

POLICY IMPLEMENTATION ON WASTE SEPARATION BEHAVIOUR
AMONG HOUSEHOLDS IN KUALA LUMPUR

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DEDICATION

This thesis is dedicated to my family and friends. Your love, patience and prayers help me through this great journey with a brave heart. To my precious Salehuddin, Sirajuddin, Syarifuddin, Syahabuddin, Afiqah, Atikah and Athirah, you are my inspiration.

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ABSTRACT

The purpose of the study is to examine the extent each policy tool influences waste separation intention and behaviour. The study applies the extended Theory of Planned Behaviour (TPB) by incorporating policy tools as Perceived Policy Effectiveness constructs. The proposed modification to the TPB comprises nine constructs which are Attitude, Subjective Norms, Perceived Behaviour Control, Perceived Policy Effectiveness (PPE) Capacity Building, PPE Mandates, PPE Inducement, PPE System Changing, Waste Separation Intention and Waste Separation Behaviour. The sample area of the study is Kuala Lumpur as it is a densely populated area. Prior to data collection, the developed questionnaire was validated by expert's review and a pilot test. The Rasch Measurement Model was used to verify the items' reliability during the pilot test. This quantitative study employed questionnaire to collect data from four residential areas in Kuala Lumpur using the random sampling method. Four hundred and eighty questionnaires were distributed. Data collected was analysed using Structural Equation Modelling (SEM) with Analysis of Moment Structures (AMOS) to determine the relationship between variables. Attitude, Subjective Norms, Perceived Behaviour Control and PPE Mandates were found to significantly influence households waste separation intention. These findings contribute towards the enrichment of literatures by integrating new variables into the TPB model to explain households waste separation behaviour, particularly in the Malaysian context. This study also provides suggestions to policy makers on improving policy intervention to influence household behaviour on waste separation.

ABSTRAK

Tujuan penyelidikan ini adalah untuk mengkaji sejauh mana setiap instrumen dasar mempengaruhi hasrat dan tingkah laku pengasingan sisa pepejal. Penyelidikan ini menggunakan Teori Tingkah Laku Terancang yang dikembangkan dengan menggabungkan instrumen dasar sebagai konstruk Persepsi Keberkesanan Dasar. Cadangan pengubahsuaian Teori Tingkah Laku Terancang melibatkan sembilan konstruk iaitu Sikap, Norma Subjektif, Persepsi Kawalan Tingkah Laku, Persepsi Keberkesanan Dasar (PPE) Pembangunan Kapasiti, PPE Mandat, PPE Dorongan, PPE Perubahan Sistem, Hasrat Pengasingan Sisa Pepejal dan Tingkah Laku Pengasingan Sisa Pepejal. Kawasan sampel kajian adalah Kuala Lumpur kerana mempunyai kepadatan penduduk yang tinggi. Sebelum menjalankan pengumpulan data, kesahan soal selidik telah disahkan melalui ulasan pakar dan ujian rintis. Model Pengukuran Rasch telah digunakan dalam kajian rintis untuk mengesahkan kebolehpercayaan item. Kajian kuantitatif ini mengambil pendekatan tinjauan menggunakan set soal selidik bagi mengumpul data secara persampelan rawak daripada empat kawasan perumahan di Kuala Lumpur. Empat ratus lapan puluh set soal selidik telah diedarkan. Data yang dikumpulkan telah dianalisa menggunakan Pemodelan Persamaan Struktur (SEM) Analisis Struktur Momen (AMOS) untuk mengenal pasti hubungan antara pemboleh ubah. Sikap, Norma Subjektif, Persepsi Kawalan Tingkah Laku dan PPE Mandat telah dikenal pasti mempengaruhi secara signifikan hasrat pengasingan sisa pepejal. Dapatan kajian menyumbang kepada pengayaan literatur yang menggabungkan pemboleh ubah baharu ke dalam model Teori Tingkah Laku Terancang untuk menjelaskan tingkah laku pengasingan sisa oleh isi rumah, khususnya di Malaysia. Kajian ini turut mengesyorkan beberapa cadangan kepada pembuat dasar bagi menambah baik intervensi dasar untuk mempengaruhi tingkah laku isi rumah terhadap pengasingan sisa pepejal.

TABLE OF CONTENTS

	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	xiv
	LIST OF FIGURES	xvii
	LIST OF ABBREVIATIONS	xix
	LIST OF SYMBOLS	xxi
	LIST OF APPENDICES	xxii
CHAPTER 1	INTRODUCTION	1
1.1	Overview	1
1.2	Research Background	4
1.3	Statement of the Problem	16
1.4	Research Objectives	18
1.5	Research Questions	19
1.6	Research Hypothesis	20
1.7	Conceptual Framework	22
1.8	Theoretical Overview	24
1.9	Significance of Study	26
1.10	Scope of Study	28
1.11	Definition of Terms	30
	1.11.1 Waste Separation Behaviour	30
	1.11.2 Waste Separation Intention	31
	1.11.3 Attitude	31

1.11.4	Subjective Norms	32
1.11.5	Perceived Behaviour Control	32
1.11.6	Perceived Policy Effectiveness	33
1.11.6.1	Perceived Policy Effectiveness: Capacity Building	33
1.11.6.2	Perceived Policy Effectiveness: Mandates	34
1.11.6.3	Perceived Policy Effectiveness: Inducement	34
1.11.6.4	Perceived Policy Effectiveness: System Changing	35
1.12	Summary	35
CHAPTER 2	LITERATURE REVIEW	37
2.1	Introduction	37
2.2	Theoretical Overview	37
2.2.1	Theory of Planned Behaviour	38
2.2.2	Perceived Policy Effectiveness	40
2.2.3	Policy Instrument Classifications	42
2.3	Conceptual Overview	44
2.3.1	Attitude	45
2.3.2	Subjective Norms	47
2.3.3	Perceived Behaviour Control	48
2.3.4	Perceived Policy Effectiveness (PPE)	49
2.3.4.1	Perceived Policy Effectiveness: Capacity Building	50
2.3.4.2	Perceived Policy Effectiveness: Mandates	53
2.3.4.3	Perceived Policy Effectiveness: Inducement	54
2.3.4.4	Perceived Policy Effectiveness: System Changing	56
2.3.5	Recycling Intention	59
2.3.6	Waste Separation Behaviour	60
2.3.7	Socio-Demographic Factors	62

2.4	Policy Overview	63
2.4.1	Solid Waste and Public Cleansing Management Corporation 2007 (Act 673)	66
2.4.1.1	Capacity Building	66
2.4.1.2	Mandates	67
2.4.1.3	Inducement	68
2.4.1.4	System Changing	68
2.4.2	Policy Cycle	69
2.5	International Studies	71
2.6	Local Studies	78
2.7	Research Gap Analysis	84
2.7.1	Theoretical and Conceptual	85
2.7.2	Methodology	86
2.7.3	Empirical	87
2.7.4	Practical	88
2.8	Summary	88
CHAPTER 3	RESEARCH METHODOLOGY	89
3.1	Introduction	89
3.2	Research Design	89
3.3	Research Instruments	93
3.3.1	Document Analysis and Interview	93
3.3.2	Questionnaire Items	93
3.3.3	Rating Scale	94
3.3.4	Translation	95
3.4	Sample and Sampling Method	95
3.4.1	Population	95
3.4.2	Unit of Analysis	97
3.4.3	Sample Size	98
3.4.4	Sampling Method	99
3.4.5	Data Collection Procedure	99
3.5	Validity and Reliability	101

3.5.1	Face and Content Validity	103
3.5.2	Construct Validity	104
3.5.3	Pilot Study	105
3.5.3.1	Reliability Index	106
3.5.3.2	Person and Item Misfit	108
3.5.3.3	Item Polarity	110
3.5.3.4	Rating Scale	111
3.5.3.5	Standardised Residual Correlation	112
3.5.3.6	Unidimensionality	113
3.5.3.7	Summary of Item Reduction	114
3.6	Data Analysis Method	115
3.6.1	Descriptive Statistics	115
3.6.2	Structural Equation Modelling	115
3.7	Conclusion	116
CHAPTER 4	ANALYSIS AND FINDINGS	117
4.1	Introduction	117
4.2	Analysis on the Governing Acts and Policies on Household Waste Separation in Malaysia.	117
4.2.1	Capacity Building	118
4.2.2	Mandates	119
4.2.3	Inducement	120
4.2.4	System Changing	121
4.3	Data Analysis	122
4.3.1	Data Screening and Missing Data	123
4.3.2	Data Normality	123
4.4	Respondent Profile	125
4.4.1	Household Demographic Analysis	126
4.5	Analysis on the Level of Household Waste Separation Practices	127
4.6	Confirmatory Factor Analysis	129
4.6.1	Fitness Index	130
4.6.2	Research Measurement Models	131

4.6.3	Measurement Model for Waste Separation Behaviour	131
4.6.4	Measurement Model for Waste Separation Intention	132
4.6.5	Measurement Model for Affective Attitude	133
4.6.6	Measurement Model for Instrumental Attitude	134
4.6.7	Measurement Model for Subjective Norms	136
4.6.8	Measurement Model for Perceived Behavioural Control	137
4.6.9	Measurement Model for Perceived Policy Effectiveness Capacity Building	138
4.6.10	Measurement Model for Perceived Policy Effectiveness Mandates	140
4.6.11	Measurement Model for Perceived Policy Effectiveness Inducement	141
4.6.12	Measurement Model for Perceived Policy Effectiveness System Changing	142
4.7	Validity and Reliability of the Measurement Models	143
4.7.1	Validity	145
4.7.1.1	Discriminant Validity	146
4.7.1.2	Validating Composite Construct on Affective Attitude and Instrumental Attitude	147
4.7.2	Reliability	150
4.7.3	The Waste Separation Behaviour Structural Model	151
4.8	Analysis on factors influencing waste separation intention and behavior among household in Kuala Lumpur.	153
4.9	The Mediation effect of Waste Separation Intention	155
4.9.1	The Mediation effect of Waste Separation Intention between Attitude and Waste Separation Behaviour	155
4.9.2	The Mediation effect of Waste Separation Intention between Subjective Norms and Waste Separation Behaviour	157

4.9.3	The Mediation effect of Waste Separation Intention between Perceived Behaviour Control and Waste Separation Behaviour.	159
4.9.4	The Mediation effect of Waste Separation Intention between Perceived Policy Effectiveness Mandates and Waste Separation Behaviour	160
4.9.5	The Mediation effect of Waste Separation Intention between PPE Capacity Building and Waste Separation Behaviour	162
4.9.6	The Mediation effect of Waste Separation Intention between PPE Inducement and Waste Separation Behaviour	163
4.9.7	The Mediation effect of Waste Separation Intention between PPE System Changing and Waste Separation Behaviour	164
4.10	Conclusion	166
CHAPTER 5	DISCUSSION, CONCLUSION AND RECOMMENDATIONS	169
5.1	Introduction	169
5.2	Discussion on Research Findings	170
5.2.1	Related Solid Waste Management Policies and Acts Governing the Household Waste Separation in Malaysia.	170
5.2.2	The Level of Waste Separation Practice undertaken by Households	172
5.2.3	The Waste Separation Behaviour Model	173
5.2.4	The Factors Influencing Waste Separation Intention and Behaviour	175
5.2.4.1	Relationship between Attitude and Waste Separation Intention	176
5.2.4.2	Relationship between Subjective Norms to Waste Separation Intention	177
5.2.4.3	Relationship between Perceived Behaviour Control and Waste Separation Intention	178
5.2.4.4	Relationship between PPE Capacity Building to Waste Separation Intention	179

5.2.4.5	Relationship between PPE Mandates to Waste Separation Intention	180
5.2.4.6	Relationship between Perceived Policy Inducement to Waste Separation Intention	181
5.2.4.7	Relationship between PPE System Changing to Waste Separation Intention	182
5.2.4.8	The Relationship between Waste Separation Intention to Waste Separation Behaviour	184
5.2.5	The Mediation Effect of Separation Intention in the Waste Separation Behaviour Model.	184
5.3	Research Implications	187
5.3.1	Research Implication for Policy Makers	187
5.3.2	Research Implication for Academia	192
5.4	Recommendations for Future Studies	193
5.4.1	Sample	193
5.4.2	Research Framework	194
5.5	Conclusion	194
	REFERENCES	197
	LIST OF APPENDICES	223
	LIST OF PUBLICATIONS	251

LIST OF TABLES

TABLE NO.	TITLE	PAGE
Table 1.1	Generation of MSW in Peninsular Malaysia by States and Federal Territories (2000-2018)	5
Table 1.2	Summary of key policy documents related to waste management	8
Table 1.3	The research hypothesis for the respected paths	21
Table 1.4	Average household waste generation in Malaysia 2012	29
Table 2.1	Taxonomies of policy instruments	42
Table 2.2	The 3Rs awareness programmes undertaken by SWCorp	67
Table 2.3	Notice, reminder and compound issued	68
Table 2.4	Number of total online feedback received	69
Table 2.5	Summary of variables used and result of previous studies in Malaysia	83
Table 3.1	Total landed houses in Kuala Lumpur	97
Table 3.2	Summary of amendments to the questionnaire	104
Table 3.3	Cronbach Alpha and Person Reliability	107
Table 3.4	Item Reliability	107
Table 3.5	Summary of misfit person	109
Table 3.6	Guttman Scalogram	109
Table 3.7	Summary of misfit items	110
Table 3.8	Summary of item polarity analysis	111
Table 3.9	Summary of category measure	112
Table 3.10	Residual correlation	112
Table 3.11	Revised residual correlation	113
Table 3.12	Unidimensionality	114
Table 4.1	Assessment of normality distribution for items in respective constructs	124
Table 4.2	Respondent demographic profile	126

Table 4.3	Respondent waste separation practice	128
Table 4.4	Summary of fit indices	130
Table 4.5	Items Factor Loading, Average Variance Extracted and Composite Reliability	143
Table 4.6	Correlation between constructs	146
Table 4.7	Revised correlation between constructs	148
Table 4.8	Items Factor Loading, Average Variance Extracted and Composite Reliability	149
Table 4.9	The standardised regression weights paths to Separation Intention	153
Table 4.10	The standardised regression weights paths to Separation Behaviour	154
Table 4.11	The results of hypothesis testing for the respected paths	155
Table 4.12	Standardised regression path for Attitude, Waste Separation Intention and Waste Separation Behaviour	156
Table 4.13	Bootstrap analysis for Attitude, Waste Separation Intention and Waste Separation Behaviour	157
Table 4.14	Standardised regression path for Subjective Norms, Waste Separation Intention and Waste Separation Behaviour	157
Table 4.15	Bootstrap analysis for Subjective Norms, Waste Separation Intention and Waste Separation Behaviour	158
Table 4.16	Standardised regression path for Perceived Behaviour Control, Waste Separation Intention and Waste Separation Behaviour	159
Table 4.17	Bootstrap analysis for Perceived Behaviour Control, Waste Separation Intention and Waste Separation Behaviour	160
Table 4.18	Standardised regression path for PPE Mandates, Waste Separation Intention and Waste Separation Behaviour	161
Table 4.19	Bootstrap analysis for PPE Mandates, Waste Separation Intention and Waste Separation Behaviour.	162
Table 4.20	Standardised regression path for PPE Capacity Building, Waste Separation Intention and Waste Separation Behaviour	162
Table 4.21	Standardised regression path for PPE Inducement, Waste Separation Intention and Waste Separation Behaviour	163

Table 4.22	Standardised regression path for PPE System Changing, Separation Intention and Separation Behaviour	164
Table 4.23	The results of hypothesis testing on the mediation effect	166

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
Figure 1.1	Conceptual framework	24
Figure 1.2	Theory of Planned Behaviour	25
Figure 2.1	Theory of Planned Behaviour	39
Figure 2.2	Modified framework to analyse the effectiveness of policy implementation	41
Figure 2.3	Illustration on objectives and thrust of Solid Waste and Public Cleansing Management Policy 2016	64
Figure 2.4	Effectiveness triangle in policy cycle	70
Figure 3.1	Research design	91
Figure 4.1	Waste Separation Behaviour measurement model	131
Figure 4.2	Waste Separation Behavior modified measurement model	132
Figure 4.3	Waste Separation Intention measurement model	132
Figure 4.4	Waste Separation Affective Attitude measurement model	133
Figure 4.5	Waste Separation Affective Attitude modified measurement model	134
Figure 4.6	Instrumental Attitude measurement model	134
Figure 4.7	Instrumental Attitude modified measurement model	135
Figure 4.8	Subjective Norms measurement model	136
Figure 4.9	Subjective Norms modified measurement model	136
Figure 4.10	Perceived Behaviour Control measurement model	137
Figure 4.11	Perceived Behaviour Control modified measurement model	138
Figure 4.12	PPE Capacity Building measurement model	138
Figure 4.13	PPE Capacity Building modified measurement model	139
Figure 4.14	PPE Mandates measurement model	140
Figure 4.15	PPE Mandates modified measurement model	140
Figure 4.16	PPE Inducement measurement model	141
Figure 4.17	PPE System Changing measurement model	142

Figure 4.18	PPE System Changing modified measurement model	142
Figure 4.19	Attitude measurement model	147
Figure 4.20	Attitude modified measurement model	148
Figure 4.21	The standardised regression weight for the Waste Separation Behaviour Model	152
Figure 4.22	Mediation relationship between Attitude, Waste Separation Intention and Waste Separation Behaviour	156
Figure 4.23	Mediation relationship between Subjective Norms, Waste Separation Intention and Waste Separation Behaviour	158
Figure 4.24	Mediation relationship between Perceived Behaviour Control, Waste Separation Intention and Waste Separation Behaviour	159
Figure 4.25	Mediation relationship between PPE Mandates, Waste Separation Intention and Waste Separation Behaviour	161
Figure 4.26	Mediation relationship between PPE Capacity Building, Waste Separation Intention and Waste Separation Behaviour	163
Figure 4.27	Mediation relationship between PPE Inducement, Waste Separation Intention and Waste Separation Behaviour	164
Figure 4.28	Mediation relationship between PPE System Changing, Waste Separation Intention and Waste Separation Behaviour	165
Figure 5.1	The Waste Separation Behaviour Model	175

LIST OF ABBREVIATIONS

ABC	-	The Action Plan for Beautiful and Clean Malaysia
AMOS	-	Analysis of Moment Structure
AVE	-	Average Variance Extracted
CB-SEM	-	covariance-based SEM
C4E	-	Communicate, Educate, Engage, Empower, Enforce
CFA	-	Confirmatory Factor Analysis
CFI	-	Comparative Fit Index
CMV	-	Common method variance
CR	-	Critical Ratio
DEFRA	-	Department of Environment, Food and Rural Affairs
DNSWM	-	Department of National Solid Waste Management
GHGs	-	Greenhouse Gases
GDP	-	Gross Domestic Product
KPI	-	Key Performance Indicator
MDG	-	Millennium Development Goal
MHLG	-	Ministry of Housing and Local Government
MSW	-	Municipal Solid Waste
Mt	-	million tonnes
NGO	-	non-governmental organisation
NSP	-	National Strategic Plan on Solid Waste Management
NSWMP	-	National Solid Waste Management Policy
RMSEA	-	Root Mean Square Error of Approximation
PAYT	-	Pay-as-you-throw
PBC	-	Perceived Behaviour Control
PLS-SEM	-	Partial Least Square SEM
PMO	-	Perceived Moral Obligation
PPE	-	Perceived Policy Effectiveness
RFID	-	Radio Frequency Identification
SCP	-	Sustainable Consumption and Production
SDG	-	Sustainable Development Goal

SEM	-	Structural Equation Modelling
SPSS	-	Statistical Package for Social Sciences
SWM	-	Solid Waste Management
SWPCMA	-	Solid Waste and Public Cleansing Management Act
SWPCCA	-	Solid Waste and Public Cleansing Management Corporation Act
SWCorp	-	Solid Waste Management and Public Cleansing Corporation
TPB	-	Theory of Planned Behaviour
TFI	-	Tucker Lewis Index
UTM	-	Universiti Teknologi Malaysia
UNFCCC	-	United Nations Framework Convention on Climate Change
WPKL	-	<i>Wilayah Persekutuan Kuala Lumpur</i>
3Rs	-	reduce, reuse and recycling

LIST OF SYMBOLS

χ^2	-	Chi-square
α	-	Cronbach alpha
Σ	-	Summation

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	The Initial and Amended Questionnaire Items	224
Appendix B	The Questionnaire	234
Appendix C	UTM Invitation Letter for Expert Validation	239
Appendix D	Expert Validation Feedback Forms	241
Appendix D	UTM Letter for Data Collection	243
Appendix E	Data Collection at DNSWM	245
Appendix F	Data Collection at SWCorp	246
Appendix G	SWCorp Service Area Map WPKL03	247
Appendix H	SWCorp Service Area Map WPKL05	248
Appendix I	SWCorp Service Area Map WPKL07	249
Appendix J	SWCorp Service Area Map WPKL16	250

CHAPTER 1

INTRODUCTION

1.1 Overview

A society's quality of life has always been associated with economic development and achievement. The pursuit of economic growth however has raised valid concerns across the globe regarding the negative impact it has on the ecological balance and the environment. In particular, rapid economic development has always been identified as one of the major culprits contributing to the increase in greenhouse gases (GHGs) emissions into the atmosphere. The issue on GHGs emissions and climate change which highlights the need for a balanced growth and sustainable development defined by the Bruntland Report (1987, para. 27) as “the development which meets the needs of the present without compromising the ability of the future generations to meet their own needs” has become the focus of many government development agendas around the world. In 1992 Rio's Earth Summit, the world community adopted the Rio Declaration on Environment and Development emphasising environmental protection as an integral part of any development process. In 2016, Malaysia has adopted the Sustainable Development Agenda 2030 with the ultimate objective to pursue a sustainable development path at an accelerated rate.

Since then, Malaysia has advanced economically embracing a low carbon development path as the underlying principle in many of its development policies. Various national development plans and policies such as the National Policy on the Environment (2002), the National Policy on Climate Change (2009), the National Green Technology Policy (2012) and the National Solid Waste Management Policy (2016), have emphasised Malaysia's green growth strategies to continue pursuing “low-carbon, resource-efficient and socially-inclusive” development. Malaysia has bravely pledged to voluntarily reduce GHGs intensity of Gross Domestic Product (GDP) by up to 40% by 2020 compared to the 2005 level during the Conference of

Parties 15 of the United Nation Framework Convention on Climate Change (Government of Malaysia, 2015). This outlook on the future is not surprising as the Intergovernmental Panel on Climate Change through scientific research has produced the Fourth Assessment Report in 2007 highlighting the magnitude of GHGs and climate change, and their impact on the environment and human beings. That 2007 report has already highlighted that one of the mitigation areas that could reduce the GHGs is the waste sector.

Rapid growth of the population, urbanization, industrialisation and social affluence have resulted in the alarming solid waste generation growth (United Nations, 1999; Varotto and Spagnolli, 2017). Globally, the growth of municipal solid waste (MSW) has exceeded the urbanisation growth rate such that the amount of waste generated is expected to almost double from 1.3 billion in 2012 tonnes to 2.2 billion tonnes by 2025 (The World Bank, 2012). Serious issues arising from rapid waste generation are increased volume of waste accumulated at landfill, limited landfill capacity, the associated waste management costs, the adverse impact from the use of unsanitary landfills and the unproductive use of waste as a resource.

Solid waste management (SWM) is the most basic of the urban services due to its importance in relation to cleanliness and human health issues. The Asian Productivity Organisation defined SWM as “the discipline associated with controlling the generation, storage, collection, transfer and transport, processing, and disposal of solid waste in a manner that is in accordance with the best principles of health, economics, engineering, conservation, aesthetics, and other environmental considerations, and that is also responsive to public attitudes.” (Asian Productivity Organization, 2007, p. 3).

Sustainable SWM based on hierarchical concept was introduced in the Johannesburg Plan of Implementation during the World Summit on Sustainable Development 2002. The hierarchy starts with waste prevention, reduce, reuse and recycling (3Rs) and the use of environmentally sound disposal technologies including waste-to-energy technologies. However, an effective implementation of the waste hierarchy requires human intervention to practice 3Rs before technologies can be

adopted to minimise the adverse impact on the environment. Most importantly, the amount of waste recycled and the cleanliness level of separated waste impacts the accumulated amount of material recycled and the quality of secondary materials that can be supplied (The World Bank, 2012).

Recycling yields the benefit of conserving natural resources and fossil fuels as well as prolongs the lifespan of disposal sites (Hassan and Rahman, 2000). Nevertheless, the success factor to increase recycling practices requires participation from the public which would require changing the mind set and behaviour (Akil, Foziah and Ho, 2015; Dinie, Samsudin and Don, 2013; Moh and Manaf, 2017; Tonglet, Phillips and Read, 2004; Vicente and Reis, 2008). As a result, Malaysia has imposed mandatory waste separation at source among households through the National Solid Waste Management Policy 2006 (NSWMP 2006), National Solid Waste Management Policy 2016 (NSWMP 2016) and the Solid Waste Management and Public Cleansing Act 2007 (SWPCMA 2007).

Since the implementation of mandatory waste separation at source in June 2016, the recycling rate has shown an increasing trend but the recycling rate is still low compared to neighbouring countries. Scholars have also highlighted that the public's perception on policy effectiveness will influence their recycling practice (Steg and Vlek, 2009). Therefore, the main aim of this study is to analyse the factors influencing waste separation intention and behaviour among households from the policy implementation perspective. Achieving this aim is critically important in order to improve the related waste management policies in the country.

This chapter introduces the research that has been carried out. Explanation on the research background, research problem, research objectives, research questions and scope of the study will provide the overall scenario and direction of the study. In addition, the operational definitions will also be elaborated and discussed to provide a clearer understanding on the studied variables.

1.2 Research Background

Managing solid waste is among the major environmental challenges faced by many municipalities around the world, including in Malaysia (Afroz and Masud, 2011; Dinie et al., 2013; Moh and Manaf, 2017; United Nations, 1999). Population growth, economic progress, social affluence as well as usage in packaging materials, have intensified the waste generation problem causing deterioration to the environment (Akil et al., 2015; Desa, Abd. Kadir and Yusoff, 2011; Moh and Manaf, 2017; Murad and Siwar, 2007). In order to reduce the impact of waste on the environment, the amount of waste has to be reduced either through recycle or re-use, leaving the least amount of unrecoverable waste to be landfilled. In developing countries, household waste amounted to 75% of the MSW and is considered to be the most problematic waste due to its complex characteristics (Welivita, Wattage and Gunawardena, 2015).

The Malaysia municipal solid waste generation trend is steadily showing a positive growth rate. The average annual growth rate for the period 2002 to 2012 was 2.9%. The Ministry of Housing and Local Government (MHLG) estimated a growth rate of about 4.3% per annum for the period of 2010-2020 (Agamuthu and Victor, 2011). Table 1.1 describes the solid waste generation trend in Malaysia.

Table 1.1 Generation of MSW in Peninsular Malaysia by States and Federal Territories (2000-2018) (Yusop and Othman, 2019)

States/Federal Territories	2010	2012	2014	2017	2018
	(tonnes/day)			tonnes	
Perlis	286	307	163	41,894	42,208
Kedah	1,937	2,078	2,448	456,182	500,975
FT Kuala Lumpur	3,698	3,968	2,525	773,684	760,174
FT Putrajaya	NA	NA	159	48,633	53,272
Negeri Sembilan	1,107	1,188	1,281	278,697	291,383
Melaka	752	807	1,030	233,548	248,210
Johor	2,800	3,005	4,206	932,494	912,907
Pahang	1,400	1,502	1,052	302,306	289,524
Kelantan	1,512	1,623	1,933	NA	NA
Terengganu	1,291	1,385	1,306	NA	NA
Pulau Pinang	1,590	1,707	1,959	NA	NA
Perak	2,233	2,396	2,950	NA	NA
Selangor	4,133	4,435	6,855	NA	NA

Solid waste generation in Malaysia comprises of 64% municipal solid waste, 25% industrial waste, 8% commercial waste and 3% construction waste. Urban centres are the main sources of MSW (Hamid and Periathamby, 2012; Samsudin and Don, 2013) with recyclables contributing more than 60% (Hamid and Agamuthu, 2010; Osman et al., 2009). In 2003, the MSW generated was 0.5 - 0.8 kg per capita per day while 1.7 kg per capita per day was reported for major cities. (Manaf, Samah and Zukki, 2009). Recently, the Solid Waste Management and Public Cleansing Corporation reported that each citizen is currently generating 1.17 kg of MSW per day compared to 0.8kg of MSW per day in 2008 (Muzamir, 2020, para. 2).

MSW can broadly be classified into organic and inorganic waste. Organic waste comprises decomposed waste such as food waste, yard and wood waste while inorganic waste consist of glass, metal, plastic and others. Waste composition varies from one country to another depending on the economic development, culture and geographical location (The World Bank, 2012). Malaysia's waste contain more than 40% organic waste while paper, plastic, glass, metal, textile make up the other 60%

(Dinie et al., 2013; Johari, Alkali, Hashim, Ahmed and Mat, 2014). This indicates that landfilling remains as the main waste disposal method because it contains a high level of recyclable waste. In addition to the increasing waste generation trend is the complexity of managing diverse waste composition arising from the consumption patterns (Badgie, Armi, Samah, Manaf, and Muda, 2012; Hassan and Rahman, 2000).

Modern waste management has shifted towards a more sustainable waste management that progresses in tandem with the upward trend of waste generation which resulted in the evolution of policies and plans on the SWM in Malaysia. Sanitation is one of the listed items under the Concurrent List of the Federal Constitution of Malaysia upon which both the state and the federal government have jurisdiction. During the 1970s, the local authorities were empowered to manage solid waste and public cleansing in areas under their jurisdiction. However, adapting to increasing waste trend and global issues, the NSWMP 2006, the SWPCMA 2007 and the SWPCMCA 2007 were enforced. The Department of National Solid Waste Management has been vested with policy formulation functions while the Solid Waste Management and Public Cleansing Corporation (SWCorp) has been entrusted to manage the operational and implementation issues. The main effect of the Act is the federalisation of SWM from local authorities.

The development of the current policy evolved through various phases. In the 1970s, the uncritical level of waste volume can be managed by the local authorities empowered through the Streets, Drainage and Building Act 1974, Local Government Act 1976, and the Town and Country Planning Act 1976 (Moh and Manaf, 2017; Hamid and Periathamby, 2012). The Action Plan for Beautiful and Clean Malaysia 1988 (ABC) was the first attempt to formulate a SWM plan aimed at minimising waste volume and had led to the development of the SWM roadmap and recycling programmes that were launched in 1999 and 2000 (Periathamby and Victor, 2012; Moh and Manaf, 2017). This marked the initial effort at introducing recycling programmes in Malaysia (Moh and Manaf, 2014; Periathamby et al., 2009).

Superseding the ABC is the National Strategic Plan 2005. The Plan adopted the waste hierarchy concept to minimise waste production as well as manage the

treatment and disposal of generated waste through the establishment of appropriate facilities (Moh and Manaf, 2017). The Solid Waste Minimisation Master Plan 2006 emphasised a hierarchical treatment of solid waste through the enhancement of 3Rs practices and the realisation of a Material Cycle Society enrooted in the behaviour of each waste generators with a target achievement of 22% recycling rate by 2020 (Moh and Manaf, 2017). The effort to reduce waste generation through recycling and waste separation has been a long endeavour for Malaysia. Table 1.2 provides the summary of programmes and initiatives relating to solid waste management in Malaysia.

Table 1.2 Summary of key policy documents related to waste management (compiled by the researcher)

No.	Document	Year	Summary
1.	Outline Perspective Plan 3, (OPP3)	2001-2010	<ul style="list-style-type: none"> • Targeted to reduce waste intensity of urban-industrial activity by encouraging recycling of materials. • Introduced renewable energy as the fifth fuel, particularly biomass, biogas, municipal waste, solar and mini-hydro. • Carried out comprehensive waste management initiatives including the installation of incinerators as well as formulate strategies for waste reduction, reuse and recycling. • Enhanced community participation based on the principles of Local Agenda 21.
2.	7 th Malaysia Plan (7MP)	1996-2000	<ul style="list-style-type: none"> • Malaysia signed the Framework Convention on Climate Change. • National Policy on the Environment for sustainable consumption and production to ensure sustainable development. • Enhanced programmes to instil knowledge and social responsibility to individual citizens. • Empowered local authorities and engaging communities in addressing environmental issues. • Conducted awareness campaigns to encourage the reduction, reuse and recycling of waste materials.
3.	8 th Malaysia Plan (8MP)	2001-2005	<ul style="list-style-type: none"> • Established solid waste privatization process on interim basis. • Introduced appropriate economic approaches such as incentives and collection charges to reduce the amount of household waste. • Continued efforts to enhance the level of environmental awareness and civic consciousness among the people. • Malaysia strategised steps to fulfil Convention obligations.
4.	9 th Malaysia Plan (9MP)	2006-2010	<ul style="list-style-type: none"> • Increased public awareness through recycling campaign undertaken with 97 Local Authorities, private sector and non-governmental organisations (NGOs). • Provided recycling buy-back centres within residential areas and shopping centres.

No.	Document	Year	Summary
			<ul style="list-style-type: none"> • National Strategic Plan on Solid Waste Management approved in 2005. • DNSWM was established to formulate policies and planning regarding SWM.
5.	10 th Malaysia Plan (10MP)	2011-2015	<ul style="list-style-type: none"> • Emphasised waste as a resource initiative. • Federalisation of solid waste management and public cleansing services. • Full enforcement of the Solid Waste and Public Cleansing Management Act 2007. • Operators subjected to stringent KPIs that include coverage of service, schedule and frequency of collection, number of complaints. • 120 litre bins distributed to households. • Separate collection for bulk waste and garden waste were implemented. • A system to allow consumers to receive refunds from the return of recyclable items were planned.
6.	11 th Malaysia Plan (11MP)	2016-2020	<ul style="list-style-type: none"> • 40% reduction in GHGs emission intensity of Gross Domestic Product (GDP) compared to 2005 level. • Targeted to achieve 22% recycling rate of household waste by 2020. • Existing regulation including Solid Waste and Public Cleansing Management Act, 2007 planned to be revised to support the green growth strategies. • New policy framework, including the Sustainable Consumption and Production (SCP) blueprint and SCP indicators have been formulated to assess the impact of SCP on the economy, society and the environment.
7.	National Strategic Plan on Solid Waste Management (NSP)	2005	<ul style="list-style-type: none"> • Outlined sustainable waste management through reuse, recycle, appropriate use of technology and standardised waste management. • Action plan prepared with local communities, private sectors and NGOs. • Enhanced related agencies' capacity and increased community participation by targeting 22% recycling rate by 2020. • Separation at source for urban areas targeted to achieve 100% by 2020.

No.	Document	Year	Summary
8.	Solid Waste and Public Cleansing Management Policy 2006	2006	<ul style="list-style-type: none"> • Solid Waste and Public Cleansing Management Act 2007 (SWPCMA 2007) or Act 672 was implemented in phases. • Solid Waste and Public Cleansing Management Corporation Act 2007 (SWPCMCA 2007) or Act 673 was implemented. • Federalisation of SWM from local authorities and the enforcement of the mandatory separation at source among households. • Established an integrated waste management system and standardised municipal solid waste services. • Superseded by Solid Waste and Public Cleansing Management Policy 2016.
9.	National Environment Policy	2002	<ul style="list-style-type: none"> • Emphasised sustainable consumption and production initiatives. • Emphasised efficient natural resource utilisation while prevents degradation of the environment.
10.	National Policy on Climate Change	2009	<ul style="list-style-type: none"> • Strengthened capacity of the nation to reduce its vulnerability to climate change whilst enhances sustainable development. • Climate-resilient development strategies including the solid waste management sector.
11.	Malaysia Green Technology Policy (2017 – 2030)	2017-2030	<ul style="list-style-type: none"> • 90.9% of methane generated from the waste sector is from landfills. • Targeted waste recycling rate to achieve 28% by 2030. • Targeted awareness programs through education. • Targeted for a Resource Efficient Society- TN50 Green – Waste to Wealth Society.
12.	Second National Communication (NC2) to the UNFCCC	2011	<ul style="list-style-type: none"> • Targeted a reduction of up to 40 percent of GHG emissions intensity of GDP by the year 2020 compared to 2005 levels. • A total of 52.41 Mt CO² equivalent for methane emission, with the highest emission was from landfills. • Ongoing education on the issues of the environment, sustainable living and climate change.

No.	Document	Year	Summary
13.	Third National Communication Second Biennial Report to the UNFCCC	2018	<ul style="list-style-type: none"> • Aimed to redirect 40% of the waste generated from waste disposal sites, 22% through recycling and 18% through waste treatment by 2020. • Targeted the recycling rate to increase from 22% in 2020 to 40% by 2030.
14.	Millennium Development Goals 2015 (MDG)	2015	<ul style="list-style-type: none"> • The waste sector emissions showed an upward trend from 223.1 Mt CO² equivalent in 2000 to 292.9 Mt CO² equivalent in 2007. • Typical sectors for which carbon dioxide emissions were estimated include energy, industrial processes, agriculture and waste as well as land use, land-use change and forestry. • Integrated sustainable development principles into country policies and programmes to minimise the loss of environmental resources.
15.	Sustainable Development Goal (SDG)	2018	<ul style="list-style-type: none"> • Goal 12: Ensure sustainable consumption and production patterns. • Green growth strategies incorporated into the 11th Malaysia Plan. • Emphasised the use of waste as a resource.
16.	SWCorp Strategic Plan	2014-2020	<ul style="list-style-type: none"> • Increased adherence to standards and specification to aspects relating to solid waste management system. • Implemented initiative on C4E (Communicate, Educate, Engage, Empower, Enforce) to change public mind set.

The National Solid Waste Management Policy 2006 was approved by the Cabinet on 13 September 2006 with the objective to provide an integrated, cost effective and sustainable SWM system. This policy continued to emphasise SWM through wider implementation of the 3R activities and technological usage before final disposal. Solid Waste Management and Public Cleansing Act 2007 (SWPCMA) was approved in 2007 but came into force in 2011 (Hamid et al., 2009). The main effect of the Act has been the federalisation of SWM from local authorities for municipal services and the enforcement of mandatory separation at source among households (Moh and Manaf, 2017). However, the adoption of the SWPCMA 2007 is only enforced in adopting states including Kedah, Perlis, Kuala Lumpur, Putrajaya, Pahang, Kelantan, Terengganu, Negeri Sembilan, Melaka and Johor. The National Solid Waste Management Policy 2016 enhanced the National Solid Waste Management Policy 2006 with an action plan and strategies.

It is typical for SWM in developing countries, including Malaysia, to face improper collection services and unsustainable disposal method (Manaf et al., 2009). The improper collection and disposal of solid waste also pose a threat as vermin and insects breeding ground that can be the source for air- and water-borne diseases (The World Bank, 2012). Currently, Malaysia has 157 operating disposal sites but only 24 are sanitary landfills (SWCorp, 2016). The unsanitary landfills are waste disposal sites without proper engineering plans to accommodate for the appropriate treatment of leachate, methane and carbon dioxide gases generated from decomposed waste process (Ithnin, 2016). The unsanitary landfills can be a source for leachate contamination seeping into land and water courses posing a threat to water quality, odour, and public health as well as GHGs emissions. In 2017, 11 percent out of 189 Malaysia's river basins were categorised as polluted (Nair, 2018, para. 2).

The heavy reliance on landfills has also resulted to over utilisation of landfill operating capacity. The alarming increasing waste flows are filling both the sanitary and unsanitary landfills rapidly resulting in the premature closure of disposal sites (Hamid and Periathamby, 2012). Economic progress and the spread of urbanisation has made land scarce and expensive that disposal capacity is becoming insufficient. Moreover, new landfills could not be located near the vicinity of residential areas as

they are deemed socially undesirable (Hassan and Rahman, 2000; Moh and Manaf, 2017).

Another green effort worth mentioning are incineration and waste-to-energy technologies that have been incorporated into Malaysia green growth strategies. Incineration is the second waste disposal option in Malaysia (Zainu, Syukri, Mohamad and Songip, 2015). It involves burning of waste that reduces the waste volume of up to 95% (Lau, 2004). Despite the high investment and operation cost, inconsistent waste volume and waste characteristics greatly influence its efficiency making it currently unsuitable (Fazeli et al., 2016). Therefore, waste separation practice is vital to improve waste composition enabling the waste-to-energy initiative to become a relevant and economical technology adoption. Without waste separation, embracing the state-of-the-art technologies will not be cost effective due to the unstable combustion and increased formation of air pollution resulting in high organic content (Xiao et al., 2017).

The increasing waste generation trend has intensified the financial needs to manage MSW. Managing solid waste for residential areas usually receives the largest budget allocation from local authority due to its high political profile and complex character (Samsudin and Don, 2013; The World Bank, 1999). In Malaysia, municipalities are spending more than 50% of their operating budget on MSW collection (Manaf et al., 2009; Behzad, Ahmad, Saied, Elmira and Mokhtar, 2011; Saeed, Hassan and Mujeebu, 2009). Annually, the government spent RM2 billion to manage solid waste and the cost is expected to increase rapidly if there is low cooperation from the public to practice 3R (Rahman: Practise 3R, 2016, para. 2).

In the global context, adopting green growth development strategies has now become imperative for Malaysia. During Conference of Parties 15 to the United Nations Framework Convention on Climate Change (COP15), Malaysia has pledged to voluntarily reduce GHG intensity of GDP by 40% of the 2005 level by the year 2020. While ensuring sustainable development and being one of the member states in the United Nations, Malaysia has pledged and committed to the 2030 Agenda for Sustainable Development. In the Third National Communication Second Biennial

Report to the UNFCCC (2018), Malaysia stated its aspiration to achieve 40% diversion of waste from landfill by 2030 through utilising waste as resource and targeted 22% recycling rate for household waste by 2020 (Government of Malaysia, 2018). The 11th Malaysia Plan also emphasised to achieve 22% recycling rate of household waste as part of the sustainable consumption and production initiative by 2020.

There is a large difference in solid waste management practices between developed and emerging economies. The developed economies have organised, high collection coverage equipped with sophisticated technologies, thus focus its resources on waste-to-resource conversion and waste reduction. In the European Union, trends of solid waste treatment show that lesser waste are disposed at landfill due to increasing trend of alternative waste treatment such as recycling, composting and incineration. On the other hand, the emerging economies are still coping with issues to increase collection coverage, upgrading waste disposal to controlled landfills while having the informal sector actively involved in recycling (Behzad et al., 2011; World Bank 2012, n.d.).

Separation of waste for recycling reduces the volume of waste to the waste stream, reduces the use of virgin materials, minimises greenhouse gases emissions from landfills, as well as expand the lifespan of landfills (Akil et al., 2015; Challcharoenwattana and Pharino, 2016). Researchers have suggested that recycling is the most suitable environmental-friendly alternative as the materials can be used for infinite cycles (Chang et al., 2016; Johari, Alkali, Hashim, Ahmed and Mat, 2014; Keramitsoglou and Tsagarakis, 2013; Ferreira et al., 2017; Xevgenos et al., 2015). In addition, the emissions of landfill gases such as methane from decomposed organic waste contributing to greenhouse gases will also be reduced (Dinie et al., 2013; Hamid and Periathamby, 2012). In addition, effective waste separation among the households will reduce collection time (Hassan and Rahman, 2000), increase the quality of recyclables and enhance the efficiency of the recycling process (Varotto and Spagnoli, 2017).

Waste separation at source was made mandatory beginning June 2016 for households to separate their waste according to paper, plastics, food waste and others

(Edward, 2016, para. 1). The recent mandatory waste separation at source showed an upsurge of recycling rate to 21%, but this rate was low compared to neighbouring countries (Mentek, 2018). The number was lower compared to those of developed countries such as Austria (63%), Germany (62%), Belgium (58%), the Netherlands (51%) and Switzerland (51%) as well as the neighbouring countries including Thailand (22%:2009), Korea (66%:2010), Singapore (61%:2013) and Taiwan (60%:2011) (SWCorp, 2014).

Malaysians have also been reported to dump trash inappropriately. Rubbish are dumped down the toilet, kitchen sinks and manholes clogging the sewerage pipes. In 2014, a total of 70,000 tonnes of trash were recovered from the sewerage system (Meikeng, 2016, para. 2). Common items found were plastic utensils, food waste, plastic wrappers, bottles, furniture and electronic gadgets. An amount of RM26 million had to be spent to clear the blockages in the sewerage system in 2015 (Meikeng, 2016, para. 2). The nation was also awakened by the tragedy where a broken chair thrown from a high-rise building took the life of a teenager (Nokman, 2018, para. 2). These incidences not only indicate that waste separation at source and recycling are uncommon among Malaysians but they indicate poor behaviour in matters concerning waste and the environment.

The success of achieving high recycling rate is highly dependent on public participation (Barr and Gilg, 2005; Vicente and Reis, 2008). Understanding the internal and external factors that influence public participation and acceptance of the established policies is an important area to be researched (Badgie et al., 2012; Kirakozian, 2016; Varotto and Spagnolli, 2017). Understanding the public's level of knowledge, attitude and practice regarding waste separation and recycling is critical to improve household engagement into waste separation and recycling programmes (Akil et al., 2015; Dinie et al., 2013; Moh and Manaf, 2017; Tonglet et al., 2004; Vicente and Reis, 2008).

The purpose of the study is to examine how attitude, subjective norms, perceived behaviour control and perceived effectiveness of the related policy instruments influence individual practice on waste separation at home. These findings

will be beneficial for the government and policy makers to improve policy intervention and promotional campaigns that will consequently improve the waste management services thus inculcating effective waste separation and recycling behaviour.

1.3 Statement of the Problem

The increasing waste generation trend is one of the major threats to sustainable development in any society. Changes in society's lifestyle have also altered the society to highly depend on a wide usage of packaging materials. The surge in packaging material consumption has resulted in the rapid increase of waste generation in Malaysia. Waste separation and recycling have been recognised to reduce the amount of waste to the landfills. However, the recycling rate among Malaysians is still low compared to its neighbouring countries. In early 2016, 6 months after the introduction of the waste separation programme, it was reported that only 15% of Malaysians separate their waste (Palansamy, 2016, para. 1). Large amount of waste is disposed without proper sorting which hinders waste recycling and causes potential environmental pollution. According to Zhang, Lai, Wang and Wang (2019), appropriate waste sorting can help to reduce up to 40% household waste for reuse or reproduction of new products.

Separation of waste at source is a popular approach adopted in many countries as part of waste management strategies. The success of waste separation is dependent on active participation at the household level as it involves significant amount of time, storage area, money and effort. Consequently, the households' decision to participate in waste separation and recycling activities is complex as it is influenced by various factors. Due to the complexity of issues involved, recycling has been the most studied environmentally responsible behaviour since the last four decades (Boldero, 1995; Lizin, Dael and Passel, 2017).

Scholars have suggested that successful recycling programmes require a comprehensive understanding of the household's attitude towards recycling and perception on the barriers to perform recycling (Chen and Tung, 2010; Knussen, Yule,

Mackenzie and Wells, 2004). Among the early research into waste recycling includes (Boldero, 1995) on newspaper recycling and (Taylor and Todd, 1995) on integrated model on household waste recycling and composting behaviour. Among the variables studied were moral norms, past experience, situational factors and consequences of recycling (Tonglet et al., 2004); moral obligation and self-identity (Pakpour, Mohammadi, Mahdi, Asefzadeh and Pearson, 2014), infrastructure convenience, familiarity, social pressure (Sidique, Lupi, and Joshi, 2010), environmental awareness (Ramayah, Lee and Lim, 2012) and perceived policy effectiveness (Wan, Shen and Yu, 2014b).

Recent studies have focused on government intervention on policy instruments to assess the effectiveness of policy implementation. Xu, Zhou, Lan, Jin and Cao (2016) stated that in order to increase recycling rates, the government should incorporate market's perspective on recycling through availability of facilities and pricing mechanism. Wan et al. (2014a), Wan et al. (2014b) and Liao (2018) has focused on the influence of public perception on policy instrument effectiveness to encourage recycling participation. Meanwhile, the impact of demographic characteristics such as age, gender, family size, education level and monthly income on recycling participation has not been conclusive (Hong and Adams, 1999; Ma and Hipel, 2016; Oztekin, Teksöz, Pamuk, Sahin and Sultan, 2017).

Public support is significant for effective implementation of waste management policy. As Steg and Vlek (2009) highlighted, public support on environmental policies provides a useful indicator to authorities of public concern on the issue. One of the measures of public support is through assessing the public's perception on policy effectiveness. The public's behavioural responses towards various policy instruments implemented within the solid waste management policy would help to improve waste management framework thus provide the policy makers with recommendations on how to improve current programmes and initiatives.

Therefore, the study investigates what are the factors influencing waste separation intention and behaviour among households in Kuala Lumpur. In order to assess household perception on implemented policies, the study first establishes the

coverage of policies and Acts governing the household waste separation behaviour in Malaysia. The study also assess what is the level of waste separation practice among households according to the established guideline. Based on collected data on the psychological factors and the defined policy variables, the study assesses whether a waste separation behaviour model can be developed. It is based on this waste separation behaviour model that the study analyses what are the factors influencing waste separation intention and behaviour, and assesses if waste separation intention mediates the relationships between the independent variables and the waste separation behaviour.

Policy makers have to fully understand the factors influencing household waste separation intention and behaviour in order to provide effective government intervention on programmes and strategies. This study will assist the government to develop an improved MSW policy that translates to practical implementation of the national strategy into local action. Furthermore, as the waste policy initiatives were adopted from western countries, the local context is important as some initiatives may not be replicable to Malaysia. Analysing the importance of each factor at influencing waste separation behaviour will provide recommendations on how to encourage households to perform waste separation and recycling. Understanding how policy instruments drive household waste separation behaviour would also be vital to ensure the success of recycling and waste separation programmes in Malaysia.

1.4 Research Objectives

The objectives of the research are:

- (a) to examine the related solid waste management policies and Acts governing the household waste separation activity in Malaysia;
- (b) to investigate waste separation practice among households in Kuala Lumpur;
- (c) to develop the waste separation behaviour model;

- (d) to analyse the factors influencing waste separation intention and behaviour among households in Kuala Lumpur;
- (e) to analyse the mediation effect of waste separation intention between psychological variables (attitude, subjective norms, perceived behaviour control) and the perceived policy effectiveness (PPE) variables (capacity building, inducement, mandates and system-changing) and waste separation behaviour; and
- (f) to propose recommendation on policies and practices in the area of household waste separation behaviour in Kuala Lumpur.

1.5 Research Questions

The research questions are as follows:

- (a) What is the coverage of policies and Acts governing the household waste separation and recycling behaviour in Malaysia?
- (b) What is the level of waste separation practice among urban residents?
- (c) Can a waste separation behaviour model be developed?
- (d) What are the factors influencing waste separation and recycling behaviour among household urban residents in Kuala Lumpur?
- (e) Does waste separation intention mediate the relationship between Attitude, Subjective Norms, Perceived Behaviour Control, PPE Capacity Building, PPE Mandates, PPE Inducement, PPE System Changing and waste separation behaviour?

1.6 Research Hypothesis

In order to address the research objectives and research questions as highlighted in Section 1.5 and Section 1.6, this section lists the research hypotheses. Research hypotheses provide a proposition, stated as a relationship between variables, which predicts the research findings based on empirical data. Hypotheses are derived from the theory on which the conceptual model is based on. Testing the hypotheses and confirming the relationships will provide the solutions to correct the encountered problems (Sekaran and Bougie, 2016). This study's objectives are to examine how each variable influences the waste separation intention and waste separation behaviour, in the extended Theory of Planned Behaviour (TPB) model. The predictions derived from the understanding of issues gathered in the study are as listed in Table 1.3.

Table 1.3 The research hypothesis for the respected paths

Hypothesis	Hypothesis Statements
H1	There is no significant relationship between Attitude and Waste Separation Intention
H2	There is no significant relationship between Subjective Norms and Waste Separation Intention
H3	There is no significant relationship between Perceived Behaviour Control and Waste Separation Intention
H4	There is no significant relationship between Perceived Policy Effectiveness of Capacity Building and Waste Separation Intention
H5	There is no significant relationship between Perceived Policy Effectiveness of Policy Mandates and Waste Separation Intention
H6	There is no significant relationship between Perceived Policy Effectiveness of Inducement and Waste Separation Intention
H7	There is no significant relationship between Perceived Policy Effectiveness of System Changing and Waste Separation Intention
H8	There is no significant relationship between Waste Separation Intention and Waste Separation Behaviour
H9	Waste separation intention mediates the relationships between attitude, subjective norms, perceived behaviour control, PPE capacity building, PPE mandates, PPE inducement, PPE system changing and waste separation behaviour.

1.7 Conceptual Framework

Policy implementation reflects the process of transforming government decisions into plans, programmes and strategies with some support from legislation and regulations aimed at the betterment of the public. Policy analysis according to Fincher (1987) is the process of analysing policy for clarifying policy issues into smaller and manageable problems for the purpose of interpreting and development of implementation strategies (Gill and Saunders, 1992). Policy analysis can provide opportunities for improvement through policy alternatives and programme improvements. In this research, the focus of policy analysis is on policy implementation on programmes and strategies in NSWMP 2016 to transform the waste separation behaviour among the households.

Policy measures are tools that are commonly used by the government to motivate the target population towards the desired behaviour. Policy measures that are perceived as effective increase the attractiveness of pro-environmental behaviour. Steg and Vlek (2009) highlighted that policy instruments that are viewed as effective can gain higher level of acceptability from the target population as has been examined in the transportation and energy sectors. This implies that a motivational device that is perceived to be effective would induce a higher level of intention to perform the particular behaviour.

In the context of recycling, the study by Wan, Shen and Yu (2014b) has shown that perceived effectiveness of policy instruments or PPE positively influence recycling intentions. Wan et al. (2014b) has empirically tested the relevance of perceived policy effectiveness from the recycling behaviour perspective using the Theory of Planned Behaviour (TPB). The PPE has been used as a direct predictor of waste separation intention which contributed to about 20% in explaining behavioural intention. Nevertheless, the perceived policy effectiveness was measured as a single construct. Recently, Liao et al. (2018) has broken down the PPE construct into capacity building and inducement to better address the PPE construct at influencing waste separation behaviour among rural households.

As it is important to understand how each policy tool influences waste separation behaviour, this study will assess the PPE variable according to several categories. The categories are drawn from theories on effects of governmental action and observed choices of policy maker. According to McDonnell and Elmore (1987), policy instruments can be categorised into four, which are mandates, inducements, capacity building and system changing. These policy tools categories are adopted to classify the programmes and strategies of the National Solid Waste Management Policy 2016 into PPE mandates, PPE inducements, PPE capacity building and PPE system changing. The definition of the policy tools categorisation will be further explained in Section 2.2.3.

Previous recycling and waste separation studies have used the TPB to investigate factors influencing household intention and behaviour. This study combines the factors in the TPB with PPE of policy tools categories into an extended TPB model. This will provide an insight into the households' perspective on how each policy tool influences their waste separation intention and behaviour.

Positive public perception on policy effectiveness will likely induce positive waste separation behaviour. By investigating each category of the policy tools, the researcher would be able to observe each policy category's magnitude of influence on waste separation behaviour. This will provide information on the type of policy tools that has the highest impact on waste separation behaviour and provide information on initiatives to enhance policy implementation.

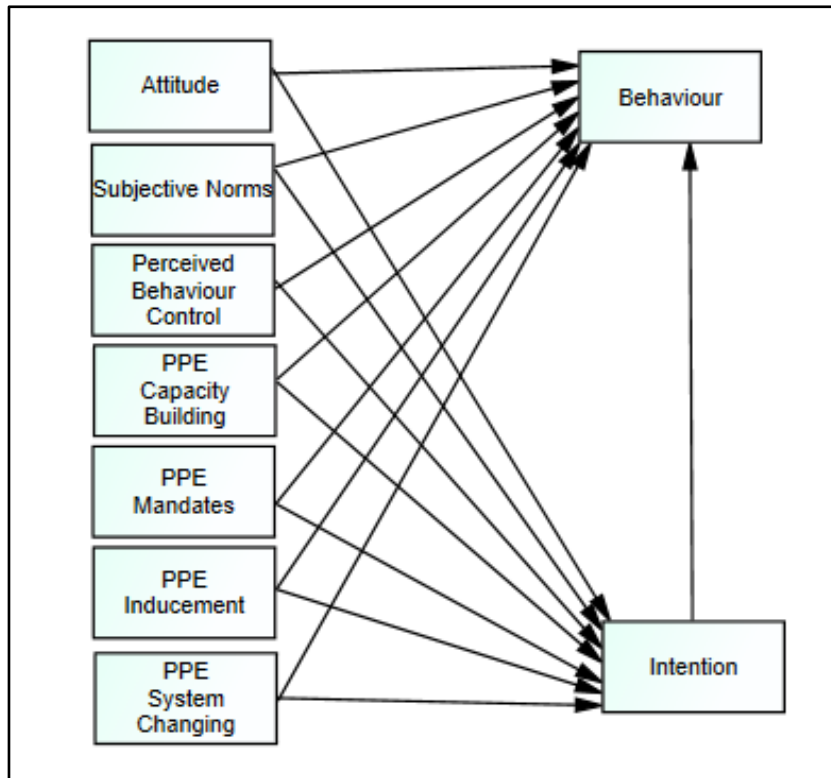


Figure 1.1 Conceptual framework

At the end of the study, a waste separation behaviour model will be developed providing information on the determining factors influencing waste separation intention and behaviour. In addition, recommendations on policies and practices in the area of household waste separation behaviour in Kuala Lumpur will be offered to assist policy makers to enhance the implemented policies to further enhance waste separation behaviour among the households.

1.8 Theoretical Overview

A theory is a set of systematically interrelated constructs and propositions intended to explain and predict a phenomenon or behaviour of interest, within certain boundary conditions and assumptions. Essentially, a theory is a systemic collection of related theoretical propositions. While propositions generally connect two or three constructs, theories represent a system of multiple constructs and propositions. Hence, theories can be substantially more complex and abstract and of a larger scope than propositions or hypotheses.

The Theory of Planned Behaviour provides a theoretical framework to systematically investigate the factors influencing behaviour. The theory hypothesised that behaviour is determined by an individual's intention to perform the behaviour while the intention to perform such behaviour is influenced by three factors which are attitude, subjective norms and perceived behavioural control. Intention captures the motivational factors that influence the behaviour. Attitude refers to the individuals' belief in performing the behaviour; subjective norms refers to the perceived expectations of other individuals or groups that are considered important to the individual while perceived behavioural control refers to the individual's perception on his/her capability in performing the behaviour (Ajzen, 1991).

This theory is an extension on the Theory of Reasoned Action with the introduction of a third variable which is the perceived behaviour control to overcome the limitation in predicting behaviour under incomplete volitional control. The theory assumes that people behave rationally and understand the consequences of their actions. Figure 1.2 provides the TPB model.

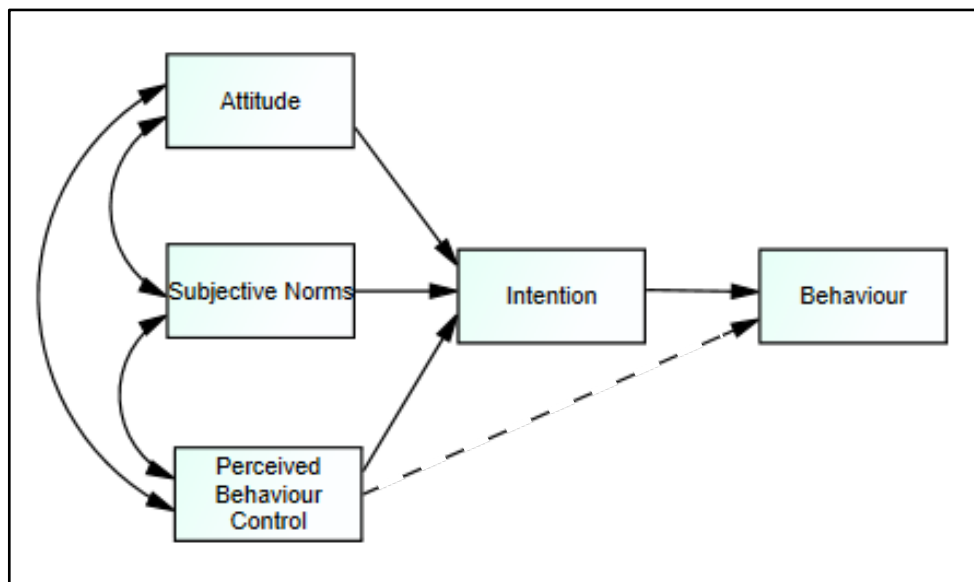


Figure 1.2 Theory of Planned Behaviour (Ajzen,1991)

Previous studies have examined the factors influencing recycling behaviour through the usage of TPB (Lizin, Dael and Passel, 2017; Stoeva and Alriksson, 2017; Taylor and Todd, 1995; Tonglet et al., 2004; Wan et al., 2014b). Previous research has indicated that recycling behaviour is influenced by various factors including attitude towards recycling, the convenience of recycling programmes and perceived policy effectiveness.

Ajzen (1991) has allowed the inclusion of additional variables in predicting behaviour in the model. Additional variables researched include moral norms, past experience, situational factors, consequences of recycling (Tonglet et al., 2004), perceived lack of facilities (Chen and Tung, 2010), action planning (Pakpour, Mohammadi, Mahdi, Asefzadeh and Pearson, 2014), and perceived policy effectiveness (Wan, Shen and Yu, 2014a). Prior research has improved the predictive variance by enhancing the variables on cognitive and external factors. Scholars have also examined both internal incentives and external factors affecting recycling performance such as the government interventions and market interventions. (Hornik, Cherian and Madansky, 1995; Xu, Ling, Lu and Shen, 2017a).

A policy instrument acts as a motivational device to induce higher level of intention to perform the desired behaviour. Therefore, in extending the research on policy effectiveness, the TPB is suitable to be expanded to include assessment of the impact on household waste separation and recycling behaviour. This will explain the significance of a particular recycling programme and initiative to assist the government at allocating resources according to the various policy instruments. It is necessary to evaluate the effectiveness of the strategies and management in the local context continuously.

1.9 Significance of Study

Worldwide, countries are transitioning towards low-carbon and green economies. Adopting green growth development strategies has now become imperative for Malaysia. The world trend on SWM has evolved from mere disposal

towards sustainable waste management. However, various researchers have repeatedly reported the poor participation of Malaysian household in performing recycling. The recycling rate recorded a mere amount of 5% in 2005, increasing to 15% in 2015 and recently achieving 21% in 2017. Nevertheless, Malaysia's green growth strategies have emphasised to achieve 22% recycling rate of household waste by 2020, with a further 40% diversion of waste from landfill by 2030.

In tandem with the set target, Malaysia having adopted the 2030 Agenda for Sustainable Development will have to report the achievement for 17 Sustainable Development Goals (SDGs). Goal 12 of the SDG is on sustainable production and consumption, and includes the reporting of the country's recycling rate. Implementation and success of this initiative rely on the country's own policies, plans and programmes. Therefore, continuous understanding on the impact of the implemented policy measures will assist in refining government intervention strategies to further improve waste separation practices among the households.

Studies on solid waste in Malaysia has mainly focused on the general status of solid waste management with limited research done to understand public participation in undertaking waste separation and recycling behaviour (Akil et al., 2015; Moh and Manaf, 2014). Currently, there is limited information available on households' responses to the current curbside recycling and waste separation programme. This research will provide an insight into the current curbside recycling scheme to further improve recycling services and policy measures to inculcate recycling among the urban households.

As highlighted by Triguero and Cuerva (2016), environmental studies in industrialised nations may not be suitable for developing country's adoption due to differences in local context and the level of public environmental awareness. The acceptability of policy tools varies according to local characteristics including waste characteristics, socio-demographic profiles, local culture and climate as well as the affordability to sustain the local SWM system (Hassan and Rahman, 2000; Wilson, Rodic, Scheinberg, Velis, and Alabaster, 2012). This study will also provide an insight into factors that influence waste management practices among households according

to the Malaysian experience with local policy measures. In addition, waste management studies have continuously been researched to identify the motivations and barriers, particularly from the developed nations perspective (Barr et al., 2013). Therefore, this study will contribute towards the enrichment of literature from the developing economy context.

The success of the future integrated waste management system highly depends on growing and sustaining the participation from households to correctly separate their recyclable waste. One of the contribution of researching the behavioural dimensions of policy tools is that the study would be able to provide comparative analysis on the relationship between policy tools and the target population's level of participation. In order to achieve policy goals for better and effective recycling programmes, information on how government strategies provide motivational drive is important. Identifying household determinants will assist the government in examining the required policy measures and initiatives to improve recycling rates. This will benefit the government in terms of better implementation and better value-for-money investment.

1.10 Scope of Study

The National Solid Waste Management Policy 2016 has 6 objectives and 6 thrusts. Objective 2 of the policy focuses on minimisation of domestic, commercial, industrial, institution, community and construction waste through 3R activities. Nevertheless, as household waste generation is the largest proportion of the MSW and the most complex due to its composition, this study focuses on household waste. In addition, based on household waste generation profile, this study focuses on those living in landed houses for medium and high cost types as these segments of the population are the largest waste generation producer as highlighted in Table 1.4.

The Survey on Solid Waste Composition, Characteristics and Existing Practice of Solid Waste Recycling in Malaysia (2012), a study by Department of National Solid Waste Management (DNSWM), indicated that the average urban households waste

generation in Peninsular Malaysia stood at 0.83 kg/capita/day compared to rural households at 0.73 kg/capita/day. In the urban area, the total medium cost landed households generate more waste compared to those living in high-rise properties. Therefore, this study focuses on households living in landed properties. Detail of waste generation according to household types is presented in Table 1.4.

Table 1.4 Average household waste generation in Malaysia 2012 (Survey on Solid Waste Composition, Characteristics and Existing Practice of Recycling in Malaysia, Final Report 2012)

House Type	Urban		
	Population	Per capita (kg/capita/day)	Total (tonne/day)
Low cost (Landed)	2,675,954	0.74	1,988
Low cost (High-rise)	3,778,052	0.63	2,394
Medium cost (Landed)	8,167,292	0.89	7,245
High-Medium cost (High-rise)	2,366,232	0.89	2,095
High cost (Landed)	3,137,440	0.73	2,303

Although 3R activities reflect the activities of reduce, reuse and recycle, this research will only focus on recycling and waste separation activities at home. A study by Barr et al.'s (2001) reveals that the factors that influence waste reduction and reuse are fundamentally different from those that drive recycling behaviour. The complex relationship of waste reduction and recycling behaviour have also been reported in both Tonglet et al. (2004) and Vining and Ebreo (2001) studies. Bortotelo et al. (2013) has also highlighted that recycling and waste prevention are influenced by different factors requiring specific analysis to increase individuals' engagement in 3Rs activities. Therefore, this study will focus on waste separation at home instead of the whole range of 3R activities.

The action, context and time elements of curbside recycling differ to other forms of recycling such as drop-off recycling. The amount of effort and time needed to undertake recycling also differ between curbside and drop-off system. Participating in curbside recycling requires lesser effort compared to drop-off system which requires

determination of preparing the waste for collection at a certain time of day (Best and Kneip, 2011; Keramitsoglou and Tsagarakis, 2013; Sidique, Lupi, and Joshi, 2010). In order to ensure consistent attitude and behaviour in terms of action, time, target and context, the study focuses on waste separation among the landed households. Moreover, the behavioural cost of undertaking recycling between high-rise and landed properties differ (Yau, 2010). Therefore, house type homogeneity is another component to be considered in the context of recycling behaviour.

The policy measures on recycling in Malaysia may be similar to other countries but are unique to Malaysia's context in terms of their implementation. Therefore, the findings may be generalised to Malaysia but not to other countries with different policy implementation tools. Another limitation of this study is the use of self-reported questionnaire which may be subjected to over-reporting. As highlighted by Armitage and Conner (2001), self-reported measures result in higher behaviour variance as compared to observed behaviour.

1.11 Definition of Terms

A measurement process involves quantifying observations in an objective and a consistent manner. The description and meaning of key terms in this study are explained below.

1.11.1 Waste Separation Behaviour

Behaviour is the way a person conducts or gets involved in a physical activity. Behaviour can be described as an individual's attempt to perform a certain state of affair, either to maintain or change the existing one (Berner, 2011). According to SWPCMA 2007 or Act 672, "recycling" means to collect and separate solid waste for the purpose of producing products. Based on the guideline provided by the Ministry of Urban Wellbeing, Housing and Local Government (2015), the separation of waste is categorised into 5 which are plastic, paper, other, residual and garden waste.

Categories for recyclables are classified into 3 which are plastic, paper and “others”. “Others” refer to recyclable materials that fall under either one of the categories: (1) glass/ceramic, (2) metal/steel/aluminium cans, (3) electronic waste/small electrical appliances, (4) leather/rubber/shoes/fabric, and (5) hazardous household waste.

Separation of waste at source refers to the activity of “distinguishing recyclables from the rest of the refuse, adequately preparing items for collection (e.g. washing and/or squeezing them), throwing them in the right bin and then bringing them to the curb or the nearest drop-off collection center” (Varotto and Spagnoli, 2017, p. 169). Scholars have also highlighted that it is important to measure the action close to the timeframe the behaviour is performed. In this study, waste separation behaviour is defined as the activity of segregating recyclables for curbside collection in the past four weeks.

1.11.2 Waste Separation Intention

Waste separation intention is an important variable that mediates the attitude-behaviour relationship. Households are more likely to perform the target behaviour when the tendency to perform is high. The degree to which the intentions are formed will completely mediate the attitude-behaviour relationships. Park and Ha (2014) refers to recycling intention as the individual’s self-commitment to engage in recycling behaviours. In this study, waste separation intention is measured similar to Liao et al. (2018) and Wan et al. (2014b) in which the research is carried out by asking respondents their intentions to separate waste and their willingness to participate in recycling schemes.

1.11.3 Attitude

Attitude refers to the tendency of an individual to perform a behaviour (Ajzen and Fishbein, 1977). Attitude towards a certain behaviour is composed of affective feeling of performing the behaviour and the instrumental knowledge on the outcomes

of performing the action (Ajzen, 1991). Scholars such as Knussen et al. (2004) and Davies, Foxall and Pallister (2002) include both attributes to measure attitude. On the other hand, studies that define attitude in terms of affective feeling of performing the behaviour are Chen and Tung (2010), Lizin et al. (2017) and Tonglet et al. (2004) while scholars such as Ramayah et al. (2012), Vining and Ebreo (1990) define attitude from the respondents' instrumental knowledge. To predict behaviour from attitude, the researcher has to ensure high correspondence between the attitude and action elements of the measures employed. Based on the available literature, attitudes in this study is operationalised as the individual's feelings or affective judgement and instrumental knowledge towards waste separation behaviour.

1.11.4 Subjective Norms

Subjective Norms refer to the presence of relevant others such as family members, friends or non-governmental organisation in performing or influencing the waste separation behavior. (Vining and Ebreo, 1990; Hornik et al., 1995). As waste separation is a visible activity, society may exert pressure on the households to perform that behaviour. The relevant others may include family, friends as well as environmental groups and the government. The significance of social norms has been found in studies by Ramayah et al. (2012), Lizin et al. (2017) but not by Vining and Ebreo (1990), Botetzagias et al. (2015) and Zhang et al. (2019). As defined by previous scholars, this study measures subjective norms as the circle of influence around the respondent such as family, friends and environmental groups.

1.11.5 Perceived Behaviour Control

Ajzen (1991) defines perceived behaviour control as one's self-efficacy and the facilitating conditions such as time, space and convenience a person has at motivating the waste separation behaviour. Davies et al. (2002) operationalises PBC by asking how much control a person has over the measured behavior and opportunities underpinning the behavior. Both internal and external attributes are

important to influence the intention to perform such behaviour. Wan et al. (2014b) and Liao (2018) identifies that this factor is significant in predicting recycling intention. Therefore, this study measures PBC as an individual's perceived ability such as knowledge of the behaviour and the personal conditions to perform the behaviour.

1.11.6 Perceived Policy Effectiveness

The perceived policy effectiveness (PPE) refers to the individual's perception on the effectiveness of a specific policy measure at accomplishing specified goals. The government exercises policy instruments in their plans and programs in an attempt to affect social change, thus accomplishing the desired policy goals. The selection of policy instruments is based on each national government preference taking into consideration the state-society relations (Howlett, 1991). According to McDonnell and Elmore (1987), policy instruments can be classified into four generic classes which are mandates, inducements, capacity-building and system-changing. How the target population perceive the policy measures implemented would have an impact on its level of participation towards the intended behaviour. The following paragraphs provide the definition of PPE of the policy tools based on McDonnell and Elmore (1987) categorization.

1.11.6.1 Perceived Policy Effectiveness: Capacity Building

A capacity building tool provides the related information, training, education and resources to enable the target population to carry out the required activities contributing to the policy goals. This includes outreach and information programmes by providing the required information and sufficient facilities to change the current practice. Capacity building policy measures assumes the household has sufficient motivation if proper information and sufficient resources are made available. Education efforts, services and facilities will increase public understanding thus enhances their rationality to participate in waste separation activities. Boldero (1995) and Chen and Tung (2010) have highlighted that a programme's perceived inadequacy

influences the non-participatory behaviour. Similar to the study by Wan et al. (2014b), PPE Capacity Building is measured by asking the respondents' level of favourableness or unfavourableness toward the effectiveness, clarity and adequacy of information and waste separation facilities.

1.11.6.2 Perceived Policy Effectiveness: Mandates

According to McDonnell and Elmore (1987), mandates are “rules governing the action of individuals and agencies, and are intended to produce compliance”. Mandates are authority tools backed by legitimate authority to guide intended behaviour to achieve policy aims. The utilisation of mandates are deemed required for the specified action stipulated in the policy to occur which would not have happened without this external prescription. Mandates require enforcement that places the responsibility for ensuring adequate resources on the government. Perceived policy effectiveness of mandates refer to the effectiveness of the enforcement rules and agencies and the supporting environmental policies at enforcing recycling and waste separation at source. A recycling programme that is perceived to be supported by sound policies and managed efficiently will have positive influence on an individual's recycling behaviour (Omran, Mahmood, Abdul Aziz and Robinson, 2009). In this study, PPE mandates refer to the perceived effectiveness of the current policy, including the issuance of warnings and penalties, at producing compliance to the desired behaviour.

1.11.6.3 Perceived Policy Effectiveness: Inducement

Incentive refers to the use of tangible payoffs which can either be positive or negative to induce the target behaviour. In the study by Xu et al. (2017a), PPE Inducement refers to the level of favourableness towards monetary initiatives as an effective influence on waste separation intention and behaviour. It is assumed that the target population are utility maximisers who will be influenced by the tangible payoffs. Providing inducements may instigate the target population to take the opportunity to

participate in waste separation activities. Perceived policy effectiveness on inducements in this study refers to the level of sufficient market incentives provided by 672 Act to the households to induce recycling and waste separation behaviour.

1.11.6.4 Perceived Policy Effectiveness: System Changing

System changing refers to the change of authority or the institutional structure of delivering the goods and services to the target population. System changing alters the distribution of authority which significantly alters the efficiency of the system. Public participation in policy and programme implementation increases the public's sense of ownership. Outreach programmes that involves active formulation and implementation with the community are able to attain households recycling behaviour (Folz and Hazlett, 1991; Uittenbroek et al., 2019). Therefore, the measurement for system changing is defined as the level of public's favourableness towards a public participatory process in policy formulation and programme implementation.

1.12 Summary

Researchers have suggested that successful recycling programmes require a comprehensive understanding of the households' attitude towards recycling and their perception on the barriers in undertaking recycling (Chen and Tung, 2010; Knussen et al., 2004). The low recycling rate in Malaysia has led to an interest in understanding which behavioural determinants and policy initiatives drive households to undertake waste separation at source. The Theory of Planned Behaviour (TPB) provides the theoretical framework for this research. Wan and Shen (2013) discusses the significance of incorporating perceived policy effectiveness (PPE) in understanding of the factors that influence recycling behaviour. The conceptual framework based on an extended TPB emphasises that attitude, subjective norms, perceived behaviour control variables and the perceived policy effectiveness variables are important to enhance understanding on factors that influence waste separation behaviour. It is vital to investigate factors influencing household waste separation behaviour in order to

provide improved policy intervention on programmes and initiatives to pursue Malaysia's green growth strategies. This study will contribute to the literature on household waste separation in the Malaysian context while providing a basis for practical recommendations to the government on waste separation at source. This study will benefit various agencies within the government sector, particularly agencies related to planning and implementation, as well as researchers in the waste management sector. The following chapter provides a literature review relating to waste separation and recycling.

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LIST OF APPENDICES

Appendix A The Initial and Amended Questionnaire Items

Variable : Waste Separation Behaviour		
The Initial Questionnaire	Amended Questionnaire	Sources
SB1 I have recycled my recyclables in the past 4 weeks.	SB1 I have separated my recyclables in the past four weeks.	Wan et al. (2014), Tonglet et al. (2004)
SB2 I separate my paper/cardboard waste.	SB2 I separate my paper waste.	Adapted from Xu et al. (2017), Pakpour et al. (2014)
SB3 I separate my plastic waste.	SB3 I separate my plastic waste.	Adapted from Xu et al. (2017), Pakpour et al. (2014)
SB4 I separate my organic/food waste.	SB4 I separate my food waste.	Adapted from Xu et al. (2017), Pakpour et al. (2014)
SB5 I separate my other waste.	SB5 I separate my other waste.	do Valle et al. (2004)
SB6 I separate my used batteries.	Deleted.	Lizin et al. (2017)
SB7 I positively engage in waste separation.	SB6 I positively engage in waste separation.	Adapted from Ramayah et al. (2012), Karim et al. (2013)

Variable : Waste Separation Intention		
The Initial Items	The Amended Items	Sources
SI1 I intend to recycle my recyclables in the near future.	SI1: I intend to separate my recyclables in the near future.	Liao (2018) and adapted from Wan et al. (2014b), Pakpour et al. (2014), Knussen et al. (2004), Tonglet et al. (2004), Lizin et al. (2017).
SI2 I will recycle my recyclables every time I have it for disposal.	SI2: I will separate my recyclables every time I have it for disposal.	Liao (2018) and adapted from Wan et al. (2014b), Tonglet et al. (2004)
SI3 I am willing to participate in the recycling scheme in the future.	SI3: I am willing to participate in the waste separation scheme in the future.	Liao (2018) and adapted from Wan et al. (2014b), Knussen et al. (2004), Tonglet et al. (2004)
	SI4: I intend to separate my waste at every opportunity.	Adapted from Chu and Chiu (2003)
	SI5: I intend to separate my waste according to waste separation categories.	Own word

Variable : Attitude (Affective)		
The Initial Items	The Amended Items	Sources
ATT1 Recycling is good.	ATT1 Waste separation is good.	Adapted from Wan et al. (2014b); Pakpour et al. (2014); Knussen et al. (2004); Tonglet et al. (2004); Liao et al. (2017)
ATT2 Recycling is useful.	ATT2 Waste separation is useful.	Adapted from Wan et al. (2014b); Pakpour et al. (2014); Tonglet et al. (2004); Liao et al. (2017)
ATT3 Recycling is rewarding.	Deleted.	Adapted from Wan et al. (2014b), Chen and Tung (2010); Lizin et al. (2017)
ATT4 Recycling is responsible.	Deleted.	Adapted from Wan et al. (2014b); Chen and Tung (2010); Tonglet et al. (2004);
ATT5 Recycling is sensible.	Deleted.	Chen and Tung (2010); Wan et al. (2014b); Lizin et al. (2017)
ATT6 Recycling is hygienic.	ATT4 Waste separation is hygienic.	Adapted from Wan et al. (2014b); Chen and Tung (2010); Tonglet et al. (2004); Liao et al. (2017)
ATT7 Recycling is satisfying.	Deleted.	Pakpour et al (2014)
ATT8 Recycling is beneficial.	Deleted.	Pakpour et al (2014); Liao et al. (2017)
ATT9 Recycling is wise.	ATT3 Waste separation is wise.	Adapted from Pakpour et al (2014)
ATT10 Recycling is necessary.	Deleted	Adapted from Xu et al. (2017)
ATT11 I find the idea of recycling pleasing.	ATTD5 I find the idea of waste separation pleasing.	Adapted from Knussen et al. (2004); Chen and Tung (2010); Chu and Chiu (2003)
ATT12 My feeling about recycling are positive.	ATTD6 My feeling about waste separation are positive.	Adapted from Knussen et al. (2004); Chen and Tung (2010)
ATT13 My feeling toward recycling are favourable.	ATTD7 My feeling toward waste separation are favourable.	Adapted from Knussen et al. (2004); Chen and Tung (2010)

Variable : Attitude (Instrumental)		
The Initial Items	The Amended Items	Sources
AI1: Recycling reduces pollution.	AI1: Waste separation reduces pollution.	Adapted from Xu et al (2017); Wan et al. (2014); do Valle et al. (2004); Ramayah et al. (2012); Sidique et al. (2010)
AI2: Recycling reduces wasteful use of landfills.	AI2: Waste separation reduces wasteful use of landfills.	Adapted from Xu et al (2017); Wan et al. (2014); Tonglet (2004); do Valle et al. (2004); Ramayah et al. (2012); Sidique et al. (2010)
AI3: Recycling conserves natural resources.	AI3: Waste separation conserves natural resources.	Adapted from Xu et al (2017); Wan et al. (2014); Tonglet (2004); do Valle et al. (2004); Ramayah et al. (2012); Sidique et al. (2010)
AI4: Recycling improves environmental quality.	AI4: Waste separation improves environmental quality.	Adapted from Xu et al (2017); C. Wan et al. (2014); Tonglet (2004); Sidique et al. (2010)
AI5: Recycling saves energy.	AI5: Recycling saves energy.	Xu et al (2017); Wan et al. (2014); Tonglet (2004); do Valle et al. (2004);
AI6: Recycling helps to reduce pollution.	Deleted.	do Valle et al. (2004); Ramayah et al. (2012); Sidique et al. (2010)
AI7: Waste separation and recycling can bring economic benefits.	Deleted.	Adapted from Xu et al (2017).
AI8: Recycling creates a better environment for future generations.	AI6: Waste separation creates a better environment for future generations.	Xu et al (2017); Wan et al. (2014); Tonglet (2004); Lizin et al. (2017)

Variable : Subjective Norm		
The Initial Items	The Amended Items	Sources
SN1 Most people who are important to me think I should recycle.	SN1 Most people who are important to me think I should separate my waste.	Adapted from Wan et al. (2014); Knussen et al. (2004)
SN2 Most people who are important to me would approve of my recycling.	SN2 Most people who are important to me would approve of my waste separation practice .	Adapted from Wan et al. (2014); Knussen et al. (2004)

SN3 My neighbours expect me to recycle household materials.	SN3 My neighbours expect me to separate my household materials.	Adapted from Sidique et al. (2012); do Valle et al. (2004)
SN4 My friends expect me to recycle household materials.	SN4 My friends expect me to separate my household materials.	Adapted from Ramayah et al. (2012); Sidique et al. (2012); do Valle et al. (2004)
SN5 My family expects me to recycle household materials.	SN5 My family expects me to separate my household materials.	Adapted from Ramayah et al. (2012); Sidique et al. (2012); do Valle et al. (2002); Liao et al. (2018)
SN6 My colleague expect me to recycle household materials.	Deleted.	Adapted from Xu et al. (2018)
SN7 Media influences me to recycle household materials.	Deleted.	Adapted from Chan (1998)
SN8 Environmental groups influence me to recycle household materials.	SN6 Environmental groups influence me to separate my household materials.	Adapted from Wan et al. (2014), Wan et al. (2017)

Variable : Perceived Behaviour Control		
The Initial Items	The Amended Items	Sources
PBC1: I have plenty of opportunities to recycle.	PBC1: I have plenty of opportunities to separate my household waste.	Adapted from Tonglet et al. (2004); Knussen et al. (2004); Wan et al. (2014), Wan et al. (2017); Liao et al. (2018).
PBC2: Recycling is convenient.	PBC2: Waste separation is convenient.	Adapted from Wan et al. (2014), Wan et al. (2017).
PBC3: Recycling is easy.	PBC3: Waste separation is easy.	Adapted from Wan et al. (2014), Wan et al. (2017); Knussen et al. (2004).
PBC4: I know where to take my household waste for recycling.	PBC4: I know where to take my sorted household waste.	Adapted from Wan et al. (2014), Wan et al. (2017); Tonglet et al. (2004).
PBC5: I know how to recycle my household waste.	PBC4: I know how to separate my household waste.	Adapted from Wan et al. (2014), Wan et al. (2017); Tonglet et al. (2004); Liao et al. (2018)
PBC6: I have enough time to sort the materials for recycling.	PBC6: I have enough time to sort the materials for recycling.	Wan et al. (2014), Wan et al. (2017); Ramayah et al. (2012); Sidique et al. (2012).
PBC7: I have enough space to store the materials for recycling.	PBC7: I have enough space to store the materials for recycling.	Wan et al. (2014); Xu et al. (2017); Ramayah et al. (2012); Sidique et al. (2012).

Variable : PPE Capacity Building		
The Initial Items	The Amended Items	Sources
PCB1 The government campaign provides clear guidelines on waste separation for recycling.	PCB1 The government campaign provides clear guidelines on waste separation.	Adapted from Wan et al (2014); Xu et al. (2017); Liao et al. (2018)
PCB2: The government campaign helps citizens understand how to prepare the materials to be recycled.	Deleted.	Adapted from Wan et al (2014); Xu et al. (2017); Liao et al. (2018)
PCB3 The Government's promotion helps citizens understand the importance of recycling.	PCB2 The Government's promotion helps citizens understand the importance of waste separation.	Adapted from Wan et al (2014); Xu et al. (2017); Liao et al. (2018)
PCB4 The Government's promotion clearly explains the benefits of recycling.	PCB3 The Government's promotion clearly explains the benefits of waste separation.	Adapted from Wan et al (2014); Xu et al. (2017); Liao et al. (2018)
PCB5 The Government's promotion increases awareness on the recycling scheme.	PCB4 The Government's promotion increases awareness on the recycling scheme.	Adapted from Wan et al. (2014), Liao et al. (2018), Xu et al. (2017), Floz (1999)
PCB6 The Government's promotion develops positive attitude towards recycling.	Deleted.	Adapted from Floz (1999), Timlett (2008), Chen and Tung (2010)
PCB7 The waste bins provided by government provides a favourable recycling for residents.	PCB5 The waste bins provided by government provides a favourable waste separation condition.	Adapted from Timlett (2008), Floz (1999), Stoeva et al. (2017)
PCB8 The size of waste bins provided by government provides a favourable recycling for residents.	PCB6 The size of waste bins provided by government provides a favourable waste separation condition for residents.	Adapted from Tonglet et al. (2004)
PCB9 The collection programme by government provides adequate array of separated materials to be collected.	Deleted	Adapted from Xu et al.
PCB10 The collection programme provided by government are	PCB7 The collection programme provided by government are effective	Adapted from Liao et al. (2018)

convenient and efficient for residents.	to collect the separated waste.	
PCB11 The mass media used by the Government via television programme and newspaper has been effective to me.	Deleted	Adapted from do Valle et al. (2002)
PCB12 The direct media used by the Government has increase the awareness on the recycling scheme (i.e., billboards, vehicle advertisement, broacher, flyers, etc.).	Deleted	Adapted from do Valle et al. (2002)
PCB13 The social media used by the Government via twitter and webpages has been effective to me.	Deleted	Adapted from do Valle et al. (2002)
PCB14 The government promotion provides information on recycling participation in my community and country.	Deleted	Adapted from Bishop and Davies (2012)

Variable : PPE Mandates		
The Initial Items	The Amended Items	Sources
PM1: Environmental Laws and penalties would oblige me to separate my waste correctly.	PM1: Environmental law would obliges me to separate my waste correctly.	Adapted from Xiao, Zhang, Zhu and Lin, (2017)
PM2: I will do better in recycling if my residential community has regulations for waste sorting.	PM2: Knowing that households will be penalised has made me more conscious of sorting my household waste.	Adapted from Folz and Hazrett (1991), Everett and Peirce (1993)
PM3: Issuance of warnings would oblige me to separate my waste correctly.	PM3: Issuance of warnings has been effective for me to comply to waste separation practice.	Adapted from Timlett and Williams (2008); Ogiri et al. (2019)
PM4: Imposing waste generation limit would oblige me to recycle my waste.	Deleted.	Adapted from Folz and Hazrett (1991), Xevgenous et al. (2015)

Variable : PPE Mandates		
The Initial Items	The Amended Items	Sources
PM5: The recycling programme is supported by sound environmental policy.	PM4: The government monitoring mechanism on waste separation is effective.	Chen et al., (2017); Baldach (1980)
PM6: I will continue to separate with expansion of materials in recycling programme.	Deleted.	Adapted from Xevgenous et al. (2015)
PM7: I will do better with continuous enforcement programme.	PM5: Enforcement programme obliges me to separate my waste correctly.	Ogiri et al. (2019); Baldach (1980); Chen et al. (2017),
PM8: I will do better if the penalty charges is imposed.	PM6: The penalty charges is sufficient for me to separate my waste correctly.	Ogiri et al. (2019); Baldach (1980); Chen et al. (2017),

Variable : PPE Inducement		
The Initial Items	The Amended Items	Sources
PPI1: I support the government to give away economic incentives to residents that carry out waste separation.	PPI1: There are sufficient economic incentives for residents to carry out waste separation.	Adapted from Xu et al. (2017); Xiao et al (2017); Vining and Ebreo
PPI2: I support the government initiative to impose charges on disposed waste.	Deleted	Adapted from Xevgenous et al. (2015)
PPI3: I support the government to intensify private sector for competitive recycling market.	PPI2: The price quoted by recycling companies are reasonable.	adapted from Xu et al. (2017)
PPI4 : I support the government initiative to impose penalties to residents who do not carry out waste separation and recycling.	Deleted	Adapted from Xevgenous et al. (2015)
PPI5 : I support the government initiative to impose levy on recyclable items.	Deleted	Adapted from Xevgenous et al. (2015), Welivita et al. (2015)
PPI6 : I support the government to legalise	PPI3: There are sufficient number of waste	Own adapted from Xu et al. (2017)

Variable : PPE Inducement		
The Initial Items	The Amended Items	Sources
the informal sector involvement for competitive recycling market.	collectors to sell my recyclable materials.	
PPI7: I support government initiative for manufacturers to acquire their used products.	PPI4 : There are sufficient types of recyclable items the collection companies are willing to buy.	Adapted from Xu et al. (2017)
PPI8: I support the government to give away other incentives like vouchers to residents that carry out waste separation.	PPI5: Incentives offered by collection companies are effective for residents to carry out waste separation.	Adapted from Xu et al. (2017)
PPI9: I support the government initiative for recycling cash back on electronic platform.	PPI6: There are sufficient recycling incentives on electronic platform.	Adapted from Xu et al. (2017)

Variable : PPE System Changing		
The Initial Items	The Amended Items	Sources
PSC1: The government informs the recycling target to citizens.	PSC1: Citizens are given adequate means for stating their views about solid waste programmes.	adapted from Hartley and Wood (2005), Vining et al. (1996); Wan et al. (2018)
PSC2: The government informs the recycling programme outcome to citizens.	PSC2: Sufficient platform are available to aggregate public opinion	adapted from Vining et al. (1996); Wan et al. (2018)
PSC3: Outreach programme involves active participation with the NGOs.	PSC3: The government is responsive to public input.	adapted from Garnett and Cooper (2014); Webler et al., (2001)
PSC4: Outreach programme involves active participation with the neighbourhood community.	PSC4: The government understood public needs.	Adapted from Wan et al. (2018)

Variable : PPE System Changing		
The Initial Items	The Amended Items	Sources
PSC5: The government provides positive image on recycling to citizens.	PSC5: Citizens' views are used in forming solid waste policies.	adapted from Vining et al. (1996); Wan et al. (2018)
PSC6: The recycling programme is organised systematically by the government.	PSC6: I am satisfied with the procedures governments use to involve citizens in formulating policies on solid waste.	Vining et al. (1996)
PSC7: The recycling programme executed portrayed good governance.	Deleted	Own, adapted from Seow et al (2015)
PSC8: Strengthening the current environmental laws and enforcements are needed to prevent illegal disposal.	Deleted	Own, adapted from Chen (2017)
PSC9: Government Recycling Programme provides community empowerment.	Deleted	Own, adapted from Chen (2017)
PSC10: Government Recycling Programme provides public participation.	Deleted	Own, adapted from Folz and Hazrett (1991)
The environmental programme organised by the Government effectively arouse environmental awareness of the general public.	Deleted	Own, adapted from Wilson and Scheinberg (2015)

Level of Waste Separation Practice		
The Initial Items	The Amended Items	Sources
Percentage of the following items being separated and recycled in a week	SP1 I separate my paper waste.	Adapted from Halvorsen (2012)
1. Glass bottles/containers	SP2 I separate my plastic waste.	Adapted from Halvorsen (2012)
2. Plastic bottles/containers	SP3 I separate my food waste.	Adapted from Halvorsen (2012)
3. Paper/cardboard	SP4 I separate my other waste.	Adapted from Halvorsen (2012)

4. Batteries	SP5 I always clean my recyclables for separation.	Own, adapted from SWPCMA 2016
5. Food Waste	SP6 I separate my recyclables into different bags for collection.	Own, adapted from SWPCMA 2016

Appendix B The Questionnaire



My name is Yuzlina Mohd. Yusop, a doctoral candidate from Universiti Teknologi Malaysia. I am currently undertaking a research on household waste separation and recycling. I would appreciate if you could spend a few minutes of your time to complete the questionnaire. I assure that all information provided will be treated confidential and shall not be disclosed to any party. Should you have any queries, kindly contact me at yyusop2000@yahoo.co.uk or 013-3180699.

Waste Separation Behaviour definition in this study

Waste separation behaviour refers to the activity of separating waste at the household level according to the local authority guideline either for curbside collection or selling. According to the guideline, separation of waste is categorised into 5 which are plastic, paper, other, residual and garden waste.

4.	Government's promotion increases awareness on the recycling scheme.	1	2	3	4	5	6	7
5.	The waste bins provided by government provides a favourable condition for waste separation.	1	2	3	4	5	6	7
6.	The collection services are effective to collect separated waste.	1	2	3	4	5	6	7
Mandates								
7.	Environmental law obliges me to separate my waste correctly.	1	2	3	4	5	6	7
8.	Knowing that households will be penalised has made me more conscious of sorting my household waste.	1	2	3	4	5	6	7
9.	Issuance of warnings has been effective for me to comply to waste separation practice.	1	2	3	4	5	6	7
10.	The government monitoring mechanism on waste separation is effective.	1	2	3	4	5	6	7
11.	The enforcement programme has been effective for me to comply to waste separation practice.	1	2	3	4	5	6	7
12.	Penalty charges is sufficient for me to separate my waste correctly.	1	2	3	4	5	6	7
Inducement								
13.	There are sufficient economic incentives for residents to carry out waste separation.	1	2	3	4	5	6	7
14.	The price quoted by recycling waste collection companies are reasonable.	1	2	3	4	5	6	7
15.	There are sufficient waste collection companies to sell my recycling materials.	1	2	3	4	5	6	7
16.	There are sufficient types of recycling materials the collection companies are willing to buy.	1	2	3	4	5	6	7
17.	The reward points offered by collection companies are effective for residents to carry out waste separation.	1	2	3	4	5	6	7
Public Participation								
18.	Citizens are given adequate means for stating their views about solid waste policies.	1	2	3	4	5	6	7
19.	Sufficient platforms are available to aggregate public opinion.	1	2	3	4	5	6	7
20.	The government is responsive to public input.	1	2	3	4	5	6	7
21.	The government understood public needs.	1	2	3	4	5	6	7
22.	Citizens' views are used in forming solid waste policies.	1	2	3	4	5	6	7
23.	I am satisfied with the procedures the government use to involve citizens in formulating policies on solid waste.	1	2	3	4	5	6	7

Section C : This section inquire about your household recycling behaviour

<p><i>scale</i></p> <p>Strongly disagree 1 2 3 4 5 6 7 Strongly agree</p>

Recycling Behaviour		1	2	3	4	5	6	7
24.	I separate my recyclables in the past four weeks.	1	2	3	4	5	6	7
25.	I separate my paper waste.	1	2	3	4	5	6	7
26.	I separate my plastic waste.	1	2	3	4	5	6	7
27.	I am positively engaged in waste separation.	1	2	3	4	5	6	7
28.	I have high compliance level to separate my recyclable materials.	1	2	3	4	5	6	7
Recycling Intention								
29.	I intend to separate my recyclables in the near future.	1	2	3	4	5	6	7
30.	I will separate my recyclables every time I have it for disposal.	1	2	3	4	5	6	7
31.	I am willing to participate in future recycling schemes.	1	2	3	4	5	6	7
32.	I intend to separate my waste at every opportunity.	1	2	3	4	5	6	7
33.	I intend to separate my waste according to waste separation categories.	1	2	3	4	5	6	7
Affective Attitude								
34.	Waste separation is good.	1	2	3	4	5	6	7
35.	Waste separation is useful.	1	2	3	4	5	6	7
36.	Waste separation is wise.	1	2	3	4	5	6	7
37.	I find the idea of waste separation is pleasing.	1	2	3	4	5	6	7
38.	My feelings toward waste separation are favourable.	1	2	3	4	5	6	7
Instrumental Attitude								
39.	Waste separation for recycling reduces pollution.	1	2	3	4	5	6	7
40.	Waste separation for recycling reduces wasteful use of landfills.	1	2	3	4	5	6	7
41.	Recycling conserves natural resources.	1	2	3	4	5	6	7
42.	Recycling improves environmental quality.	1	2	3	4	5	6	7
43.	Recycling saves energy.	1	2	3	4	5	6	7
44.	Waste separation for recycling creates a better environment for future generations.	1	2	3	4	5	6	7

Subjective Norm								
45.	Most people who are important to me think I should separate my household materials.	1	2	3	4	5	6	7
46.	Most people who are important to me would approve of my waste separation method.	1	2	3	4	5	6	7
47.	My friends expect me to separate household materials.	1	2	3	4	5	6	7
48.	My family expects me to separate household materials.	1	2	3	4	5	6	7
49.	Environmental groups influence me to separate my household materials.	1	2	3	4	5	6	7
Perceived Behaviour Control								
50.	I have plenty of opportunities to separate my household waste.	1	2	3	4	5	6	7
51.	Waste separation is convenient.	1	2	3	4	5	6	7
52.	Waste separation is easy.	1	2	3	4	5	6	7
53.	I know how to separate my household waste.	1	2	3	4	5	6	7
54.	I have enough time to sort the materials for recycling.	1	2	3	4	5	6	7
55.	I have enough space to store the materials for recycling.	1	2	3	4	5	6	7

Section D : Waste separation practice

The following are my current waste separation practice.


56.	I always separate my paper waste.	1	2	3	4	5	6	7
57.	I always separate my plastic waste.	1	2	3	4	5	6	7
58.	I always separate my food waste.	1	2	3	4	5	6	7
59.	I always separate my other waste.	1	2	3	4	5	6	7
60.	I always clean the recyclables before separating them.	1	2	3	4	5	6	7
61.	I separate all my recyclable waste in different bags for collection.	1	2	3	4	5	6	7

62. Please rank your preferred mode to receive information on solid waste	Rank
Mass media (i.e. television, newspaper, radio, etc)	
Direct media (i.e. billboards, vehicle advertisement, broacher, flyers, etc)	
Social media (i.e. websites, twitter, Instagram, etc.)	

Your Comment on the waste separation at source, if any :

- Thank You/Terima kasih -

Appendix C UTM Invitation Letter for Expert Validation

 UTM UNIVERSITI TEKNOLOGI MALAYSIA	UTM Razak School of Engineering and Advanced Technology UTM Kuala Lumpur	and Advanced Technology Level 7, Menara Razak Universiti Teknologi Malaysia Jalan Sultan Yahya Petra 54100 Kuala Lumpur, Malaysia
---	--	---

Tel: +(6)03-21805138 Fax: +(6)03-21805380 <http://www.razakschool.utm.my>

OUR REF.: Our Ref : UTM.K56.01.03/13.11/1/4 Jld. 8 (29)
Date : 27 May 2019

Assoc. Prof. Dr. Maslin bte Masrom
Razak Faculty of Technology and Informatics
Universiti Teknologi Malaysia Kuala Lumpur

Dear Dr.,

INVITATION TO EXPERT FOR CONTENT VALIDATION OF THE RESEARCH INSTRUMENT

STUDENT NAME : YUZLINA BINTI MOHD. YUSOP
IC. NO. : 751203105548
MATRIC NO. : PFF153007
PROGRAMME : DOCTOR OF PHILOSOPHY
FACULTY : RAZAK FACULTY OF TECHNOLOGY AND INFORMATICS
RESEARCH TITLE : INFLUENCING FACTORS IN WASTE SEPARATION AND
RECYCLING BEHAVIOUR AMONG HOUSEHOLD IN KUALA
LUMPUR
SUPERVISOR : ASSOC. PROF. DATIN DR. NOORAINI BINTI OTHMAN

With reference to the above matter, we are pleased to appoint you as an expert in research validation.


2. For your information, our student require your expertise to evaluate the propose research model and the survey instruments. Comments obtained from the expert evaluation will become as a part of the discussions in her findings. All information will be confidential and used solely for the purpose of this research.

3. Your cooperation, time and assistance are greatly appreciated.

Thank you,

"Berkhidmat untuk Negara kerana Allah"

I, who uphold trust,


(NASIR BIN OSMAN)
Deputy Registrar
Razak Faculty of Technology and Informatics
UTM Kuala Lumpur
For The Vice Chancellor
☎ 03-21805360
☎ 03-21805380
✉ nasir.kl@utm.my



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

UTM Razak School of
Engineering and Advanced Technology
UTM Kuala Lumpur

UTM Razak School of Engineering
and Advanced Technology
Level 7, Menara Razak
Universiti Teknologi Malaysia
Jalan Sultan Yahya Petra
54100 Kuala Lumpur, Malaysia

Tel: +(6)03-21805138 Fax: +(6)03-21805380 <http://www.razakschool.utm.my>

OUR REF: _____

Our Ref : UTM.K56.01.03/13.11/1/4 Jld. 8 (29)
Date : 27 May 2019

Assoc. Prof. Dr. Nik Hasnaa bte Nik Mahmood
Razak Faculty of Technology and Informatics
Universiti Teknologi Malaysia Kuala Lumpur

Dear Dr.,

INVITATION TO EXPERT FOR CONTENT VALIDATION OF THE RESEARCH INSTRUMENT

STUDENT NAME : YUZLINA BINTI MOHD. YUSOP
IC. NO. : 751203105548
MATRIC NO. : PFF153007
PROGRAMME : DOCTOR OF PHILOSOPHY
FACULTY : RAZAK FACULTY OF TECHNOLOGY AND INFORMATICS
RESEARCH TITLE : INFLUENCING FACTORS IN WASTE SEPARATION AND
RECYCLING BEHAVIOUR AMONG HOUSEHOLD IN KUALA
LUMPUR
SUPERVISOR : ASSOC. PROF. DATIN DR. NOORAINI BINTI OTHMAN

With reference to the above matter, we are pleased to appoint you as an expert in research validation.

2. For your information, our student require your expertise to evaluate the propose research model and the survey instruments. Comments obtained from the expert evaluation will become as a part of the discussions in her findings. All information will be confidential and used solely for the purpose of this research.

3. Your cooperation, time and assistance are greatly appreciated.

Thank you.

"Berkhidmat untuk Negara kerana Allah"

I, who uphold trust,


(NASIR BIN OSMAN)
Deputy Registrar
Razak Faculty of Technology and Informatics
UTM Kuala Lumpur
Ee The Vice Chancellor
☎ 03-21805360
☎ 03-21805380

Appendix D Expert Validation Feedback Forms

BORANG MAKLUMBALAS PENGESAHAN SEMAKAN BORANG SOAL SELIDIK

TAJUK KAJIAN:

THE INFLUENCING FACTORS IN RECYCLING BEHAVIOUR ~~AMONG~~ HOUSEHOLD IN KUALA LUMPUR

Nama Pengkaji:

YUZLINA BINTI MOHD. YUSOP (PFF153007)

Catatan / Komen:

- (i) Need to relook into system cleaning construct.
- (ii) Need to add a few more items for recycling intention construct.

Maklum Balas Pemeriksaan Borang Soal Selidik Kajian

Setelah memeriksa borang soalselidik kajian yang bertajuk:

THE INFLUENCING FACTORS IN RECYCLING BEHAVIOUR ~~AMONG~~ HOUSEHOLD IN KUALA LUMPUR

Yang dijadikan instrumen utama kajian dan didapati bahawa, borang soal selidik ini (tanda / pada ruang yang disediakan)

Sesuai

Tidak sesuai

digunakan dalam mengukur konstruk-konstruk yang dikaji.

Tandatangan:



Nama:

DR. NIK HASNAA BTE NIK MAHMOOD

Jawatan:

Associate Professor
UTM Razak School of Engineering & Advanced Technology
Level 13, Menara Razak
Universiti Teknologi Malaysia Kuala Lumpur
Jalan Sultan Yahya Petra, 54100 Kuala Lumpur.
Tel : 03-2180 5243 Fax : 03-2180 3360

Tarikh:

24/5/2019

BORANG MAKLUMBALAS PENGESAHAN SEMAKAN "CONCEPTUAL FRAMEWORK" DAN
BORANG SOAL SELIDIK

TAJUK KAJIAN:
THE INFLUENCING FACTORS IN RECYCLING BEHAVIOUR **AMONG** HOUSEHOLD IN KUALA
LUMPUR

Nama Pengkaji:
YUZHINA BINTI MOHD. YUSOP (PFF153007)

Catatan / Komen:

*Instrumen kajian boleh digunakan dalam mengukur
konstruk-konstruk yang dikaji. Walau bagaimanapun
sedikit pembetulan wajar dibuat.*

Maklum Balas Pemeriksaan

Setelah memeriksa borang soalselidik kajian yang bertajuk:

THE INFLUENCING FACTORS IN RECYCLING BEHAVIOUR **AMONG** HOUSEHOLD IN KUALA
LUMPUR

Yang dijadikan instrumen utama kajian dan didapati bahawa, borang soal selidik ini (tanda / pada ruang
yang disediakan)

Sesuai

Tidak sesuai

dipunakan dalam mengukur konstruk-konstruk yang dikaji.

Tandatangan:

Matlin

Nama:

DR. MATLIN SHAWDRI
Associate Professor

Jawatan:

Research Faculty of Technology and Education
Universiti Teknologi Malaysia Jalan Sultan Yahya Petra
54100 Kuala Lumpur
Tel: 03-2580 5225 Fax: 03-2580 5880 e-mail: msh@utm.my

Tarikh:

13/6/2019

Appendix E UTM Letter for Data Collection

 UTM UNIVERSITI TEKNOLOGI MALAYSIA	UTM Razak School of Engineering and Advanced Technology UTM Kuala Lumpur	UTM Razak School of Engineering and Advanced Technology Level 7, Menara Razak Universiti Teknologi Malaysia Jalan Sultan Yahya Petra 54100 Kuala Lumpur, Malaysia
Tel: +603-21805138 Fax: +603-21805380 http://www.razakschool.utm.my		
OUR REF.:	Our Ref.: UTM.K56.01.03/13.11/14 Jld. 6 (96) Date : 15 March 2019	
TO WHOM IT MAY CONCERN		
Dear Sir/ Madam,		
DATA COLLECTION FOR RESEARCH		
NAME	: YUZLINA BINTI MOHD. YUSOP	
IC NO.	: 751203105548	
MATRIC NO.	: PFF153007	
PROGRAMME	: DOCTOR OF PHILOSOPHY	
RESEARCH TITLE	: INFLUENCING FACTORS IN WASTE SEPARATION AND RECYCLING BEHAVIOUR AMONG HOUSEHOLD IN KUALA LUMPUR	
SUPERVISOR	: ASSOC. PROF. DATIN DR. NOORAINI BINTI OTHMAN	
SUPERVISOR'S EMAIL	: p-noraini@utm.my	
SUPERVISOR'S CONTACT NO.	: 03-21805157/ 019-2638838	
This is to certify that the bearer of this letter is a student at Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia Kuala Lumpur, who is currently pursuing Doctor of Philosophy.		
2. It would be greatly appreciated if you could assist her field work in order to execute her research at your organization.		
3. Please do not hesitate to contact her supervisor for further information.		
Thank you for your kind support.		
BERKHIDMAT UNTUK NEGARA		
I, who uphold trust,		
 (NASIR BIN OSMAN) Deputy Registrar Razak Faculty of Technology and Informatics UTM Kuala Lumpur For The Vice Chancellor 03-21805360 03-21805380		



Universiti Teknologi Malaysia
Jalan Sultan Yahya Petra
54100 Kuala Lumpur, Malaysia
Tel: 03-2615 4100

Our Ref.: UTM.K56.01.03/13.11/1/4 Jld. 11 (ss)

Date : 8 November 2019

To Whom it May Concern

Dear Sir/Madam,

DATA COLLECTION FOR RESEARCH

This is to certify that the name as mentioned below is currently a student of Universiti Teknologi Malaysia (UTM). Details of the student are as follows:

Name	: Yuzlina binti Mohd Yusop
MyKad/ ISID	: 751203105548
Matric No.	: PFF153007
Faculty	: Razak Faculty of Technology and Informatics
Programme	: Doctor of Philosophy
Research Title	: "Influencing Factors in Waste Separation and Recycling Behaviour Among Household in Kuala Lumpur"
Supervisor	: Assoc. Prof. Datin Dr. Nooraini binti Othman
Supervisor's Email	: p-noraini@utm.my

2. It would be greatly appreciated if you could assist her to execute data collection for her research at your organization.

3. For further information, please do not hesitate to contact us. Your cooperation in assisting the student is highly appreciated.

Thank you.

"Berkhidmat untuk Negara"

I, who uphold trust,

(NURUL AIN BTE MOHD YUNOS)
Assistant Registrar
Razak Faculty of Technology and Informatics
Universiti Teknologi Malaysia Kuala Lumpur
For The Dean
☎ : 03-2180 5154
✉ : nurulain.kl@utm.my

UAM/0300

Appendix F Data Collection at DNSWM

PENGESAHAN SESI TEMUBUAL DAN PENGUMPULAN DATA

NAMA: YUZLINA BINTI MOHD. YUSOP
NO. K/P: 751203-10-5548
TAJUK PENYELIDIKAN: INFLUENCING FACTORS IN WASTE SEPARATION AND
RECYCLING BEHAVIOUR AMONG HOUSEHOLD IN
KUALA LUMPUR

Saya dengan ini mengesahkan bahawa pelajar seperti maklumat di atas telah menemui saya untuk sesi temubual dan pengumpulan data pada 15 April 2019 di pejabat saya.

Sekian, terima kasih.



ISMAIL BIN MOKHTAR
Ketua Pengarah
Jabatan Pengurusan Sisa Pepejal Negara
Kementerian Perumahan dan Kerajaan Tempatan

15/4.

Appendix G Data Collection at SWCorp

PENGESAHAN SESI TEMUBUAL DAN PENGUMPULAN DATA

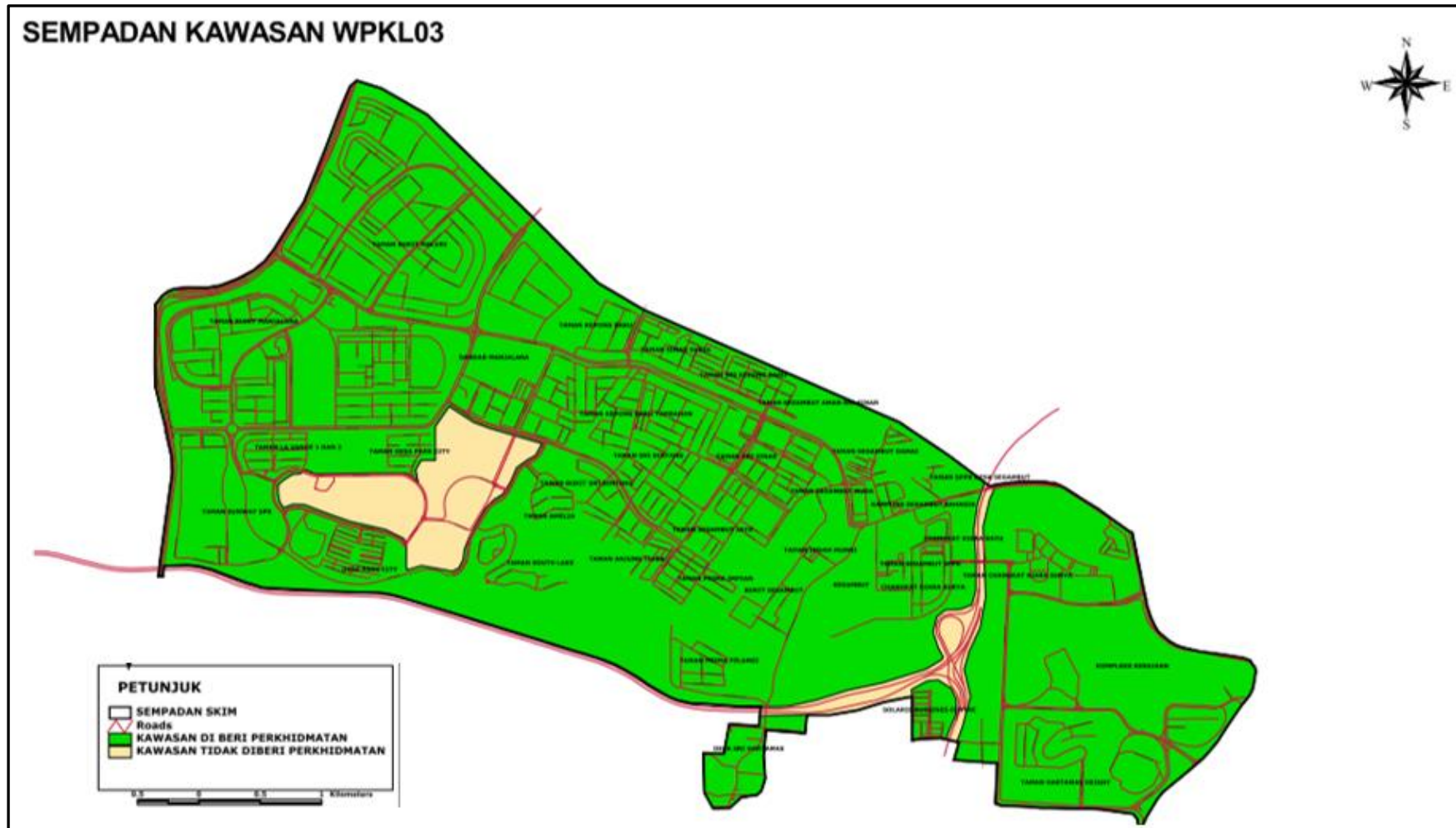
NAMA: YUZLINA BINTI MOHD. YUSOP
NO. K/P: 751203-10-5548
TAJUK PENYELIDIKAN: INFLUENCING FACTORS IN WASTE SEPARATION AND
RECYCLING BEHAVIOUR AMONG HOUSEHOLD IN
KUALA LUMPUR

Saya dengan ini mengesahkan bahawa pelajar seperti maklumat di atas telah menemui saya untuk sesi temubual dan pengumpulan data pada **17 April 2019** di pejabat saya.

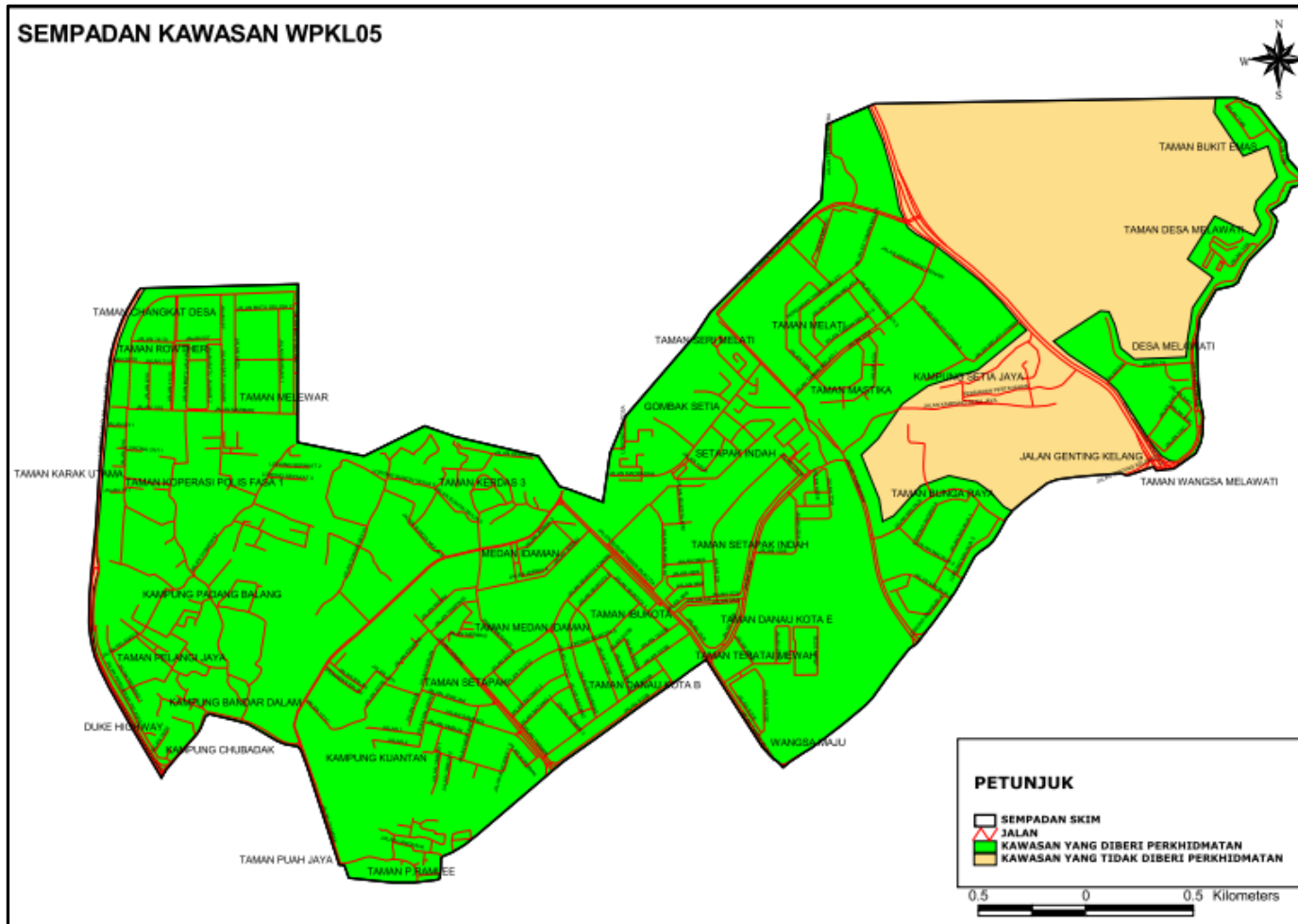
Sekian, terima kasih.


MOHD SAFRI BIN ABDUL RAHMAN
Pegawai Kesihatan Persekitaran
Bahagian Pendidikan Masyarakat
Perbadanan Pengurusan Sisa Pepejal
dan Pembersihan Awam

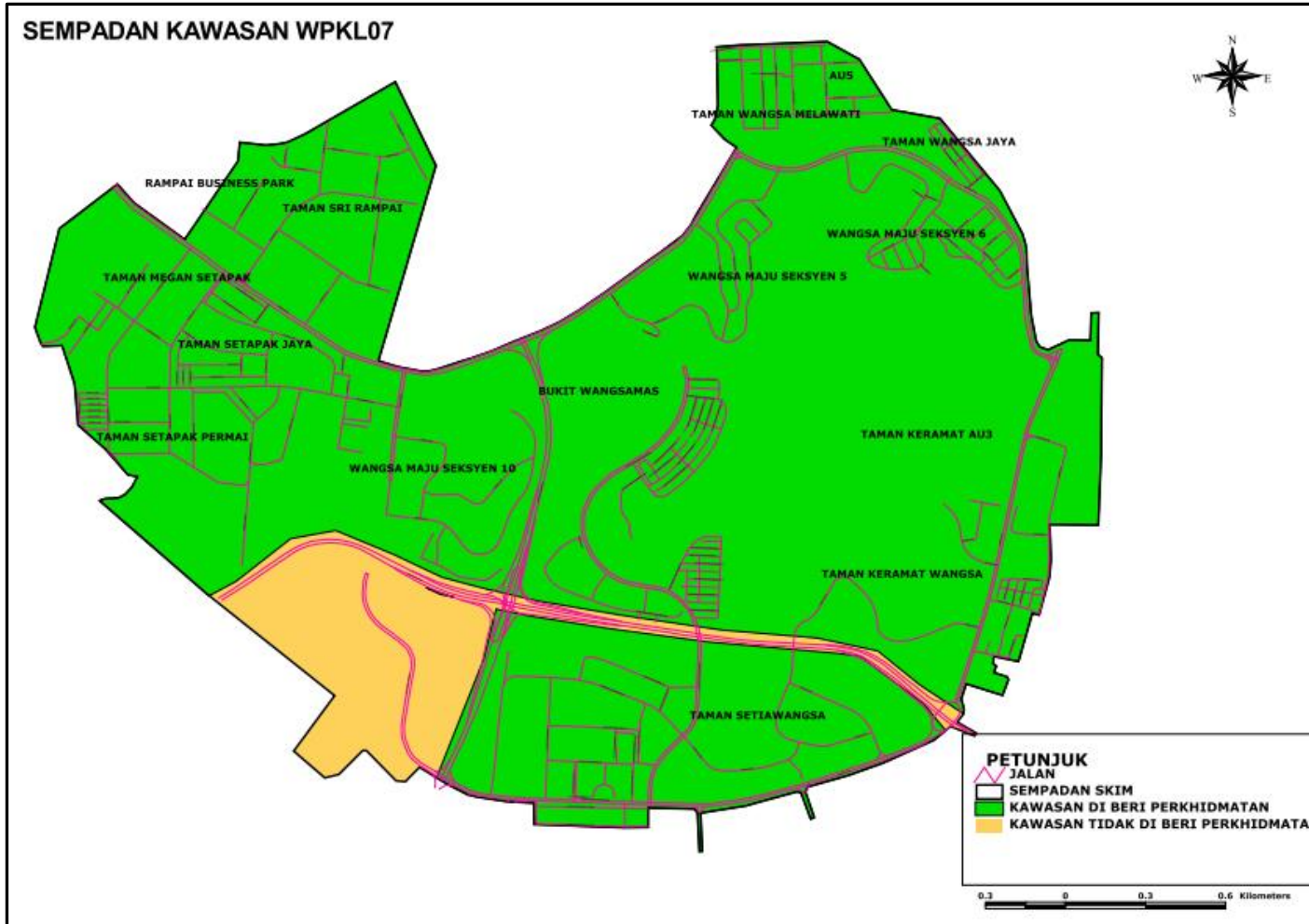
Appendix H SWCorp Service Area Map WPKL03



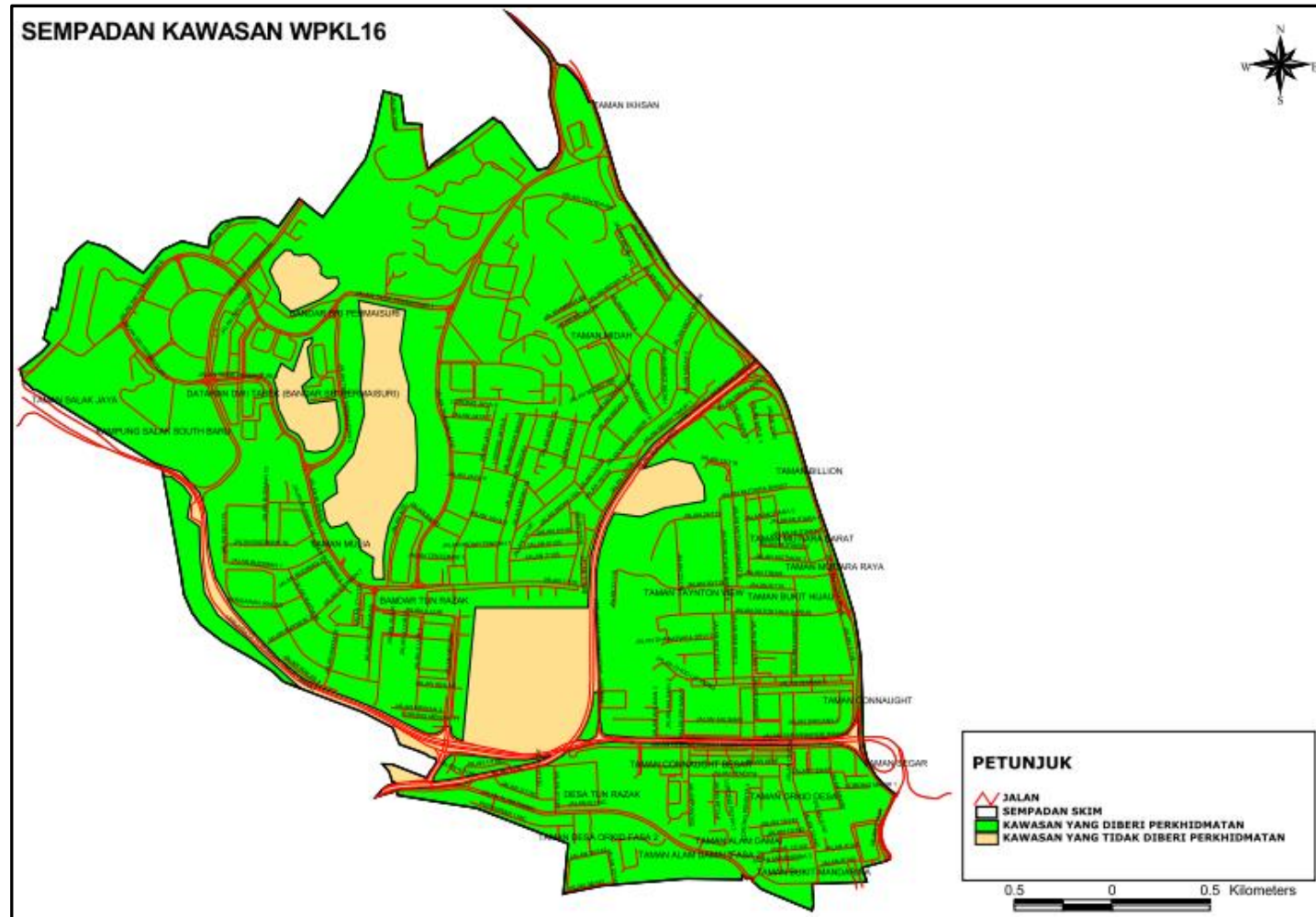
Appendix I SWCorp Service Area Map WPKL05



Appendix J SWCorp Service Area Map WPKL07



Appendix K SWCorp Service Area Map WPKL16



LIST OF PUBLICATIONS

Indexed Journal

1. Yusop, M.Y. and Othman, N. (2019) Linking the Malaysia's Solid Waste Management Policy Instruments with Household Recycling Behavior. *International Journal of Academic Research in Progressive Education and Development*, 8(4), 474–488. <http://dx.doi.org/10.6007/IJARPED/v8-i4/6567>.
(Indexed by ERA)
2. Yusop, M.Y. and Othman, N. (2021) Concepts in Waste Management: A Preliminary Study. *International Journal of Academic Research in Business and Social Sciences*, 11(2), 546–557. <http://dx.doi.org/10.6007/IJARBSS/v11-i2/8865>. **(Indexed by ERA)**