SUSTAINABILITY PERFORMANCE ASSESSMENT OF MUNICIPAL SOLID WASTE MANAGEMENT UTILISING AGGREGATED INDICATORS APPROACH

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DEDICATION

I like to dedicate this thesis to my beloved family. Thank you for all the supports and encouragements invested in me along this journey. The amount of gratitude I felt towards your love and support cannot be put into words.

I love you.

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ABSTRACT

There is a need for effective and sustainable municipal solid waste (MSW) management system to be implemented in Malaysia, especially in the urban areas. Indicators have often been chosen as a tool to evaluate the performances of the current MSW management system in Malaysia. From the literature reviewed, no index was found to be similar with the one being proposed by this study. This study was conducted to produce a set of indicators that evaluate the MSW management system throughout the entire life cycle. The development of these indicators involved intensive literature reviews, discussion meetings with stakeholders, and workshop organisation with solid waste management experts. Weightage were assigned to the established indicators by using analytical hierarchy process, which were then incorporated into a performance index, known as municipal solid waste management performance index (MSWMPI). Data collection were done at five cities, which were Muar, Rembau, Putrajaya, Langkawi and Pekan. As a result, a total of nine indicators under four criteria, C1 (MSW Generation and Segregation), C2 (MSW Collection and Transportation), C3 (MSW Treatment) and C4 (MSW Disposal), were finalised. The weightage for the four criteria were found to be 32.17% for C1, 19.82% for C2, 25.41% for C3, and 22.60% for C4. Among the five cities, Pekan had the highest MSWMPI, with a value of 74.85 and was rated as performing good. On the other hand, the MSW management system in Muar had the lowest MSWMPI, with a value of 51.23. Langkawi had an MSWMPI of 59.89, which was followed behind closely by Rembau (58.12) and finally, Putrajaya had the MSWMPI value of 52.43. City profiling among the respective cities had also been done to identify the hotspots in the MSW management system. It was found that most cities performing well in C1 and C2, would not perform greatly in C3 and C4, and vice versa.

ABSTRAK

Terdapat keperluan untuk pelaksanaan sistem pengurusan sisa pepejal perbandaran (MSW) yang berkesan dan mampan di Malaysia, terutamanya di kawasan bandar. Penunjuk selalunya dipilih sebagai alat penilaian prestasi sistem pengurusan MSW terkini di Malaysia. Didapati bahawa tiada indeks yang sama dengan yang telah dicadangkan oleh kajian ini daripada kajian lepas. Kajian ini dijalankan untuk menghasilkan satu set penunjuk yang menilai sistem pengurusan MSW. Pembangunan penunjuk ini melibatkan tinjauan intensif kajian literatur, perbincangan dengan pihak berkepentingan, dan bengkel dengan pakar pengurusan sisa pepejal. Penetapan pemberat telah dijalankan melalui proses hierarki analitik yang seterusnya telah diguna-pakai dalam indeks prestasi dikenali sebagai indeks prestasi MSW (MSWMPI). Pengumpulan data dijalankan di lima bandar, Muar, Rembau, Putrajaya, Langkawi, dan Pekan. Hasilnya, sembilan penunjuk di bawah empat kriteria, C1 (penjanaan dan pengasingan MSW), C2 (pengutipan dan pengangkutan MSW), C3 (rawatan MSW), dan C4 (pelupusan MSW), telah dimuktamadkan. Pemberat bagi empat kriteria tersebut adalah 32.17% untuk C1, 19.82% untuk C2, 25.41% untuk C3, dan 22.60% untuk C4. Antara lima bandar, Pekan mempunyai MSWMPI yang tertinggi dengan markah 74.85 dan telah dinilai sebagai berprestasi baik. Sebaliknya, sistem pengurusan MSW di Muar mempunyai MSWMPI yang paling rendah, dengan markah 51.23. Langkawi mempunyai markah MSWMPI sebanyak 59.89, yang diikuti oleh Rembau (58.12), dan akhirnya Putrajaya mempunyai markah MSWMPI sebanyak 52.43. Pemprofilan bandar untuk kesemua lima bandar juga telah dibuat untuk mengenal pasti titik panas dalam setiap sistem pengurusan MSW. Didapati bahawa kebanyakan bandar yang berprestasi baik dalam C1 dan C2, mempunyai prestasi yang kurang memuaskan dalam C3 dan C4, dan sebaliknya.

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LIST OF ABBREVIATIONS

AHP	–	Analytical Hierarchy Process
LCT	–	Lifecycle Thinking
MSWMPI	–	Municipal Solid Waste Management Performance Index
PTT	–	Proximity-to-Target
MCDM	–	Multi-Criteria Decision Making
MPRRP	–	Maximum Practicable Recycling Rate Provision
MSW	–	Municipal Solid Waste
RCE	–	Resource Conservation Efficiency
ZWI	–	Zero Waste Index
SWCorp	–	Solid Waste and Public Cleansing Management \ Corporation
FT	–	Federal Territory
NGOs	–	Non-governmental organizations
PPSPPA	–	Perbadanan Pengurusan Sisa Pepejal dan Pembersihan Awam
CBA	–	Cost – Benefit Analysis
CEA	–	Cost Effectiveness Analysis
Eco-Eff	–	Eco-Efficiency Analysis
EA	–	Emergy Analysis
EIA	–	Environmental Impact Assessment
LCA	–	Life Cycle Assessment
LCC	–	Life Cycle Cost
RA	–	Risk Assessment
SEA	–	Strategic Environmental Assessment
WTT	–	Waste Treatment Technique
C&D	–	Construction and demolition
EU SDS	–	European Union Sustainable Development Strategy

UNCSD	–	United Nations Commission on Sustainable Development
SDI	–	Sustainable Development Indicators
OECD	–	Organisation for Economic Co-operation and Development
DSR	–	Driving Force, State and Response
SWM	–	Solid Waste Management
EPI	–	Environmental Performance Index
ISWM	–	Integrated and Sustainable Waste Management
DPSIR	–	Driving Force-Pressure-State-Impact-Response
GHG	–	Greenhouse gas
CTI	–	Cleaner Treatment Index
NRI	–	Net Recovery Index
RCE	–	Resource Conservation Efficiency
SC%	–	Percentage of Separate Waste Collection
ZWI	–	Zero Waste Index
MRI	–	Material Recovery Indicator
ERI	–	Energy Recovery Indicator
CI	–	Costs Indicator
MAU	–	Multi-Attribute Utility
MAUT	–	Multi-Attribute Utility Theory
ELECTRE	–	*Élimination Et Choix Traduisant la Réalité*
PROMETHEE	–	Preference Ranking Organization Method for Enrichment Evaluations
TOPSIS	–	Technique for Order Preference by similarity to Ideal Solution
GMM	–	Geometric Means
WAMM	–	Weighted Arithmetic Means
CR	–	Consistency Ratio
RI	–	Random Index
CI	–	Consistency Index
MCF	–	Methane Correction Factor
RM	–	Ringgit Malaysia

LIST OF SYMBOLS

CO_2	–	Carbon Dioxide
CH_4	–	Methane
N_2O	–	Nitrous Oxide
kg	–	Kilogram
$\sum$	–	Sum
$\prod$	–	Product
λ_{max}	–	Largest eigenvalue
MSW_x	–	Mass of solid waste sent to landfill in inventory year
L_o	–	Methane generation potential
f_{rec}	–	Fraction of methane recovered at landfill (flared or energy recovery)
OX	–	Oxidation factor
DOC	–	Degradable organic carbon in year of deposition
DOC_F	–	Fraction of DOC that is ultimately degraded
F	–	Fraction of methane in landfill gas

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Under this chapter, introduction towards this study were made. Firstly, the background of study was shared to give a general idea where the study focusing on. Then, the problem that this study focusing on were highlighted and discussed. With that, the research objectives of this study were identified. The scope of this study was discussed to show the boundary of this study. Furthermore, the significance of this study was discussed to show the importance and contribution of this study to society. The layout of this thesis was explained at the end of the chapter.

1.2 Background of Study

Municipal solid waste (MSW) is commonly understood as waste that is generated from residential and commercial areas, that excludes those from hazardous properties that are generated from industrial premises and construction areas (Environmental Protection Agency, 2003). Environmental Protection Agency (2010) explained materials like construction and demolition debris, municipal waste water treatment sludge and non-hazardous industrial waste are not classified as MSW, although these materials are most likely to be disposed to landfills.

Globalization, industrialization, rapid social and economic development has started a disturbing trend of solid waste generation in many countries (Chang, 2015; Jayasinghe *et al.*, 2013; Jin and Lin, 2012). Breaking the historical link between wealth creation and waste creation remains as one of the tough challenge for every country (Hester and Harrison, 2002; Islam, 2017). As the status of a country increases, incomes and living standards of the citizens increases, which then leads to more consumption of goods and services. This increases the rate of waste generation in the country as its citizens afford to spend more money for a more comfortable living (Hoornweg and Bhada-Tata, 2012).

Malaysia, as one of the developing countries located in South East Asia, faces the same fate. The country is separated into two regions by the South China Sea, which are West Malaysia and East Malaysia. The capital city Kuala Lumpur, while Putrajaya is set as the administrative centre of the federal government. As explained by Abu Eusuf *et al.* (2011) and Johari *et al.* (2014), the management of solid waste process usually involves the generation, storage, collection and transport, processing and disposal of solid waste. In Malaysia, the management of MSW in certain regions has been outsourced by the government to private waste consortia, while the remaining-are under the responsibility of its own local municipality respectively (Abdul Manaf *et al.*, 2009; Johari *et al.*, 2014). There are four (4) private waste consortia currently collecting, transporting and disposing the generated MSW, which are: Alam Flora Sdn. Bhd., SWM Environment Sdn. Bhd., E – Idaman Sdn. Bhd. and Eastern Waste Management Sdn. Bhd. (Johari *et al.*, 2014). Each of the waste consortia is responsible for its own region and has its own operation coverage (Johari *et al.*, 2014). However, it is reported that about 70 – 76% of MSW generated is successfully collected by waste consortia (Abdul Manaf *et al.*, 2009; Johari *et al.*, 2014), and about 95% of the collected MSW are send to disposal. The most common MSW disposal being practiced in Malaysia landfilling. With the increasing population and rocketing generation of MSW along with time, concerns arise on the issue whether land filling will be sufficient to tackle and receive the disposed MSW or not (Abu Eusuf *et al.*, 2011).

Budhiarta *et al.* (2012) found that the main source that contributes to MSW generation in Malaysia is household, instead of commercial and industrial premises. It is found that the waste composition among the household waste is of food waste and its mixture (74%), plastics (21%), others (2%) and mixed organic and wood (1%). Food waste can be reused as composting while plastic waste can be easily recycled, however, they are found to be the largest components among the household waste generated. It is brought to light that only less than 5% of waste are separated and recycled in reality, though the amount of waste conceivably be recycled is massive (Abdul Jalil, 2010; Hassan *et al.*, 2000; Isa *et al.*, 2005; Omran *et al.*, 2009; Periathamby *et al.*, 2009). This shows that until today, not only the awareness on waste reduction among the public is still low since more than a decade ago, the practices and behaviour towards waste reduction are still poor as well.

Many studies (Abdul Manaf *et al.*, 2009; Ahmed *et al.*, 2013; Johari *et al.*, 2014; Tarmudi *et al.*, 2009) have been conducted by various researches in Malaysia over the years to further investigate the factors contributing and promoting the generation of MSW. All authors in unison concluded that, rapid economic and population growth, changing lifestyle and rural-urban migration are the four (4) main factors that contributes to the increasing generation of MSW. Tarmudi *et al.* (2009) has also discovered that multi-racial community in Malaysia plays a role in the increasing generation of MSW. Since there are different cultures and beliefs, there are various festivities along the year to be celebrated among the community as well. With these celebrations, there is no doubt that the generation of MSW would then be multiplied.

Ineffective and inefficient solid waste management will cause degradation and harm towards the environment (Kurniawan, 2010), this is a fact that everybody is aware of. Open dumpsites bring severe environmental issues to a country, which includes contamination of surface water, ground water and solid through direct contact of waste or leachate (Zurbrugg, 2002). This not only affects the health of humans and animals, but it also causes serious losses to the country's economy and other welfare. Emissions of greenhouse gases from waste stream, contributes to climate change and global warming (Environmental Protection Agency, 2002; Kurniawan, 2010), too

cannot be ignored. Calabro (2009) highlighted in his study that waste management practices have directly emitted greenhouse gases such as: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) into our atmosphere. Chua *et al.* (2011) agreed and further explained that landfills and various practices of waste water treatments released greenhouse gases, where the common greenhouse gases produced by landfills are CH_4, wastewater treatment commonly produced CH_4 and N_2O, and lastly burning of wastes that contained carbon would produce CO_2.

1.3 Problem Statement

Along with the development of the nation, waste generation has been one of the critical issues that need immediate attention in Malaysia. It has been well established by many studies that urbanization rate and economic development increases along with waste generation (Budhiarta *et al.*, 2012; Guerrero *et al.*, 2013; Hoornweg and Bhada-Tata, 2012; Hoornweg *et al.*, 2015). From a MSW generation rate of 0.5 – 0.8 kg per capita per day recorded at year 2003, it has increased to 0.5 – 2.5 kg per capita per day recently, as highlighted by Johari *et al.* (2014). Ninth Malaysia Plan (2006 – 2010) had published that in year 2001, a rate of 16,200 tonnes per day of waste were generated in Peninsular Malaysia (Government of Malaysia, 2006). This means that, an amount of 5.91 million tonnes of MSW were generated in that year. Government of Malaysia (2006) has also stated that in year 2005, MSW generation rate had reached an amount of 19,100 tonnes per day. On the other hand, Fauziah *et al.* (2004) had estimated that the local authorities and waste management consortia in Malaysia have to handle approximately 17,000 tonnes of MSW generated daily throughout the country. In short, the MSW generation in Malaysia has escalated steadily with time from the past decade, where Periathamby *et al.* (2009) highlighted that the escalation was more than 91%. Furthermore, Mohamad Taha (2016) has made a worrisome statement, where Malaysia is estimated to generate an approximate amount of 16.76 million tonnes of MSW at year 2020.

In Malaysia, the enforcement of managing and minimizing MSW is a shared responsibility not only among local authorities, but also federal government agencies like: Ministry of Housing and Local Government, Ministry of Environment, Ministry of Health and many more (Sreenivasan *et al.*, 2012). This hinders and challenges the management of MSW in Malaysia (Abdul Manaf *et al.*, 2009; Ogawa, 2008; Tarmudi *et al.*, 2009). Besides that, hitherto there is no way for us to ensure, or even assess the performance of the existing MSW management system in Malaysia. With this overwhelming situation of MSW escalation happening in Malaysia, it portrays an urgent need for a holistic approach on the management of MSW to ensure its efficiency and effectiveness. Duraiappah (1996) highlighted that in order to provide the service of waste disposal for the increased waste generation, or even improve the solid waste management, it would be costly and results in allocating more money by government on existing waste management system. Collapse of the MSW management system would give rise to extravagant operation cost and environment degradation, as discussed earlier (Kurniawan, 2010; Periathamby, 2001; Sreenivasan *et al.*, 2012; United Nations Development Programme Malaysia, 2008; Weitz *et al.*, 2002).

There are few methods being used to assess the performance of waste management system (Coelho *et al.*, 2012), which includes benchmarking, lifecycle assessment, multi-criteria decision making and many more. Indicators are chosen to be used as a tool that would altogether assess and ensure the performance of the existing MSW management system. This is because the utilisation of indicators not only reflect the current conditions of the existing waste management system, it can also help to monitor for future trend as well (Lockerbie *et al.*, 2016; Visvanathan, 2012). However, the development of useful sustainable indicators is not easy. It requires not only an understanding of concepts and definitions, but also a good knowledge of environmental policy, fiscal instruments and social needs. Indicators, which are derived from data, are commonly the first and most basic tools for analysing change in society. Zabaleta (2008) mentioned that although accessibility towards data on social, economic and physical environment are expanded due to rapid development in information technology, usable information produced from these data ~~was~~ are at a slower rate, and thus unable to meet the increasing demand for information of environmental issue.

From the literatures reviewed, there is no index similar to the one that is being proposed in this study. This study aims to develop an index, known as "Municipal Solid Waste Management Performance Index (MSWMPI)", where this index was interpreted from an established set of indicators that assess the environmental and socio-economic performances of the current MSW management system in Malaysia. This index represents the overall performance of MSW management system through aggregation of the established indicators. The challenge of this study is to define a simple but comprehensive set of indicators that cover all aspects of sustainability, and also to be able to be calculated by local administrators, as well as managers of the MSW management system and not only by scientists or academic experts. Nevertheless, the developed index will have the following main characteristics:

- It will evaluate the performance of an entire integrated waste management system (and not just of some of its components);
- It will focus on MSW (and not just one of its fractions);
- It will evaluate both the environmental and socio-economic performances of the system.

1.4 Research Objectives

The research objectives of this study are as follows:

1. To establish a set of indicators that covers all the sustainability aspects throughout the entire lifecycle of MSW management process.

2. To assign weightage to the established set of indicators using Analytical Hierarchy Process (AHP).

3. To develop a performance index that evaluate the performance of MSW management system in Malaysia by aggregating the established set of indicators.

4. To validate the developed performance index by conducting case studies.

5. To identify the hotspot in the MSW management system through the developed performance index.

1.5 Scope

- This study focused mainly on the MSW only, where mostly the waste generated are from residential and commercial areas.

- Lifecycle Thinking (LCT) approach is adopted so that the evaluation of the current MSW management system performance covered the entire lifecycle of the MSW management process.

- Comprehensive literature surveys and reviews are conducted to produce an extensive list of potential indicators. A finalised set of indicators suitable and applicable for Malaysia are established by conducting numerous discussion meetings and a workshop with relevant stakeholders. Besides that, it is made certain that the established set of indicators are readily available and accessible

data that are provided by SW Corp Malaysia. Survey questionnaire was used to obtain data for one of the established indicators, where the target respondents are of the community living in the selected cities.

- Analytical Hierarchy Process (AHP) was adopted to assign weightage to the criteria of the study. Therefore, another set of survey questionnaire specifically for AHP weightage assignment was designed and developed. The target respondents for this AHP questionnaire were solid waste management experts. In this study, the solid waste management experts are defined as those who have knowledge and experiences in the solid waste management in Malaysia, including government officers, researchers, academicians, officers of private waste consortia and many more.

- The performance index, which is also known as MSW Management Performance Index (MSWMPI) is determined through aggregation of the criteria score with its respective criteria weight age. Consequently, the criteria score was then being determined through aggregation of the Proximity-to-Target (PTT) score of the established indicators and its indicator weightage.

- It should be noted that in this study, the weightage of one (1) criteria is being equally distributed among the indicators established under that respective criteria. In other words, one (1) criteria weight age equals to the sum of all indicator weight age under that respective criteria.

- MSWMPI is then validated through end-user approach at five (5) selected cities, which are: Langkawi, Muar, Pekan, Putrajaya and Rembau. Data collection in these five (5) cities were conducted, where it took approximately one (1) month to finish collecting all the necessary data. The collected data were then being fed into the established indicators, where MSWMPI for each selected city was determined. Lastly, the interpretation of results given by the MSWMPI were carried out to identify the areas for improvements for each city.

1.6 Significance of Study

Since currently there is no way for the policy makers and society to know the performance of the existing MSW management system in Malaysia, MSWMPI is able to provide insights on the current performance of MSW management system in Malaysia. With these insights, evaluation on the performance and identification of potential problems in the current MSW management system can be carried out.

Besides that, since MSWMPI covers the entire lifecycle of MSW management system, the weaknesses and strength of the current MSW management system can be clearly highlighted. This provides reliable information for policy making, thus helps in decision making among the policy makers. Unnecessary and avoidable costs along the current MSW management system can be successfully identified and thus, save governmental expenditures on MSW management.

Most importantly, the framework of developing MSWMPI is flexible and adaptable with time. Not only MSWMPI monitors the performance of MSW management system from time to time, the indicators established for the development of MSWMPI can be replaced. This is to ensure MSWMPI adequately reflects the latest MSW management scenario in Malaysia. In short, MSWMPI is a useful tool for the policy makers to continuously measure and monitor the performance of the current MSW management system in Malaysia entirely.

1.7 Thesis Layout

Chapter 1 discussed about the background and problem statements of this study. Research objectives of the study were identified and listed as well. The scope and significance of this study were also discussed in Chapter 1.

Chapter 2 discusses all the relevant literatures that are included in this study. Under this chapter, solid waste, municipal solid waste (MSW), MSW management, assessment methods with respect to solid waste management, indicators and data aggregation are discussed. Lastly, multi-criteria decision making (MCDM) were discussed as well.

Chapter 3 discusses the research methodology of this study. The research background of this study was discussed, along with the methodological flow chart. Besides that, the establishment of the indicators and framework structure, and also the adoption of Proximity-to-Target (PTT) method were discussed. Weightage assignment through Analytical Hierarchy Process (AHP) and data collection for each indicator were explained as well. The raw data suitable for the indicators were explained clearly in this chapter. Lastly, the aggregation of indicators to form MSWMPI were also described.

As for Chapter 4, the results and outcomes of the study were conferred. Under this chapter, the development of study framework, along with the description of each established indicator. The results obtained from AHP were showed and discussed too. The type, target and low benchmark on each established indicator are discussed lastly.

Chapter 5 further discusses the MSWMPI for the five (5) involved cities, where the weaknesses and strengths of the MSW management of each cities are identified and discussed. This is carried out through creating a profile for each involved city. Strategical enhancements based on the MSWMPI result were proposed for each city respectively.

Lastly, with the results obtained from the study, conclusions, recommendations for future study and limitation of study were made and discussed in Chapter 6.

REFERENCES

Abas, M. A., and Seow, T. W. (2014). Municipal solid waste management in Malaysia: An insight towards sustainability. Paper presented at the 4th International Conference on Human Habitat & Environment 2014.

Abba, A. H., Noor, Z. Z., Yusuf, R. O., Din, M. F. M., and Hassan, M. A. A. (2013). Assessing environmental impacts of municipal solid waste of Johor by analytical hierarchy process. *Resources, Conservation and Recycling*. 73: 188-196.

Abdul Jalil, M. (2010). Sustainable development in Malaysia: A case study on household waste management. *Journal of Sustainable Development.* 3(3): 91-102.

Abdul Manaf, L., Samah, M. A. A., and Zukki, N. I. M. (2009). Municipal solid waste management in Malaysia: Practices and challenges. *Waste management*. 29(11): 2902-2906.

Abe, N., and Didham, R. (2013). *Measuring Public Awareness and Actions for 3Rs*. Retrieved on July 25, 2017, from https://pub.iges.or.jp/pub_file/3r08pdf/download

Abu Eusuf, M., Ibrahim, M., Din, M., Affendi, S., and Islam, R. (2011). Solid waste generation characteristics: The Malaysian local authorities' outlook. *Planning Malaysia-Journal of the Malaysian Institute of Planners*. 2011(9): 51-76.

Achillas, C., Moussiopoulos, N., Karagiannidis, A., Banias, G., and Perkoulidis, G. (2013). The use of multi-criteria decision analysis to tackle waste management problems: A literature review. *Waste Management and Research*. 31(2): 115-129.

Acton, Q. A. (2012). *Issues in Environmental Law, Policy, and Planning: 2011 Edition*. Atlanta, Georgia: ScholarlyEditions.

Afroz, R., Hanaki, K., and Tuddin, R. (2010). The Role of Socio-Economic Factors on Household Waste Generation: A Study in a Waste Management Program in Dhaka City, Bangladesh. *Research Journal of Applied Sciences*. 5(3): 183-190.

Ahamad, R., Yusop, Z., Salim, M. R., Mohd Yusoff, A. R., Aris, A., and Noor, Z. Z. (2015). Environmental Performance Index for Malaysia 2014. Johor, Malaysia: Ministry of Natural Resources and Environment.

Ahmed, S. I., Johari, A., Hashim, H., Ramli, M., and Alkali, H. (2013). Landfill gas and its renewable energy potentials in Johor, Malaysia. *International Journal of Emerging Trends in Engineering and Development*. 1(3): 506-520.

Al-Momani, A. H. (1994). Solid Waste Management: Sampling, Analysis and Assessment of Household Waste in the City of Amman. *International Journal of Environmental Health Research*. 4: 208-222

Alexander, M. (2012). *Decision-Making using the Analytic Hierarchy Process (AHP) and SAS/IML*. Retrieved on July 9, 2017, from http://analytics.ncsu.edu/sesug/2012/SD-04.pdf

Ali, H. A. E. M., Al-Sulaihi, I. A., and Al-Gahtani, K. S. (2013). Indicators for measuring perforamnce of building construction companies in Kingdom of Saudi Arabia. *Journal of King Saud University-Engineering Science*. 25(2): 125-134.

Ali, S. M., Pervaiz, A., Afzal, B., Hamid, N., and Yasmin, A. (2014). Open dumping of municipal solid waste and its hazardous impacts on soil and vegetation diversity at waste dumping sites of Islamabad city. *Journal of King Saud University-Science*. 26(1): 59-65.

Allesch, A., and Brunner, P. H. (2014). Assessment methods for solid waste management: A literature review. *Waste Management & Research*. 32(6): 461-473.

Allin, C. W. (2010). *Encyclopedia of Global Resources*. New York, U.S.A.: Salem Press.

Alsalmi, H., Leao, S., and Elkadi, H. (2013). Developing Abu Dhabi's Solid Waste Sustainability Indicators. *SB 13 : Proceedings of Conference Dubai - Advancing the Green Agenda Technology, Practices and Policies.* 8 – 10 December, 2013. Dubai, United Arab Emirates.

Anand, S. (2010). *Solid Waste Management*. New Delhi, India: Mittal Publications.

Arendse, L., and Godfrey, L. (2010). *Waste management indicators for national state of environment reporting*. Retrieved online on June 1, 2016, from: http://www.unep.or.jp/ietc/kms/data/2010.pdf

Atkindon, A. (2007). *Techniques and Technologies for Sustainability - Proceedings: International Conference and Summer School 2007*. Berlin: Sonderpublikation.

Aziz, H. A. (2015). *Control and Treatment of Landfill Leachate for Sanitary Waste Disposal*. IGI Global.

Badgie, D., Samah, M. A. A., Manaf, L. A., and Muda, A. B. (2012). Assessment of Municipal Solid Waste Composition in Malaysia: Management, Practice, and Challenges. *Polish Journal of Environmental Studies*. 21(3): 539-547.

Bahia, S. R. (1996). Sustainability indicators for a waste management approach. *Congreso Interamericano de Ingeniería Sanitaria y Ambiental*. 25, 1-11.

Banar, M., Cokaygil, Z., and Ozkan, A. (2009). Life cycle assessment of solid waste management options for Eskisehir, Turkey. *Waste management*. 29(1), 54-62.

Bandara, N. J. G. J., Hettiaratchi, J. P. A., and Pilapiiya, S. (2007). Relation of waste generation and composition to socio-economic factors: A case study. *Environmental Monitoring Assessmen*t. 135, 31-39.

Barbiroli, G. (2009). *Principles of Sustainable Development - Volume II*. Encyclopaedia of Life Support Systems (EOLSS).

Bavani, M. (2009). *Using Worms to Reduce Organic Waste*. Retrieved on June 3, 2017, from http://www.thestar.com.my/news/community/2009/11/23/using-worms-to-reduce-organic-waste/

Beccalli, E., and Poli, F. (2016). *Lending, Investments and the Financial Crisis*. Palgrave Macmillan UK.

Bi, Y., Kapoor, S., and Bhatia, R. (2016). *Intelligent Systems and Applications: Extended and Selected Results from the SAI Intelligent Systems Conference (IntelliSys) 2015*. Springer International Publishing.

Bockstaller, C., and Girardin, P. (2003). How to validate environmental indicators. *Agricultural systems*. 76(2): 639-653.

Bolaane, B. (2006). Constraints to promoting people centred approaches in recycling. *Habitat International*. 30(4): 731-740.

Borysiewicz, M., Garanty, I., and Kozubal, A. (2005). *Practical Approach to Safety Analyses for Incineration of Hazardous Wastes*. Retrieved on June 3, 2017, from http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/37/103/37103099.pdf - page=90

Bours, D. (2014). *A good start with S.M.A.R.T. (indicators)*. Retrieved on July 7, 2017, from https://www.linkedin.com/pulse/20141022071803-18927814-a-good-start-with-s-m-a-r-t-indicators

Brebbia, C. A., and Itoh, H. (2016). *Waste Management and the Environment VIII*. WIT Press.

Briggs, D., Corvalan, C., and Nurminen, M. (1996). *Linkage Methods for Environment and Health Analysis*. Retrieved on July 7, 2017, from http://apps.who.int/iris/bitstream/10665/62988/1/WHO_EHG_95.26_eng.pdf

Briguglio, L., Islands, U. O. M., Institute, S. S., and Secretariat, C. (2008). *Small States and the Pillars of Economic Resilience. Islands and Small States*. Institute of the University of Malta.

Budhiarta, I., Siwar, C., and Basri, H. (2012). Current status of municipal solid waste generation in Malaysia. *International Journal on Advanced Science Engineering and Information Technology*. 2(2): 129-134.

Buekens, A. (2013). *Incineration Technologies*. New York, U.S.A.: Springer.

Cairns, J., McCormick, P. V., and Niederlehner, B. (1993). A proposed framework for developing indicators of ecosystem health. *Hydrobiologia*. 263(1): 1-44.

Calabro, P. S. (2009). Greenhouse gases emission from municipal waste management: the role of separate collection. *Waste Management*. 29(7): 2178-2187.

Cartwright, K., and Sherman, F. B. (1969). *Evaluating sanitary landfill sites in Illinois*. Retrieved on July 9, 2016, from https://www.ideals.illinois.edu/bitstream/handle/2142/78841/evaluatingsanita27cart.pdf?sequence=1

Chandrasekharan, I., Kumar, R. S., Raghunathan, S., and Chandrasekaran, S. (2013). Construction of environmental performance index and ranking of states. *Current Science*. 435-439.

Chang, N.-B. (2015). *Sustainable solid waste management: A systems engineering approach*. John Wiley & Sons.

Chavez, A. P., de Vega, C. A., and Benitez, S. O. (2011). Measuring progress of waste management programs. *International Journal of Environmental Science and Development*. 2(5): 372.

Cheremisinoff, N. P. (2003). *Handbook of Solid Waste Management and Waste Minimization Technologies*. Butterworth-Heinemann.

Cherubini, F., Bargigli, S., and Ulgiati, S. (2008). Life cycle assessment of urban waste management: Energy performances and environmental impacts. The case of Rome, Italy. *Waste Management*. 28(12): 2552-2564.

Chong, T. L., Matsufuji, Y., and Hassan, M. N. (2005). Implementation of the semi-aerobic landfill system (Fukuoka method) in developing countries: A Malaysia cost analysis. *Waste Management*. 25(7): 702-711.

Choo, E. U., Schoner, B., and Wedley, W. C. (1999). Interpretation of criteria weights in multicriteria decision making. *Computers and Industrial Engineering*. 37(3): 527-541.

Christensen, T. (2011). *Solid waste technology and management*. John Wiley & Sons.

Chua, K., Sahid, E. J. M., and Leong, Y. (2011). Sustainable municipal solid waste management and GHG abatement in Malaysia. *ST-4: Green & Energy Managemen*t. 4(02): 1-8.

Coelho, H. M. G., Lange, L. C., and Coelho, L. M. G. (2012). Proposal of an environmental performance index to assess solid waste treatment technologies. *Waste Management*. 32(7): 1473-1481.

Daven, J. I., and Klein, R. N. (2008). *Progress in Waste Management Research*. Nova Science Publishers.

Davis, M. L., and Masten, S. J. (2004). *Principles of Environmental Engineering and Science*. McGraw-Hill: New York.

Den Boer, J., Den Boer, E., and Jager, J. (2007). LCA-IWM: a decision support tool for sustainability assessment of waste management systems. *Waste Management*. 27(8): 1032-1045.

Department of National Solid Waste Management. (2009). *Source Separation of Food Waste - Turning Waste into Compost*. Retrieved on January 19, 2018, from http://jpspn.kpkt.gov.my/resources/index/user_1/3R/panduan_3R/SWMC_CI_Creating Awareness and Public Participation on Recycling Among Hawkers in Subang Jaya.pdf

Department of National Solid Waste Management Malaysia. (2013). *Survey on Solid Waste Composition, Characteristics & Existing Practice of Solid Waste Recycling in Malaysia*. Retrieved on June 3, 2017, from http://jpspn.kpkt.gov.my/resources/index/user_1/Sumber_Rujukan/kajian/Final_Report_REVz.pdf

Department of Statistic Malaysia. (2011). *Population Distribution and Basic Demographic Characteristics 2010*. Retrieved on May 17, 2015, from http://www.statistics.gov.my/portal/download_Population/files/census2010/Taburan_Penduduk_dan_Ciri-ciri_Asas_Demografi.pdf

Department of Statistic Malaysia. (2012). *Population Projection Malaysia 2010 - 2040*. Retrieved on May 17, 2015, from http://www.statistics.gov.my/portal/download_Population/files/population_projections/Population_Projection_2010-2040.pdf

Department of Statistic Malaysia. (2016). *Current Population Estimates, Malaysia, 2014 – 2016: Population and Demography*. Retrieved June, 2, 2017, from https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=155&bul_id=OWlxdEVoYlJCS0hUZzJyRUcvZEYxZz09&menu_id=L0pheU43NWJwRWVSZklWdzQ4TlhUUT09

Department of Statistic Malaysia. (2017). *Press Release: Report of Household Income and Basic Amenities Survey 2016*. Retrieved on January 18, 2018, from https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=RUZ5REwveU1ra1hGL21JWVlPRmU2Zz09

Desai, A. R., and Bhagat, S. S. (2017). Analysis of Suitable Locations of Urban Green Space based on AHP for Surat city. *Journals of Recent Activities in Infrastructure Science*. 2(2): 1 - 10.

Dinie, M., Samsudin, M., and Don, M. (2013). Municipal solid waste management in Malaysia: current practices, challenges and prospect. *Jurnal Teknologi*. 62(1): 95-101.

Doran, G. T. (1981). There's a S.M.A.R.T. way to write management's goals and objectives. *Management Review*. 70(11): 35-36.

Duraiappah, A. (1996). *The Economic and Environmental Impacts of the Waste Paper Trade and Recycling in India: A Material Balance Approach*. Institute for Environmental Studies. Amsterdam, the Netherlands.

Dwivedi, A. N. (2009). *Handbook of Research on Information Technology Management and Clinical Data Administration in Healthcare*. IGI Global.

El Haggar, S. (2010). *Sustainable industrial design and waste management: cradle-to-cradle for sustainable development*. Academic Press.

Environmental Protection Agency. (2002). *Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks*. Retrieved on June 3, 2017, from http://infohouse.p2ric.org/ref/42/41257.pdf

Environmental Protection Agency. (2003). *Municipal Solid Waste*. Retrieved on May 14, 2015, from https://archive.epa.gov/epawaste/nonhaz/municipal/web/html/

Environmental Protection Agency. (2009). *Hazardous Waste Characteristics: A User-Friendly Reference Document*. Retrieved on May 21, 2015, from https://www.epa.gov/sites/production/files/2016-01/documents/hw-char.pdf

Environmental Protection Agency. (2010). *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010*. Retrieved on May 15, 2015, from https://archive.epa.gov/epawaste/nonhaz/municipal/web/pdf/msw_2010_factsheet.pdf

Environmental Protection Agency. (2016). *How to Prevent Waste Food through Source Reduction*. Retrieved on June 3, 2016, from https://www.epa.gov/sustainable-management-food/how-prevent-wasted-food-through-source-reduction

Fauziah, S. and Periathamby, A. (2010). Closure and post-closure of landfills in Malaysia: lessons learnt. *Malaysian Journal of Science*. 29(3): 231-238.

Fauziah, S., and Periathamby, A. (2013). Challenges in 3R Implementation and Public Participation. *Malaysian Journal of Science*. 32(2): 49-58.

Fauziah, S., Simon, C., and Periathamby, A. (2004). Municipal solid waste management in Malaysia-Possibility of improvement? *Malaysian Journal of Science*. 23(2): 61-70.

Fauziah, S. H. and Periathamby, A. (2012). *Municipal Solid Waste Management in Malaysia: Strategies in Reducing the Dependency on Landfills*. Retrieved on July 26, 2017, from http://repository.um.edu.my/27036/1/Banda Aceh Fullpaper.pdf

Fei, L., Hu, Y., Xiao, F., Chen, L., and Deng, Y. (2016). *A Modified TOPSIS Method Based on Numbers and Its Applications in Human Resources Selection*. Retrieved online on September 28, 2017, from https://www.hindawi.com/journals/mpe/2016/6145196/

Fragkou, M. C., Vicent, T., and Gabarrell, X. (2010). A general methodology for calculating the MSW management self-sufficiency indicator: application to the wider Barcelona area. *Resources, Conservation and Recycling*. 54(6): 390-399.

Fujii, Y. (2014). *Successful Source Separation in Asian Cities: Lessons from Japan's Experience and an Action Research in Thailand*. Retrieved on July 12, 2017, from http://www.nswai.com/DataBank/Reports_pdf/reports_aug15/Successful source separation in asian cities lessons from japan Experience and an action research in thailand.pdf

Gamberini, R., Del Buono, D., Lolli, F., and Rimini, B. (2013). Municipal solid waste management: identification and analysis of engineering indexes representing demand and costs generated in virtuous Italian communities. *Waste Management*. 33(11): 2532-2540.

García-Cascales, M. S., and Lamata, M. T. (2012). On rank reversal and TOPSIS method. *Mathematical and Computer Modelling*. 56(5): 123-132.

Gauci, J. (2001). *Solid Waste Management Indicators.* Retrieved online on September 8, 2016, from www.um.edu.mt/islands/si-mo/Files/Gauci_report1.doc

Getachew, S. (2014). *Energy Potential of Municipal Solid Waste for Incineration: Reppi Open Dump Site, Addis Ababa*. Retrieved on June 3, 2017, from http://etd.aau.edu.et/bitstream/123456789/11892/1/Getachew Shiferaw.pdf

Global Environment Centre. (2002). *Solid Waste in Malaysia.* Retrieved online on May 18, 2015, from http://www.gecnet.info/index.cfm?&menuid=83

Goepel, K. (2014). *BPMSG's AHP Online System*. BPMSG Online System Retrieved January 10, 2017, from https://bpmsg.com/academic/documents/BPMSG-AHP-OS-2017-05-25.pdf

Government of Malaysia. (2000). *Eighth Malaysia Plan (2000 - 2005).* Putrajaya, Malaysia: Economic Planning Unit.

Government of Malaysia. (2006). *Ninth Malaysia Plan (2006 - 2010).* Putrajaya, Malaysia: Economic Planning Unit.

Greco, S. (2006). *Multiple Criteria Decision Analysis: State of the Art Surveys.* Springer New York.

Greco, S., Pereira, R. A. M., Squillante, M., and Yager, R. R. (2010). *Preferences and Decisions: Models and Applications.* Springer Berlin Heidelberg.

Grigoroudis, E., and Siskos, Y. (2009). *Customer Satisfaction Evaluation: Methods for Measuring and Implementing Service Quality.* Springer US.

Grossman, D., Hudson, J. F., and Marks, D. H. (1974). Waste generation models for solid waste collection. *Journal of the Environmental Engineering Division*. 100: 1219 - 1230.

Guarnieri, P. (2015). *Decision Models in Engineering and Management*. Springer International Publishing.

Guerrero, L. A., Maas, G., and Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste Management*. 33(1): 220-232.

Gunders, D. (2012). *Wasted: How America is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill.* Retrieved on June 3, 2017, from https://www.indianasna.org/content/indianasna/documents/NRDC_Wasted_Food_Report.pdf

Hadjibiros, K. (2013). *Ecology and Applied Environmental Science*. Boca Raton, Florida:Taylor & Francis Group..

Harder, M., Stantzos, N., Woodard, R., and Read, A. (2008). Development of a new quality fair access best value performance indicator (BVPI) for recycling services. *Waste Management*. 28(2): 299-309.

Harris, P. G., and Lang, G. (2014). *Routledge Handbook of Environment and Society in Asia*. Taylor & Francis.

Hassan, M., Chong, T., Rahman, M., Salleh, M., Zakaria, Z., and Awang, M. (2001). *Solid waste management in Southeast Asian countries with special attention to Malaysia*. Proceedings Sardinia, 8th International Waste Management and Landfill Symposium. Italy, 1-5.

Hassan, M. N., Rahman, R. A., Chong, T. L., Zakaria, Z., and Awang, M. (2000). Waste recycling in Malaysia: Problems and prospects. *Waste Management and Research*. 18(4): 320-328.

Hassan, M. N., Zakaria, Z., and Rahman, R. A. (1998). Managing costs of urban pollution in Malaysia. *Nederlandse Geografische Studies*. (240): 127-147.

Hawkins, R. G. P., and Shaw, H. S. (2004). *The Practical Guide to Waste Management Law: With a List of Abbreviations and Acronyms, Useful Websites and Relevant Legislation*. Thomas Telford.

Helming, K., Pérez-Soba, M., and Tabbush, P. (2008). *Sustainability Impact Assessment of Land Use Changes*. Springer Berlin Heidelberg.

Herva, M., and Roca, E. (2013). Ranking municipal solid waste treatment alternatives based on ecological footprint and multi-criteria analysis. *Ecological Indicators*. 25: 77-84.

Hester, R. E., and Harrison, R. M. (2002). *Environmental and health impact of solid waste management activities*. (Vol. 18). Cambridge, U.K.: Royal Society of Chemistry.

Hong, S. H., Adams, R. M., and Love, H. A. (1993). An Economic Analysis of Household Recycling of Solid Wastes: The Case of Portland, Oregon. *Journal of Environmental Economics and Management*. 25: 136-146.

Hoornweg, D., and Bhada-Tata, P. (2012). What a waste: a global review of solid waste management. *Urban Development Series Knowledge Papers*. 15: 1-98.

Hoornweg, D., Bhada-Tata, P., and Kennedy, C. (2015). Peak waste: When is it likely to occur? *Journal of Industrial Ecology*. 19(1): 117-128.

Hoornweg, D., and Thomas, L. (1999). *What a waste: Solid waste management in Asia*. Washington, D.C., U.S.A.: The World Bank.

Horbach, J. (2006). *Indicator Systems for Sustainable Innovation*. Physica-Verlag HD.

Hosetti, B. B. (2006). *Prospects and perspective of solid waste management*. New Age International.

Hossain, M. F., Adnan, Z. H., and Hasin, A. A. (2014). Improvement in Weighting Assignment Process in Analytical Hierarchy Process by Introducing Suggestion Matrix and Likert Scale. *International Journal of Supply Chain Management*. 3(4): 91 - 95.

Hotta, Y. (2012). Performance *Indicators in the 3Rs and Resource Efficiency: Overview of Session Background and 3R Policy Indicator Factsheets*. Retrieved on July 25, 2017, from http://www.uncrd.or.jp/content/documents/Hanoi 3R ForumPS4_IGES.pdf

Hunt, L. C., and Robinson, C. (2003). *Energy in a Competitive Market: Essays in Honour of Colin Robinson*. Edward Elgar.

Intergovernmental Panel on Climate Change. (1997). *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. (Vol. 2): IPCC WGI Technical Support Unit.

Intergovernmental Panel on Climate Change. (2000). *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. IPCC National Greenhouse Cost Inventories programme, Technical Support Unit.

Intergovernmental Panel on Climate Change. (2007). *Climate Change 2007 - Mitigation of Climate Change: Working Group III contribution to the Fourth Assessment Report of the IPCC*. Cambridge University Press.

International Finance Corporation. (2007). *General EHS Guidelines: Environmental - Waste Management*. Retrieved on May 18, 2017, from https://www.ifc.org/wps/wcm/connect/6e4e348048865839b4cef66a6515bb18/1-6%2BWaste%2BManagement.pdf?MOD=AJPERES

Isa, M. H., Asaari, F. A. H., Ramli, N. A., Ahmad, S., and S., T. S. (2005). Solid waste collection and recycling in Nibong Tebal, Penang, Malaysia: A case study. *Waste Management and Research*. 23: 565 - 570.

Ishizaka, A., and Nemery, P. (2013). *Multi-criteria decision analysis: methods and software*. John Wiley & Sons.

Islam, K. N. (2017). Greenhouse gas footprint and the carbon flow associated with different solid waste management strategy for urban metabolism in Bangladesh. *Science of The Total Environment*. 580: 755-769.

Jacobs, D. E. (1996). *Guidelines for the evaluation and control of lead-based paint hazards in housing*. DIANE Publishing.

Japan International Cooperation Agency. (2006). *The Study on National Waste Minimisation in Malaysia: Final Repor*t. Retrieved on May 18, 2015 from http://jpspn.kpkt.gov.my/resources/index/user_1/Sumber_Rujukan/kajian/PSP/Volume1_MainReport.pdf

Jayarama, R. P. (2011). *Municipal Solid Waste Management: Processing Energy Recovery Global Examples*. Hyderabad: BS Publications.

Jayasinghe, R., Mushtaq, U., Smythe, T. A., and Baillie, C. (2013). The garbage crisis: A global challenge for engineers. *Synthesis Lectures on Engineers, Technology, and Society*. 7(1): 1-155.

Jekins, R. B. (1993). *The Economic of Solid Waste Reduction: The Impacts of User Fees.* Brookfield, Vermont: Edward Elgar Publishing.

Jenkins, R. R., Martinez, S. A., Palmer, K., and Podolsky, M. J. (2003). The Determinants of Household Recycling: A Material-Specific Analysis of Recycling Program Features and Unit Pricing. *Journal of Environmental Economics and Management*. 45: 294 - 318.

Jeremic, V., Radojicic, Z., and Dobrota, M. (2016). *Emerging Trends in the Development and Application of Composite Indicators*. IGI Global.

Jin, D., and Lin, S. (2012). *Advances in Electronic Commerce, Web Application and Communication*. Springer.

Johari, A., Ahmed, S. I., Hashim, H., Alkali, H., and Ramli, M. (2012). Economic and environmental benefits of landfill gas from municipal solid waste in Malaysia. *Renewable and Sustainable Energy Reviews*. 16(5): 2907-2912.

Johari, A., Alkali, H., Hashim, H., Ahmed, S. I., and Mat, R. (2014). Municipal solid waste management and potential revenue from recycling in Malaysia. *Modern Applied Science*. 8(4): 37-49.

Kaufman, S. M., Krishnan, N., and Themelis, N. J. (2010). A screening life cycle metric to benchmark the environmental sustainability of waste management systems. *Environmental Science and Technology*. 44(15): 5949-5955.

Kirkpatrick, S., and Tarasuk, V. (2003). The Relationship Between Low Income and Household Food Expenditure Patterns in Canada. *Public Health Nutrition*. 6(6): 589-597.

Kolaventi, S. S., and Prasad, J. R. (2014). Improving Waste Management Performance of Construction Projects by Assessing Influence Factors. *International Journal of Engineering Science and Technology (IJEST)*. 3(3): 1991-1995.

Kraemer, R., and Peichert, H. (2007). *Analysis of the Yale Environmental Performance Index (EPI)*. Retrieved on June 29, 2017, from http://ecologic.eu/sites/files/publication/2015/kraemer_08_analysis_of_the_epi.pdf

Kurniawan, T. (2010). *Long-Term Impact of Excessive Solid Waste Generation on the Environment.* Retrieved on May 27, 2015, from http://www.iwawaterwiki.org/xwiki/bin/view/Articles/Tonni1

Kutty, R. (2015). *Challenges with Waste Separation*. Retrieved on July 12, 2017, from http://www.thestar.com.my/metro/views/2015/08/25/challenges-with-waste-separation-changes-need-to-be-made-for-successful-implementation-of-this-new-l/

Lee, C. C. (2005). *Environmental engineering dictionary*. Maryland, U.S.A.: Government Institutes.

Li, D. F. (2017). *Theoretical and Practical Advancements for Fuzzy System Integration*. IGI Global.

Liao, H., and Xu, Z. (2016). *Hesitant Fuzzy Decision-Making Methodologies and Applications*. Springer Singapore.

Liu, C., and Wu, X.-w. (2011). Factors influencing municipal solid waste generation in China: a multiple statistical analysis study. *Waste Management and Research*. 29(4): 371-378.

Lockerbie, E., Shannon, L., and Jarre, A. (2016). The use of ecological, fishing and environmental indicators in support of decision making in southern Benguela fisheries. *Ecological Indicators*. 69: 473-487.

Lorek, S. (2004). *Household Energy and Waste Consumption and Waste Generation: A German Case Study*. Retrieved on July 1, 2017, from http://seri.at/wp-content/uploads/2009/09/SERI-Studies-2.pdf

Ludwig, C., Hellweg, S., and Stucki, S. (2012). *Municipal Solid Waste Management: Strategies and Technologies for Sustainable Solutions*. Springer Berlin Heidelberg.

Mahadevia, D., and Wolfe, J. M. (2008). *Solid Waste Management in Indian Cities: Status and Emerging Practices*. Concept Publishing House.

Majlis Daerah Pekan. (2017). *Latar Belakang*. Retrieved on July 24, 2017, from http://www.mdpekan.gov.my/ms/md-pekan/profil/latar-belakang

Majlis Daerah Rembau. (2017). *Info Rembau*. Retrieved on July 24, 2017, from http://www.mdr.gov.my/ms/pelawat/info-rembau

Majlis Perbandaran Langkawi. (2017). *Latar Belakang*. Retrieved on July 24, 2017, from http://www.mplbp.gov.my/ms/mplbp/profil/latar-belakang

Majlis Perbandaran Muar. (2017). *Info Muar*. Retrieved on July 24, 2017, from http://www.mpmuar.gov.my/ms/pelawat/info-muar/page/0/1

Majlis Perbandaran Putrajaya. (2017). *Background of Putrajaya*. Retrieved on July 24, 2017, from http://www.ppj.gov.my/portal/page?_pageid=311,1&_dad=portal&_schema=PORTAL - 1208

Malaysia. (2007). *Solid Waste and Public Cleansing Management Act 2007*. Retrieved on June 30, 2017, from http://www.agc.gov.my/agcportal/uploads/files/Publications/LOM/MY/Akta 672 - salinan bersih TP.pdf

Malaysian Digest. (2015). *How Malaysians Are Coping with The Waste Separation Programme A Week After Implementation*. Retrieved on June, 1, 2017, from http://www.malaysiandigest.com/news/568784-how-malaysians-are-coping-with-the-waste-separation-programme-a-week-after-implementation.html

Mansvelt, J. (2011). *Green consumerism: An A-to-Z guide*. (Vol. 6). California, U.S.A.: SAGE Publications, Inc.

Marcomini, A., Suter, G. W., and Critto, A. (2008). *Decision Support Systems for Risk-Based Management of Contaminated Sites*. Springer US.

Mateo, J. R. S. C. (2012). *Multi Criteria Analysis in the Renewable Energy Industry*. Springer London.

Mbeng, L. O., Phillips, P. S., and Fairweather, R. (2012). Waste Characterization as an Element of Household Waste Management Operations: A Case Study in Limbe, Cameroon. *The Open Waste Management Journal*. 5: 49-58.

McKinney, M. L., and Schoch, R. M. (2003). *Environmental Science: Systems and Solutions*. Jones and Bartlett Publishers.

Medina, M. (1997). The effect of income on municipal solid waste generation rates for countries of varying levels of economic development: A model. *Journal of Resource Management and Technology*. 24(3): 149-155.

Miezah, K., Obiri-Danso, K., Kádár, Z., Fei-Baffoe, B., and Mensah, M. Y. (2015). Municipal solid waste characterization and quantification as a measure towards effective waste management in Ghana. *Waste Management*. 46: 15-27.

Mihelcic, J. R., Fry, L. M., Myre, E. A., Phillips, L. D., and Barkdoll, B. D. (2009). *Field guide to environmental engineering for development workers: Water, sanitation, and indoor air*. American Society of Civil Engineers.

Miller, G. T., and Spoolman, S. (2015). *Environmental Science*. Boston, U.S.A.: Cengage Learning, Inc.

Moh, Y., and Abdul 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 Taha, M. P. (2016). *Integrated Solid Waste Management: Challenge and Future*. Retrieved on May 13, 2017, from http://nehapmalaysia.moh.gov.my/wp-content/uploads/2016/03/Paper-2-Solid-Waste.pdf

Mohd Safian, E. E., and Nawawi, A. H. (2011). *The Evolution of Analytical Hierarchy Process (AHP) As A Decision-Making Tool in Property Sectors*. Retrieved on July 9. 2017, from http://www.ipedr.com/vol6/6-A00016.pdf

Mohd Yusof, M. B., Othman, F., and Ali, N. C. (2002). The Role of Socio-Economic and Cultural Factors in Municipal Solid Waste Generation: A Case Study in Taman Perling, Johor Bahru. *Jurnal Teknologi*. 37(F): 55 - 64.

Momani, S. (2014). *2013 International Conference on Electrical, Control and Automation Engineering (ECAE2013).* DEStech Publications, Inc.

Morawicki, R. O. (2012). *Handbook of Sustainability for the Food Sciences*. West Sussex, U.K.: John Wiley & Sons, Inc. .

Munier, N. (2011). *A strategy for using multi-criteria analysis in decision-making: a guide for simple and complex environmental projects*. Springer Science & Business Media.

Murad, W., and Siwar, C. (2007). Waste management and recycling practices of the urban poor: a case study in Kuala Lumpur city, Malaysia. *Waste Management and Research*. 25(1): 3-13.

Nag, A. (2005). *Environmental education and solid waste management*. New Age International.

Neo, S. M., Choong, W. W., and Ahamad, R. (2017). Public Environmental Awareness and Behaviour in Malaysia. *Asian Journal of Quality of Life*. 2(5): 43-53.

Nijkamp, P., and Siedschlag, I. (2010). *Innovation, Growth and Competitiveness: Dynamic Regions in the Knowledge-Based World Economy*. Springer Berlin Heidelberg.

Noor, Z. Z., Yusuf, R. O., Abba, A. H., Hassan, M. A. A., and Din, M. F. M. (2013). An overview for energy recovery from Municipal Solid Wastes (MSW) in Malaysia scenario. *Renewable and Sustainable Energy Reviews*. 20: 378-384.

Oelke, N. D., Suter, E., Silva Lima, M. A. D. D., and Vliet-Brown, C. V. (2015). Indicators and Measurement Tools for Health System Integration: A Knowledge Synthesis Protocol. *Systematic Reviews*. 4(99): 1 - 88.

Ogawa, H. (2008). Sustainable solid waste management in developing countries: waste management. *Imiesa*. 33(9): 57-71.

Ogola, J. S., Chimuka, L., and Tsivhase, S. (2011). *Management of Municipal Solid Waste: A Case Study in Limpopo Province, South Africa.* Retrieved on July 1, 2017, from http://cdn.intechopen.com/pdfs/17432/InTech-Management_of_municipal_solid_wastes_a_case_study_in_limpopo_province_south_africa.pdf

Ogwueleka, T. (2009). Municipal solid waste characteristics and management in Nigeria. *Journal of Environmental Health Science & Engineering*. 6(3): 173-180.

Omran, A., El-Amrouni, A. O., Suliman L. K., Pakir, A. H., Ramli, M., and Aziz, H. A. (2009). Solid Waste Management Practices in Penang State: A Review of Current Practices and The Way Forward. *Environmental Engineering and Management Journal*. 8(1): 97 - 106.

Omran, A., Mahmood, A., Abdul Aziz, H., and Robinson, G. (2009). Investigating households attitude toward recycling of solid waste in Malaysia: a case study. *International Journal of Environmental Research*. 3(2): 275-288.

Organisation for Economic Co-operation and Development. (2000). *Towards Sustainable Development Indicators to Measure Progress (Proceedings of the Rome Conference): Indicators to Measure Progress (Proceedings of the Rome Conference)*. OECD Publishing.

Organisation for Economic Co-operation and Development. (2004a). *Addressing the Economics of Waste*. France: OECD Publications.

Organisation for Economic Co-operation and Development. (2004b). *Glossary of Statistical Terms*. Retrieved on July 25, 2017, from https://stats.oecd.org/glossary/detail.asp?ID=6278

Organisation for Economic Co-operation and Development. (2005). *Statistics, Knowledge and Policy Key Indicators to Inform Decision Making: Key Indicators to Inform Decision Making*. OECD Publishing.

Organisation for Economic Co-operation and Development. (2008). *Handbook on Constructing Composite Indicators: Methodology and User Guide*. Retrieved on June 29, 2017, from http://www.oecd.org/std/42495745.pdf

Othman, S. N., Noor, Z. Z., Abba, A. H., Yusuf, R. O., and Hassan, M. A. A. (2013). Review on life cycle assessment of integrated solid waste management in some Asian countries. *Journal of Cleaner Production*. 41: 251-262.

Pandey, R. U., Surjan, A., and Kapshe, M. (2017). Exploring linkages between sustainable consumption and prevailing green practices in reuse and recycling of household waste: Case of Bhopal city in India. *Journal of Cleaner Production.* 173: 49-59.

Panirchellvum, V., and Nugi, A. (2016). *RM2b spent annually on waste separation, public cleaning, says Rahman Dahlan.* Retrieved on June 3, 2017, from http://www.thesundaily.my/news/1822255

Parekh, H., Yadav, K., Yadav, S., and Shah, N. (2015). Identification and assigning weight of indicator influencing performance of municipal solid waste management using AHP. *KSCE Journal of Civil Engineering*. 19(1): 36-45.

Park, C. C. (2001). *The Environment: Principles and Applications*. London, U. K.: Routledge.

Pascoal, D. S. B., Gois, J. C. M., and de Quina, M. M. J. (2012). *Analysis of the Protuguese Municipal Solid Waste Management System*. Retrieved on July 28, 2017, from https://estudogeral.sib.uc.pt/bitstream/10316/20460/1/Daniela_Pascoal.pdf

Passarini, F., Vassura, I., Monti, F., Morselli, L., and Villani, B. (2011). Indicators of waste management efficiency related to different territorial conditions. *Waste Management*. 31(4): 785-792.

Periathamby, A. (2001). *Solid waste: principles and management; with Malaysian case studies*. Institute of Biological Sciences, University of Malaya.

Periathamby, A. (2012). *Waste Management and Recycling Performance Indicators: Priorities and Challenges*. Retrieved on July 29, 2017, from http://www.iges.or.jp/en/archive/wmr/pdf/activity20121213/1-4_Agamuthu.pdf

Periathamby, A., and Fauziah, S. (2011). Challenges and issues in moving towards sustainable landfilling in a transitory country-Malaysia. *Waste Management & Research*. 29(1): 13-19.

Periathamby, A., Hamid, F. S., and Khidzir, K. (2009). Evolution of solid waste management in Malaysia: impacts and implications of the solid waste bill, 2007. *Journal of Material Cycles and Waste Management*. 11(2): 96-103.

Periathamby, A., Hotta, Y., and Mohanty C. R. C. (2013). *Suggested Core Set of 3R Policy Indicators for Monitoring Implementation of the Hanoi 3R Declaration (2013 - 2023)*. Retrieved on July 26, 2017, from http://www.uncrd.or.jp/content/documents/13475-3R_P1-2.pdf

Pharino, C. (2017). *Challenges for Sustainable Solid Waste Management: Lessons from Thailand*. Springer Singapore.

Pichtel, J. (2014). *Waste Management Practices: Municipal, Hazardous, and Industrial*. Second Edition. CRC Press.

Pinderhughes, R. (2004). *Alternative Urban Futures: Planning for Sustainable Development in Cities Throughout the World*. Rowman & Littlefield.

Pinto, D., Shrestha, S., Babel, M. S., and Ninsawat, S. (2017). Delineation of Groundwater Potential Zones in the Comoro Watershed, Timor Leste using GIS, Remote Sensing and Analytical Hierarchy Process (AHP) Technique. *Applied Water Science*. 7: 503 - 519.

Qin, X. (2013). Local ideal point method for GIS-based multi-criteria analysis: A case study in London, Ontario. Retrieved on August 18, 2017, from https://ir.lib.uwo.ca/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=2665&context=etd

Qu, X., Li, Z., Xie, X., Sui, Y., Yang, L., and Chen, Y. (2009). Survey of Composition and Generation Rate of Household Wastes in Beijing, China. *Waste Management*. 10: 2618 - 2624.

Rahim, M. H. A., Zukni, R. Z. J. A., Ahmad, F., and Lyndon, N. (2012). Green advertising and environmentally responsible consumer behaviour: The level of awareness and perception of Malaysian youth. *Asian Social Science*. 8(5): 46-54.

Rajaram, V., Siddiqui, F. Z., Agrawal, S., and Khan, M. E. (2016). *Solid and Liquid Waste Management Waste to Wealth: Solid and Liquid Waste Management Waste to Wealth*. Prentice-Hall of India.

Ramachandra, T. (2006). Management of municipal solid waste. New Delhi: TERI Press.

Rao, R. V. (2012). *Decision Making in Manufacturing Environment Using Graph Theory and Fuzzy Multiple Attribute Decision Making Methods*. Springer London.

Rigamonti, L., Sterpi, I., and Grosso, M. (2016). Integrated municipal waste management systems: An indicator to assess their environmental and economic sustainability. *Ecological Indicators*. 60: 1-7.

Ripa, M., Fiorentino, G., Vacca, V., and Ulgiati, S. (2017). The relevance of site-specific data in Life Cycle Assessment (LCA). The case of the municipal solid waste management in the metropolitan city of Naples (Italy). *Journal of Cleaner Production*. 142: 445-460.

Roszkowska, E. (2011). Multi-criteria decision-making models by applying the TOPSIS method to crisp and interval data. *Multiple Criteria Decision Making/University of Economics in Katowice*. 6: 200-230.

Saaty, R. W. (1987). The analytic hierarchy process—what it is and how it is used. *Mathematical modelling*. 9(3-5): 161-176.

Saaty, T. L. (2000). *Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process*. RWS Publications.

Saeed, M. O., Hassan, M. N., and Mujeebu, M. A. (2009). Assessment of municipal solid waste generation and recyclable materials potential in Kuala Lumpur, Malaysia. *Waste Management*. 29(7): 2209-2213.

Salita, D. (2002). *Environmental Geography*. Quezon City, Philippines: JMC Press, Inc.

Senn, D. (2013). *Using Indicators to Measure Progress and Performance*. Retrieved on July 7, 2017, from http://www.sswm.info/sites/default/files/ppts/SENN 2013 Using Indicators to Measure Progress and Performance-131218.ppt

Shah, R. (2003). *Sustainable Development: Statistics, Indicators and Decision Making*. Retrieved on July 7, 2017, from http://slideplayer.com/slide/5999803/

Singh, J., and Ramanathan, A. L. (2010). *Solid Waste Management: Present and Future Challenges*. I.K. International Publishing House Pvt. Limited.

Sinha, K. C., and Labi, S. (2007). *Transportation Decision Making: Principles of Project Evaluation and Programming*. Wiley.

Smith, S. R., Cheeseman, C., and Blakey, N. (2009). *Waste Management and Minimization*. Eolss Publishers.

Sobh, T. (2010). *Innovations and Advances in Computer Sciences and Engineering*. Springer Netherlands.

Solomon, A. O. (2011). *The Role of Households in Solid Waste Management in East Africa Capital Cities*. The Netherlands: Wageningen Academic Publishers.

Spooner, A. M. (2012). *Environmental Science for Dummies*. Hoboken, New Jersey: John Wiley & Son, Inc.

Sreenivasan, J., Govindan, M., Chinnasami, M., and Kadiresu, I. (2012). *Solid waste management in Malaysia: A move towards sustainability*. Retrieved on November 11, 2017, from https://www.intechopen.com/books/waste-management-an-integrated-vision/solid-waste-management-in-malaysia-a-move-towards-sustainability

Stanković, J., Delias, P., Marinković, S., and Rochhia, S. (2016). *Tools and Techniques for Economic Decision Analysis*. IGI Global.

Stapleton, R. M., Hemminger, P., and Senecah, S. (2004). *Pollution A to Z Vol. 2*. Macmillan Reference USA: New York.

Stepping, K. M. K. (2013). *Challenges in Measuring the State of the Environment in Developing Countries*. Retrieved on June 29, 2017, from https://www.die-gdi.de/uploads/media/DP_25.2013.pdf

Sureshkumar, M., Sivakumar, R., and Nagarajan, M. (2017). Selection of Alternative Landfill Site in Kanchipuram, India by Using GIS and Multi-criteria Decision Analysis. *Applied Ecology and Environmental Research*. 15(1): 627 - 636.

Sustainable Communities. (2014). *Using indicators and performance measurement*. Retrieved on July 7, 2017, from https://cms.sustainablecommunities.gov/indicators/using-indicators-and-performance-measurement

Swati, A. (2009). *Waste Management as a Sector of Green Economy*. Retrieved on July 1, 2017, from http://81.47.175.201/flagship/attachments/UNEP_Waste.pdf

Tait, S., and Van der Spuy, E. (2010). *Cooperation and Accountability in the Cross-border Policing of Southern Africa*. Woodstock, Cape Town: African Policing Civilian Oversight Forum.

Tarmudi, Z., Abdullah, M. L., Tap, M., and Osman, A. (2009). An overview of municipal solid wastes generation in Malaysia. *Jurnal Teknologi*. 51(F): 1-15.

Tarmudi, Z., Abdullah, M. L., Tap, M., and Osman, A. (2012). A review of municipal solid waste management in Malaysia. *Jurnal Teknologi*. 57: 41-56.

Taylor, P., Liden, R., Ndirangu, W., and Jin, L. (2008). *Using indicators to Measure Progress and Performance.* Retrieved on July 2, 2017, from http://www.sswm.info/content/using-indicators-measure-progress-and-performance

Thanh, N. P. (2010). *A Study on Evaluation Methodologies for Household Solid Waste Management Toward A Sustainable Society in Vietnam (Abstract)*. Retrieved on July 1, 2017, from http://openaccess.tu-dresden.de/ojs/index.php/jve/thesis/view/6

Thanh, N. P., Matsui, Y., and Fujiwara, T. (2010). Household Solid Waste Generation and Characteristic in a Mekong Delta city, Vietnam. *Journal of Environmental Management.* 91: 2301-2321.

The Star Online. (2016). *Research Shows Malaysian Waste Enough to Feed Millions Daily.* Retrieved on June 3, 2017, from http://www.thestar.com.my/news/nation/2016/05/31/food-and-money-down-the-drain-research-shows-malaysians-waste-enough-to-feed-millions-daily/

Torelli, N., Pesarin, F., and Bar-Hen, A. (2013). *Advances in Theoretical and Applied Statistics.* Springer Berlin Heidelberg.

Triantaphyllou, E. (2000). *Multi-criteria Decision-Making Methods: A Comparative Study.* Springer US.

Trimble, D. C. (2011). *Afghanistan and Iraq: DoD Should Improve Adherence to Its Guidance on Open Pit Burning Solid Waste.* DIANE Publishing Company.

UN Habitat. (2010). *Solid Waste Management in the World's Cities: Water and Sanitation in the World's Cities 2010*. Retrieved on June,3, 2017, from https://thecitywasteproject.files.wordpress.com/2013/03/solid_waste_management_in_the_worlds-cities.pdf

United Kingdom Department of Environment. (1999). *Quality of Life Counts*. London, U. K.: Government Statistical Service.

United Nations Development Programme Malaysia. (2008). *Malaysia Developing a Solid Waste Management Model for Penang*. United Nations Development Programme Kuala Lumpur.

United Nations Publications. (2015). *Guidelines for National Waste Management Strategies: Moving from Challenges to Opportunities*. United Nations Environment Programme.

United States Office of Technology Assessment. (1979). *Materials and energy from municipal waste: resource recovery and recycling from municipal solid waste and beverage container deposit legislation.* DIANE Publishing.

Vaidya, O. S., and Kumar, S. (2006). Analytic hierarchy process: An overview of applications. *European Journal of Operational Research*. 169(1): 1-29.

Van Calster, G. (2014). *Waste Management and Climate Change in the EU*. Retrieved on June 3, 2017, from https://lirias.kuleuven.be/bitstream/123456789/482140/1/Climate+change+and+waste+management+law+in+the+EU+-+GAVC+11+2013.pdf

Vatn, A. (2015). *Environmental Governance: Institutions, Policies and Actions*. Edward Elgar Publishing, Incorporated.

Victor, D., and Periathamby, A. (2013). Strategic environmental assessment policy integration model for solid waste management in Malaysia. *Environmental Science and Policy*. 33: 233-245.

Visvanathan, C. (2012). *Waste Management Indicators: Priority and Challenges*. Retrieved on September 29, 2015, from http://www.iges.or.jp/en/archive/wmr/pdf/activity20121213/1-3_Visu_WM.pdf

Visvanathan, C., Tubtimthai, O., and Kuruparan, P. (2004). Influence of landfill top cover design on methane oxidation: Pilot scale lysimeter experiments under tropical conditions. *3rd Asia Pasific Landfill Symposium*. Kitakyushu, Japan. Oct, 27-29.

Vivanco, D. F., Ventosa, I. P., and Durany, X. G. (2012). Building waste management core indicators through Spatial Material Flow Analysis: Net recovery and transport intensity indexes. *Waste Management*. 32(12): 2496-2510.

Von Schirnding, Y. (2002). *Health in Sustainable Development Planning: The Role of Indicators.* Retrieved on July 7, 2017, from http://www.who.int/wssd/resources/indicators/en/

Wang, L. K., Hung, Y. T., and Shammas, N. K. (2009). *Handbook of Advanced Industrial and Hazardous Wastes Treatment.* Baco Raton, Florida: CRC Press.

Ward, A. D., Trimble, S. W., Burckhard, S. R., and Lyon, J. G. (2015). *Environmental Hydrology.* (6th ed.). Baco Raton, Florida: CRC Press.

Waste Atlas. (2013a). *Waste Atlas 2013 Report*. Retrieved on July 1, 2017, from http://www.iswa.org/fileadmin/galleries/News/WASTE_ATLAS_2013_REPORT.pdf

Waste Atlas. (2013b). *Using Waste Atlas for Forecasting Waste in Mena Region*. Retrieved on June 30, 2017, from http://www.atlas.d-waste.com/Documents/USING WASTE ATLAS FOR FORECASTING WASTE IN MENA REGION.zip

Weitz, K. A., Thorneloe, S. A., Nishtala, S. R., Yarkosky, S., and Zannes, M. (2002). The impact of municipal solid waste management on greenhouse gas emissions in the United States. *Journal of the Air & Waste Management Association*. 52(9): 1000-1011.

Wertz, K. L. (1976). Economic Factors Influencing Household's Reproduction of Refuse. *Journal of Environmental Economics and Management*. 2: 263 - 272.

Williams, P. T. (2005). *Waste treatment and disposal*. West Sussex, U.K.: John Wiley & Sons.

Williams, P. T. (2013). *Waste Treatment and Disposal*. (2nd ed.). West Sussex, U.K.: John Wiley & Sons.

Wilson, D., Rodic-Wiersma, L., Cowing, M., Whiteman, A., Stretz, J., and Scheinberg, A. (2013). *Benchmark indicators for Integrated Sustainable Waste Management (ISWM).* Retrieved on June 2, 2016, from http://nswaienvis.nic.in/Waste_Portal/wasteportalpdf/Benchmark%20Indicators%20for%20Integrated%20and%20Sustainable%20Waste%20Management%20(ISWM).pdf

Winterfeldt, D. V., and Fischer, G. W. (1975). *Multi-attribute utility theory: Models and assessment procedures*. In Wendth, D. and Vlek, C. (eds) Utility, Probability and Human Decision Making. Theory and Decision Library (an International Series in the Philosophy and Methodology of the Social and Behavioral Sciences). 11. Springer: Doredrecht.

Wyrzykowski, R., Dongarra, J., Karczewski, K., and Waśniewski, J. (2012). *Parallel Processing and Applied Mathematics*. Part II: 9th International Conference, PPAM 2011, Torun, Poland, September 11-14, 2011. Revised Selected Papers. Springer Berlin Heidelberg.

Yahaya, N., and Larsen, I. (2003). *Federalising Solid Waste Management in Peninsular Malaysia.* Retrieved on July 28, 2017, from http://www.ecoideal.com.my/danidaurban/swmc/download/SWMC_TEC_03-123-Federalising SWM Peninsular M'sia.pdf

Yang, L. T. (2005). *Embedded Software and Sys*tems. Second International Conference, ICESS 2005, Xi'an, China, December 16-18, 2005, Proceedings. Springer.

Younas, M., Awan, I., Kryvinska, N., Strauss, C., and van Thanh, D. (2016). *Mobile Web and Intelligent Information Systems*. 13th International Conference, MobiWIS 2016, Vienna, Austria, August 22-24, 2016, Proceedings. Springer International Publishing.

Yuan, H. (2013). Key indicators for assessing the effectiveness of waste management in construction projects. *Ecological Indicators*. 24: 476-484.

Yunus, M., and Kadir, K. (2003). The development of solid waste treatment technology based on refuse derived fuel and biogasification integration. *International Symposium on Renewable Energy*. Kuala Lumpur, 14-17.

Yusof, N., Haraguchi, A., Hassan, M. A., Othman, M. R., Wakisaka, M., and Shirai, Y. (2009). Measuring organic carbon, nutrients and heavy metals in rivers receiving leachate from controlled and uncontrolled municipal solid waste (MSW) landfills. *Waste Management*. 29(10): 2666-2680.

Zabaleta, A. (2008). Sustainability Indicators for Municipal Solid Waste Treatment Case study: The City of Stockholm: landfill vs. incineration. Retrieved May 28, 2016, from http://www.diva-portal.org/smash/get/diva2:402958/FULLTEXT02.pdf

Zaman, A. U. (2014). Measuring waste management performance using the 'Zero Waste Index': the case of Adelaide, Australia. *Journal of Cleaner Production*. 66: 407-419.

Zaman, A. U., and Lehmann, S. (2013). The Zero Waste Index: a performance measurement tool for waste management systems in a 'zero waste city'. *Journal of Cleaner Production*. 50: 123-132.

Zardari, N. H., Ahmed, K., Shirazi, S. M., and Yusop, Z. B. (2014). *Weighting Methods and their Effects on Multi-Criteria Decision-Making Model Outcomes in Water Resources Management.* Springer International Publishing.

Zhang, X., and Xu, Z. (2016). *Hesitant Fuzzy Methods for Multiple Criteria Decision Analysis.* Springer International Publishing Switzerland.

Zhu, D., Asnani, P. U., Zurbrugg, C., Anapolsky, S., and Mani, S. (2008). Improving Municipal Solid Waste Management in India: A Sourcebook for Policymakers and Practitioners. Washington, DC.: The World Bank.

Zimring, C. A., and Rathje, W. L. (2012). *Encyclopedia of Consumption and Waste: The Social Science of Garbage.* SAGE Publications.

Zurbrugg, C. (2002*). Urban solid waste management in low-income countries of Asia: How to cope with the garbage crisis.* Scientific Committee on Problems of the Environment (SCOPE) Urban Solid Waste Management Review Session. Durban, South Africa, 1-13.

The different types of municipal solid waste generated mostly from houses, streets, public places, shops, offices and hospitals. Management of these types of waste is most often the responsibility of municipal or other governmental authorities. Expect in the metropolitan cities, M.S.W. is found only the transportation work. The activity of mostly oriented labour intensive and 2-3 workers are provided per 100 residential served. The municipal agencies spend 5-25% of their budget on M.S.W. A typical waste management practices performed by the sections of lower and middle income community special Waste-to-Energy Options in Â Municipal Solid Waste Management. A Guide for Decision Makers in Developing Â and Emerging Countries. As a federally owned enterprise, GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.Â Friedrich-Ebert-Allee 36 + 40 53113 Bonn, Germany T +49 228 44 60 - 0 F +49 228 44 60 - 17 66. E info@giz.de I www.giz.de. Project description: Advisory Project: Concepts for Sustainable Solid Waste Management and Circular Economy. Authors: Dieter Mutz, Dirk Hengevoss, Christoph Hugi, Thomas Gross from the University of Applied Sciences and Arts Northwestern Switzerland (FHNW). Edited by: Daniel Hinchliffe, Johannes Frommann and Ellen Gunsilius from GIZ. This article assesses the performance of the city of Accra, Ghana, in municipal solid waste management as defined by the integrated sustainable waste management framework. The article reports on a participatory process to socialise the Wasteaware benchmark indicators and apply them to an upgraded set of data and information. The process has engaged 24 key stakeholders for 9 months, to diagram the flow of materials and benchmark three physical components and three governance aspects of the city's municipal solid waste management system. The results indicate that Accra is well below some ot