To maintain its status as a UNESCO Global Geopark, hospitality players in Langkawi need to consider sustainable food waste management by separating and composting food waste. In this study, more than 90% of the hoteliers interviewed admitted that they do not implement waste separation before sending food waste to landfills due to lack of adequate funding, knowledge, labour, space, infrastructure, and hotel management support. Waste separation is the starting point for sustainable disposal of food waste (such as composting or making animal feed or biogas from food wastage). It could reduce the number of food waste dumped into landfills. The separation of waste also avoids the mixing of all kinds of waste. It helps implement waste recovery

treatment such as recycling (e.g., solid waste) or composting (e.g., food waste) in the hotel sector.

Apart from waste separation, good quality composting methods could decompose organic waste (including food waste) and turn into valuable soil fertilisers. At the same time, composting can reduce food waste and the costs of managing food waste in the hotel sector. According to the Environment Protection Agency (2010), the hotel sector can reduce 150 tons of food waste per year with cash savings of €30,000 each year through practical composting activities. Furthermore, Grand Hyatt Hotel in Singapore managed to save \$100,000 a year by composting 500 kg of food waste (Tan, 2017). In Langkawi Island, this study found that only two hotels practice composting such as hotel *Ambong-Ambong Langkawi Rainforest Retreat* and *The Frangipani Langkawi Resort & Spa*. Therefore, waste separating and composting strategies should be implemented in the Langkawi hotels to reduce waste disposal into the landfill. The following section discusses the actions that can be taken to encourage waste separation and composting in hotels in Langkawi Island.

- a. Effective monitoring by establishing a special team of hotel staff

Effective monitoring and comprehensive enforcement are essential to increase hotelier's awareness of the separation and composting, including at the grass-root level. Hotel management in Langkawi Island should implement waste separation and composting activities through effective monitoring by establishing a special hotel staff team. These hotel staff teams will provide sufficient information via talks, lectures, training, education and goal setting to encourage food waste reduction.

- b. Cooperation with waste management contractors

Cooperation with waste management contractors is equally crucial to the cooperation between multiple departments to encourage sustainable food waste management in the hotel. Although the hotel management has taken all efforts to minimise food waste, their initiatives cannot be optimally achieved if there is no cooperation from waste management contractors taking waste. Hence, hoteliers also work with the contractors to reduce food waste dumped into the landfill. Hoteliers should also separate

their hotel waste based on category (such as paper, plastic, glass, rubber, metal and food waste) by using different colour bins or plastics. These practices will make it easier for contractors to ensure that food waste is not mixed with other solid waste.

- c. Ensure systematic waste collection with a fixed schedule

Approximately half of those interviewed (50%) indicated that contractors do not have a fixed schedule to collect all waste, including food waste and cooking oil. Therefore, Langkawi's local authorities should establish a fixed schedule for the contractors to follow systematic waste collection for the hotel sector. Usually, there is a significantly higher number of tourists at peak times, and subsequently, food waste generation is also very high. Therefore, the hotel sector requires a systematic and regular waste collection schedule, particularly at peak time.

- d. Implementing waste audit and waste mapping

A waste audit is a way to quantify the current amount of food waste generated, disposed and composed in each hotel. The waste audit also helps identify the primary source of food wastage and provides valuable information to implement effective strategies to reduce food waste (Eriksson et al. 2018; Omidiani & Hashemihezaveh, 2016). However, the study results found that more than 90% of hoteliers do not perform waste audits. Therefore, hoteliers should set up a special internal audit team to measure and records the amount of food waste generated, disposed and composited. Apart from the audit, food waste mapping is also vital for managing waste efficiently by placing a separate waste bin for each quantity and waste component in a suitable hotel location. Through the implementation of waste mapping, staff from various departments could improve waste management in the hotel.

- e. Provide adequate infrastructure

The provision of adequate facilities and equipment also motivates the hotel staff to manage food waste effectively. For example, the use of different coloured bins allows waste to be separated based on categories. This study found that one of the best food waste practices is adopted by the top management of Frangipani Langkawi Resort and Spa. This hotel provides adequate bins to separate decomposing waste such as food waste and non-decomposing

wastes (e.g. bottles, plastics, aluminium, and so on). This study observed that Frangipani Langkawi Resort and Spa has successfully separated food waste into three categories, such as bread, rice and vegetables, using different bins. The foodwaste is then used as feed for chickens, geese, ducks and turkeys, and fish in the constructed wetland pond. The remaining food is composted. This practice resulted in to reduce the large of food being disposed into the landfill. Therefore, top-level management should provide appropriate infrastructure to assist hotel staff and contractor to manage waste efficiently and effectively.

CONCLUSION

The current study aims to identify the challenges of separating food waste and turning waste into compost and propose relevant actions. The challenges identified help understand the complexity of food waste issues, particularly separating and composting food waste in the island-based hotel sector. In this regard, while hotels' business strategy and concept are to make a profit, hoteliers should take their responsibility more seriously by proactively minimising food waste to ensure sustainable development for the present and future generations. The tourism industry's rapid growth leads to unsustainable practices, including generating a large amount of food wastage from the hospitality sector. Subsequently, these unsustainable practices have caused environmental deterioration and put severe stress on natural resources management. The hotel sector will waste more food if the current development trend persists, and no effective actions on food waste are taken seriously by relevant authorities and stakeholders (include hoteliers). Even though food waste seems like a minor issue for island-based hotels, excessive food wastage could still affect the island ecosystem. The natural resources would suffer from uncontrolled exploitation, resulting in major deterioration in the island's overall sustainability. In this light, any form of deterioration would significantly negatively impact Langkawi Island's uniqueness, which has made it an attractive and vibrant tourist destination. Thus, these island-based hotels' long-term survival is closely linked to the conservation of natural resources. This study shows that a holistic approach is required to manage and prevent food waste effectively and sustainably. The most prominent finding to emerge from this study is that collaborations between the hoteliers

and stakeholders are crucial to facilitating more effective waste separation and composting practices in their hotel. At the same time, hoteliers also need support from other stakeholders such as customers, other hoteliers (competitors), suppliers, NGOs, government, and communities achieve sustainable food waste management in the hotel sector.

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REFERENCES

- Agamuthu Pariatamby and Nagendran Periaiah. 2007. Waste management challenges in sustainable development of islands.
- Ali, H., Dermawan, D., Ali, N., Ibrahim, M., & Yaacob, S. 2012. Masyarakat dan amalan pengurusan sisa pepejal ke arah kelestarian komuniti : Kes isi rumah wanita di Bandar Baru Bangi, Malaysia. *Geografia - Malaysian Journal of Society and Space* 5(5): 64-75.
- Environment Protection Agency. 2010. *Case Studies of Organisations Managing Food Waste Properly*. <http://www.envirocentre.ie/includes/images/Case-Studies-of-Organisations-Managing-Food-Waste-Properly.pdf>
- Eriksson, M., Persson, C., Björkman, J., Hansson, E., Malefors, C., Eriksson, E., & Ghosh, R. 2018. The tree structure - A general framework for food waste quantification in food services. *Resources, Conservation & Recycling* 130(November 2017): 140-151.
- Fariz, Ahmad Mohamed, Abdul Samad Hadi, Shaharudin Idrus, M. R. R. & A. H. H. S. 2011. Pengembalian sisa sebagai sumber proses metabolisme untuk kelestarian bandar Malaysia. *Malaysian Journal of Environment Management* 12(2): 43-53.
- Ghafar, S. 2017. Food waste in Malaysia: Trends, current practices and key challenges. *Food and Fertilizer Technology Center for the Asian and Pacific Region*, 1-10.
- Halimatun Saadiah Hashim, Sarah Aziz, R. A. A. 2011. Conservation with development showcasing Langkawi Geopark. *Planning Malaysia* 1: 1-24.

- Hassan, M. N., A. Rahman, R., Chong, T., Zakaria, Z., & Awang, M. 2000. Waste recycling in Malaysia: problems and prospects. *Waste Management & Research* 18(4): 320-328.
- Ibrahim, Y. 2017. *Towards Sustainable Environmental Management through Green Tourism : Case study on Borneo Rainforest Lodge*. December: 64-74.
- Ismail, S. 2013. The challenge of future landfill: A case study of Malaysia. *Journal of Toxicology and Environmental Health Sciences* 5(6): 86-96.
- Johnson, R.B. & Onwuegbuzie, A. J. 2004. Mixed method research: A research paradigm whose time has come. *Educational Researcher* 33(7): 14-26.
- Kasavan, S., & Halim, A. Fariz M. and S. A. 2017. Sustainable food waste management in hotels: Case study Langkawi UNESCO global geopark. *Planning Malaysia* 15(4): 15-25.
- Kasavan, S., Mohamed, A. F., & Halim, S. A. 2018. Knowledge and attitudes of hoteliers in Langkawi UNESCO Global Geopark towards Sustainable Food Waste Management (SFWM). *Pertanika Journal of Social Sciences & Humanities* 26(3): 1941-1955.
- Kasavan, S., Mohamed, A. F., & Halim, S. A. 2019. Drivers of food waste generation: Case study of island-based hotels in Langkawi, Malaysia. *Waste Management* 91: 72-79.
- Kasavan, S., Nurul Izzati Mohd Ali, Ali, S. S. S., Yusoff, S., & Siron, R. 2022. Implikasi Pandemik COVID-19 terhadap penjaan sisa pepejal semasa perintah kawalan pergerakan di Semenanjung Malaysia. *Akademika* 92(1): 179-194.
- Khan, I. N. G., & Nopiah, Z. M. 2019. A survey on perceptions of legal and non-legal factors affecting sustainable solid waste management in Malaysia. *Akademika* 89(Special Issue 2): 41-51.
- Khun N. 2011. *The Coral Bay Hotel: Case Study on Phuket Island*. https://ecampus.itcilo.org/pluginfile.php/13681/mod_page/content/24/hotel1.pdf
- Lim, W. J., Chin, N. L., Yusof, A. Y., Yahya, A., & Tee, T. P. 2016. Food waste handling in Malaysia and comparison with other Asian countries. *International Food Research Journal* 23(December): S1-S6.
- Majid, M. R. 2007. Sustainable solid waste management for island resorts: Potential for Perhentian Island, Terengganu. *International Conference on Built Environment in Developing Countries (ICBEDC 2007), Pulau Pinang, Malaysia.*, 16.
- Moh, Y. & Abd Manaf, L. 2017. Solid waste management transformation and future challenges of source separation and recycling practice in Malaysia. *Resources, Conservation and Recycling* 116: 1-14.
- Mohamad Ridzuan Mohamad Salleh, Azhan, A., Abas, A., & Mazlan, S. M. 2020. Amalan keselamatan makanan dalam kalangan pengendali makanan. *Akademika* 90(1): 87-101.
- Noor Khafazilah Abdullah. 2015. Pengurusan sisa buangan pepejal dalam sektor komersial dan rekreasi di Pulau Langkawi. Tesis Master, Fakulti Sosial Sains dan Kemanusiaan, Universiti Kebangsaan Malaysia.
- Noor, Z. Z., Yusuf, R. O., Abba, A. H., Abu Hassan, M. A., & Mohd Din, M. F. 2013. An overview for energy recovery from municipal solid wastes (MSW) in Malaysia scenario. *Renewable and Sustainable Energy Reviews* 20: 378-384.
- Nor Fatimah Ibrahim, Tengku Adeline Adura Tengku Hamzah, R. H. 2016. Pengurusan sisa pepejal di Pulau Pangkor: Isu dan cabaran. *Geografia - Malaysian Journal of Society and Space* 12(14): 50-63.
- Omidiani, A., & Hashemihezaveh, S. 2016. Waste management in hotel industry in India : a review. 6(9): 670-680.
- Ong, P. L., Nur Hafizah Yusoff, & Sharina Abdul Halim. 2010. Menjejak semangat "kawi": Langkawi sebagai Geopark. *Akademika* 80: 55-68.
- Quested, T. E., Marsh, E., Stunell, D., & Parry, A. D. 2013. Spaghetti soup: The complex world of food waste behaviours. *Resources, Conservation and Recycling* 79: 43-51.
- Rahimah Abdul Aziz, Halimaton Saadiah Hashim, I. K. 2011. Geopark for heritage conservation: a need for integrated planning and management. *Planning Malaysia* 1: 25-38.
- Shamshiry, E., Nadi, B., Mokhtar, M. Bin, Komoo, B., Hashim, H. S., & Yahaya, N. 2012. Impact of landfill leachate on water quality in Langkawi Island using management of environmental system. *Asian Journal of Chemistry* 24(5): 1919-1923.
- Sharina Abdul Halim, Ong Puay Liu, Nurhafizah Yusoff, L. C. S. 2011. Participation towards heritage conservation: Case of fishing community in Langkawi Geopark. *Planning Malaysia* 1: 185-196.
- Singh, N., Cranage, D., & Lee, S. 2014. Green strategies for hotels: Estimation of recycling benefits. *International Journal of Hospitality Management* 43: 13-22.
- SWCorp. 2014. *Pelan Tindakan Komprehensif Pengurusan Sisa Pepejal 2015-2020*. SWcorp.
- Tan, S.-A. 2017. Hotel recycles 500kg of food waste into fertiliser within 24 hours using food-waste digester. *The Straits Times Singapore*, 1.
- Vani, R. 2020. Tackling food loss and food wastage. *Bernama*. [https://www.bernama.com/en/thoughts/news.php?id=1890397#:~:text=Ironically%2C about 90 per cent,to overcome food waste issues](https://www.bernama.com/en/thoughts/news.php?id=1890397#:~:text=Ironically%2C%20about%2090%20per%20cent,to%20overcome%20food%20waste%20issues).
- Wong, A. K. H. 2016. *The 300 Green Practices of The Frangipani Langkawi Resort & Spa*.
- Zamhari, S. K., & Ali, N. 2014. Komuniti bandar dan pengurusan sisa pepejal: Kajian kes di Bandaraya Kuching. *Geografia - Malaysian Journal of Society and Space* 10(6): 126-137.

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