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ANALYSING SUSTAINABILITY OF SOLID WASTE MANAGEMENT IN MALAYSIA USING ECOLOGICAL MODERNISATION PERSPECTIVE.

by

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Declaration of Author's Rights

Signed:
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Abstract

The thesis addresses the evolution, nature and appropriateness of the national waste management system in Malaysia in terms of its capability to meet sustainability goals. This requires a investigative methodology that encompasses the policies, processes, scales and actors the comprise the national waste management system.

It does this by adopting the concept of ecological modernisation as a reference for analysing the policy and institutional structures that control waste management and sustainability policy. It examines the relevance the institutional dimension of the ecological modernisation theory to the Malaysian context and non-western countries generally, and to the particular characteristics of the waste management system. For effective waste management and economic growth there is need for assessment of not just waste quantities and composition but also of the flow of resources and waste through the joint economic and environment systems. To this end, the thesis applies Material Flow Analysis to the Malaysian context seeking to identify more precise understandings of the processes that give rise to waste outputs. Discussion focuses on whether a Material Flow Analysis (MFA) tool is relevant as an assessment and for analysing sustainable solid waste management in Malaysia.

The nature of waste generation, flow and management is outlined and found to be complex. The methodology reflects this complexity by investigating the institutional organisations and by testing the understandings and attitudes to sustainability and action of all the actors in the waste management system namely policy makers, local authorities and individuals. It found a varied and inconsistent understanding which is set against an increasing level of waste generation and a shortage of disposal and handling facilities. Waste management within current understandings and institutional systems is found to be intractable.

Conclusions are made that the national waste management system in Malaysia lacks clarity of strategic policy and management, measurement gaps are identified and aspects of institutional inertia are found which combine to frustrate the sustainability goal. Ecological Modernization is found to be a partially satisfactory approach to explaining the policy and institutional organisations but it does not in Malaysia provide answers for future policy intervention or indeed readily identify the direction of previous policy development. Material Flow Analysis (MFA) tool is relevant as a sustainability assessment and provide a platform for analysing sustainable solid waste management in Malaysia using institutional dimension of Ecological Modernisation Theory but requires integration into the social and institutional processes.

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Abbreviations

DMC	**Domestic Material Consumption**
SWM	**Solid Waste Management**
SERI	**Sustainable Europe Research Institute**
MFA	**Material Flow Analysis**
MHLG	**Ministry of Housing and Local Government**
MSWM	**Municipal Solid Waste Management**
EF	**Ecological Footprint**
EM	**Ecological Modernization**
SSD	**Strong Sustainable Development**
WSD	**Weak Sustainable Development**
EU	**European**
EUTROSTAT	**European statistic**
LA 21	**Local Agenda 21**
TDO	**Total Domestic Output**
TMR	**Total Material Requirement**
WRI	**World Resource Institute**
UN	**United Nation**
NSP	**National Strategic Plan**
JICA	**Japan International Agency**

Chapter 1

Introduction, Research Problem and Structure of the Thesis

1.1 Introduction

In 1990, the idea of 'sustainability' had grown out of concerns about global environmental pollution and degradation. In one form, sustainability is recognition that, without intervention, the global environment will not be able to provide a reasonable standard of living for future generations. In the now famous Brundtland definition, Sustainable Development (SD) was 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development, 1987, p.43). The essence of SD is threefold: it acknowledges the link between environmental and social issues; it proposes an integrated response; and it offers a framework strategy for the prevailing institutions of power to be redeemed (Howes, 2005).

The concept of Ecological Modernisation (EM) provides a theoretical underpinning for SD policies. The ideas of EM have been used to describe the ways in which environmental problems come to be framed as issues that are politically, economically and technologically solvable within the context of existing institutions and power structures and continued economic growth (Murphy and Gouldson, 2000). This thesis will examine the potential of the theory of EM to provide a useful analysis with respect to the sustainability of Solid Waste Management (SWM) and policy in the Malaysian context. The EMT requires a national approach and system of SWM to deliver solid programmes in a more sustainable way. However, the current institutional arrangement, managerial process and policy formulation of Solid Waste Management in Malaysia has not delivered a cohesive sustainability policy of

SWM. Thus, the thesis examines why this is the case by applying an institutional dimension of EMT and examination of the policies and the actions in the process of SWM.

There is a need for accurate and dynamic measurement of waste flows to inform policy makers. A number of sustainability tools have been developed and applied at the national level, including Ecological Footprint (EF), Material Flow Analysis (MFA), Input- Output analysis and various types of environmental indicators for analysing sustainability. Such measurements and their combination give a guide for policy which is lacking in Malaysia. It is hypothesised that MFA could be a tool for analysing sustainability of SWM in Malaysia. MFA is a tool to measure material flows within an economic system and it is one of the key element methods internationally recognised as being important for formulating and evaluating environmental policies (e.g OECD, 2004). The principle concept underlying MFA is a simple model of this interrelation between the economy and the environment, in which the economy is an embedded subsystem of the environment (Brunner, P.H.& Rechberger, H,2004). MFA has proven that it can deliver useful information for issues related to resource scarcity, pollution abatement, and waste management (Binder et al. 2009). Mastellone and colleagues (2009) put MFA to very good use to identify a great number of specific waste streams. MFA has not been undertaken in Malaysia to date so this study seeks to construct a formative MFA from available data against which the current situation and policies can be tested. The study argues that MFA can be used as a platform for policy makers to analyses sustainability of SWM using institutional dimension of EMT. It further investigates the relationship between measurement of the national level and the conditions of EMT in Malaysia.

1.2 The National Problem of Solid Waste Management

Waste management is currently one of the key areas of public policy. Population growth in cities usually results in corresponding increase in waste generation. Basically solid waste generation has always been related to the economic status of a country and the lifestyle of its population. This is turning also affects the management style of the waste generated. In Asia, the management of waste materials requires immediate attention, especially in countries such as China, South Korea and Malaysia which have been categorised as emerging industrialised countries. (L. Lau, 2003).

Asia consists of two groups, developing and developed countries. Generally, the higher income countries generate more waste, recyle more and have the money to employ advance technology to treat their waste. On the other hand, countries with lower income and greater rural populations are expected to produce more organic waste, such as kitchen wastes, and fewer recyclable items, such as paper, metals, and plastics. Table 1.1 shows that countries with low incomes have the lowest waste-generation rates, averaging 0.64kg per capita per day, while for the middle- income countries this rate averaged 0.73 kg per capita per day in 2003. High- income countries, such as Singapore, tend to have higher waste generation in comparison to other countries. For example, in Singapore the current urban waste generation is 1.1 kg per capita per day which is the highest rate among the ASEAN countries. National governments in Asia are spending about US$ 25 billion per year (1999-2000) on Urban Solid Waste of which more than 90% in high-income countries is spent on the collection of waste. In middle- income countries this rate is in between 50% to 80% of federal SWM budget allocation and in low-income countries it is 30 to 60% of total budget of SWM. Waste-generation rates also increased in Malaysia averaging 1.2 kg per capita per day. The Malaysian government also spent almost 80% of the budget per year on urban solid waste services and management (MHLG, 2003). The World Bank also considers SWM as one of the major problems faced by Malaysian municipalities (World Bank, 1999).

Table 1.1: The trends of Solid Waste generation in urban ASEAN

Country	Population		Waste generation rates		Predicted urban waste Generation	
	Total (millions)	Urban (% of total)	Generation rates (kg/cap/day)	Total (tons/day)	SWM (kg/cap/day)	Total (tons/day)
High income						
Singapore	4.4	100	1.1	4840	1.1	4840
Middle income						
Malaysia	26.6	72.7	0.81	15,663	1.4	26,812
Thailand	62.8	39.1	0.64	15,715	1.5	36,738
Indonesia	212.0	60.7	0.76	96,672	1.0	127,200
Philippines	87.0	74.3	0.52	33,477	0.8	51,504
Low income						
Myanmar	57.3	47.3	0.45	12,118	0.85	22,891
Cambodia	14.2	48.6	0.52	3544	1.1	7497
Loas	5.7	44.5	0.55	1379	0.9	2257
Brunei	383	59.0	0.65	149,140	0.95	216,931
Vietnam	84.0	39.0	0.61	19,983	1.0	32,760

Source; The state-of-the-art of waste management in Vietnam, 2003

One of the most dramatic examples of the environmental policy paradox may be found in the area of SWM (C. Hostovsky, 2006). For example, for many years municipalities in Malaysia have faced problems in finding suitable sites for new landfill and yet policy makers have been slow to act. The problem and its solutions have been well known to policy makers for decades. However, the best long-term solutions to municipal waste problems are expensive, while short-term solutions

seem to be cheap. Municipal SWM in many areas is reaching the crisis stage. Policy makers in some areas are being forced to take what they consider drastic measures that they might not otherwise be willing to consider. Together with increasing industrialisation and modernisation, the types of solid waste produced are becoming more complex and the sources are becoming increasingly more diverse.

Solid Waste Management in Malaysia also has a number of implementation problems, including low collection coverage on average due to the inaccessibility by vehicles of some areas, irregular collection services, inadequate equipment used for waste collection, crude open dumping and burning without air and water pollution control, institutional deficiencies, inadequate legal provisions and resource constraints (Azni, 2004). These problems are caused by complex factors, which mitigate against the development of an effective national policy of a SWM system. Institutional deficiencies have been identified as a major problem in SWM. Even though several agencies such as the state department of SWM and Municipal Councils are involved in waste management, they often have no clear functions in relation to waste management and there is no single agency designated to coordinate their projects and activities. The lack of coordination among the relevant agencies often results in duplication of efforts in waste management, wasting of resources, and unsustainability of overall waste- management programmes.(J.Jahi, 2002). Thus, SWM is not only a technical problem but it is also strongly influenced by political, legal, socio-cultural, environmental and economic factors. Moreover, these factors have interrelationships that are usually complex in the waste- management system.

1.3 Conceptual Framework

The core theory that will be used in this study is the Ecological Modernisation theory. In broad outline, EM refers to a series of institutional, operational, economic, governance, social and political shifts that are set in motion by environmental drivers. These drivers push new social arrangements, new discourses, new scientific and technical developments, and a shift in responsibilities and interests between

public and private sectors, between governments and their citizens, between civil society and other economic actors, and between the formal and informal sectors and arrangements within a wide range of disciplines. Although political institutions have contributed to poor environmental outcomes in the past, EMT argue that they can be readily reformed to better address ecological issues (Mol, 2000; Mol and Sonnenfeld, 2000). Proponents hope that, through marginal shifts in focus, political actors could be responsible for building new and different coalitions to make environmental protection politically feasible. Thus, EM research has examined the institutional changes that accompany a shift from government to environment governance. For example, EM argues for a more substantial transformation towards decentralised, consensual forms of governance, and a focus on new forms of political intervention. Advocates consider the role of the nation-state to be central to achieving more sustainable societies. There is a focus on "open, democratic decision-making, maximising participatory opportunities for broader social interests" (Berger et al, 2001). These opportunities will only occur alongside increasing activism by non-governmental organisations, economic agents and changes to the institutional structure of society.

EM has a good chance of influencing decision makers since it frames the debate in non-threating terms by supporting industrial development, the market and liberal-democracy. EM argues that economic growth can be decoupled from environmental harm through institutional transformations. In essence EM supports the existing institutional of power and modest initial reforms and also prepares the groundwork for substantial transformations later. EMT suggests that the market will play a central role in the transmission of ecological ideas and practices, with producers, financial institutions and consumers all playing their parts. The government can provide such an incentive by applying the poluter pays principle, notably through the use of market-based instruments such as eco-taxes and tradable permits which penalize environmentally damaging activities.

Ecological Modernisation also advocates greater public disclosure and community participation in decision making. Devotees argue that globalization and new

international market dynamics have shifted the away from traditional top-down influences of supranational bodies towards greater emphasis on the sub-national level. This regional and local focus is in line with increasing prominence of local initiatives such as *Local Agenda 21* programs. In EM, the government takes the role of 'contextual steering' and policy-making changes from 'curative and reactive to preventative'. While international agreements can set the broad policy goal of SD, it is regional planning and changes to management systems in local businesses that translate these goals into real changes on the ground.

Ultimately Ecological Modernisation treats all environmental issues, solid waste included, as a challenge to eliminate inefficiency via better design. It promotes the use of more eco-efficient technology as well as the redesign of economic and political institutions to create incentives that will effectively decouple economic growth from raw material use, waste and environmental damage (Berger 2001; Dryzek 2003; Howes, 2005). Waste is seen as an indicator of inefficiency. Businesses use their desire to cut costs by innovating to find new ways of reducing their raw material and energy use, cutting pollution in the process. Governments correct markets failures that encourage environment damage and create incentives to innovate by penalizing damaging behavior and rewarding eco-efficient improvements. They also act as a clearing house for information about the state of the environment and support the research, development and deployment of better technologies. The actions of the market and the state together work in partnership to develop a cleaner, low cost future that is good for both business and the environment.

The Malaysian government considers the adoption of a comprehensive waste management policy including the installation of incinerators for safe and eficient disposal of waste as well as to formulate strategies for waste reduction, reuse and recycling. However, SWM approach in Malaysia seems not successfully implemented and institutional framework relate to SWM still fragmented. Thus, an approach to SWM in Malaysia is required which is an integrated approach under sustainability policies. The study argues that EM offers a theoretical framework that supports the national policy of SWM in Malaysia. EMT allows research into

institutional and policy, how the management has evolved and worked and what the outcomes of the current approach have been implemented in Malaysia. Thus, EMT can be used to examine what has transpired in waste management in Malaysia, to look at the process of management, the opportunities of such an approach to achieve sustainability of SWM. EM suggests that in the face of increasing environmental problems, responsive forms of governance should emerge perhaps using different forms of economic or policy intervention. MFA would constitute one such type of policy intervention. MFA is a tool to measure material flows within an economic system and it is one of the key element methods internationally recognised as being important for formulating and evaluating environmental policies .The study argues that MFA can be used as a platform for policy makers to analyses sustainability of SWM. In this study, the transformation the role of state and the increasing role of economic and market actors in environmental improvement will be focus for analysing sustainability of SWM in Malaysia. Further, it can be used as a guide to design better policies to assist in the transition strategies to achieve a sustainability policy for SWM in Malaysia.

1.4 Research Objectives

This study aims to analyse sustainability of SWM in Malaysia based on EMT. In investigating, the study has two main objectives:

1. The first objective is to apply EMT perspectives, with a focus on institutional dimension of EMT for analysing sustainability of SWM in Malaysia.

2. The second objective is to investigate the relation between MFA measurement and the condition of EMT in Malaysia.

1.5 Research Questions

Based on the two main objectives stated above, a number of research questions have been set up as follows:

RQ1: What is the current Malaysian position with regard to SWM?

RQ2: To what extent does the theory of EM assist in creating a framework for investigating the national system of SWM?

RQ3: To what extent is there a need for a MFA understanding to inform policy makers and make management decisions?

RQ4: How do the actors in the government, municipalities and households contribute to this position?

1.6 Contributions of my study

Ecological Modernisation theory has been offered as a possible solution to the environmental problems currently facing advanced industrial and developing countries. EMT also has become a focus for academic debate in recent years and consider as a pragmatic policy. Thus, the first contribution of the study is to examine the potential of the theory of EMT to analyse sustainability of SWM policy and practice in Malaysia with specific focus on institutional dimension of EMT. While the EMT is a broad encompassing theory on environmental reform, this study will focus on transformation the role of state and the increasing role of economic and market actors in environmental improvement of SWM. The core argument of EM is that although democracy, the state and the market have gone astray, they can be preserved by restructuring in a way that will make them sustainable (Dryzek, 2005; Howes, 2005, p.29; Mol and Spaargaren, 2000). EM argues that economic growth

can be decoupled from raw material throughput, energy use and waste generation through the application of new technology and the redesign of institutions. EMT not only provides a way for environmental policies to more directly conceptualise environmental improvement, but also provides a fresh perspective on the role of environmental movements by avoiding their romanticisation, and by appreciating the particularly fundamental roles that state, capital, science and technology might play in the process of environmental improvement.

Ecological Modernisation presumes that economic and environmental goals need not be mutually exclusive. It assumes that well designed interventions by government do not hinder economic growth but instead stimulate new and more efficient industries. Industry reduces its costs from increased technological efficiency and both the environment and community benefit from less pollution. Governments continue to play a regulatory role but are also cast as a facilitator to assist industry in becoming more sustainable. New policies are directed towards correcting market failures by improving on the impacts of actions, imposing green tax regimes to internalize negative externalities, and pricing ecological goods and services so that they can be properly valued (Lundqvist, 2000, p.22). There is strong emphasis on retaining the key institutions of modernity (science, technology, the market, industry, and the state) but embedding ecologically-reformed economic practices within them (Berger 2001, p.56).

Much of the early investigation of Ecological Modernisation ideas was based on European case studies and less work has been done on applying the theory to developing countries particularly in Malaysia, providing an opportunity for some original research. However, the three studies in Vietnam and like wise the two studies in Thailand as outlined in the EMT showed the limited role and the obstacles faced by the states and industry in policy matters in relation to ecological restructuring (Sonnenfeld, 2000; Rock, 2002 ; Yang, 2006). Institutional development of SWM in Malaysian context also facing the similar problems and there is less participation from stakeholders in the policy decision making process by both the state and the industry. Ecological Modernisation theoretical framework

feeds into broadly accepted policy goal of SD and it can generate programs for change that constructively engage with the existing institutions of power. Therefore, for the purpose of the study, it is useful to focus on the institutional dimension of the EMT for analysing the policy and institutional structures that control waste management and policy in Malaysia. The study argues that EMT is a useful tool for providing a theoretical framework for analysing sustainability and efficient policy and management in solid waste policy in Malaysia but the adaptation of EMT need to be modified to suit the Malaysian political and economic context and creates a framework for future research.

The second contribution in this study is the demonstration for the need of data and a dynamic focus of the process of waste management MFA approach. MFA approach is presented as a measurement and modelling process for policy formulation. It is examined as to its test with respect to policy making in Malaysia. This has not been done before in Malaysia. This study will explore the potential of MFA as a decision tool for policy makers to formulate sustainability policy for SWM. The purpose of a MFA is to follow and quantify the flow of materials in a defined situation and over a set period of time. MFA is a necessary pre-requisite to operationalise the concept of sustainability and support the effective planning and management of natural resources. MFA is practical and can be carried out by municipal staff, deal with changes in solid waste flows and impacts, and provides comprehensive information on programme cost, incremental program cost, economic development, employment, environmental impacts, regulatory, technical, operational, public acceptability and local government policy.

MFA study for solid wastes provides policy makers with lots of information, especially if the wastes are linked to human activities. For them, an increase or decrease of wastes is valuable e.g. when conducting scenario analysis. MFA provides a direct quantitative measure of the actual material and energy flow through an economy. It quantifies the lingkage of environmental problems, supports the planning of adequate management measures and provides for monitoring the efficacy

of those measures. On the other hand, MFA approach also could inform the actors involved in formulating national policy of SWM and allows the political process and public process to see the relationship between EM and social process and SWM. Thus the study argues that MFA provides a platform for analysis sustainability of SWM focus on institutional dimension of EMT.

1.7 Organisation of the Thesis

This thesis is organised into 10 chapters.

- Chapter 1 presents background and research problem statements, research objectives and research questions.
- Chapter 2 describes methodology research of the study
- Chapter 3 provides a literature review of MFA. This chapter discusses the concept of MFA as a sustainability tool for analysing sustainability of SWM in Malaysia and links to EMT
- Chapter 4 presents theory perspective of EM.
- Chapter 5 present solid waste policies in Malaysia. In this chapter, the theory of EM will link with the solid waste policy in Malaysia. The institutional dimension of EMT will be given specific focus to analysing sustainability policy of SWM in Malaysia.
- Chapter 6 presents results of MFA of SWM in Malaysia, and evaluation of SWM policy and practices in Malaysia.
- Chapter 7 presents phone survey results among local authorities in Malaysia
- Chapter 8 presents interview responses and issues related to SWM.
- Chapter 9 presents household survey results.
- Chapter 10 presents the findings and discussion of the study

Chapter 2

Methodology Research

2.1 Introduction

This chapter presents research methodology to outline how the data and information will be obtained to achieve the overall research aim. The thesis analyses the sustainability of solid waste policy in Malaysia using the principles of EM. The study will focus specifically on the institutional dimension of EM and, to carry out this work the research will conduct interview surveys among the local governments, NGOs and waste experts who had experience of this policy -making process in SWM in Malaysia. The objective of the survey is to obtain responses from local government and stakeholders regarding solid waste policy in Malaysia and address the policy and institutional gaps in SWM. In this study, both survey research methods and non-survey data research methods were deemed most appropriate to be employed in order to gather the desired information. The survey research methods that were employed in this study are self-administered questionnaires, phone surveys and face- to- face interviews. The survey methods were used to gather information from the following four major groups of informants: municipality personnel, federal government personnel, solid- waste experts, NGOs and households. The non-survey research methods that had been utilised to gather information were field observations and document analysis.

2.2 Data gathering process and method

The study obtained information from different groups of people involved in SWM. One director and four senior officers of solid -waste department, twelve local authorities, eights waste experts and researchers and six NGOs were interviewed to gain information regarding SWM issues and policy in Malaysia. In this study, interview survey has been conducted to each group to obtain information of SWM policy and current government practices regarding SWM in Malaysia.

In general, qualitative interviews are useful analytical tools by offering the integration of multiple perspectives, the description of processes, and the development of holistic descriptions (Weiss 1994). There are six types of interviews that are possible to be conducted: (i) structured interviews (ii) semi-structured interviews (iii) unstructured interviews (iv) one-to-one interviews (v) group interviews and (vi) focus group interviews (Denscombe, 2003). The unstructured format was utilised mostly to interview solid-waste experts, NGOs and non-municipal official. A face-to-face format was utilised to interview municipal officers and local authorities to gather specific information regarding municipal SWM.

For this study, qualitative interviews were conducted with 31 people, who were involved in the SWM in Malaysia. These people included director of Solid Waste Department, four Senior Officers of SWM, six NGOs, eight researchers, and twelve local authorities in Malaysia. Interviews were conducted in person and lasted between 10 minutes to 1 hour. (Table 2.1). The individual face-to-face interview offered the most straightforward route to gathering research relevant information through a structured conversation. Questions were open-ended and interviews were conducted as conversation. Interview process is a social process, constructed by

contribution of the participants (Denscombe, 2003). Accordingly, the designs of the interviews are described as follows:

2.3 Interview with the Director of Solid Waste Management and Senior Officers in Malaysia

In this study, one director of solid waste and four senior officers of SWM in Malaysia were interviewed on topics related to SWM issues in Malaysia. The question was divided into 4 themes. The first theme regards the solid- waste status in Malaysia and its current issues. Second theme: solid- waste policies and practices, and how the policies are implemented, Third theme: Analysing the issues of sustainability of SWM. Fourth theme: Future plan for sustainability of SWM. For some of the senior officers it was difficult to give cooperation during the interview because they have limited time to arrange for interview. Thus, the researcher had a difficult time to make an appointment with senior officers of solid waste departments in Malaysia. Respondents' responses did not satisfy some of the questions asked during the interview. To enhance the reliability of information gathered from the respondents, all of them were asked to provide written documentation to enable verification their answer.

2.4 Interview among Solid Waste Researchers and NGOs

Eight researchers from public universities in Malaysia and six NGOs were also interviewed in this study. These were important to provide more information from a different point of view on issues relevant to SWM, in order to show why SWM is of such importance in this country. The questions were divided into 3 themes: the first theme is the current status of SWM policy and practice in Malaysia, the second theme is effectiveness of government policy towards sustainability SWM policy in Malaysia and the third theme iss opinion and suggestions to improve SWM in Malaysia towards the sustainability of SWM and EMT.

Table 2.1 Profile of respondents

Items	Numbers of responses
Gender:	
Female	4
Male	27
Position	
1. Director of Solid Waste Management	1
2. Senior officer of Solid Waste Management	4
3. Local authorities in Malaysia	12
4. Waste experts and researchers	8
5. NGOs	6
Total:	31

2.5 Phone survey among Local Authorities in Malaysia.

The telephone interviews survey served to evaluate and examine policy of SWM among the local authorities in Malaysia. The result from the phone survey is described in chapter 7 of the study. Survey techniques could provide simple evidence which could be analysed quantitavely, but the research also required more in- depth responses. A telephone survey could provide the opportunities for a more detailed investigation amongst the municipal councils, while gathering data for general evaluation. Like personal interviews, they allowed some personel contact between the interviewer and the respondent. There were 12 officers among the local authorities in Malaysia who were interviewed through the telephone survey. They were 12 Local Authority officials from 12 states in Malaysia chosen in this study. The respondents were chosen from among the senior officers in every local authority, which were also the local Authorities' head of Departments of Local Authorities in every state in Malaysia.

The questions are shown in the box below;

Phone Survey Question as follows;

1. What is the government stance on SWM?

2. Have you ever heard of the concept of SD?

3. Do you understand the concept of EM?

4. In your opinion is the concept of EM a useful tool?

5. Do you understand the concept of Local agenda 21 and the role of the local Government in deliver sustainability policy in SWM?

6. Are you participating in a recycling programme?

7. Do you utilise used paper for printing and photocopying in your office?

8. Do you use a greening guidebook personally?

9. Do you buy or use environmentally safe products?

10. Have you ever been involved in a recycling campaign?

11. What are the issues and problems regarding SWM?

12. What do you consider to be the main problems in Solid Waste disposal?

13. Do you think that the Government provides insufficient funding for SWM?

14. How can SWM in Malaysia be improved?

2.6 Survey among Household in Malaysia

A questionnaire survey among households in Malaysia was conducted in the study to gather information regarding perception and attitude towards waste management. Respondents were given a list of questions ranging from personal and social background information to level of education. 250 questionnaires were distributed in selected areas in Malaysia. From the 250 questionnaires distributed, 188 useable questionnaires were received and analysed. The questionnaire was divided into 3 sections which are a) Household socio-economic characteristics, b) Household level of environmental awareness and attitude towards solid- waste recycling, c) Solid-Waste collection service. A copy of the final questionnaire is included as (Appendix 1).

2.7 Document Analysis

The non-survey research methods that were utilised to gather information in this study were field observations and documents analysis. In the study, the documents studied included laws and regulations, national policies, municipal annual reports and solid- waste budget report**.** According to De Vos et al. (2005: 314) a document study involves an analysis of any written material which contains information on the phenomenon being studied. A variety of classifications exist of the types of data sources that can be utilized during a document study. In this study, the research data was obtained from primary documentation consisting of Solid Waste Management Strategic Report 2005, Solid Waste Management Act 2007, Annual Report of Ministry of Local Government (2000-2005), World Bank Report (1999-2000) and other relevant information regarding Solid Waste Management and policy in Malaysia. This documentation is important to analyse in order to obtain the statistical data and information regarding Solid Waste Policy and Practice in Malaysia.

This research was conducted from March 2007 to March 2009. Within that time, the research tasks were divided as follows:

Table: 2.2 The time table of interviews and household survey

Time-frame	***Research task***
March 2007-November 2007 April 2007-May 2007 June2007-November 2007	a) Literature search and analysis - Set -up research question and objectives - Literature review and analysis - Documentation search and analysis - Multimedia search and analysis (via newspapers and internet/ website)
March 2008- October 2008	b) Conducted interview Local authorities, local council, decision makers, waste expert, NGOs , waste pickers.
January 2009-March 2009	c) Phone survey among local authorities d) Distribute questionnaire among household - Total sample 188 - Landfill site visit
April 2009- November 2009	e) Analysing data collection -Thesis write-up

2.8 Landfill Site Visit

Landfill site visits were also conducted to fulfill the purpose of this study. Four landfill sites in Malaysia were visited to understand and experience the practical observation of SWM

2.8.1 Preparation and pre-testing of the questionnaire

a) Interview: Appointments with the Director and senior officers of SWM Department were made by letter and telephone. Letters of introduction, outlining the researcher's background, were sent to the SWM Department and local authorities in Malaysia.

b) Questionnaire: The questionnaire for household survey was develop based on the theme of the study and is described in Appendix 1. The questionnaire contained a total of 20 questions. The original questionnaire was prepared in the Malay language and then translated into English. The household survey was conducted through three trained enumerators.

c) Pre-test study: This step provided the opportunity to review the survey questions and check the language, the validity and the reliability of questions so that no serious problems were met in the study. Pre- test study was conducted in March 2008. The pre- test aimed to obtain basic responses from the prospective respondents and to gather more information from the study side and from the households. On pre-test study a sample of 30 responses were obtained, coded, and analysed. Questions that were not providing useful data were discarded, and the final revisions of the questionnaire were made. The pre-test can be used to measure how much time it

takes to complete each questionnaire. For the survey, a small part of the sample of 5 people had been contacted and interviewed.

2.8.2 Data analysis

In order to meet the objectives of the study, the interviews were conducted with local government to obtain realiable information and opinion regarding Solid Waste Management policy in Malaysia. During the interviews, the conversation had been written down and any observation made during interviews also had been written. In order to determine the validity, the data from interview survey, personal judgements and expert comments had been used in this study. Data collected from the interview, investigation, and field work was processed, reviewed and edited.

The quantitative data from the household survey was analysed using SPSS (Statistical Package for Social Sciences). Data from the household survey will be analysed using descriptive analysis. The result of the household survey using descriptive analysis is presented in chapter 9 of the thesis.

The next chapter will discuss the concept of Material Flow Analysis (MFA) and its relation to EMT.

Chapter 3

Material Flow Analysis and Ecological Modernisation Theory

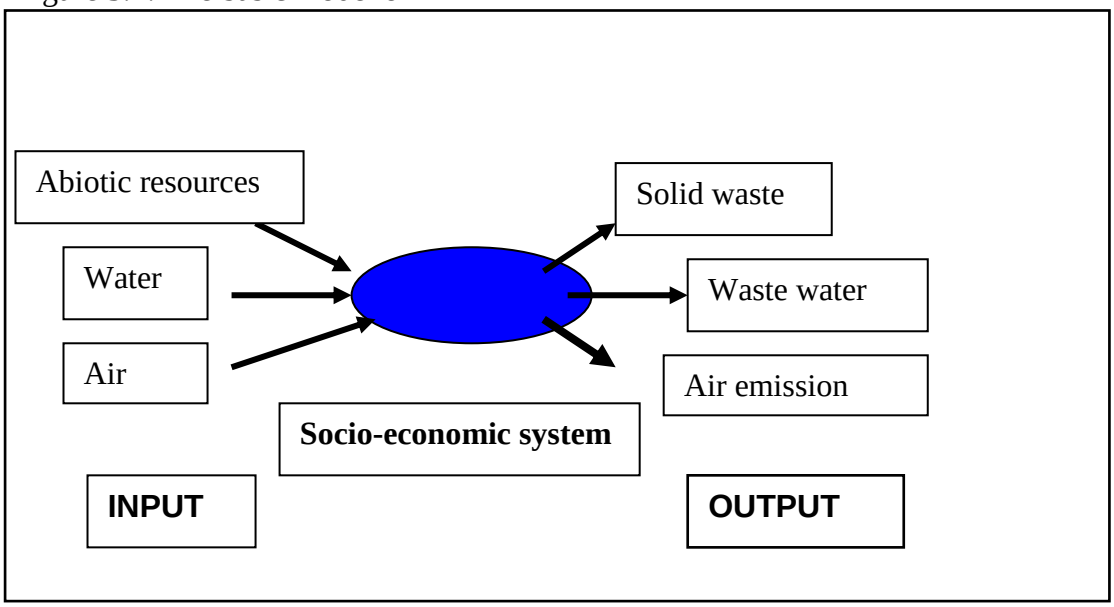
3.1 Introduction

Solid Waste Management has been a challenging task for the developing countries. Lack of appropriate policies, budgetary constraints and inefficient management and operation have been the main obstacles to maintain an improved and sustained SWM in the developing countries. A consistent and holistic approach is needed to manage the complexity of SWM in these countries with particular focus on Malaysia. Thus, institutional dimension of EMT can be used to identify failure to achieve a sustainable policy and effective measurement system of SWM in Malaysia. Institutional dimension of EMT also can identify the gaps in policies and seek to adjust quickly to maintain the progress towards efficient resource management and the balance between weak and strong sustainability. This approach can provide an opportunity to define common goals and identify the most critical issues, eliminate data redundancy, and improve effectiveness through cooperation and coordination. An effective and dynamic measurement system of waste is also essential for managing sustainability of SWM and detailed information on resource flows will be an essential input into any solid waste strategy that is able to respond to these challenges. This study applies MFA to the Malaysian context seeking to identify more precise understandings of the processes that give rise to waste outputs. Discussion focuses on whether a MFA tool is relevant as an assessment for analysing sustainable SWM in Malaysia. This chapter will discuss the concept of MFA and the link with the EMT in the context of SWM.

3.2 The Concept of Material Flow Analysis

The principle concept underlying MFA is a simple model of the interrelation between the economy and the environment, in which the economy is an embedded subsystem of the environment. (SERI, 2003) (figure 3.1) MFA tracks the amounts of materials as classes or individual substances that enter the economy, accumulate in capital stock such as housing and automobiles, or exit to the environment as waste. In short, MFA documents the commercial life- cycle of materials that become part of the industrial economy, from extraction, processing, and manufacturing to use, reuse, recycling, or disposal (WRI, 2005).

Figure 3.1: The basic model of MFA



Source: SERI, 2003

The basic premise of MFA is that the amount of resources flow that inputs into the economy determines the amount of all outputs to the environment, including wastes and emissions. According to the first law of thermodynamics (the law of the conservation of mass), total inputs must by definition equal total outputs plus net accumulation of materials in the system. This material-balance principle holds true

for the economy as a whole as well as for any sub-system (an economic sector, a company, a household). Thus, a reduction in resources inputs will normally also reduce the outputs, including emission and waste. Therefore, understanding the whole system of MFA from source to ultimate disposition can help us better manage the use of natural resources and protect the environment. Forecasting material flow is essential for sound policy-making on issues of waste management. In 1997, the International Human Dimensions Programme on Global environment (IHDP) chose the issues of 'Industrial transformation' as a future research programme. The research seeks to understand society-environment interaction, the driving forces behind change, and to assess alternative development. The United Nation environment programme is also considering MFA as an approach to address sustainability after advice from scientist on problems of the environment.

During the mid- 1990s, an international team led by the World Resources Institute (WRI) generated national estimates of material inputs in the economies of four industrial countries - Germany, Japan, the Netherlands, and the United States and published the findings in 1997 in Resource Flows: The Material Basis of Industrial Economies. The next phase of the work covered the material outputs for the same four countries plus Austria. The results were published in 2000 in The Weight of Nations: Material Outflows from Industrial Economies. Analysis of the indicators published in The Weight of Nations showed that, while industrial economies may be using materials more efficiently as their economies expand, total waste generation continued to increase in all of the countries considered.

The increasing interest in the physical basis of economies is also reflected in the large and growing number of economy-wide material flow accounts on the national level. Full MFAs have been presented for the USA, Japan, Austria, Germany and Netherlands (Matthews et al., 2000; Adriaanse et al., 1997). In Europe, national studies have been presented by a large number of national statistical offices and research institutions. The latest comprehensive analysis of material use in the EU-15

has been presented by EUROSTAT. Additionally, MFAs have been compiled for Australia and selected countries in Asia, Eastern Europe and Latin America.

The importance of improved material management for Sustainable Development is recognised by various institutions in international politics. Facilitating and stimulating economic growth while reducing environmental impacts associated with resource use in Europe and beyond is central to the European "Thematic Strategy on the sustainable use of natural resources" (European Commission, 2005). A similar approach has been adopted in Japan, where a number of quantitative targets for material -flow indicators to be reached by 2010 have been agreed upon in the national plan for a recycling –based society (Government of Japan, 2003).

In principle, material and energy flow analyses (LCA, MFA, SFA etc.) can all leave the problematic distinction between economic activity and environment behind by integrating the ecological and economic consequences of flows. The flow concept usually shares the pre-analytical view that systems connect natural and the social sphere. This can be modeled statically or dynamically. Yet, system modeling rarely explicitly considers social reflexivity, e.g. intentions and motivations of individual actors in relation to a context though it might be aiming at initiating public discourses and subsequent learning processes. The models rather tackle different sorts of environmental problems pragmatically. The applied methods aim, for instance, at different structural levels of society thus relying on specific social theoretical assumptions, which remain for the most part implicit. For instance, most applied LCA have focused on the production side even though they integrate the entire ex-post life cycle of a product. On the other hand SFA has mostly been linked to risk management while MFA has aimed for a comprehensive material account of all economic activity, which usually links to the national or supranational level. All these models can be used for scenario building, pointing away from neoclassical economic modelling. And even though the scenarios may assume constant emission or resource- use coefficients, or adjust these to current trends, they focus on ecological rather than economic consequences. For theoretical purposes the

implications of the different concepts can be modeled and compared (Bouman et al., 2000).

There are three types of MFA research which have been developed. First is MFA for all materials at national level. EU uses MFA as an indicator towards sustainability and published a methodological guide for MFA (EUROSTAT, 2001a, 2001b, 2000). Japan introduced some indicators based on MFA as policy target (MOE, 2003, Moriguchi, 1999). OECD also adopts MFA approach for sustainable society (OECD 2004). MFA researchers for an individual country carried out MFA in Sweden, England and Denmark (Pedersen, 2002)

Second is MFA which concentrates on a specific substance. This is called an SFA (Substantial Flow Analysis). The SFA is the most historical approach. (For the history of MFA see an excellent review by Brunner and Rechberger, 2004). Nitrogen flow in waste environment and carbon circulation in the global system has been much researched for Nitrogen cycle in local level, for Carbon cycle in global level). However, SFAs focus on substances which have a harmful effect on humans. MFA can be carried out for substances as well as goods. MFA for substances, often named substance flow analysis (SFA), is a method for investigating pathways of specific substances through anthropogenic and natural systems (Baccini and Brunner, 1991; Baccini and Bader, 1996)

Most SFA studies are motivated by a specific environmental problem associated with the substance under study, such as heavy metal or nitrogen . The uses of SFA help to relate critical emissions of these substances to processes, products and material inputs in the system. Applications in developing countries are described in Binder et al., (2001) and Streicher- Porte et al.,(2005). SFA is an analytical tool that is used to describe or analyse the flows of one or more substances into and out of a system. It has been used to identify the direct, economic and ultimate causes of environmental problems (for example for Cadmium soil load, the direct cause is atmospheric deposition, which is caused by incineration. Its ultimate origin lies in the flow of zinc

and to identify the most effective policy measures to eliminate or to reduce them. Within the framework of SFA, several types of analysis can be used. These include accounting and static and dynamic modelling. So far, the attention in the SFA community has been focussed mainly on drawing accounts and on comparative static modelling (Bringezu et al., 1997). Recently it has been acknowledged that an important difference between static and dynamic models lies in the inclusion of stocks in society: substances accumulated in the stocks of materials and products in households or in the built environment. These stocks can be very large and, sooner or later, these will lead to waste and emissions. The present stock of materials in society will strongly influence future waste streams and emissions of many hazardous substances to the environment. Third is MFA for the regional and sector level. As mentioned above, Japan uses MFA as a tool for policy-making. However, there are not so many national governments which use MFA for an environmental management tool, because they cannot find effect of practical policy in national level on MFA easily. On the other hand, MFA in the local area is effective on local government policy, because the field of MFA are at local city level (Hendriks et al., 2000), rural village, small island and prefecture level.

3.3 The Importance of Material Flow Analysis

In the past 20 years, several methods have been developed which allow for the quantification of the use of natural resources by modern societies (Daniels and Moore, 2002). One of the key methods is MFA, internationally recognised as an important tool for evaluating environmental and resources use policies (e.g. OECD, 2004). MFA builds on earlier concepts of material and energy balancing, as introduced, for example, by Ayres (1978). The first MFA on the national level have been presented at the beginning of the 1990s for Austria and Japan (Environment Agency Japan, 1992). Since then, MFA has been a rapidly-growing field of scientific interest and major efforts have been undertaken to harmonise the different methodological approaches developed by different research teams. The Concerted Action “ConAccount” (Bringezu et al., 1997; Kleijn et al., 1999), funded by the

European Commission, was one of these milestones in the international harmonisation of MFA methodologies.

The second important cooperation was guided by the World Resources Institute (WRI). In an international working group on MFA, standardization for economy-wide MFA was the first time achieved and published in a methodological guidebook by the European Statistical Office (EUROSTAT, 2001). A number of empirical MFA studies on regional or local levels have been carried out in the past (Hendriks et al 2000). However, so far the number of published regional or local studies is still much lower than of national ones and a standardised methodology like that presented by Eurostat (2001) for the national levelt does not exist yet.(F.Luks et al 2003).

A main difference between regional and national MFA concerns the data sources. At the national, level most of the data needed can be obtained from statistical publications and offices directly in published form. Almost all input and trade data in physical units is accessible. On a regional level, data availability seems to be much weaker. Data may have to be gathered in a more time consuming process as it may be dispersed among several institutions and not be available centralised. Further, a number of material-flows data may not be available in physical units at all and therefore may have to be estimated from more general data. In case of Malaysia, there is lack of sufficient and statistical data to develop national MFA for SWM. For the purpose of the study only estimation data have been used to develop MFA model for SWM in Malaysia.

3.4 The Role of Material Flow Analysis for Sustainability Measurement

Material Flow Analysis is a method that studies the fluxes of resources used and transformed as they flow through a state or region. MFA tracks the amounts of materials as classes or individual substances that enter the economy accumulate in

capital stock such as housing and automobiles, or exit to the environment as waste. Thus, MFA is a systematic assessment of the flows of materials and resources within a defined system (Brunner and Rechenberger, 2004 and Daniels and Moore, 2002). It is based on the Law of Material Conservation. In short, MFA documents the commercial life-cycle of materials that become part of the industrial economy, from extraction, processing and manufacturing to use, reuse, recycling, or disposal. The MFA component visualises the waste flows and processes (e.g. waste generation, temporary storage, transportation, treatment or disposal) over a defined time period of a city's SWM system. Based on the model of the existing SWM system, future treatment scenarios can be modelled and calculated. This approach allows the measures of changes in waste flows and costs induced by new processes (Silke et al., 2006). Therefore, MFA can be used as a platform for analysing sustainability of SWM in Malaysia using EMT specific focus in institutional dimension of EM perspectives.

Material Flow Analysis is an analytical tool that systematically describes material flows, generally for a state or region, expressed in physical units (kilograms, tons), through extraction, production, transformation, recycling, and final disposal as waste or emissions. MFA has been used to evaluate losses during the material life-cycle and to provide measures for the more efficient use of resources (Bringezu, et al., 1997). MFA can be performed on different levels. It is performed to include the total material flows within the system, which is referred to as bulk MFA (Kleijn, 2001) or for specific materials such as biomass, or in a narrower sense for a chemical element or compound, which is referred to as Substances Flow Analysis (SFA).

In industrialised countries, MFA proved to be a suitable instrument for early detection of environmental problems and development of appropriate measures (Baccini and Brunner, 1991). Examples of application are resource management planning at city, regional and state level, waste management planning, and the development environmental management systems in enterprise, the derivation of

indicators as a basis for monitoring SD used by official statistics in several EU member states (e.g nationwide material throughout GDP). MFA has already been applied in urban areas of developing countries in the field of environmental sanitation (Binder, 1996; Montangero et al., 2004; Huang et al., 2006). However, data uncertainty has been identified as one barrier to a broader use of the method, particularly as a tool for policy decision (Danius, 2002). This issue is even more important in the context of developing countries where data availability and reliability is low and means of the data collection are limited.

3.5 Material Flow Analysis and Ecological Modernisation Theory

A central element in EM is the attempt to make ecology measurable in order to integrate it into programmes, policy and institutions (Hajer, 1996). Among other things, it builds on specification of 'substance flows, for example flows of energy, material and water, which make it possible to measure the environment action and to map, compare, and set the target.(Spaargaren et al (2000)

One of the possible applications of the MFA method is the quantification of urban waste and food flows and the corresponding nutrient flows in a given district or city. This quantification enables the identification of key processes and flows as well as the simulation of new environmental sanitation concepts or measures. These can be evaluated according to their impact on nutrient load into the environment as well as on nutrient saving or recovery. Current development clearly demonstrates that a tool such as MFA would be beneficial for environmental planning. It could assist in evaluating the impact of measures regarding resources management and hence in designing a sound action plan. MFA is increasingly used for modelling material flows on regional or even a global level (Hendriks, 2000). Waste management is a very important application for MFA. Numerous examples are given in Baccini and Bader (1996a), Brunner and Rechenberger (2004) and Mc Dougal et al (2002).

MFA has already been applied in developing countries in the field of the environmental sanitation (Binder et al., 1997; Gumbo, et al., 2003). Binder et al., (1997) demonstrated that the method can be applied even with poor data quality and quantity. However, depending on the content (availability and reliability of data as well as means for further data collection: budget, laboratory equipment, etc), the application of the method may not be affordable for planners in developing countries. MFA is widely applied in many areas of industrial ecology, environmental management and protection, resource management, and the waste management. It is used as a basis for life-cycle assessment, eco-balancing, environmental impact assessments, and waste management concepts (Brunner 2002).

MFA could be helpful for environmental policy-making and management. In common with several other tools or techniques for environmental assessment, MFA has been promoted as the most invaluable approach that will improve environmental policy-making and management. MFA study for solid wastes provides policy makers with lots of information, especially if the wastes are linked to human activities. For them, an increase or decrease of wastes, is valuable e.g. when conducting scenario analysis. MFA provides a direct quantitative measure of the actual material and energy flow through an economy. It quantifies the lingkage of environmental problems, supports the planning of adequate management measures and provides for monitoring the efficacy of those measures. MFA allows early warning and supports precautionary measures. Its provide aggregated information to support decision making and can be applied at different levels of economic activity. EMT have helped to describe the ways in which environmental problems come to be framed as issues that are politically, economically and technologically solvable within the context of existing institutions and power structures and continued economic growth (Murphy and Gouldson, 2000). Thus MFA could provide comprehensive information of waste problems that are linked to modern society activities and can be used for policymakers to develop policies through institutional dimension of EM perspectives.

The practical applications of MFA provide a great deal of quantitative information on the regional metabolism, as an important aspect of the environmental situation in a certain municipality. It is important for comparison of different activities regarding their environmental pressure, and for comparison of anthropogenic materials flows. However, the most interesting aspect of the MFA approach is the qualitative information provided from practical applications. An example of qualitative is the clarification of links between activities in a municipality, and inflows and outflows of materials (with goods, products, wastes and emissions) within the municipal. Of course, this qualitative information is obtained from interpretation of quantitative information or data, but only to some extent. Some qualitative information provided from MFA study comes out gradually as the study proceeds through its different stages, especially the systems definition and inventory stages.

MFA also provides a foundation for making and evaluating environmental policy decisions at both strategic and operational levels. MFA data offer government leaders a sound basis for setting strategic targets and tracking the effectiveness of environmental policies towards sustainability. The data can also help policy-makers understand and deal with the origins of specific environmental problems. In the case of SWM, MFA allows municipal decision makers a view from a new angle on their waste management system. The thorough development and discussion of a baseline scenario facilitates further discussion on how to change or improve an existing SWM system. MFA also provide a basis for choosing cost-effective environmental solutions.

Understanding the flow of materials can help policymakers address the shift in pollution sources from one part or the environment to another. The identification of wastes is a major issue in MFA, as the purpose of conducting a MFA is to minimize the flow of materials while maximising the human welfare generated by the flow. Its methodology allows for the monitoring of wastes that are typically unaccounted for in traditional economic analyses. As such, it is a method for evaluating the efficiency of using material resources. Consider the programme theme of technological

innovation of EMT. EM proposes this as the first necessary, but not sufficient, step towards sustainability.

Data of MFA can help the government to develop new technologies for sustainability of national SWM. This new technology should reduce raw material and energy use, cut emissions, sustainably harvest renewable resources, conserve biodiversity, and protect essential environmental services. The economic benefit derived for business is to reduce the costs of raw materials, energy use and waste disposal (Mol 2000; Berger et al 2001; Fisher & Freudenberg 2001; Welford and Hills, 2003; Cohen, 2006). In a nutshell, EM advocates technological innovation that decouples economic growth and industrial development from environmental damage to a cleaner industrial revolution. EMT also has potential to reconstruct the technology barriers as opportunities and gives policy makers some guidance as to what should be targeted. It might also win business over by identifying new opportunities for profit making.

MFA can improve communication among policymakers and provide detailed information for public use. MFA offer a common source of data that technical experts, government managers and the public can use to set targets and track the effectiveness of environmental policies. MFA also can facilitate more informed policy debate on issues such as choosing sites for new facilities and can support more effective changes in how society uses its materials. The possibility to link municipal solid waste and resulting environmental pressures to their direct and indirect underlying causes in society is another benefit of MFAs, in comparison to traditional inventories. Transforming the role of social movement is the theme of EM that relates to the political and institutional changes. The idea is to empower non-government organisations so that they are able to provide an effective early warning system for emerging problems and feed innovative ideas into the decision making process. The goal is to generate an effective social and environmental feedback mechanism for policy-makers. MFA could help policy-makers to build cooperation with stakeholders and encourage participation from the public in environmental

policy to help the government set the target and formulate policy towards SD. The study argues that MFA can be used as a platform for anaysing sustainability of SWM in Malaysia using EM perspectives in specific focus on institutional dimension.

3.6 Conclusion

A theory of EM is centrally concerned with the relationship between industrial development and the environment and with social capacities to recognise and respond to existing and emergent environmental problems. In this study, the institutional dimension of EM has been addressed to link with the policy of SWM in order to analyse sustainability of SWM and practice in Malaysia. EM not only provides a way for environmental sociologists to more directly conceptualise environmental improvement; it also provides a fresh perspective on the role of environmental movements by avoiding their romanticisation, and by appreciating the particularly fundamental roles that science, technology, capital, and state might play in the processes of environmental improvement.

MFA could provide comprehensive information of waste problems that are linked to modern society's industrial metabolism in real terms and can be used for policymakers to develop policies through EM perspectives. This establishes a persistent link between economic development and ecological deterioration of ecosystems. Thus, MFA is possible to deliver the dimension of EM for analysing environmental problem and policy areas of SWM in Malaysia. An integrated policy and holistic approach is also important to implement for the formulation of a sustainability policy of SWM in Malaysia, since SWM is a complex challenge for the environment .However, due of accurate data of SWM, the result of MFA for SWM not statisfactory implemented in Malaysia context. Detail of MFA for SWM in Malaysia will be discussed in chapter 6 of the thesis. The next chapter will discuss the concept of EMT.

Chapter 4

The Theory of Ecological Modernisation

4.1 Introduction

Ecological Modernisation Theory has become one of the leading perspectives in environmental sociology. Starting in the beginning of the 1980s, the EMT was developed initially and still primarily in a small group of West-European countries, most notably Germany, the Netherlands and the UK. EMT can be understood as a sociological interpretation of how contemporary industrialised countries (try to) deal with the environmental crisis (Mol 2000). As a sociological theory, it is broader in definition than, for example, political sciences, including the role of (civil society) actors in bringing about environment- induced social change. The concept of EM is both applied in empirical analyses and developed as a theoretical concept. Obviously, both uses involve theoretical concerns; hence both empirical and theoretical approaches will be taken into consideration. EM "has become the dominant discourse of SD" amongst environmental policymakers (Hinchliffe et al, 2003, p 256), creating "a way of thinking about how to move beyond the conflict relationship that it assumed to exist between the economy and environment'' (Murphy, 2000 p 31). The aim of this chapter is to evaluate the fruitfulness of the concept of EM with the solid waste policy in Malaysia. This chapter also discusses the comparison between the concept of EMT and SD. EMT and SD are the two dominant paradigms in environmental policy. However, EMT is more useful than SD as a macro or overarching framework for thinking about the environmental problem of metropolitan transformative industry in industrial countries. For the purpose of the study, focus will be on the institutional dimension of EMT for analysing sustainability of SWM and policy in Malaysia.

4.2 The Historical Development of Ecological Modernisation Theory

According to Mol (2000), there are three stages of EMT development. The first contribution by Jopesh Huber and Martin Janicke, was characterised by: a heavy emphasis on the role of technological innovation, especially in the shape of industrial production; a rather critical attitude towards the bureaucratic state; a relatively favourable one towards the market; a system-theoretical perspective with a relatively under developed notion of human agency; and an orientation at the nation state level. The second period, from the late 1980s onward, showed a less strong emphasis on technological innovation as the motor behind ecological restructuring, a more balanced view of state and market dynamics in ecological transformation processes, more attention being given to the institutional and cultural dynamics of EM with studies on industrial production complemented with attention paid to consumption processes. The emphasis was still very much on national studies regarding West-European countries. The third period, since the mid 1990s onward, has seen a progressive broadening in its theoretical and geographical frontiers to include the ecological transformation of consumption and EM outside Europe, particularly in Asia (Mol and Sonnenfeld, 2000; Revell, 2003). In this stage the focus was on how EM affects the everyday consumption of households (Spaargaren, 2000; Spaargaren and Van Vliet, 2000; Southerton et al., 2004).

Ecological Modernisation was originally presented in the German language by Huber (1985, 1991). EMT arose in the 1980s as a challenge to the steady-state and zero-growth ideologies dominant in the 1960s and 70s. In opposition to the Club of Rome's 'limits to growth' argument, the architects of the theory (Joseph Huber, Martin Janicke and Udo Simonis) postulated that through human ingenuity the economy could continue to grow whilst also ensuring environmental protection. This was to be achieved via resource efficient technical innovation which would allow

greater productivity to occur without the need for more material and energy usage, thereby de-linking economic growth from environmental degradation. Since then, EMT has developed considerably and is now a mainstream theory with disciplines which focus on socio-environmental relations. Today, scholars are exploring the usefulness and applicability of EMT to a wide variety of contexts and countries beyond those initially envisioned by the theory's founders (see Mol and Sonnenfeld 2000).

4.3 The Concept of Ecological Modernisation from Different Scholars' Perspectives.

Some scholars (such as Weale, 1992: Mol, 1995; and Spaargaren, 1997) use EM as an analytical tool to explore current processes of environmental reform and social change in industrialised nations. Others (such as Christoff, 1996, and Dryzek 1997) argue for the notion that EM has normative merit as a political programme. Murphy (2000) highlights that the distinction between EM as a theory of social change and as a political programme is an important one, particularly as it is common in the literature for its analytical and prescriptive dimension to be confused.

In Dryzek's (1997) world of ecological discourses, EM is understood as one of two sustainability discourses, which in turn is also an expression of one of four predominate ecological discourses of modern society. Basically, Dryzek indentifies EM as a political-economic discursive formation. Dryzek also specifies the benefits of EM for business in four points: pollution prevention pays, it becomes more expensive to solve the problem in the future, a better environment is achieved, and there is money to be made in selling green goods and in prevention products.

Mol and Spaargaren have contributed to the discourse on EM both together and indepently (Spaargaren & Mol 1992; Mol & Spaargaren, 1993; Mol 1995, 1996,

Spaargaren 1997) and they distinguish between EM as theory and as a political programme. As a socio-political programme, it is a description of the historical process that has taken place; as a theory of social change, it is an attempt to develop existing 'social science' models.

Mol and Sonnenfeld (2000) also identify five transformations that are addressed in the EM literature: the (i) the transformation of the role of the nation-state in environmental reform and the emergence of more centralised, flexible and consensual styles of governance; (ii) the increasing involvement of market actors and dynamics in environmental reform; (iii) the changing role of science and technology (both as a cause of and potential cure for environmental problems); (iv) modification in the position, role and ideology of environmental NGOs; and (v) changing discursive practices and emerging new ideologies in which the neglect of environment and counter-positioning of economy and environment are no longer seen as tenable positions.

Weale (1992), referring to Germany, describes the 'ideology' of EM as denial of the validity of the assumptions underlying the pollution- control strategies of the 1970s. These strategies were, according to Weale, based on the following assumption:

… that environmental problems could be dealt with adequately by a specialist branch of the machinery of government; that the character of environmental problems could be handled discretely; that end-of pipe technologies were typically adequate; and that in the setting of pollution-control standards a balance had to be struck between environmental protection and economic growth and development (p. 75)

The strategies based on these assumptions soon proved to be incapable of solving the environmental problems they were supposed to deal with. Instead, they resulted in problem displacement, across time and space, rather than problem solving (Weale, 1992, p76). Nonetheless, the 'reconceptualisation' of the relationship between

economy and the market represented a decisive break from the assumptions that informed the first wave of environmental policy. The ideology of EM challenged 'the fundamental assumption of the conventional wisdom, namely that there was a zero-sum trade-off between economic prosperity and environmental concern.

Hajer (1995) gives a description of EM in accordance with Wealer's interpretation, and argues, in the same manner, that a decisive break has taken place. In Hajer's perspective, however EM is presented not so much as a reaction to the radical environmental movements of the 1970s.

"The historical argument, in brief is that a new way of conceiving environmental problems has emerged since the late 1970s. This policy discourse of EM recognises the ecological crisis as evidence of a fundamental omission in the working of the modern society. Yet, unlike the radical environmental movements of the 1970s, it suggests that environmental problems can be solved in accordance with the workings of the main institutional arrangements of society. Environmental management is seen as a positive-sum game: pollution prevention pays.

In its most general form, Hajer (1995, p.25) defines EM as 'the discourse that recognises the structural character of the environmental problematique but nonethe less assumes that existing political, economic, and social institutions can internalise the care of the environment'.

Scholars have taken a great interest in EMT in recent years and have subjected it to rather vociferous criticism. The volume of criticism, though, does not necessarily mean that a theory is a poor one. Rather, it can mean that a theory gets enough right that others pay attention to it, even if they disagree with much of it. This is how scholarship moves along. Also, Mol and Spaargaren have been usually forthcoming in responding to the critics and in accepting many their points, so as to improve EMT.

EMT has been criticised for ignoring those dynamics of power which can (and frequently do) subvert environment reform (Keil and Desfor, 2003), ignoring issues of equity (Gibbs 2000), and underplaying the nature and scale of social changes required to move to more sustainable forms of development. As Christoff (1996) points out, EM "may serve to legitimise the continuing instrumental domination and destruction of the environment and the promotion of less democratic forms of government, foregrounding modernity's industrial and technocratic discourse over its more recent resistant and critical ecological components". Criticism of EM are well summarised by a critique of the concepts of SD and environmental management by Escobar (1996, 50) who argues that they are a means by which capitalist institutions and global power structures find new ways to exploit nature under a progressive guise of environmental concern.

EM theorists agree that they seek the solution to problems of science, technology, industry, and capitalism in science. But these institutions won't look the same anymore. "EMT puts forth a radical reform programme," writes Mol. "The institutions of modern societies, such as the market, the state and science and technology, will be radically transformed in coping with the environmental crisis, although not beyond recognition". EMT may be reformism, in other words, but it is radical reformism.

Another criticism is that EM has little to say about issues of environmental justice. Nor does it have much to say about the rights and beauty of habitat. Its focusses almost entirely on issues of sustainability and EM theorist accept these points, though, and are working on ways to incorporate them into the theory.

Ecological Modernisation Theory overlooks social and cultural consideration and instead focuses only on economic and technical considerations. One critic observed that "in EM the environment is reduced to a series of concerns about resources inputs, waste and pollutant emissions".

Limited spatial and temporal scales also trouble critics of EMT. Ecological Modernisation research tends to examine specific economic sectors, industries, or even individual actors in specific historical and geographical settings to demonstrate how EMT is solving environmental problems. However, in order to demonstrate real environmental change, limited spatial and temporal scales are not sufficient.

Finally, the question is whether the EMT is simply a legitimating theory for the commodification of nature's services and the subsumption of the environmental within the economic. EM could be nothing more than another version of green capitalism that ultimately produces little beyond environmental rhetoric. By subsuming the environment into the economy, EM proponents place the environment at the mercy of the market. Thus, when market conditions change and protecting the environment no longer produces profit, any environmental protection measures based on this logic will effectively cease. In essence, EM does not delink the environment from the economy in a productive way (Pellow et al. 2000), and in fact actually strengthens the link by becoming the greening of "business as usual". Instead, EMT only evades the challenging alternatives to real structural change to the environment-society relationship that can only come outside the capitalism system. This avoidance strategy begs the question of whether EMT is really concerned with ecology at all, or if it is simply about institutional responses to profiting from the ecological crisis (York and Rosa, 2003).

4.4 Ecological Modernisation and Sustainable Development

Both Sustainable Development and Ecological Modernisation are contested concepts. Ecological Modernisation theory originated in Europe during the 1980s. In its original form, it can be regarded as the social scientific elaboration and formalisation of the underlying philosophy concerning environmental change articulated in the Brundtland Report. Or as Spaargaren and Mol put it in 1992:

. . . the concept of SD is based more on opinions than on scientifically based ideas. For this reason and because of the many possible interpretations that can be placed

upon it, the concept of SD is only suited to our purpose to a very limited extent. Therefore, we introduce a more analytical and sociological concept consonant with the primarily political concept of SD and EM.

Ecological Modernisation and Sustainable Development emerged independently but share the belief that economic growth must be decoupled from increasing resources use and environmental degradation. EM is however less ambitious than SD since it does not directly address issues such as poverty alleviation within and between generations (Langhelle 2000). As Christoff (1996) points out, EM is used in different ways by different authors. Some use it to describe technological developments; others use it to define changes in environmental policy discourse. Others again seem to think of it as a new belief system. Mol & Spaargaren (1993) uses the term to cover a set of sociological theories about the development of modern industrialised society and a political programme favouring a particular set of policies.

Dryzek (1997, p.27) argues that the main accomplishment of the World Commission on Environment and Development (WCED) was that it managed to combine systematically a number of issues that had often been treated in isolation. Among them are development, global environmental issues, population, peace and security, and social justice both within and between generations. The most striking difference between SD and EM is thus that SD attempts to address a number of issues about which EM has nothing to say. Moreover, as Jacobs (1995, p.65) points out, SD (and sustainability) were not intended as economic terms but 'were and remain, essential ethico- political objectives'

SD is not only about the environment. *Our Common future* was first and foremost an attempt to reconcile the tension between developmental and environmental concerns at the global level. The context of SD derives partly from global concerns, partly from intergenerational concerns and partly from a growing awareness of global

environmental problems (Lafferty, 1996; Langhelle, 1996; Lafferty & Langhelle, 1999**)**. The context of EM on the other hand, relates primarily to the experiences of western industrialized societies (Christoff, 1996; Mol, 1996; Dryzek, 1997). As such, EM has no established relationship either to the global environmental problems or to social justice. There are, in fact, no explicit references or connections at all to the global dimensions of developmental and distributional problems. As such, EM is neither concerned with social justice within our own generation (intergenerational justice) nor with social justice between generations.

Furthermore, Mol & Spaargaren (1993) argue that global warming cannot be handled within the framework of EM. Global warming must be seen as a problem of ; ecological high- consequence risks' and by their very nature ecological high-consequence risks raise problems of technical and political control, awareness of existential anxiety, and so on, which cannot be dealt with within the framework of EM (Mol & Spaargaren, 1993).

Instead, they argue, EM belongs to the 'simple modernisation' phase, making unproblematic use of science and technology in controlling environmental problems. The problems of ground and surface water pollution, chemical and household waste, regional problems like acid-rain and the diffuse pollution by high- technology agriculture can in principle and practice be controlled by following an EM approach. These problems, therefore, should not be connected directly to eco-alarmist prospects.

Another difference between SD and EM seems to be the institutional level on which they focus. EM, according to Mol & Spaargaren (1993) does not so much emphasise the relation between the global and the individual, but rather concentrates on strategies of environmental reform on the meso- level of national governments, environmental movements, enterprises and labour organisations. Dryzek (1997) argues that EM implies a partnership in which governments, businesses, moderate environmentalists, and scientist cooperates in the restructuring of the capitalist

political economy along more environmentally defensible lines. The global level, in other words, seems to be lacking both institutionally and as a problem area in EM.

Sustainable Development, on the other hand, is directed towards both the national and global institutional level. *Our Common Future* was undoubtedly directed towards intergovernmental organisations, like United Nations and the World Bank, but this does not imply, as Dryzek (1997) claims, that SD de-emphasises the role of national governments and state actors. Like EM, SD acknowledges that actors of the state play an important role. But states play an even more important role with regard to the global environmental problems, where international cooperation and international agreement seem crucial to any attempt at solving these problems. The state is thus fundamental to the conception of SD in *Our Common Future.* 'The integration of environment and development is required in all countries, rich and poor. The pursuit of SD requires changes in the domestic and international policies of every nation (WCED, 1987).

Another crucial difference between SD and EM relates to nature's carrying capacity and ecological limits for global development. According to Dryzek (1997), both concepts pay little attention to limits to growth. Limits in EM are not so much explicitly denied as ignored and *Our Common Future* is seen as a bit ambiguous on the existence of limits. This leads Dryzeks to the conclusions of 'no limits' as one of the basic entities of SD. Despite the claim of lack of limits, however, nature's carrying capacity and ecological limits for global development must be seen as crucial to SD in a way they are not, and cannot be, in EM.

The assumption of global ecological interdependence is lacking in EM. Together with the differences relating to the context of social justice, global environmental and developmental problems, global politics and global limits, it seems clear that EM and

SD are quite different concepts, even when EM is compared with *Our Common Future.*

These differences however are not sufficient to substantiate the claim that the implications for environmental policy are different. In fact, Mol (1996) seems to argue that a broader framework (such as SD) has no further implications for environmental policy beyond the perspective of EM:

"EM theory puts forward a radical reform programme as regards the way modern society deals with the environment…But the point reference for this radical transformation is the movement towards an environmentally sound society, and not a variety of other social criteria and goals, such as the scale of production, the capitalist mode of production, worker's influence, equal allocation of economic goods, gender criteria and so on. Including the latter set of criteria might result is a more radical programme (in the sense of moving further away from the present social order), but not necessarily a more ecologically-radical programme".

One of the confrontations that EM theory has deliberately sought has been with ecology, biology and the natural sciences. The premise of this contention is based upon the conviction that the environmental crisis is a 'real' crisis, dealing with real, objective, physical properties of social systems. In this sense, physical properties that have been changing over time confront us with a challenge that has to be taken seriously in order to avoid distorted social reproduction. This objectivist or realist position of EM theory has resulted in some severe criticisms and significant disagreement from some (strong) constructivists (Blühdorn, 2000).

EMT is not the specific realm of naïve technical scientists believing that the environmental crisis can be reduced to physical properties and their technical engineering. Instead, the approaches of environmental scientists and policy makers

who work with substance and energy flows-related definitions of the environment in a too narrow or restricted way are precisely the approaches being challenged. By taking substance flows into consideration from a sociological point of view, the objective is to bridge the gap between the technical and social environmental sciences. This is not an easy task, given the gulf between over socialised constructivists and under socialised environmental (e.g. climate change) experts and policymakers, who tend to overlook the fact that there are people, social systems and human behaviours attached to changing substances flows.

EMT as developed by sociologists, stresses the fact that the environmental crisis is a thoroughly social crisis in terms of a series of problems in the way we deal with the sustenance base. These problems, it is argued, are not incidental or *ad hoc* in character, but stem from a 'structural design fault' (Giddens, 1990) in the organisation of production and consumption in modern societies. EM theory focusses on the ways in which substance- flow management can and should be organised in modern society in a more appropriate way, arguing that such management or control pertains both to technological and social devices and mechanisms.

The concept of EM implies that it is possible, through the development of new and integrated technologies, to reduce the consumption of raw materials, as well as the emissions of various pollutants, while at the same time creating innovative and competitive products. Hence, it is an optimistic message; a message that has an impact on the existing institutions, and as such, should be expected to bring about structural adjustments and changes in production and consumption. Although the conceptual debate on EM has primarily been an academic one, it has indeed had a number of policy ramifications, like environmental management systems, green accounting and cleaner technology development.

Ecological modernist discourse manifest in policy institutions promoting environmental innovation (e.g market-based instruments, win-win regulations,

public-private-civic environmental partnerships) (Berkhout and Gouldson, 2003); Hajer, 1995), and yet, the effectiveness and possibility of EM is disputed. People drawing upon competing discourses interpret its limited achievements more critically, and argue that capitalism's need for growth remains culpable in environmental degradation (York and Rosa, 2003). Despite critical distinctions between EM and SD discourses (Langhelle, 2000), policy-making is more strongly embedded in the former and policy makers routinely drawn upon ecological modernist claims in their justifications.

4.5 Ecological Modernisation and Environmental Policy

Much of the analytical EM perspective is focussed on environmental issues that are particularly relevant to industries and urban societies such as those of Europe. It reflects the fact that European countries have been at the forefront in developing rational environmental practices to cope with such issues as energy development and energy saving technologies, air pollution, waste recycling and disposal, transport, and the development of cleaner technologies. Recent EM thought now fits neatly into the neoliberal project that sees the ecological crisis as a medium for a form of governance that incorporates economic/environmental development, techno-optimistic environmentalism, and a neoliberal environmental state. (Jeremy.B, 2007). For instance, in 1987 the Organisation for Economic Co-operation and Development (OECD) reported that environmental policy in most countries was influenced by ' command and control'; while in 1997 the European Environmental Agency (EEA) stated that New Environmental Policy Instruments (NEPIs), such as voluntary agreements, green taxes, eco- labels, etc had grown massively (Jordan et al., 2003).

Ecological Modernisation as a term has been variously applied to several separate phenomena (Hertin and Berkhout, 2003). They include a growing body of theoretical literature in environmental sociology, political and industrial programmes concerned with improving the environmental policy models, 'reconciling economic

development and environment' (Gibbs, 2003). Examples of representative practices include 'strategic environmental management', 'cleaner production', 'industrial life cycle analyses, and 'environmental quality assessment' systems such as ISO 14001. Some proponents of EM view it as synonymous with SD (Buttel, 2000); others provide a broader, more confident discourse developed as 'story-lines'. As Hajer (1995, p.64) puts it:

"Ecological Modernisation is based on some credible and attractive story-lines: the regulation of the environmental problem appears as a positive-sum game; pollution is a matter of inefficiency, nature has a balance that should be respected; anticipation is better than cure".

According to proponents, EM does not assume that ecological sustainability and capitalist production and consumption are incompatible (Gouldson and Murphy, 1996; Spaargaren, 1999). On the contrary, a basic tenet is that, by means of environmental technologies and the transformation of modern institutions, capitalist structures can be transformed to avoid long term environmental damage; that ecologically sustainable economic development is not only possible but necessary in order to provide for the expected increase in the human population over the next 50 years (Green et al., 2003). Spaargaren (1999) argues that environmental crises are socially constructed, and as such, they are amenable to analysis and change. He describes EM as "a general theory of environment-induced social change" (Spaargaren, 1999, p.3). In this he argues that environment crises provide the impetus for social institutions to change. Spaargaren , Mol and others agree that 'solutions to the problems caused by modernisation, industrialisation, and science can only be solved through more modernisation, industrialization and science (Buttel, 2000, p.62) For these theorists, EM as social practice offers the means by which industrial society can hope to make a transition toward ecologically sustainable production. They espouse greener technologies, 'polluter pays', and 'ecological rationality' (Carolan, 2004). Socio-political practices and policies that

promote such change should be encouraged, including knowledge-based institutions, innovation and the application of sophisticated new technologies.

Goulsdon and Murphy (2000) have noted the importance of distinguishing between analytical-descriptive and normative-prescriptive dimensions of EM theory. As an analytical/descriptive enterprise, EM theory is concerned with identifying how modern societies construct the environment (Hajer, 1995); how social and economic change impacts on the environment and environmental relations (Gouldson and Murphy, 1996; 2000); how social institutions can be improved in their treatment of environmental issues (Jänicke and Jörgens, 1999); understanding the social and economic institutions that promote or resist environmental sustainability (Buttel 2000; Hertin and Berhout 2003; Gouldson and Murphy, 1996; 2000; Jamieson and Baark, (1999). More recently, theorists have broadened their analysis to include the role of consumption as a driver of production (Carolan, 2004; Mol and Spaargaren 2004).

Recent years have shown increasing EM of international environmental policy. For instance, in 1987 the Organisation for Economic Co-operation and Development (OECD) reported that environmental policy in most countries was influenced by ' command and control'; while in 1997 the European Environmental Agency (EEA) stated that New Environmental Policy Instruments (NEPIs), such as voluntary agreements, green taxes, eco- labels, etc had grown massively (Jordan et al., 2003).

Dutch environmental policy is identified as pioneering EM (Gouldson and Murphy, 1998: Weale, 1992; Hajer, 1995). The Netherlands was among the first countries to develop comprehensive environmental policy planning in partnership with business. This served as a model for other countries (Jänicke, Kunig et al, 2000: Jänicke and Jörgens 1999; Jörgens 2003). Then, in its fourth national plan in 2001 (NMP4), the Dutch government overhauled environmental planning with the new 'transition approach'. Progress under earlier plans, whilst positive, was considered insufficient for decoupling the economy from environmental degradation. As such, the

transitions approach can be considered an attempt to reinvigorate the EM discourse and move it from a weak to a strong version (Breukers and Wolsink, 2007).

The EM of today has a much more sophisticated grasp of environmental risks and hazards, the shift to post- industrial society, and the role of social movements in political change. The compromises of the SD agenda developed through the Brundtland Report of 1987 and at Rio in 1992 marked a mainstreaming of EM ideas in state bureaucracies, corporate organisations, civil society actors, and international institutions such as the EU and OECD. The discourse of SD carries the modern rationalist idea of progress and what Dryzek has termed "the rhetoric of reassurance" that is a central dimension of EM. (1997:132). At the same time, social justice and ethics still remain part of the EM argument through the compromise articulated by the Brundtland Report between poverty alleviation and economic growth (WCED, 1987; Harvey, 1998: 339) and are arguably still a component of the progressive social democratic discourse within the United Nations and other multilateral institutions.

4.6 Conclusion

A question raised concerns of the fit between the EM strategy and the serious environmental problem facing the 21st century. EM is a different, and in many ways an improved, synonym for SD. EM is a policy concept characterising the types of processes towards sustainability rather than judging the results of these processes. EM theories are interested in the process of reflexive modernisation that allows societies to recognize and respond to emergent environment problems. They are concerned with the discourses through which environment-economy relations are framed and re-framed (Hajer 1995), notably as being mutually supportive rather than antagonistic (Gouldson and Murphy, 1996). They have also been used as basis for prescribing new ways of mediating the relationship between environment and

economy. In broad outline, ecological modernisation refers to a series of institutional, operational, economic, governance, social and political shifts that are set in motion by environmental drivers. These drives push new social arrangements, a new discourse, new scientific and technical developments, and a shift in responsibilities and interests between public and private sectors, between governments and their citizens, between civil society and other economic actors, and between the formal and informal sectors and arrangements within a wide range of disciplines. Arguably, EM has three main strengths. First, it invites an integrated approach to environmental issues by conceptually linking ecological priorities with other policy areas (e.g. the focus on economic growth and development). Second, its theoretical framework feeds into the broadly accepted policy goal of sustainable development. Third, it can generate programs for change that constructively engage with the existing institutions of power.

In the next chapter the studies discussed the institutional dimension of EMT to examine what has transpired in waste management in Malaysia, to look at the process of management, the opportunities and constraints of such an approach and relate to solid waste policy in Malaysia.

Chapter 5

Solid Waste Policy in Malaysia and Ecological Modernisation Theory

2.5 Introduction

Ecological Modernisation is often used as a synonym for strategic planning in environmental management in industrial ecology, eco-restructuring, and so on (Ayres et al, 1998). Theory has also been developed as a way of analysing emergent policy discourses (Hajer, 1995) and as the theoretical basis from which various policy prescriptions can be brought forward to encourage a shift toward more environmentally benign modes of industrial development (Huber, 1985; Simons, 1989; Mol, 1995; Gouldson and Murphy, 1996). In each case, EM is centrally concerned with the relationship between industrial development and the environment and with social capacities to recognise and respond to existing and emergent environmental problems (Gouldson et al. 2008, Mol et al, 2009). EM theories have helped to describe the ways in which environmental problems come to be framed as issues that are politically, economically and technologically solvable within the context of existing institutions and power structures and continued economic growth (Murphy and Gouldson 2000). EMT suggests the need of a national policy of SWM and efficient solid waste system for sustainability of SWM in Malaysia. However, this has not occurred in Malaysia due to lack of institutional arrangements, policy gaps, privatisation failure process, behavioural unresponsiveness and poor understanding dealing with sustainability of SWM. For these reasons, this chapter will focus on the institutional dimension of EMT to examine the national policy of SWM in Malaysia for analysing sustainability of SWM. This chapter also discusses the process of privatisation and waste minimisation programme to examine how they

relate to EMT process with specific focus on transformation of the role of state and market.

5.2 Solid Waste Management Issues and Institutional context in Malaysia

Malaysia, with an area of 329 750 sq Km, had a population of approximately 24.8 million in 2007, with a per-capita GDP of US$ 14 400. Malaysia is facing serious environmental challenges in terms of managing solid, hazardous, and toxic waste, water pollution, and air pollution. The World Bank (2000) reported that SWM was considered as one of the major problems in developing countries, particularly in Malaysia. The daily generation of waste in Malaysia escalated from 13 000 tonnes in 1996 to 19 100 tonnes in 2006. Generation of Municipal Solid Waste (MSW) in Malaysia has increased more than 91% over the past 10 years, due in particular, to the rapid development of urban areas, rural-urban migration, increase in per-capita income, and the change in consumption patterns brought about by development. The urban population, which constitutes more than 65% of the total population, is the main generator (MHLG,2005).

The changes in lifestyle in Malaysia, particularly in the urban areas, have led to more acute waste problems. On the composition of solid waste, the 9th Malaysia Plan (2005-2010) estimated about 45% of the waste is made up of food waste, 24% of plastic, 7% of paper, 6% of iron and glass and others made of the rest. It seems that Malaysians are approaching an unsustainable consumption pattern by buying more food that is needed and unnecessarily generating more waste than is necessary.(Nadzri, 2007).

The EMT emphasises the importance of consumers actively demanding green products and technologies as a main driver for more sustainable everyday life in households (Mol, 2000). Change in consumer behaviour in Malaysia is resulting in

reduction in waste generation. However, it must be remembered that the choices for the consumer product industries and consumer behaviour may be the most critical factors in tackling SWM. This is because treating solid waste after being generated will only partially solve the problem, especially when solid waste generation keeps on increasing due to packaging and consumer behaviour. This result in solid waste being treated but it still does not solve the problem of solid waste generation or the need for society to make changes in its behaviour. In fact there is also need to change political practices and institutional managing of Solid Waste, but these are ineffective in SWM due to lack of an institutional framework, policy failure, and managerial aspects dealing with SWM in Malaysia.

Institutionally, SWM in Malaysia involves the participation of various government agencies from federal to state and down to local authorities. All of the government agencies are involved with SWM either directly or indirectly. Malaysia is governed as a parliamentary democracy with three tiers of government, namely the Federal Government, state government and local authority.Under the Federal government, the administration of SWM is under the purview of the Ministry of Housing and Local Government (MHLG). There are two units in this ministry involved directly with SWM, the Local Government Department and Town and Country planning unit. The roles of the Federal government in SWM are principally as an advisory and coordinating nature. As provided by the constitution, the National Council of local government is an important vehicle that provides the avenue for consultation between the MHLG, from time to time, in the formulation of national policies for the promotion, development and control of the local authority.

Another government agency related to SWM is the Prime Minstry Department. There are several bodies which are under this department, such as Environmental and Economic Planning Unit (EPU), Cabinet Division, and Public Service Department (JPA). Other agencies involved indirectly are the Ministry of Finance and the Ministry of Health, which involved the Engineering Services Department, and Health

Education Unit. Although the responsibility for SWM lies with local governments, they generally lack the financial and technical capacity to manage this complex task.

Even though several agencies, such as the State Department of the Environment and Municipal Council are involved in waste management, they often have no clear functions in relation to waste management and there is no single agency designated to coordinate their projects and activities. The lack of coordination among the relevant agencies often results in duplication of efforts in waste management, under utilisation of resources, and un-sustainability of overall waste-management programmess and policies. On the management side, lack of skilled manpower, irregular collection services, inadequate legal provisions, and resource constraints are the key factors challenging the waste management in the country today (J.Jahi, 2002).

The Municipal Solid Waste Management (MSWM) services account for a high percentage of the municipal budgets as waste management and planning under municipal responsibility. On average, 50% of the municipal operating budget is spent on MSWM and, of this 70% is spent on the collection of waste (Juzhar,2003). There are three sources of funds for the municipal solid waste operation, namely, municipal taxes, fees charged for services and subsidies from municipal revenues received from government sources. Cities and towns rely heavily upon municipal taxes for their communities as the fees charged for collection and transfer services are not covering the costs of these operations. Moreover, there is no standardised procedure for setting fees and debates about this issue are ongoing (M.Nassir ,2000). To some degree, an integrating function is provided by the Economic Planning Unit (EPU) of the Prime Minister's Department through its overseeing financial role. The EPU produces medium and long- term development policies and budget allocations for the national five-year plans and ensures that developments conform to the current outline perspectives plan. (Malaysia EPU, 2006). However, financial support is one of the problems faced by the government in managing urban SWM in Malaysia.

Most municipalities in Malaysia are also facing the problem of getting new disposal sites as most of the existing disposal sites are nearly exhausted (Hassan et al. 2000). Results from one assessment showed that there were 77 open dumps (mainly in the rural states), 49 controlled tipping landfills, and only 35 sanitary landfill sites (MHLG, 2005). Although land-scarcity situation is not as serious compared to developed countries like Japan, landfills may not continue to be a feasible option in the future. As population density increase, the land-filling of wastes become more difficult and unacceptable for the nearby population. Kuala Lumpur, for instance, is on dire need to reduce its dependence on landfills because of population density. However, an alternative solution such as an incinerator has proven to be equally difficult to implement. In 2003, a plan to build a 1500 tonnes thermal incinerator in Broga, Semenyih had to be scrapped due to citizen opposition. Partly concerned with dioxin contamination, partly driven by *not-in-my-back-yard* (NIMBY) syndrome, the Broga residents took the Federal government to court in 2005. As a result, the Federal government cancelled the project in 2006 ostensibly due to what was officially announced as 'high capital cost'.

SWM monitoring systems and reporting in Malaysia are also rather weak as there is no systematic procedure for reporting to such authorities as the MHLG and therefore no basis for planning beyond the local level (J.Jahi 2001). Limited types of information are therefore obtained from commissioned studies or from concession firms. The governance and regulations for homogeneous waste are clear as this is the responsibility of the Department of the Environment and the waste is generated by an identifiable sector. However, the issues become somewhat confused when the stream is mixed, as in the municipal waste sector, where responsibilities fall between the Department of the Environment, the MHLG, and the local authorities themselves. Lacking an integrated framework and appeal body, agencies plan and deliver services according to their own objectives and mandates, and the lack of coordination results in an inability to resolve issues beyond their immediate jurisdiction. Handling

and disposal of household hazardous waste in the municipal solid waste stream is a notable example.

Waste management is a highly active area in both policy development and academic research across a range of disciplines. Waste practice has altered radically in developed countries over the last generation as priorities have shifted from public health to resource conservation. However, variable, but often significant, gaps remain between policy objectives and practice. Policy objectives can be related to theorisations of SD, but formulation may lack sufficient understanding of the implications of the theorities to overcome barriers to implementation. Theorisations in turn need to be cognisant of policy and practice to be of value, especially to policymakers. In developed countries, pollution control remains a highly important aspect of waste management. Developing countries like Malaysia may have similar policy aspirations and even regulations to developed countries, but lack the infrastructure and organisational structures to implement effectively.

In terms of political and institutional change, the EMT stresses that the importance of the state in steering the development trajectory be acknowledged and it is proposed that the institutions of government be structured to allow for more democratic, decentralised and participatory decision-making. The overall aim is to create an institutional context for governance that is flexible and innovative, thus preventing policy making from becoming ossified, out of touch or captured by powerful economic interest. However, SWM in Malaysia seems to be lacking both institutionally and managerially as a problem area in EM. The study pointed out the need for more transformation in environmental governance, particularly in SWM. At the macro level, the state needs to iniate policy reforms to affect the full devolution of environment and SWM functions. Policy reforms provide the rational institutional arrangements. However, the existing policy framework dealing with complexity issues of SWM in Malaysia seems fragmented. The study also found that, currently there is no national policy on SWM in Malaysia.Thus, adaptation of EMT to SWM

and policies in Malaysia appearsto be not yet ready for such transformation and de-linking the environment and economy in SWM is also difficult. However, the study argues that institutional dimension of EM is a useful tool and can be used as references to analyse sustainability of SWM in Malaysia, particularly in terms of transformation of the role of government and institutional aspects. The next section will discuss the National Strategic Policy of SWM in Malaysia and link with EMT for analysing sustainability of SWM.

5.3 National Strategic Policy of Solid Waste Management in Malaysia

The National Vision Policy (NVP) in Malaysia, developed to meet the challenges posed by Vision 2020, incorporates key strategies of the New Economic Policy (NEP) and the National Development Policy (NDP). A key thrust of the NVP is pursuing environmentally SD to reinforce long term growth, which presents a challenge to established policies and practices in the rapidly expanding area of SWM. (figure 5.1).

In the 8th Malaysia Plan (2001-2005), one of the main objectives was pursuing environmentally SD to enforce long term growth. However, all studies and research related to SWM by MHLG and other agencies in Malaysia were more focussed to upgrade their present practice such as sanitary landfill method, composting, recycling and so on. Despite the fact that the information on SWM of Malaysia is currently limited, the volume of municipalities solid waste generated by Malaysia is fast increasing taking into account the rapid rate of population growth and urbanisation. In addition, because of the improved standard of living, affluence and a significant change in the economic production structure of the country, the composition of municipal solid waste is becoming more varied and complex.

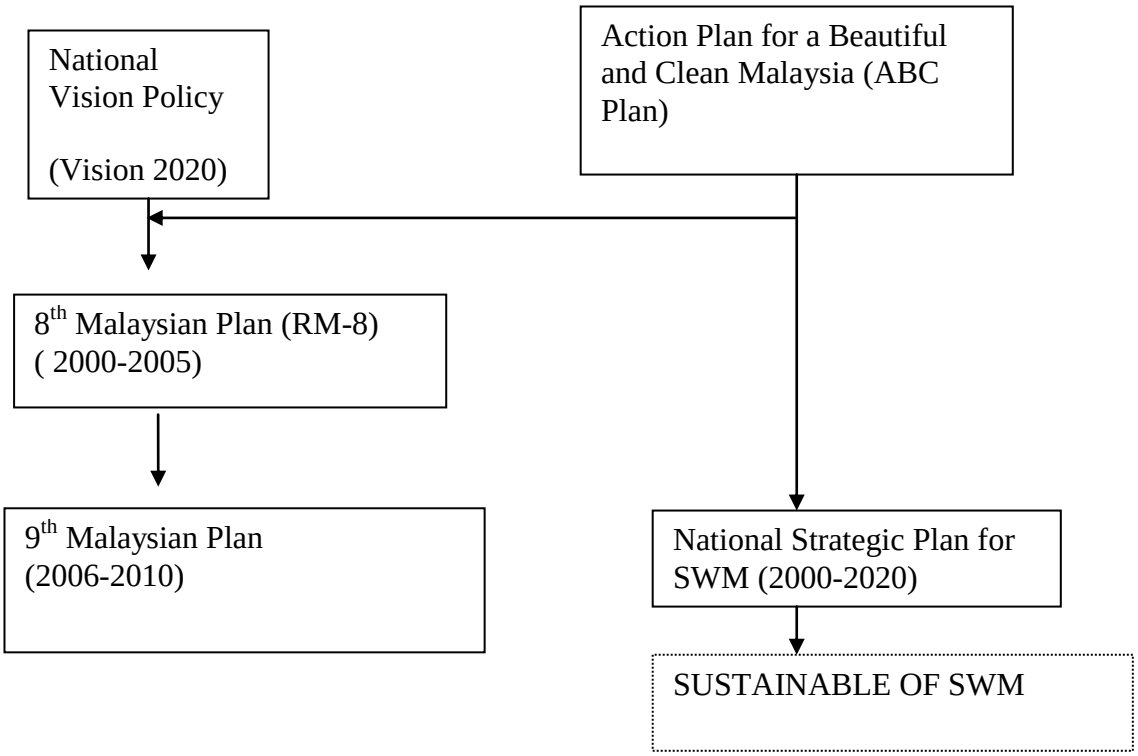


Figure 5.1 : Solid Waste Management Policy .

The National Strategic Plan (NSP) is an attempt to move the somewhat inadequate management system currently in place towards one that is better, taking due consideration of economic development and the needs and responsibilities of the various stakeholders within society. In order to achieve this, the plan addresses the current situation in all functional aspects of SWM- storage, collection, transfer, treatment and disposal, and outlines the basis for addressing the relevant issues and proposing solutions. Action Plan, outlined within the NSP, provides the basis for future action to achieve the visions of the National Vision Policy. The Ninth Malaysia Plan explicitly supports the National Strategic Plan (NSP) strategies including the adoption of sustainable waste management through reduction, reuse and recycling which are to be given priority together with the use of appropriate

technologies, facilities, and equipment and service standards. In relation to sustainable SWM, the Ministry of Housing and Local Government (MHLG) also reported that principles to guide development of strategic plan of SWM (2005) were:

a) Direct participation of Federal government
b) Privatisation of SWM services
c) Sustainable waste management
d) Inter -cooperation amongst government and stakeholders
e) Public awareness programme
f) Development of technical and managerial capability

Source; MHLG, Malaysia, 2003

Through the 'National Strategic Plan for Solid Waste Management (2000-2020)', waste minimisation is recognised as one of the priorities. The Strategic Plan is in line with the Vision for Malaysia to achieve a fully developed country status by 2020. The National Strategic Plan is actually consistent with EMT, but the response from the government was tepid, and its recommendations were not successfully implemented. For example, according to the director of SWM, solid waste is a major challenge for Malaysia to address in the light of Vision 2020 which lays out the direction for Malaysia to become a fully developed Nation by 2020 (MHLG, 2003). However, at this stage there are various problems managing SWM in Malaysia such as lack of coherence and integration of policy at different levels of governance, insufficient manpower, and lack of financial support, social and behavioural unresponsiveness dealing with complexity of SWM. Thus, sustainability as a policy goal is more complex when examined in terms of SWM in Malaysia due to various reasons dealing with SWM.

According to NSP, SWM service targets in Malaysia have been established to focus and implement plans and to measure their efficiency as shown in Table 5.1. These targets are achievable within the timeline up to 2020. However, they should be

reviewed periodically during the planning period to ensure that they remain relevant with respect to the prevailing conditions at the time of review. Such revisions could include the ultimate vision of 2020 (zero waste) that is to be achieved within the timeframe that is to be established. In addition, the government has considered an adoption of a comprehensive waste -management policy including the installation of incinerators for safe and efficient disposal of waste as well as to formulate strategies for waste reduction, reuse and recycling (3rd Outline Perspective Plan, 2001-2010). However, the study found that SWM service target by 2003-2009 has not been achieved successfully by the government. Policy failure and lack of financial support are the most major problems faced by the government to deliver their policy target for SWM in Malaysia (MHLG, 2005). Thus, sustainability as a policy goal is more complex when examined in term of SWM (zero waste by 2020) in Malaysia due to various reasons and complexity in SWM.

Table 5.1: Solid Waste Management service targets

Level of Service	**2003-2009**	**2010-2014**	**2015-2020**
Extended collection service	80%	85%	90%
Reduction and recovery	10%	15%	17%
Closure of dump sites	50%	70%	100%
Source Separation	20%	80%	100%

Source: National Strategic Plan for SWM (MHLG, 2005)

5.3.1 Waste Minimisation Programmes in Malaysia

Waste, from a government perspective, is seen as a national resource that can be used to develop a 'recycling society'. The main problem with this statement is that Malaysia currently remains a very wasteful society. However, waste management policies in Malaysia indicate that the country is looking towards innovative solutions to the problems of inadequate and inefficient services provided by local authorities. There is evidence that Malaysia is gradually incorporating the principles of 3R policies, albeit only in a haphazard fashion. In Malaysia, efforts have been incrementally stepped up to embrace the waste minimisation principles. However, beyond the waste minimisation goal, lacking in Malaysia is a functionally differentiated stage of waste recovery at an industrial scale. This demands a parallel transition in industrialisation process which is greener; or an "ecological modernisation process". More modestly, expression of the resource recovery goal can be found in Malaysia's Solid Waste and Public Cleansing Management Act (Act 672) and the Solid Waste and Public Cleansing Corporation in 2007, whereby the government can specify which kinds of products shall be collected by manufacturers. For example, article 102 of the Act stipulates that the government can place responsibility for the collection of products on the manufacturer, assembler, importer, or dealer. However, the strength of enforcement in Malaysia is not clear. (Er, 2007). EM theorists have indicated that the reactive 'command- and- control strategies were less effective in solving environmental degradation problems (Weale, 1992, Mol 2003). To their view, other forms of environmental governance are gaining importance, complementing the role of regulation. Moreover, the roles of non-state actors in environmental policy are becoming more pronounced, and new government styles are replacing the old hierarchic state models. A trend can be detected in the transformation in the role of the state from a hierarchical command-and-control form of government to participatory, consensual, cooperation and interactive forms of governance.

The study found that Malaysia is struggling with the earlier goals of waste management, while concurrently trying to embrance the newer goals. In this country, the dynamics of policy-development process are contrained from attaining a "paradigmatic" change, or graduating onto 3Rs stage. This essentially would require a process in which deep values in the policy contents and actors are altered, leading to a fundamental realignment of other aspects of policy development. In other words, this can only occur only when the policy institutions themselves are transformed. However, institutional policy in SWM in Malaysia is still fragmented and needs more transformation in the role of government in SWM. Thus, it seems that adaptation of EMT to SWM in Malaysia is more difficult to achieve and this may happen through a reconfiguration of institutional relationships or a general increase in policy capacity. In the absence of such processes, any policy changes are hypothesised to follow "incremental" patterns (Cashore and Howlett, 2007).

On the other hand, Malaysia is yet to graduate from the waste collection and disposal objective or stage. In other word, the *means* of achieving the 3Rs goal in Malaysia is constrained by at least four factors, namely:

- First, the 2007 law provides for the 'federalisation' of waste management, a trend comparable to water management, and increasingly forestry sectors, in Malaysia. This is an inimical force to the 'bottom-up' or devolution of authorities to the lowest possible level, which is important in the case of waste management. For instance, in the case of Extended Producer Responsibilities (EPR), only large cities with substantial operating budget are able to impost EPR from producers but the smaller ones will be less likely to do so.

- Second, 3R implementation in Malaysia will proceed through the process of solid-waste management services privatisation, which in the past has proven to cause more problems than engender solution (Sun & Tong 2002). The political economy of public finance and fiscal regime is complex and mirrors the various stakeholders and poltical interests present in contemporary

Malaysian society. The high and increasing costs of waste collection and disposal provided the ground for the privatisation of waste management in Malaysia. Therefore, the government opted for privatisation of the waste-collection function of the local authorities, driven by the fact that the dual operational and regulatory roles of local authorities did not seem to be in the best interests of high environmental standards. The objective of privatisation was to provide an integrated, efficient, and technologically-advanced waste management system. In addition, this was also expected to resolve the problems on waste management faced by the local authorities (lack of budget and expertise, illegal dumping, open burning, and lack of proper solid waste disposal sites). However, privatisation did not really solve the issues, but only transferred the problems from local authorities to the private companies. In particular, some concessionaires faced difficulties in generating income to cover expenditure.

- The third begs the question if it is socially desirable for the government and businesses to be the only actors in 3Rs implementation. Moreover, based on stipulations in the 2007 Act, the already small role of informal recycling in Malaysia will be more uncertain.

- Fourth, the awareness of public on 3Rs is also low, affecting the push for modern solid-waste management. Since the late 1980s, the Malaysian government had funded public information campaigns to establish awareness and to create environmental consciousness among the general public. In 1988, the Action Plan for a Beautiful and Clean (ABC) Malaysia was introduced. However, there were only minimal responses from the general public. A survey showed that 59% of respondents were moderately aware with some basic knowledge and were midly alert to solid-waste issues (Hassan et al 2000). This may come as a surprise to some because as much as 50% of the public complaints lodged to the government are on waste and cleanliness issues.

In contrast, Malaysia's policy style exhibits characteristics of a strong government policy. Thus, more research is needed to ascertain how this preference affects the calibration of 3Rs instruments, for instance in terms of recycling targets (Malaysia 22% by 2020). In theory, scaling for credible institutions (departments, legislation, etc) may be appropriate for a strong state only if enough funding and infrastructure are channeled to waste- management purposes, such as in the case of Japan. Be that as it may, the enactment of the 2007 Act came with a few positive signs for the future. With the establishment of the Department of Solid Waste Management, a regulatory body established on 30 August 2007, solid-waste management received an institutional boost. This agency is integrated in design compared to its predecessor with waste-management function, that is, the Division of Engineering and Environmental Health and Division of Project Implementation, Departmernt of Local Government. Efforts are currently underway at the Department to prepared detailed regulation to implement this Act.

More recently, in April 2009, the Ministry of Energy, Green technology and Water was established to handle green-technology development in Malaysia, whereby waste management is one of the thrust areas. However, the study suggests the need for more transformation in environmental governance in Malaysia. The government should encourage the private sector to invest in green technology to promote the usage of more environmentally-sound waste management towards facing the changes in the global climate. Additionally, reforms should be geared towards improving public accountability among local government officials adhering for responsive use of power and faithful execution of delegated functions. It could be said, however, that it is going to be more painful than institutional policy reforms, because it demands culture change- this change, requires behaviour modification to understand that the exercise of power, authority and responsibility is shared, and that public officials are accountable for their actions.

5.3.2 Privatisation of Solid Waste Management in Malaysia and Ecological Modernisation Theory

A Solid Waste Management programme in Malaysia has developed in phases and was quite primitive until the late 1970s. The local district health offices cleaned only the streets and hauled away household wastes to municipal disposal sites assigned as authorised dumping grounds. However, with the rapid increase in MSW generation, the collection frequency improved slightly to prevent detrimental health impacts to the community. At this phase, the waste-management system was still unsatisfactory. In order to increase efficiency further, the government delegated waste management to four (4) companies to privatise services based on geographical regions as follows:

1. Alam Flora Sdn Bhd (1997) which is responsible for the central and eastern regions; (the Federal Territory of Kuala Lumpur, Selangor, Pahang, Terengganu and Kelantan)
2. Northern Waste Industries Sdn Bhd which is responsible for the northern region (Perlis, Kedah, Penang and Perak)
3. Southern Waste Mangement Sdn Bhd which is responsible for the southern region (Negeri Sembilan, Melaka and Johor)
4. Eastern Waste Management Sdn Bhd which is responsible for East Malaysia (Sarawak, Sabah and the Federal Territory of Labuan)

The scope of privatisation with regard to SWM involves a number of activities: (a) collection; (b) transportation; (c) treatment; (d) transfer stations; (e) recycling; and (f) disposal. Those activities will eventually be extended to encompass drain- cleaning, grass-cutting and park maintenance, and road cleaning. (table 5.2).The above companies have been given a 20-year concession to manage solid waste. It is planned that the whole nation will come under the privatisation programme; as an interim

measure, the existing local authorities were to continue undertaking waste-management functions until such time that the private companies were ready to take over the responsibility. In fact, before the privatisation exercise, some local authorities had already been contracting the waste-collection services to a number of contractors.

By the end of Seventh Malaysia Plan 1995-2000 (Malaysia Plan), two of the four consortia involved started collection of solid waste in 26 of the 145 Local Authorities in Malaysia. Overall, 23 municipal disposal sites were upgraded to ensure proper disposal. The Government also conducted awareness campaigns to encourage the reduction, re-use and recovery of waste material. To ensure optimum efficiency in the waste-collection system, the concessionaires reorganised and optimised their collection routes, resulting in an increase in the number of collections per trip. In terms of improving the storage system, the concessionaires also introduced and provided standardised waste bins with wheels for certain areas. To further improve service level to the public, the concessionaires also purchased additional equipment and vehicles as well as invested in improvement works to the existing landfills.

The Government announced in 2002 that the waste-collection services only would be subject to federalisation and privatisation; while the treatment and disposal of waste will remain under the control of Government at Federal Level. Also, cleansing will be excluded from the Concession Agreement, although this does not preclude Local Authorities from entering into contractual agreements with the Concessionaires for the provision of cleansing services.

In essence, the privatisation exercise is aimed at reorganising the existing SWM system used by most local authorities into a system that is prepared to undertake disposal of wastes from expanding urban localities, incorporating recycling and safe environmental management measures. In conjunction with that goal, laws and regulations will be streamlined at the Federal, State and Local Government levels to

ensure proper disposal, including mandatory separation of recyclable waste by households. Efforts in SWM will be given high priority, considering the adverse effect of environmental degradation from waste that is left unattended, especially in the cities. Taking into account the related problems such as finance, lack of expertise and the myriad functions that need to be carried out by the local authorities, the government felt that the job of managing solid waste would be best handled by the private sector.

Privatisation process is considering one of the main elements in EM T. However, the study found that privatisation of SWM in Malaysia is not successful implemented by the government. Currently, the privatisation of the SWM system in Malaysia has not reached full privatisation. (Zaini, 2011 p,37). The system is still in an interim period, and is not running as expected due to some problems arising from the lack of funds, the length of the interim period, and unavailability of financial resources.Problems faced by consortia have led to the inefficient operation of the waste-management system. These problems affect future planning for SWM in Malaysia, and frustrate the implementation privatisation. The Principles of governance and the voluntary agreements with the private sector have not yet delivered in SWM in Malaysia. There is also lack of monitoring and strong instrument of regulation in implementation of privatisation of solid waste in Malaysia. Therefore, it seems that the privatisation in solid waste in Malaysia is not really successfully implemented and the government has a crucial role to tackle the problem to achieve sustainability of SWM. All these reasons suggest that it will be more difficult for Malaysia to undertake the principles of EMT.

A transformation in the role of the state is one of the core elements addressed in EMT. Dryzek (1997) argues that EM implies a partnership in which governments, businesses, moderate environmentalists, and scientists cooperate in the restructuring of the capitalist political economy along more environmentally-defensible lines. Transformations in the role of state and market can also be in the form of higher

level of participation of the private and public actors in policy formulation, decision-making and implementation. The involvement of representatives from relevant government agencies and the industry in the development of environmental policies signifies the increasing opportunities and importance of the involvement of the private sectors in the traditional administrative, regulatory, managerial, corporate and mediating functions of the state (Mol and Sonnenfeld 2000). This carries the implication that industry does not merely attempt to influence government policy but is a part of the decision-making and implementation process. In the case of Malaysia, the study found that limited community engagement was a key barrier to the uptake of new technology. The civil society also seems not active in ways that generates pressure groups and movements to engage with both business and the state. The role of government and state are important to integrate and cooperate with all stakeholders to reform the national policy of SWM more effectively to achieve sustainability of SWM in Malaysia. Thus, different types of governance are needed: more open, flexible, and oriented towards learning and experimenting. The local authorities must implement and introduce mandatory specific guidelines or regulalations for every private contractor registered with the municipalities. Using the integrated and centralised management, it is easy and systematic for local authorities to implement monitoring and make the effort to develop a database. Thus, the study suggests that the privatisation of SWM in Malaysia should be given more emphasis by the government in order to deliver sustainability of SWM through EM perspectives.

Table 5.2: *Initial Planned Terms and Conditions for the National Privatisation of Solid Waste in Malaysia*

Parameters	Terms and Conditions
Period	Exclusive for 20 years
Coverage	The Concessionaire will take over the SWM services of all Local Authorities in its region
Scope of service	Storage, collection, transportation, intermediate treatment, and disposal of wastes of all Local Government areas, which consists of: • Domestic waste • Commercial waste • Institutional waste • Garden waste and grass-cutting waste • Construction waste; • Industrial waste which can be accepted at municipal landfills.
Asset	Takeover of movable assets, such as vehicles and equipment for SWM owned by the Local Authorities.
Landfill	• Take over management and operation of designated landfill sites that would be used for an interim period • Manage all gazetted landfill sites in an environmentally-friendly manner; and • Plan, design, construct and commission new sanitary landfills, as well as operate and maintain new waste-treatment plants and sanitary landfills sites in accordance with best available engineering and sanitary standards.
Employees	Transfer of Local Authorities employees involved in the service to the Concessionaires
Payment for the service	Concessionaire to collect directly from consumers

Adjusted from: Ninth Malaysia Plan 2005-2010.

5.4 Adaptation of Ecological Modernisation theory to Solid Waste Management in Malaysia

The integration of environmental policy goals into all policy areas of government is considered as central to a programme of EM (Mol & Spaargaren, 2000; Howes, 2005). SD also requires radical changes in functional systems and changes not only in government policy but also in current systems of governance. However, there is lack of coherence and integration of policy in different levels of governance in SWM in Malaysia. The existing policy frameworks with fragmented policy areas in Malaysia are also not suited for dealing with social complexity and desired long-term change. Recent policies in Malaysia have adopted an incremental rather than radical response to reducing waste and improving overall Malaysia response to sustainable SWM. There is also a clash between the very capitalist system of production and consumption which drives the national economy and the efficiency of the operation of the SWM system. In order to integrate policy, the role of the government has to be seen as more flexible, decentralised and a consensual style of national governance with less top-down hierarchic command, and control regulation emergance. The government also should encourage more participation from the private sector and NGOs in SWM in Malaysia. However, the study found that there is little evidence of a substantial restructuring of government institutions, no apparent increase in flexibility, only limited public input, and no decentralisation to empower local communities.

Transforming the role of social movements is the theme of institutional dimension of EM that relates to the political and institutional changes. The idea is to empower non-government organisations so that they are able to provide an effective early warning system for emerging problems and feed innovative ideas into the decision-

making process (Hajer, 1995; Mol, 2000; Mol & Sonnenfeld 2000; Fisher & Freudenberg 2001). The goal is to generate an effective social and environmental feedback mechanism for policy makers. However, transforming the role of social movements in Malaysia will be difficult. Malaysian political culture is far less corporatist. For example, participation from private sectors, community groups, civil society and stakeholders in SWM and policy seems to not be successfully achieved in Malaysia (Danish, 2005).

There is little evidence of involvement of non-state organisations and private sector in SWM in Malaysia. If EM were to become the prevailing framework for analysing sustainability of solid waste in Malaysia, governments would be inclined to support community empowerment as a way to harness its problem-solving potential. Business resistance to such a change might be tempered by the idea that bringing these groups into the process might actually reduce resistance to future projects (Dryzek, et. al. 2003). It would also allow for constructive partnerships between government, business and community groups to be formed that could actually facilitate policy implementation and industrial development. Environmental movements and NGOs, to be effective, need to transform not only government policies, but also the environmental 'common sense' or field of discourse of a society. Transforming common sense requires, in essence, powerful cultural change, sometimes affecting deep values. That is a form of cultural politics- the clash between coalitions supporting different values and visions about issues such as the environment. Through the emergence of new ideas and dialogues, often carried by social movements and NGOs, a transformation occurs. As movements turn into NGOs, and conflicts turn into negotiations, tensions go down and inter-coalition learning can occur. In this way, society can learn new collective goals through less conflictual means.

From political strategies perspectives and in order to make radical shift towards a stronger form of EM, Malaysia will most probably need to make fundamental

changes to the current approach. Thus, the role of government needs to shift to be open and more flexible when dealing with SWM. It is also important to make sure that waste is optimally managed, so that the costs to society of dealing with waste, including the environmental costs, are minimised. There may be market failures and other barriers that prevent this ideal situation from occurring**.**

There are many factors to take into account when considering the environmental impacts of waste. There is a case for government intervention where the market alone does not produce the optimal situation. The landfill tax is the most obvious example of an instrument which tackles externalities, through reflecting the environmental damage from landfilling, although there are also other interventions operating across the waste hierarchy. Interventing with the right instrument for the particular situation is necessary to deliver the desired outcomes in a cost-effective manner. The potential for greater use of environmental taxes to deliver better environmental and economic outcomes is recognised in the government's commitment taxes to increase the proportion of revenues accounted for by environmental of taxes. Thus, the study would suggests that the Malaysian government should introduce market-based instruments such as taxes and trading systems for better SWM policy in Malaysia.

Market-based instruments such as taxes and trading systems are an efficient and cost-effective way of pricing in the value of environmental resources. By giving certainty over the price of these resources, they create new opportunities for businesses in markets for environmental goods and services. However, an environmental tax will not be the most appropriate policy instrument in every circumstance. For example, when the environmental risks are large, such as with hazardous wastes or when the problem is fairly specific to a sector or waste stream, direct regulation could be more effective. When appropriate, consideration will be given to taxes in waste policy that can support the implementation of the waste hierarchy reflecting the environmental benefits of shifting waste up the hierarchy. Such instruments will be developed in the context of wider government levers, such as voluntary agreements and regulations,

ensuring that the approach is simple, efficient and cost-effective while supporting growth and maintaining a sound fiscal position.

Ecological Modernisation advocates technological innovation that decouples economic growth and industrial development from environmental damage to a cleaner industrial revolution. The theory aims to encourage industry to research, develop and deploy more eco-efficient technology. This new technology should reduce raw material and energy use, cut emissions, eliminate the use of hazardous material, wean production off the depletion of non- renewable resources, sustainability of harvest-renewable resources, conserve biodiversity, and protect essential environmental materials, energy use and waste disposal. (Mol 2000; Berger, et al. 2001; Fisher & Freudenberg, 2001; Welford and Hills 2004; Cohen, 2006). Thus, MFA may be a tool for more effective understanding of resource use and efficiencies but also for driving political and social transformation. On the other hand, part of technological transformation, the government should explore the potential of new technologies to achieve eco-efficiency of SWM. In so far as technical innovation is concerned, clearly Malaysia has less capacity in terms of research, development and deployment, something that could affect its ability to ecologically modernise. The study suggests that the Malaysian government should encourage private companies and international investors to invest for new technology. There are many opportunities for 'win-win' scenarios where firms invest in energy- efficient technology that also reduces their operating costs. (Hargroves & Smith 2005; Mc Neil, 2009). EM therefore has a potential to reconstruct the technology barriers as opportunities and gives policy- makers some guidance as to what should be targeted. It might also win business over by identifying new opportunities for profit-making. Thus, in order to achieve the policy target for SWM in Malaysia, the government should generate more technology innovation and encourage more private sectors and businesses to invest in new technology towards efficiency of SWM in Malaysia.

5.5 Conclusion

Ecological Modernisation is theory of environmental sociology, which provides a sociological interpretation of environmental reforms. The theory suggests that the need of a national policy of SWM and an effective system for sustainability of SWM. However, the national system of SWM in Malaysia seems to be not working effectively to deliver sustainability due to lack of responsiveness of governmental officials, policy and institutional gaps, privatisation process failures and managerial aspect problems. The study argues that EMT provides a new framework for understanding and analysing sustainability of SWM in Malaysia.

The EMT has identified good options for strategies to overcome the deficiencies of the traditional bureaucratic state in environmental policy-making. Thus, a transformation in the role of the state is one of the core elements addressed in EMT that could be adopted for sustainability of SWM in Malaysia. The study pointed out the need for more transformation in environmental governance, particularly in SWM. The study suggests the government needs to become more open, flexible and have a less top-down approach to deal with the social complexity and policy in SWM in Malaysia. At the macro level, the state needs to initiate policy reforms to affect the full devolution of environment and SWM functions, enabling Local Government to legally allocate funds and provide technically- qualified personnel. EM also implies a partnership in which governments, business, moderate environments, and scientists cooperate in the restructuring of the capitalist political economy along more environmentally-defensible lines. However, the evidence show that the Malaysian political culture is far less corporatist and involvement from non-organisation state is also not active in SWM. Thus, the role of the government in Malaysia is to integrate and cooperate with all stakeholders to achieve a sustainable policy of SWM.

EM can be used to generate an integrated approach to environmental issues and has the advantage of supporting programmes that engage with the existing institutions of

power. It was, however, developed within a continental European context which has some differences to the Malaysian situation. In this country, less is invested in technology research, there is less corporatist approach to politics and environment groups have had fewer opportunities to participate in the national policy- making process. Adapting EM to the Malaysian situation, either as an analytical tool or as a programme for action will therefore require some care. However, the institutional dimension of EM is useful as a framework for thinking about the solid-waste problem in Malaysia in order to analyse sustainability of SWM.

The next chapter provides the empirical chapter of Material Flow Analysis (MFA) as a mesurement tool to provide useful information for formulating policy and as a platform for analysing sustainability of SWM using EM perspectives.

Chapter 6

Material Flow Analysis of Solid Waste Management in Malaysia and Ecological Modernization perspective

6.1 Introduction

Solid waste is a growing problem in all countries, and a major problem in many cities of the developing countries. SWM is also a major challenge for Malaysia to address in the light of Vision 2020 which lays out the direction for Malaysia to become a fully developed nation by 2020 (MHLG, 2007). Together with increasing industrialisation and modernisation, the types of solid wastes produced are becoming more complex and the sources are becoming increasingly more diverse (M.N.Hassan et al. 2000). MFA is a useful tool for systematically capturing the flow of wastes, as well as the problems associated with these flows. EMT focusses on the ways in which material flow management can and should be organised in modern society in a more appropriate way to deliver sustainability development. Environmental reform can even result in an absolute decline in the use of natural resource and discharge of emissions and waste, regardless of economic growth in financial or material flows. Thus, MFA is a measurement tool and policy relationships are conditioned by the transformation of EM by the state. This is conceptually possible but very difficult in terms of SWM and the circumstances in Malaysia context. This empirical chapter discusses the role of MFA and relation between the concept of EMT and MFA with specific focus on institutional analysis. This chapter addresses the third research question RQ3: To what extent is there a need for a MFA understanding to inform policy makers and make management decisions?

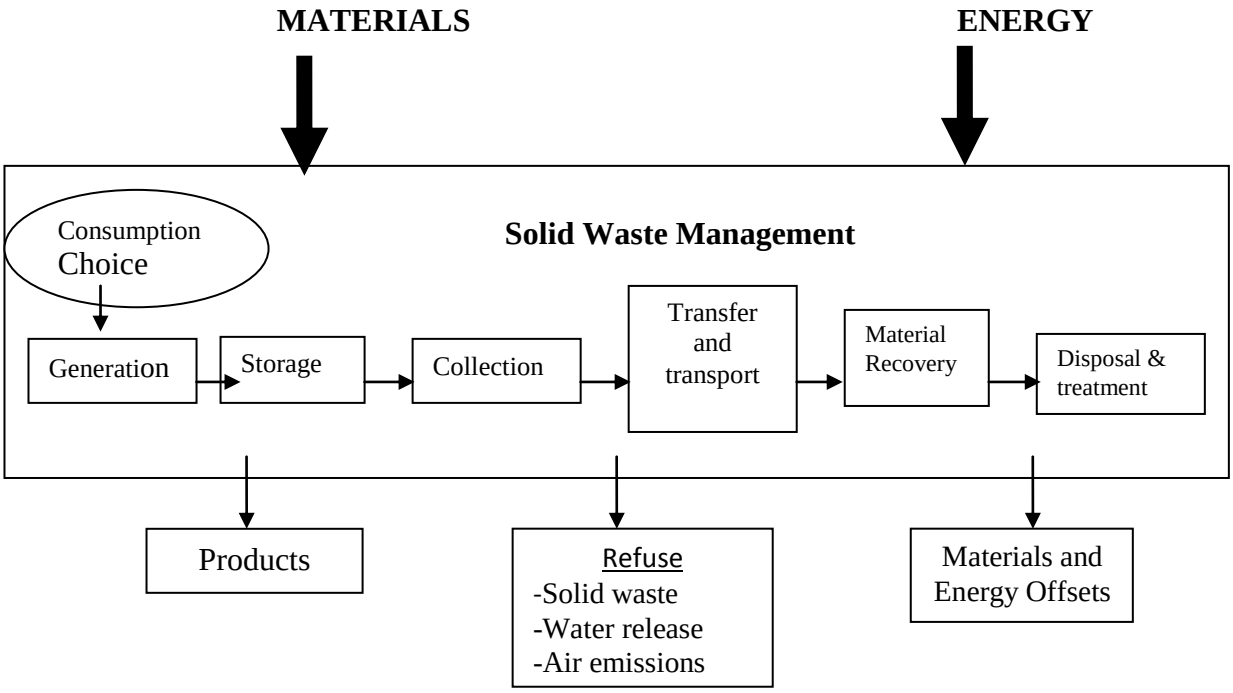
6.2 Framework of Material Flow Analysis for Solid Waste Management

Material Flow Analysis is a systematic tool which comprehensively describes the material inputs to a system of concern, the material outputs from that system, and the material throughputs throughout the system. Both the terms material flow accounting and MFA are abbreviated to MFA. "Accounting" is mainly used in the context of environmental-economic integration, whereas "Analysis" is a more general term. However, they are often used interchangeably. For industrialised systems, typical inputs are raw materials and energy resources, and typical outputs are products and by products, including undesirable ones such as wastes and pollutants. Thus, from the viewpoints of municipal SWM, the term "material" used here refers to any materials that are moving around in the system. A material is a solid, liquid or gaseous entity with certain physical characteristics, such as weight and volume, while a substance is a chemical compound, built up from at least two atoms of the same or different type. (Moriguchi, 1999). This section examines the potential of MFA framework for policy makers to provide information regarding SWM and linking with the theory of EM

Based on the basic concept of MFA, the framework of MFA for SWM has been developed for analysing sustainability of SWM in Malaysia. MFA framework measures the waste flows system and processes, for example waste generation, temporary storage, transportations, and treatment and disposal systems analysed. Therefore, using MFA approach as a framework, the existing SWM system can be evaluated and analyzes sustainability of SWM system. The MFA approach also analyses the actors and institutions involved in SWM in Malaysia in order to achieve

a sustainability policy of SWM. An indication of how and where MFA influences municipal SWM is shown in the simplified diagram presented in Figure 6.1

Figure 6.1: Material Flow Analysis framework of Solid Waste Management in Malaysia



Source: Adjusted from Weitz et al., 1999

Solid waste flow starts with the consumption choice of the consumer that will influence the generation of solid waste from residential, commercial, institutional and other areas within the municipalities. The next stage in MFA is waste collection. The local authority or municipal council will collect the waste that is generated from different resources. The waste is then transported for separation and recycling, treatment or disposal. These activities consume materials and energy and result in environmental releases. Any materials or energy that is recovered may create offsets of virgin materials in the manufacturing and energy sectors.

MFA are analysed in units of human activities, such as, a household for waste generation rate, a collection rate by municipality, waste recycling rate, waste composting, waste treatment and a landfilling cost from an economic perspective. In other words, MFA is a tool to understand the material development and link with the economic growth. MFA also provides comprehensive data of material flows that could help to understand the interlingkages between "discourse and development".

The main question to answer is whether and how the application of a system for MFA could be helpful for policy making in Malaysia for analysing sustainability of SWM and connection with EMT. In common with several other tools or techniques for environmental assessment, MFA has been promoted as the most invaluable approach that will improve environmental policy making and management. MFA study for solid wastes provides policy makers with lots of information, especially if the wastes are linked to human activities. A central element in EM is the attempt to make ecology measurable in order to integrate it into programmes, policy and institutions (Mol & Spaargaren, 2001). MFA can be used to measure the environmental action and to map, compare and set the national policy target. According to Mol (1995), the measurement of material and energy flows between industries and ecosystems informs how production processes are to be changed to increase recycling and reduce throughput in the ' ecologisation of the economy'. Through the 'economisation of the ecology' society's views regarding the environment and nature are moulded to accommodate to economic institutions so economic actors can systematically take ecological criteria into account. Thus a MFA can be used as a platform for analysing the sustainability of SWM in Malaysia using institutional dimension of EMT

The practical applications of MFA provide a great deal of quantitative information on the regional metabolism, as an important aspect of the environmental situation in a certain region. It is important for comparison of different activities regarding their

environmental pressure, and for comparison of anthropogenic materials flows. However, the most interesting aspect of the MFA approach is the qualitative information provided from practical applications. An example of qualitative is the clarification of links between activities in a region, and inflows and outflows of materials (with goods, products, wastes and emissions) within the state. Of course, this qualitative information is obtained from interpretation of quantitative information or data, but only to some extent. Some qualitative information provided from the MFA study emered gradually as the study proceeded through its different stages, especially the systems definition and inventory stages. This information is useful for stakeholders that are involved in the SWM system such as local government, private sectors, NGOs, businesses, and public. Thus, MFA could inform the main actors that involved in SWM.

EM concept suggests that it is possible to link between economic growth and MFA. This linking will help the environment and increase industry profits for example through energy efficiency, improved technology and closed- loop production. The idea of an industrial transformation is fundamental to the theory of EM. As Joseph Huber (2000) described “major of basic technology innovations, not just incremental efficiency- increasing change and minor modifications of existing production chains”. Huber’s belief in industrial transformation is exemplified in the quote, “… the dirty and ugly industrial caterpillar will transform into an ecological butterfly”(Huber 1985 quoted in Mol and Spaargaren 1992)

MFA could provide a foundation for making and evaluating environmental policy decisions at both strategic and operational levels. MFA data offer government leaders a sound basis for setting strategic targets and tracking the effectiveness of environmental policies. The data can also help policy-makers understand and deal with the origins of specific environmental problems. In the case of SWM, MFA allows municipal decision makers a view from a new angle on their waste management system. The thorough development and discussion of a baseline scenario facilitates further discussion on how to change or improve an existing SWM

system. MFA can measure the success of a strategic of dematerialisation. It provides the necessary information to monitor development by means of an indicator. On the other hand, the results of MFA could influence the discourse or the development. MFA also provide a basis for choosing cost-effective environmental solutions. Understanding the flow of materials can help policymakers address the shift in pollution sources from one part of the environment to another, for example from cadmium emissions at mines and smelters to growing stocks of cadmium batteries in solid waste landfills across the country. Through EM perspective, the role of government should support and fund energy efficiency awareness campaigns specifically directed towards industry, and the general population.

MFA can improve communication among policymakers and provide detailed information for public use. MFAs offer a common source of data that technical experts, government manager and public can use to set targets and track the effectiveness of environmental policies. MFA also can facilitate more informed policy debate on issues such as choosing sites for new facilities and can support more effective changes in how society uses its materials. The possibility to link solid waste and resulting environmental pressures to their direct and indirect underlying causes in society is another benefit of MFAs, in comparison to traditional inventories.

In industrialized countries, MFA proved to be a suitable approach for the early recognition of environmental problems and development of management (Baccini and Bruner, 1991; Baccini and Bader, 1996). Examples of the application of the method are resource management planning at city and regional level, waste management planning, the development of environmental management systems in enterprises, the derivation of indicators as a basis for monitoring SD used by official statistics in several EU member states (e.g. nationwide material throughput per GDP).

MFA has already been applied in urban areas of developing countries in the field of environmental sanitation (Binder, 1996; Belevi, 2002; Montangero et al; 2004; Huang et al., 2006). However, data uncertainty has been identified as one barrier to a broader use of the method, particularly as a tool for policy decision (Danius, 2002). This issue is even more important in the context of developing countries where the data availability and reliability is low and means for data collection are limited. Data from developed countries are more accessible due to their well-established policies and proper waste management systems that make continuous improvement feasible.

Several empirical MFA studies on regional or local levels have been carried out in the past. However, compared to the large number of MFA studies on the national level, published studies on the regional or local level are still very limited and a standardized method such as presented by EUROSTAT (2001) for the national level does not exist yet.

In contrast, weak enforcement, lack of technology, and ineffective policy implementation make the management of waste in developing countries inefficient with a very low possibility of improvement. Malaysia also faces a similar problem; lack of institutional arrangements, policy failure, financial support, technologies and insufficient data of solid waste to cope with the ever-increasing rate of waste generation. In order to adopt the MFA approach, basic data on the quality and quantity of the waste that is generated in Malaysia are essential. There have been many publications on the characteristics of the waste that is generated in Malaysia but they are not comprehensive enough to identify who is generating, what, how much and how frequently. This is essential for the design of any facility, as it will give an insight into the waste quality and quantity not only for now but also for the future and its effects on the treatment technology adopted for sustainability SWM.

6.3 Material Flow Analysis Model for Solid Waste Management in Malaysia

The result of MFA can illuminate the amounts of materials involved and the amounts of material waste, but due to a lack of comprehensive data provided by state agencies in Malaysia it is not able to visualise the information of material input and output in the system. Only the amount of waste flow analysis including waste generation, waste recycling, and waste disposal can be illuminated in this study. Based on the statistical data of SWM from the Ministry of Housing and Local Government (MHLG) the MFA model for solid waste has been developed in order to analyse sustainability of SWM in Malaysia and link with the EMT. Figure 6.2 shows the MFA of SWM in Malaysia. The MFA results show that solid waste material is generated from a variety of materials including food material, plastic material, paper material, glass material and other sources of material. The analysis it was found that food material generated the highest percentage of solid waste 7461t/day (almost 60% of the waste.) MFA results also show that total import of solid waste in Malaysia is 305 395 t/y and only 2361t/y total amount of export waste from Malaysia to other countries. Based on the MFA results it is estimated that 70% of the waste is being collected while 30% of solid waste is disposed of by other methods, including illegal means. The analysis of MFA the results shows that SWM in Malaysia is not managed properly and needs a comprehensive policy to achieve sustainability of SWM. Several studies show MFA is increasingly used for modelling material flows on a regional or even global level (Hendriks, 2000). Waste management is a very important application for MFA. Applications in developing countries are described in Binder et al. (2001) and Streicher-Porte (2005).

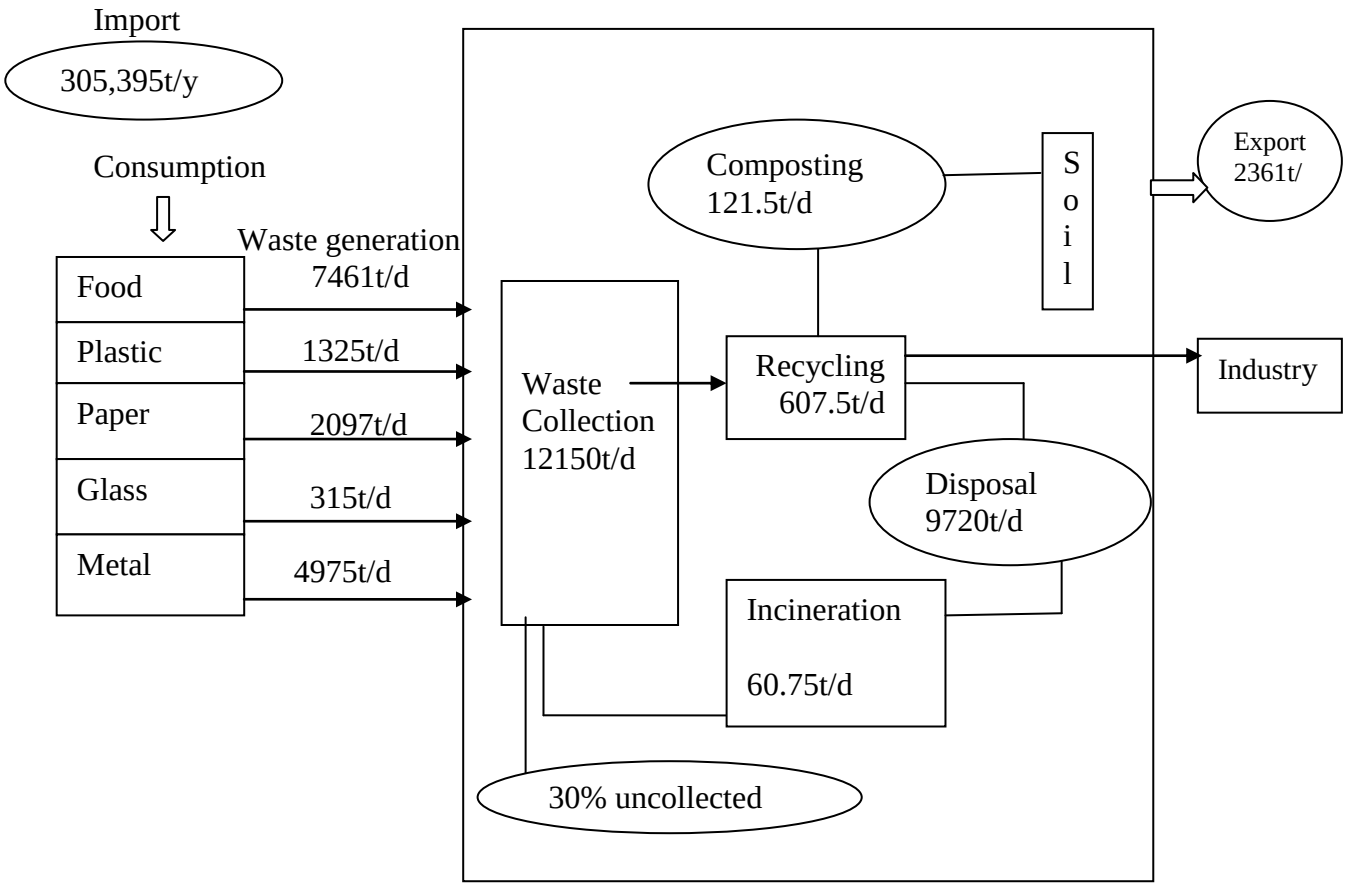


Figure 6.2 Material Flow Analysis for the current Solid Waste Management situation in Malaysia
Source: Adjusted from MHLG 2003

6.3.1 Material Flows analysis for Solid Waste Generations in Malaysia

Solid waste generation is an inevitable consequence of production and consumption activities in any economy. Generally, it is positively related to the level of income and urbanization, with higher income and more urbanized economies generating higher levels of solid waste per capita (World Bank 2000). For example in Asia, mostly high income countries such as Korea, Hong Kong, Singapore, and Japan tend to generate more waste compared to lower and middle income countries. In most developed countries for which data are available (such as European countries),

increased affluence, associated with economic growth and changes in consumption patterns, and tends to generate higher rates of waste per capita. In Malaysia, due to economic growth and lifestyle change, society tends to generate more waste. However, the amount of municipal waste also depends on national waste management practices .Only a few countries have succeeded in reducing the quantity of solid waste to be disposed of. (Kit Strange 2007). By 2020, the OECD estimates Europe generating 45% more waste than in 1995. In Germany and the Netherlands, municipal waste generation fell during the 1990s. The EU plans a significant cut in waste generation, through waste prevention, better use of resources, and a shift to more sustainable consumption patterns. The EU approach is based on three principles: waste prevention, recycling and reuse and improving final disposal and monitoring (OECD 2002). In Malaysia, the promotion of waste minimisation and recycling is at the heart of government policy and it is from an economic perspective relient on producer and consumer goodwill. However, current trends indicate little change in either producer or consumer attitudes from the perspectives of reducing emissions and waste in Malaysia. SWM is still considered a major environmental problem in Malaysia due to policy failure and institutional deficiency to manage sustainability of SWM .

One of the most important requirements for applied MFA method is to have reliable and inaccurate data on SWM. However, in Malaysia there is presently no periodical and systematic analysis and documentation of waste generation rate, which has resulted in accurate and outdated databases of SWM. Accurate estimation of comprehensive waste data at local levels is also essential to the design of new waste management plans such as resource recovery systems and waste minimization programmes, estimation of the life of landfills and evaluation of environmental impacts caused by certain types of wastes managements technologies or options (Nassir, et al (2000). Up until the present, periodical information about solid waste was not carried out satisfactorily. Even if it is available, the data is scattered and inconsistent, and the method for data collection has not been properly defined and thus is subject to a lot of variations and uncertainties.

Data gathered and reported by the private companies are different from those collected by local authorities and this could also be different to those reported by researchers. However, there have been some data collection and compilation efforts by the Ministry of Housing and Local Government (MHLG). The first nationwide compilation of waste generation and composition was carried out in May 1987 and published in 1988 (MHLG 1988) .Based on the report by MHLG 2003, the total amount of solid waste generated in Malaysia is shown in Table 6.1. With a population of 25 million, the per capita solid waste generation per day comes to 0.72 kg/day and it is close to the average generation in developing countries. The study shows that there is a lack of comprehensive data provided by the government in Malaysia. The study argues that comprehensive data of SWM is crucial in order to develop a national policy and effective management system of SWM in Malaysia.

Table 6.1 Solid Waste Generation in Malaysia, 2003

State	Kg/capita/day
Perlis	0.50
Kedah	1.08
Pulau Pinang	0.96
Perak	0.80
Selangor	1.26
Kuala Lumpur	1.57
Kelantan	0.50
Terengganu	0.86
Pahang	0.92
Negeri Sembilan	1.20
Melaka	1.20
Johor	1.35

Source: Ministry of Housing and Local Government 2003

It is reasonable to assume that the waste generation rate will differ from one state to another, depending on the types of activities that dominate the respective region. For example Kuala Lumpur as a capital city produces more waste than small cities such as Kelantan, Perlis and Terengganu. In addition, the waste generation rate will differ between rural and urban areas within a state. For example, highly urbanized areas such as Kuala Lumpur, Pulau Pinang and Johor Baharu would produce a greater amount of waste and therefore their generation rates could reach the upper limit of 1.5 kg to 1.6 kg/capita/day.

The overall rate generation of solid waste for Peninsular Malaysia is estimated to increase from the current 0.90 kg/per capita/day to 1.15 kg/capita/day. This represents a 27% increase over an 18 year period. In urban areas, the rate is expected to increase from 1.02 kg/capita/day to 1.22 kg/capita/day while for rural areas it is expected to increase from 0.40kg/capita/day to 0.48kg/capita/day. Waste generated for rural areas is currently estimated at 2,500 tonnes/day and is expected to rise to 3,300 tonnes/day by 2020, and for urban areas is currently estimated at 41,500 tonnes/day, anticipated to rise to 28,200 tonnes/day by 2020. Based on population growth projections for the period 2002-2020, waste generation is estimated to increase by an average of 3.50% per annum. Therefore, it is estimated that by 2020, 31,500 tonnes of solid waste will be generated by the population daily (MHLG, 2007). Malaysia expects to increase its waste generation every year leading to an unsustainable waste management and needing more attention from the government to tackle the problems related to waste generation to achieve sustainability of SWM.

The EM suggests the need of a national policy system of SWM to deliver sustainability policy of SWM in Malaysia. However, the study found that the national policy system of SWM in Malaysia is not working effectively to achieve sustainability policy due of institutions and policy gaps, lack of financial support and managerial aspects. Thus the transformation of institutional arrangements and the role of government are needed to deliver sustainability of SWM in Malaysia.

The results of MFA provide comprehensive data regarding solid waste flows in economic systems. This could be useful for policy makers to formulate sustainability policy and address the institutional dimension of EM theory. The study argues that the need for more transformation of institutional arrangements and the role of government in SWM to make fundamental changes to the current approach. In particular, it will need to make the integrated policy approach of Solid Waste policy in Malaysia. The government also needs to work with private sector, NGOs, informal sector, solid waste planners to help them integrate into SWM modernisation process in Malaysia. Partnership, cooperation and the building of social capital between stakeholders, such as corporations and governments, are crucial to the EM platform (Dryzek, 1997; Lulofs, 2003)

6.3.2 Material Flow Analysis of Waste Composition

Results of Material Flow Analysis also can be used to determine waste composition in the system using direct analysis of the waste generation (P.H Brunner 2001). The waste flow analysis results (figure 6.2) shows organic waste forms the biggest component in waste composition in Malaysia, with paper and plastic (including rubber) at second and third positions respectively. Others categories of solid waste are metals, fabrics and constructions waste (debris) (table 6.2). The composition of solid waste in Malaysia is similar to that of most developing countries where organic matter (biodegradable waste) is the main component of SWM: the proportion, ranging between 43% and 70%, is higher than that of most European countries at(20%-30%) (E. Damanhuri et al 2009).

Implementing environmental policy and management of solid waste also depends on its composition (e.g waste recyclable vs non- recyclable waste) (UNDP, 2008). For example, in many developing countries, food waste that is generated from households, in particular has a high water content, and casual disposal of sand and other building materials results in very dense waste which is much more difficult to

handle (figure 6.3). Containers, vehicles and systems that operate well with low-density wastes in Industrialised countries may not be suitable or reliable in countries where wastes usually are heavier. Therefore the results from MFA give information regarding waste composition and characteristics of solid waste that could be used for policy makers to design and setup the suitable facilities for SWM system.

Differences in waste composition, climate, culture and socio-economic conditions require that innovations and solutions in waste management be tailor-made for each country especially when the differences between developed countries and developing countries are wide ranging. One main difference is that waste composition between countries where generally waste composition in developing countries is higher in organic material and moisture content as compared with developed countries. Most of the developing countries have high percentage (50-80%) of organic matter in their waste stream with high moisture content making them unsuitable for incineration (AIT, 2004). On the other hand, developed countries usually have higher percentages of recyclable items such as paper and plastic due to increased affluence as compared to developing countries. International trends reflect that incineration and recycling are particularly popular in densely populated countries such as Japan and the Netherlands. However, differences in waste composition and socio-economic conditions may not render them as the optimal solutions for SWM in Malaysia.

Table 6.2 : General Composition of Waste in Malaysia

Materials	% by weight
Organic	47.0
Paper	15.0
Plastics	14.0
Wood, garden waste	4.0
Metal	4.0
Glass	3.0
Textiles	3.0
Other	10.0

Source: National Waste Recycling Program, Ministry of Housing and Local Government 2004

There are, however, variations in the composition of waste among the different areas. A detailed study in 2000 in Kuala Lumpur showed that there were differences in the percentages of different types of waste according to building use and the socioeconomic background of the residents. Table 6.3 describes the waste composition based on economic status, commerce, and offices.

Table 6.3: Waste composition of selected Areas (dry basis, % by weight)

Materials	**High income**	**Medium Income**	**Low income**	**Commerce**	**Office**
Organic (food)	51.3	45.7	50.4	60.0	36.6
Paper	9.0	7.1	10.3	8.3	8.9
Plastic	16.9	24.4	24.3	17.5	30.7
Textile	2.5	2.1	2.3	0.8	1.0
Wood	0.7	0.7	0.8	4.3	0.3
Yard waste	6.8	3.8	1.0	0.1	6.7
Glass	3.3	3.3	4.4	3.2	2.8
Metal	6.3	6.6	4.1	4.3	12.1
Others	3.2	6.3	4.7	1.5	0.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Bulk density	273.1	310.7	278.8	371.1	277.1
Moisture	52.9	62.7	52.6	66.2	50.9

Source: Mohd. Nasir Hassan et al. “SWM- What’s the Malaysian Position?” in Urban Sustainability in the Context of Global Change, edited by R, B. Singh. Plymouth: Science Publications, 2004.

There is also a difference in waste composition between the bigger cities and the smaller towns. In Kuala Lumpur, the largest city in the country, organic waste accounted for about 48.4% while in Muar, an average- size municipality of about 0.5 million people, it was 63.7%. In terms of paper, Kuala Lumpur, the centre of commerce and business, had higher percentage than that of Muar. Table 6.4 below describes the waste composition in Kuala Lumpur and Muar. The study argues that any waste management plan must be related to a specific waste composition; thus it is important to provide information of solid waste composition for a sustainability policy of SWM.

Table 6.4: Waste Composition for selected Municipal Councils (% of weight)

Materials	Kuala Lumpur	Muar
Organic waste	48.4	63.7
Paper	30.0	11.7
Plastic/rubber	9.8	7.0
Metal	4.6	6.4
Others	7.2	11.2
Total	100	100

Source; MHLG (2003)

Many cities in United States, have already taken steps to reduce their waste output by actively adopting policies to minimize their ecological footprints. During the last few decades, many have developed recycling programs to reduce the amount of trash heading into landfills. More recent efforts involve reducing urban demands for natural resources. Some cities are requiring buildings to include more efficient water and electrical fixtures and appliances. Others are changing their government-owned fleets to more fuel- efficient vehicles or those that run onalternatives fuels. Urban solid waste compositing is an alternative to the disposal of significant components of the waste stream in sanitary landfills that has attracted interest among a growing number of communities in the United States and Europe.

Solid waste disposal has become a serious issue for country and governments throught the nation. As available landfill space decreases and the cost of siting and building new landfills increases, local authorities are struggling to develop alternative means of meeting the waste disposal challenge. Composting has emerged

as a potentially viable means by which local governments can reduce the volume of waste entering landfills by diverting the organic fractious. Currently, Malaysia is facing urban solid waste management issues as landfills are rapidly filling up, increasing amount of waste are generated, shortage of disposal land, resulting of serious environmental and human health impacts. These circumstances happened due to the growing amount and the variety types of waste generated in relation with the rapid population and industrial growth, and also due to the rising in the standard of living of the people. Therefore, composting is considering being one of the methods of SWM in Malaysia, mainly due to the high percentage of organic material in the waste composition. However, there is only a small scale composting plan in Malaysia and a bigger scale is not that popular in the whole region (M.Nasir, 2002), as shown by the MFA results where less than 2 % of the solid waste in Malaysia is used for composting.

The main reason why centralised composting plants are not functioning effectively includes high operating and maintenance costs, incomplete separation, and lack of effective marketing. The use of compost instead of chemical fertilizer is a good example in composting. The composition of solid waste in Malaysia (see table 6.3) reveals a high potential for making compost from organic matter after sorting and appropriate biological treatment. With composting, it seems feasible to reduce the amount of solid waste in Malaysia and generate economic benefits for national government. The significant volume reductions associated with composting and the possible uses of compost make SWM composting attractive as a potential means of diverting waste from landfills. On the other hand, SWM composting requires considerable presorting of the incoming, waste and creening of the finished product to remove uncomfortable materials such as glass, metal and plastic activities that tend to be relatively costly. The study found that, there is no clear evidence that actors are involved in composting plans in Malaysia. Thus, the national government should create an effective market for compost and create opportunities for stakeholders to be involved in composting activities in Malaysia.

6.4 Material Flow Analysis for recycling option in Malaysia

As the population keeps on growing, so does the demand for more food, comfort and luxuries. Inevitably we on our part should learn to live with less energy and materials. We must start to search for alternative and renewable energy sources, which is essential once the supply of fossil fuels is depleted. We must constantly develop ways and means to turn our waste into a resource. For this to work, recycling, reuse and recovery of energy is essential in an integrated approach towards sustainable SWM. The study argues that integration recycling into SWM is a key dimension of EMT.

There is no standard definition of recycling, but a widely accepted view is that recycling constitutes “the beneficial reuse” of products that would otherwise be disposed of. Recycling of SWM is capable of meeting several objectives. On one hand, it reduces the amount of waste introduced into the environment; on the other, it reduces the use of primary commodities and increases energy recovery. One of the most important requirements for the successful recycling programme is to have reliable data on waste generation rates and composition. However, due to a lack of comprehensive and accurate data of waste characteristic the recycling programme cannot be successfully implemented in Malaysia. The result from MFA for SWM in Malaysia (figure 6.2) shows that only 607.5 t/d of solid waste in Malaysia is diverted for recycling practice. The MFA result also represents that plastic, glass, metal and paper are the types of waste that have the greatest potential for recycling. Table 6.5 describes the major recyclable items in terms of their respective share of the waste composition, estimated recycling rate and general conditions of their market demand.

Table 6.5 Major recyclable items from municipal waste

Item	Share of waste composition	Remarks
1) Food waste	49.3%	• Composting of food waste is not employed at a large scale
2) Paper	17.1%	• Waste paper for recycling is mostly collected from generation source after separation • Source separation is limited to certain paper categories that have high market value.
3) Plastics	9.7%	• Waste plastic actively collected for recycling include PET bottles, plastic sheets, foamed plastic etc. • Source separation is limited due to comparatively lower price compared to waste paper and metal.
4. Glass	3.7%	• Waste glass recycled includes glass bottles, jars and coloured or clear glass. • Source separation is low • Limited number of glass bottle manufacturers in Malaysia generates low demand • Bottles reuse market exists.
5. Ferrous metal	1.6%	• Wide range of ferrous metal recyclables in the local market. • Source separation and direct selling is high
6. Aluminium	0.4%	• Source separation and direct selling is high due to high selling price.

Source: JICA, 2006

According to Chamhuri (2007), the amount of waste being diverted for recycling is about 3% to 5% and recycling in Malaysia has been carried out informally. At present there are two main routes for recyclables collection: one is through buy-back or collection centres set up by local authorities, concessionaires, NGOs and private

organisations, and the other is by private collectors of recyclable materials. In either way, the collected recyclable materials are then sold to recycling factories or intermediate buyers. Such intermediate buyers also export a considerable amount of recyclable materials to other countries. The MFA result shows that the total export recyclable material from Malaysia to other countries is 2361 tonne per year, however total import material recyclable from other countries is 305 0396 tonne per year which is mostly higher than export of material recyclable.

In Malaysia, a concerted government action for recycling programs began only in the early 1990s and the first official recycling campaign was launched in October 1991 in Shah Alam in Selangor by the Minister of Housing and Local Government (MHLG). Twenty local authorities were identified as the lead agencies to promote recycling. This recycling campaign was part of the "Clean and Beautiful Programme" launched by the ministry earlier. In the following year, the minister announced that all city and municipal councils would be required to launch recycling programmes. The smaller district councils would still be exempted.

On 2 December 2000, the Government relaunched the national recycling campaign with 29 local authorities participating. (Engku Azman 2001). The second phase of the new recycling programme was launched on 11 November 2002 with 95 local authorities participating. The target was to reduce waste generation to a minimum rate of 22% by the year 2020 (Huszain 2004).

During 2001-2003, the government spent MYR25 million on awareness campaign and another MYR11 million purchasing and building an infrastructure to support the programme. There is now a Recycling Secretariat at the Ministry of Housing and Local Government. It has established a website (www.kitarsemula.com) to propagate recycling and provide information. The local authorities are required to submit reports on the status of recycling in their areas. Unfortunately, according to the ministry, the response has been poor, and unreliable data has been used.(MHLG, 2003)

Community participation is critical to the success of any recycling programme. The recovery of large volumes of the high quality recyclables material depends on citizen involvement. Wastes separation at households would reduce collection time, hence the collection cost. However, there is no separation waste system at households in Malaysia. According to Ministry of Housing and Local Government in Malaysia (MHLG) almost 60% to 80% of the budget has been spent for solid waste collection particularly in residential areas. Effective implementation of the separation of waste at source requires continuous effort from government and non- governmental organisations to create an effective educational programme which is able to educate people to participate in recycling activities and raise the awareness of environmental protection as a whole. At present, there is no organised programme for recycling in Malaysia. Stakeholders are now working on their own programme and objective. (MN. Nassir, et.al 2001).Therefore, involvements from all stakeholders are crucial to get information regarding solid waste and achieve sustainability policy in SWM.

Strategic planning is also critical to the success of recycling programmes. Short- term goals for a recycling programme will be oriented toward planning and implementation. Long-term goals normally pertain to program expansion and attainment of a mandated and self imposed waste reduction-recycling goal. The study found that recycling is still at an infant stage in Malaysia; nonetheless with increasing environmental awareness, the government is starting to promote waste recycling by drafting policies and offering support to private waste management companies. However the SWM in Malaysia displays an array of problems, including institutional deficiencies, inadequate legislation and resources constraint.

Lack of coordination among the relevant agencies often results in duplication of efforts in waste management programs. On the management side there is lack of

skilled manpower, irregular collection services, inadequate equipment used for waste collection, inadequate legal provision, and the resource constraints are the key factors challenging the waste recycling in Malaysia. Therefore it is crucial for government and other agencies to play a role to develop sustainability policy for SWM in Malaysia. Institutional capacity in SWM must be strengthened to effectively manage solid waste problems. The local government also needs to provide comprehensive and reliable information on the amount and nature of the different types of waste produced in order to find a suitable approach of treating or disposing of such waste.

Transforming of the role of social movements in EM theory relates to political and institutional changes. The idea is to empower non-government organisations so that they are able to provide an effective early warning system for emerging problems and feed innovative ideas into decision making processes. The goal is to generate an effective social and environmental feedback mechanism for policy makers. Thus, the state should encourage more participation from non organisations to be involved in recycling programs in Malaysia. Recycling serves a variety of political agendas, and thus it was defined differently by various organisational actors. (S. Allan, 1999). The key roles for NGOs, includes interacting with industry and encouraging them to be more environmentally conscious. On the other hand, the dynamics of solid waste modernisation elevates the importance of knowledge about recyclable materials and markets for them, without this knowledge, many investments are made in vain and separate collection and recycling of organic waste and recyclable materials is likely to be expensive and ineffective.

6.5 Material Flow Analysis of Solid Waste Disposal and treatment system in Malaysia

Based on MFA study in Malaysia, the study found that landfilling is the most important and most cost effective method of municipal solid waste disposal in Malaysia. It is the only final disposal processs which restores the waste to nature. Landfilling is always required no matter what intermediate treatment process is introduced. Even though, government and municipalities are already working to develop the sanitary landfill sites in a few urban areas, open dumping still remains the cheapest and most effective solution to get rid of the mounting garbage.(Fauziah S. H et al., 2007). New sanitary landfill is often too distantly located compared to the open dumpsites within municipal limits. The sites far away from the source of waste generation increases transfer costs and additional investments for the infrastructure of roads, hence intensifying the financial problems of the responsible authorities making longer collection and hauling time.(M.Nassir, 2001)

At present, the most common method for the disposal of wastes in Malaysia is by landfill. (MHLG, 2005) (figure 6.2). Open dumps, where the waste is unloaded in piles, make very uneconomical use of the available space, allows free access to waste pickers, animal, and insects and often produce unpleasant odour and aesthetic nuisance. Such inadequate waste disposal creates severe environmental problems that affect the health of humans and animals and cause serious economic and other welfare losses. (C.Visvanathan, et. al 2003). The MFA results show that almost 90% of the solid waste in Malaysia goes to open dump sites which is not a sustainable method. Financial and institutional constraints are one of the main reasons for inadequate waste disposal in Malaysia. Despite the degradation of valuable land resources and creation of long–term environmental and human health problems, uncontrolled open dumping is still prevalent in most developing countries (ISWA & UNEP, 2002) which indeed desperately need an immediate action due to the associated harmful impacts. In Malaysia, almost all landfill sites, either closed or

those that are still in operation, were developed and operated on ad-hoc basis. Table 6.6 shows the condition of selected landfill sites in 2007.

Table 6.6: Condition of selected landfill sites in 2007

Condition	Municipal council	District Council
Sanitary Landfill	4 (33%)	1 (2%)
Controlled tipping	4 (33%)	19 (38.8%)
Open dumping	3 (25%)	29 (59.2%)
Dumping into water body	1 (9%)	0 (0%)
Number of data	12 landfill sites	49 landfill sites

Source: Department of Environment (DOE) 2007

In 1990, there were about 114 waste disposal sites in Malaysia with an average area of 15 hectares. More than 80 percent of these sites have a remaining operating lifetime of less than 2 years (Table 6.9). The management and operation practices at most of these sites are relatively poor. About 60 percent of these sites are open dumps and thus do not have site suitability studies, lack of cover materials, inadequate facilities such as weighing bridge and fence, and lack of pollution control measures in particular leachate and gas emissions (M. Nasir ,2000). Table 6.8 shows the condition of selected landfill sites in 2007.Before 1989, Environmental Impact Assessment (EIA) studies of landfill sites were not mandatory. Solid waste landfill sites have a number of environmental impacts, particularly those sites that are not properly managed. Improper management of these sites has and will continue to post short and long-term hazards and risks to the environment and the public.

The dumpsite should become a landfill with a linear and leachate collection to protect ground water; it should have perimeter fencing and gate controls to restrict dumping of hazardous materials and a weighbridge for registering the loads and recovering costs of dumping. Open burning in dumpsites is now a source of air pollution and no longer welcome as volume reduction. Protective clothing,

restrictions on lifting, controlled exposure to dangerous substances, and ergonomically improved tools are increasingly required to protect the health and safety of workers (Watson, 2000; Wilson, 2007).

At the moment, all closed landfill sites in Malaysia are not properly secured, some sites have been developed and some are left vacant. The risks that could be introduced by these sites can be significant and proper evaluation and assessments have to be conducted before further developments are carried out on the sites. The pollution from closed landfill sites could pose health risks either directly (direct health risk) or indirectly (indirect health risk through consumption of contaminated groundwater near landfill sites). Detailed results of the studies can be referred to in reports. (Department of Environment, 2000). However, the policy on the appropriate development of closed landfill sites, long-term monitoring of pollution generated from the landfill sites and strict enforcement of pollution from active landfill sites owned by local councils are not clearly defined and adhered to.

Table 6.7 shows the number of landfill in each state according to types of landfill. There are 114 of landfills in Malaysia, with five types of landfill stages. Most of the landfill has a short life span ranging from two to eight years.

In terms of solid waste disposal system, the analysis demonstrates that the government is still not able to provide the proper and effective system for waste disposal in Malaysia. Lack of institutional arrangements, policy gaps, financial support and technical aspects are the main barriers that make the policy and management of solid waste disposal in Malaysia difficult still to be deliver in a sustainable manner. For example, the MFA result shows that almost 90% of the solid waste in Malaysia goes to open dump site which is not a sustainable method. The EMT suggests that science and technology is the way to solve the problem of the environmental crisis. Thus, the government needs to explore new technologies which are more efficient to solve the problems that relate to waste disposal and treatment. Participation from different agencies such as private sector, business, NGOS and

community is important to solve the problem of solid waste disposal. The state should encourage and offer more opportunities for private companies and business to invest in waste treatment and disposal in Malaysia.

Table 6.7: Number of landfill sites and their levels in Malaysia

State	Landfill stage					Total
	0	1	2	3	4	
Johor	13	8	4	1	0	26
Melaka	2	0	1	0	0	3
Negeri Sembilan	6	3	1	0	0	10
Selangor	0	7	1	1	2	11
Perak	9	5	2	2	0	18
Kedah	3	2	3	0	1	9
Pulau Pinang	0	0	1	1	0	2
Perlis	0	0	0	0	1	1
Pahang	5	3	3	3	1	14
Terengganu	2	4	4	0	1	8
Kelantan	10	1	1	0	0	12
Kuala Lumpur	0	1	0	1	0	1
Total	50	34	21	9	6	114

Source: Ministry of Housing and Local Government 2009

0: Open Dump site

1: Open tipping site

2: Landfill with bund and waste disposed covered with a layer of suitable cover materials

3: Land equipped with pipe system for leachate recirculation and aeration

4: Sanitary landfill

6.6 Conclusion

The main purpose of MFA in SWM is to organise solid waste data in a way that make communications on solid waste issues between different actors in society more effective, and ultimately leads to more balanced and informed decision making. Thus, data stored and processed in the MFA system would be used for different purposes in connection to policy making and management in SWM. The MFA approach is also a useful tool to measure the environmental problems and could be used to deliver EM theory for analysing sustainability of SWM in Malaysia.

There are several areas of MFA application to consider for assessment purposes. First, MFAs could be used for identification of major problem flows to the environment, together with an analysis of the causes by stepwise tracing them back to their origins in society. MFAs could also be used as a basis for priority setting in SWM, by assessment of the effectiveness of potential measures of material flows, as means of either pollution abatement of rendering of more efficient resource utilization. It may also serve as a screening tool, identifying issues for further and more detailed investigation by other tools. In addition, MFA could possibly play a role in between the present and future SWM strategies. It is likely to see that an early adoption of MFA in municipalities could promote and speed up the change towards regional SWM. In relation to this, MFA can be considered as a technical tool for physical input-output analysis, a tool used for regional and structural economic analysis in relation to regional development planning of municipal SWM. MFA have the potential to play important roles in municipal SWM. Due to the difference of specific design for each SWM stage, reliable data and information is needed. If applied in a proper practice, MFA will provide valuable information for planning and setting up the programs. Thus, it is a valuable tool for policy making and the stakeholder involved in SWM and provides a platform to analyses sustainability

Solid waste management in Malaysia specific focus on the institutional dimensions of EMT.

EM suggests the needs of a national policy and an effective system for SWM to deliver sustainability policy of SWM. However the management of solid waste in Malaysia still has many problems such as insufficient institutional arrangement, policy failing, and lack of financial support that is needed for effective and efficient policy for SWM. The current environmental regulation system in Malaysia is not perfect and the existing management system and the collection facilities do not fit the present requirements. There are also problems of institutional deficiencies, lack of managerial aspects and resource constraints that can impact on the development of effective national waste management system in Malaysia. Therefore, the government needs to formulate policies for sustainable SWM in Malaysia and develop a integrated approach to improve the SWM system particularly strengthening the institutional framework and managerial aspect of SWM. Thus, transformation the role of government and social movement seem relevant to address for analysing sustainability of SWM in Malaysia.

The next chapter presents the phone survey result among local authorities in Malaysia. The chapter obtains to examine the role of local authority in deliver sustainability of SWM and reflect to institutional dimension of EMT as a core theory tested in this study.

Chapter 7

Phone survey results

7.1 Introduction

The chapter outlines the phone survey result among local authorities in Malaysia. This chapter examines the transformation the role of the local government in SWM to address the institutional dimension of EMT. The phone survey was conducted to gain some information and perception regarding SWM among the local authorities in Malaysia. As many as 12 decision makers of local authorities in Malaysia were chosen as key respondents through telephone interview sessions. The respondents have been chosen among the senior officer in every local authority, which is also the head of the department of Local Authorities in 12 states in Malaysia. The respondents were chosen based on their seniority and experience dealing with SWM issues in Malaysia. Detailed information regarding solid waste policy and practices in Malaysia is crucial in order to find at what level the majority of Malaysian local government has attained and what are the barriers and facilitating factors that could affect the progress towards SD and EMT in SWM. Of the respondents 11 were males and 1 female, a ratio which generally represents the unequal distribution of men and women at the level of decision making in local authorities. The mode of age group is 50 years and above (58.3%). 83.3% of the respondents have attained diploma level education while 16.7% were graduates. The questions administered were close-ended and divided into four themes: (a) a general part of question regarding management of SWM including environmental awareness (b) The concept of Local agenda 21, Ecological Modernisation theory

and Sustainable Development (c) question about behaviour for environmental reasons (d) Solid Waste Management issues and problems in Malaysia.

7.2 Environmental Awareness among Local Authorities

This section describes the environmental awareness among local authorities in Malaysia that have been interviewed through a phone survey. Prior to implementing environmental policies or regulations, public awareness has to be one of the primary deliberations that need to be raised by local authorities, particularly by its decision makers. Awareness is encompassed in education. Similarly, environmental awareness is encompassed in education. On the other hand, the notion of environmental political awareness is in its broadest sense to encompass raising environmental awareness, respect for democratic values, acquiring knowledge and skills and demonstrating institutional or policy processes leading to changed behaviour in support of a sustainable environment.

According to the survey, as indicated in the Table 7.1, most respondents were less knowledgeable about complex conceptual issues about EM and SD. 83% of respondents did not understand the concept EM, whereas a 75% of respondents had never heard of the concept of SD. This could be related to the inaccessibility to knowledge necessary to shape their opinions, resulting from inadequate infrastructure and resources for service delivery and planning and conflicts arising from development priorities.

Table7.1. Knowledge of Ecological Modernisation and Sustainable Development

Question	Proposition of answers			Total
	Yes	no	not sure	
1. Do you understand the concept of EM?	17.0%	83%	0	100%
2. Have you ever heard the concept of SD?	16.7%	75%	8.3%	100%
3. Do you understand the concept of Local Agenda 21 (LA21)?	25%	75%	0	100%

Source: survey 2009

Meanwhile, the survey also reveals, as indicated in table 7.2, that respondents expressed low concern towards behaviour or values for environmental awareness. From the questions that were asked, 7 or 58.3% of the respondents did not participate in recycling campaigns.

Table 7.2 Behaviour for environmental awareness reason among decision-makers of local Authorities

Question	Proposition of Answers			Total
	Yes	No	Not sure	
Do you utilise used paper for printing and photocopying in your office?	25% (3)	66.6% (8)	8.4% (1)	100.0
Do you think that people who litter should be fined?	50.0% (6)	41.6% (5)	8.4% (1)	100.0
Do you use a greening guidebook personally?	16.6% (2)	75.0% (9)	8.4% (1)	100.0
Do you buy or use environmentally -safe products?	0 % (0)	91.6% (11)	8.4% (1)	100.0
Do you participate in recycling campaigns?	58.3% (7)	33.3% (4)	8.4% (1)	100.0

Source; survey 2009

Within the government sector, raising awareness should focus on the local government, who is responsible for proper municipal SWM. In this respect, the national government shall inform the top administrators of local government the national policies on sustainable SWM including waste recycling program which is one of the national agenda to implement 3Rs (Reduce, Reuse and Recycle) activities in their localities. The objective of EM is to increase the efficiency of material use through waste minimization and recycling. These efficiency improvements need to

occur at both the macro and micro-economic levels through structural economic change and changes in infrastructure and technology, and through the adoption of new technologies and techniques. Clean technologies that integrate environmental factors into the design and application of products and processes progressively replace technologies synonymous with end-of-pipe pollution control and tackle pollution problems at source. However, the survey found that there is no proper planning to implement 3Rs activities at local authorities and the recycling programme is not successfully implemented in local authorities area. Therefore, the national government should guide the local government to implement recycling program and organise public, businesses, NGOs and other relevant stakeholders to promote 3Rs activities for sustainability of SWM.

Involvement from different actors such as NGOs, academics, consultants provides legitimacy, opens inflexible bureaucracies, brings in new ideas, and increases provider willingness to innovate (Scheinberg et.al 2010). Involving the private sector and non-profit organisations will change the behavior of the public and will create better alternatives for SWM. The private sector can be encouraged to enter into the business of collection, recycling, and disposal by providing incentives and soft loans for purchasing equipment. Government laws and regulations should clearly define the responsibilities of personnel, government organization, and the private sector. However, the study found that the government less commitment to encougrage private sector and non-profit organizations contribute in SWM in Malaysia. The role of government therefore needs changes under EM from the traditional centralised, regulatory nation state towards a more flexible, decentralized state. In case of Malaysia, the emphasis will be on partnership and co-operation between government, industry, scientists and those moderate environmental groups that are willing to be co-opted into the system.

7.3 The concept of Local Agenda 21 plan and the transformation of the role of Local governments

Question- Do you understand the concept of Local Agenda 21 and the role of the local government in deliver sustainability policy in SWM?

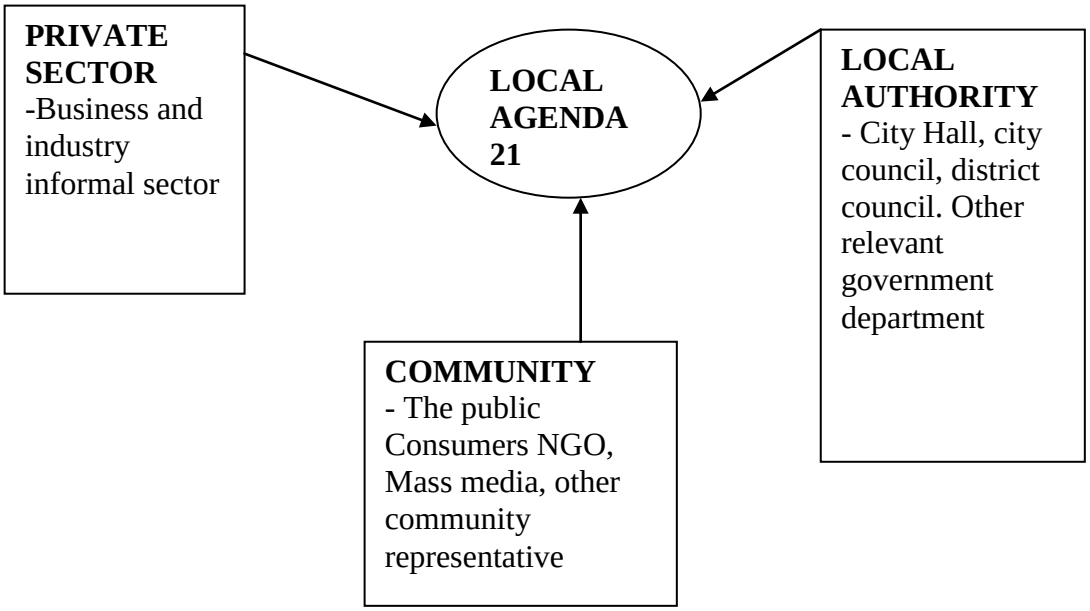
Agenda 21 is a comprehensive plan adopted as the framework for achieving SD in the 21st century at the Earth Summit in Rio de Janerio in 1992. Chapter 28 of Agenda 21 proposes Local Agenda 21 (LA21). LA21 is a decentralized initiative that focuses on the role of local governments in the implementation of sustainability programs within a country. The implementation of LA21 is seen as an opportunity to include people in planning for sustainability at local level. One of the main strengths of EM relates to the way in which it has been used to analyse various discourses surrounding the relationships between industrialism and the environment. For example, discourse analysis has also been applied at the local level in Norway within the context of LA21 (Lindseth 2001). Lindseth argues that discourse coalitions gather around certain arguments and the confrontations that take place assist in clarifying our understanding of how change/ innovations takes place. According to Lindseth (2001), LA21 is part of a common international regime that open up debate within communities and contributes in translating global problems into local action. EM also advocates greater public disclosure and community participation in decision making. Devotees argue that globalization and new international market dynamics have shifted the away from traditional top-down influences of supranational bodies towards greater emphasis on the sub-national level. This regional and local focus is in line with increasing prominence of local initiatives such as LA 21 programs (Berger et al, 2001). The study argues that LA21 as the important process to deliver EMT for SWM in Malaysia. In EM, the government takes the role of 'contextual steering' and policy-making changes from 'curative and reactive to preventative'. Hence, in this section examines the LA 21 and the role of local government to deliver sustainability of SWM in Malaysia and make links to EMT.

The overall theme of Agenda 21 is to ensure that resources are used in the most efficient and effective way with minimum waste and limited emissions. It represents a shift in the traditional development paradigm to one that provides a comfortable level of living for the present generation without compromising the ability of the future generations to maintain and increase their quality of life. It is an agenda of the millennium that future generations will be able to take care of their needs within the context of a reasonably clean and safe environment. In the case of Malaysia, the government response to the implementation of Agenda 21 is reflected in the Seventh Malaysia Plan (1996-2000), which provides an in-depth treatment of the issues of concern identified in the Agenda (7^{th} Malaysian Plan 2000). Although local governments (cities, towns, or countries) generally lead the efforts toward the implementation of LA21, community groups, NGOs, businesses, universities, and the individual, have also acted as the driving force (ICLEI, 2002). Independent of who acts as the leader, LA21 initiatives requires participatory assessment and decision-making. This emphasis on participation by multiple stakeholders is a manifestation of the diversity of policy goals that SD entails and of the interest for procedural justice as a criterion in decision-making at the local, national, and international level (Paavola and Adger, 2006). LA 21 initiative specifically recognized the role of governments, as 'the level of governance closet to the people' and communities in delivering SD policy.

Chapter 28 of Agenda 21 entitled "local authorities' calls for local authorities to initiate dialogues with the community to achieve consensus on a "Local agenda 21" action plan towards SD. It is a process where local authorities work in partnership with all sectors of the local community, in planning and implementing appropriate programmes and projects that address the priorities and concerns of residents in a sustainable manner. Through Local Agenda 21, communities work together with their local authorities to identify and analyse local SDs issues, and later formulate and implement action plans. Figure 7.1 below illustrates partnerships between local

authorities (such as District Councils, Municipals council, City councils and City Halls) and the communities they serve to work together for SD.

Figure 7.1: Local Agenda 21 partnership



Source: Lee Lik Meng, et.al.2002

At this point, the important role of local authorities is to provide opportunities to the local community to take greater interest and responsibility in planning and implementing identified activities and projects. In addition, the private sector and local communities are offered an opportunity to monitor, to provide feedback and to propose other projects within the planning mechanism. It provides an opportunity to the community to take control of development in areas that matter. At the same time, they share with each other and together handle the maintenance and enhancement of the ecosystems. Within EM theory there is an expectation that several sectors will partially go through a modernisation process which involves more environmental production and consumption. On the other hand the concept of SD and the theory of

EM are the policy concept suggesting how environmental consideration are increasingly being integrated into institutional, business, and personal decision-making, rather than being external and only within the environmental sector.

The survey shows that about 75% of the respondents do not understand the concept of Local Agenda 21, whereas only 25% understand the concept of Local Agenda 21 (table 7.1). The survey also shows that most departments of local authorities were still in the early stage of planning for Local Agenda 21. All but one is at the level of 'not yet decided to produce an action plan'. The one that has given some attention to producing an action plan is Department of licensing, Urban and social services, but details have not been decided. However, the preparation of action plans by all departments is generally slow. It is suggested that the reason for this is the legitimacy of Local Agenda completion of planning activities of Local Agenda 21 pilot project at national level. This pilot project has been initiated but is yet to be completed. The result of the pilot project will serve as a guideline to all local authorities in the country.

A challenge posed by global environmental transformation for local government is to take a proper account of the impact of SD. In this regard, at the preliminary stage, Agenda 21 calls for local authorities to initiate dialogues with the communities to achieve consensus on a "Local Agenda 21" action plan. From the findings it was concluded that most decision- makers in local authorities were less knowledgeable about complex issues of SD and were expressing low concern with regard to behaviour or value for environmental awareness, this highlights the essential point of the preparedness and their contribution in meeting the challenge of SD. Local authority staff should be made available to be sent for retraining in aspects related to SWM and their specialized jobs to keep them abreast of the latest developments.

Hence, this would suggest that general training activities among the decision makers in Malaysia is needed in order to enhance the capacity building. (Table 7.3) As a

result from the fact that most departments of local authorities are still at the level of not having decided to produce an action plan of Local Agenda 21 planning, the above suggestions for training would also encourage the formulation of local action of Agenda 21.

The capacities needed for development of the society vary in the different phases of the modernisation process. Enablers for the modernisation process are a certain level of economic capacity and actual performance, socio-cultural capacity to handle conflicting situations in consensual style. The political and administrative systems were seen as central in a sense that institutional capacities must exist or be created in order to react on environmental pressures. On the strategic side Jänicke required from the political and administrative system that there must be enough decision-making resources (competence, staff and material resources). Further they have to work in a long- term, open and integrated fashion, in order to enable the innovation capacity building for the economic sphere.

The states must make concerted effort towards capacity building of urban local bodies for improved accounting system and private sector participation. It could be carried out through a training program, providing hands on experience in project and research development. It may be beneficial to provide career growth opportunities based on such learning. State must also move towards benchmarking service delivery between various cities in Malaysia.

Table 7.3 : Capacity Building Activities for Local Authorities Decision Makers in Malaysia

Format of Training	Objectives	Goals
National conference Technical meeting/ workshops	• To assess the country's issue and situation • To raise environmental political awareness • To draft technical documents for political endorsement and follow up	• To develop national legislation and policy for the ' emergency' adoption of Agenda 21'
Inter- district / state workshops	• To raise awareness • To standardize locally relevant approaches • To consolidate experience • To clarify needs and draft projects for political endorsement	• To develop plans and procedures for Local Agenda 21 management. • To strengthen institutional and human resources for the management.
Technical meeting	• To identify relevant message and appropriate audiences and media	• To develop programmes for public education, awareness and community participation
• Workshops	• To draft plans of local action for political endorsement and follow up • To plan for community mobilization	
• Technical meetings/ workshop at country and inter country levels	• To identify available indicators • To facilitate networking • To identify sources and systems • To make compatible parallel system	• To promote the collection, analysis and dissemination of information related to 'global' actions

Source; adjusted from Lee Lik Meng (2002)

7.4 Issues and Problem dealing with Solid Waste Management in Malaysia

These sections discuss the issues and problems of SWM among Local Authorities in Malaysia and how effectively the local government tackles the problems related to SWM.

a) *Question; what are the issues and problems regarding with Solid Waste Management in your area?*

In general, some of the local councils show less concern regarding solid waste problems in their area. There are many reasons for that and almost 70% of local councils in Malaysia do not have enough workers to deal with waste collection. The reason was to cut budgets especially at district council level. Local Authorities also seem to have a problem regarding inadequate planning and management. They are faced with inadequate personnel (expert) to run and manage SWM activities. Most of the problems are tackled on an ad-hoc basis without a proper master plan.

As NGOs comments;

"When local authorities need to discard waste, they just find some place and dump everything there without any planning, engineering and even site selection to see if it is safe". When public start complaining about stench, pests and scavengers, they just bring lorries full of soil to cover them.

The survey showed that almost 80 percent of local authorities face problems dealing with solid waste disposal. They do not have enough suitable land for landfill. Almost 90 % of solid waste in Malaysia is disposed to open landfill and so more land is needed to build new landfill. At present, one of the biggest problems faced by big cities in Malaysia for example Kuala Lumpur is to find suitable land for waste disposal. Land is becoming scarcer and will continue to become an acute problem

with the current pace of economic development. At the moment, all closed landfill sites in Malaysia are not properly secured, some sites have been developed and some are left vacant. The risks that could be introduced by these sites can be significant and proper evaluation and assessments have to be conducted before further developments are carried out on the sites. The pollution from closed landfills sited could still pose health risks either directly (direct health risk) or indirectly (indirect health risk through consumption of contaminated ground water near landfill sites).

The study found that the policy on the appropriate development of closed landfill sites, long-term monitoring of pollution generated from landfill sites and strict enforcement of pollution from active landfill sites owned by local councils are not clearly defined and adhered to. Despite the degradation of valuable land resources and creation of long-term environmental and human health problems, uncontrolled open dumping is still prevalent in most developing countries (ISWA and UNEP, 2002) which indeed desperately need an immediate action due to the associated harmful impacts. Moreover, in South and Southeast Asia, more than 90% of all landfills are non-engineered disposal facilities.

Waste experts comment;
"The landfill required a proper set-up – a carefully selected location and soil which is of clay-like texture that has minimum permeability to prevent underground water contamination. On the other hand, the landfill should also be properly engineered in accordance with geological and hydro geological requirements"

However, during this study it was observed that human resources and expertise in waste management was lacking in most of local authorities in Malaysia. There is not enough staff to implement sustainability method for SWM in their local area. Therefore, the number of staff with expertise and training in waste management within the local authorities needs to be increased if waste management plans are to be implemented in the future.

According to the survey, SWM requires large financial resources. In Malaysia, the expenditure for managing solid waste is around 40 to 50 percent for larger councils and more than 50 percent for smaller councils. Since SWM was not one of the priority tasks for most local councils until recently, its financial management was relatively inefficient.

As waste experts pointed out;
"Local authorities are spending between 30% and 80% of their assessment collection for waste treatment. And, these councils do nothing more than makes the garbage pile up into a seemingly endless problem"

b) Question: What is lacking the financial management of waste?

The interview among the local councils and authorities, found that there were several reasons for a lack of funding. Summary below (table 7.4).

Table 7.4: Reason for a lack of funding in SWM

Reason of lack of funding	Response	Percentage (%)
a) Low assessment rate	• rates have not been increased for several years	9 (75.0%)
b) Poor budgeting	• no separate accounting is kept for SWM, therefore, budgeting for this area does not reflect the true cost/expenditure involved • The increase in population/generation of waste is not reflected in the assessment charges being levied	11 (91.7%)
c) No enforcement of debtors	• resulting in poor collection of funds from the public	8 (66.7%)
d) No proper charging:	• tipping fees are low and do not reflect the actual cost of maintaining the landfills	6 (50%)
e) Ineffective Accounting system	• Lack of standard financial reporting structure • Poor monitoring of budget on SWM due to lack of basic data and untimely reports. • No benchmarking to assess efficiency of services • Budget set are not based on levels of service to be provided • No proper evaluation of capital expenditure	10 (83.3%)

Source; survey 2009

Most of the Local authorities suggest that enforcement must be implemented (etc: compound) in order to educate people and make them more aware and responsible. According to J. Jahi (2003), if enforcement is carried out constantly and without interruption from certain quarters, local authority areas can be as clean as they should be. Responses from local authorities found some suggestions to improve SWM in Malaysia.(table 7.5).

Table 7.5: Suggestion to improve SWM in Malaysia

Question: How can SWM in Malaysia be improved?		Percentage (%)
a)	Carry out proper and thorough research on solid waste generation-identify according to areas or sectors, households, amount and types of solid waste generated	8 (66.7%)
b)	Local authorities should require residents to separate their waste into different types for recycling purposes. If this is enforced, violators can be fined.	4 (33.3%)
c)	Local authorities should allow limited amount of solid waste to be generated by households. If the amount is exceeded, the residents should be made to pay extra.	10(83.3%)
d)	Collection of solid waste should be carried out professionally (either privatized or not).	9 (75%)
e)	Different types of solid waste should be handled differently and disposed of differently	7 (58.3%)
f)	A thorough study should be made of suitable sites for disposal of solid waste taking into consideration of their environmental consequences.	6(50.0%)
g)	Local authority staff should be made available to be sent for retraining in aspects related to environmental management and in their specialized jobs to keep them abreast of the latest development**.**	12 (100%)

Survey; 2009

The survey found that the major issues and problems in managing SWM in Malaysia are due to inadequate resources and absence of national level policy and guidelines

for allocation of resources for SWM. Under Ecological Modernisation, the state is seen in a variety of roles and capacities for example as the enabler for markets that help produce the technological advances via competition. In some cases the state is seen as an institution that is incapable of addressing critical local, national and global environmental problems. A more recent development in the EM literature has been the emergence of civil society as a key agent of change (Fisher & Freudenburg, 2001). Thus, the national government should encourage more investment by industry and private companies involved in SWM. In terms of engaging economic imperatives, the idea is to harness market forces and steer them in a direction that encourages eco-efficiency. This starts with internalising the externalities of environmental damage (e.g making the polluter pay for the damage done) but moves on the creating substantive incentives for both consumers and investors to support greener firms (Gouldson & Murphy 1997; Mol 2000; Mol & Sonnenfeld 2000; Mol & Spaargaren 2000; Seippel, 2000; Berger, et al.2001). In this new green market a healthy environment is seen as essential for a healthy economy.

7.5 Conclusion

Sustainable Development agenda's for local authorities have become the national agenda. Thus local authorities must be prepared to meet the challenge, particularly in relation to growing urbanization within the context of sustainability of SWM. The survey among local authorities in Malaysia shows that SWM has a low priority within the local authorities causing mismanagement of existing resources and a lack of formal planning. Consequently there is lack of expertise, inadequate equipment and untrained staff with minimal education in waste management. Despite these shortcomings the local authorities require technical and financial resources in order to improved SWM in Malaysia. In fact, inadequate support from decision-makers of local authorities raises the question whether smaller or less advanced local authorities will have the capacity and capability to assume new roles to meet the new challenges. There also seems to be problems with translating excellent policies at the national level into actions on the ground. Thus, national policy of SWM in Malaysia

is not successful to deliver sustainability agenda. In the context of SWM, analysing sustainability of solid waste is a complex task but an important agenda in order to achieve national policy goals. The ability of its proponents to achieve real and positive impacts on social and environmental conditions will also require the practice of democratic values, cooperation of stakeholders and implementation of supportive national government framework for SD. The theory of EM also highlights the need of transforming the role of state and integration of stakeholders that are involved in the formulation of environmental policy. Thus, the role of government in SWM and institutional arrangements in Malaysia need for more transformation in association with the SWM problems to deliver sustainability policy of SWM.

MFA is also an accounting tool that provides a national analysis and will enable both credible targets to be set and more readily understood and accepted by decision makers. It also enables relationships to economic growth and consumption to be drawn which again have policy benefits with respect to SD and EMT. It is important that decision makers understand the value of MFA and agree that it is a national accounting tool of relevance to their work. There is also potential for national SD policies to be coupled more effectively with the monitoring of SWM targets as driver of institutional change.

The next chapter will discuss the interview responses among the Local Government, NGOs and waste expert involved in SWM in Malaysia to analyses sustainability SWM focus on institutional dimension of EMT.

Chapter 8

Interview responses and issues related to Solid Waste Management

8.1 Introduction

In Malaysia, the solid waste problem is one of the most debatable environmental issues. This chapter presents qualitative data to discern how people express their views and opinions regarding SWM. The interview was conducted among senior officer of Local government, waste expert and NGOs involved in SWM in Malaysia. This chapter responds to questions ***RQ1****: What is the Malaysia position in regards to SWM?*. The answer to RQ 1 continues from chapter 7, using the phone survey technique among local authorities in Malaysia. Throughout the chapter, the interview technique has been used among senior officers, waste expert and NGOs to respond to the first research question. The transformations of the role of government and institutional framework are the key elements to address in the EM theory that will focus in this chapter. This chapter examines the role of government and stakeholders who are involved in SWM and policy making processes in Malaysia to analyses sustainability of SWM in Malaysia using EM perspective focus on institutional dimension. This chapter also evaluates the realism of the National Strategic Plan for SWM in Malaysia and particularly its policy to establish a SWM system which is holistic, integrated, cost effective, sustainable and acceptable to the community

8.2 Institution Framework dealing with Solid Waste Management

In Malaysia, the agencies and institutions that are involved directly in municipal SWM are divided among the Federal Authorities, State and Local Authorities. Non-governmental organisations and private sectors are also involved. However, the study found that there is less commitment showed by non-governmental organisations involved in managing SWM in Malaysia. At the federal level, the Ministry of Housing and Local Government (MHLG), in particular its Local Government Department, handles all matters pertaining to SWM. The Local Government Department, however, is in charge of all local government issues and not only matters relevant to SWM.

Two departments of this ministry are involved in municipal SWM:

- **Local Government Division**

  This Division, under its Technical Section, is responsible for providing technical advice on engineering functions in urban areas, which includes SWM. The Local Government's Policy and Planning Advisory Section is involved in preparing and reviewing existing by- laws and regulations concerning Local Authorities.

- **National Department of SWM**

  SWM Department was established in 2003 to develop policies, plan programmes and projects and manage the expenditure for SWM in Malaysia.

State governments play a co-ordinating role with a focus on policy and financial matters pertaining to Local Authority functions. In general, States implement policies which may be initiated by the Federal Government, but which have been approved by the National Council for Local Government. Local authorities have direct

responsibilities over local authority functions and services, such as solid waste collection, treatment and disposal; public health and environmental cleanliness; landscaping, planning and others such as licensing and enforcement of by-laws. As far as SWM is concerned local authority are directly responsible to manage such services.

Other authorities involved in SWM play more of an indirect role. The Department of Environment, for example, is the authority responsible for the enforcement of standards for discharges and emissions into the environment. The Ministry of Health, through the Rural Environmental Sanitation Programme, has been promoting and supporting the implementation of SWM in rural areas which are presently not served. The Economic Planning Unit of the Prime Minister's Department is the agency that is directly involved in the privatisation of SWM services in the country. Besides these authorities, other stakeholders that have a major role in SWM include waste generators (such as public, industries and businesses), the concessionaires, manufacturers and the waste recyclers. Waste generators constitute the most important group of stakeholders as they include households, industries and businesses. Participation of waste generators in SWM presently is significant as there is no defined role or opportunity for them to participate, whether in planning, operation or management. For example, public awareness for recycling and waste reduction is in its infancy and the indiscriminate dumping of waste is still rampant, especially in urban townships and squatter areas. Manufacturers currently play an insignificant role in sustainable waste management practices as there are no clearly defined policies or incentives for waste reduction, recycling of products, and recovery and reuse of materials.

This shortcoming is also prevalent at the State and Local Authority levels where the day-to-day management of solid waste currently resides.

As waste expert said;

“Institutional and organisational arrangements for SWM at the Federal, State and Local Authority levels are generally weak and lack the resources for effective planning and management of waste. As in the case of a lack of national policies, there is a lack of capacity and focus in the administration and management of SWM at all levels”.

Forward planning is often lacking and data on solid waste is sparse. The efficient and effective management of solid waste requires the involvement of all levels of government. Federalization must not result in the alienation or deprivation of the vital role of the State Governments and Local Authorities in SWM. State governments have a role to play in assisting in the formulation and implementation of policies, the allocation of land, encouraging and supporting inter- municipal cooperation and ensuring that the interests of the public in the state are adequately provided for. Local authorities, who traditionally have been handling solid waste, should continue to play a role. The implementation of an appropriate institutional framework will have a major impact on SWM in the country. EM theory stresses that the transformation of the role of states and institutional structures is important in formulating the delivery of sustainability policy for SWM. Thus, the transformation the role of government is needed to formulate sustainability for SWM in Malaysia.

Communication is an essential ingredient for effective implementation of public policy. The study argues that through communication, orders to implement policies are expected to be transmitted to the appropriate personnel in a clear manner while such orders must be accurate and consistent. Inadequate information can lead to a misunderstanding on the part of the implementators who may be confused as to what exactly are required of them. In effect, implementation instructions that are not transmitted, that are distorted in transmission, that are vague, or that are inconsistent may cause serious obstacles to policy implementation. Where implementation orders are clear, consistent and accurately transmitted the absence of inadequate resources

will result in implementation problems. Resources include both the human and material such as adequate number of staff who are well equipped to carry out the implementation, relevant and adequate information on implementation process, and the authority to ensure that policies are carried out as they are intended, and facilities such as equipment, and buildings which are deemed necessary for the successful implementation of the policy. Without sufficient resources it means that laws will not be enforced, services will not be provided and reasonable regulations will not be developed.

8.3 Investigating Policies related to Solid Waste Management in Malaysia

The purpose of this section is to identify and discuss the various policies and programs of the federal and state governments of Peninsular Malaysia that, either directly or indirectly, have an influence on SWM of municipalities of Peninsular Malaysia. Information from key official at MOHLG revealed four existing national policies that may have direct or indirect implications on SWM in Malaysia. A brief discussion of each and how each was believed to affect the country's SWM is provided below:

8.3.1 National policy for Solid Waste Management

Strategic planning is essential to improve the efficiency and effectiveness of SWM in line with the vision of achieving environmentally SD to reinforce long-term growth. Improving standards of waste collection, phasing out open dumping of solid waste and introducing environmentally sound treatment and disposal facilities through implementation of new technologies will cost money. However, systematic planning and the adoption of cost-effective waste management strategies is a means to maximise returns on such an investment. Thus, the National Strategic plan for sustainable SWM in Malaysia is an attempt to move an imperfect waste management system that is currently practiced towards one that is better, taking due consideration

of economic development and the needs and responsibilities of the various stakeholders within society.

The National Strategic Plan for SWM forms the basis for solid waste policy and practice in Malaysia until 2020, and a foundation for future development in the ensuing years. This strategic plan is to serve as a guide in planning and allocating resources with consideration of priorities in the sector concerned (MHLG, 2005)

As senior officer said,

The purpose of National Strategic Plan for SWM is to develop a sustainable waste management strategy for Malaysia based on the principles of federalisation and privatisation. This Strategic Plan outlines the strategies to be adopted to fulfill the vision and objectives embodied in a national policy for SWM.

The strategic plan also provides a framework within which Malaysia can reduce the amount of waste it produces and deal with the waste that is generated in more sustainable ways (Table 8.1). It integrates environmental and development decision-making processes in SWM, and thereby promotes SDs, which is socially equitable and responsible, and environmentally sound. The Strategic Plan sets out a number of objectives, strategies, and principles relating to the provision of waste treatment and disposal facilities, protection of health and protection of the environment. The Strategic Plan is actually address the core elements of EMT, however the response from the government was tepid, and its recommendations were not fully implemented. At this present, SWM in Malaysia is still facing with the various problems such as lack of integration of policy, insufficient financial support, lack of social and behavioural unresponsiveness dealing with complexity of SWM.

Table 8.1; National Strategic Plan for SWM in Malaysia

Policy
• To establish a SWM system which is holistic, integrated, cost effective, sustainable and acceptable to the community. • To implement SWM based on the waste hierarchy which emphasize waste minimization through 3R, intermediate treatment and final disposal. • Emphasis on environmental protection and public health • Utilised proven cost effective technology
Goals
• To provide a strategic framework related to the overall management of solid waste in Malaysia including the scope of privatisation and implementation strategies, taking into account current obstacles' or shortfalls faced in implementing the privatisation policy • To recommend and effective management plan, which identifies the roles of each of the stakeholders, and actions that are required to be taken to meet the objectives of the National Development Plan (NDP) • To adopt an integrated approach to SWM which considers impacts of substances and activities on natural resources. • To work for all sectors of society, to develop approaches which deliver SWM requirements and goals, without imposing excessing costs on the nation as a whole • To adopt clear objectives and effective targets • To focus on an overall strategy for the long term, and an action plan for progressive implementation • To build on existing data to provide a system for monitoring and measuring

on-going performance • To adopt policies that recognise the aim of SD through: - effective protection of the environment - Prudent use of natural resources - High and stable levels of economic growth and employment; and - Social progress that recognises the needs of everyone.
Trusts
• Waste minimization through 3R (Reduce, Reuse, Recycle) • SWM services that is holistic, uniformed, efficient, quality and cost effective. • Establishment of legal and institutional framework • Provision of SWM service through privatisation • Technologies that are environmentally friendly and safe, cost effective, proven and priority to local technologies • Public Education and participation programme
Strategies
• Determination of SWM priorities • Rapid and comprehensive development of the necessary legal and institutional framework • Development of public participation in SWM • Provision of sustainable technologies to manage solid wastes in Malaysia • A comprehensive approach to develop the waste reduction, reuse and recovery elements of SWM • A socially acceptable SWM system that calls for substantial initial government intervention with gradual shift towards full cost recovery.
Principles
• Federalisation of the SWM function

- Privatisation of the SWM service
- Sustainable waste management through reduction, reuse and recovery and the use of appropriate technologies, facilities and equipment to provide a sustainable and comprehensive SWM services.
- Adopting service standards to achieve a clean Malaysia

- A social framework comprising;

a) Increasing public awareness
b) Increasing the Government's understanding of effective SWM and public perception
c) Building partnerships between all stake holders including the public; and
d) Social equity, with charges appropriate to the level of services and the ability and willingness to pay.

- Development of the national technical and managerial capability in SWM.

Source: Adjusted from MHLG, 2007

8.3.2National Privatisation Policy

Some attempt has been made by the Government to address the problems related to SWM, and the need for changes and development of policies and programmes. It is observed that waste management is an important element within any national approach to environmental planning and management. Due to the constraints and burden faced by the federal, state and Local authorities in planning and implementing an effective system: the operational, technical resources, financial and infrastructural, privatisation of SWM were suggested as an alternative to improve the service and at the same time to reduce financial burden of local authorities. The objectives of this privatisation are to provide an integrated, efficient and effective technology that will provide a better quality of environment through the practices of resources recovery and waste minimisation.

Introduced in 1985, the privatisation policy of Malaysia has a broad goal of involving the private sector to assume a greater role in promoting economic growth of the country. Among the stated objectives of national privatisation policy of Malaysia are (MHLG, 2003):

1. Reduction of the financial and administrative burden of the government
2. Promotion of competition and increased productivity
3. Stimulation of private entrepreneurship, investment and growth
4. reduction in the Role of the state: and,
5. Promotion of the objectives of the New Economic Policy through increasing the supply of private equity.

With regard to SWM in Malaysia, the national privatisation policy has one major impact, which is an increase in tendency by local governments to contract out many of the essential public services that were previously provided by them. Several key local government services that have been contracted out include urban cleansing activities such as waste collection and disposal activities, sewerage activities, grass cutting and parks maintenance, roadside maintenance, and parking services and so on. While the degree of private sector involvement in the SWM system of the 18 municipal governments varies from one municipality to another, there is an overall trend over the past several years by all to increase collection capacity via privatisation. The privatisation of urban SWM in Malaysia was initiated in 1993 with the objective of providing an integrated, effective, efficient, and technologically advanced SWM system. It was also expected to resolve the problems of SWM faced by the local authorities such as finance, lack of expertise, illegal dumping, open burning, and a lack of proper solid waste disposal sites. However, the privatization of the waste management system in Malaysia has not reached full privatization.

As waste expert said;
Privatisation in Malaysia did not really solve the issues of SWM, but only transferred the problems from local authorities to the private companies.

8.3.3 Recycling Programs

The first official recycling program of peninsular Malaysia was launched sometime in 1993 and was initiated by the MOHLG. The stated objectives of the national recycling program were (i) to divert valuable resources in the waste stream from waste disposal; and (ii) to help control costs of managing solid waste.(MHLG,2005). The recycling program of most local governments was envisioned as comprising of the setting up of buy-back centers and the placement of drop-off containers for recyclables at strategic areas such as at schools, shopping malls, and so on. At the start of the national recycling program, 23 Local governments of peninsular Malaysia had volunteered to become participants of the program. Because of poor planning and a lack of public participation, the total number of participants of this program declined to only 10 local governments in 1998.

In December 2000, the MOHLG decided to re-launch the second national municipal solid waste recycling program. In contrast to the first program, where municipalities volunteer to be participants, the second national recycling program were chosen by the MOHLG.

In the second national solid waste recycling program, 13 local governments of Malaysia were chosen based on several criteria. One of which was volume of wastes. Officials at Malaysia's MOHLG revealed that every participant of the second national recycling program was provided with special drop-off containers for recyclables and these containers were to be placed at strategic locations in each municipality. To encourage public participation in the second recycling program, the MOHLG decided to engage the services of one local public relation company to carry out various activities such as production of pamphlets, posters and billboards, commercial advertisement, and even a recycling song. In addition to this, in many of the major cities of Malaysia, several buy-back centres were also established.

Another key difference of the second national recycling program was that the MOHLG also invited several companies that were known to be the major procurers of recyclables to participate in the second national recycling program. Thus far, no report is available to make an assessment regarding the Malaysian National Recycling Program. Successful SWM requires the cooperation of the people, especially those who generate wastes. If they do not understand the rationale of certain procedures, such as separation of wastes, the compliance will be very low. For example, the recycling program has not successfully been implemented in Malaysia since 2000.

As NGO observed;

The government do not provide enough information regarding recycling. The rather well-hidden recycling website is also a let down. Information is sketchy and severely dated, as far back as 2001 and 2002. It gives the impression that the ministry is not interested in recycling.

Studies carried out by Local Government in 2005 estimated that the overall maximum recycling rate achievable in Kuala Lumpur is about 17% (table 8.2). This figure contrasts sharply with the current recycling rate estimated by various surveys to be between 3% and 5%. It is reported that the proportion recovered for recycling by scavengers, collection crews and from household's amounts to about 4%. The study also stated that to achieve a recycling rate of 20% or more would require activities such as composting of yard waste.

As senior officer said;

The solid waste sector has the potential to contribute significantly to the country's economy. Significant employment and business opportunities can be created. The experiences and expertise gained from privatisation and waste management can be an area of export from the country, particularly to developing countries

Table 8.2 Estimation of Achievable Recycling Rate in Kuala Lumpur

Recyclable Materials	Recyclable Waste amount (Tonnes per year)	Current Recycling (Tonnes per year)	Current Recycling Rate	Achievable Recycling Amount (Tonnes per year)
Paper	463.5	78.5	17%	232
Plastics	489.8	11.8	2.4%	73
Aluminium (non-ferrous)	16.43	2.03	12.4%	11
Steel (ferrous)	84.61	7.81	9.2%	63
Glass	70.0	-	0%	45
Total	1,124.37	100.14	41.0%	424

Source; MHLG, 2005

Environmental awareness is also reported relatively low in Malaysia. Whilst the Government may have the will and take the necessary action to implement the institutional structure to change the way that waste is managed, it may be unable to achieve change without the support and active participation of the people. The current recycling initiative, the National Recycling Programme, undertaken by the Ministry of Housing and Local Government, does contribute to a greater awareness of the need to preserve resources. However, public response has been disappointing, and reflects that greater public education and awareness is required. The focus of existing public awareness campaigns should be broadened to cover issues on the requirement for SWM facilities and the costs associated with SWM service provision. The public at large must recognise that they are active players in the waste industry, as waste generators, who have the potential to reduce waste for disposal. Therefore, no programme will be effective unless the public is actively engaged, at the very least in recycling programmes, and this remains a key priority for change.

According to senior officer, the most significant feedback from the questionnaire survey to the Local authorities undertaken in the preparation of the strategic plan study showed that the general lack of public cooperation is a major complaint. On the other hand, newspapers also publish complaints by the public on the poor management of solid waste by local authorities. This shows that much more effort is required to build confidence, understanding and cooperation between SWM service providers and the public. Overall, there is a lack of a concerted public educational programme on SWM at the national and local level. As a result, one of the key requirements to making a success of the privatisation of the waste management service is the improvement of public education and raising awareness of the issues. Pro-active and assertive steps must be undertaken on a continual basis to improve and sustain public awareness and active participation in SWM. EM theory also suggests that changes in cultural attitude and the structures of states and other institutions are enabling an environmentally sustainable form of modern society to emerge.

8.4 Issues and problems related to Solid Waste Management in Malaysia

Solid waste services are currently managed by Local Authority with a focus on waste collection, and to a lesser extent on disposal. Presently, waste collection is limited to service areas within the local authority and this is confined to wastes generated from households, commercial premises and public facilities. Waste from industrial areas or industrial premises and those from large private enterprises are served by private contractors.

There is little information on waste arising, the per capita generation rate or the composition, as only a few local authorities have operating weighbridges to record waste disposed. There is no systematic programme to collate information on wastes collected or disposed from various sources. In cases where SWM services have been taken over by the concessionaires, there are attempts to rectify this situation by the

installation of weighbridges at the disposal sites. However, until there is a formal agreement to allow implementation of the SWM privatisation, there are no serious attempts by the concessionaires to install weighbridges at all the disposal sites, due to the high cost involved. Similarly, information on recycling and re-use relates to surveys at one or two sites only, although there are attempts by the MHLG to obtain such data as part of its recycling campaign.

As a waste expert comments;

There is no proper system for the collection of data on solid waste generation in general, and on waste types and characteristics or waste minimisation initiatives, in particular. Most significant is the poor, incomplete, non-representative or outdated information.

In any national plan to manage waste effectively, it is necessary for reliable data to be available for planning and management and for setting re-use, recycling and recovery targets. (Chamhuri, 2007). It is clear that, to measure progress against targets, it is necessary to understand the baseline situation. For example, what waste is currently produced, how it is managed, what the constituent parts of that waste are and whether they are amenable to re-use, recycling or recovery. In the absence of such data, targets are meaningless and cannot be quantified. In addition to baseline data, against which to measure targets, there needs to be some sort of management and measurement tool capable of providing information on progress against targets.

Government leadership is vital in publicising the importance of good SWM by educating the nation as well as supporting any actions taken by the Local authorities in improving the waste management systems. In some cases, for local councils in Malaysia there are no non-statutory guidelines for them to follow in order to manage their waste. Looking at the leadership role on SWM in Malaysia at present, municipal solid waste is under the responsibility of the Local Government and

Housing Ministry, whereas the Department of Environment of the Ministry of Environment and Science is responsible for issues regarding pollution. When this happens, there is always a conflict of interest between two agencies. A single independent body should be established where waste is concerned. By doing this, in designing a SWM system, aspects of physical, technical, legal, institutional, financial, environmental and socio-cultural can be drawn together into a single integrated policy.

As the NGOs said;

"The local authorities have not been doing a good job in keeping their municipalities clean and pleasant. They certainly need assistance from the federal government, such as capacity building and introducing latest innovations in SWM, including recycling. The manpower and financial resources which will be needed to implement the policy"

As waste expert said;

"Lack of enforcement from the government level is always an issue. Any national legislation and policy on waste, which does exist, is not well documented. Most of the legislation has been devised to ensure cleanliness, sanitary conditions and public health and is not directly formed for the management of the municipal solid waste. Local authorities do not have enough funds to support enforcement support"

In Malaysia enforcement is not given serious attention by the local authorities. Due to this, the number of enforcement officers available is not sufficient. According to J.Jahi (2000), if enforcement is carried out consistently and without interruption from certain quarters, local authority areas can be as clean as they should be. In the UK for example, the enforcement comes from the regulatory body that is called the Environment Agency. In Germany, organisation is formed by the Landers (equivalent to state government) to coordinate in the implementation and enforcement of waste management. Malaysia should learn that an enforcement body

should be formed in order to monitor waste management issues which include the solid waste problems. The advantage of having a committee which comprises of agencies either government or non- government and enforcing waste management legislation and practices should be seen as an important option for Malaysia to consider seriously. In the United States for example, a strong rules and regulations enforcement is the basis of their waste management successes to date.

The current status of SWM in Malaysia makes it evidence that local authorities lack coherence in adoption of measures to effectively cope with the growing solid waste menace, while the citizenry appears to be ignorant under their supervision. The existing legal system governing the SWM sector needs to be modified to make it executable. The government should emphasize more on enforcement and implementation of the existing laws and regulations. The possible reasons for poor implementation could be a combination of social, technical, institutional and financial issues. Public awareness, political will, private and public participation are essential for the successful implementation of the legal provision. Moreover, the government should consider environmental impact assessment as a prerequisite for solid waste disposal sites that includes risk assessment and economic feasibility of the project.

As Waste expert pointed out;

"Lack of planning both at local authority and federal government levels, unclear policies and outdated ambiguous legislation are the most severe constraints faced by the municipalities in developing countries like Malaysia".

8.5 Conclusion

Proper waste management in developing economies in Malaysia is an important aspect to consider in minimizing further environmental contamination. In contrast, lack of institutional framework, weak enforcement, lack of technology, and ineffective policy implementation make the management of waste in Malaysia inefficient with a very low possibility of improvement and achieve sustainability of SWM. EMT suggests the need of national policy and effective management to achieve sustainability of SWM. Despite policy gaps and managerial problems, the national policy of SWM in Malaysia has failed to deliver sustainability of SWM. Transformation of the role of government is important to develop a sustainable policy for SWM and implementation of the policy to make sure that the policy could be delivering in a sustainable way at local and national level. The top down management and policy need to be change for more open, flexible and integrated approach to achieve sustainability of SWM in Malaysia. The government should take an initiative to improve or modify the SWM system and create effective system. The cooperation between public and private sector is an important aspect for the success of the government SWM program. The next chapter will present the survey result among the households in Malaysia regarding the household behavior and participation in SWM and link with the EMT with focus on institutional dimension.

Chapter 9

Household survey results

9.1 Introduction

Solid waste is one of the greatest environmental challenges facing most municipalities in Malaysia (MHLG, 2005). The amount of waste generated continues to increase in response to the rapid increase in population and accelerated urbanization and industrialization process. From a governance perspective, the management of municipal solid waste is an important and interesting case because it brings together a wider array of actors, including from all levels of government, local communities, householders and commercial service providers (S. Rachel, 2007). The household sector is the primary source of solid wastes in Malaysia, accounting for almost 60% the other important sources of solid wastes are industries, commercial establishments, markets, and institutions including schools and government offices. Read. A (2000) argues that, household waste is an element of MSW which by nature is one of the hardest sources of waste to manage effectively, due to the diverse nature of its content, diverse sources of generation and MSW management by local government is a statutory obligation. Households were also key elements the success of the national recycling policy.

The EMT considers the importance of the role of society behaviour in the context of production and consumption of daily life to contribute in environmental crisis (Spaargaren et al. 1999). Spaargaren (1997, 1999) has emphasized the fact that the theory of EM should re-consider the role of citizen-consumers in the context of the production and consumption cycles and the role of citizents, individuals or human agents in relation to institutional developments. Kit strange (2007) argues that the

role of householder as consumer and producer, as tax-payer and customer, and as democratic decision- taker- is perhaps the single most important element in assisting or obstructing moves towards a more resource- efficient, waste avoiding and sustainable future. EM also advocates greater public disclosure and community participation in decision making (Mol, 1999). Thus, public awareness and public participation from household in SWM is important for analysing sustainability of SWM. Empirical studies have confirmed that an efficient SWM services derives from an appropriate participate of public, private agencies and community (United Nation, 2003). On the other hand, strong involvement from government, private sectors and NGOs are also crucial for sustainability policy of SWM (M. Joseph, 2007). This chapter presents the result of the survey among the households in Malaysia regarding the household behavior and participation in SWM. This chapter examines the public participation and awareness among the households in Malaysia towards sustainability SWM and link with the institutional dimension of EMT.

9.2 Knowledge and attitude regarding Solid Waste Management among households in Malaysia

This section discusses the knowledge and perception among households regarding SWM collection and service that are provided by local authorities in their area. Respondents were asked questions about types of solid waste collection services, frequency of collection, and level of satisfaction of collection services among households provided by local authorities. The purpose of this survey was to gain some information about solid waste collection services and how householders regarded the service collection that was provided by local authorities. Responses and perception from households are very important in order to analyse sustainability of policy and practice regarding SWM in Malaysia.

9.2.1 Householders knowledge and Attitude Regarding Municipal Solid Waste Collection Service

Solid waste collection includes not only the gathering of solid wastes and recyclable materials, but also the transportation of these materials, after collection, to the location where the collection vehicle is emptied. This location may be a material processing facility, a transfer station, or a landfill disposal site. In small cities, where final disposal sites are nearby, the hauling of wastes is not a serious problem. In large cities, however, where the haul distance to the point of disposal is often greater than 15 miles, the haul may have significant economic implications. Where long distances are involved, transfer and transport facilities are normally used.

In this survey, respondents were asked whether they were aware or not about solid waste collection in their area. Virtually all respondents know that household waste collection services are provided in their living areas. The survey shows that 75% of respondent said waste collection was provided in their area, 23% not provided and 1% not sure whether the service was provided or not. In general, the survey shows that most of the respondents are aware about waste collection systems in their area.

The survey shows that there are three types of waste collection in an area. 43% of respondent used door to door collection services, particularly in big cities such as Kuala Lumpur, Penang, Johor Bahru and Selangor. Households will be charge on average RM 60 per year, for a door to door collection service. However, the communal bin seems the most popular service (55.9%) chosen among households in Malaysia particularly in small cities. Most of the respondents are not willing to pay for the waste collection service, so that is why they choose communal bin services (Table 9.1). There are about 21% of respondents who choose self bin services which means they used their own effort to dispose of the garbage, for example by using their own transport to collect their waste and dispose to the bin provided by local authorities. In this case, respondent were asked why they choose this service.

The response was that there was not a waste collection service or bins provided in their area. Therefore they need to collect their garbage and throw to the bins which are normally located 2.5 miles from their house. From the observation it was found that this kind of problem always happened in small cities and particularly in rural areas. The collection rates vary from state to state due to differences inefficiency in collection and transfer. For example in Kuala Lumpur, the capital city of Malaysia, 80% of all waste is collected (Lina Lau, 2003)

Table 9.1. The type of waste collection service

Types of collection	Frequency	Percentage
Door to door collection	43	22.9
Communal bin	105	55.9
Others (self bin services)	40	21.3

Source; survey 2009

According to survey (2009) in Malaysia the collection of solid waste in the rural areas are often neglected. The current collection system focuses mainly on urban or areas with a proper access road (housing area). In fact, wastes from illegal settlements in urban areas are often not collected mainly due to improper access roads and wastes from traditional villages have never been collected. The waste generated is regularly dumped into rivers, buried or burned by the residents. Therefore, data on waste generation and discarded/disposed at such areas are not available. In some cases, they used their own transport to throw the waste in the bins that are provided by local authorities. Commonly most cities in Malaysia are deprived of proper waste collection services and only a fraction of generated waste is actually collected. Financial constraints and lack of technical expertise severely limit the effectiveness of solid waste collection and transportation. Inefficiency in collection systems creates a main constraint on SWM capacity.

There are potential health and environmental risks from improper handling in the collection, storage, transportation, and transfer of solid waste. Solid waste is a source of contamination and pollution to humans, scavenging animals, and bats. As the

organic portion of the solid waste ferments, it gives off a foul odor which attracts flies in addition to causing air and water pollution.(P. Agamuthu, 2001)

Collection accounts for almost 50 percent of the total annual cost of urban SWM (MHLG, 2005). Typically, collection is provided under various management arrangements, ranging from municipal services to franchised private services conducted under various forms of contracts. From this survey, 40% of respondents knew that waste collections were provided by local authority, 34% of respondents believed that waste collection services were provided by a private waste contactor. However, about 20% of respondent are not sure that household waste collection services are provided in their living areas.

Table 9.2 Frequency collection of solid waste collection in Malaysia

Frequency of collection	Frequency	Percentage
Every day	46	24.0
2-3 times per week	71	38.0
Once a week	13	7.0
Not on schedule	58	31.0

Source; survey 2009

The survey shows that 38% of respondents said the average frequency of waste collection is 2-3 times per week in many areas. Only 24% of respondents said every day and about 7% said only once a week (table 9.2). However, the survey also found that 31% of respondent said waste collection services in their area is not on schedule. Sometimes, the garbage is not collected for a few days and this is getting worse because some of the areas are just provided with open bins which mean there is no cover of the bins. When the bins were overloaded, respondents normally just throw their trash outside the bins.

Frequency of collection of waste becomes a critical issue in developing countries, including Malaysia and especially those in the humid tropics where high temperatures and accelerated decomposition of organic waste is a major issue. Daily collection of waste not only requires a larger work force than in countries with a

weekly collection system, but also has a significant impact on equipment and its maintenance (A. Idris et al., 2004).

9.2.2 Level of Satisfaction of Waste Condition among Householders

In this survey, respondents also were asked about level of satisfaction regarding waste collection services that are provided by local authorities in their area. Generally, households in Malaysia show different levels of satisfaction of collection services from local authorities in their areas. The result shows that, of the 188 respondents surveyed, 47% of respondents indicate they are "satisfied" with the services and 10% "very satisfied" with local waste conditions (table 9.3). Differences in householders' views on local waste conditions neither differ significantly among areas and household education levels. However, 80 respondents (40%) were not satisfied with the waste collection services and local waste condition, the problem of greatest relative importance is "time of waste collection not fixed". Next in order of importance are "waste collectors don't collect all the waste and too infrequent waste collection that can attract mosquitoes and flies. The remaining percentages of respondents indicate not being very satisfied with the general street cleaning and local waste conditions in their area.

Table 9.3. Level satisfaction of waste condition among household in Malaysia

Level of satisfaction	Frequency	Percentage
Very satisfied	19	10
Satisfied	89	47
Not satisfied	80	40

Source; Survey 2009

9.3 Solid Waste Attitude and participation in recycling activity among households in Malaysia

This section discusses public attitudes to waste behavior including recycling, sorting of waste at the source and waste disposal habits among households in Malaysia. Overall the public are aware of problems dealing with solid waste, however, their attitude is still low with regards to the practice of recycling etc. Environmental awareness and behavioral knowledge has been found to play a significant part in shaping waste management behavior. (S.Barr et al. 2007). In this study, recycling is seen as one of the most sensible solutions both economically and ecologically for managing and analysing sustainability of SWM in Malaysia. On the other hand, a recycling programme is also a key dimension in addressing EM process.(A.Scheinberg, 2008).

The survey showed that the majority (99%) of respondents claimed that they are aware of a recycling programme in their area, however only less than 30 percent of them were participating in the programme. By far the most common sources of information about recycling programmes for all respondents collectively are television (92%) and Local authority (6%), followed by newspaper and friends (1%). However, integrated use of all media can increase public participation (Abdelnaser et al., 2006), whereas traditional methods of promotion (including media campaigns, leaflet drops, newsletters, etc) can only achieve a limited level of success in shifting public perception, behavior and attitude (Grodzinska-Jurczak et al., 2006).Table 9.4 illustrates the results of various sources through which households obtained information about recycling.

Table 9.4 Source of information regarding recycling programme

Source of information	Frequency	percentage
Local Authority	12	6.4
Newspaper	2	1.1
Friend	2	1.1
TV/mass communication	172	92

Source; Survey 2009

An education campaign will need to be conducted in order to encourage participation in the scheme by householders from a life cycle perspective and to motivate positive recycling and waste minimization behaviour in the community (MHLG, 2005). Results from the questionnaire show that changing the attitude of residents towards protection of the environment, which has been shown to be one of the main drivers of recycling and waste minimization behaviour , will need to be the thrust of the educational campaign. Read. A (1998) proved that the success of a recycling scheme depends largely on the public's participation. Increasing household participation must be carried out using all available media, such as television and radio networks, as well as newspapers, to increase public awareness. Without appropriate information and rising of public awareness, new plans will fail to be implemented and new systems not effectively utilized (Read, A, 1999). Additionally, the study by Evison and Read (2001) stated that using a regular leafleting campaign to help to maintain public awareness, interest and understanding was vital for maintaining good responses.

In order to increase household participation, the message of recycling and other forms of appropriate waste management need to be adequately communicated to the public, so that residents' habits, behavior and traditions can be changed for the better, enabling local authorities to achieve government goals of recycling and recovery (Robinson & Read, 2005). In contrast, adverts in the local press intended to raise awareness of a scheme in Glasgow, Scotland, appear to have made little impression on the public and the visual impact of the sites themselves seemed to have been the

best advert. A similar conclusion was reached by Belton et al, (1994) concerning the futility of newspaper adverts for a 'bring' scheme in Glasgow, where 84% of users had learnt of the bring sites existence simply by seeing sites.

When housing conditions and other socio-economic matters are taken into account differences in attitude to recycling are seen. Most clearly in the case of rural areas, where they did not know of a recycling programme or how to participate in recycling activities. On the other hand, a less educated background and low income also influence their attitude to involvement in recycling. For example, the survey found that respondents who lived in rural areas show less concern and willing to be involved in recycling programmes. However, in urban areas the public shows a good effort to contribute in recycling activities. This survey also shows that men in general and people without a college education normally are less- likely to recycle.

The study suggested more than a few strategies for the government to achieve sustained success in its recycling campaign. As Price (2001, P, 334) says the role of the local authority and actions of the householders are paramount to the success of sustainable waste policies. Firstly, to improve the operational aspects of recycling facilities by improving convenience by placing recycling bins in more accessible and visible locations particularly in small cities and rural areas. Local authorities also need to make their recycling service reliable, convenient and easy to use because the conventional dustbin, a convenient and reliable single point of disposal, is seen by many householders as a better option than recycling (Martin et al., 2006).

Peurin and Barton (2001) note that the key link in increasing recycling rates is the householders. Belton et al. (1994) point out that not only is public participation in recycling essential but that there must also be a market for recyclables; some understanding of the public's attitude towards buying products made from recycled materials is therefore necessary. Secondly, local authorities need to work closely with private sector companies and NGOs to design a range of waste containers that are suitable for given locality. In this case, clear instructions should be provided as to

how the schemes operate and they must communicate the benefits of recycling, and emphasize that recycling does not have to be inconvenient, or take up too much time or space in the home (Read, 1999; Thomas, 2001). Thirdly, awareness of recycling and concern for the environment should be inculcated from an early age. Unfortunately, there is no formal subject dedicated to achieving this purpose in the present education system at primary and secondary level in Malaysia. The survey also found that the involvement from local authorities, private sectors, and NGOs in promoting recycling programme show a weak commitment. The study suggests that the Malaysian government should encourage civil society and community groups to continue to work with local communities as well as with government. Parts of civil society are well placed to work with communities on a wide range of waste issues, including helping to educate people about how to reduce waste and manage it more effectively, including through participating in wider campaigns on waste, developing networks around particular location or services, facilitating volunteering, and working with communities to increase their participation in local decision-making on waste issues. The study argues that cooperation and the building of social capital between stakeholders are crucial to the EM platform.

9.4 Waste Disposal Habits of Households

Waste disposal habits or behavior are determined by climate, cultural factors, housing conditions, expectations about the role of (local) governments and other factors (A. Idris et al, 2004). Also, some characteristic of waste (for example, odour and the impact of flies and rodents) exhibit a distance decay function. When primary waste collection service is not reliable, people explore other options. When regulation is either absent or is followed in its breach rather than compliance by a majority, there are incentives to dump the wastes in open access spaces such as streets and public spaces. In hot and humid climates, there are disincarnates for accumulation or storing of wastes and positive incentives for disposing of wastes as and when they arise waste management in any city in the developing world requires

understanding and realigning these incentives in institutional arrangements.(Zalina, 2000)

The survey shows that the majority (80%) of respondents have a problem with waste storage in their area. The present situation with respect to on-site storage varies from one area to another. However, in most cases on-site storage is not satisfactory; storage is not secure, and does not allow for effective collection, resulting in health and environmental problems. Dustbins usually remain open, increasing the risk of epidemics from infectious diseases such as hepatitis, typhoid fever, anthrax in animals, tetanus, and pneumonia. Open bins allow for the easy transmission and spreading of infection pathogens such as *Salmonella typhi, Salmonella paratyphi, Bacillus anthralis, Clostridium tetani, and Clostridium perfringens*, many of which are present in health- care waste.(M.Nassir, 2002).

Residents with no proper waste storage facilities particularly in rural areas, often hang waste packed in plastic bags outside the house, on fences, trees, or left at the roadsides. Apart from the aesthetic problems, this contributes to the inefficiency of collection. Insufficient supply of communal trash cans results in the storage area becoming a dump site. Scavenging by rodents and stray animals eventually leaves the waste scattered all around the site, and this is unhygienic and can cause health problems to local residents.

Table 9.5; Method of disposal among the household in Malaysia

Method of disposal	**Frequency**	**Percentage**
Dispose in my own dust-bin	75	40
Dispose in a public dust-bin from a private source	44	23
Burning	24	13
Put in a plastic bag placed in front of my house	20	11
Pile loose in front of my house	20	11
Others	5	3

Source; survey 2009

The survey found that households have few options to dispose of their waste (table 9.5). Result shows that 43% of respondent, normally in urban areas throw their waste in the bin that is provided by local authorities, 34% of respondent used communal bins where only one bin is provided in every area and sometimes respondents found it difficult to throw their trash because the bin was always over loaded. This survey also found that 13% of respondents burn their waste as an option to dispose of their waste and it seems this happened in small villages in Malaysia. Other methods of disposal are; put in a plastic bag placed at curbside and pile waste loose at curbside (11%).

Some of the common problems of storage in Malaysia are:

a) Bin lids, which are damaged or lost, are often not replaced leaving waste exposed, emitting odour and attracting flies, rodents and stray animals

b) Residents with no proper storage bins often hang waste packed in plastic bags outside the house, on fences, trees or just left on the road side- apart from the aesthetic problems, this contributes to the inefficiency of collection.

c) Insufficient supply of communal bins result in the storage area becoming a dump-sites

d) Attacks from rodents and stray animals eventually leave the waste scattered all around the site and this is unhygienic to the public.

The survey found that poor storage facilities, public attitude- wide variation of types and size used and haphazard storage collection by residents contribute to the inefficiency of collection. Financial and institutional constraints are the main reasons for inadequate waste disposal in Malaysia. Introduction of SWM user fees cover only the collection and transportation costs leaving practically no resources for safe

disposal of the waste (MHLG, 2005). The government should reinforce the management aspects of SWM disposal by encouraging and promoting private sector participation either as individual units or as joint ventures for investment in waste recycling, marketing and utilization of SWM for environmental friendly projects. However, the management of such enterprises must be under the supervision of the government for monitoring their effectiveness.

9.5 Conclusion

The result from the survey among households in Malaysia shows less concern to contribute in recycling activities. Education background, condition of house, established income were the main factors influencing people to contribute in a recycling programme. However, there is also a lack of facilitates provided by local authorities such as recycling bins and information related to recycling that influence peoples not concerned with recycling and not aware of waste problems. In some cases there is no recycling bins provided particularly in rural areas and so it is not possible for the public to participate in recycling activities. The survey also found that there are few options for how respondents can dispose of their waste. 23 % of respondents choose to burn their waste particularly in small cities. Lack of storage provided by local authorities was the reason given why respondents burn their waste as an option to dispose of their waste. Its seems that society in Malaysia is still not aware regarding waste problems and some of them are not interested to contribute in any activities that relate to SWM.

In summary, the whole system of SWM in Malaysia is still weak and fragmented. There are also problems in institutions arrangements and managerial aspects in SWM thus, national policy for SWM in Malaysia is important to deliver sustainability of SWM. Awareness on the problems and impacts associated with solid waste generation, collection and transport, and disposal must be promoted through

campaign and education. The government should become more open and flexible to take an initiative to improve the SWM system and create a sustainability system for SWM in Malaysia. The public and private participation also plays an important aspect for the success of the government programme in delivering positive impact towards sustainability SWM. Ecological Modernisation theorists contend that the recognition of environmental problems is starting to reshape the institutions and everyday social practices of modernity in fundamental ways.(Spaargaren, 2000). The active engagement of citizens making choices in their consumption that pushes the government and the economy along in their embrace of ecological rationality. Thus participation and household behaviour in SWM is crucial to delivering sustainability policy of SWM in Malaysia.

A key aspect of governance for sustainability is the capacity of individual citizens and organisations to develop an informed perspective on critical issues relating to sustainability. Civic education is crucial to the development of new ways of creative solutions to intractable social and environmental problems.(Benn.S et al. 2005). Governments, private sectors and NGOs all have a role to play in contributing to civic education for sustainability of SWM in Malaysia and assist in the development of an active public sphere. The relationship between decision makers and experts to inform and educate individuals to be involved in environmental self- governance is evidence for EM.

Chapter 10

Conclusion, limitations and recommendations

10.1 Introduction

The study aims to analyses sustainability of SWM in Malaysia. In this study the institutional dimension of EM theory will be focused to achieve the aim of the study. The theory of EM has become one of the dominant sociological theories that try to understand and interpret how modern societies are dealing with the environmental crisis. Ecological Modernisation is found to be a partially satisfactory approach to explaining the policy and institutional organisations in SWM in Malaysia. The study argues that MFA can be used as a decision tool for policy makers to formulate sustainability policy for SWM and as a platform to deliver EMT process in Malaysia. MFA has proven that it can deliver useful information for issues related to resource scarcity, pollution abatement, and waste management (Binder et al. 2009). The chapter will summarise the main results and conclusions of the study. Section 10.2 presents a summary of the findings from the theory of EM. Section 10.3 highlights MFA approach and how to apply analysing sustainability of SWM. Section 10.4 presents the results survey. Limitations of the study are discussed in section 10.5. Finally, section 10.6 suggests areas for further research.

10.2 The theory of Ecological Modernisation

Ecological Modernisation is manifest in institutional transformations in government and one of the goals of these transformations is to overcome the environmental crisis. Mol and colleagues (Mol, 2006; Mol and Sonnenfeld, 2000a, 2000b, 2000c) suggest EM theory can be thought of in terms of clusters or themes of social and institutional transformations and practices. Key to these transformations and practices is

implementing a form of environmental governance that enables capacity building the ability of a society to identify and solve environmental problems, seen to depend on factors influencing strength of governance, as well as cognitive, politico- institutional and economic- technology conditions (Janicke 1990; Weidner, 2002). In this study EM theory has been used as a reference for analysing the sustainability of policy and institutional structures that control waste management in Malaysia. The study found that EM not only provided a way for environmental sociologists to more directly conceptualize environmental improvement; EM also provided a fresh perspective on the role of environmental movements by avoiding their romanticization, and by appreciating the particularly fundamental roles that sciences, technology, capital, and state might play in the processes of environmental improvement. The changes regarding the traditionally central role of the government and the nation-state in environmental reform; more decentralised, flexible and consensual styles of national governance with less top-down hierarchic command-and-control regulation emerge. Thus, the EM theory requires the integrated national policy system of SWM and effective to achieve sustainability policy of SWM in Malaysia.

Ecological Modernisation research has examined the institutional changes that accompany a shift from government to environmental governance. In an early contribution Weale (1992) referred to 'the new politics of pollution', and subsequent work has explored the transformation of a wide range of institutions in the face of environmental challenges. Discussions concerning the role of governments in the process of EM have been profoundly influenced by political modernisation debates. Thus, the study argues that the role of government in managing of SWM in Malaysia need a reform to become more open and flexible in dealing with complexity social of SWM system in Malaysia. Top down management approach in SWM should be replacing with more decentralised, flexible and consensual styles to tackle the issues of SWM.

According to Mol (1995, 2000), EM theory has identified two options for strategies to overcome the deficiencies of the traditional bureaucratic state in environmental

policymaking. First, a transformation of state environmental policy is necessary: from curative and reactive to preventive, from exclusive to participatory policy-making, from centralized to decentralized wherever possible, and from domineering, over- regulated environmental policy to a policy which creates favorable conditions and contexts for environmentally sound practices and behavior on the part of producers and consumers. The state will have to widen the competence of civil law in environmental policy, focus more on steering via economic mechanisms and change its management strategy by introducing collective self-obligations for economic sectors via discursive interest mediation.

The second, related, option includes a transfer of responsibilities, incentives, and tasks from the state to the market. This will advance and accelerate the ecological transformation process, mainly because the market is considered to be a more efficient and effective mechanism for coordinating the tackling of environmental problems than the state. The central idea is not a withering away of the state in environmental management, but rather a transformation in the relation between state and society and different accents on the steering role of the state. The state provides the conditions and stimulates social 'self-regulation', either via economic mechanisms and dynamics or via the public sphere of citizen groups, environmental NGOs and consumer organisations. In this theory, the state plays a prominent role, with little real significance attached to abstractions like the 'free' market. The state constrains market through policies that establish incentives to channel market behaviour in environmentally sound directions (Mol and Spaargaren, 2000; Spaargaren et al., 2000).

The theory of EM may have more to offer as a theoretical approach where it allows us to think about problems in environmental policy area. Dryzek (1997) argues that EM implies a partnership in which governments, business, moderate environmentalists, and scientist cooperate in the restructuring of the capitalist political economy along more environmentally defensible lines. Bache and Flinders (2004) suggest that governance refers to the increased role of NGOs in public policy

making and delivery. It captures a more complex relationship between state and society where the state's role is coordination rather than control. In case of SWM in Malaysia there is lack of contribution and cooperation from private sector and NGOs involve in SWM. There is no strong social network between public sector and private sectors in national planning and management related to SWM. For example, the privatisation process has been found not successfully implemented in managing SWM in Malaysia. Thus the study argues the Malaysian Government and local authorities should jointly introduce truly integrated policies in order to achieve effectiveness SWM in Malaysia. Closer engagement is also needed between public, civil society, market and state in improve sustainability SWM in Malaysia.

10.3 Material Flow Analysis

In the past 20 years, several methods have been developed which allow a qualification of the use of natural resources by modern societies. Material Flow Analysis (MFA) is one of the key methods and internationally recognized as an important tool for evaluating environmental policies. The principle concept underlying MFA is a simple model of this interrelation between the economy and the environment, in which the economy is an embedded subsystem of the environment. This study found that, MFA could be useful tool for analysing sustainability of SWM. Based on the basic conceptual of MFA the framework of MFA for SWM has been developed for analysing sustainability of SWM in Malaysia. MFA framework measures the waste flows system and processes for example waste generation, temporary storage, transportations, and treatment and disposal systems. Therefore, using MFA approach as a framework, the existing SWM system can be evaluated and analyses sustainability of SWM system. MFA approach also analyse the actors and institutions involved in SWM in Malaysia in order to achieve sustainability policy of SWM

Material Flow Analysis tool also can be used as a tool to support policy decision making in the field of SWM. EM suggests that in the face of increasing solid waste

management problems, responsive forms of governance should emerge perhaps using different forms of economic or policy interventions. Thus, MFA would constitute one such type of interventions. In terms of policy, MFA can be used for early recognition, priority setting, to analyses and improve the effectiveness of measures and to design efficient material management strategies in view of sustainability. The MFA approach provides useful information to measure environmental problems that could be possible to link with EMT.

There are several areas of MFA application to consider for assessment purposes. First, MFAs could be used for identification of major problem flows to the environment, together with an analysis of the causes by stepwise tracing them back to their origins in society. MFAs could also be used as a basis for priority setting in SWM, by assessment of the effectiveness of potential measures of material flows, as a means of either pollution abatement of rendering of more efficient resource utilization. It may also serve as a screening tool, identifying issues for further and more detailed investigation by other tools. In addition, MFA could possibly play a role in between the present and future SWM strategies. It is likely that an early adoption of MFA in solid waste could promote and speed up the change towards regional SWM. In relation to this, MFA can be considered as technical tool for physical input-output analysis, a tool used for regional and structural economic analysis in relation to regional development planning of SWM. In this study MFA can be used as a policy intervention to tackle the problem of SWM and as a platform for analysing sustainability of SWM using institutional dimension of EMT.

10.4 Survey results

The phone survey results show that most decision- makers in local authority in Malaysia were less knowledgeable about complex issues of SD and were expressing low concern with the regard to behaviour for environmental awareness; this highlights the essential points of the preparedness and their contribution in meeting the challenge of SD. Local Agenda 21 is very important to adopt in local authority

plan, however is seems that most of the local authorities are not ready to apply the Local Agenda 21 plan.

Another finding of this survey is that most decision making in SWM by the local authority is mostly done based on an ad-hoc basis which has led to a non-strategic practice for SWM. Ineffective of local authorities planning is also caused by non-formal existence on data collection neither on municipal solid waste collection, generation nor on its composition. Data are acquired only when there are studies conducted on certain local authorities by interested parties or by private consultant when required by the local authorities. Therefore, any waste future projection and target to set up are impossible to implement by the federal or local government. In decision making, the environmental and economic cost should also be taken into account. Following that, matters pertaining to waste, the environment and economic impact of waste are the main concerns in formulating a sustainability policy of SWM in Malaysia.

In EM suggests that the government and state have an important role to play in promoting changes in economic activity that are environmentally beneficial. For example, EM in developing economies must take into account features such as the tendency for environmental policy networks to be dominated by government and industry elites and the lack of a coherent environmental movement associated with a lesser role for civil society. In Malaysia, SWM is under the responsibility of local government and today this issue is becoming more critical due to unresolved problems at local and national levels. Thus, EMT in developing economies seems more difficult to deliver for SWM and need for more transformation the role of government in integrated SWM policies across their various functions. They should encourage more civil society and stakeholders involve in formulate sustainability policy of SWM.

The most fundamental aspect still unsolved is the basic information about waste for example the comprehensive data on the sources and types of solid wastes.

Comprehensive data of solid waste is important to formulate sustainability of solid waste in Malaysia. In designing a SWM system, all physical, technical, legal, institutional, financial, environmental and socio-cultural aspects of SWM should be considered and taken into account. Even Malaysia formulates clear policy but they still have problems with the implementation of the policy. For example with a 3Rs policy (Reduce, Reuse and Recycled) and support for systems of waste disposal the nation has a poor performance. To achieve SD, national policies and programmes must aim to improve the quality of life and distribute resources more equally. The objective of EM is to increase the efficiency of material use through waste minimization and recycling, and changing the composition of output by moving away from products that are material intensive to those causing less damage to the environment. Thus the policy of waste reduction and recycling programme are important element should be addressed in formulate policy for sustainability of SWM in Malaysia.

Working towards a sustainable waste management involves a wide-range of groups and requires commitment at all levels. It is important that all stakeholders such as the Federal, regional, local government, industry, non-governmental organisations (NGOs) and householders are clear about their responsibility. Inefficiency in SWM in developing countries is commonly caused by inefficient institutional arrangement of the municipal government. Top priority concern amongst the institutions is to create an interactive process on SWM issue, where waste is treated as a resource. A National waste policy and strategy on SWM that creates co-operation and integration among governments, planning developers and public should be established. However the study found that the national policy of SWM in Malaysia is still fragmented and there is lack of institutional arrangements among the actors involve in SWM.

The institutions involved are the federal government, state government and local government where their roles are to provide the services and be closest to the public and stakeholders. However, there is lack of coherent and integration policy all level governance in SWM in Malaysia that make the national policy process of SWM

become more difficult to achieve sustainability policy of SWM. Therefore, the gaps among the institutions in SWM should be removed and integrated management among the agencies is important for efficient implemented sustainability policy of SWM. In order to formulate sustainability policy of SWM, the government should consider waste management issues as one of their top priorities and it is important for the institution to create an interactive process and waste should be treated as a resource.

The need for privatising of municipal solid waste (MSW) in Malaysia is based on the notion that the Municipal government is inefficient in managing waste services. Although the local authorities have acquired large manpower and equipment facilities, they are faced with limited a budget. Although a large proportion of the allocated budget is given for waste management compared to other services such as sanitation facilities, the fast population growth followed by the conurbation municipal area that extends the collection area have reduced the efficiency of municipal government to manage MSW. Thus, privatising MSW management to the private sector as an alternative provider of urban services is one of the answers to this problem. However, the study found that the privatisation process has failed to achieve in Malaysia to deliver national SWM system and there is more complicated issues faced by government dealing with privatisation of SWM in Malaysia.

From the household survey in Malaysia, the study found the participation from householders is also important to achieve sustainable SWM in Malaysia. Waste in Malaysia is dominated by organic waste which is almost 60% generated from household waste. This is why people have to be informed how to reduce the waste generation through comprehensive education especially in recycling activities. The study argues that recycling programme is a key dimension of EM theory that needs to implement in national solid waste policy in Malaysia. Gerhard (1994) carried out a study on waste minimization and recycling strategies and their chances of success by using different scenarios combining ecological and economical aspects with facts and trends in human ethnology. He found that the household waste fraction could be

reduced 10% by recycling. He also concluded that waste minimization and recycling could be successful given the cooperation of different public educational programs on waste management. On the other hand, National Policy in Malaysia should give more priority to the 3R programme (Reduce, Reuse and Recycling). Many programmes have been implemented, for example JICA working project on minimization Solid Waste through 3Rs programme. However, the public have to be more informed regarding recycling and how to change the public behaviour towards sustainability of SWM.

For example, a designed recycling programme without any participation and willingness from the public will not be successful. This is what happens in Malaysia, whenever the local authorities implement a project on recycling, the participation from general public is always not satisfying and end up with termination of the programme. In this matter education is the most important tool in making the programmes successful. Education mentioned here involves all levels of the public with different method of approach such as environmental awareness and education especially for school level and public in general, staff training on environmental awareness for industries, institution and partnership among public. Thus, an integrated responsibility approach is vital in tackling the waste problem and must include local government, NGOs and public participation.

10.5 Limitation of the study

Despite the complexity of the concept of EMT and sustainability issues, there is lack of knowledge and understanding among the state government regarding the conceptual of EMT and sustainability policy in SWM. The local government and local authorities not be able to provide comprehensive information regarding the issues of SD. Thus, the study found difficulty to gain the information among the state government regarding the theory of EM and sustainability issues of SWM in

Malaysia. There is also limited studies done in Malaysia relate to EMT and Solid Waste policy. The study found difficulty to find evidence of EM process in terms of Solid Waste policy and practices in Malaysia.

Accurate data of SWM is also important to a develop model based on MFA approach. However in Malaysia there is a lack of comprehensive data and information regarding SWM. Even if it is available, the data is scattered and inconsistent, and the method for data collection is not properly defined and thus is subjected to a lot of variations and uncertainties. Thus, the result of MFA method is not satisfactory to be applied in Malaysia. The phone survey technique and interview has been used in this study to gain some information regarding SWM among the local authorities, senior officer, waste experts, and NGOs in Malaysia. The study found that there is a lack of commitment and interest among the senior officer involved in the survey. With regard to the fieldwork, there were time limitations and financial constraints which affected the study.

10.6 Suggestion of the further research

Further research is highly suggested on the following areas.

The EM has potential to be applied in managing of SWM and policy in Malaysia. The core scholarship on EM deals with changes in institutions and social practices, rather than on physical improvements in the environment or in the patters of natural resource consumption (Mol and Sonnenfeld, 2000). One central transformation is that of the role of the nation state. The state is seen as altering its traditionally central role, being transformed to a more decentralized and advisory position .Thus, the transformation of the role of the state and government in Malaysia should be highlights in managing sustainability of SWM. The policy style in Malaysia needs to be change from centralized, less top-down approach, static and hegemonic to more

decentralized, flexible, deliberative and consensual style. On the other hand, changes in the performance of what has come to be known as the 'environmental state' have been seen as going together logically with increasing engagement with economic actors and new roles emerging for civil society actors, such as non-governmental organisations. In addition, civil society sometimes in the form of social movements, is seen as shifting from the role of critically commenting on political issues to that of being important participants in ecological transformation. Thus, the non-state agents and civil society should be encourage to be participate more actively in the policy process in managing SWM at all stages, including implementation process.

The initial problem facing both SD and EM is the cautious or incrementalist approach used by government. Certainly, evidence in this study suggests this cautions approach will not work for implementation of EM core themes in the area of solid waste policy. As a possible avenue of future research, the idea of Transition Management as developed by researchers in the Netherland, described intergenerational societal transformation processes that lead to measured structural change at both a macro and micro level. A transition is " described as a set of connected changes, which reinforce each other but take place in several different areas, such as technology, the economy, institutions, behaviour, culture, ecology and belief systems" (Rotmans et al. 2001).

The study also suggests that the Malaysian Government should adopt the Market-based instruments (MBIs) as complementary tools for environmental protection in the Malaysian context of rapid industralisation and emerging economic and financial systems. As Susan Baker (2007) describes how Ecological Modernization requires the development of new environmental tools such as market based instruments (ranging from treable permits to eco-taxes), eco-labels, environmental management systems, negotiated voluntary agreements and code of practice. Eskeland and Jimenez (1992) state that MBIs provide equal incentives to all by increasing the marginal cost of polluting. With many heterogeneous polluters and weak public administration, the Command and Control (CAC) policies are not effective in

implementation.The authors conclude that MBIs provide greater certainty about abatement costs which are superior when there are concerns that underestimating costs would yield controls that are “too strict” and environmental quality that is “ too high”. Such concerns trouble policy makers in many developing countries. Empirical studies in the United States (US) show substantial efficiency gains associated with using MBIs rather than non-MBIs (United Nations Environment Program, 2004).

Ecological Modernisation theory informs market-based instruments (MBIs) for environmental management, appealing to both governments and industry because they are proactive, enabling approaches to manage impacts. They encourage firms through economic incentives to uptake technologies and practices to reduce their environmental performance, while promoting longer term lower operational costs through eco-savings, and to encourage responsible purchasing by customers.The rise in uptake of MBIs, as opposed to command and control systems, can be interpreted as evidence of uptake of Ecological Modernisation by public sector agencies. MBIs allow market agents to regulate themselves as they have the most accurate information, they are dynamic systems that provide economic incentives for continued improvement, eco-savings made can be reinvested, and through appropriate resources pricing they preserve resources for future generations. Thus the study argues that MBIs provide the useful tool to adopt in Malaysia context for effectiveness sustainability policy of SWM.

This study also examined that MFA is considered as a useful tool for measuring sustainability of SWM in Malaysia, however due to lack of accurate data of SWM the MFA method cannot be able satisfactory applied in Malaysia. MFA method should be adopted in Malaysia as a sustainability tool for measuring sustainable SWM. In order to adopt this method, government should develop a data base for SWM in Malaysia and provide a comprehensive information regarding SWM. On the other hand the government should identify the possibility of a global system of national accounting and indicators for sustainability. There is also a need to understand more fully how MFA can assist policy.

10.7 Conclusion

The study found that there is a lack of coherent and integration policy all level governance in SWM in Malaysia. There is considerable overlap of administrative and enforcement authorities at the national, regional, and local levels as far as environmental control is concerned. Moreover, adequate municipal SWM is much more than a technological issues it always also involves institutional, social, legal and financial aspects and involves coordinating and managing a large workforce and collaborating with many involved stakeholders as well as the general public. Thus, there is a need for a more integrated approach to SWM , policy, economic, resource, and social management.

Ecological Modernisation theory is a useful theory that tries to understand and interpret how modern industrial societies are dealing with the environmental crisis. The core element of EM offers many opportunities to apply in SWM. The theory of EM suggests the need of national policy system of SWM to achieve sustainability of SWM. However there is lack of institutional arrangements, policy gaps, insufficient man power, financial supportive problems, and social and behavioural unresponsiveness dealing with SWM in Malaysia. National policy system of SWM needs a transformation of institutional structures and role of government to deliver sustainability policy of SWM. Thus, in order to deliver sustainability national policy of solid waste the Malaysian government has to take some actions to shift the institutional structures of SWM and improve the SWM system in Malaysia. The role of government has to become more open and flexible to deal with complexity social of SWM in modern societies. The government also should consider waste management as one of its target field in the policy for sustainable national development. To set up a national waste policy and guidelines, sustainable approach and commitment should be introduced in Malaysia.

The local government in Malaysia also is facing many problems in SWM including lack of comprehensive data of SWM to formulate sustainability national policy for SWM. Government is still struggling with basic issues of having reliable and consistent data on waste generation rate and its characteristics. Therefore, MFA tool is relevant as a sustainability assessment for analysing sustainable SWM in Malaysia but requires integration into the social and institutional processes. MFA also provide background for EM process to achieve sustainability policy of SWM in Malaysia. In this study, MFA would constitute one such type of policy intervention to tackle SWM issues in Malaysia and as a platform for EM process to analyses sustainability of SWM in Malaysia. EM can be used to generate an integrated approach to environmental issues and has the advantage of supporting programs that engage with the existing institutions of power. It was however, developed within a continental European context which has some significant differences to the Malaysian context. In this country less is invested in technological research, there is less of a corporatist approach to politics and environment groups have had fewer opportunities to participate in national policy making. Thus, adapting EM to the Malaysian context, either as an analytical tool or as a program for action, will therefore require some care.

Bibliography

Abdelnaser, O., Mahmood, A. and Aziz, H.A. (2006a). A brief case on the attitude of households toward recycling of solid waste on Terengganu State, Malaysia. Paper presented at the International Conference on Infrastructure Development and Environmental, Abuja City, Nigeria.

Abu Bakar Jaafar& Haniba, N.M. (2002). The role of Non- Private Organisation (NPO) in waste management. AAAWM symposium. Nikko Hotel. Kuala Lumpur.

Abu Bakar Jaafar. (2002). Prospects for alternative management of waste in Malaysia. Asia Solid & Hazardous Waste Management Trade Expo and Conference. Kuala Lumpur.

Adam D Read. (1999). The Implementation of Municipal SWM Policy: The barriers experienced by Local Government in the UK, school of Geography, Kingston University, UK.

Adriaanse, A., Bringezu, S., Hamond, A., Moriguchi, Y., Rodenburg, E., Rogich, D., Schutz, H. (1997). Resource flows: The material base of Industrial Economies. World Resource Institute, Washington.

Agamuthu P. and Fauziah S.H. (2007). Recent issues in SWM in Malaysia:The Solid Waste Bill, 2007. Proceedings of The 3rd expert meeting on SWM in Asia and Pacific Islands, Okayama, Japan, pp.S1-3-1 –S1-3-6.

Agamuthu.P. (2001). Solid Waste: Principles and management. University of Malaya. Kuala Lumpur.

Anderberg, S.Prieler,K.Olendrznski and S.de Bruyn (2001) Old Sins- industrial metabolism, heavy metal pollution and environmental transition in Central Europe, UN University Press, Tokyo.

Anne Scheinberg, Arnold Van de Klundert and Justine Anschutz (1994). Integrated Sustainable Waste Management- the concept: report of the working Group on SWM in Low-income Countries.

Anne Scheinberg (1999). Worse before it gets better- Sustainable waste management in Central and Eastern Europe. Warmer Bulletin, Number 68, pp 18-20.

Anne Scheinber (2003). The proof of the pudding: Urban recycling in North America as a process of Ecological modernisation, Environmental Politics, v. 12, No.4, winter 2003, pp 49-75.

Anne Scheinberg and Jeroen IJgosse. (2004). Waste management in the Netherlands. Report prepared for UNITRABALHO, recife, Brazil, Gouda, The Netherlands: WASTE, Gouda, the Netherlands.

Anne Scheinberg and Justine Abschutz (2007). Slim pickin's: Supporting waste pickers in the Ecological Modernisation of urban waste management systems". International Journal of Technology Management and Sustainable Development, Volume 5, number 3, pp 257-270.

Anne Scheinberg, Aleksandra Mitrovic, and Valetin post (2007). Assessment report: Needs of Roma collectors and other stakeholders in the PEP SE region for training, technical assistance, and financial services and recommendations for programmatic response. Prepared for the recycling lingkages private enterprise programme South East Europe (PEPSE) of the international Finance Corporation, Skopje, Macedonia.

Anne Scheinberg (2008). A bird in the hand: Solid Waste Modernisation, recycling and the informal sector. CWG-Green partners workshop, Romania.

Anne Scheinberg and Mol. A (2010). Multiple modernities: transitional Bulgaria and the EM of SWM. Journal of Environment and Planning : Government and policy, Vol 28, 18-36.

Anton Leist & Alan Holland, Clive L. Spash & Claudia Carter. (2000). Conceptualising Sustainability. Policy Research Brief, Vol 5, 3-18, Cambridge Research for the Environment.

Asian Institute of Technology- AIT (2004). Municipal Solid Waste Management in Asia, Asian Regional Research Program on Environmental technology (ARRPET), AIT, Thailand, ISBN: 974-417-258-1

Ayres ,R. U. and L. W. Ayres (1998). Accounting for resources 1. Economy-wide applications of mass-balance principles to materials and waste, Edward Elgar publishing, UK.

Ayres, R. U. and L. W. Ayres.(1999) . Accounting for resources 2. The life cycle of materials, Edward Elgar publishing, UK.

Ayres, R. (1978). Resources, Environment and Economics, New York.

Azni Idris (2004). Overview of waste disposal and landfill/ dumps in Asian Countries. Journal of Material Cycle waste Management. Vol 3: 48-59.

Baccini, P, Brunner PH. (1991). Metabolism of the Anthroposhere. Springer, NewYork.

Baccini, P, Bader HP. (1996). Regionaler Stoffhaushalt- Erfassung, Bewertung, Steuerung. Spektrum Akademischer Verlag GmbH, Heidelberg.

Bache ,I and Flinders, M. (2004) 'Multi-level governance and British politics', in Bache I. and Flinders, M. (eds) *Multi-level Governance*, Oxford University Press, Oxford,pp93–106

Baumann and Cowell, H. Baumann and S.J. Cowell. (1999). An evaluative framework for conceptual and analytical approaches used in environmental management, *Greener Management International* 26 (1999), pp. 109–123.

Barry,N (2007). Categorising tools for sustainability assessment. Journal of Ecological Economics,Vol 60, issues 3 p,498-508.

Barry , U-P. Evelin, A.Stefan and O. Lennart (2007). Categorising tools for sustainability assessment. Journal of Ecological economics 60 (2007) (3).

Barry, J. & Doran, P. (2006). Refining green political economy: from Ecological Modernisation to economic security and sufficiency. Analyse & critic, 28, 250-275.

Barry, J. (2004). From environmental politics to the politics of the environment: The pacification and normalization of environmentalism? In Wissenburg, M.& Levy, Y. (eds). Liberal democracy and environmentalism: The end of environmentalism? London: Routledge

Barber, J. (2003). Production, Consumption and the world summit for Sustainable Development. Integrative Strategies Forum. Netherlands: Kluwer Academic Publisher; 2003.

Barr ,S, Ford NJ, & Gilg AW. (2003) Attitudes towards recycling household waste in Exeter, Devon: quantitative and qualitative approaches. Local Environment 2003;8(4): 407-21.

Becker ,B. (1997). Sustainability assessment: a review of values, concepts and methodological approaches, issues in agriculture, CGIAR World Bank 10 (1997), pp. 1-63.

Beckerman, W. (1994). 'Sustainable Development': is it a useful concept? Environmental Values 3: 191-209.

Behrens,A, S. Giljum, J.Kovanda & S. Niza .(2007). The material basis of the global economy worldwide patterns of natural resource extraction and their implications for sustainable resource use policies. Ecological Economics (64) p.444-453.

Belton, V., Crowe, D.V., Mathews, R. and Scott,S. (1994). A survey of public attitudes to recycling in Glasgow (U.K). J. Waste Management., 12, 351-667.

Bell, S & Morse, S. (2001). Breaking through the glass ceiling: Who really cares about sustainability indicators?, Local Environment, 6, 291-309.

Benn, S & Dunphy. D (2005). Towards New Forms of Governance for issues of sustainability: Renewing relationships between corporates, government and community. Electronic Journal of radical organisation theory, 9(1), 1-29

Benton, T.G., Vickery, J.A., and Wilson, J.D.(2003). Farmland biodiversity: is habitat heterogeneity the key? Trends in Ecology and Evolution, 18 (4), 182-188.

Berger, G., A. Flynn, F. Hines, & R. Johns. (2001). 'Ecological Modernisation as a basis for environmetal policy: current environmental discourse and policy and the implications on environmental supply chain management.' Innovation 14 (1): 55-72

Berkhout, F and Gouldson A (2003) shaping, modulating, adapting: perspectives on technology, environment and policy. In F Berkhout, M Leach and I scones (eds) Negotiating Change: advances in Environmetal Social Science 9pp 231-260).Cheltenham; Edward Elgar.

Beukering, P., Sekher, M., Gerlagh., R. and Kumar, V (1999). Analysing Urban Solid waste in Developing Countries: A perspective on Bangalore, India, CREED,London.

Binder, C, Van der Voet and K. Sinclair Rosselot. (2009). Implementing the results of MFA. Journal of Industrial Ecology. Vol 13, No5, 643-649.

Binder,C., Bader, H.-P. Scheidegger , R. and Baccini, P.(2001): Dynamic models for managing durables using a stratified approach : the case of Tunja, Colombia. Ecological Economics 38, 191-207.

Binder, C. (1996). The early recognition of environmental impacts of human activities in Developing Countries. ETHTZ PhD thesis, Zurich, Switzerland.

Blight, G.E & C.M. Mbande. (1996). Some problems of Waste Management in Developing Countries. The Journal of Solid Waste technology and Management. Vol. 23. No.1.

Blühdorn, I. (2000). Ecological Modernisation and post-ecologist Politics. In Environment and global modernity, eds. G.Spaargaren, A.P.J. Mol and F.H. Buttel, 17-40. London: Sage studies in international Sociology

Blowers, A. (1997). ' Environmental policy: Ecological Modernisation of risk society?' Urban studies 34 (5-6): 845-871

Boldero, J. (1995). The prediction of household recycling of newspapers; the role of attitudes, intentions and situational factors. J. App. Soc. Psych., 25, 440-462.

Bouman, M., Heijungs, R., Van Der Voet, E., Van Den Bergh, J.C.J.M., Huppes, G., 2000. Material Flows and Economic Models: An Analytical Comparison of SFA, LCS and Equilibrium models. Ecological Economics 32, 195-216.

Boyle, C.A (2000). Solid Waste Management in New Zealand. Journal of Science Direct.Vol 20. Issue 7.

Bratt, C. (1999). The impact of norms and assumed consequences on recycling behavior. J. Environ. Behav., 31, 630-656.

Bringezu, S., Fischer- Kowalski, M., Klein, R., Palm, V. (1997). Regional and National Material Flow Accounting: From Paradigm to Practice of sustainability. Leiden.

Bringezu, S., (2000). Resource use in economic regions, Material Flow Analysis for sustainable regional development. Springer, Berlin.

Bringezu, S & Schutz H, (2001a) Material use indicators for the European Union, 1980-1997. Economy-wide material flow accounts and balances and derived indicators of resource use. EUROSTAT Working paper 2/2001/B/2. Wuppertal Institute, Germany.

Bringezu, S & Schutz H (2002) Resource use and efficiency of the UK economy, Prepared by Wuppertal Institute for Department for Environment, Food and Rural Affairs, London, UK

Bringezu, S., Fischer- Kowalski, M., Klein, R., Palm, V. (1997). Regional and National Material Flow Accounting: From Paradigm to Practice of Sustainability. Leiden.

Bringezu, S, Schutz H and Moll S.(2003). Rationale for and interpretation of economy-wide Material Flow Analysis and derived indicators, Journal Industrial ecology. 7, 43-64.

Bringezu, S, Schutz H, Steger S and Baudisch, J (2004) International comparison of resource use and its relation to economic growth: the development of total material requirement, direct material inputs and hidden flows and the structure of TMR, Ecological Economics. 51, 97-124.

Bringezu, S., (2002). Towards sustainable resource management in the European Union. Wuppertal papers No. 121. Wuppertal Institute for climate, Environment and Energy, Wuppertal, Germany.

Breukers, S. and M. woolskin (2007). 'Wind energy policies in the Netherlands; Institutional capacity-building for Ecological Modernisation' Environmental politics 16, 1: 92-112.

Brunner, P. (2002). Beyond Materials Flow Analysis. Journal of Industrial Ecology 6 (1), 8-10.

Brunner , P., Rechenberger H., (2004). Practical Handbook of Material Flow Analysis, CRC Press LLC.

Bullock,D.R &Salvador, R. (1993). Setting recycling goals and priorities. McGraw-Hill.

Buttel,F., H.(2000). Ecological Modernisation as social theory. Geoforum 31, 57-65.

Capello, R and Nijkamp.P (2002). In search of sustainable human settlements: prefatory remarks, Ecological Economics 40, pp. 151-155

Carolan, M. S. (2004). Ecological Modernisation theory: What about consumption? Society and Natural Resources, 17, 247-260.

Carter, N. T. & Mol, A. P. J. (2006). China and the Environment: Domestic and Transnational Dynamics of a Future Hegemon. *Environmental Politics*, 15(2): 330-344.

Chambers, N, Simmons. C & Wackermagel, M. (2000). Sharing Nature's Interest: Ecological Footprints as an indicator of sustainability.

Chamhuri Siwar (2007). Solid Waste Management: Greens jobs and challenges in Malaysia. LESTARI, UKM. Malaysia.

Chamhuri Siwar, Hasnah Ali, Abd. Rashid Ahmad & Mohd Zahir Abdul Hamid.(2001). Policies to improve municipal solid waste management. Institute For Environment and Development. UKM, Bangi.

Chang, J (2006), Malaysia exporter guide, GAIN Report no. MY6042, Foreign Agriculture Service, US Department of Agriculture, Washington DC.

Charles Hostovsky .(2006). The Paradox of the rational comprehensive model of planning. Tales from waste management planning in Ontario, Canada. Journal of Planning Education and Research. Vol 25: 382-395.

Chris Zurbrugg. (2003). Solid Waste Management in developing countries. SANDEC/EAWAG.

Christoff ,P.(1996). Ecological Modernisation, Ecological modernties. Environmental Politics 5: 476-500.

Chua T.E, L.R. Garces and C.J.Edmonds (1992). Waste management in the Coastal areas of the ASEAN region: a need for action. In : T.E. Chua and L.R. Garces, Editors, proceedings of the Conference on Waste Management in the Coastal Areas of the ASEAN Region, Singapore ICLARM, Manila, Philippines (1992), pp. 197-205.

Chung, R. K. (2005). Achieving Environmentally Sustainable Growth - Keynote Address**,** Paper presented at the Fifth Ministerial Conference on Environment and Development in Asia and the Pacific (MCED 2005), Seoul.

Cohen, J.(2006). 'The Greenhouse Mafia'. Four Corners. Sydney: ABC. URL: http://www.abc.net.au/4corners/content/20006/s1568867.htm. Consulted 21 July 2009.

Corbiere-Nicollier, T., Ferrari, Y., Jemelin, C and Jolliet, O. (2003). Assessing Sustainability: an assessment framework to evaluate Agenda 21 actions at the local level, International Journal of Sustainable Development and World Ecology, 10, 225-237.

Damanhuri & T. Padami. (2009). Evaluation of Municipal solid waste flow in Bandung metropolitan area, Indonesia. J.Material Cycles Waste management ,11: 270-276.

Danies, P.L. and Moore, S (2002): approaches for quantifying the metabolism of physical economies: a comparative survey. Journal of Industrial Ecology, 6: 69-93.

Daniel Hoornweg. (1999). What a waste: Solid Waste Management in Asia: Urban Development sector Unit East Asia and Pacific Region.

Danius L.(2002). Data uncertainties in Material Flow Analysis. Local case and literature survey. Licentiate thesis. Industrial ecology, Dept of Chemical Engineering & Technology, Royal Institute of Technology, Stockholm 2002.

Denscombe, M (2003). The Good Research Guide for small scale social research: 2nd edition. Buckinghan: Open University Press.

Desmond, M (2006). Municipal Solid Waste Management in Ireland: assessing for sustainability. Irish Geography, Vol 30(1),22-33.

De Vos, A.S., Strydom, H., Fouche, C.B., & Delport, C.S.L (2005). Research at grass roots: For the social sciences and Human Service professions. (3rd ed). Pretoria: Van Schaik.

Dietz, S and E. Neumayer (2007). Weak and strong sustainability in the SEEA: Concepts and measurement. Ecological economics (61) 617-626.

Dryzek, J.S. (1997). The Politics of the Earth: Environment Discourses, Oxford University Press, Oxford.

Dryzek, J., D. Downes, C. Hunolad, & D. Schlosberg, with H-K. Hernes. (2003). Green States and Social Movements: Environmentalism in the United States, United Kingdom, Germany and Norway. Oxford: Oxford University Press.

Dryzek, John (2005), The Politics of the Earth: environmental discourses, 2nd edition, Oxford: Oxford University Press.

Dunlap, R.E., Grieneeks, J.K.,& Rokeach,M. (1983). Human Values and Pro-Environmental behavior. In W.D.Conn (Ed), Energy and Material resources: Attitudes, value, and public policy. Boulder, CO: Westview.

ECOTEC Research & Consulting Limited. (2001). Beyond the bin: The economics of waste management options. A final report to friends of the earth, UK waste and waste watch.

Economic Planning Unit (EPU)- Malaysia. (2006). Outline Perspectives Plan (OPP). Malaysia

Economic Planning Unit -DANCED.(1998). A Contingent Valuation Study of Solid Waste Management in Kuala Lumpur. Final Report, July 1998

EEA (European Environmental Agency). (1999). Environmental Indicators: Typology and overview, Technical Report, No 25. EEA.

EEA (2005). The European Environment: State and Outlook 2005. County Analysis. EEA

Elkington, (1997). Cannibals with Forks: The Triple Bottom Line of 21st century Business, Capstone Publishing, Oxford, United Kingdom

EPA Network. (2006). Delivering the Sustainable Use of Natural Resources: A contribution from the Following Members of the Network of Heads of European Environment Protection Agencies on the Thematic Strategy on the Sustainable Use of Natural Resources.

EPA (2002). Environment in Focus: key environmental indicators for Ireland. Wexford: EPA.

Eight Malaysia Plan (2001). Kuala Lumpur, Malaysia.

Engku Azman Tuan Mat (2001). "Partnership between Government, waste Management Companies, Recyclers, and Communities in the Context of the 3Rs," in Waste 2001 Management

Environment Task Force, World Economic Forum, Yale Center for Environmental Law and Policy and Center for International Earth Science Information Network, Columbia University, (2002). Environmental Sustainability Index. Yale Center, New Haven.

Er AC (2007). A quantitative methodology to test ecological modernization theory in the Malaysian context (PhD dissertation). Wageningen University, The Netherlands.

Escobar, A. (1996). Constructing nature, elements for a poststructural political ecology. In peet, R., and Watts, M, Liberation Ecologies, 46-114. Routledge, London.

European Commission, (2005). Thematic Strategy on the sustainable use of natural resource, COM (2005) 670 final. European Commission, Brussels.

European Environment Agency (EEA). (2005). The European Environment: State and Outlook 2005. Copenhagen, Denmark. Environment Report No. 1/2005 .

European Environment Agency (EEA).(2002).Case studies on waste minimisation practices in Europe. Copenhagen, Denmark, Topic Report No.2/2002

European Environment Agency (EEA). (2002). Environment in Focus: key environment indicators for Ireland. Wexford: EPA

European Environment Agency (EEA), Signals (2004). A European Environment Agency update on selected issues, 2004.

Weisz, H.; Fischer-Kowalski, M.; Amann,C,;Eisenmenger, N.; Erb, K.; Hubacek, K.; Krausmann,F.;Schulz, NB.(2002): Material use in the European Union 1980-2000. Indicators and analysis. Working papers and studies. Luxembourg: Eurostat. (Working papers and studies).

Eurostat (2001a): economy-wide material Flow Accounts and Derived Indicators. A methodological guide. Luxembourg: Eurostat, European Commission, office for official publications of the European Communities.

Eurostat (2001b): Material use indicators for the European Union, 1980-1997. Economy-wide material flow accounts and balances and derived indicators of resource use. Working paper No. 2/2001/B/2. Luxemburg: European Commission/ Eurostat, prepared by Bringezu, S. and Schütz.,

Evison, T. and Read, A.D. (2001). Local authority recycling and waste awareness publicity/ promotion in UK. Journal Resource Recycling., 32, 275-291.

Farah A.Z., Allely E.G (2003). Household Consumption patterns in OECD countries: trends and figures. Journal of Cleaner Production, 2003; 11(8): 819-827

Farrell & Hart. (1998). What does sustainability really mean? The search for useful indicators, Environment 40 (1998) (9), pp. 151-155.

Fauziah S.H., Noorazamimah Aiza, A. andAgamuthu, P. (2007). Closure and Post-closureof Landfills in Malaysia - Case Studies.Proceedings of ISWA/WMRAS World Congress2007, Amsterdam, The Netherlands, pp. 1-9.

Figge & Hahn (2004a). Sustainable value added- measuring corporate contributions to sustainability beyond eco- efficiency, Ecological Economics 48 (2004) (2), pp.173-187.

Finnveden,G and Å. Moberg, Environmental systems analysis - an overview, *Journal of Cleaner Production* 13 (2005) (12), pp. 1165–1173

Fiorino, D.J.,(2006). The New Environmental Regulations, Cambridge, MIT Press.

Fischer-Kowalski, M., Amann, C., (2001). Beyond IPAT and Kuznets curves: globalization as a vital factor in analysing the environmental impact of socio-economic metabolism. Population and Environment 23 (1), 7-47.

Fischer-Kowalski and Huttler, (1998) M.Fischer-Kowalski and W.Huttler, Society's metabolism. The intellectual history of MFA, part 11, 1970- 1998, Journal of Industrial Ecology 2 (1998) (4), pp. 107-136.

Fisher, D. and Freudenberg, W. (2001). Ecological Modernisation and its Critics: Assessing the past and Looking Toward the Future, Society & Natural Resources, 14, (8), pp. 701-709.

Fobil J N, Armah N A, Hogarh J N and Carboo D (2008). The Influence of Institutions and Organisations on Urban Waste Collection Systems: an analysis of Waste Collection System in Accra, Ghana. Journal of Environmental Management 86 262-71

Fraanje, P.J., and Verkuijlen, E., (1996). Balansen van non-ferro metalen in de Nederlandse woningbouw in 1990. IVAM- onderzoeksreeks no. 76, Amsterdam.

Freebairn, D.M & King, C.A., (2003). Reflection on collectively working toward sustainability: indicators for indicators. Australian Journal of Experimental Agriculture, 43, 223-238.

Fred Luks & Mark Hammer. (2003).Material Flow Analysis, Discourse Analysis and the Rhetorics of (Ecological) Economics. Working papers. SERI.

Georgescu-Roegen, N., (1979). Energy Analysis and Economic Valuation. The Southern Economic Journal 45, 1023-1058. Global Leaders of Tomorrow.

Gerhard. (1994). Waste minimisation and recycling strategies and their chance of success. Waste Management and Research Observer 12 (3): 271-283

Gibbs, D.(2000). Ecological Modernisation, regional economic development agencies. Geoforum 31, 9-19.

Gibbs, D. (2003). Reconciling economic development and the environment. Local Environment 8(1) 3-8.

Gibbs, D. (2006). Prospects for an environmental economic geography: linking Ecological Modernisation and regulationist approaches. Economic Geography 82: 193-215.

Giddens.,A. (2009). The Politics of Climate Change, Cambridge UK: Polity Press

Giddens. A. (1990). The Consequences of Modernity. Polity Press: Cambridge.

Gille, Zsuzsa (2007). From the Cult of waste to the trash heap of history: The politics of waste in socialist and postsocialist Hungary. Indiana University Press, Bloomington, Indiana, USA.

Giljum, S. (2004). 'Trade, material flows and economic development in the South: the example of Chile', Journal of Industrial Ecology, 8 (1-2), 241-261.

Gonzalez- Torre, B. and Adenso-Diaz, P.L. (2005). Influence of distance on the motivation and frequency of household recycling. Int. J.Waste.Manag.,5, 15-23.

Goto, N.,A. Sakoda and M.Suzuki (1994) Modelling of soil carbon dynamics as a part of carbon cycle in terrestrial ecosystems, Ecological Modelling, 1994, 74, 183-204.

Goto N, Y. Naito, Hu H-Y and Fujie K (2001). Analysis and assessment of Material Flow in Aichi prefecture for regional zero emission, Environmental science, 14(2), 211-220, in Japanese, 2001.

Goto N, (2004). Material Flow in Yakushima island, Yakushima Zero emission working group , 2004, in Japanese.

Gouldson, A. and Murphy, J. (1996). Ecological Modernisation and the European Union. Geoforum 27(1) 11-21

Gouldson, A. and Murphy, J. (2000). Environmental policy and industrial innovation: integrating environment and economy through Ecological Modernisation. Geoforum 31, 33-44.

Gouldson A, Hills P and Welford R (2008). Ecological Modernisation and Policy learning in Hong Kong. Geoforum 39(1): 319-330

Government of Japan, (2003). The Basic Plan for establishing a recycling-based society. Tokyo

Grant Anderson.E (1998). Privatizing management of Solid Waste in Developing Countries, the Malaysia Experience. Roundtable on Urban SWM. 27-28 September 1998. Brazil.

Green, K., Harvey, M. and McMeekin, A.(2003). Transformations in food consumption and production systems. Journal of Environmental Policy and Planning 5(2) 145-163.

Grodzinska-Jurczak, M., Tomal, P., Tarabula-Fiertak, M., Nieszporek, K. and Read, A.D. (2006). Effects of an educational campaign on public environmental attitudes and behaviour in Poland. Int. J. Resource Conservation and Recycling., 46,182-197.

GTZ/CWG (2007). 'Economic aspects of the informal sector in solid waste'. Research report prepared by WASTE, Skat, and city partners, principal authors Anne Scheinberg, Michael Simpson, Dr. Yamini Gupt, and Justine Anschütz. German Technical Co-operation, Eschborn, Germany (in press).

Hanks, T.G. (1967). Solid waste/ Disease Relationships, U.S. Department of Health, Education and Walfare, Solid Wastes Program, Publication SW- 1c, Cincinnati, OH.

Hartmut Bossel.(1999). Indicators for Sustainable Development: Theory, Method, application: A report to the Balaton Group. International Institute for Sustainable Development, Canada.

Hardi and Zdan, (1997) Assessing Sustainable Development: Principles in Practice, International Institute for Sustainable Development

Hargroves, K. & M. Smith. (eds). (2005). The natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century. London: Earthscan.

Harvey, David (1998). What's green and makes the environment go round? In the cultures of globalization Fredic Jameson and Massao Miyoshi, eds., Durham and London:Duke University Press, 327-355.

Ha Huong (1999). Environmental policies and natural Resource management in Southeast Asia. Global Nest. International Journal. Vol 1, 217-225. Global Nest

Hajer MA.(1995). The Politics of Environmental Discourse: Ecological Modernisation and the Policy Process. Oxford University Press: Oxford.

Hanley N., I.Moffatt, R. Faichney and M. Wilson (1999). Measuring Sustainability: a time series of alternative indicators for Scotland, Ecological Economics 28 (1999)

Hawken, P. (1993). The Ecology of Commerce. Harper Collins. New York.

Hendriks C., Obernosterer R., Müller D., Kytzia S., Baccini P. and Brunner, P (2000), Material Flow Analysis - a tool for regional environmental and resource management. Case Studies on the City of Vienna and the Swiss Lowlands. Local Environment. Volume 5, No.3,2000, pp. 311-328

Hertin, J. and Berkhout, F.(2003). Analysing institutional strategies for environmental policy integration: the case of EU enterprise policy. Journal of environmental policy and planning 5(1) 39-56

Hills, P., Roberts, P. & Welford, R.J. (2003). Editorial: Ecological Modernisation, environmental reform and the transformation of production and consumption. International Journal of Environment and Sustainable Development, 2(3),pp, 231-236

Hills P, Welford RJ.(2002). EM as a weak form of Sustainable Development in Hong Kong, International Journal of Sustainable Development and World Ecology, 9,pp. 315-331.

Hinchliffe S, Blowers A, Freeland J, (2003), "Sustainable environmental futures: opportunities and constraints", in Environmental Responses Eds A Blowers, S Hinchliffe (John Wilay, Chichester, Sussex) pp237-280.

Hinterberger, F., Luks, F., Stewen, M., van der Straaten, J., (2000). Environmental policy in a complex world. International Journal of Sustainable Development 3, 276-296.

Hisashi Ogawa (2004). Sustainable Solid Waste Management in Developing countries. WHO Western Pacific Regional Environmental Health Centre (EHC), Kuala Lumpur Malaysia.

Huang DB, Bader HP, Scheidegger R, Schertenleib R, Gujer W. (2006). Confronting limitations: New Solution required for urban water management in Kunming City. Journal of Environmental Management. In Press.

Herring and Roy (2002). Sustainable services, electronic education and the rebound effect, Environmental Impact Assessment Review 22 (2002) (5), pp. 525-542.

Hueting.R and Reijnders. L (2004). Broad Sustainability contra sustainability: the proper construction of sustainability indicators, Ecological Economics 50, pp. 249-260.

Hunold, C. and J. S. Dryzek,(2001), 'Greening the State? Ecological Modernisation between State and Movement in the USA, UK, Germany and Norway', in Paper Presented at the *Joint Sessions of the European Consortium for Political Research*, Grenoble, 6 -11 April.

Huszain Huzin. (2004). National Waste Recycling Program. Power-point presentation at the Seminar for the study on National Waste Minimisation in Malaysia, Ministry of Housing and Local Government.

Holden, E., Linnerud, K.,(2007). The Sustainable Development area: Satisfying basic needs and safeguarding ecological sustainability. Sustainable Development 15, 174-187.

Holland, A. (2001). 'Sustainability. In D. Jamieson (ed). Oxford Companion to Applied Ethics, Oxford: Blackwell, pp.390-401.

Ho, P. (2006). China's Limits to Growth: Greening State and Society - Preface. Development and Change, 37: 1-2.

Howes, M. (2005). Politics and the Environment:Risk and the Role of government and Industry. Sydney:Allen &Unwin

Intergovernmental Panel on Climate Change (IPCC), (2007). Climate Change 2007: The Physical Science Basis. Summary for policy makers. Formally Approved at the 10th Session of Working Group 1 of the IPCC. IPCC, Paris.

International Council for Local Environmental Initiatives (ICLEI), (2002). Second Local Agenda 21 survey, Background paper No 15. Department of Economic and social Affairs, United Nations.

IJgosse, J., Ansshütz, J. and Scheinberg, A.(2004). Putting integrated sustainable waste management into practice: using the ISWM assessment methodology as applied in the UWEP plus programme (2001-2003), Gouda, The Netherlands: WASTE.

ISWA, UNEP (International Solid Waste Association and United Nations Environment Programme), (2002). Waste Management, Industry as a Partner for Sustainable Development.

Jacobs M. (1995). Sustainable Development, capital substitution and economic humility: a response to Beckerman. Environmental Values 4: 57-68

Jacobs, M.(1991). The Green Economy, London: Pluto Press.

Jamal Othman (2002). Household Performances for Solid Waste Management in Malaysia. Report to EEPSEA. Corpcom Services Sdn. Bhd (www.eepsea.org)

Jamaluddin Md Jahi (2001). Pengurusan Alam sekitar di Malaysia. UKM. Bangi

Jamaluddin Md Jahi (2002). Environmental Management in Malaysia. UKM. Bangi

Jamaluddin Md. Jahi (2003). Environmental issues in Malaysia. UKM. Bangi.

Jim Glenm. (1999). BioCycle NationWide Survey. The State of Garbage in United States.

Jamieson, A. and Baark, E. (1999). National shades of green: Comparing the Swedish and Danish styles in Ecological Modernisation. Environmental Values 8, 199-218.

Jänicke, M. (1990). State Failure: The Importence of Politics in Industrial Society, Polity Press, Cambridge.

Jänicke, M. and Jörgens, H. (1999). National environmental policy planning in the face of uncertainty. In Kenny, M. and Meadowcroft, J. (Eds.), Planning Sustainability. Routledge, London.

Jänicke, M.& P. Kunig (2000). Umweltpolitik. Bonn, Bundeszentrale für politische Bildung.

Japan International Cooperation Agency (JICA). (2006). The Study on National Waste Minimisation in Malaysia.

Jonsson, A. (2000): The trace of metals: use emissions and sediment load of urban heavy metals. Dissertation. Linköping studies in arts and Science, 221

John, L. Sznopek & William M. Brown (1998). Material Flow and Sustainability. U.S Geological Survey.

Jörgens, H. (2003). Governance by diffusion- implementing global norms through cross-national imitation and Learning. Berlin, Forschungsstelle für Umweltpolitik.

Jordan, A., Wurzel, R.K.W. and Zito, A.R. (2003).' New' instruments of environmental governance: patterns and pathways of change. Environmental politics, 12, 1-26.

Juzhar Jusoh. (2002). Improving Municipal Solid Waste Landfills of Peninsular Malaysia: organisational and structural adjustment: Phd thesis, Graduate School of the University of Wisconsin. Madison. United States

Kates , T. Parris and A. Leiserowitz (2005), What is Sustainable Development? Goals, indicators, values and practice, Environment 47 (2005), pp. 8–21

Kemp Reně , Derk Loorbach & Jan Rotmans. (2007). Transition management as a model for managing processes of co-evolution towards Sustainable Development. International Journal of Sustainable Development & World Ecology 14, 78-91.

Keil, R. and Desfor, G. (2003). Ecological Modernisation in Los Angeles and Toronto. Local Environment 8(1), 27-44

King, C., Gunton, J., Freebairn, D., Coutts, J. & Webb, I. (2000). The Sustainability Indicator Industry: where to from here? A focus group study to explore the potential of farmer participation in the development of indicator, Australian Journal of Experimental Agriculture, 40, 631-642.

Kytzia, S., and Nathani, C., (2004). Bridging the gab to economic analysis: economic tools for industrial ecology. Progress in Industrial Ecology, 143-164.

Kleijn, R. (2001). Adding It all Up. The Sense and Non-Sense of Bulk-MFA. Journal of Industrial Ecology 4 (2), 7-8.

Kleijn R., Bringezu, S., Fischer- Kowalski, M., Palm, V. (1999). Ecologizing Societal Metabolism. Designing scenarios for sustainable material managemet. CML Report 148, Leiden.

Lafferty, W. (1996). The Politics of Sustainable Development: global norms for national implementation. Environmental Politics 5: 185-208.

Lafferty,W, and Meadowcroft, J. (Eds.), (2000). Implementating Sustainable Development: Strategies and Initiatives in High Consumption Societies. Oxford University Press, Oxford.

Langhelle, O. (1996). Sustainable Development and social justice. Paper presented at IPSA round table on 'The Politics of Sustainable Development', Oslo,.

Langhelle, O. (1999). Sustainable Development: exploring the ethics of Our Common Future. International Political Science Review 20 (2), 129-149.

Langhelle, O. (2000).' Why Ecological Modrnisation and Sustainable Development should not be conflated' Journal of environmental policy & Planning 2: 303-322.

Latifah Abd Manaf. (2007). Solid Waste Management system in Malaysia. Utusan Malaysia

Lee Lik Meng (2002). Pushing the frontiers of town planning for agenda 21: protecting the treasures of USM. A working paper presented in seminar on ' The Role of university in supporting the agenda 21: building partnership' 14th august 2002. University of Malaya, Kuala Lumpur

Lele, S (1991). Sustainable Development: a critical review. World Development 19, 607-621.

Lina Lau. (2003). Case study on the Management of Waste Materials in Malaysia. University Putra Malaysia.

Lindseth, G. (2000). Local Agenda 21 and Discourse Analysis: Groundwork for an Empirical Study of 3 Norwegian Municipalities, Working Paper No. 2/01, programme for Research and Documentation for a Sustainable Society, Oslo: University of Oslo.

Loh, J.(2002). Living Planet report 2002. World Wildlife Fund&Redefining.

Longhurst P, Chackiath S, Mitchell N, Little R and Pollard S (2005). Modelling London's waste- policy relevant research for multi- level governance. In: Proc. Waste- the Social Context, Alberta, Canada 11th-14th May, 2005.

Lorne ,K. Kriwoken. (2000). Waste Management & Research: 18, 557-566
Iddo K. Wernick & Frances H.Irwin. 2005. Material Flows Accounts: A tool for making environmental policy. World Resources Institute.

Lulofs, K., Bultmann, A., Eames, M., Schucht, S. & Watzols, F. 920030. Implementing environmental regulations across governance scales in the EU. In H. Bressers & W. Rosenbaum (Eds.), Achieving Sustainable Development. Westport: Praeger.

Lundqvist, L.J. (2000): The International Spread of Ecological Modernisation ideas. Paper prepared for the International Workshop on diffusion of Environmetal Policy Innovations, Berlin 8-9 December 2000.

Martin, M., Williams, I.D. and Clark, M. (2006). Social, cultural and structural influences on household Waste recycling: A case study. J. Resou. Conserv. Recyc. 48(4), 357-395.

Margaret Desmond. (2006). Municipal Solid Waste Management in Ireland: assessing for Sustainability. Irish Geography, volume 39(1), 22-33.

Mastellone, M.L., P.H.Brunner, and U.Arena. (2009). Substance flow analysis-based scenarios of waste management for a waste emergency area. Journal of industrial Ecology

Matthews E, Amann C, Bringezu S, Fischer-Kowalski M, Huttler W, Kleijn R, Moriguchi Y, Otteke C, Rodenburg E, Rogich D, Schandl H, Schutz, Van Der Voet E and Weisz H (2000). The weight of nations: Material outflows from industrial economies, World Resources Institute, Washington DC, USA.

Mayer, W.(1992). Synergetic effects of Municipal Solid Waste Collection, Recycling and disposal. International Reterence Center for Waste Disposal (IRCWD), Duebendortf, Switzeerland.

Matthews, E., Bringezu, S., Fischer-Kowalski, M., Kleijn, R., Moriguchi, Y., Ottke, C., Rodenburg, E., Rogich, D., Schandl, H., van der Voet, E., Weisz, H. (2000). The weight of nations. Material outflows from industrial economies. World Resources Institute, Washington.

McDonald, S. and Oates, C. (2003). Reasons for non- participation in a kerbside recycling schemes. J. resou. Conserv. Recyc.39, 369-385.

McNeil, B.(2009). The clean industrial revolution: growing Australian prosperity in a greenhouse Age. Sydney: Allen & Unwin.

Ministry of Housing and Local Government(MHLG), (1988).Action Plan for a Beautiful and Clean Malaysia (ABC). Kuala Lumpur, Malaysia: Ministry of Housing and Local Government.

Ministry of Housing and Local Government (MHLG). (2003). Overview of Solid Waste Management in Malaysia

Ministry of Housing and Local Government (MHLG).(2007). Action Plan for a Beautiful and Clean Malaysia (ABC), Kuala Lumpur, Malaysia: Ministry of Housing and Local Government.

Ministry of Housing and Local Government.(2005). Solid Waste Management Report, 2005. Kuala Lumpur, Malaysia

Millennium Ecosystem Assessment, 2005. Millennium Ecosystem Assessment Synthesis Report.

M.N. Hassan, R.A. Rahman, T.L. Chong, Z. Zakaria & M.Awang. (2000). Waste recycling in Malaysia: problems and prospects. Waste Management Resources. Vol. 18:320-328

M.N. Hassan, R.A. Rahman, T.L. Chong, Z. Zakaria & M.Awang. (2001). SWM in Southeast Asian countries with special attention to Malaysia. Proceedings Sardinia 2001, eighth International waste management and landfill symposium S. Margherita di Pula, Cagliari, Italy; 1-5 October 2001.

McDougal,F., White, P., Franke, M., Hindle, P., (2001). Integrated Solid Waste Management: A life-Cycle Inventory, Second Edition.

MOE (Ministry of Environment, Japan), Jyunnkann hakusyo (2003) (White paper about a sound recycle), 2003, in Japanese.

Mol, A.P.J. (1995).The Refinement of Production: Ecological Modernisation Theory and the Chemical Industry, Jan Van Arkel/ International Books.

Mol, A. (2000). 'The Environmental Movement in an era of Ecological Modernisation.' Geoforum 31: 45-56

Mol APJ, Sonnenfeld DA.(2000b). Ecological Modernisation around the World: perspectives and critical Debates. Frank Cass, London.

Mol, A. P. J. & Sonnenfeld, D. A. (2000a). Ecological Modernisation around the world: An Introduction. Environmental Politics, 9(1): 3 - 4.

Mol, A. P. J. & Spaargaren, G. (2000c). Ecological Modernisation theory in debate: A review. Environmental Politics, 9(1): 17-49.

Mol, A.P.J. (2001). Globalization and environmental reform: The Ecological Modernisation of the Global Economy, MIT Press, Cambridge, Mass.

Mol APJ, Spaargaren G. (1993). Environment, modernity and the risk-society: the apocalyptic horizon of environmental reform. International Sociology 8: 431-459.

Mol, Arthur P.J.(2002) Ecological Modernisation and the global economy. Global Environmental Politics 2:2,92-115.

Mol, A. P. J. & Spaargaren, G. (2002). Ecological Modernisation and the environmental state. In F. H. Buttel & A. P. J. Mol (Eds.), Environmental State Under Pressure: 33 - 52. Oxford: Elsevier Science

Mol, A.P.J. (2003). The Ecological Modernisation of the global economy. London: Frank Cass Publishers. London: MIT Press.

Mol, A.P. J. and Spaargaren, G. (2004). Ecological Modernisation and consumption: a reply. Society and Natural Resources, 17, 261-265.

Mol, A.P.J. (2006). Environment and modernity in transitional China: Frontiers of Ecological Modernisation. Department and change, 37, (1), 29-56.

Mol A Sonnenfeld D and Spaargaren G (eds) (2009). The Ecological Modernisation Reader: Environmental reform in theory and practice. London: Routledge

Montangero A., Thai Nguyen Thi Kim, Belevi H. (2004). Material Flow Analysis as a tool for environmental sanitation planning in Viet Tri, Vietnam. In: Proceeding of the 30th WEDS Conference, Vientiane, Loas PDR, October 2004.

Moriguchi, Y. (1999) recycling and waste management from the viewpoint of material flow accounting, Journal of Material Cycles and waste management, 1 (1), 2-9.

Murphy J.(2007). Sustainability: understanding people, technology and governance. Earthscan publications Ltd.

Murphy, J. and Levidow, L. (2006) Governing the transatlantic conflict over Agricultural Biotechnology, Routledge, London

Murphy, J. And Gouldson, A. (2000) 'Environmental Policy and Industrial Innovation: Integrating environment and economy through ecological modernisation? An assessment of the impact of environmental policy on industrial innovation. ,Geoforum, Vol.31, 33-44

Murphy, J.(2000). "Ecological Modernisation" Geoforum 31 (1-8).

Musthapa,A.(1996). Mahathir's Vision 2020: Towards a developed and industrialized Society" Malaysian Entrepreneurship, 11-19.

Mutha N H, Patel M and Premnath V (2006), Plastic materials flow analysis for India, Resource., Conservation. Recycling., Vol 47, 222-224.

Nadzri Yahya. (2007). Overview of Solid Waste Management and policies in Malaysia. Ministry of Housing and Local Government, Malaysia.

Nagel, S.S. (1974). Environmental Politics. New York: Praeger Publishers

Neale, A. (1997). " Organising environmental self regulation: Liberal Governmentality and the pursuit of Ecological Modernisation in Europe". Environmetal Politics. Vol 6, No.4, 1-24.

Nilsson-Djerf, J., & McDougall, F. (2000). Social factors in sustainable waste management, Warmer Bulletin, 73, 18-20.

Noorman K.J (1998) .Green household? Domestic, consumers, environment and sustainability. London: Earthscan Publications Ltd; 1998.

OECD. (2000). Environmental Indicators; development, measurement and use. Paris: OECD

OECD, (2004). Recommendation on material flows and resource productivity. Adopted by the OECD Council on 21 April 2004. No. OECD, Paris.

OECD, (2004).Workshop on material flows and related indicators Environment Directorate Environment Policy Committee, 2004a

OECD, (2004).Key Environmental Indicators, 2004b.

OPP. (2001).3rd Outline Perspective Plan, 2001-2010. Putrajaya Malaysia
Overview of Solid Waste Management in Malaysia: (2000). Local Government Department Ministry of Housing and Local Government

Ostrom, E. (2000). " Crowding out citizenship". Scandinavian Political Studies, Vol. 23, No. 1, 2000, 3-13.

Paavola, Jouni, Adger, W. Neil, (2006). Fair adaptation to climate change. Ecological Economics 56, 594-609.

Paul Ekins (2003) Policy Studies Institute

Paul H. King & Rolf Eliassen. (1993). Integrated SWM: Engineering Principles and Management Issues. McGraw- Hill. United States.

Pedersen, Ole G (2002): DMI and TMR for Denmark 1981, 1990, 1997. An Assessment of the Material requirement of the Danish Economy. Statistics Denmark.

Pellow, David, Allan Schnaiber and Adam Weinberg.(2000). Putting the ecological modernisation thesis to the test: The promises and performance of urban recycling. In

Ecological Modernisation around the world: Perspectives and critical debates, ed. Arthur Mol and David Sonnenfeld, 109-137. Portland; Frank Cass & Co.

Petts, J. (2000). Municipal waste management: inequities and the role of deliberation, Risk Analysis, 20(6), 821-832

Pezzey & Toman (2002). The Economics of Sustainability, International Library of Environmental Economics and Policy, Ashgale Dautmouth (2002)

Princen, T.(1999). Consumption and Environment: some conceptual issues. Ecological Economics. 1999; 31(3): 347-363.

Raffield, T (2006) .Modelling materilas and waste flows in the domestic economy, MSc Thesis, Cranfield University, UK

Raman, S. (2003) 'The significance of political rationality in governance: Assessing the energizing of UK building regulation 1990–2002', PhD thesis, University of Pittsburgh

Ratner, B.D. (2004) 'Sustainability as a dialogue of values: challenges to the sociology of development. Sociological Inquiry 74: (1), pp.50-69

Razman, M.S. (1995). Solid Waste Management: materials flow and generation of solid waste, solid waste collection and transport. Paper presented at short-course on environmental engineering for non-environmental engineers, Senai, Johor

Read, A.D. (1998). The Waste Hierarchy: a local authority perspective, preliminary survey findings**.** IBG-RGS Conference. Surrey University.

Read, A.D. (1997). The waste hierarchy: the local government role in driving national policy. School of Geography. Kingston University. UK

Read, A.D. (1999). A weekly doorstep recycling collection, I had no idea we could overcoming the Local barriers to participation. Int. J.Resource., Conservation. Recycling., 26, 217-249

Reijnders, L. (1998), 'The Factor X debate: Setting targets for eco- efficienc', Journal of Industrial Ecology, 2 (1), 13-22

Reed, M.S., Fraser, E.D.G & Dougill, A.J. (2006). An adaptive learning process for learning and applying sustainability indicators with local communities. Ecological Economics.

Revell, A. (2005). Ecological Modernisation in the UK: Rhetoric or reality? European Environment, 15 (6), 344-361.

Revell, A. (2002). Ecological Modernisation of small firms in Japan. Environmental Economics and Policy Studies, 5: 291 - 317

Riley, J. (2001). Multidisciplinary indicators of impact and change: key issues for identification and summary, Agriculture, Ecosystems & Environment, 87, 245-259

Robinson, G.M. & Read A.D.(2005). Recycling behavior in a London Borough: Result from large-scale household surveys. Int. J.Resource, Conservation and Recycling, 45, 70-83

Rospidah Ghazali & Chamhuri.(2001). Pengurusan Buangan Sisa Pepejal: Penggunaan Instrumen berasaskan Pasaran sebagai satu alternatif penyelesaian. Jurnal of Environmental Management. *Vol 2 (45-58)*

Salequzzaman.M (2005). Ecological Footprint of waste generation: A Sustainable tool for Solid Waste Management of Khulna City Corporation of Bangladesh. Institute for Sustainability and Technology Policy.

Sanderson, I. (2002). Evaluation, policy learning and evidence-based policy making, Public Administration, 80, pp. 1-22.

Schandl, Heinz and Schulz, Neils B. (2002): Changes in United Kingdom's natural relations in terms of society's metabolism and land use from 1850 to the present day. In: Ecological economics, 41 (2), pp. 203-221.

Schmidt-Bleek, F., (1994). How Much Enivironment do we need? MIPS, the measure for ecological sound economic performance. Berlin, Basel, Boston.

Schultx, P.W., & Zelezny, L. (1999). Values as predictors of environmental attitudes. Journal of Environmental Psychology, 19(3), 255-276.

Seadon.J.K. (2006). Integrated waste management- Looking beyond the solid waste horizon. Journal of Waste Management.Vol 26, 1327-1336.

Shimura.S, I.Yokota & Y. Nitta. (2001). Research for Solid Waste Management Flow Analysis in Developing Nations: Journal of Material cycle Waste management. Vol 6 48-59.

Shmelev S.E and Powell J.R (2007). Ecological-economic modelling for Strategic.

Silke Dresher, Christian Müller, tedros Kubrom, Sirak Mehari, Christian Zurbrügg and Susanne kytzia (2006) Decentralised Composting- Assessment of Viability through Combined MFA and Cost accounting. Eawag. Switzerland

Simon, H. (1997). Administrative Behavior: A study of decision-making processes in administrative organisation, Free Press, New York (4th edition)

Singh, SJ. And Grünbühel, CM (2004): Environmental relations and biophysical transitions: The case of trinket Islands. In: Geografiska Annaler, series B, Human Geography 85 (4). 53-86.

Slater, R (2007). Local Governance of public services: The role of partnerships in sustainable waste management. In : Murphy Joseph ed. Governing Technology for sustainability, UK: Earthscan Publications Ltd, pp. 151-167.

Sneddon C, Richard B. Howarth & Richard B. Norgaard. (2006). Sustaianable development in a post-Brudtland world. J.Ecological economics 57 (2006) 253-268
Clifford,M. 1996. Can Malaysia Take that next step. Business Week. February 26.

Sörme, L. (2003): Urban heavy metals stocks and flows. Disseration. Linköping Studies in Arts and Science, 76.

Solows, R.M. (1993). Sustainability: An economist's perspective'. In R. Dorfman and N. Dorfman (eds) Economics of the Environment: Selected Reading, New York: W.W. Norton, pp. 179-187

Sonya C. Newenhouse & Joan T. Schmit. (2000). Qualitative methods add value to waste charaterization studies. Waste Management Reseource: 18 : 105-114

Sonnenfeld, D. & Mol, A. P. J. (2007). Environmental Reform in Asia. *The Journal of Environment and Development*, 15: 112 - 137.

Sonnenfeld, D. (2000). Contradictions of Ecological Modernisation: Pulp and Paper Manufacturing in South-east Asia. In A. P. J. Mol & D. Sonnenfeld (Eds.), EM around the World**.** pp. 235-256 London: Frank Cass Publishers.

Sonnenfeld, D. (2002). Social Movements and EM: The Transformation of Pulp and paper manufacturing, development and change, 33: 1-27.

Sonnenfeld, D. and Mol, A. (2002). Ecological Modernisation, governance and globalisation, American Behavioral Scientist, 45: 1456-1461.

Southerton, D., Chappels, H. and Van Vliet, B.(2004). Sustainable Consumption: The implications of changing infrastructures of provision, Edward Elgar, Cheltenham.

Spaargaren, G (2000).Ecological theory and domestic consumption. Environmental Policy and Planning, 2(4),323-335.

Spaargaren, G. and Van Vliet, B. (2000). Lifestyle, consumption and the environment: the ecological of domestic consumption. Environmental politics, 9(1), 50-77

Spaargaren, G, peter Oosterveer, Joost van Buuren and Authur P.J Mol (2005). Mixed modernities: towards viable urban environmental infrastructures development in east Africa. Position paper. Environmental policy Group, Wageningen University and Research Centre, The Netherlands: October 2005

Spaargaren, G. and Mol, A.P.J. (1992) 'Sociology, Environment and Modernity: EM as a Theory of Social Change', Society and Natural Resources, 5, 4, pp. 323–344.

Spaargaren, G. (1997). The Ecology Modernisation of Production and Consumption: essay in environmental sociology. PhD thesis, Wageningen Agricultural University.

Spaargaren, G. (1999). The Ecological Modernisation of domestic consumption. From the Reader distributed for the 'Consumption, everyday live and sustainability' summer school 1999, Lancaster university, UK.

Spaargaren, G. and Mol, A. (1991). Sociology, Environment and Modernity: Ecological Modernisation as a Theory of Social Change, LUW, Wageningen.

Streicher- Porte M., Widmer R., Jainc A., Bader H-P., Scheidegger R. And S. Kytzia (2005), Key drivers of the e-waste recycling system: Assessing and modelling e-Waste processing in the informal sector in Delhi. Environmental Impact Assessment Review 25 (2005), pp. 472-491

Stern, P.C. (2000). Towards a coherent theory of environmentally significant behavior. Journal of Social issues, 56(3), 407-424

Stern, N., (2007). The Economics of Climate Change. The Stern Review. Cambridge University Press, Cambridge.

Steven Van Passel, Frank Nevens, Erik Mathijs & Guido Van Huylenbroeck. (2006). Measuring Farm Sustainability and Explaining differences in sustainable efficiency. *Journal of Ecological Economics*. Vol 62 149-161.

Stoate, C., Boatman, N.D., Borralho, R.J., Rio Carvalho, C., de Snoo, G.R., and Eden, P. (2001) Ecological impacts of arable intensification in Europe. Journal of Environmental Management, 63, 337-365.

Sustainable Europe Research Institute (SERI). (2003). Material Flow Accounting and Analysis (MFA); A valuable tool for analyses of society-nature interrelationships Nr.2, August 2003 ISSN 1729-3545

Susan Baker. (2007). Sustainable development as Symbolic Commitment. Environmental Politics 16(2), 297-317

Taiwo Makinde. (2005). Problems of policy implementation in developing nations: The Nigeria experience. Journal of Social Science., 11(1), 63-69.

Taking Stock managing our impact: an ecological footprint of the South east region. (2005). Biffaward

Thomas, C. (2001). Public Understanding and its Effect on recycling performance in Hampshire and Milton Keynes. International Journal of Resource, Conservation and Recycling., 32, 259-274

Tietenberg, T., (2006). Environmental and natural resource economics, 7th ed. Pearson/Addison Wesley, Boston.

Tonglet, M., Phillips, P.S. and Ba Schultx, P.W., & Zelezny, L. (1999). Values as predictors of environmental attitudes. Journal of Environmental Psychology, 19(3), 255-276

Tonglet, M., Phillips, P.S. and Bates, M.P. (2004). Determining the drivers for householders behavior: Waste minimization compared to recycling. Int. Journal of Resource, Conservation and Recycling., 42, 27-48

Tyteca. D (1998). Sustainability Indicators at the firm level, pollution and resource efficiency as a necessary condition toward sustainability, Journal of Industrial Ecology 2, pp. 61-77

UNESD. (2005). Available at www.un.org/unesd.

UNEP: (1972): Statement of Malaysia at UN Conference on Human Environment
Virginia Peterson, Nancy R. Jacobs & Mark A. Siegel.1999. Garbage and other pollution. How do we live with all the trash? Wylie. Texas

UNEP-IETC (1970). The UNEP solid waste sourcebook. United Nations environmental Programme, International Environmental Technology Centre (UNEP_IETC), Osaka, Japan.

UNEP, (2002). Global Environmental Outlook-3. Earthscan, London

United Nations. (2003). Cities and Sustainable Development; lessons and experiences from Asia and the Pacific. New York, UN.

United Nations Development Programme (UNDP), Malaysia. (2008). Malaysia Developing a SWM. Kuala Lumpur. Malaysia.

United Nations Environment program. (2004).The Use of Economic instruments in Environmental Policy: opportunities and challenges. Bangkok: United Nations Development Program (UNDP)

Urban Development Sector Unit East Asia and Pacific Region. (1999). What a waste : Solid Waste Management in Asia. United States.

Uyen Nguyen Ngoc & H.Schnitzer. (2009). Sustainable solutions for Solid Waste Management in Southeast Asian countries. Journal of Waste Management , 29, 1982-1995.

Van Den Burg, S. (2006). Governance through information. PhD thesis, Wageningen University, Wageningen.

Van Der Heijden Anton (2001) Review of Ecological Modernisation around the world: perspectives and Critical Debates in Environmental Politics 175-176

Van Tatenhove, J.P.M, and Lorey, P. (2003). Environment and participation in a context of political modernisation, Environmental Values, 12 (12), 155-174

Van Vliet, B.J.M., Chappells, H. and Shove, E. (2005). Infrastructures of consumption, environmental restructuring of the ulity industries, Earthscan, London.

Verheem, R.A.A. (2002).Netherlands Commission for EIA (ed) . Recommendations for sustainability assessment in the Netherlands. Environmental Impact Assessment in the Netherlands: Views from the Commission for EIA in 2002

Veleva & Ellen Becker. (2000). A Proposal for measuring business sustainability: addressing shortcomings in existing frameworks, Greneer Management International 31 (2000), pp. 101-120.

Veleva & Ellen Becker. (2001). Indicators of sustainable production: framework and methodology, Journal of Cleaner Production 9 (2001) (6), p.p. 519-549

Visvanathan, C., & Trankler, J. (2003). Municipal Solid Waste Management in Asia: A comparative analysis, proceeding of workshop on sustainable landfill management, 3-5 December 2003, Chennai, India.

Voet E. Van de (1996): Substances from cradle to grave- Development of a methodology for the analysis of substance flows through the economy and the environment of a region. Ph.D. Thesis, Leiden University. Netherlands.

Von Lina Lau. (2004). Case study on the Management of Waste Materials in Malaysia. Forum GEOÖKOL. 15 (2), 2004.

Wadood, A., (1994). Effects of Urban Wastes on environmental and its control. In : Hoq, Mofizul, Lenchner, H. (Eds). Aspects of Solid Waste Management Bangladesh Context. German Cultural Institute, Dhaka

Watson D. (2000). The International Resource cities program: building capacity in Bulgarian local governments. Public Administration review 60, 457-463.

WCED. (1987). Our Common Future. World Commission on Environment and Development, Oxford University Press 1987.

Weale A. (1992). The New Politics of Pollution. Manchester University Press: Manchester.

Weidner, H. (2002). Capacity Building for Ecological Modernisation: Lessons from Cross-National Research, American Behavioral Scientist, 45: 1340-1368.

Weisz, H.; Fischer-Kowalski, M.; Amann,C,;Eisenmenger, N.; Erb, K.; Hubacek, K.; Krausmann,F.;Schulz, NB.(2002): Material use in the European Union 1980-2000. Indicators and analysis. Working papers and studies. Luxembourg: Eurostat. (Working papers and studies).

Weith, K., Barlaz., M., Ranjithan, R., Brill, D., Thorneloe, S. and Ham, R.(1999). Life cycle management of municipal solid waste. International Journal. LCA 4 (4). Landsberg, Germany. 195-201

Weiss, R.S. (1994). Learning from Strangers: the Art and Method of Qualitative Interview Studies. New York, NY, USA: The Free Press.

Welford, R.& P. Hills. 2004. 'Ecological Modernisation, environmental policy and innovation priorities for the Asia-Pacific region.' International Journal of Environmental and Sustainable Development 2(3): 324-340

Williams, I.D. (2005). Waste Strategies for local authorities: a systematic approach: paper presented at the annual Conference of CIWM, Raising Standard.

Wilson, Sir David C.,(2007). "Development drivers for waste management. Waste management and research Vol. 25, pp 198-207.

World Bank. (1999). What a Waste*:* Solid Waste Management in Asia, World Bank, Washington, DC.

Wilson, D.C. (1981). Waste Management: Planning, Evaluation, technologies. Oxford University Press. Oxford

Wuppertal Institute. (2005). Fair Future. Begrenzte Ressourcen und globale Gerechtigkeit (Fair Future. Limited Resources and Global Fairness). Wuppertal Institute for Climate, Environment and Energy. C.H. Beck. Müuchen.

WWF, UNEP, Global Footprint Network, (2004). Living Planet Report. WWF, Gland, Switzerland.

Yong Eu Fan & Tan Ka Kheng.(1986). Management and utilization of solid wastes. UPM. Serdang.

York, Richard & Eugene Rosa. (2003). Key challenges to Ecological Modernisation theory: Institutional efficacy, case study evidence, units of analysis, and the pace of eco-efficiency. Organisation and Environment 16: 273-288

Zadek, S. (2004). The civil corporation: the new economy of corporate citizenship. Earthscan, London.

Zaini Sakawi.(2011). Municipal Solid Waste Management in Malaysia: Solution for Sustainable Waste Management. Journal of Applied sciences in environmental sanitation. Vol 6, Number 1: 29-38

Zhao S, Li Z & Li W (2005). A modified method of ecological footprint calculation and its application, Ecol. Model. 185, 65-75.

Zurbrugg, C. (2003). Urban Solid Waste Management in low- income countries of Asia- how to cope with the garbage crisis, SANDEC publication

Appendix 1

Questionnaire survey

Section A: Household profile

1) House Address:_____

2) Please indicate the type of your area …….

1) Urban
2) Rural

3) Gender:_____

4) please indicate your age by ticking the approprite box:

a) under 15 d) 15-29
b) 30-49 e) 51-65
c) Over 65

5) Please indicate your religion by ticking the appropriate box

a) Buddhism c) Christian
b) Islamism d) Others

6) Status:_____

7) Please indicate your education by ticking in the appropriate box

a) No Education e) Primary school
b) Junior Secondary
c) College
d) University degree

8).What is your current occupation?

a) Bussiness d) Government officer
b) Student e) Company officer
c) Housewife

Section B: Participation in and attitude towards solid waste recycling

9).Do you know regarding waste law and management?

a).Yes
b).No
c.)Not sure

10).Have you ever heard regarding recycling program in your area?

a)Yes
b)No
c)Not sure

11). Are you aware of any household recycling initiatives in your area?

a) Yes
b) No

12).Which source do you use to find out about waste issue

a).Newspaper d). Radio

b)Television e).Magazines

c)Internet f).Others

13).Do you recycle your solid household waste?

a).Yes
b).No

14). Reason for involved in recycling program

Section C: waste collection service

15).What is the type of waste collection in your area?

a) Door to door collection
b) Communal bin

c) Others

16). Is that waste collection service provided in your area?

a)Yes
b)No
c)Not sure

17). Who is responsible for waste collection services in your area ?

a)Local authority
b)Contractor
c)Not sure

18). How often per week the waste collection services provided in your area?

a) Every day
b) Every two days
c) 3 times per week
d) Once a week
e) not on schedule

19). How often would you prefer your waste to be collected?
a) Once a week
b) Twice a week
c) Others (please specify)
_____

20). How satisfied are you with the waste collection services in your area?

a) Very satisfied
b) Quite satisfied
c) Unsatisfied
d) No answer

Thank you for your time and cooperation

Appendix 2

KAJIAN PENGUKURAN KELESTARIAN SISA PEPEJAL DI MALAYSIA

A. PROFIL RESPONDEN

1)Alamat Rumah: _____

2. Jenis kawasan kediaman _____

1= Bandar
2= Luar Bandar

3). Jantina _____

1= Lelaki
2=perempuan

4). Umur _____tahun

5). Keturunan responden _____

1= Melayu
2=Cina
3=India
4= lain-lain (nyatakan)_____

6). Status perkahwinan responden

1= Bujang
2=Berkahwin
3=Duda/janda
4=Balu

7). Kelulusan pendidikan

1= Tak sekolah
2= Sekolah rendah
3= Sekolah Menengah
4= Sijil/diploma
5=Ijazah

8). Jenis pekerjaan responden

1= Kakitangan kerajaan
2= Kakitangan swasta
3= Ahli perniagaan
4= Bekerja sendiri
5= Lain-lain (nyatakan) _____

B. PERSEPSI RESPONDEN TERHADAP MASALAH PEMBUANGAN SAMPAH SARAP

9). Bagaimanakah responden biasanya membuang sampah?

1. Membuang di tong sampah sendiri
2. Membuang di tong sampah awam
3. Membuang di tong sampah swasta
4. Membuang di dalam sungai/parit/longkang
5. Bakar sampah
6. Ditanam
7. Lain-lain (Nyatakan) _____

10). Adakah responden tahu tentang undang-undang berkaitan dengan pemungutan, pembuangan dan pelupusan sampah-sarap?

1= Ya
2= Tidak

11). Adakah responden pernah mendengar berkenaan program kitar semula?

1= Ya
2= Tidak

12). Dari mana responden mendengar program kitar semula?

1. Majlis Perbandaran/ daerah
2. Rukun tetangga
3. Jiran tetangga
4. Kawan-kawan
5. Media masa / tv

13). Pernahkan mengutip sampah yang dibuang di merata tempat oleh orang lain?

1. Ya
2. Tidak

14). Apakah alasan untuk megikuti program kitar semula ?

_____

15). Pada pandangan responden adakah keadaan sampah di kawasan responden menjejaskan kesihatan manusia?

1. Bahaya sekali
2. Bahaya
3. Tak bahaya
4. Tidak tahu

C. KEPUASAN RESPONDEN MENGENAI KUTIPAN SAMPAH RUMAH

16). Adakah terdapat perkhidmatan kutipan sampah di kawasan rumah responden?

1. Ya
2. Tidak
3. Tidak tahu

17). Apakah jenis kutipan sampah yang dijalankan?

1. Kutipan ke setiap rumah
2. Tong samaph awam/ bersama (Communal bins)
3. Lain-lain (Nyatakan) _____

18). Siapakah yang menjalankan kutipan sampah tersebut?

1. Majlis perbandaran/ Daerah
2. Kontraktor Majlis perbandaran/Daerah
3. Tidak pasti

19). Berapa kerapkah seminggu sampah dikutip di kawasan anda?

1. Setiap hari
2. Selang sehari
3. 3 kali seminggu
4. Sekali seminggu

20). Secara amnya, adakah responden berpuas hati dengan kutipan sampah di kawasan anda?

1. Sangat berpuas hati
2. Berpuas hati
3. Tidak berpuas hati
4. Amat tidak berpuas hati

Terima kasih di atas kerjasama anda

Appendix 3

Area

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Urban	128	68.1	68.1	68.1
	rural	60	31.9	31.9	100.0
	Total	188	100.0	100.0	

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	79	42.0	42.0	42.0
	female	109	58.0	58.0	100.0
	Total	188	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	.5	.5	.5
	20	1	.5	.5	1.1
	21	3	1.6	1.6	2.7
	22	2	1.1	1.1	3.7
	23	6	3.2	3.2	6.9
	24	4	2.1	2.1	9.0
	25	11	5.9	5.9	14.9
	26	3	1.6	1.6	16.5
	27	5	2.7	2.7	19.1
	28	10	5.3	5.3	24.5

29	11	5.9	5.9	30.3
30	10	5.3	5.3	35.6
31	5	2.7	2.7	38.3
32	2	1.1	1.1	39.4
33	4	2.1	2.1	41.5
34	7	3.7	3.7	45.2
35	7	3.7	3.7	48.9
36	7	3.7	3.7	52.7
37	4	2.1	2.1	54.8
38	6	3.2	3.2	58.0
39	4	2.1	2.1	60.1
40	1	.5	.5	60.6
41	4	2.1	2.1	62.8
42	4	2.1	2.1	64.9
43	5	2.7	2.7	67.6
44	7	3.7	3.7	71.3
45	8	4.3	4.3	75.5
46	6	3.2	3.2	78.7
47	6	3.2	3.2	81.9
48	3	1.6	1.6	83.5
49	2	1.1	1.1	84.6
50	4	2.1	2.1	86.7
51	1	.5	.5	87.2
52	5	2.7	2.7	89.9
53	6	3.2	3.2	93.1
54	4	2.1	2.1	95.2
55	3	1.6	1.6	96.8
58	1	.5	.5	97.3
59	1	.5	.5	97.9
61	2	1.1	1.1	98.9
62	1	.5	.5	99.5
65	1	.5	.5	100.0
Total	188	100.0	100.0	

Ethnitiy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Malay	174	92.6	92.6	92.6
	Chienese	6	3.2	3.2	95.7
	India	4	2.1	2.1	97.9
	Others	4	2.1	2.1	100.0
	Total	188	100.0	100.0	

Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	primary school	9	4.8	4.8	4.8
	secondary school	9	4.8	4.8	9.6
	diploma	84	44.7	44.7	54.3
	Degree	86	45.7	45.7	100.0
	Total	188	100.0	100.0	

Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Goverment	133	70.7	70.7	70.7
	Private	15	8.0	8.0	78.7
	Business	3	1.6	1.6	80.3
	Others	37	19.7	19.7	100.0
	Total	188	100.0	100.0	

Method

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	selfbin	64	34.0	34.0	34.0
	communal bin	80	42.6	42.6	76.6
	private company	8	4.3	4.3	80.9
	Burn	34	18.1	18.1	98.9
	soil	1	.5	.5	99.5
	others	1	.5	.5	100.0
	Total	188	100.0	100.0	

Law

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	153	81.4	81.4	81.4
	No	35	18.6	18.6	100.0
	Total	188	100.0	100.0	

Recycling

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	186	98.9	98.9	98.9
	No	2	1.1	1.1	100.0
	Total	188	100.0	100.0	

Q13

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	117	62.2	62.2	62.2
	No	71	37.8	37.8	100.0
	Total	188	100.0	100.0	

Service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	141	75.0	75.0	75.0
	No	45	23.9	23.9	98.9
	Not sure	2	1.1	1.1	100.0
	Total	188	100.0	100.0	

Type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Door to door	43	22.9	22.9	22.9
	communal bin	109	58.0	58.0	80.9
	Selfbin	36	19.1	19.1	100.0
	Total	188	100.0	100.0	

Person

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Local authority	98	52.1	52.1	52.1
	Contractor	75	39.9	39.9	92.0
	not sure	15	8.0	8.0	100.0
	Total	188	100.0	100.0	

Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Everyday	55	29.3	29.3	29.3
	every 2 days	39	20.7	20.7	50.0
	3 times per week	59	31.4	31.4	81.4
	once a week	18	9.6	9.6	91.0
	not on schedule	17	9.0	9.0	100.0
	Total	188	100.0	100.0	

Satisfactoy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	very satisfy	21	11.2	11.2	11.2
	satisfaction	102	54.3	54.3	65.4
	Not satisfaction	46	24.5	24.5	89.9
	Not very satisfaction	19	10.1	10.1	100.0
	Total	188	100.0	100.0	

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Area	188	1.00	2.00	1.3191	.46739
Ethnitiy	188	1.00	4.00	1.1383	.53938
Gender	188	1.00	2.00	1.5798	.49491
Status	188	1.00	4.00	1.8670	.60158
Education	188	1.00	4.00	3.3138	.77558
Occupation	188	1.00	4.00	1.7021	1.19562
Method	188	1.00	7.00	2.2926	1.46785
Law	188	1.00	2.00	1.1862	.39028
Recycling	188	1.00	2.00	1.0106	.10287
Source	188	1.00	4.00	3.7766	.76213
Q13	188	1.00	2.00	1.3777	.48610
Service	188	1.00	3.00	1.2606	.46382
Type	188	1.00	3.00	1.9628	.64890
Person	188	1.00	3.00	1.5585	.63900
Frequency	188	1.00	5.00	2.4840	1.25590
Satisfactoy	188	1.00	4.00	2.3351	.80735
Valid N (listwise)	188				