THE EFFECTS OF SOCIO-ECONOMIC CHARACTERISTICS ON HOUSEHOLD WASTES IN JOHOR BAHRU DISTRICT

MOHD.BADRUDDIN MOHD.YUSOF

A thesis submitted in fulfilment of
the requirements for the award of the degree of
Doctor of Philosophy

Faculty of Civil Engineering
Universiti Teknologi Malaysia

OCTOBER 2004

ACKNOWLEDGEMENT

First of all, I would like to thank Assoc. Professor Dr. Hj. Fadil Othman, as well as the School of Postgraduate Studies, and the Faculty of Civil Engineering for the opportunity and support to make the research possible. I am also indebted to Universiti Teknologi Malaysia (UTM) for funding my Ph.D. study. The study would not have been possible without the support from research assistants who gathered and provided a lot of information pertaining to the waste management and services industry. Finally, to those who directly or indirectly helped me carry out the tasks of completing the research and members of my family who have been supporting me throughout the study.

ABSTRACT

Studies on the effects of socio-economic backgrounds, lifestyles of individuals and recycling behavior on the generation of household wastes are lacking in the country. The objectives of the study include to analyze the effects of personal factors such as income, age, race, marital status, family size, and housing characteristics, as well as attitudes toward waste minimization on the amount of wastes produced and recycled. Survey data and waste characterization studies were gathered and conducted within both rural and urban areas within the Johor Bahru District involving samples of 500 urban and 385 rural families. Various statistical analyses were conducted using the Statistical Packages for Social Sciences (SPSS) software program. The study reveals that recycling activities not only vary according to urban and rural differences, but also to the types of recyclable materials concerned. There is a significant difference in the recycling of papers and newspapers, paper cardboards, and plastics amongst the two communities. Based on linear regression analysis, newspaper recyclers amongst rural residents appear to have low income and are married, while the plastic recyclers older groups. On the other hand, urban residents who recycle paper, cardboards, and plastics appear to be older with low educational background (with $p < 0.05$ and 0.01). Racial factor was found to be significant only amongst urban residents in terms of the selling of newspapers, as the Chinese (65% amongst themselves) and Malays (46%) were found to be active in the activity. Renters are generally found to be non-recyclers in the study areas. The study supports the theory connecting the environmental values with recycling. Those who support the need to recycle are also found to separate their wastes, reuse plastics and cardboards indicating the positive correlation between values and recycling. Average solid waste figures per household in the study area are 1.78 kg (urban) and 2.12 kg (rural), with per capita weights of 0.41 and 0.48 kg, respectively (which is lower than the average per capita for the whole Johor Bahru area (1.29) due to the exclusion of yard and bulky wastes from the study. From the linear regression, the explanatory variables for the wastes in the urban area are found to be marital status and home-cooking activities ($p < 0.01$) with a correlation value, R of 0.45). Rural wastes, on the other hand, increase as the family size ($p < 0.01$) and the frequency of home cooking increase ($p < 0.01$) with R value of 0.21. The research supports previous findings indicating higher organic and food wastes in the lower-income or rural areas (38 %) and higher paper wastes (30 %) in the urban or high-income areas. Both areas give strong support for resource recycling facility, an increase in number of recycling programs, promotions, and the enforcement of a mandatory recycling and source separation programs all with mean values of between 3.6 and 4.2 (i.e., 5 being ‘strongly agree’).

ABSTRAK

Kajian mengenai kaitan antara latarbelakang sosio-ekonomi ke atas penjanaan sisa perumahan dan tahap kitarsemula kurang diberi perhatian. Objektif kajian ini adalah untuk menganalisis peranan faktor peribadi seperti umur, ras, jantina, pendapatan, tahap perkahwinan, pendidikan, saiz keluarga, serta status pemilikan rumah, jangkamasa menetap serta pandangan terhadap kitar semula terhadap jumlah sisa yang dihasilkan dan dikitarsemula. Kajian melibatkan 500 sampel penduduk bandar dan 385 luar bandar di kawasan sekitar Daerah Johor Bahru. Hasil kajian menunjukkan terdapat perbezaan antara aktiviti kitarsemula di kalangan penduduk bandar dan luar bandar serta bahan yang dikitarsemula, terutamanya kertas, suratkabar, kotak, dan plastik. Menurut regresi linear, penduduk luar bandar yang mengitarsemula kertas didapati berpendapatan rendah dan berkahwin, manakala yang mengguna semula plastik di kalangan mereka yang lebih berumur. Responden di kawasan bandar yang mengitarsemula kertas, kadbod, dan plastik pula adalah di kalangan orang yang lebih berumur dan mempunyai pendidikan lebih rendah (dengan nilai $p < 0.05$ dan $p < 0.01$). Faktor ras mempunyai hubungkait hanya dengan penjualan suratkabar di bandar di mana penduduk berketurunan Tionghua (65% antara mereka) dan Melayu (46%) lebih aktif menjual suratkabar. Penduduk yang menyewa pada keseluruhannya kurang menjalankan aktiviti kitar semula. Terdapat hubungkait antara nilai keperihatinan terhadap keperluan mengitarsemula dan aktiviti kitarsemula. Mereka yang menyokong keperluan program kitarsemula juga didapati aktif mengasingkan sampah, mengitarsemula plastik beg dan kadbod. Purata sampah bagi setiap rumah di bandar adalah 1.78 kg dan di luar bandar 2.12 kg (memberikan tahap pembuangan per kapita pada 0.41 bagi bandar dan 0.48 kg di luar bandar, kadar yang lebih rendah daripada purata Johor Bahru disebabkan kajian tidak mengambilkira sampah halaman rumah dan sisa pukal (‘*bulky waste’*). Daripada regresi linear, faktor perkahwinan dan kekerapan memasak di rumah memainkan peranan di bandar dengan nilai $p< 0.01$ dan $R = 0.45$, manakala jumlah isi rumah dan kekerapan memasak di luar bandar ($p < 0.01$) dan nilai $R = 0.21$. Kajian mengesahkan keputusan kajian terdahulu yang mengaitkan sampah organik yang lebih bagi kawasan berpendatan rendah atau luar bandar (38 %) dan kertas bagi kawasan berpendapatan tinggi atau bandar (30%). Terdapat perbezaan ketara antara penduduk bandar dan luar bandar mengenai tahap kepuasan terhadap cara pemungutan sampah dan lokasi kontena, masalah sampah berlebihan, pembuangan secara haram, dan kos pemungutan tinggi. Kedua-dua kawasan kajian menunjukkan sokongan kuat terhadap kemudahan kitarsemula, penambahan program kitarsemula, promosi, dan penguatkuasaan program kitarsemula mandatori dan pengasingan sampah dengan nilai min antara 3.6 dan 4.2 (di mana nilai 5 untuk “sangat setuju”).

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	TABLE OF CONTENTS	vi
	LIST OF TABLES	xii
	LIST OF FIGURES	xviii
	LIST OF ABBREVIATIONS	xx
	LIST OF SYMBOLS	xxiv
	LIST OF APPENDICES	xxv
1	**INTRODUCTION**	1
1.1	Background Information	1
1.2	Problem Statement	3
1.3	The Objectives of Study	7
1.4	Scope of Study	9
1.5	Hypothesis Formulation	12
1.6	Organization of the Thesis	13
II	**MUNICIPAL SOLID WASTE GENERATION: PUBLIC ATTITUDES, PERCEPTIONS AND ENVIRONMENTAL BEHAVIOR**	16
2.0	Introduction	16

2.1 Importance of Socio-Economic Aspects and Activities in Waste Management 17
2.2 Public Perceptions and Recycling Behavior 18
2.2.1 Dynamic Social and Economic System 19
2.2.2 Increasing Environmental Concerns 20
2.2.3 Importance of Information Availability 21
2.2.4 The Importance of Environmental Education 23
2.3 The Effects of Economic Activity and Income on Solid Waste Generation 24
2.4 Regulatory Trends 26
2.5 Toward a Framework for An Integrated Waste Management 29
2.5.1 Jurisdiction, Responsibility and Stakeholder 29
2.5.2 Financing Services: Costs of Municipal Solid Waste Management 30
2.6 The Need for Planning 31
2.6.1 Waste Reduction/Waste Minimization 33
2.6.2 Source Separation and Citizen Recycling 35
2.6.3 Collection and Transfer 37
2.6.4 Composting 38
2.6.5 Incineration 39
2.6.6 Landfills 41
2.6.7 Special Wastes 43
2.6.8 Developments in Technology 45
2.6.9 Regulatory Approach 47

III UNDERLYING THEORIES ON EFFECTS OF PERCEPTIONS, CULTURAL BACKGROUND, AND RECYCLING ACTIVITIES ON WASTE GENERATION 49

3.1 Introduction 49
3.2 Underlying Theories on Attitudes, Perceptions, and Environmental Behavior 49
3.2.1 Beliefs and Attitudes 55
3.2.2 External Influences 58
3.2.3 Availability of Information 58
3.2.4 Demographics 59

3.3 Underlying Theories on Waste Generation 60
3.3.1 The Wertz Model 62
3.3.2 Other Empirical Papers at The International Level 63
3.3.3 Empirical Papers on Waste Generation at The Local, National Level 68

3.4 Variables Used in the Study 69
3.4.1 Demographic, Economic and Social Background 69
3.4.2 Environmental Values and Behavior: 70
3.4.3 Opinions on Existing Management System 71
3.4.4 Lifestyle and Dining Activity 72

3.5 Research Hypothesis 72

IV **PRIMARY DATA AND RESEARCH METHODOLOGY** 74
4.0 Introduction 74
4.1 Solid Waste Management in Malaysia 74
4.1.1 Waste generation in Urban and Rural Areas 77
4.1.2 Waste Composition: State of Johor 81
4.1.3 Solid Waste Management in Johor Bahru 84

4.2 The Study Area: Background Information 86

4.2.1 Urban Areas: Residential Communities Within Johor Bahru District 86
4.2.2 Rural Areas: Johor Bahru District 90
4.2.3 Study Area: Before Privatization 93
4.2.4 Study Area: After Privatization 95

4.3 Methodology and Approach 98
4.4 Objectives of Study 98
4.5 Sampling of Data 99
4.6 Survey Instruments: Questionnaire 102
4.7 Variable Values 103
4.8 Survey Distribution 109
4.9 Data Analysis 109
4.9.1 Test of Normality 110
4.9.2 Reliability Analysis 111
4.9.3 Independent Sample *t*-Test 113
4.9.4 The *t*-Test of Difference of Means 114
4.9.5 Descriptive Analysis 115
4.9.6 Inferential Statistics 115
4.9.6.1 Linear Regression 116
4.9.6.2 Multiple Regression 117
4.10 Hypothesis Testing 118
4.11 Probable Setbacks 119

V ANALYSIS OF RESULTS 120
5.1 Introduction 120
5.2 Reliability Tests 121
5.3 Test of Normality 123
5.4 Significant Testing 125
5.5 Waste Minimization Activities Among Urban and Rural Activities 125

5.5.1 Linear Regression: Rural (Selling of Newspapers) 127

5.5.2 Linear Regression: Urban (Selling of Newspapers) 129

5.5.3 Linear Regression: Rural (Home Separation) 132

5.5.4 Linear Regression: Urban (Home Separation) 134

5.5.5 Linear Regression: Rural (Reuse of Plastics) 136

5.5.6 Linear Regression: Urban (Reuse of Plastics) 138

5.6 Household Waste Generation in the Study Area. 144

5.6.1 Household Generation in Urban and Rural Area 144

5.6.2 Linear Regression : Household Wastes (Urban Area) 153

5.6.3 Linear Regression: Household Wastes (Rural) 156

5.6.4 Linear Regression: Household Wastes (Urban and Rural) 157

5.7 Composition and Recycling of Household Waste 159

5.7.1 Waste Composition and Recycling in Urban Area 159

5.7.2 Waste Composition and Recycling in Rural Area 160

5.8 Summary of Results for Each Variable: Urban and Rural Residents' Recycling Activities 168

5.8.1 Gender or Sex 168

5.8.2 Family Income 168

5.8.3 Education 169

5.8.4 Age 170

5.8.5 Marital Status 170

5.8.6 Family Size 171

5.8.7 Race 171

5.8.8 Ownership Status 172

5.8.

		5.8.99 Length of Stay	172
		5.8.10 Overall Support for Recycling	173
	5.9	Opinions on Existing Problems and Future Policies	173
VI	**CONCLUSION AND POLICY RECOMMENDATIONS**		177
	6.0	Introduction	177
	6.1	Recycling of Waste Materials	177
	6.2	Selling of Newspapers	178
	6.3	Home Separation	178
	6.4	Reuse of Plastics Bags	179
	6.5	Other Recyclables	180
	6.6	Waste Generation	181
	6.7	Policy Recommendations	185
	6.8	Recommendations for Future Research	188

REFERENCES 190
Appendices A- I 201-221

LIST OF TABLES

TABLE NO.	TITLE	PAGE
2.1	Federal Laws of Malaysia with Provisions on Solid Waste Management	27
2.2	Leachate Samples From Landfill Sites in Malaysia and Other Countries (All in mg/l Except for pH).	42
2.4	The Total Quantity of Scheduled or Hazardous Waste (HW) in Malaysia	44
4.1	Distribution of Urban and Rural Population in Peninsular Malaysia	78
4.2(a)	Solid Waste Composition in Malaysia (2004)	78
4.2(b)	Percentage of Dry MSM Disposed from High, Medium, and Low Socio-economic Areas in Petaling Jaya	79
4.3	Solid Waste Generation in Major Towns in Malaysia (tonnes/day).	80
4.4	Waste Generation Rate in Petaling Jaya, Malaysia	81
4.5	Waste Generation in Johor Municipalities in 1995.	82

4.6	Percentage of Waste Components in Johor Bahru (1986-1997)	83
4.7	Solid Waste Composition at Selected Sites in Malaysia	84
4.8	The Breakdown of 1997 Waste Management Budget for MBJB and MPJBT	85
4.9	Expenditures on Public Cleansing Services and Solid Waste Management Services of Municipalities in Malaysia	85
4.10	Property Growth in MPJBT (1991-2002)	89
4.11	Total Number of Urban Households in the Study Areas	90
4.12	Rural Population and Number of Households in the Study Area.	92
4.13	Development of Property in Study Area (1997-1998)	93
4.14	Mobile Assets of MPJBT (in 1997 and 2000)	94
4.15	Types of Containers Currently Used by SWM	97
5.1	Reliability Test – Scale (Alpha): Item Total Statistics	122
5.1	Reliability Test – Scale (Alpha): Intra-class Correlation Coefficient	123

5.2(a)	Descriptive Statistics (Marital Status and Reselling of Newspapers) and Linear Regression: Rural Residents and Recycling of Newspapers	127
5.2 (b)	Selling of Newspaper and Personal, Housing, and Attitude Factors (Rural)	129
5.3(a)	Linear Regression: Urban Residents and Recycling of Newspapers	130
5.3 (b)	Selling of Newspaper and Personal, Housing, and Attitude Factors (Urban)	131
5.4(a)	Linear Regression: Rural Residents and Home Separation of Wastes	133
5.4 (b)	Home Separation of Wastes and Personal, Housing, and Attitude Factors (Rural)	134
5.5(a)	Linear Regression: Urban Residents and Home Separation of Wastes	135
5.5(b)	Home Separation of Wastes and Personal, Housing, and Attitude Factors (Urban)	136
5.6(a)	Linear Regression: Rural Residents and Reuse of Plastics	137
5.6(b)	Reuse of Plastics and Personal, Housing, and Attitude Factors (Rural)	138

5.7(a)	Linear Regression: Urban Residents and Reuse of Plastics)	139
5.7(b)	Reuse of Plastics and Personal, Housing, and Attitude Factors (Urban)	140
5.7 (c)	Overall Summary of Coefficients (Status of Significance with Positive or Negative Direction) for Environmental Behavior	141
5.8	Waste Generation in Urban Area	144
5.9	Average Weight per Household (Rural)	146
5.10(a)	Linear Regression and Pearson's Correlation Coefficients (Household waste (Urban))	154
5.10(b)	Linear Regression (Summary of Coefficients – Household Waste (Urban))	155
5.11(a)	Linear Regression (Waste Weight (Rural))	156
5.11(b)	Linear Regression and Pearson's Coefficient (Summary of Coefficients - Household Waste (Rural))	157
5.12	Linear Regression and Pearson's Coefficient (Waste Weight (Urban and Rural))	158
5.13	Solid Waste Composition (Urban)	16

5.15	Solid Waste Composition (Rural)	162
5.16	Weight of Recycled Materials (Rural)	162
5.17(a)	Cross-tab (Recycling of Newspapers (RESELL) by Racial Background for All (Rural and Urban Areas).	163
5.17(b)	Independent Samples Test between Urban and Rural Household Wastes	165
5.18	Independent Samples Test (Urban and Rural Recycled Materials)	165
5.19	Group Statistics (Mean for Recyclables between Urban and Rural Areas)	166
5.20	Coefficients (Actual Recycling of Materials – Rural)	167
5.21	Coefficients (Actual Recycling of Materials – Urban)	167
5.22	Overall Summary of Coefficients (Status of Significance With Positive or Negative Direction) for Recycling in the Study Areas	169
5.23	Opinions on Current and Future Programs and Policies	174
5.24	Group Statistics on Existing Management Problems	176

6.1	Summary of Results (Dependent Variable (Recycling of Materials) by Independent/Explanatory Variables)	182
6.2	Summary of Results (Dependent Variable (Waste Amount) by Independent/ Explanatory Variables)	183

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
1	Work Schedule/ Approach of Study	10
2 (a)	Location of Study Areas	46
2 (b)	Location of Study Areas	47
3.1	Environmental Perception and Behavior	58
3.2	Factors Affecting Recycling Activities Among Householders	63
5.1(a)	Normality Test: P-P Plot (Age)	99
5.1(b)	Normality Test: P-P Plot (Income)	100
5.2	Average Waste Weight in Urban Areas (Percentages)	117
5.3	Average Waste Weight in Rural Areas (Percentages)	118
5.4	Average Waste Weight Per Household (Between Urban And Rural Communities)	119
5.5	Waste Weight and Income	120
5.6	Household Waste Generation (Rural Area)	121
5.7	Household Waste Generation (Rural Area)	121

5.8	Linear Fit (Average Waste and Income (Rural)	123
5.9	Quadratic Sit (Average Waste Weight and Income (Rural))	123
5.10	Linear Fit (Average Waste Weight and Income (Urban))	124
5.11	Quadratic Fit (Average Waste Weight and Income (Urban))	124
5.12	Household wastes (y) and Income (x) (Polynomial Fit Curve)	125

LIST OF ABBREVIATIONS

ACTUALWG	Actual weight in kg per household per day
ADVERT	Advertising and campaigns
AER	Advanced electric reactor
AVEWEIGH	Average weight of waste per day per family
AWARENES	Awareness among the public
BOD_3	Three-Day Biochemical Oxygen Demand
CA	Comparative Appraisals
CBD	Central Business District
Cd	Cadmium
CERCLA	the Comprehensive Environmental Responsibility, Compensation and Liability Act
CLOGDRAI	Clogged drainage
COD	Chemical Oxygen Demand
COLL	Number of collection per week
COP	Convenience of operational
COSTINC	Increase in cost to improve management
DININGOUT	Frequency of dining out per week
DOE	Department of Environment
DT	Demographic traits
EC	Environmental Consciousness
EMS	the Environmental Management Systems
ENFORC	Lack of enforcement
ENFPRG	Increase current level of enforcement
EPA	Environmental Protection Agency's (EPA) of the U.S
EQA	Environmental Quality Act

EWB	Sense of environmental-well-being
FACMISUS	Misuse of waste management facilities
FAMSIZE	Number of occupants living in a residential unit
FCF	Fisher Classification Function
FREQSAT	Satisfactory level of collection frequency
GLASBOT	Glass bottles
HCS	Hauled Container System
HDPE	High Density Poly-ethylene
HIGHCOST	High cost of waste management
HRR	households' response to recycling
IETC	the International Environmental Technology Centre
ILLDUMP	Problem of illegal dumping
IME	Integrated Manufacturing and Environmental Approach
INAPPLOC	Inappropriate location of current container
INCFINES	Increase in fines and compounds
ISWM	Integrated Solid Waste Management
kg	Kilogram
Kg.	*"Kampung"*
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LENGTHST	Length of stay in current residential unit
LOCSAT	Satisfactory location of containers
LW	Level of Awareness
MANDSEP	Mandatory separation of waste
MARITST	Marital status of resident
MBJB	Majlis Bandaraya Johor Bahru (Johor Bahru City Council)
METHSAT	Satisfactory method of collection
MOHLG	Ministry of Housing and Local Government
MOREREC	More recycling programs
MPJBT	Majlis Perbandaran Johor Bahru Tengah (Central Johor Bahru City Council)

MSW	Municipal solid waste
MSWM	Municipal Solid Waste Management
NGO	Non-governmental organizations
OCCUPATI	Occupation of respondent
OCCUPST	Status of occupancy (tenant/renter)
ODORPRO	Problems of odor
OWT	Organic waste technologies
OVERFLO	Problem of waste overflow
PAT	Plasma arc technology
Pb	Lead
PE	Polyethylene
PEQI	Perceived Environmental Quality Indices
PJ	Preferential judgments
PLASTBOT	Plastic bottles
PP	Polypropylene
PRIVATIZ	Privatization of waste management
PVC	Polyvinyl Chloride
R^2	Co-efficient of Determination
3R's	Recycle, Reduce and Reuse
RCRA	United States Resource Conservation and Recovery Act
RECAVAIL	Availability of recycling program
RM	Ringgit Malaysia
RORO	Roll-on Roll-off
RRF	Resource Recycling Facility
SA	Socio-economic assessment
SCS	Stationary Container System
SEPAR	Activity of home separation
SPSS	Statistical Packages for Social Sciences
SSEPAR	Source separation program
SUPPRECY	Support for recycling programs
SWM	The Southern Waste Management Pte. Ltd.

SWM	Solid Waste Management
TIMCOLFA	Failure to collect on time
Tmn.	*Taman* (Residential park)
TOC	Total Organic Carbon
U.K.	the United Kingdom
USD	Dollar (United States)
WSTVALUE	Wastes have values
Yr	year

LIST OF SYMBOLS

$\langle$	Alpha (Cronbach)
M	Mean
M_1, M_2	Mean of the first group and second group.
p	probability
r	Correlation coefficient
R	Multiple correlation coefficient
S	Unbiased estimate of the population standard deviation.
$S_{Difference}$	Standard deviation of the distribution of difference between means.
t score	Number of standard deviations from the mean on a t distribution.

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
A	Sampling Requirement by Size of Population	201
B	Survey Questionnaire	202
C	Reliability Analysis – Scale Alpha	209
D	Independent Sample *t*-test: Waste Minimization of Urban Rural Population	212
E	Values of *t* for v degrees of freedom and p-⟨	213
F	Raw Data: Average Waste Weight (Urban)	214
G	Raw Data: Average Waste Weight (Rural)	216
H	Summary of Means (Urban Areas)	219
I	Summary of Means (Rural Areas)	221

INTRODUCTION

1.1 Background Information

In tandem with our nation's goal of becoming a developed nation by the year 2020, while ensuring the emphasis on "Sustainable Development", Malaysia needs a complete and clear information regarding the trends in waste generation as well as benefits and effects of source reduction, recycling, composting, land-filling and combustion of MSW. Data on trends in urban-rural differences in attitudes, perceptions, recycling behavior as well as the householders' waste generating behaviors are necessary to design and plan for an effective waste management system in the near future.

Rapid urbanization process and increasing urban population in Malaysia have exacerbated the problem of increasing waste volume, particularly the municipal solid waste (MSW). At an average annual growth rate of 4.82 percent in urban population for the country since 1991 (Department of Statistics, 2002), the country is currently generating more than 15,000 tonnes of wastes per day (Anon, 2001(a)). The demand for urban infrastructure and services and the complex inter-relationship of various economic

and social factors which follow, have caused problems in terms of both financial burden faced by the government in managing the wastes as well the intangible effects of environmental degradation associated with it (i.e., foul odor, aesthetics, degrading property values and health, and environmental pollution) (Agamuthu, 1997; Fadil, 1996, and Mohd. Nassir, 1996). Annually, the Government of Malaysia has to spend an average of RM70 per tonne or RM 26 per person for the purpose of collection and disposal of its solid wastes, while the landfills in the nation are further decreasing in number (Juzhar, 2002).

Sixty-two (62) percent of the population in Malaysia are urban inhabitants (i.e., defined by Malaysian authorities as those places with 10,000 persons or more). The state of Johor belongs to the top four, most urbanized areas after Kuala Lumpur (100%), Selangor (88%), and Pulau Pinang (80%)(Department of Statistics, 2002). Sixty-five (65) percent of the population in Johor currently lives in urban areas. The state population has been growing at 2.6 percent since 1991 giving the total population of 2.7 million in the year 2002, with a population density of 144 persons per square kilometer. The rapid urbanization in the whole state makes the study on solid waste generation crucial and timely. In Johor Bahru District, i.e., the study area, the population stands at 1.065 million (Department of Statistics, 2002). With a total of 176,000 households, the areas generate 1.29 kg per capita per day (Juzhar, 2002). Experts believe a landfill can last 10 years longer if Malaysians recycled 50% of their garbage. The residents of Johor Bahru currently generate 1,300 tons of waste every day. It takes only 3 days to fill the entire length of the Johor Causeway with this amount of garbage (Ministry of Housing and Local Government, 2004). Thus, it is important to look at urban-rural differences in socio-economic background and life styles of residents and analyze how these factors affect the overall waste amounts.

The environmental effects and costs are indirectly related to waste quantities, which are dependent on consumption patterns and behavior of individuals (Park, 1998).

Even though mixed approaches employing more than one particular method have been called for in an integrated management system (White et al., 1995), basic data of waste composition and background information of the waste generators as well as existing management system are equally important. These factors, along with the perceptions of waste generators are prerequisites to developing any management policies as far as future suggestions are concerned (Park, 1998).

Most of these trends and problems originate at the source, namely waste generators. Therefore, an understanding of the public behaviors need to be addressed systematically through more rigorous efforts in future research in related fields to find ways to improve refuse management of a particular country. Studies such as this, along with other waste generation analysis are among a few areas requiring continuous emphasis if a sound management were to be reached.

1.2 Problem Statement

Solid waste management in emerging industrialized and developing countries is closely linked to the public for it is considered as an essential part of proper public health and environmental control. The focus on "fitness for purpose", the need to adapt by the differences between developed and developing countries such as socio-economic background (Azman, 1995; Mohd.Razman, 1994) have further the needs for more elaborate research on similar matters in developing countries. Another important issue in discussing the differences between the different economies includes the understanding of behavior and waste generation.

An understanding of public behavior is considered one of the most essential parts of an integrated waste management. Householders' behavior in waste management has a

critical effect on the overall environmental impact. Communicating with these vital players in the system is essential, for investing money and time in educating households about the effect their own actions in generating and handling waste can have on the environment would seem to be time and money well spent (White et al., 1995). In fact, future strategies for minimization of impacts and developments in urban solid waste management are likely to involve greater public participation, developments of legislation, codes of practice and guidelines, and only to a limited extent, improvements in technology (Anderson, 1999).

The collection and sorting of waste require an appropriate public awareness and participation. Public initiative is needed to generate the appropriate conditions, such as education and infrastructure, for the participation of the citizens in the recycling effort. The effort must be emphasized for the amounts of resources at stake are enormous. The recycling of resources has generated more than 600 million tonnes of secondary raw materials, of which 200 million tonnes were traded internationally (Bontoux et al., 1996). The public has to be informed of the economic benefit of recycling as well as their poor recycling efficiency. Malaysia has to import papers from outside even though the materials can be obtained if our papers were recycled (Juzhar, 2002).

The issue of increasing wastes has been importantly linked to the most crucial aspect of health. Due to the strong link between waste management and health issues, directly and indirectly related to the environmental effects solid waste has on our lives, developing countries are further challenged in finding the best economical and efficient way of resolving the problem. It not only involves a multiplicity of elements ranging from financing, collection and transportation, educational programs, but also of institutional matters. In fact, these factors have been recognized as important prerequisites for an effective Municipal Solid Waste Management (MSWM) in a given country, particularly countries in South-Asia (Bontoux et al., 1996).

In order to achieve an effective integrated waste management in the country several issues have to be tackled. According to the International Environmental Technology Centre (IETC), ".... the greatest impediment to improving planning in MSWM in South-Asia is lack of knowledge: of waste quantities, and characteristics and factors that affect their variations; of generators' attitudes, behaviors and needs, of how much different operations actually cost; of staff performance; and of sound practices, elsewhere the main handicap is lack of knowledge of the appropriate ways to gather the data that would assist good planning." (Bontoux et al., 1996, p. 211). Therefore, more research works must be done locally to provide a better understanding of the issues mentioned, particularly waste minimization and recycling.

Recycling is considered a part of an integrated waste management solution. It reduces the amount of waste that needs to be buried in a landfill or incinerated. The reduction in volume not only reduces the disposal costs, but also adds to useful life expectancy of a landfill. According to IETC, next to the role of industry and public authorities, environmental awareness and consumer participation are crucial for the success of recycling operations (Bontoux et al., 1996). However, the efficiency of a recycling program is dependent upon several requirements including the adequate data on contents of wastes, the understanding of recycling activities carried out in both rural and urban areas, as well as the attitudes of residents about recycling, most of which are still lacking in the country. Another issue, which also needs to be analyzed, includes the knowledge of recycling options might best meet the residents' needs.

In general, the MSW is related to income and socio-economic status, in that as an economy grows, society produces and consumes more on a per person basis. This results in larger amounts of MSW. The attitudes and behavior of the public also play a role in affecting the amounts. The level of recycling behavior determines the amount of waste that finally goes to the landfill sites. Only through public opinion survey or behavioral studies could these issues be analyzed. The planning and designing of future systems may

be made easier if a clear understanding of the public expectations and perceptions of political and institutional practices is achieved as well as the pattern of waste generation and its components analyzed.

Studies involving waste generation and its link with economic indicators, management and environmental policies, and its relationship with behavior and perceptions have been conducted in many countries. Many have indicated the direct linkage between income and economic growth (Li, 2003; Metin, 2003; McCollough, 2001; Agamuthu, 2001; Nemat, 1994; Mohd. Nazri, 1994; Wan Rahim, 1992; Richardson and Havlicek, 1978; Wertz, 1976; Kemper and Quigley, 1976, and Grossman et al., 1970), and biospheric and altruistic values (Davio, 2001; Schwartz, 1994), locational and age factors (Park, 1998), ownership status, educational, socio-economic and environmental awareness levels (Metin, 2003; Irra, 1999; Uche, 1998, Kinnaman and Fullerton, 1997; Ahmad Termizi and Fadhil (1992) as well as lifestyles (Sabarinah, 1998; Saltzman and William, 1993) with the amounts of municipal solid waste. However, little attention was given on recycling and home cooking or dining activities of residents on the amounts of household wastes. The study will look at these areas while testing the applicability of the previous underlying theories described by the researchers on the study area.

Studies, particularly on the public perceptions and behavior in regards to environmentally relevant political behavior and management system and waste data are lacking in this country. It is timely that information be made available to ease managers to make better decisions as to which alternatives to be used in a particular situation with specific waste composition at a particular location and time. There will be a time when the conventional and most commonly used method of landfill may no longer be a cheap and affordable management approach in this country. This is due to the ever-increasing maintenance and operating costs along with costs of land and other intangibles associated with the negative environmental effects resulted (Read, 1997; Serji, 1997, Agamuthu,

2001). Such a phenomenon may require waste managers to sort to waste reduction as the most viable approach in the future. Such studies and researches on waste composition are highly beneficial, for the data gathered can be of very much use to decision makers in the future. Thus, this study (which looks at the household waste generation among various communities of various economic backgrounds, particularly on both urban and rural or village communities) can help provide invaluable data on the trends currently occurring within the study area.

1.3 The Objectives of Study

Wastes are defined as materials considered as unwanted goods or seen as materials for which there are no further use (Peavy et al., 1986; Anderson, 1999), while environmental behavior as activities which are associated with waste minimization practices including reuse, reduce or recycle of wastes before being discarded. Waste generation, on the other hand, involves activities resulting in materials being discarded or thrown away. The study emphasizes mainly on household wastes (i.e., wastes generated in the preparation and consumption of foods, which include garbage, fuel residues like ash, house sweepings, household discards such as paper, glass, plastic or metal containers, garden wastes, and animal dung (Agamuthu, 2001)) generated from both rural and urban communities within Johor Bahru and its vicinity areas. Garden wastes and animal dung are omitted in the study.

Among the issues discussed in this study include the role of education, family income, marital status, family size, recycling activities, and lifestyles (in terms of eating and cooking habits) in affecting the amount of wastes generated as well as the geographical factors (rural-urban locations) in determining the variations in the MSW

being produced. Homeownership factor is another criteria analyzed to see if it has any influence on the practice of waste minimization amongst both urban and rural residents.

The management of solid wastes should be integrated and not only emphasizes on urban areas, but also the need for improvements in rural areas. The objectives of the study include:

1. To study the perceptions and attitudes on the environment, in general, and recycling activities, in particular, of both the urban and rural households living in Johor Bahru and its vicinity areas.

2. To analyze how explanatory variables such as income, age, education, marital status, family size, housing characteristics, cooking and eating habits as well as recycling activities affect the households' waste generation.

3. To analyze the variations in terms of waste composition generated and materials recycled by the residents of various socio-economic backgrounds.

The study is to investigate differences in both urban and rural residents and their perceptions toward environmental and waste management policies and recycling practices currently employed. It also analyzes the variations in terms of the compositions of household wastes generated, and how income and other demographics, recycling behavior, as well as daily dining and home-cooking activities of these two sample groups affect the waste amount. Focus is emphasized on various housing settlements from urban and rural areas and socio-economic backgrounds of residents who stayed in the study areas. The research looks at the area as a whole without referring to specific sites. The whole sample is categorized into either urban or rural.

Among factors or explanatory variables examined in the study include respondents' demographics or 'personal factors', i.e., particularly age, race, marital status, educational achievement, family size, economic indicator such as family income, participation in pre-cycling behavior (or 'source-reduction' or waste minimization practices), and lifestyle (i.e., measured by home-cooking and dining activities). Other factors also include environmental views on the need to recycle and the benefit of recycling among the respondents.

The whole process of the study begins with the analysis of previous studies on the similar issues, definition of the terms and variables used, the collection of secondary data of the study area, and finally, the actual primary data collection and analysis stages. The underlying theories developed by the previous researchers are later used to develop hypotheses and will be tested in the study.

1.4 Scope of Study

The study area covers both urban and rural areas within the southern region of Peninsular Malaysia. It involves established communities within Majlis Perbandaran Johor Bahru Tengah (MPJBT) as well as less developed villages or 'kampung' in the surrounding areas. While the established communities are located within the service area administered by the Southern Waste Management (SWM) Pvt.Ltd., a private company responsible for the management of solid wastes, under the national privatization project, as well as various corresponding local and municipal councils, the less developed villages or 'kampung' lack a properly managed waste collection services. Some of the villagers either have to treat their own wastes by burning or dig special holes into which they throw

their wastes, or bring their wastes to drop off centers at the nearby roads serviced by waste contractors.

"Urban", as defined by the Population and Housing Census, include areas which are developed, with a population of 10,000 or more and involved in non-agricultural activities (Department of Statistics, 2002), with houses complete with modern toilet facilities. Therefore, the study areas are selected from communities with large population size and are defined as those communities which are well established with adequate waste collection services provided by local councils or waste contractors appointed by the Southern Waste Management (SWM). Residents of the study areas come from various socio-economic backgrounds and live in planned, mixed residential developments. The rural areas are selected based on the socio-economic and employment characteristics of the households living in the communities. The residents in the rural areas are working in agricultural sectors and stay in houses, which are often scattered and have inadequate or no waste collection services.

A sample of 500 is taken from urban communities and 385 from rural areas, giving it a 95 percent confidence level (i.e., a precision level of between 4-5 percent). This is based on the total population of more than 100,000 for the selected urban communities and 6,646 for the rural villages (The actual appropriate sample sizes for both areas, according to the Table, are 400 and 378, respectively - refer to Appendix A; Yamane, 1983). The communities in the urban areas have a total population of include Taman (Tmn.) Permas Jaya, Tmn. Perling, Tmn. Sri Skudai, Tmn.Sri Pulai, Tmn. Mutiara Rini, Tmn. Universiti. They are selected based on the fact that they are among the fastest growing housing areas in the Majlis Perbandaran Johor Bahru Tengah (MPJBT). Most of these developments have been growing at an average of 5-10 percent per year (Southern Waste Management, 1998). The urban communities are selected based on the well-planned development of terrace, semi-detached, bungalow units or flats, which are provided with proper house-to-house or communal collection facilities.

Rural areas, on the other hand, are villages containing traditional *kampung* houses or squatters, rather than well-planned, mixed developments with terraced housing units, flats and bungalows. Majority of the residents in rural areas selected belong to lower income category, i.e., with a monthly family income of RM 1,000 or less), and have lower level of academic qualifications (i.e., primary or high school education), and are employed mainly in agricultural or fishery sectors (Department of Statistics, 2002). Most of these areas lack the adequate cleaning and waste collection services, which the other urban communities have.

The villages selected include Kampung (Kg) Sungai Danga, Kg. Pasir, Kg. Sungai Melayu, Kg. Pertanian, Kg. Jaya Sepakat, Kg. Sri Gunung Pulai, and Kg. Baru Ulu Choh. These areas are chosen based on their housing characteristics and demographic background, such as the socio-economic status of its population and the ways solid wastes are managed (i.e., the use of rural drop off centers and burning, or dumping of wastes in holes). Majority of the homeowners involve in agricultural activities (Maklumat Kampung, 2002).

The study begins with the analysis of the problem situation by looking into previous researches and theoretical developments of the scopes understudied. The background of the study area is also analyzed. The second half of the study period involves the actual survey and data collection from both urban and rural areas, followed by the data tabulation and analysis before making the final conclusion based on results obtained (Refer to Figure 1 for the work flow of the study). The statistics used include descriptive and inferential statistical methods such as mean, percentage, standard deviation, correlation coefficient (R) in multiple and linear regression analyses as well as other tests of significance (t-tests, p values, and standardized correlation coefficients (beta values)).

1.5 Hypothesis Formulation

Proposition and hypothesis are two essential terms often used in any research. While the former is defined as a statement of concepts which may be judged as true or false if it refers to observable phenomena, the latter is when it is formulated for an empirical testing (Babbie, 1986). Research hypotheses are used to predict based on theories of how one attribute has an effect on another and explains the difference between populations predicted by a theory. Several of the factors identified in previous research will be tested in this research.

In this study, the hypotheses included are:

1- Residents in urban areas participate in recycling more in comparison to their rural counterparts.
2- Recyclers are mostly married, homeowners, have a higher family income, and live in big families.
3- Younger and female respondents tend to recycle more.
4- Recycling is influenced by educational or academic qualifications and the concern for the needs to recycle.
5- High-income families, homeowners, and those who live in a big family generate more wastes.
6- Waste generation is influenced by residents' marital status, recycling, home-cooking and dining-out activities.
7- Rural areas generate higher amounts of food and organic wastes.

Normality test of distribution is tested using P-P plot method using SPSS software, while the reliability test uses Cronbach's Alpha. Hypothesis testing in the study is conducted using several methods. Firstly, indications of the significant level, such as "$p < 0.05$" or "$p < 0.01$" are used to indicate the probability of the results if the null hypothesis were true is less than 0.05 (5 percent) or 0.01 (1 percent), respectively. If this is the case, the null hypothesis is rejected, and thus the result is said to statistically significant. Other tests include two-tailed tests, due to the non-directional nature of the hypotheses (Anon and Anon, 1997), as well as tests of significance using beta (a standardized regression coefficient in linear regression with stepwise method of elimination), p, and correlation coefficient (R) values (in multiple regression analysis).

1.6 Organization of the Thesis

The thesis begins with statements of the purpose and objectives of the study in Chapter I, together with problems understudied and followed by the importance of the study. Chapter II explores the literature reviews concerning the topics of waste generation, as well as environmental values and behavior, perceptions on waste management, and factors influencing it. It later analyzes previous research works conducted locally and abroad. The overview of the theories provides a basis of all hypotheses developed in the study.

Secondary data sources of existing management and institutional situations in the country are included in the chapter before focusing on the more specific scopes of the study. The secondary data collected include the development trends, geographical background of the area, previous and current waste management and legislative framework as well as trends in the quantity of waste being disposed.

Chapter III looks at the underlying theories on attitudes, perceptions, and environmental behavior as well as theories developed by previous researchers on the topic as well as on waste generation. They are essential in delineating specific variables and factors used in the study. While other primary data and the information gathered about the study areas are discussed in Chapter IV, along with the methodology and approach of the study. The chapter also explains the statistical analyses used. Chapter V covers the analysis of results and Chapter VI, the conclusion of the study and recommendations for future policy and program guidelines based on the findings.

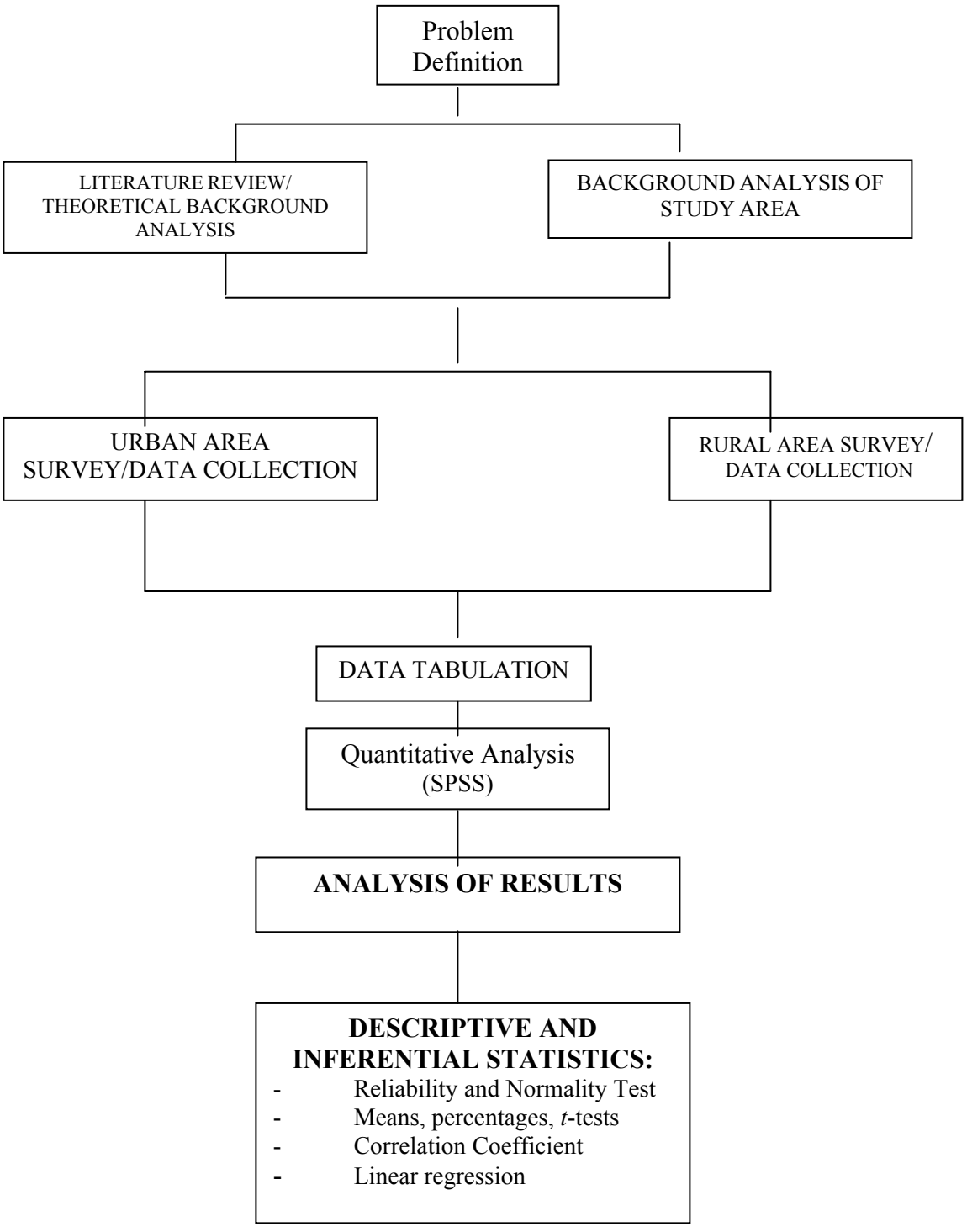

Figure 1: Work Schedule/ Approach of Study

REFERENCES

Abdul Mutalib Mohammad (2004). A Personal Communication. Southern Waste Management Pvt. Ltd. January.

Agamuthu, P. and Khan, N. (1997). "Solid Waste Characterization and Quantification." In: Effective Solid Waste Management. Eds. P.Agamuthu and L.Nather. Ecotone Management Sdn.Bhd.pp.2.4-2.13.

Agamuthu, P. (2001). "Solid Waste: Principles and Management." Institute of Biological Sciences. Universiti Malaya. Kuala Lumpur. University of Malaya Press. ISBN 983-2085-26-8. pp.395.

Anderson, G.K. (1999). "Waste Minimization." Unpublished Report. Seminar in Advanced Wastewater Treatment, Faculty of Civil Engineering. UTM-Skudai.27-29 January.

Ahmad Termizi Abd.Karim and Fadil Hj.Othman, (1992). "The Effect of Living Standard and Culture on Refuse Generation in the Johor Bahru Area." Proceedings International Conference on Environmental Protection and Control Technology, Kuala Lumpur. **Vol.3**.pp. 1071-1078.

Anon (1996). "*RM60 Juta Mengurus Sampah."* Utusan Malaysia. June,20.

Anon (2001(a)). " *MPP Wajar Tambah Program Kitar Semula."* Harian Metro. March.,22.

Anon (2001(b)). " *Kerajaan Pergiat Kempen Kitar Semula*." Berita Harian. February,20.

Anon (2001(c)). "*Kempen Kitar Semula Sasar Kutip 100 Tan*." Harian Metro. June, 20.

Anon (2001(d)). "*Kesedaran Pentingnya Kitarsemula Masih Rendah*." Utusan Malaysia June, 25.

Aron, A. and Aron, E. N. (1997). "Statistics for the Behavioral and Social Sciences: A Brief Course." U. S.: Prentice Hall, Inc. pp.329.

Azman Ahmad Termizi (1995). "*EPU Kenalpasti Enam Konsortium."* Berita Harian. July, 3.

Babbie, E. (1986). "Principles for Social Sciences for Research." Woodsworth Publishing.

Bell, J.M. (1963) J. M. "Development of Method for Sampling and Analyzing Refuse." Purdue University: Ph.D. Thesis.

Berenyi, E. B.(1997). "1997 Update to the Materials Recycling and Processing Industry in the United States." Westport, CT, USA: Government Advisory Associates, Inc.

Bontoux, L., Leone, F., Nicolai, M., and Papameletiou, D.(1996). "The Recycling Industry in the European Union: Impediments and Prospects." Institute for Prospective Technological Studies (IPTS). EUR 17271 EN. Spain. pp.53.

Britton, P.W. (1973). "Improving Solid Waste Separation Studies." *Journal of the Sanitary Engineering Division*. ACE. **Vol.98.**No.SA5. October.pp.717-730.

Carmichael, B.A. (2000). " A Matrix Model for Resident Attitudes and Behaviors in A Rapidly Changing Tourist Area." *Tourism Management.* **Vol. 21**.No.6. pp. 601-611.

Chertoff, L. and Buxbaum, D. (1986). "Public Perceptions and Community Relations." The Solid Waste Handbook. pp.31-42.

Clark, M. J. (1993). "Consumer Response to Environmental Shopping Campaigns: Design of A New York City Case Study." Proceedings of IEM/ICE Conference or Solid/ Industrial Waste Management System. 19-21 September, 1994. Kuala Lumpur, Malaysia .4B.

Crichton, L.M. and Lucas, J.L.(1994). "Strategic Planning for the Management of Municipal Solid Waste." Proceedings of IEM/ICE Conference or Solid/ Industrial Waste Management System. 19-21 September, 1994. Kuala Lumpur, Malaysia. 4C.

Cointreau, S.J.(1982). "Environmental Management of Urban Solid Wastes in Developing Countries: A Project Guide." Urban Development Department. The World Bank.

Davio, R.L. (2001). "Influences and Motivations on Curbside Recycling Participation." University of Texas,Austin,Texas.The United States of America. ProQuest Information and Learning Company: Ph.D. Thesis.

Department of Statistics, Malaysia (2002). "Population and Housing Census 2002". Percetakan Nasional Malaysia Berhad (PNMB).

Downs, R.M. (1970). "Geographic Space Perception: Past Approaches and Future Prospects." *Progress in Geography*.**Vol**.**2**. pp.65-108.

Department of Environment (DOE) (1997). *Era Hijau.* Ministry of Environment, Science, and Technology, Malaysia: DOE brochure.

Fadil Hj.Othman (1997). "Penyingkiran Kadmium and Plumbum dalam Sampel Air dan Air Larut Resap Menggunakan Tempurung Kelapa Sawit Terubah Suai." Universiti Teknologi Malaysia: Ph.D. Thesis.

Gamba, R. J. and Oskamp, S. (1994). "Factors Influencing Community Residents' Participation in Commingled Curbside Recycling Programs." *Environment and Behavior.* **Vol.26**. No.5.September. p.587.

Grossman D., Hudson, J.F. and Mark D.H. (1974). "Waste Generation Models for Solid Waste Collection." *Journal of the Environmental Engineering Division.* **Paper 1102**. Dec. pp. 1219-1230.

Harper, K. M. (1998). "Middle-income African-Americans and Household Hazardous Waste Management for Adults Environmental Education." New York University, USA. ProQuest Information and Learning Company: Ph.D. Thesis.

Hindle,P., White, P.K., & Minion, K (1993). "Achieving Real Environmental Improvement Using Value Impact Assessment." *Long-Range Planning*. **26** (3). pp. 36-48.

Hong, S., Adams, R., and Love, A.H. (1995). "An Economic Analysis of Household Recycling of Solid Wastes: The Case of Portland, Oregon*". Journal of Environmental Economics and Management*. September. pp. 136-146.

Irra T. M. Sundram (1999). " Sustainable Waste Management: An Awareness Study on Cleaner Technologies in the Klang Valley." Institute of Postgraduate Studies and Research. Universiti Malaya: M.Tech.(Environmental Management) Thesis.

Jamaluddin Jamil (2001). A Personal Communication. The Southern Waste Management Pvt.Ltd., Permas Jaya, Johor. December 15.

Johor Bahru District Office (2002). *"Maklumat Penduduk Kampung*." Unpublished Report.

Jurin, R. R. (1995). "College Students' Environmental belief and Value Structures, and Relationship of These Structures to Reported Environmental Behavior." Ohio State University, Ohio, USA.: Ph.D. Thesis. ProQuest Information and Learning Company

Juzhar Jusoh (2002). "Improving Municipal Solid Waste Landfills of Peninsular Malaysia: Organizational and Structural Adjustments." University of Wisconsin-Madison, U.S.A. :Ph.D. Thesis. ProQuest Information and Learning Company.

Kemper and Quigley (1976). "The Economics of Refuse Collection." Cambridge, MA: Balinger.

Kinnaman,T. and Fullerton, D.(1997). "Garbage and Recycling in Communities With Curbside Recycling and Unit-Based Pricing." *National Bureau of Economic Research Inc., Working Paper Series* **#6021**. April 1997.

Letcher, R. C. and Sheil, M.T. (1986). "Source Separation and Citizen Recycling." In Robinson, William D.(Ed.) *The Solid Waste Handbook: A practical Guide*." John Wiley and Sons.

Li S. (2003). "Recycling Behavior Under China's Social and Economic Transition: The Case of Metropolitan Wuhan." *Environment and Behavior.* November. **Vol.35**. No.6. pp. 784-80.

Lokman Hd.Hani and Fadil Hj.Othman (1992). "Collection and Disposal Problems of Solid Waste in Major Cities of Developing Countries: A Case Study in Malaysia*."* *Journal of Resource Management and Technology*. **20** (11) .105.

Maddox, R.N. (1985). " Measuring Satisfaction with Tourism." *Journal of Travel Research*. **Vol. 28** (3). pp.3-9.

Maklumat Kampung (2002). Unpublished report.

McCollough, J. (2001). "The Effects of Income Growth in the Generation of Municipal Solid Waste." Temple University Graduate Board. USA: Ph.D. Thesis. ProQuest Information and Learning Company.

Md. Ghazaly Shaaban (1997). "Hazardous Waste Management, Treatment, and Clean Technology." In: Effective Solid Waste Management. Eds. P.Agamuthu and L.Nather. Ecotone Management Sdn.Bhd. pp.9.1-9.11.

Metin,E,.Erozturk,A.,and Neyim,C.(2003). "Solid Waste Management Practices and Review of Recovery and Recycling Operations in Turkey." *Waste Management*. **Vol.23**. No.5. pp. 425-432.

Ministry of Housing and Local Government (2004) (online). "*Kitar Semula: Fikir Dulu Sebelum Buang*." World wide web. http://www. kitarsemula.com.).

Mohd.Nassir Hassan (1996). "Waste Paper Recycling – Problems and Prospects*." The Star.* Star Publication (M) Pvt.Ltd. January, 9.

Mohd. Nazri Omar (1994). "Characterization and Management of Solid Waste in Klang Valley." Faculty of Engineering. Universiti Malaya. Kuala Lumpur: M.Eng. Thesis.

Mohd. Razman Salim, Fadil Othman and Sabarinah Marzuky(1994). "Problems and Challenges of Solid Waste Management: A Case Study in South Johor, Malaysia." *Jurnal Fakulti Kejuruteraan.* Universiti Teknologi Malaysia. **Vol. 7**. No.1. pp. 1-8.

Mohd. Razman Salim (1995). "Solid Waste Management: Materials Flow and Generation of Solid Waste, Solid Waste Collection and Transport." A Lecture Note. Short-course on Environmental Engineering for Non-Environmental Engineers. March 14-15.Senai, Johor.

MPJBT (2001). *Lapuran Jumlah Pegangan Di Bawah Pentadbiran Majlis Perbandaran Johor Bahru Tengah (MPJBT)*. Unpublished Report.

Murdick, R. (1982). "Business Research – Concepts and Guides." Grid Publications.

Musa E and Ho G.E. (1981). "Optimum Sample Size in Refuse Analysis." *Journal of Environmental Engineering Division.* **107**. EE6. Dec. pp. 1247-1279.

Nakamura, M. (1989). "An Overview of JICA Study: Solid Waste Management Needs and Prospects in Malaysia: Would Japanese Statistics Infer Malaysia Future." Proceedings of Seminar/Workshop for the Development and Importance of Solid Waste Management Master Plan for Local Authority. 3-7 July, 1989. Pulau Pinang.

Nemat Shafik (1994). "Economic Development and Environmental Quality: An Econometric Analysis." *Oxford Economic Papers* **46**. (1994): pp. 757-773.

Odum, H.H. (1992). "Approach to Mulitvariate Analysis." Joglas Publishers.

Oskamp, S. (1995). "Resource conservation and Recycling: Behavior and Policy." *Journal of Social Issues*. Winter 1995. **Vol.51**. No.4. p.166.

Oskamp, S., Harrington, M. J., Edwards,T. C., Sherwood, D. L.,Okuda, S.M., and Swanson, D.C. (1991). "Factors Influencing Household Recycling Behavior." *Environment and Behavior*. **Vol.23**. No.4. July. p.515.

Park, S. (1998). "Attitudes Toward waste Management and Environmental Policies in Washtenaw County, Wisconsin". Urban, Technological and Environmental Planning. University of Michigan, USA.: PhD Thesis. ProQuest Information and Learning Company.

Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. (1986). "Environmental Engineering." McGraw-Hill. International Addition.

Porter, J.W. (1989). "Waste Management: A Look to The Future." *Journal WPCF*. **Vol**.**61**(5). May.

Rathje,W.L (1991). "Once and Future Landfill". *National Geographic.* May. pp.116-131.

Read, A. D. (1997). "Landfill: Availability, Life-Expectancy, and Government Influence: An Assessment of Private and Public Sector Opinions*." The Journal of Solid Waste Technology Management***. Vol. 24**(2). May 1997.

Richardson, R.A.and Havlicek,J.Jr.(1978). " Economic Analysis of the Composition of Household Solid Wastes". *Journal of Environmental Economics and Management*. May 1978. pp. 103-111.

Rolston, C. P. (1997). "Correlates of Environmental Behavior and The Relative Importance of Environmental Attributes in Consumer Decision-Making." Temple University. USA: Ph.D.Thesis. ProQuest Information and Learning Company.

Sabarinah Marzuky(1994). "*Kajian Kes Penjanaan Sisa Domestik di Johor."* Faculty of Civil Engineering. Universiti Teknologi Malaysia: M.Eng. Thesis.

Sakai, S. (1995). "World Trends in Municipal Solid Waste Management." *Waste Management.* Elsevier Science Ltd. **16** (5/6). pp. 341-350.

Saltzman, D. and Williams (1993). "Income and The Recycling Effort: A Maximization Problem." *Energy Economics*. January. pp. 33-38.

Sawell, S.E. (1997). "A History of The Integrated Solid Waste Management Group." *The International Energy Agency, Integrated Solid Waste Management Group (IEA-ISWMG).* Kyoto International Community House. Sept. 24-25.

Schultz, P.W. and Oskamp, S. (1996). "Effort as a Moderator of the Attitude-Behavior Relationship: General Environmental Concern and Recycling." *Social Psychology Quarterly*. **Vol.59**. No.4. p.376.

Serji Amirkhanian (1997). "Utilization of Waste Materials in Highway Industry – A Literature Review." *The Journal of Solid Waste Technology and Management*. **Vol.24**(2). May 1997.

SOFRES Intersearch Corporation (1998). "CEQ Recycling Focus Groups Report." September. MR & A #2397. World wide web. http://www.ofee.gov/html/ceq.htm.

Southern Waste Management (1998*). "Lapuran Pengurusan Sisa Pepejal dan Pembersihan Secara Interim.*" Malaysia: SWM Interim Report. October 1998.

Southern Waste Management (2003). World wide web http://www. swmsb.com.

Starik, M. and Gribbon, C. (1993). "European Strategic Environmental Management: Towards a Global Model of Business Environmentalism*." Research in Corporate Social Performance and Policy*. **Vol. 14.** pp.167-97.

Tacq, Jacques, 1997. "Multivariate Analysis Techniques in Social Research." Sage Publications. London.

Uche, A. G. (1998). "Households Recycling Behavior in Johor Bahru." Faculty of Civil Engineering. Universiti Teknologi Malaysia: M.Eng Thesis.

U.S. EPA (1997). "Characterization of Municipal Solid Waste in the United States : 1996 Update." Washington D.C., U.S.: EPA 530.R-970.015. Office of Solid Waste and Emergency Response.

Wagenet, L.P. (1997). "Impact of a Focused Environmental Education Program on Adults and Study of Knowledge, Attitudes, and Behaviors in the New York City Watersheds." Cornell University. USA.: Ph.D. Thesis. ProQuest Information and Learning Company.

Walmsley,D.J. and Lewis G.J.(1984). "Human Geography: Behavioral Approaches." Singapore. Longman Publishers.

Wan M,Rahim Wan Ali (1992). "Classification and Characterization of Local Domestic Waste". Faculty of Engineering. Universiti Malaya. Kuala Lumpur: M.Eng.Thesis.

Wertz. K.L. (1976). "Economic Factors Influencing Households' Production of Refuse." *Journal of Environmental Economics and Management*. February. pp. 263-272.

White,P.R., M.Franke and P.Hindle (1995). "Integrated Solid Waste Management: A Lifecycle Inventory." Chapman & Hall. Pp.362.

Wood, D. J. (1991). "Corporate Social Performance Revisited." *Academy of Management Review*. **Vol. 16.** No.4. pp. 691-718.

Yamane, T.(1983). "Statistics: An Introductory Analysis." New York, USA: Harper and Row.

Yaffee, Robert A. (2003). **"**Common Correlation and Reliability Analysis with SPSS for Windows." Statistics and Social Science Group. Academic Computing Facility, New York University.

Yu, Alex (1996). "Cronbach Alpha--Educational Assessment Course." http://seamonkey.ed.asu.edu/~alex/teaching/assessment/Alpha.html