UNIVERSITI PUTRA MALAYSIA

SOURCE SEPARATION OF SOLID WASTE FOR RECYCLING PRACTICE AT HOUSEHOLD LEVEL IN JOHOR AND SELANGOR, MALAYSIA

MOH YIING CHIEE

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By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

December 2017

Here is the strongest rock in the world
Metamorphosed through furious heat and demanding pressure
Unswerving strength and endurance and silently ready to engage
It was never really the same since then
Yet it remains grounded to its roots
Warmly it glows and silently announces
All these, for you, I give
I become this rock for you to bloom

You may have thought that I didn't notice
Sometimes it seems that I forget
Your struggle and sacrifice
All in the name of family
For the comfort and stability
I may seem nonchalant
But I pick up everything
Keep them closely in my heart

For being my source of strength
Allowing me to keep dreaming and
The freedom to pursue my passion
Having you in good health
Earnestly I pray and wish for
Reminding myself
How blessed I am
To be your daughter

Mom, Dad,
This is dedicated to you.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

SOURCE SEPARATION OF SOLID WASTE FOR RECYCLING PRACTICE AT HOUSEHOLD LEVEL IN JOHOR AND SELANGOR, MALAYSIA

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MOH YIING CHIEE

December 2017

Chair : Latifah Abd Manaf, PhD
Faculty : Environmental Studies

Beginning June 1st, 2016, source separation of solid waste for recycling practice is mandatorily enforced with compound taking effect at household level in Malaysia as part of the country's transformed strategy towards sustainable solid waste management. However, not all states in Malaysia share similar policy approach in introducing and sustaining the practice among households. Addressing that, this study evaluated source separation of solid waste for recycling practice from the perspectives of the main organizations and households in two of the most populated states that represent different policies of solid waste management in Malaysia, specifically Johor and Selangor. Based on purposive sampling, 19 lead officers representing solid waste management organizations in both states participated in the semi-structured interviews. Data derived from interview transcripts were analyzed and the interpretations were corroborated with the documents provided by participants. This study also conducted questionnaire survey involving randomly selected respondents from each area of jurisdiction under local authorities in both states. The sampling successfully gathered 589 respondents from Johor and 806 respondents from Selangor. This study also adopted Theory of Planned Behaviour (TPB) to provide a more nuanced view of the practice among households in both states. Based on the interviews, the overall management in Johor and Selangor were different in terms of expectations and organizational structure and system. However, participants revealed similar conflicts of interest between organizations and households in both states. Despite comparatively similar challenges in resources, personnel, and technicality, participants in Selangor encountered issues that were more apparent without specific regulatory instrument. As for households, majority were supportive of mandatory approach regardless of the type of policy implemented ($U = 232134.5$, $z = -0.839$, $p = 0.402$). Households' responses on perception towards solid waste, challenges faced, expectations, and willingness to participate were comparatively similar between both states. Meanwhile, attitude explained significantly more of the variance in behavioural intention for households in Johor (r

= 0.56, $p < 0.01$) than in Selangor ($r = 0.43$, $p < 0.01$). Similarly, moral norm explained significantly more of the variance in behavioural intention for households in Johor ($r = 0.70$, $p < 0.01$) than in Selangor ($r = 0.63$, $p < 0.01$). Interestingly, there was also a statistically significantly difference in the strength of the correlation between attitude and moral norm for households in both states where attitude explained significantly more of the variance in moral norm for households in Johor ($r = 0.77$, $p < 0.01$) than in Selangor ($r = 0.72$, $p < 0.01$). Standard multiple regression were subsequently performed for cases of Johor and Selangor, which revealed that the inclusion of moral norm increased the predictiveness of TPB based on the results of three proposed models. Obtained principal component analysis results revealed attitude, moral norm, and behavioural intention loaded strongly on a single component, suggesting these components may not be separately considered. This also reaffirmed the unique association between attitude and moral norm on behavioural intention of households, despite under different policy approach. Meanwhile, the one-way between-groups multivariate analysis of variance results revealed that gender, age group, and education level do not play a defining attribute in determining households' overall behaviour in both states. The number of children in household, however, may have potential influence over households' moral norm under mandatory approach (Johor), $F (2, 586) = 4.67$, $p = 0.010$, partial eta-squared = 0.016 using a Bonferroni adjusted alpha level of 0.01. Conclusively, this study addressed pertinent issues and challenges within the existing solid waste management system in the context of source separation of solid waste for recycling practice at household level in Malaysia from multifaceted perspectives. In this context, this study also proposed and recommended a framework of planning and management, implementation, and evaluation based on the obtained qualitative findings and quantitative results.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

AMALAN PENGASINGAN SISA PEPEJAL DI PUNCA UNTUK KITAR SEMULA PADA PERINGKAT ISI RUMAH DI JOHOR DAN SELANGOR, MALAYSIA

Oleh

MOH YIING CHIEE

Disember 2017

Pengerusi : Latifah Abd Manaf, PhD
Fakulti : Pengajian Alam Sekitar

Mulai 1 Jun 2016, amalan pengasingan sisa pepejal di punca untuk kitar semula dikuatkuasa secara mandatori pada peringkat isi rumah di Malaysia sebagai salah satu strategi untuk mentransformasikan negara ke arah pengurusan sisa pepejal secara mampan. Walau bagaimanapun, tidak semua negeri di Malaysia mempunyai pendekatan dasar yang sama dalam memperkenalkan dan mengekalkan amalan ini dalam kalangan isi rumah. Dengan itu, kajian ini menilai amalan pengasingan sisa pepejal di punca untuk kitar semula dari kacamata organisasi utama yang bertanggungjawab dalam pengurusan sisa pepejal dan isi rumah di dua negeri yang mempunyai kepadatan penduduk tertinggi di Malaysia, iaitu Johor dan Selangor. Berdasarkan kaedah persampelan bertujuan, 19 pegawai dari organisasi yang bertanggungjawab di kedua-dua negeri telah mengambil bahagian dalam sesi temubual separuh berstruktur. Hasil temubual dianalisis dan ditaksir dengan bahan yang disediakan oleh para pegawai yang terlibat. Selain itu, kajian soal selidik juga dijalankan dengan penglibatan isi rumah dari setiap kawasan di bawah kuasa pihak berkuasa tempatan secara rawak di kedua-dua negeri. Seramai 589 responden dari Johor dan 806 responden dari Selangor terlibat dalam kajian soal selidik ini. Kajian ini juga mengadaptasikan Teori Tingkahlaku Terancang untuk mendapatkan gambaran yang lebih jelas tentang amalan pengasingan sisa pepejal di punca untuk kitar semula dalam kalangan isi rumah di kedua-dua negeri. Secara keseluruhannya, analisis kajian temubual mendedahkan perbezaan dalam pengurusan sisa pepejal di Johor dan Selangor dari segi jangkaan, struktur dan sistem organisasi. Walau bagaimanapun, terdapat persamaan konflik di antara organisasi dan isi rumah di kedua-dua negeri. Walaupun organisasi dari kedua-dua negeri menghadapi kekangan dari segi sumber, kakitangan dan teknikal, organisasi di Selangor menghadapi isu yang lebih serius dan lebih-lebih lagi, tanpa rangka kerja pengawalseliaan yang lebih khusus. Bagi isi rumah pula, majoriti menyokong pendekatan dasar mandatori tanpa

mengira jenis dasar yang dilaksanakan ($U = 232134.5$, $z = -0.839$, $p = 0.402$). Persepsi isi rumah di kedua-dua negeri terhadap sisa pepejal, kekangan yang dihadapi dan kesanggupan untuk mengambil bahagian dalam aktiviti-aktiviti yang diketengahkan dalam kajian soal selidik adalah serupa. Selain itu, komponen sikap menjelaskan lebih banyak variasi bagi komponen niat tingkahlaku dalam kalangan isi rumah di Johor ($r = 0.56$, $p < 0.01$) berbanding dengan isi rumah di Selangor ($r = 0.43$, $p < 0.01$). Begitu juga bagi komponen norma moral yang menjelaskan variansi yang lebih tinggi bagi komponen niat tingkahlaku dalam kalangan isi rumah di Johor ($r = 0.70$; $p < 0.01$) berbanding dengan isi rumah di Selangor ($r = 0.63$, $p < 0.01$). Menariknya, terdapat juga perbezaan statistik yang signifikan bagi korelasi antara sikap dan norma moral isi rumah di kedua-dua negeri, yang mana komponen sikap menjelaskan variasi yang lebih tinggi secara signifikan bagi komponen norma moral di Johor ($r = 0.77$, $p < 0.01$) berbanding dengan Selangor ($r = 0.72$, $p < 0.01$). Berdasarkan tiga model yang dicadangkan, keputusan analisis regresi berganda mendedahkan kemasukan komponen norma moral ke dalam model meningkatkan ramalan model Teori Tingkahlaku Terancang. Keputusan analisis komponen utama menunjukkan komponen sikap, norma moral dan niat tingkahlaku digabungkan di bawah satu komponen utama yang sama. Ini menunjukkan pertimbangan ke atas ketiga-tiga komponen ini tidak perlu secara berasingan dan mendedahkan hubungan unik antara komponen sikap dan norma moral terhadap niat tingkahlaku isi rumah walaupun di bawah pendekatan dasar yang berbeza. Sementara itu, keputusan analisis variansi antara kumpulan yang diperoleh menunjukkan bahawa jantina, kumpulan umur dan tahap pendidikan tidak memainkan peranan yang penting dalam tingkahlaku isi rumah di kedua-dua negeri. Walau bagaimanapun, bilangan anak dalam isi rumah mungkin mempunyai pengaruh terhadap norma moral isi rumah di bawah pendekatan dasar mandatori (Johor), $F (2, 586) = 4.67$, $p = 0.010$, eta kuadrat parsial = 0.016 dan menggunakan nilai 0.01 sebagai penyesuaian aras alpha Bonferroni. Secara keseluruhannya, kajian ini telah mengetengahkan pelbagai isu dan masalah dalam sistem pengurusan sisa pepejal khasnya dalam aspek pengasingan sisa pepejal di punca untuk kitar semula pada peringkat isi rumah di Malaysia dari pelbagai perspektif. Dalam konteks ini, kajian ini juga telah menyarankan satu rangka kerja bagi perancangan dan pengurusan, pelaksanaan serta penilaian berdasarkan dapatan kajian kualitatif dan kuantitatif.

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And a pat on the back—yes, I did it.

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

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LIST OF ABBREVIATIONS

ABC Plan	Action Plan for a Beautiful and Clean Malaysia
Act 672	Solid Waste and Public Cleansing Management Act 2007
Act 673	Solid Waste Management and Public Cleansing Corporation Act 2007
GIS	Geographic Information System
JICA	Japan International Cooperation Agency
JPSPN	National Solid Waste Management Department
JUPEM	Department of Survey and Mapping Malaysia
NSP	National Strategic Plan
SWCorp	Solid Waste and Public Cleansing Management Corporation
SWM Environment Sdn Bhd	Southern Waste Management Environment Sdn Bhd
TPB	Theory of Planned Behaviour
WM-MP	Waste Minimization Master Plan

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Issues of solid waste management transcend boundaries with its complex and costly management. Solid waste management is closely linked to urban sustainability (Liang & Zhang, 2012). How we deal with solid waste today determines how solid waste affects the environment (Zhang et al., 2016), and it greatly reflects the state of progress we have achieved. A well-functioning solid waste management is a proxy of good and effective governance (Aleluia & Ferrão, 2016). Similar to many other countries globally, inefficient solid waste collection systems and improper disposal practices are major inadequacies for Malaysian solid waste management (Zamali et al., 2012), also with an uncontrollable increase in the amount of solid waste generated (Abdul Jalil, 2010; Agamuthu & Fauziah, 2011). Malaysians generate approximately 33,000 tons of solid waste per day (Mokhtar, 2013; SWCorp, 2014) with 95% of solid waste collected being disposed at landfills (NSP, 2005).

However, disposing solid waste at landfills or open dumps is not publicly regarded as an environmental problem. In fact, landfilling process has been so overstressed that many of these disposal sites have exceeded its operating capacity. Landfills and open dumps create nuisance, provide breeding ground for pests, and pose health hazards and pollution. Landfilling adversely affects the environment and contaminates the soil and groundwater (Carvalho & Marques, 2014). Addressing these concerns, besides incinerator, sanitary landfills are usually opted. However, most of these disposal sites remain not upgraded due to the cost and space needed for upgrading to sanitary landfills or constructing incinerators. Solid waste continues to be compacted and piled as high as they are allowed; otherwise, ignited to obtain more space at the disposal sites. Thus, with almost non-existential recovery attempt, organic waste and recyclable materials are continuously disposed at landfills.

With an overall recycling rate of 10.5% (SWCorp, 2015), the recycling rate of other Asian countries is higher than Malaysia's: Nepal (12%), Bangladesh (13.8%), Pakistan (20%), Sri Lanka (23.5%), cities in Vietnam (12.2%-23.5%), Mongolia (51%) (Shapkota et al., 2006), Philippines (25%) (Andin, 2006), Korea (66%), Singapore (61%), Taiwan (60%), Thailand (22%), and Japan with plastic recycling rate of 77% (SWCorp, 2014). Undoubtedly, recyclable materials in Malaysia are not fully recovered and recycled despite the significant dominance of recyclable materials in the overall solid waste composition (Agamuthu et al., 2009; Mohamed Osman et al., 2009; SWCorp, 2015). Apart from that, illegal dumping is as much as of a social problem where solid waste is simply disposed inexpensively at anyone's convenience, anywhere. Illegal dumping cases in Malaysia are ubiquitous but rather intermittent over certain areas.

1.2 Problem Statement

Addressing the aforementioned issues of solid waste in Malaysia, Solid Waste and Public Cleansing Management Act 2007 (Act 672) was formulated. Basically, the overall management of solid waste in Malaysia are presently divided into two groups, which are (1) under Act 672 and (2) not under Act 672. With regards to Act 672, this leads us to the central topic of this study—source separation of solid waste for recycling practice at household level in Malaysia. With Malaysia's transition towards sustainable solid waste management, source separation of solid waste for recycling practice has deemed as a sustainable option because of its potential to reduce the amount of solid waste disposed at landfills, considering the dominance of recyclable materials in the overall solid waste composition (SWCorp, 2015).

Typically, households gather their solid waste in plastic bags and place these bags in solid waste bins (for landed properties) or storage containers (for high-rise properties). With the enforcement of mandatory source separation of solid waste for recycling strategy nationwide with compound taking effect in majority of states under Act 672 starting from June 1st, 2016, households are responsible to separate solid waste at source for recycling. Meanwhile, appointed private contractors collect solid waste based on a fixed collection schedule with a collection frequency of three times per week where recyclable materials are collected once per week and non-recyclable materials are collected twice in the same week.

Nevertheless, solid waste collection system in certain states in Peninsular Malaysia remains as usual, with collection frequency of three times per week as well. These states are Selangor, Perak, and Pulau Pinang. It is not mandatory for households in these states to separate solid waste at source for recycling, as solid waste management in these states are not under Act 672.

As federalization and privatization are yet to be fully established and do not include all states in Malaysia, the roles and responsibilities of main organizations in solid waste management (namely local authorities, private concessionaires, and SWCorp) specifically source separation of solid waste for recycling practice remain ambiguous. This poses severe constraint on the planning and management of solid waste at all levels throughout Malaysia. Furthermore, there are also other significant issues and challenges faced by both organizations and households in source separation of solid waste for recycling practice, which hinder efforts of initiating and sustaining the practice at household level, regardless of the different policies in solid waste management in Malaysia.

As a corollary, this has fostered debate on how different (or possibly, how effective) the management of solid waste particularly source separation of solid waste for recycling practice is for states under Act 672 from other states that are not under Act 672, and households' perspectives towards practicing source separation of solid waste for recycling under mandatory approach (under Act 672) as opposed to voluntary approach (not under Act 672).

1.3 Research Objectives

In general, this study evaluated source separation of solid waste for recycling practice at household level in selected states of Malaysia from the perspectives of organizations and households. The specific objectives of this study were as follows:

1) To assess the perspectives of local authorities, private concessionaires, and SWCorp in Johor and Selangor towards source separation of solid waste for recycling practice at household level;
2) To assess challenges, perceptions, and willingness to participate with regards to source separation of solid waste for recycling practice among households in Johor and Selangor;
3) To examine relationships among components of Theory of Planned Behaviour (TPB) and demographic profile attributes in source separation of solid waste for recycling practice at household level; and
4) To identify factors affecting households in source separation of solid waste for recycling practice.

1.4 Research Questions

With respect to the first objective, this study investigated the following question:

i. What are the differences in the management of solid waste particularly source separation of solid waste for recycling practice at household level between organizations in Johor and Selangor of different policies of solid waste management?

With respect to the second objective, this study focused on the following questions:

ii. Are there any significant differences in the support of mandatory source separation of solid waste for recycling, sources of information, and perceived economic value and generation of recyclable materials among households in Johor and Selangor?
iii. What are the main challenges in source separation of solid waste for recycling practice among households in Johor and Selangor?
iv. What is the perception towards good solid waste management among households in Johor and Selangor?
v. What are households' expected improvements from organizations in Johor and Selangor with regards to source separation of solid waste for recycling practice?
vi. What do households in Johor and Selangor willing to contribute or participate?

With respect to the third objective, this study investigated the following questions:

vii. What are the levels of attitude, subjective norm, perceived behavioural control, moral norm, and behavioural intention among households in source separation of solid waste for recycling practice?

viii. What are the relationships between attitude, subjective norm, perceived behavioural control, moral norm, and behavioural intention among households in Johor and Selangor?
ix. Is there any difference in the relationships among components of Theory of Planned Behaviour (TPB) between Johor and Selangor with regards to source separation of solid waste for recycling practice among households?
x. How well do attitude, subjective norm, perceived behavioural control, and moral norm predict behavioural intention of source separation of solid waste for recycling practice? How much variance in behavioural intention scores can be explained by scores of these four scales? Which is the best predictor of behavioural intention among these four scales?
xi. Are there any significant differences in attitude, subjective norm, perceived behavioural control, moral norm, and behavioural intention in source separation of solid waste for recycling practice between households in Johor and Selangor based on gender, age group, education level, and number of children in household?

With respect to the final objective, this study focused on the following questions:
xii. What factors that significantly predict the likelihood of households' reported willingness to practice source separation of solid waste for recycling in Johor and Selangor?
xiii. What is the underlying factor structure of components of Theory of Planned Behaviour (TPB) in explaining factors affecting households in source separation of solid waste for recycling practice based on case studies of Johor and Selangor?

1.5 Scope of Study

With respect to different management of solid waste, this study unravelled various perspectives towards source separation of solid waste for recycling practice at household level among related organizations and households in Johor and Selangor, Malaysia.

SWM Environment Sdn Bhd, which represents operating private concessionaires in Malaysia, is an integrated solid waste management and public cleansing provider to Johor, the second most populated state in Peninsular Malaysia (after Selangor state) and the most populated state under Act 672 in Malaysia. Despite under Act 672, local authorities in Johor may not be related to the roles and responsibilities of solid waste management but they were included in this study to ensure its possible relevance. On the contrary, solid waste management in Selangor, the most populated state in Peninsular Malaysia, remains under the jurisdiction of local authorities.

With that, the state of Johor was selected in representation of solid waste management under Act 672 while the state of Selangor was selected as representation of areas that are not under Act 672. The list of local authorities in both Johor and Selangor states is provided in **Table 1.1**. The sampling area for this study

was confined to all 15 areas of jurisdiction under local authorities in Johor and 12 areas of jurisdiction in Selangor.

There are three different types of local authorities, which are (1) city council, (2) municipal council, and (3) district council. Referring to the Ministry of Urban Wellbeing Housing and Local Government (2017), city councils are upgraded municipal councils to city level with the largest population (not less than 500,000 people) and annual income (more than RM 100 million) compared to municipal and district councils. Meanwhile, municipal councils are urban-based areas with population of more than 150,000 people and annual income of more than RM 20 million. District councils, on the other hand, are focused on rural areas with smaller population (of less than 150,000 people) and annual income of less than RM 20 million. Areas within the jurisdiction of city and municipal councils are regarded as urban areas while areas within the jurisdiction of district councils are rural areas.

Table 1.1: Local authorities in states of Johor and Selangor

	Local authorities in Johor		Local authorities in Selangor
1	Johor Bahru City Council	1	Shah Alam City Council
2	Batu Pahat Municipal Council	2	Petaling Jaya City Council
3	Johor Bahru Tengah Municipal Council	3	Ampang Jaya Municipal Council
4	Kluang Municipal Council	4	Kajang Municipal Council
5	Kulai Municipal Council	5	Klang Municipal Council
6	Muar Municipal Council	6	Selayang Municipal Council
7	Pasir Gudang Municipal Council	7	Sepang Municipal Council
8	Kota Tinggi District Council	8	Subang Jaya Municipal Council
9	Labis District Council	9	Hulu Selangor District Council
10	Mersing District Council	10	Kuala Langat District Council
11	Pontian District Council	11	Kuala Selangor District Council
12	Segamat District Council	12	Sabak Bernam District Council
13	Simpang Renggam District Council		
14	Tangkak District Council		
15	Yong Peng District Council		

This study incorporated both qualitative and quantitative methods to obtain the necessary data in line with the objectives of this study. The focus of interview aspect (qualitative) included lead officers (participants) of solid waste management in local authorities of both states, SWM Environment Sdn Bhd Johor (Main Branch), and SWCorp Johor (Main Branch) where participants were selected through purposive sampling method. Meanwhile, the focus of questionnaire survey aspect (quantitative) was inclusive of all households (respondents) residing within the areas of these two states where respondents were selected through random sampling method.

1.6 Significance of Study

Solid waste management is, in fact, the biggest environmental problem globally (Omran et al., 2009; Son, 2014) and Malaysia is of no exception (Mohamed Osman et al., 2009). With the enforcement of mandatory source separation of solid waste for recycling strategy at household level in September 1st, 2015, with compound taking effect beginning June 1st, 2016, this study significantly extends the existing knowledge base of source separation of solid waste for recycling practice. It is regarded as an initial effort to fill the knowledge gap in the scope of source separation of solid waste for recycling practice at household level as well as to unravel how exactly different solid waste management policies function in initiating and sustaining participation of households to practice source separation of solid waste for recycling.

Assessing the perspectives of local authorities, private concessionaires, and SWCorp while reviewing solid waste management policy and plan strategies over the years (1970–2016) bring into perspective the issues and challenges of current solid waste management and source separation for recycling practice in Malaysia from multifaceted aspects. These findings contribute to various stakeholders in solid waste management on initializing and enhancing future projects of sustainable solid waste management at household level, not limited to source separation of solid waste for recycling practice.

Subsequently, given the centrality of this study in source separation of solid waste for recycling practice at the most fundamental level—at household level, comprehending households' current perspectives towards source separation of solid waste for recycling practice with the adoption of TPB provides improved understanding over factors affecting households in practicing source separation of solid waste for recycling, considering that they are presently under different policies of solid waste management. On another note, this study also plays a significant role in bridging the gap between organizations and households in terms of compatibility in the roles and responsibilities they play towards improved cooperation while meeting current demands from both organizations and households.

Additionally, the integration of Geographic Information System (GIS) provides tremendous potential of mapping and visualization. In fact, this approach initiates extension of state of the art information on source separation of solid waste for recycling practice for the assessment, characterization, and future monitoring towards improved planning and management of solid waste at household level in Malaysia.

In a nutshell, this study provides significant contributory outcomes and pertinent recommendations on related policy and plan strategies in source separation of solid waste for recycling practice. With the first step taken towards sustainable solid waste management through mandatory source separation of solid waste for recycling strategy, the outcomes of this study, undoubtedly, serve as a catalyst and stimulate

future research, and provide tailored recommendations towards improving the discussed issues and challenges within the existing solid waste management system in Malaysia. Conclusively, this study also recommends a framework based on the obtained qualitative findings and quantitative results specifically in the context of source separation of solid waste for recycling practice at household level in Malaysia.

1.7 Thesis Organization

Overall, this thesis consists of five chapters, which is organized as follows:

Chapter 2 presents critical and comprehensive review of various literatures regarding solid waste management and related policy and plan strategies in Malaysia. With respect to the main focus of this study—source separation of solid waste for recycling practice, this chapter further unravels opportunities for recycling in Malaysia and highlights its issues and challenges from multifaceted aspects. Literature review further elaborates on the behavioural theory adopted in this study (Theory of Planned Behaviour—TPB) and its fundamental components. This chapter also reveals an overview of Geographic Information System (GIS) and mapping techniques.

Chapter 3 provides descriptions and justifications of the overall study framework and research design applied in this study. Besides description of selected study areas, sample size, instrumentation, data collection, sampling strategies, and qualitative as well as quantitative data analysis are described in details in this chapter.

Chapter 4 presents a complete account of the interview findings and questionnaire survey results obtained as well as interpretations in relation to the objectives and research questions.

Chapter 5 concludes the main findings and significance of this study before drawing conclusions with respect to each of the objectives and research questions. In this chapter, limitations of this study and relevant recommendations for future research are also discussed.

REFERENCES

Aadland, D., & Caplan, A. (2003). Willingness to pay for curbside recycling with detection and mitigation of hypothetical bias. *American Journal of Agricultural Economics*, *85*(2), 492–502.

Abbott, A., Nandeibam, S., & O'Shea, L. (2013). Recycling: social norms and warm-glow revisited. *Ecological Economics*, *90*, 10–18.

Abd' Razack, N. T. A., Medayese, S. O., Shaibu, S. I., & Adeleye, B. M. (2017). Habits and benefits of recycling solid waste among households in Kaduna, North West Nigeria. *Sustainable Cities and Society*, *28*, 297–306.

Abdrabo, M. (2008). Assessment of economic viability of solid waste service provision in small settlements in developing countries: case study Rosetta, Egypt. *Waste Management*, *28*, 2503–2511.

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

Act 672. Solid Waste and Public Cleansing Management Act 2007 (Act 672) (2007). Malaysia.

Adama. (2012). Urban livelihoods and social networks: emerging relations in informal recycling in Kaduna, Nigeria. *Urban Forum*, *23*(4), 449–466.

Afroz, R., & Masud, M. M. (2011). Using a contingent valuation approach for improved solid waste management facility: evidence from Kuala Lumpur, Malaysia. *Waste Management*, *31*(4), 800–8.

Afroz, R., Muhammad, M. M., Rulia, A., & Jarita, D. (2013). Survey and analysis of public knowledge, awareness and willingness to pay in Kuala Lumpur, Malaysia - a case study on household WEEE management. *Journal of Cleaner Production*, *52*, 185–193.

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

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

Agamuthu, P., Khidzir, K. M., & Fauziah, S. H. (2009). Drivers of sustainable waste management in Asia. *Waste Management & Research*, *27*, 625–633.

Aiedah, A. K. (2014). Young consumers' attitude towards halal food outlets and JAKIM's halal certification in Malaysia. *Procedia Social and Behavioral Sciences*, *121*, 26–34.

Aja, O. C., & Al-Kayiem, H. H. (2013). Review of municipal solid waste management options in Malaysia, with an emphasis on sustainable waste-to-energy options. *Journal of Material Cycles and Waste Management*, *16*, 1–18.

Ajzen, I. (1988). *Attitudes, personality and behavior*. Milton Keynes: Open University Press.

Ajzen, I. (1991). The Theory of Planned Behavior. *Orgnizational Behavior and Human Decision Processes*, *50*, 179–211.

Ajzen, I. (1996). The directive influence of attitudes on behavior. In P. Gollwitzer & J. A. Bargh (Eds.), *Psychology of action* (pp. 385–403). New York, NY:

Guilford.
Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. Englewood Cliffs, NJ: Prentice-Hall.
Alam Flora. (2008). *3R Annual Report 2007*. Shah Alam, Selangor.
Aleluia, J., & Ferrão, P. (2016). Characterization of urban waste management practices in developing Asian countries: a new analytical framework based on waste characteristics and urban dimension. *Waste Management*, *58*, 415–429.
Al-Khatib, I. A., Kontogianni, S., Nabaa, H. A., Alshami, N., & Al-sari, M. I. (2015). Public perception of hazardousness caused by current trends of municipal solid waste management. *Waste Management*, *36*, 323–330.
Amirhossein, M., Muhammad Za'im Zaki, C. M. N., Shamsul Rahman, M. K., & Mohammed Hasnain, I. (2010). Solid waste characterization and recycling potential for University Technology PETRONAS academic buildings. *American Journal of Environmental Sciences*, *6*(5), 422–427.
Andersen, J. J. L. E., & Landex, A. (2009). GIS-based Approaches to Catchment Area Analyses of Mass Transit. In *ESRI International User Conference San Diego*. California.
Andin, Z. L. J. (2006). Implementation of the 3Rs in the Philippines. In *Senior Officials Meeting on the 3R Initiative*. Tokyo, March 6-8, 2006.
Andrews, A., Gregoire, M., Rasmussen, H., & Witowich, G. (2013). Comparison of recycling outcomes in three types of recycling collection units. *Waste Management*, *33*, 530–535.
Anghinolfi, D., Paolucci, M., Robba, M., & Taramasso, A. C. (2013). A dynamic optimization model for solid waste recycling. *Waste Management*, *33*, 287–296.
Aphale, O., Thyberg, K. L., & Tonjes, D. J. (2015). Differences in waste generation, waste composition, and source separation across three waste districts in a New York suburb. *Resources, Conservation and Recycling*, *99*, 19–28.
Arief, I. (2015, September 11). How Malaysians are coping with the waste separation program a week after implementation. *Malaysian Digest*. Retrieved from http://goo.gl/QwOjqL
Armitage, C. J., & Conner, M. (2001). Efficacy of the Theory of Planned Behaviour: a meta-analytic review. *British Journal of Social Psychology*, *40*, 471–499.
Asadi, S., Vuppala, P., & Anji Reddy, M. (2007). Remote sensing and GIS technique for evaluation of groundwater quality in municipal corporation of Hyderabad (Zone-V), India. *International Journal of Environmental Research and Public Health*, *4*(1), 45-52.
Asian Development Bank (ADB). (2003). *Waste analysis and characterization survey (WACS)-metro Manila solid waste management project in second meeting of the regional 3R forum in Asia*. Retrieved from http://goo.gl/9zyfXE
Asian Development Bank (ADB). (2011). *Towards Sustainable Municipal Organic Waste Management in South Asia–A Guidebook for Policy Makers and Practitioners*. Manila: Asian Development Bank.
Asim, M., Batool, S., & Chaudhry, M. (2012). Scavengers and their role in the recycling of waste in South Western Lahore. *Resources, Conservation and Recycling*, *58*, 152–162.
Asmawati, D., Nor Ba'yah, A. K., & Fatimah, Y. (2011). A study on the knowledge, attitudes, awareness status and behaviour concerning solid waste management. *Procedia—Social and Behavioral Sciences*, *18*, 643–648. doi:10.1016/j.sbspro.2011.05.095
Assaf, H., & Saadeh, M. (2008). Assessing water quality management option in

Upper Litani Basin, Lebanon using an integrated GIS based decision support system. *Environmental Modelling & Software*, *23*, 1327–1337.

Babaei, A. A., Alavi, N., Goudarzi, G., Teymouri, P., Ahmadi, K., & Mohammad, R. (2015). Household recycling knowledge, attitudes and practices towards solid waste management. *Resources, Conservation and Recycling*, *102*, 94–100.

Bamberg, S., & Moser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: a new meta-analysis of psycho-social determinants of pro-environmental behavior. *Journal of Environmental Psychology*, *27*, 14–25.

Bamberg, S., & Schmidt, P. (2003). Incentives, morality, or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz, and Triandis. *Environment and Behavior*, *35*(2), 264–285.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, *37*, 122–147.

Barr, S., Guilbert, S., Metcalfe, A., Riley, M., Robinson, G. M., & Tudor, T. L. (2013). Beyond recycling: an integrated approach for understanding municipal waste management. *Applied Geography*, *39*, 67–77.

Batool, S. A., Chaudhry, N., & Majeed, K. (2008). Economic potential of recycling business in Lahore, Pakistan. *Waste Management*, *28*, 294–298.

Beale, D. A., & Manstead, A. S. R. (1991). Predicting mothers' intentions to limit frequency of infants' sugar intake: testing the theory of planned behavior. *Journal of Applied Social Psychology*, *21*, 409–431.

Beck, L., & Ajzen, I. (1991). Predicting dishonest actions using the theory of planned behavior. *Journal of Research in Personality*, *25*(3), 285–301.

Beede, D. N., & Bloom, D. E. (1995). The economics of municipal solid waste. *World Bank Research Observer*, *10*, 113–150.

Begum, R. A., Siwar, C., Pereira, J. J., & Jaafar, A. H. (2009). Attitude and behavioral factors in waste management in the construction industry of Malaysia. *Resources, Conservation and Recycling*, *53*, 321–328.

Beigl, P., & Salhofer, S. (2004). Comparison of ecological effects and costs of communal waste management systems. *Resources, Conservation and Recycling*, *41*, 83–102.

Benabou, R., & Tirole, J. (2006). Incentives and prosocial behavior. *American Econonomic Review*, *96*(5), 1652–1678.

Beniot, D., & Clarke, G. (1997). Assessing GIS for retail location planning. *Journal of Retailing and Consumer Services*, *4*, 239–258.

Berglund, C. (2006). The assessment of households' recycling costs: The role of personal motives. *Ecological Economics*, *56*, 560–569.

Black, J. S., Stern, P. C., & Elworth, J. T. (1985). Personal and contextual influences on household energy adaptations. *Journal of Applied Psychology*, *70*, 3–21.

Blaine, T. W., Lichtkoppler, F. R., Jones, K. R., & Zondag, R. H. (2005). An assessment of household willingness to pay for curbside recycling: a comparison of payment card and referendum approaches. *Journal of Environmental Management*, *76*, 15–22.

Bobek, D. D., & Hatfield, R. C. (2003). An investigation of the theory of planned behavior and the role of moral obligation in tax compliance. *Behavioral Research in Accounting*, *15*, 13–38.

Bohm, R. A., Folz, D. H., Kinnaman, T. C., & Podolsky, M. J. (2010). The costs of municipal waste and recycling programs. *Resources, Conservation and Recycling*, *54*(11), 864–871.

Boissoneault, E., & Godin, G. (1990). The prediction of intention to smoke only in

designated work site areas. *Journal of Occupational Medicine*, *32*, 621–624.
Boldero, J. (1995). The prediction of household recycling of newspapers: the role of attitudes, intentions and situational factors. *Journal of Applied Social Psychology, 25*(2), 440–462.
Boonrod, K., Towprayoon, S., Bonnet, S., & Tripetchkul, S. (2015). Enhancing organic waste separation at the source behavior: a case study of the application of motivation mechanisms in communities in Thailand. *Resources, Conservation and Recycling*, *95*, 77–90.
Borgers, A., & Timmermans, H. (1986). A model of pedestrian route choice and demand for retail facilities within inner-city shopping area. *Geographical Analysis*, *18*, 115–128.
Bortoleto, A. P., Kurisu, K. H., & Hanaki, K. (2012). Model development for household waste prevention behaviour. *Waste Management*, *32*, 2195–2207.
Botetzagias, I., Dima, A.-F., & Malesios, C. (2015). Extending the Theory of Planned Behavior in the context of recycling: the role of moral norms and of demographic predictors. *Resources, Conservation and Recycling*, *95*, 58–67.
Botetzagias, I., Malesios, C., & Poulou, D. (2014). Electricity curtailment behaviours in Greek households: different behaviours, different predictors. *Energy Policy*, *69*, 415–424.
Bouvier, R., & Wagner, T. (2011). The influence of collection facility attributes on household collection rates of electronic waste: the case of televisions and computer monitors. *Resources, Conservation and Recycling*, *55*, 1051–1059.
Bovea, M. D., & Powell, J. C. (2006). Alternative scenarios to meet the demands of sustainable waste management. *Journal of Environmental Management*, *79*(2), 115–132.
Burrough, P. A., & McDonnell, R. A. (1998). *Principles of Geographical Information Systems*. Oxford University Press.
Byrne, S., & O'Regan, B. (2014). Attitudes and actions towards recycling behaviours in the Limerick, Ireland region. *Resources, Conservation and Recycling*, *87*, 89–96.
Calcott, P., & Walls, M. (2005). Waste, recycling, and "'Design for Environment'": roles for markets and policy instruments. *Resource and Energy Economics*, *27*(4), 287–305.
Campos, H. K. T. (2014). Recycling in Brazil: challenges and prospects. *Resources, Conservation and Recycling*, *85*, 130–138.
Canal-Vergés, P., Petersen, J. K., Rasmussen, E. K., Erichsen, A., & Flindt, M. R. (2016). Validating GIS tool to assess eelgrass potential recovery in the Limfjorden (Denmark). *Ecological Modelling*, *338*, 135–148.
Cancer rates in the United States. (n.d.). Retrieved from https://goo.gl/zdstSH
Caplan, A. J., Grijalva, T. C., & Jakus, P. M. (2002). Waste not or want not? A contingent ranking analysis of curbside waste disposal options. *Ecological Economics*, *43*, 195–197.
Carton, L. (2007). *Map Making and Map Use in a Multi-Actor Context*. Delft, Netherlands: Delft University of Technology.
Carvalho, P., & Marques, R. C. (2014). Economies of size and density in municipal solid waste recycling in Portugal. *Waste Management*, *34*(1), 12–20.
Catlin, J. R., & Wang, Y. (2012). Recycling gone bad: when the option to recycle increases resource consumption. *Journal of Consumer Psychology, 23,* 122-127.
Cecere, G., Mancinelli, S., & Mazzanti, M. (2014). Waste prevention and social preferences: the role of intrinsic and extrinsic motivations. *Ecological*

Economics, *107*, 163–176.
Chalkias, C., & Lasaridi, K. (2011). Benefits from GIS based modeling for municipal solid waste management. *Integrated Waste Management*, *1,* 417-436.
Chan, L., & Bishop, B. (2013). A moral basis for recycling: extending the theory of planned behaviour. *Journal of Environmental Psychology*, *36*, 96–102.
Chang, M. K. (1998). Predicting unethical behaviour: a comparison of the theory of reasoned action and the theory of planned behaviour. *Journal of Business Ethics*, *17*, 1825–1833.
Chang, N. B., Parvathinathan, G., & Breeden, J. B. (2008). Combining GIS with fuzzy multicriteria decision-making for landfill siting in a fast-growing urban region. *Journal of Enviromental Management*, *87*(1), 139–153.
Chang, N. B., Pires, A., & Martinho, G. (2011). Empowering systems analysis for solid waste management: challenges, trends, and perspectives. *Critical Reviews in Environmental Science and Technology*, *41*, 1449–1530.
Charnpratheep, K., Zhou, Q., & Garner, B. (1997). Preliminary landfill site screening using fuzzy geographical information systems. *Waste Management & Research*, *15*(2), 197–215.
Che, Y., Yang, K., Jin, Y., Zhang, W., Shang, Z., & Tai, J. (2013). Residents' concerns and attitudes toward a municipal solid waste landfill: integrating a questionnaire survey and GIS techniques. *Environmental Monitoring and Assessment*, *12*, 10001–10013.
Chen, M.-F., & Tung, P.-J. (2010). The moderating effect of perceived lack of facilities on consumers' recycling intentions. *Environment and Behavior*, *42*(6),
Chi, X., Steicher-Porte, M., Wang, M. Y. L., & Reuter, M. A. (2011). Informal electronic waste recycling: a sector review with special focus on China. *Waste Management*, *31*, 731–742.
Church, R. L. (1999). Location modelling and GIS. *Journal of Geographic Information System*, *1*, 293–303.
Cohen, J. W. (1988). *Statistical power analysis for the behavioural sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
Cole, C., Osmani, M., Quddus, M., Wheatley, A., & Kay, K. (2014). Towards a zero waste strategy for an English local authority. *Resources, Conservation and Recycling*, *89*, 64–75.
Collete, M., Godin, G., Bradet, R., & Gionet, N. (1994). Active living in communities: understanding the intention to take up physical activity as an everyday way of life. *Canadian Journal of Public Health*, *85*, 418–421.
Comber, A., Brunsdon, C., Hardy, J., & Radburn, R. (2009). Using a GIS based network analysis and optimisation routines to evaluate service provision: a case study of the UK post office. *Applied Spatial Analysis and Policy*, *2*, 47–64.
Conner, M., & Armitage, C. (1998). Extending the Theory of Planned Behaviour: a review and avenues for further research. *Journal of Applied Social Psychology*, *28*, 1429–1464.
Conner, M., Martin, E., Silverdate, N., & Grogan, S. (1996). Dieting in adolescence: an application of the theory of planned behavior. *British Journal of Health Psychology*, 315–325.
Conner, M., & Sparks, P. (1996). The theory of planned behavior and health behaviours. In M. Conner & P. Norman (Eds.), *Predicting health behaviour* (pp. 121–162). Buckingham, UK: Open University Press.
Consonni, S., Giugliano, M., & Grosso, M. (2005). Alternative strategies for energy recovery from municipal solid waste: Part B: Emission and cost estimates.

Waste Management, *25*(2), 137–148.
Corral-Verdugo, V. (2003). Situational and personal determinants of waste control practices in northern Mexico: a study of reuse and recycling behaviors. *Resources, Conservation and Recycling, 39,* 265-281.
Creswell, J. W. (1998). *Qualitative inquiry and research design, choosing among five traditions* (2nd ed.). Sage.
Creswell, J. W. (2007). *Qualitative inquiry and research design* (2nd ed.). Sage.
Cronan, T. P., & Al-Rafee, S. (2008). Factors that influence the intention to pirate software and media. *Journal of Business Ethics*, *78*, 527–545.
Culiberg, B. (2014). Towards an understanding of consumer recycling from an ethical perspective. *International Journal of Consumer Studies*, *38*(1), 90–97.
Czajkowski, M., Kądziela, T., & Hanley, N. (2014). We want to sort! Assessing households' preferences for sorting waste. *Resource and Energy Economics*, *36*(1), 290–306.
Damghani, A., Savarypour, G., Zand, E., & Deihimfard, R. (2008). Municipal solid waste management in Tehran: current practises, opportunities and challenges. *Waste Management*, *28*, 929–934.
Daniel, E. G. S., Nadeson, T., & Mhd Shafiee, A. G. (2006). Organising for action in environmental education through smart partnerships: a Malaysian experience. In *International Conference for the Environment*. Malaysia.
Daras, G., Agard, B., Cambazard, H., & Penz, B. (2015). Development of business spatial analysis tools: methodology and framework. In *International Federation of Automatic Control (IFAC)* (pp. 1894–1899). Elsevier Ltd.
Davies, J., Foxall, G. R., & Pallister, J. G. (2002). Beyond the intention-behaviour mythology: an integrated model of recycling. *Marketing Theory*, *2*(1), 29–113.
Davis, G., Phillips, P. S., Read, A. D., & Iida, Y. (2006). Demonstrating the need for the development of internal research capacity: understanding recycling participation using the Theory of Planned Behaviour in West Oxfordshire, UK. *Resources, Conservation and Recycling*, *46*, 115–127.
De Feo, G., & De Gisi, S. (2010). Public opinion and awareness towards MSW and separate collection programmes: a sociological procedure for selecting areas and citizens with a low level of knowledge. *Waste Management*, *30*(6), 958–976.
Delgado, O. B., Mendoza, M., Granados, E. L., & Geneletti, D. (2008). Analysis of land suitability for the siting of inter-municipal landfills in the Cuitzeo Lake Basin, Mexico. *Waste Management*, *28*(7), 1137–1146.
Denzin, N. K., & Lincoln, Y. S. (1994). *Handbook of qualitative research*. Sage.
Department of Statistics Malaysia. (2010). *Preliminary count report: population and housing Census of Malaysia*. Malaysia. Retrieved from https://goo.gl/h5hFMg
DeVellis, R. F. (2012). *Scale development - Theory and applications* (3rd Ed.). California: Thousan Oaks, Sage.
Dhanasekarapandian, M., Chandran, S., Devi, D. S., & Kumar, V. (2016). Spatial and temporal variation of groundwater quality and its suitability for irrigation and drinking purpose using GIS and WQI in an urban fringe. *Journal of African Earth Sciences*, *124*, 270–288.
Dhokhikah, Y., Trihadiningrum, Y., & Sunaryo, S. (2015). Community participation in household solid waste reduction in Surabaya, Indonesia. *Resources, Conservation and Recycling*, *102*, 153–162.
Do Valle, P., Rebelo, E., Reis, E., & Menezes, J. (2005). Combining behavioral theories to predict recycling involvement. *Environment and Behavior, 37*(3), 364–396.

Doll, J., & Ajzen, I. (1990). *The effects of direct experience on the attitude-behaviour relation: stability versus accessibility*. Hamburg, West Germany.

Dot distribution map. (2008). Retrieved from https://goo.gl/zaZYys

Dragicevic, S., Lai, T., & Balram, S. (2015). GIS-based multicriteria evaluation with multiscale analysis to characterize urban landslide susceptibility in data-scarce environments. *Habitat International*, *45*, 114–125.

Dunn, K. I., Mohr, P., Wilson, C. J., & Wittert, G. A. (2011). Determinants of fast-food consumption. An application of the theory of planned behaviour. *Appetite*, *57*(2), 349–357.

Dvorsky, J., Snasel, V., & Vozenilek, V. (2010). On maps comparison methods. In *International Conference on Computer Information Systems and Industrial Management Applications (CISIM 2010)* (pp. 557–562).

Edjabou, M., Moller, J., & Christensen, T. (2012). Solid waste characterization in Kétao, a rural town in Togo, West Africa. *Waste Management and Research*, *30*(7), 745–749.

ELSamen, A. A. A., & Hiyasat, R. I. (2017). Beyond the random location of shopping malls: a GIS perspective in Amman, Jordan. *Journal of Retailing and Consumer Services*, *34*, 30–37.

Eskandari, M., Homaee, M., & Mahmodi, S. (2012a). A criticism of applications with multi-criteria decision analysis that are used for the site selection for the disposal of municipal solid wastes. *Waste Management*, *32*(12), 2315–2323.

Eskandari, M., Homaee, M., & Mahmodi, S. (2012b). An integrated multi criteria approach for landfill siting in a conflicting environmental, economical and socio-cultural area. *Waste Management*, *32*(8), 1528–1538.

Esri Corporation. (2016). *ArcGIS Desktop: mapping and visualization in ArcGIS Desktop*. Retrieved May 4, 2017, from https://goo.gl/8bqyKd

Esri Corporation. (2017). *What is GIS?* Retrieved March 30, 2017, from http://www.esri.com/

Eugene, K. & Joseph, K. (2009). Determinants of residents' recycling behaviour. *International Business and Economics Research Journal, 8*(8), 1-12.

Ezeah, C., Fazakerley, J. a, & Roberts, C. L. (2013). Emerging trends in informal sector recycling in developing and transition countries. *Waste Management*, *33*(11), 2509–19.

Faccio, M., Persona, A., & Zanin, G. (2011). Waste collection multi objective model with real time traceability data. *Waste Management*, *31*(12), 2391–2405.

Fahmi, W. S., & Sutton, K. (2006). Cairo's Zabaleen garbage recyclers: multi-nationals' takeover and state relocation plans. *Habitat International*, *30*, 809–837.

Fauziah, S. H., & Agamuthu, P. (2012). Trends in sustainable landfilling in Malaysia, a developing country. *Waste Management & Research*, *30*(7), 656–663.

Fazeli, A., Bakhtvar, F., Jahanshaloo, L., Nor Azwadi, C. S., & Bayat, A. E. (2016). Malaysia's stand on municipal solid waste conversion to energy: a review. *Renewable and Sustainable Energy Reviews*, *58*, 1007–1016.

Fei, F., Qu, L., Wen, Z., Xue, Y., & Zhang, H. (2016). How to integrate the informal recycling system into municipal solid waste management in developing countries: based on a China's case in Suzhou urban area. *Resources, Conservation and Recycling*, *110*, 74–86.

Feo, G. De, & Gisi, S. De. (2014). Using MCDA and GIS for hazardous waste landfill siting considering land scarcity for waste disposal. *Waste Management*,

34, 2225–2238.
Fielding, K. S., van Kasteren, Y., Louis, W., McKenna, B., Russell, S., & Spinks, A. (2016). Using individual householder survey responses to predict household environmental outcomes: the cases of recycling and water conservation. *Resources, Conservation and Recycling*, *106*, 90–97.
Fishbein, M. (1993). An investigation of the relationships between beliefs about an object and the attitude toward that object. *Human Relations*, *16*, 233–240.
Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: an introduction to theory and research*. Reading, MA: Addison-Wesley.
Flow lines. (n.d.). Retrieved from https://goo.gl/AuL2Ic
FMT. (2016, June 18). Garbage in, garbage out? Flat dwellers confused. *Free Malaysia Today (FMT) News*. Retrieved from http://goo.gl/WhqGcA
Francis, J., Eccles, M. P., Johnston, M., Walker, A. E., Grimshaw, J. M., Foy, R., Kaner, E. F., Smith, L., & Bonetti, D. (2004). *Constructing questionnaires based on the theory of planned behaviour: a manual for health services researchers*. Newscastle upon Tyne, UK: Centre for Health Services Research, University of Newscastle upon Tyne.
Fritch, T. G., Yelderman, J. C., Dworkin, S. I., & Arnold, J. G. (2000). A predictive modeling approach to assessing the groundwater pollution susceptibility of paluxy aquifer, Central Texas, using geographic information system. *Environmental Geology*, *9*, 1063–1069.
Gallardo, A., Carlos, M., Peris, M., & Colomer, F. J. (2014). Methodology to design a municipal solid waste generation and composition map: A case study. *Waste Management*, *34*, 1920–1931.
Gamba, R. & Oskamp, S. (1994). Factors influencing community residents' participation in commingled curbside recycling programs. *Environment and Behavior, 26,* 587-612.
Gay, L. R., Mills, G. E., & Airasian, P. (2012). *Educational research: Competencies for analysis and application* (10th ed.). Pearson.
Gbani, S. P., Tengbe, P. B., Momoh, J. S., Medo, J., & Kabba, V. T. S. (2013). Modelling landfill location using Geographic Information Systems (GIS) and Multi-Criteria Decision Analysis (MCDA): case study Bo. Southern Sierra Leone. *Applied Geography*, *36*, 3–12.
Gellynck, X., Jacobsen, R., & Verhelst, P. (2011). Identifying the key factors in increasing recycling and reducing residual household waste: a case study of the Flemish region of Belgium. *Journal of Environmental Management*, *92*(10), 2583–2590.
Geneletti, D. (2010). Combining stakeholder analysis and spatial multicriteria evaluation to select and rank inert landfill sites. *Waste Management*, *30*(2), 328–337.
Goddard, H. C. (1995). The benefits and costs of alternative solid waste management policies. *Resources, Conservation and Recycling*, *13*, 183–213.
Godden, B. (2004). *Sample size formulas*. Retrieved from https://goo.gl/ZZdpHG
Godin, G., & Kok, G. (1996). The theory of planned behavior: a review of its applications to health-related behaviours. *American Journal of Health Promotion*, *11*, 87–98.
Godin, G., Valois, P., Jobin, J., & Ross, A. (1990). *Prediction of intention to exercise of individuals who have suffered from coronary heart disease*. *Journal of Clinical Psychology, 47*(6), 762-772.
Godin, G., Valois, P., Lepage, L., & Desharnais, R. (1992). Predictors of smoking

behaviour: an application of Ajzen's theory of planned behaviour. *British Journal of Addiction*, *87*(9), 1335–1345.

Godin, G., Vezina, L., & Leclerc, O. (1989). Factors influencing intentions of pregnant women to exercise after giving birth. *Public Health Reports*, *104*, 188–195.

Golden Ecosystem Sdn Bhd (GESB). (2011). *A study on plastic management in Peninsular Malaysia - final report*. Retrieved from http://goo.gl/zyZRZC

Gorsevski, P. P., Donevska, K., & Mitrovski, C. D. (2012). Integrating multi- criteria evaluation techniques with geographic information systems for landfill site selection: a case study using ordered weighted average. *Waste Management*, *32*, 287–296.

Grodzinska-Jurczak, M. S. (2001). Management of industrial and municipal solid wastes in Poland. *Resources, Conservation and Recycling*, *32*(2), 85–103.

Gu, B., Wang, H., Chen, Z., Jiang, S., Zhu, W., Liu, M., Chen, Y., Wu, Y., He, S., Cheng, R., Yang, J., & Bi, J. (2015). Characterization, quantification and management of household solid waste: A case study in China. *Resources, Conservation and Recycling*, *98*, 67–75.

Guagnano, G. A., Stern, P. C., & Dietz, T. (1995). Influences on attitude-behaviour relationships: a natural experiment with curbside recycling. *Environment and Behavior*, *27*, 699–718.

Guerrero, L. A., Maas, G., & Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste Management*, *33*(1), 220–32.

Guiqin, W., Li, Q., Guoxue, L., & Lijun, C. (2009). Landfill site selection using spatial information technologies and AHP: a case study of Beijing, China. *Journal of Environmental Management*, *90*, 2414–2421.

Guo, D., Gahegan, M., MacEachren, A. M., & Zhou, B. (2005). Multivariate analysis and geovisualization with an integrated geographic knowledge discovery approach. *Cartography and Geographic Information Science*, *32*(2), 113–132.

Gutberlet, J., & Baeder, A. (2008). Informal recycling and occupational health in Santo Andre, Brazil. *International Journal of Environmental Health*, *18*, 1–15.

Hahn, C. (2008). *Doing qualitative research using your computer: a practical guide*. Sage.

Hall, F. K. (1995). Paper recycling and the environment. In C. Rader, S. D. Baldwin, D. D. Cornell, G. D. Sadler, & R. F. Stockel (Eds.), *Plastics, Rubber, and Paper Recycling, ACS Symposium Series* (pp. 286–295). Washing, DC: American Chemical Society.

Harland, P., Staats, H., & Wilke, H. A. M. (1999). Explaining pro-environmental intention and behavior by personal norms and the theory of planned behavior. *Journal of Applied Social Psychology*, *29*(12), 2505–2528.

Hassan, M. N., Chong, T. L., Rahman, M., Salleh, M. N., Zakaria, Z., & Awang, M. (2011). Solid waste management in Southeast Asian countries with special attention to Malaysia. In *8th International Waste Management and Landfill Symposium*. S. Margherita di Pula Cagliari, Italy.

Heath, Y., & Gifford, R. (2002). Extending the theory of planned behaviour: predicting the use of public transportation. *Journal of Applied Social Psychology*, *32*(10), 2154–2189.

Hernandez, T. (2007). Enhancing retail location decision support: the development and application of geovisualization. *Journal of Retailing and Consumer Services*, *14*(4), 294–258.

Herranz, S., Romero-Gómez, R., Díaz, P., & Onorati, T. (2014). Multi-view visualizations for emergency communities. *Journal of Visual Languages and Computing*, *25*, 981–994.

Highfill, J., & McAsey, M. (1997). Municipal waste management, recycling, and landfill space constraints. *Journal of Urban Economy*, *41*, 118–136.

Hoornweg, D., & Bhada-Tata, P. (2012). Waste generation. In *What a waste: a global review of solid waste management* (pp. 8–12). Retrieved from http://go.worldbank.org/BCQEP0TMO0

Hosetti, B. B. (2006). *Prospects and perspectives of solid waste management*. New Delhi, India: New Age International.

Huang, W., Wang, J., Dai, X., Li, M., & Harder, M. K. (2014). More than financial investment is needed: food waste recycling pilots in Shanghai, China. *Journal of Cleaner Production*, *67*, 107–116.

Huhtala, A. (2010). Income effects and the inconvenience of private provision of public goods for bads: the case of recycling in Finland. *Ecological Economics*, *69*, 1675–1681.

Hunecke, M., Blobaum, A., Matthies, E., & Hoger, R. (2001). Responsibility and environment-ecological norm orientation and external factors in the domain of travel mode choice behavior. *Environment and Behavior*, *33*, 845–867.

Idris, A., Inane, B., & Hassan, M. N. (2004). Overview of waste disposal and landfills/dumps in Asian countries. *Journal of Material Cycles and Waste Management*, *6*(2), 104–110.

Israel, G. (1992). *Determining the sample size*. Program Evaluation and Organisational Development (PEOD-6), University of Florida.

Ittiravivongs, A. (2012). Recycling as habitual behavior: the impact of habit on household waste recycling behavior in Thailand. *Asian Social Science*, *8*(6), 74–81.

Jacobsen, R., Buysse, J., & Gellynck, X. (2013). Cost comparison between private and public collection of residual household waste: multiple case studies in the Flemish region of Belgium. *Waste Management*, *33*(1), 3–11.

Japan International Cooperation Agency (JICA). (2006). *The study on National Waste Minimisation in Malaysia: Final report summary*. Retrieved from http://goo.gl/nzqMt8

Josimovic, B., & Krunic, N. (2004). Implementation of GIS in selection of locations for regional landfill in the Kolubara Region. *Spatium*, 72–77.

JPSPN (National Solid Waste Management Department). (2013). *Survey on solid waste composition, characteristics and existing practice of solid waste recycling in Malaysia*. Retrieved from http://goo.gl/ZkZQLz

JPSPN (National Solid Waste Management Department). (2015a). *Department Project (Technical)*. Retrieved April 12, 2016, from http://goo.gl/lmy5Yi

JPSPN (National Solid Waste Management Department). (2015b). *Number of disposal sites according to states in Malaysia*. Retrieved April 12, 2016, from http://goo.gl/tf2H6l

Kaiser, F. G. (2006). A moral extension of the Theory of Planned Behaviour: norms and anticipated feelings of regret in conservationism. *Personality and Individual Differences*, *41*, 71–81.

Kaiser, F. G., & Gutsher, H. (2003). The proposition of a general version of the Theory of Planned Behavior. *Journal of Applied Social Psychology*, *33*, 586–603.

Katusiimeh, M. W., Burger, K., & Mol, A. P. J. (2013). Informal waste collection

and its co- existence with the formal waste sector: the case of Kampala, Uganda. *Habitat International*, *38*, 1–9.
Katzev, R. D., Blake, G., & Messer, B. (1993). Determinants of participation in multi-family recycling programs. *Journals of Applied Social Psychology, 23,* 189-215.
Kawai, K., & Tasaki, T. (2016). Revisiting estimates of municipal solid waste generation per capita and their reliability. *Journal of Material Cycles and Waste Management*, *18*(1), 1–13.
Keramitsoglou, K. M., & Tsagarakis, K. P. (2013). Public participation in designing a recycling scheme towards maximum public acceptance. *Resources, Conservation and Recycling*, *70*, 55–67.
Kinnaman, T. C. (2005). Why do municipalities recycle? *Topics in Economic Analysis and Policy*, *5*(5), 23.
Kinnaman, T. C. (2014). Determining the socially optimal recycling rate. *Resources, Conservation and Recycling*, *85*, 5–10.
Knussen, C., & Yule, F. (2008). "I'm not in the habit of recycling" The role of habitual behavior in the disposal of household waste. *Environment and Behavior*, *40*(5), 683–702.
Kontos, T. D., Komilis, D. P., & Halvadakis, C. P. (2005). Siting MSW landfills with a spatial multiple criteria analysis methodology. *Waste Management*, *25*(8), 818–832.
Kubicek, P., Kozel, J., Stampach, R., & Lukas, V. (2013). Prototyping the visualization of geographic and sensor data for agriculture. *Computers and Electronics in Agriculture*, *97*, 83–91.
Kumar, S., & Bansal, V. K. (2016). A GIS-based methodology for safe site selection of a building in a hilly region. *Frontiers of Architectural Research*, *5*, 39–51.
Kuo, Y. L., & Perrings, C. (2010). Wasting time? Recycling incentives in urban Taiwan and Japan. *Environmental and Resource Economics*, *47*, 423–437.
Kurland, N. B. (1995). Ethical intentions and the theories of reasoned action and planned behaviour. *Journal of Applied Social Psychology*, *25*, 297–313.
Kurland, N. B. (1996). Sales agents and clients: ethics, incentives, and a modified theory of planned behavior. *Human Relations*, *49*, 51–74.
Kwakkel, J. H., Carley, S., Chase, J., & Cunningham, S. W. (2014). Visualizing geo-spatial data in science , technology and innovation. *Technological Forecasting & Social Change*, *81*, 67–81.
Lake, I., Bateman, I., & Parfitt, J. (1996). Accessing a kerbside recycling scheme: a quantitative and willingness to pay case study. *Journal of Environmental Management, 46,* 239-254.
Lakhan, C. (2015). Differences in self reported recycling behavior of first and second generation South Asians in Ontario, Canada. *Resources, Conservation and Recycling*, *97*, 31–43.
Lakota, M., & Stajnko, D. (2013). Using of GIS tools for analysis of organic waste management in Slovenia region Pomurje. *Procedia Technology*, *8*, 570–574.
Largo-Wight, E., Bian, H., & Lange, L. (2012). An empirical test of an expanded version of the Theory of Planned Behavior in predicting recycling behavior on campus. *American Journal of Health Education*, *43*, 66–73.
Latifah, A. M., Mohd Armi, A. S., & Nur Ilyana, M. Z. (2009). Municipal solid waste management in Malaysia: practices and challenges. *Waste Management*, *29*(11), 2902–2906.
Leão, S., Bishop, I., & Evans, D. (2004). Spatial-temporal model for demand and

allocation of waste landfills in growing urban regions. *Computers, Environment and Urban Systems, 28*(4), 353–385.

Lee, A. C.-D., & Rinner, C. (2015). Visualizing urban social change with self-organizing maps: Toronto neighbourhoods, 1996-2006. *Habitat International*, *45*, 92–98.

Leedy, P. D., & Ormrod, J. E. (2005). *Practical research: planning and design (8th ed.)*. New Jersey: Merri II Prentice Hall.

Liang, S., & Zhang, T. (2012). Comparing urban solid waste recycling from the viewpoint of urban metabolism based on physical input-output model: a case of Suzhou in China. *Waste Management*, *32*(1), 220–5.

Lim, M. (2012). Measuring waste in Malaysia: a neglected approach. *Procedia—Social and Behavioral Sciences*, *42*, 198–204.

Lin, H. Y., & Kao, J. J. (1998). A vector-based spatial model for landfill siting. *Journal of Hazardous Materials*, *58*(1-3), 3–14.

Linda, A. (2015, September 25). New mandatory waste separation raises more questions. *The Malaysian Reserve*. Retrieved from http://goo.gl/K0sukR

Linzner, R., & Salhofer, S. (2014). Municipal solid waste recycling and the significance of informal sector in urban China. *Waste Management*, *32*(9), 896–907.

Liu, R. T. K. (2004, September 23). Broga incinerator - an open letter to Pak Lah. *MalaysiaKini*. Retrieved from https://goo.gl/z4h7Cn

Loh, Y. S. (2006). *Public awareness-raising on POPs and incineration using film*. Retrieved from https://goo.gl/Sr1GGJ

Ma, J., & Hipel, K. W. (2016). Exploring social dimensions of municipal solid waste management around the globe – a systematic literature review. *Waste Management*, *56*, 3–12.

Mannetti, L., Pierro, A., & Livi, S. (2004). Recycling: planned and self-expressive behaviour. *Journal of Environmental Psychology*, *24*, 227–236.

Manstead, A. S. R. (2000). The role of moral norm in the attitude-behaviour relation. In D. J. Terry & M. A. Hogg (Eds.), *Attitude, behaviour, and social context. The role of norms and group membership* (pp. 11–30). Mahwah, NY: Lawrence Erlbaum.

Marsden, J. (2013). Stigmergic self-organization and the improvisation of Ushahidi. *Cognitive Systems Research*, *21*, 52–64.

Martin, M., Williams, I. D., & Clark, M. (2006). Social, cultural and structural influences on household waste recycling: a case study. *Resources, Conservation and Recycling*, *48*(4), 357–395.

Masui, T., Morita, T., & Kyogoku, J. (2000). Analysis of recycling activities using multi- sectoral economic model with material flow. *European Journal of Operational Research*, *122*, 405–415.

Mathieson, K. (1991). Predicting user intentions: comparing the technology acceptance model with the theory of planned behaviour. *Information Systems Research*, *2*(3), 173–191.

Matter, A., Dietschi, M., & Zurbrügg, C. (2013). Improving the informal recycling sector through segregation of waste in the household - the case of Dhaka Bangladesh. *Habitat International*, *38*, 150–156.

McEachern, M. G., Schroder, M. J. A., Willock, J., Whitelock, J., & Mason, R. (2007). Exploring ethical brand extensions and consumer buying behaviour: the RSPCA and the "Freedom Food" brand. *Journal of Product and Brand Management*, *16*, 168–177.

Mean annual precipitation. (2008). Retrieved from https://goo.gl/A05kZZ
Mendes, M. R., & Imura, H. (2004). Eastern prospect: municipal solid waste management. Retrieved from http://goo.gl/GZWMi6
Meneses, G. D., & Palacio, A. B. (2005). Recycling behavior: a multidimensional approach. *Environment and Behavior*, *37*(6), 837–860.
Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.
Merriam, S. B. (2009). *Qualitative research: a guide to design and implementation*. John Wiley & Son, Inc.
Miafodzyeva, S., Brandt, N., & Andersson, M. (2013). Recycling behaviour of householders living in multicultural urban area: a case study of Jarva, Stockholm, Sweden. *Waste Management & Research*, *31*(5), 447–57.
Michael, S., & Oh, I. Y. (2017, November 14). Long-awaited solid waste and public cleansing enactment still being scrutinised by legal team. *The Star*. Retrieved from https://goo.gl/UL3DHo
Miles, M. B., & Huberman, A. B. (1994). *Qualitative data analysis: an extended sourcebook* (2nd ed.). Sage.
Miliute-Plepiene, J., Hage, O., Plepys, A., & Reipas, A. (2016). What motivates household recycling behaviour in recycling schemes of different maturity? Lessons from Lithuania and Sweden. *Resources, Conservation and Recycling*, *113*, 40–52.
Miller, B. (2000). *Fat of the Land: Garbage in New York the Last Two Hundred years*. New York: Four Walls Eight Windows.
Ministry of Urban Wellbeing Housing and Local Government. (2015). Separation at source. Retrieved from http://goo.gl/UNJIjV
Ministry of Urban Wellbeing Housing and Local Government. (2017). *Pihak Berkuasa Tempatan*. Retrieved April 13, 2017, from https://goo.gl/fh3B2h
Mitchell, M. L., & Jolley, J. M. (2010). *Research design explained* (7th Ed.). Wadsworth Cengage Learning.
Moeinaddini, M., Khorasani, N., Danehkar, A., Darvishsefat, A. A., & Zienalyan, M. (2010). Siting MSW landfill using weighted linear combination and analytical hierarchy process (AHP) methodology in GIS environment (case study: Karaj). *Waste Management*, *30*, 912–920.
Moghadam, M., Mokhtarani, N., & Mokhtaran, B. (2009). Municipal solid waste management in Rasht City, Iran. *Waste Management*, *29*, 485–489.
Moh, Y. C. (2014). *Evaluation of knowledge, awareness, perception, and behavior towards recycling of household solid waste practice in Muar, Malaysia*. Universiti Putra Malaysia.
Moh, Y. C., & Latifah, A. M. (2014). Overview of household solid waste recycling policy status and challenges in Malaysia. *Resources, Conservation and Recycling*, *82*, 50–61.
Mohamed Osman, S., Mohd Nasir, H., & Abdul Mujeebu, M. (2009). Development of municipal solid waste generation and recyclable components rate of Kuala Lumpur: perspective study. *Waste Management*, *29*, 2209–2213.
Mohd Nasir, H., Rakmi, A. R., Theng, L. C., Zulina, Z., & Muhamad, A. (2000). Waste recycling in Malaysia: problems and prospects. *Waste Management & Research*, *18*, 320–328.
Mok, O. (2016, July 1). Register for "No Plastic Bags" or face action, Penang outlets warned. *The Malay Mail*. Retrieved from http://goo.gl/RK8xOR
Mokhtar, I. L. (2013, August 27). Need to act on rubbish now. *New Straits Times*, p.

4.
Monirozzaman, S., Bari, Q., & Fukuhara, T. (2011). Recycling practises of solid waste in Khulna City, Bangladesh. *Journal of Solid Waste Technology and Management*, *37*, 1–15.
Monmonier, M. (1996). *How to Lie with Maps* (2nd ed.). Chicago: University of Chicago Press.
MORI Social Research. (2002). *Public attitudes towards recycling and waste management: quantitative and qualitative review*. Strategy Unit, London.
Morrissey, A., & Browne, J. (2004). Waste management models and their application to sustainable waste management. *Waste Management*, *24*(3), 297–308.
Mueller, W. (2013). The effectiveness of recycling policy options: waste diversion or just diversions? *Waste Management*, *33*(3), 508–18.
Murali, R. S. N. (2015, December 30). Malacca bans plastic bags. *The Star*. Retrieved from http://goo.gl/2vJ4Ik
Murkherji, S. B., Sekiyama, M., Mino, T., & Chaturvedi, B. (2016). Resident knowledge and willingness to engage in waste management in Delhi, India. *Sustainability*, *8*, 2–14.
Netemeyer, R. G., Andrews, J. C., & Durvasala, S. (1990). *A comparison of three behavioural intention models using within and across subjects designs*. Baton Rouge.
Ngoc, U. N., & Schnitzer, H. (2009). Sustainable solutions for solid waste management in Southeast Asian countries. *Waste Management*, *29*, 1982–1995.
Nguyen, T. T. P., Zhu, D., & Le, N. P. (2015). Factors influencing waste separation intention of residential households in a developing country: evidence from Hanoi, Vietnam. *Habitat International*, *48*, 169–176.
Nicholas, H. J. (2015, October 9). Indonesia in state of waste emergency. *The Jakarta Post*. Retrieved from http://goo.gl/WT4d7u
Noehammer, H. C., & Byer, P. H. (1997). Effect of design variables on participation in residential curbside recycling programs. *Waste Management & Research*, *15*, 407–427.
Nollenburg, M. (2007). Geographic visualization. *Computer Science*, *4417*, 257–294.
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.
NSP. (2005). *National Strategic Plan for solid waste management*. Malaysia.
Nucifora, J., Gallois, C., & Kashima, Y. (1993). Influences on condom use among undergraduates: testing the theories of reasoned action and planned behaviour. In D. J. Terry, C. Gallois, & M. McCarmish (Eds.), *The Theory of Reasoned Action: its application to AIDS-preventive behaviour* (pp. 47–64). Oxford, UK: Pergamon.
Nzeadibe, T. C. (2009). Solid waste reforms and informal recycling in Enugu urban area, Nigeria. *Habitat International*, *33*(1), 93–99.
Oh, I. Y. (2016, June 23). Only 5% of flat dwellers complying. *The Star*. Retrieved from http://goo.gl/of6qNw
Ojeda-Benitez, S., Armijo-De-Vega, C., & Ramírez-Barreto, M. E. (2002). Formal and informal recovery of recyclables in Mexicali, Mexico: handling alternatives. *Resources, Conservation and Recycling*, *34*, 273–288.
Omran, A., Mahmood, A., Abdul Aziz, H., & Robinson, G. M. (2009). Investigating households attitude toward recycling of solid waste in Malaysia: a case study. *International Journal of Environmental Research*, *3*(2), 275–288.

Ong, T. K. (2007). More landfills to be built. *The Sun*.
Organization for Economic Cooperation and Development (OECD). (2001). *Glossary of Statistical Terms: Waste*. Retrieved August 5, 2015, from https://goo.gl/SzGPpZ
Oskamp, S., Harrington, M., Edwards, T., Sherwood, P. L., Obuda, S. M., & Swanson, D. L. (1991). Factors influencing household recycling behavior. *Environment and Behavior, 23,* 494-519.
Owens, J., Dickerson, S., & Macintosh, D. (2000). Demographic covariates of residential recycling efficiency. *Environment and Behavior, 32*(5), 637-650.
Ozcaglar-Toulouse, N., Shiu, E., & Shaw, D. (2006). In search of fair trade: ethical consumer decision making in France. *International Journal of Consumer Studies*, *30*, 502–514.
Pakpour, A. H., Hidarnia, A., Hajizadeh, E., & Plotnikoff, R. C. (2012). Action and coping planning with regard to dental brushing among Iranian adolescents. *Psychology, Health and Medicine*, *17*(2), 176–187.
Pakpour, A. H., Zeidi, I. M., Chatzisarantis, N., Molsted, S., Harrison, A. P., & Plotnikoff, R. C. (2011). Effects of action planning and coping planning within the theory of planned behaviour: a physical activity study of patients undergoing haemodialysis. *Psychology of Sport and Exercise*, *12*, 609–614.
Pakpour, A. H., Zeidi, I. M., Emamjomeh, M. M., Asefzadeh, S., & Pearson, H. (2014). Household waste behaviours among a community sample in Iran: an application of the theory of planned behaviour. *Waste Management*, *34*(6), 980–6.
Pallant, J. (2007). *SPSS survival manual: a step by step guide to data analysis using SPSS for windows* (3rd ed.). Maidenhead: Open University Press.
Pallant, J. (2013). *SPSS survival manual - A step by step guide to data analysis using IBM SPSS* (5th Ed.). McGraw-Hill Inc.
Parker, D., Manstead, A. S. R., Stradling, S. O., Reason, F. T., & Baxter, J. S. (1992). Intention to commit driving violations: an application of the theory of planned behavior. *Journal of Applied Psychology, 77*, 94-101.
Patton, M. Q. (1990). *Qualitative evaluation and research methods*. Sage.
Permana, A. S., Towolioe, S., Norsiah, A. A., & Siong Ho, C. (2015). Sustainable solid waste management practices and perceived cleanliness in a low income city. *Habitat International*, *49*, 197–205.
Prestin, A., & Pearce, K. E. (2010). We care a lot: formative research for a social marketing campaign to promote school-based recycling. *Resources, Conservation and Recycling*, *54*(11), 1017–1026.
Proportional symbols map. (2012). Retrieved from https://goo.gl/06BxAy
Raats, M., Sheperd, M., & Sparks, P. (1995). Including moral dimensions of choice within the structure of the theory of planned behaviour. *Journal of Applied Social Psychology*, *25*, 484–494.
Rada, E. C., Ragazzi, M., & Fedrizzi, P. (2013). Web-GIS oriented systems viability for municipal solid waste selective collection optimization in developed and transient economies. *Waste Management*, *33*, 785–792.
Ramayah, T., Wai, J. C. L., & Lim, S. (2012). Sustaining the environment through recycling: an empirical study. *Journal of Environmental Management*, *102*, 141–147.
Randall, D. M., & Gibson, A. M. (1991). Ethical decision making in the medical profession-an application of the theory of planned behaviour. *Journal of Business Ethics*, *10*, 111–122.

Randall, D. M., & Wolff, J. A. (1994). The time interval in the intention-behaviour relationship: meta analysis. *British Journal of Social Psychology*, *33*, 405–418.

Rhodes, R. E., Beauchamp, M. R., Conner, M., de Bruijn, G.-J., Kaushal, N., & Latimer-Cheung, A. (2014). Prediction of depot-based specialty recycling behavior using an extended Theory of Planned Behavior. *Environment and Behavior*, 1–23.

Rimal, A. P., Moon, W., & Balasubramanian, S. (2005). Agro-biotechnology and organic food purchase in the United Kingdom. *British Food Journal*, *107*, 84–97.

Robinson, A. H., Morrison, J. L., Muehrke, P. C., Kimmerling, A. J., & Guptill, S. C. (1995). *Elements of cartography* (6th ed.). New York: Wiley.

Roznah, A. J. (2016, July 1). Confusion continues over waste separation. *Property 360 Online*. Retrieved from http://goo.gl/DtPf6L

Sanusi, Y. A. (2010). Capacity issues of private sector participation in urban solid waste management in Nigeria. *Humanity and Social Sciences Journal Pakistan*, *5*(1), 7–18.

Saripah, A. L., Mohd Shukri, O., Yeop, H. B., & Zainudin, A. (2012). Environmental problems and quality of life: situational factor as a predictor of recycling behaviour. *Procedia - Social and Behavioral Sciences*, *35*, 682–688.

Schifter, D. B., & Ajzen, I. (1985). Intention, perceived control, and weight loss: an application of the theory of planned behavior. *Journal of Personality and Social Psychology*, *49*, 843–851.

Schlegal, R. P., D'Averna, I. R., Zanna, M. P., DeCourville, N. H., & Manske, S. R. (1990). Problem drinking: a problem for the theory of reasoned action? *Journal of Applied Social Psychology, 22*(5), 358-385.

Sekaran, U. (2003). *Research methods for business* (4th Ed.). New York: John Wiley & Son, Inc.

Sembiring, E., & Nitivattananon, V. (2010). Sustainable solid waste management toward an inclusive society: integration of the informal sector. *Resources, Conservation and Recycling*, *54*(11), 802–809.

Sener, S., Sener, E., Nas, B., & Karaguzel, R. (2010). Combining AHP with GIS for landfill site selection: a case study in the Lake Beysehir catchment area (Konya, Turkey). *Waste Management*, *30*, 2037–2046.

Shapkota, P., Coowanitwong, N., Visvanathan, C., & Trankler, J. (2006). Potentials of recycling municipal solid waste in Asia vis-a-vis recycling in Thailand. SEA-UEMA Project.

Shaw, D., & Shiu, E. (2002). An assessment of ethical obligation and self-identity in ethical consumer decision-making: a structural equation modelling approach. *International Journal of Consumer Studies*, *26*, 286–293.

Shaw, D., & Shiu, E. (2003). Ethics in consumer choice: a multivariate modelling approach. *European Journal of Marketing*, *37*, 1485–1498.

Shaw, D., Shiu, E., & Clarke, I. (2000). The contribution of ethical obligation and self-identity to the theory of planned behaviour: an exploration of ethical consumers. *Journal of Marketing Management*, *16*, 879–894.

Shepperd, B., Hartwick, J., & Warshaw, P. R. (1988). The theory of reasoned action: a meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research*, *15*, 325–343.

Sidique, S. F., Lupi, F., & Joshi, S. V. (2010). The effects of behavior and attitudes on drop-off recycling activities. *Resources, Conservation and Recycling*, *54*, 163–170.

Siti Nur Diyana, M., & Kamisah, O. (2010). The determinants of recycling intention behavior among the Malaysian school students: an application of Theory of Planned Behaviour. *Procedia - Social and Behavioral Sciences*, *9*, 119–124.

Skupin, A., & Hagelman, R. (2005). Visualizing demographic trajectories with Self-Organizing Maps. *Geoinformatica*, *9*(2), 158–179.

Son, L. H. (2014). Optimizing municipal solid waste collection using chaotic particle swarm optimization in GIS based environments: a case study at Danang city, Vietnam. *Expert Systems with Applications*, *41*, 8062–8074.

Sparks, P., Shepherd, R., & Frewer, L. J. (1995). Assessing and structuring attitudes toward the use of gene technology in food production the role of perceived ethical obligation. *Basic and Applied Social Psychology*, *16*, 267–285.

Stake, R. E. (2005). Qualitative case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Handbook of Qualitative Research* (3rd ed., pp. 443–466).

Stevens, J. (1996). *Applied multivariate statistics for the social sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates.

Sudin, L., Geoffrey, H. T., & Hainudin, A. (2009). Predicting intention to choose halal products using theory of reasoned action. *International Journal of Islamic and Middle Eastern Finance and Management*, *2*(1), 66–76.

Sukholthaman, P., & Sharp, A. (2016). A system dynamics model to evaluate effects of source separation of municipal solid waste management: a case of Bangkok, Thailand. *Waste Management*, *52*, 50–61.

Sumathi, V. R., Natesan, U., & Sarkar, C. (2008). GIS-based approach for optimized siting of municipal solid waste landfill. *Waste Management*, *28*, 2146–2160.

Sumiani, Y., Onn, C. C., Mohd Din, M. A., & Wan Jaafar, W. Z. (2009). Environmental planning strategies for optimum solid waste landfill sitting. *Journal of Sains Malaysiana*, *38*(4), 457–462.

Sutton, S. (1998). Predicting and explaining intentions and behavior: how well are we doing? *Journal of Applied Social Psychology*, *28*, 1317–1338.

SWCorp. (2015). *Comprehensive Solid Waste Management Action Plan 2015-2020*. Malaysia.

SWCorp Malaysia. (2014). *SWCorp Strategic Plan (Pelan Strategik SWCorp) 2014-2020*. Malaysia.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th Ed.). Boston: Pearson Education Limited.

Tan, C. L. (2013, April 9). Nothing goes to waste. *The Star*. Retrieved from http://goo.gl/HdWDFk

Tanskanen, J. H., & Kaila, J. (2001). Comparison of methods used in the collection of source-separated household waste. *Waste Management & Research*, *19*, 486–497.

Tarkianen, A., & Sundqvist, S. (2005). Subjective norms, attitude and intentions of Finnish consumers in buying organic food. *British Food Journal*, *107*(11), 808–822.

Tchobanoglous, G., Theisen, H., & Vigil, S. (1993). *Integrated solid waste management*. Singapore: McGraw-Hill Inc.

Tetrapak. (2014). *Carton Finder*. Retrieved July 11, 2016, from http://goo.gl/UWhIfw

Tetrapak. (2016). *Tetrapak and the Environment*. Retrieved July 11, 2016, from http://goo.gl/nZOdMD

Thanh, N. P., Matsui, Y., & Fujiwara, T. (2010). Household solid waste generation and characteristic in a Mekong Delta city, Vietnam. *Journal of Environmental*

Management, *91*, 2307–2321.
The Star. (2015, November 14). Recycling is key to Selangor's waste management strategy. Retrived from https://goo.gl/Ux4xTJ
The Star. (2016, June 19). High-rises unsure over waste separation. Retrieved from http://goo.gl/lQKBai
The Sun. (2007, July 6). Govt drops Broga incinerator project. Retrieved from http://www.thesundaily.my/node/169813
Thogersen, J. (1999). The ethical consumer. Moral norms and packaging choice. *Journal of Consumer Policy*, *22*, 439–460.
Thogersen, J. (2003). Monetary incentives and recycling: behavioural and psychological reactions to a performance-dependent garbage fee. *Journal of Consumer Policy*, *26*, 187–228.
Timlett, R. E., & Williams, I. D. (2008). Public participation and recycling performance in England: a comparison of tools for behaviour change. *Resources, Conservation and Recycling*, *52*(4), 622–634.
Timlett, R. E., & Williams, I. D. (2009). The impact of transient populations on recycling behaviour in a densely populated urban environment. *Resources, Conservation and Recycling*, *53*, 498–506.
Tonglet, M., Phillips, P. S., & Read, A. D. (2004). Using the Theory of Planned Behaviour to investigate the determinants of recycling behaviour: a case study from Brixworth, UK. *Resources, Conservation and Recycling*, *41*, 191–214.
Tonjes, D. J., & Mallikarjun, S. (2013). Cost effectiveness of recycling: a systems model. *Waste Management & Research*, *33*(11), 2548–56.
Trafimow, D., & Finlay, K. A. (1996). The importance of subjective norms for a minority of people: between subjects and within-subjects analyses. *Personality and Social Psychology Bulletin*, *22*, 820–828.
Tucker, P. (1999). Normative influences in household waste recycling. *Journal of Environmental Planning and Management*, *42*(1), 63–82.
Van den Putte, B. (1991). *20 years of the theory of reasoned action of Fishbein and Ajzen: a meta analysis*.
Van Ryn, M., & Vinokur, A. D. (1990). *The role of experimentally manipulated self-efficacy in determining job-search behavior among the unemployed*. Ann Arbor.
Velis, C. A., Wilson, D. C., Rocca, O., Smith, S. R., Mavropoulos, A., & Cheeseman, C. R. (2012). An analytical framework and tool ('InteRa') for integrating the informal recycling sector in waste and resource management systems in developing countries. *Waste Management & Research*, *30*(9), 43–66.
Vermette, L., & Godin, G. (1996). Nurses' intentions to provide home care: the impact of AIDS and homosexuality. *AIDS Care*, *8*, 479–488.
Vining, J. & Ebreo, A. (1990). What makes a recycler? A comparison of recyclers and non-recyclers. *Environment and Behavior, 22*(1), 55-73.
Wagner, T. P., & Broaddus, N. (2016). The generation and cost of litter resulting from the curbside collection of recycling. *Waste Management*, *50*, 3–9.
Wahid, M., & Siwar, C. (2007). Waste management and recycling practices of the urban poor: a case study in Kuala Lumpur city, Malaysia. *Waste Management & Research*, *25*, 3–13.
Wan Azlina, W. A. K. G., Iffah, F. R., Dayang Radiah, A. B., & Azni, I. (2013). An application of the theory of planned behaviour to study the influencing factors of participation in source separation of food waste. *Waste Management*, *33*(5), 1276–81.
Wan, C., Shen, G. Q., & Yu, A. (2014). The role of perceived effectiveness of policy

measures in predicting recycling behaviour in Hong Kong. *Resources, Conservation and Recycling*, *83*, 141–151.

Ward, M. N., Wells, B., & Diyamandoglu, V. (2014). Development of a framework to implement a recycling program in an elementary school. *Resources, Conservation and Recycling*, *86*, 138–146.

Watters, A. E. (1989). *Reasoned/intuitive action: an individual difference moderator of the attitude-behaviour relationship in the 1988 U.S. presidential election*. University of Massachusetts, Amherst.

Werner, C. M., & Makela, E. (1998). Motivations and behaviors that support recycling. *Journal of Environment Psychology, 18,* 373-386.

White, K. M., & Hyde, M. K. (2012). The role of self-perceptions in the prediction of household behavior in Australia. *Environment and Behavior*, *44*(6), 785–799.

Williams, W. (2012). *Strengths and weaknesses of data presentation*. Retrieved May 4, 2017, from https://goo.gl/1lw0bn

Wilson, D., Araba, A., Chinwah, K., & Cheeseman, C. (2009). Building recycling rates through the informal sector. *Waste Management*, *29*, 629–635.

Wilson, D. C., Velis, C., & Cheeseman, C. (2006). Role of informal sector recycling in waste management in developing countries. *Habitat International*, *30*, 797–808.

Wilson, M. W. (2015). On the criticality of mapping practices: Geodesign as critical GIS? *Landscape and Urban Planning*, *142*, 226–234.

World Bank. (2012). *What a Waste: A Global Review of Solid Waste Management*. Washing, DC.

Wu, A., Convertino, G., Ganoe, C., Carroll, J. M., & Zhang, X. (2013). Supporting collaborative sense-making in emergency management through geo-visualization. *International Journal of Human-Computer Studies*, *71*, 4–23.

Wu, H., Wang, J., Duan, H., Ouyang, L., Huang, W., & Zuo, J. (2016). An innovative approach to managing demolition waste via GIS (geographic information system) : a case study in Shenzhen city, China. *Journal of Cleaner Production*, *112*, 494–503.

Yahaya, N. Bin, & Larsen, I. (2008). Federalising Solid Waste Management In Peninsular Malaysia. In *International Solid Waste Association (ISWA) World Congress*. Singapore.

Yan, Y. H. (2002). *Recycling as a sustainable waste management strategy for Singapore: an investigation to find ways to promote Singaporean's household waste recycling behaviour*. Lund University.

Yin, R. K. (2003). *Case study research: design and methods* (3rd ed.). Sage.

Yoshida, H., Gable, J. J., & Park, J. K. (2012). Evaluation of organic waste diversion alternatives for greenhouse gas reduction. *Resources, Conservation and Recycling*, *60*, 1–9.

Zain, S. M., Ahmad Basri, N. E., Basri, H., Zakaria, N., Elfithri, R., Ahmad, M., Tiew, K. G., Zarina, S., Sarifah, Y., & Istear Khan, I. A. (2012). Focusing on recycling practice to promote sustainable behavior. *Procedia - Social and Behavioral Sciences*, *60*, 546–555.

Zamali, T., Mohd Lazim, A., & Abu Osman, M. T. (2012). A review of municipal solid waste management in Malaysia. *Jurnal Teknologi*, *57*, 41–56.

Zambelli, P., Lora, C., Spinelli, R., Tattoni, C., Vitti, A., Zatelli, P., & Ciolli, M. (2012). A GIS decision support system for regional forest management to assess biomass availability for renewable energy production. *Environmental Modelling & Software*, *38*, 203–213.

Zamorano, M., Molero, E., Hurtado, A., Grindlay, A., & Ramos, A. (2008). Evaluation of a municipal landfill site in Southern Spain with GIS-aided methodology. *Journal of Hazardous Materials.*, *160*, 473–481.

Zen, I. S., & Siwar, C. (2015). An analysis of household acceptance of curbside recycling scheme in Kuala Lumpur. *Habitat International*, *47*, 248–255.

Zen, I. S., Zainura, Z. N., & Rafiu, O. Y. (2014). The profiles of household solid waste recyclers and non-recyclers in Kuala Lumpur, Malaysia. *Habitat International*, *42*, 83–89.

Zentes, J., Morschett, D., & Schramm-Klein, H. (2007). *Strategic Retail Management-Text and International Cases* (1st ed.). Gabler: Wiesbaden.

Zhang, S., Zhang, M., Yu, X., & Ren, H. (2016). What keeps Chinese from recycling: Accessibility of recycling facilities and the behavior. *Resources, Conservation and Recycling*, *109*, 176–186.

Zulkifli, Z. (1993). Improvement of disposal sites in Malaysia. In *Workshop on Partnerships towards Responsive Solid Waste Management in Southeast Asia*. Pulau Pinang.

Zuo, R., John, E. J. M., & Wang, J. (2016). Spatial analysis and visualization of exploration geochemical data. *Earth-Science Reviews*, *158*, 9–18.