Chapter 3

Recycling System in Malaysia: Case studies on Industrial Waste

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I. Introduction

Manufacturing industry has played an important role for Malaysia's economic growth for the past four decades. This sector's contribution to Malaysia's overall Gross Domestic Product (GDP) has grown from 13.9% in 1970 to 31.9% in 2000(Malaysia 2006). Malaysia continues to maintain the manufacturing industry as the main sector for the country's development process and economic growth. This sector also provides services and products that changed the way of life and the quality of life for Malaysia people and its ecosystem. However, the rapid change in industrialization generates huge amount of wastes and this signaled the need for a new way of looking at solid waste management. The existing management system in Malaysia for industrial wastes gives priority to end-of-pipe approach and promotes the use of treatment and disposal method, rather than recovery. But this approach has been found creating many environmental problems such as illegal dumping, the need for new land for the establishment of disposal facilities, among others. There are many cases of illegal dumping of industrial waste which have a significant impact to human and environment health. Table 1 listed important incidents of illegal dumping of industrial waste in Malaysia, creating social and environmental issues.

The current management method needs to be changed towards a more sustainable management regime, as there are now technology and demand to recover the waste for other uses. For example, Japan emphasizes recovery of waste and by-products through implementation of strategies to replace material resources with technology development (Erkman, 2002). Pongrácz and Pohjola (2004) also emphasize the importance of resource conservation towards achieving more sustainable waste practice. Wastes recovery allows industry to reduce manufacturing process costs, increases efficiency of resources utilization, promotes environmental friendly product design, and most importantly it reduces negative impacts on the environment and human health. Recovery of industrial waste creates alternative resources and promotes costs efficiency (Jo Dewulf and Langenhove 2005). Furthermore Ui (1984), Hirayama et.al., (1987) and Gotoh, (1987) have identified the importance of industrial waste recovery in Japan, that with proper recovery system implemented by the government and businesses, this mechanism has led towards a sustainable industrial waste management in the country.

Table 1: Reported Incidents of Hazardous Wastes Illegal Disposals in Malaysia

Year	Location	Amount and Type of Wastes	Company
1989	Pantai Remis, Perak	1,500 tonnes of toxic wastes	Unknown
1993	Bukit Merah, Perak	Radioactive wastes	Asian Rare Earth Plant, Mitsubishi Kasei.
1995	Pangkor Island, Perak	Forty-one drums of highly toxic potassium cyanide	Unknown

1995	Penang Island	28 drums of trichiorofluoromethane	unknown
2001	Ulu Tiram, Johor	1,000 tonnes of metal ashes	Foreign-based smelting company
2003	Ijok, Selangor	500 drums of paint sludge and glue.	Unknown

Source: Recycling Point Dot Com (2003), The Star, (2003)

The Malaysia government recognized the importance of industrial waste recovery. Through the Ministry of Natural Resources and the Environment and the Ministry of Housing and Local Government, waste recovery has been identified as an important environmental and economic activity. Awareness and education programs on waste recovery have been implemented with targeted audience of many levels of stakeholders, which include schools, businesses, industries and the community. Industrial waste recovery for the past decade has been identified as an emerging economic activity. Recovery of industrial solid wastes, such as plastic, steel, paper and glass has become an important support industry. This is in line with the increasing demand for limited natural resource, hence waste recovery provides alternative resources and reduces dependency on natural resource such as oil for plastic.

II. Manufacturing Industry Development in Malaysia

Industrialization in Malaysia could be traced since middle of the 19th century. Early industrial economy was of a special type based on the commercial production of industrial raw materials. The focus of Malaysian industry during that period until the independence was on producing rubber, tin, timber and palm oil. Rubber and tin industry gained an enormous boosts in value due to 1949 to 1953 Korean War (Brookfield 1994). Well planned and structured industrialization process in Malaysia started after the independence in 1957. This was stated in the First Malaya Plan1956 to 1960, which had driven the initial industrialization process in Malaysia. It also created more manufacturing industries which focused on tin, rubber and palm oil industry.

During Second Malaya Plan 1961 to 1965, industrial activity had been diversified to reduce dependency on agricultural and natural resources based industry. Manufacturing industry producing products such as textiles, food and building materials were established to enhance economic growth of Malaya. Modern manufacturing industry development in Malaysia which began during the early 1960s, started with industries processing primary commodity especially rubber, small-scale food processing and handicrafts.

However in mid-1960's, diversification of new industry was promoted and these include textiles, beverages, wood and furniture as well as printing and publication. These industries continued to dominate the 1970's industrial sector in Malaysia. As technology and human resource developed during 1980s, industrial sector expanded to include higher technology industry for food and beverages, furniture, textiles, plastic and petroleum based products. Since 1990s until now, more advance and high technology industries have been established and this includes electrical and electronics, engineering, information, communication and telecommunication. Four key factors driving manufacturing industrial development in Malaysia were identified, and these include the following:

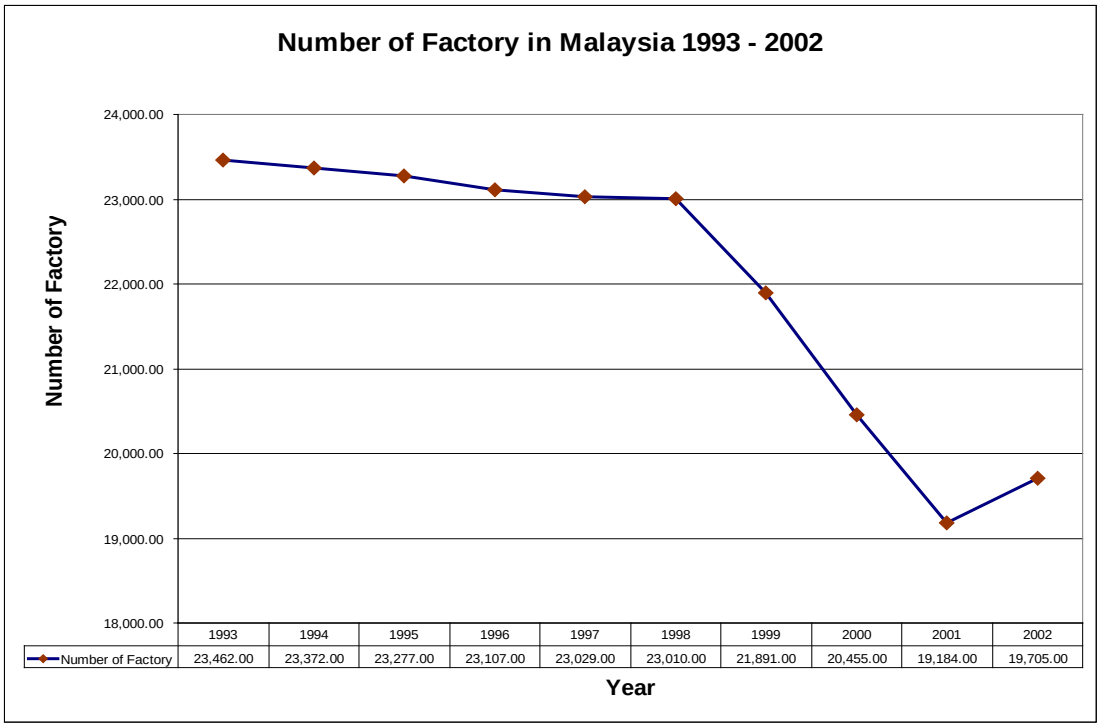
- policies and strategies – Industrial Master Plan (IMP) 1986 – 1995, Second Industrial Master Plan (IMP2) 1996 – 2005, Third Industrial Master Plan (IMP3) 2006 – 2020, First to Ninth Malaysia Plan (MP1 – MP9) 1966 - 2010, First Outline Perspective Plan (OPP1) 1971– 1990, Second Outline Perspective Plan (OPP2) 1991–2000 , Third Outline Perspective Plan (OPP3), 2001-2010;
- infrastructure – roads, ports, rail tracks, airports, energy, water, industrial parks;
- support services – financial agencies, transport services; and
- skilled labour – university, polytechnics, colleges, training institute.

Value added industry has been promoted through introduction of Pioneer Industries Ordinance 1958. As a result, manufacturing industry increased its GDP contribution from 8% in 1957 to 12% in 1969. The increase of GDP was also accelerated with the establishment of the Federal Industry Development Authority in 1966 and with the introduction of the Investment Incentives Acts 1968, which offered a variety of tax holidays for pioneer industry (Rasiah 2002; Samad 1994). In 1970, the manufacturing sector contributed 13.9% to GDP in Malaysia. With the introduction of Free Trade Zones in 1971, growth in the manufacturing sector accelerated. In 1990, it had doubled to 27.0%. The share of manufactured product in export by value was 11.1% in 1970 but by 1990, this had soared to 58.9% (Taylor and Ward 1994). This dramatic transformation which occurred over a period of two decades was the result of the policies and strategy implementation as outline above. Thus, industrial sector has fulfilled its responsibility to achieve the objectives of the New Economic Policy, which include an increased employment, increased income and restructured the society.

Malaysia envisages being an industrialized country by 2020. To achieve this vision, the government has identified industrial sector as the key sector. Therefore, manufacturing industry will play a vital role in enhancing Malaysian economic growth. The Industrial Master Plan (IMP) (1986 to 1995) and its revision, the Second Industrial Master Plan (IMP2) (1996 to 2005) commissioned in March 1995, guide the development of the manufacturing industry in Malaysia. According to The Ministry of International Trade and Industry, during the IMP period from 1985 to 1995, the manufacturing outputs expanded significantly, surpassing most of the targets set (Malaysia 1997). This sector performed very well, and in 1996, it contributed RM 45.2 billion (put the equivalent in US$) to the GDP, about 34.6% of the overall GDP, with 13.3% growth over the previous year value (Malaysia 1996).

However, during the economic recession from 1997 to 1998, the manufacturing growth reduced by 13.4%. The performance of manufacturing industry had been geared up and its growth increased 13.5% in year 1999 and 21% in year 2000. This had led to GDP contribution of 33.4% in year 2000 (Malaysia, 2001). As of 2002, there were more than 19,000 factories in all state (Figure 1).

Figure 1: Number of Factory in Malaysia from 1993 to 2002



Source: Department of Statistics, Malaysia 2005a, 2005b.

Manufacturing industry had continued as a key sector in economic growth for Malaysia. Its GDP contribution increased by 5.2% in 2005, and by 4.6% in 2007 (baseline year 2000) (EPU 2009). Future development of manufacturing sector will be guided by the Third Industrial Master Plan (IMP 3) (2006 – 2020), where it has a target to ensure growth of GDP at 5.6 % annually and to contribute 28.5% to GDP in 2020.

III. Industrial Waste Management in Malaysia

Industrial waste management in Malaysia has become an important activity that goes along with industrialization process. During 1950's after independence, environmental problems were ignored by industries in Malaysia and most of incidents were not taken care of. In 1960s, diluting and dispersing of pollutants were practiced by industries. However, when environmental problems became national issues, industries treated wastes by end-of-pipe solutions controlled by pollution standard established by Malaysian Government. In 1980s, waste minimization was emphasized using cleaner technology and production of cleaner products. The use of advanced technology, increased awareness campaigns among consumers and industries, and the application of approaches focusing on ecosystem sustainability were introduced and practiced in the country. These include application of eco-efficiency for resources, eco-design for cleaner products and use of life cycle assessment as a tool for eco-sustainability. Coming into 21st century, waste recovery for alternative resources was promoted to reduce dependency on natural resources and to ensure sustainability of industries.

This current practice in managing industrial wastes in Malaysia still maintains "end of pipe" approach, focusing on treatment and disposals. This system promotes

illegal dumping and increased incidents of environmental degradation. Therefore, legislative framework in managing industrial waste has been established to ensure that industrial waste will be managed better. However, there is no working industrial waste definition available in Malaysia. Hence, in managing industrial wastes, it is conducted based on sectoral legislative structure, which focuses on type and generator of wastes. Industrial wastes in Malaysia are categorized into two types as follows:

a) Solid waste, which includes wastes generated by manufacturing process, or activity or by product; and
b) Toxic and hazardous wastes, which include any matter prescribed to be scheduled waste, or any matter whether in a solid, semi-solid or liquid form, or in the form of gas or vapour which is emitted, discharged or deposited in the environment in such volume, composition or manner as to cause pollution.

The solid wastes generated by industries were non-hazardous waste. Its management falls under the jurisdiction of Local Government Act 1976, Street, Drainage and Building Act 1974, and Town and Country Planning Act. Specific definition of industrial solid waste is not available under the Local Government Act 1976. However, under the local government by laws, Rahmah (2001) stated that solid wastes were categorized as follows:

i. Waste materials, which include any valuable or non-valuable by products, reject or spoilt products produce in manufacturing process;
ii. Trade waste, which includes any waste materials generated by trade activity;
iii. Industrial waste, which includes any waste materials generated from industrial activity;
iv. Park waste, which includes leaves, grass, tree branches or soil from parks or from house or building compound or from land; and
v. Household waste, which includes all types of waste generated from household.

Solid wastes generated by industries fall under these categories, hence the Local Government Act 1976 and local governments by laws were able to manage industrial solid wastes. The key stakeholders in managing solid waste generated by industry were the Ministry of Housing and Local Governments, Department of Local Government, local governments, solid wastes contractors companies, industry and solid wastes recyclers. The government agencies lead by the Ministry of Housing and Local Government provide legislative and guideline in managing industrial waste. This includes how to recycle, treat and disposed the industrial solid wastes. The Local Government Act 1976 provide important legislative and technical requirements as a guide for the local government, waste generator, waste operator, waste recycler and disposal sites operator in conducting daily operation in managing industrial wastes.

However with increasing industrial waste generation and complexity in managing solid wastes, the Malaysian government established the Department of National Solid Waste Management (DNSWM) in 2007, to ensure effective and sustainability in managing solid waste which includes industrial solid waste. DNSWM role was to implement the National Strategic Plan for Solid Waste Management (Nazri,). The policy implementation was supported by legislative tool, the Solid Waste and Public Cleansing Management Act 2007. DNSWM will implement sustainable waste management based on waste management hierarchy which prioritize waste reduction through 3R,

intermediate treatment and final disposal as well as emphasis on environmental protection and public health (Abdul Nasir, 2007).

Industrial solid waste has different way of handling compare to household. The volume of these waste are bigger and its characteristics is different. In Klang Valley, collection of industrial solid wastes has been privatized. Companies such as Alam Flora Sdn Bhd have been awarded concession to manage the wastes. There was valued industrial waste which has been recovered and recycled, however those with no value were sent to landfill or dumpsite. Scrap iron, steel, aluminium, carton boxes, paper, plastics and glass were valuable solid wastes generated by industries. These wastes were recovered and there are factories in Malaysia that recycled these materials to produce other products. Meriahtek Sdn Bhd, for example is a recycling company recover electronic waste which includes ferrous and non-ferrous metal, plastic, glass and industrial oil. Paper, plastic and aluminium can recycling have been very successful in Malaysia. The recycling centre located in 148 local governments in Malaysia, shows that these three wastes were the most popular item recycled by public and industries. In supporting recovery activity in Malaysia, as of 2008, there are 119 licensed solid waste recyclers in Malaysia.

Other materials recycling scheme is in the process of research and development and hoping that it will start off soon. Solid waste recovery through recycling program has been the main agenda in Malaysia. Ministry of Housing and Local Government spearheaded this program and promote recycling by household, institutions, factories and people. Later this activity was taken over by the Department of National Solid Waste Management. Priority will be given for reduction and recovery of controlled solid waste. This includes prescribed recycling and separation of recyclables as well as implementing the take back system and deposit refund system. The recycling activity conducted with support from community associations, schools, institutions, private company, recycling associations, recyclers and non-government associations.

Similar to industrial solid waste management, managing industrial toxic and hazardous waste are also done through specific legislative structure. At present, the Environmental Quality Act (EQA) 1974, the Local Government Act 1976, and the Customs and Excise Act are the three laws playing a major role in managing industrial toxic and hazardous waste better. The EQA specifically addresses the toxic and hazardous wastes under its subsidiary legislations as follows:

- Environmental Quality (Prescribed Premises) (Crude Palm Oil), 1977.
- Environmental Quality (Prescribed Premises) (Raw Natural Rubber), 1978.
- Environment Quality (Sewage and Industrial Effluent), 1979.
- Environmental Quality (Scheduled Wastes), Regulation 1989.
- Environmental Quality (Prescribed Premises) (Scheduled Wastes Treatment and Disposals Facilities), Order 1989.

These regulations fall under the jurisdiction of the Department of Environment (DOE) Malaysia. Specifically, toxic and hazardous waste are directly managed under the Environmental Quality (Scheduled Wastes), Regulation 1989. Others have a significant role in managing toxic and hazardous waste through its activities and characteristics. The EQA defined toxic and hazardous wastes as scheduled waste rather than using the toxic and hazardous waste term. In the regulation, scheduled wastes refer to only 58 categories and 107 types of wastes listed in the First Schedule of the regulation. However, toxic and

hazardous wastes definition goes beyond of this waste. Therefore, scheduled wastes stated in the Environmental Quality (Scheduled Wastes) Regulation 1989 will be also referred to as toxic and hazardous wastes.

In addition to EQA 1974, there are other specific acts which have equal responsibility, these includes Poisons Ordinance, Dangerous Drugs Ordinance, Explosive Ordinance, Occupational Safety and Health Act, Radioactive Substances Ordinance and Pesticides Act (Jamaluddin 1993). These legislatives are under the responsibility of other agencies with different responsibilities. At least four different agencies and legislations that deal with aspects of toxic and hazardous wastes management (Table 2).

Table 2: Industrial Waste Management Stakeholders and Legislative Instruments in Malaysia

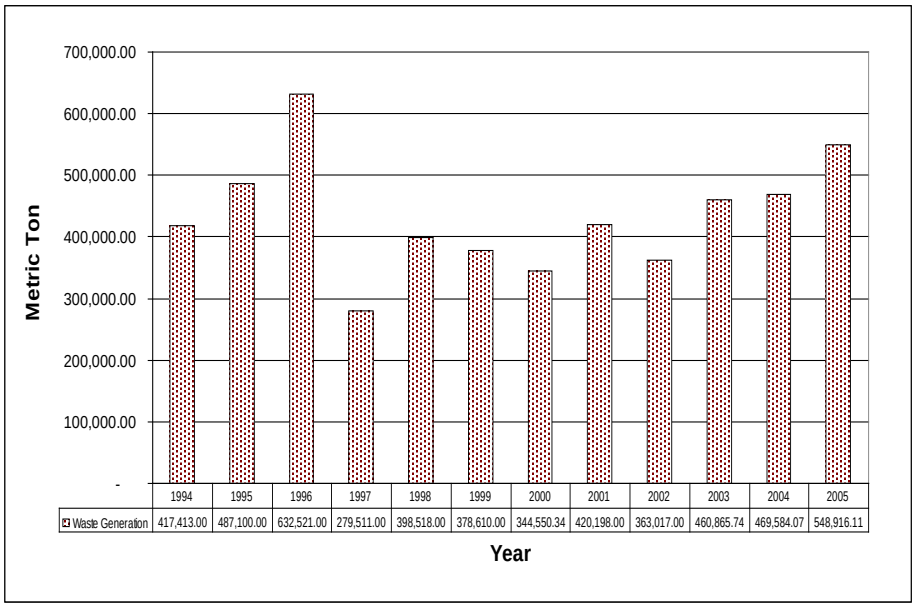
Agency	Legislations	Scope
Ministry of Natural Resources and Environment Department of Environment (DoE) Enforcement measures are shared with: Ministry of Trade and Industry Ministry of Agriculture with the support of Department of Agriculture Department of Fisheries	Environmental Quality Act 1974 (From this Act, there are at least five Regulations that can be linked directly and nine indirectly)	Prevention, abatement and control of pollution Regulation to recover wastes and resources under EQA 1974 Part IV Regulations provided for industrial activities such as: ● Crude Palm Oil ● Raw Natural Rubber ● Scheduled Wastes, Treatment and Disposal Facilities ● Marine Pollution Use of controlled substances in soap, synthetic and other cleaning agents
Ministry of Housing and Local Government Department of National Solid Waste Management Department of Local Government	Solid Waste Management and Public Cleansing Act 2007. Local Government Act 1976 and local governments' bylaws. Street, Drainage and Building Act, 1974 and Town and Country Planning Act.	The National Strategic Plan for Solid Waste Management emphasizes waste recovery.
Ministry of Agriculture	Pesticides Act 1974	Control of pesticides for use, sale and import of, and production
Ministry of Home Affairs Department of Royal Customs and Excise	Control of Supplies Act 1961 Environmental Quality Act 1974 Pesticides Act 1974	Control and rationing of controlled articles / items Control of import and export
Ministry of Human Resource Development	Occupational Safety and Health	Health, safety and welfare of workers

III-1. Industrial Waste Generation Trends

A high volume of industrial waste generated daily demands good management system and effective support of infrastructure. With a limited number of landfill to handle increasing volume of wastes, there is a need to recover wastes for other uses. Wastes such as plastic, steel, wood, glass and paper generated during manufacturing or packaging have been found having significant values. Industries now have developed a system and design to recover their products by recycling or reuse (ADEME 1999). Depletion of natural resources has created critical problems to manufacturing industry. For example, with increasing price of petroleum, the price of plastic pellet for manufacturing industry increases many folds. Hence, recovery of plastic waste help industry to obtain alternative resources and at the same time it would reduce their manufacturing cost. High volume of waste generated by Malaysian industries for the past three decades has provided enough supply of wastes for recovery purposes (Azni et.al. 2004). This will help to change the focus from end-of-pipe approach to sustainable use of wastes. Industrial wastes recovery also will minimize the vulnerability of ecosystems as it will reduce requirements for new landfills since most of the landfills in Malaysia have reached their maximum capacity.

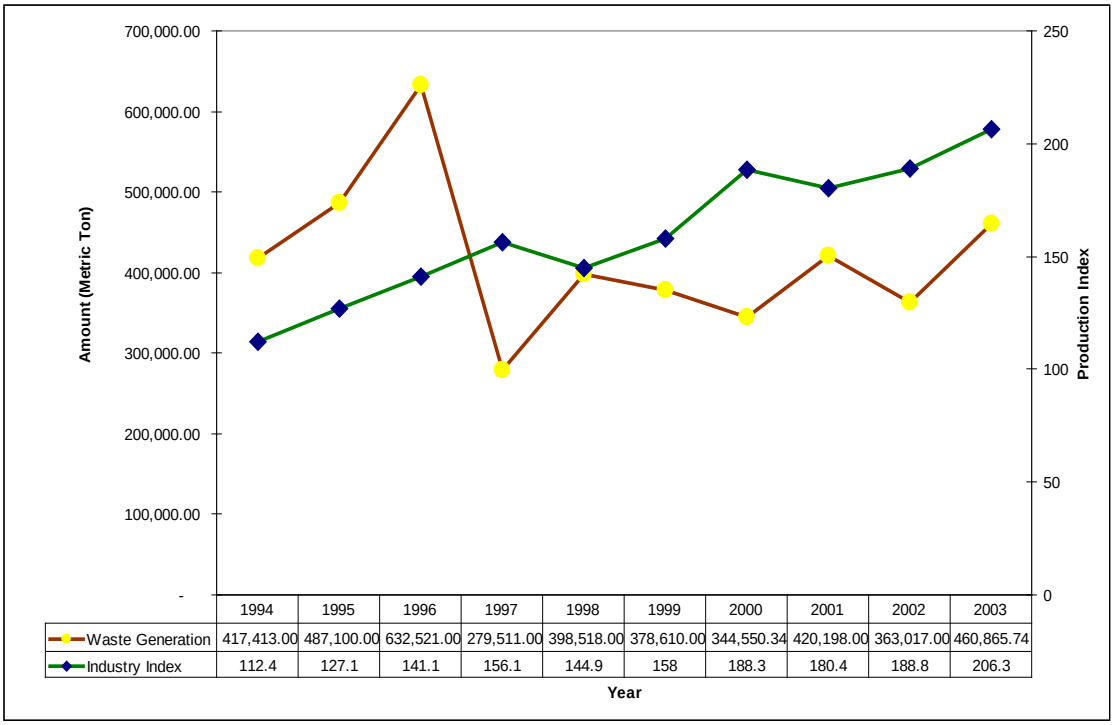
The amount of solid waste generated in Malaysia increased from 16,200 tonnes per day in 2001 to 19,100 tonnes in 2005 or an average of 0.8 kilogram per capita per day (Malaysia 2006). Nasir et. al. (1998) found that industries in Malaysia contributed 30% of solid wastes and that wastes generation increased at about 4% annually. It was estimated that the industrial solid wastes generation has increased from 7,721.58 ton/day in 1994 to 11,519.24 ton/day in 2005. Hazardous waste generation varied from 1994 to 2005, 417,413 metric tons of waste generated in 1994 and increased to 632,521 metric tons in 1996, later reduced to 548,916 metric tons in 2005 (DoE 1995, 2003, 2006). The trend of hazardous wastes generation is shown in Figure 2. There are significant relationship between industrial waste generation and industrial production. Figure 3 and 4 shows the significant relationship, where waste generation increased with increased of industry production index and manufacturing industry index.

Figure 2: Toxic and Hazardous Waste Generation Malaysia 1994 - 2005



Source: DoE 1995, 2003, 2006.

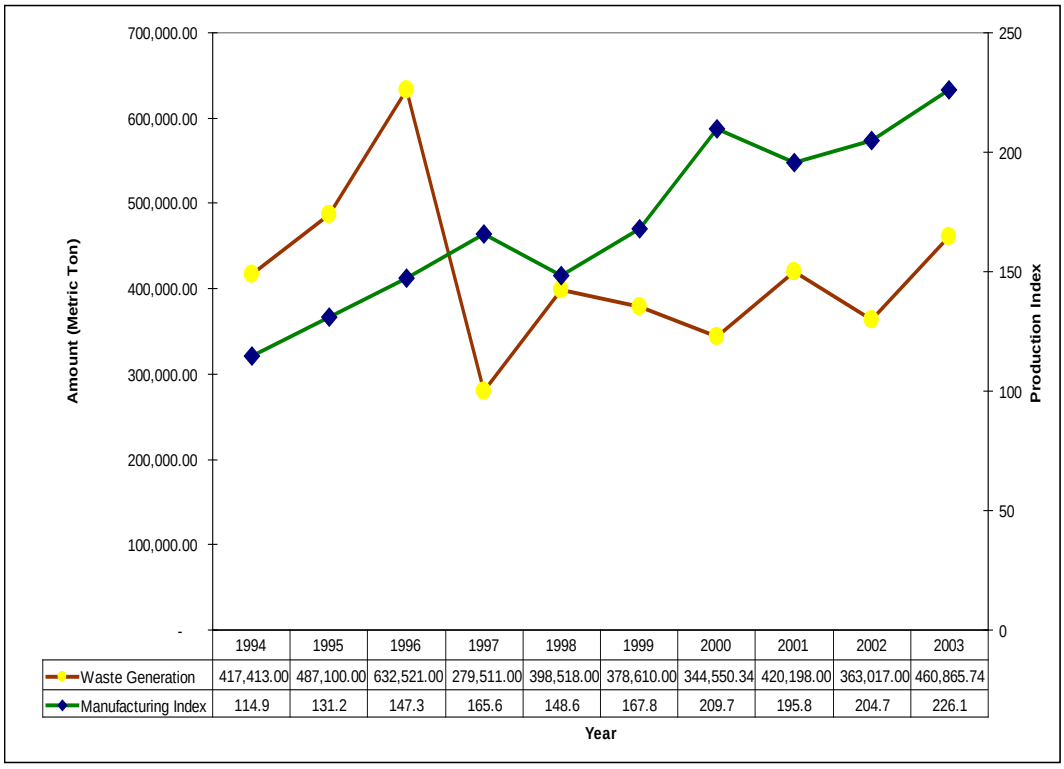
Figure 3: Relation between Industry Production Index and Waste Generation



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Waste Generation	417,413.00	487,100.00	632,521.00	279,511.00	398,518.00	378,610.00	344,550.34	420,198.00	363,017.00	460,865.74
Industry Index	112.4	127.1	141.1	156.1	144.9	158	188.3	180.4	188.8	206.3

Source: Department of Statistics, Malaysia 2005b; DoE 2000, 2004

Figure 4: Relation Between Manufacturing Production Index with Waste Generation.



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Waste Generation	417,413.00	487,100.00	632,521.00	279,511.00	398,518.00	378,610.00	344,550.34	420,198.00	363,017.00	460,865.74
Manufacturing Index	114.9	131.2	147.3	165.6	148.6	167.8	209.7	195.8	204.7	226.1

Source: Department of Statistics, Malaysia 2005b; DoE 2000, 2004

III-2. The Need for Resource Recovery from Waste

Malaysia has accepted many sustainable development principles. Malaysia is also a signatory to multi-lateral agreements which includes Basel Convention, Rotterdam Convention and Kyoto Protocol. These agreements require industries in Malaysia to practice sustainable concept which includes resource efficiency and sustainable waste management. Malaysians are also aware about the importance of practicing sustainable waste management since key markets for Malaysian products such as European, North America, Japan, Australia and New Zealand emphasize sustainable practice. Moreover, in the future ASEAN Free Trade Agreement, it will implement the need for cleaner production emphasizing sustainable waste management. With increasing amount of industrial waste generated, there are opportunities to increase waste recovery as resource. This will help to reduce industrial dependency on natural resources. The practice for waste recovery was supported by Malaysian government through policy, legislation and pro-active role which include economic mechanism.

The trend of industrial wastes generation shows that there is sufficient amount for recovery. In 2008, there are 119 industrial solid wastes recyclers licensed by the Ministry of Housing and Local Government Malaysia (Table 3). For hazardous wastes, 122 recyclers were licensed by the Department of Environment Malaysia in 2006 to recover the wastes (Table 4). Table 5 shows the types of industrial solid wastes recovered by the recyclers. Nasir et.al. (1998) estimated that 70% of total industrial solid wastes generated were recovered. The estimated amount of industrial solid wastes recovered was about 5,405.1 ton/day in 1994, and increased to 8,063.47 ton/day in 2005.

Table 3: Number of Solid Waste Recycler Licensed by Ministry of Housing and Local Government for 2008

State	Number of Recycler
Johor	11
Negeri Sembilan	4
Perak	1
Sarawak	10
Selangor	44
Kedah	1
Melaka	2
Pahang	1
Pulau Pinang	20
Terengganu	1
Federal Territory Kuala Lumpur	22
Kelantan	2
Total	119

Table 4: Number of Hazardous Waste Recycler Licensed by DoE in Malaysia for 2006

State	Number of Recycler	Type of Waste Recycled in Each State
Johor	18	33
Negeri Sembilan	2	4
Perak	11	17
Sarawak	2	2
Selangor	32	44
Kedah	10	3
Melaka	9	9
Pahang	3	12
Pulau Pinang	31	15
Terengganu	1	6
Federal Territory Kuala Lumpur	3	1
Total	122	

Source: Data of DoE

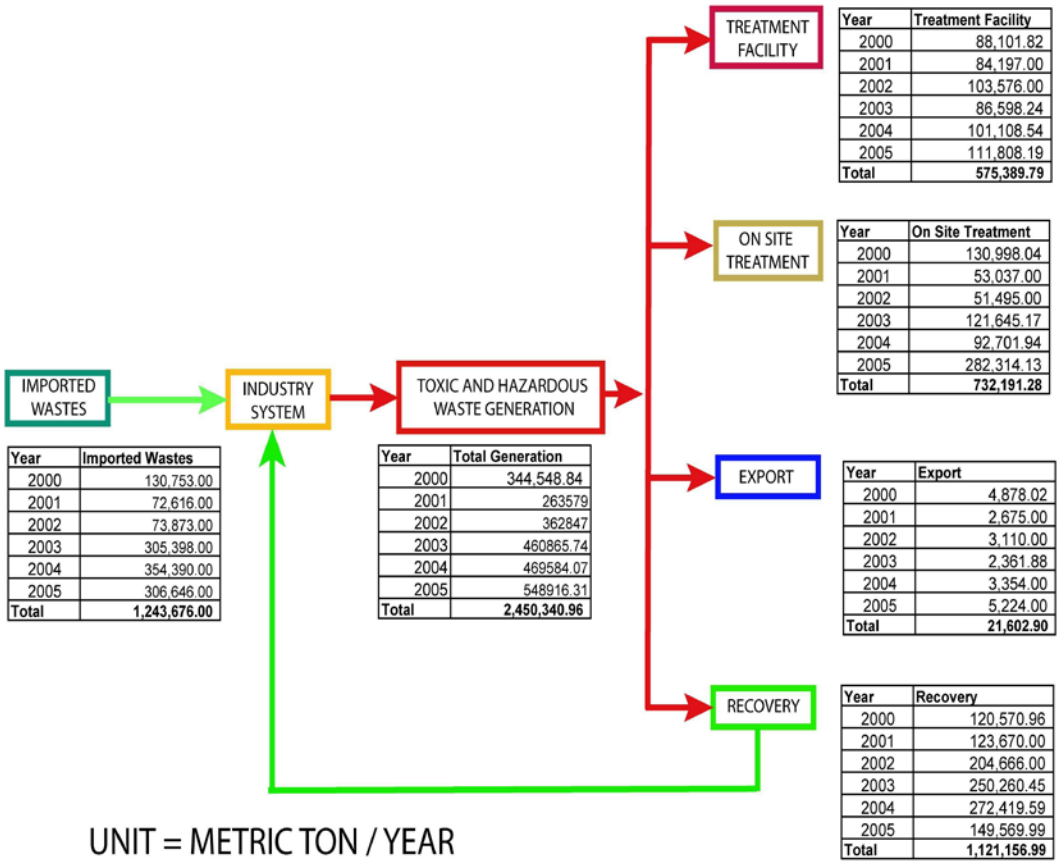
Table 5: Example of Recoverable Materials

Type of Manufacturing Industry	Type of Waste
Electrical and Electronics	Paper, box, glass, scrap metal, wood, plastic, sludge, domestic waste, copper, aluminum, cast iron and steel
Mineral, concrete and ceramic	paper, carton box, glass, wood, plastic, concrete waste, metal and drum
Metal engineering	metal (copper, iron, aluminum) paper, carton box, glass, wood and plastic
Food and Beverages	paper, carton box and plastic
Pharmaceuticals	paper, carton box and glass
Paper, packaging and labeling	plastic and paper shreds
Chemicals	paper, carton box, glass, woods, plastic, metal (zinc, nickel, chromate, alodine)
Rubber	Paper, carton box, plastic, hydroxide metal sludge, vulcanized rubber waste, jute
Textiles	textile waste

Approximately 45.75% of hazardous wastes have been recovered from total wastes generation from 2000 to 2005 (Figure 5). Increasing trend of wastes recovery was observed, where recovery increased from 35% in 2000 to 58% in 2004. However, the amount of waste recovered was reduced to 27% in 2005. This significant amount of waste recovered from hazardous waste showed the potential for these wastes to be recovered and to generate economic benefits. Many types of these wastes were being traded both in the local and international markets and the demand for these wastes is increasing (Malaysia 2006). Within the period of 2000 to 2005, 1.12 million metric ton of industrial

hazardous waste has been recovered. Using estimated value of RM 4,000 (USD 1081) per metric ton, estimated value of industrial hazardous waste recovery within this period is RM 4.48 billion (USD 1.21 billion) The total value of industrial hazardous waste recovery cycle between year 2000 to 2005 in Malaysia which includes importation of this waste is estimated at RM 9.46 billion (USD 2.56 billion) (3.4 million metric ton).

Figure 5: Flow of Industrial Hazardous Waste Stream from 2000 to 2005



Year	Imported Wastes
2000	130,753.00
2001	72,616.00
2002	73,873.00
2003	305,398.00
2004	354,390.00
2005	306,646.00
Total	1,243,676.00

Year	Total Generation
2000	344,548.84
2001	263579
2002	362847
2003	460865.74
2004	469584.07
2005	548916.31
Total	2,450,340.96

Year	Treatment Facility
2000	88,101.82
2001	84,197.00
2002	103,576.00
2003	86,598.24
2004	101,108.54
2005	111,808.19
Total	575,389.79

Year	On Site Treatment
2000	130,998.04
2001	53,037.00
2002	51,495.00
2003	121,645.17
2004	92,701.94
2005	282,314.13
Total	732,191.28

Year	Export
2000	4,878.02
2001	2,675.00
2002	3,110.00
2003	2,361.88
2004	3,354.00
2005	5,224.00
Total	21,602.90

Year	Recovery
2000	120,570.96
2001	123,670.00
2002	204,666.00
2003	250,260.45
2004	272,419.59
2005	149,569.99
Total	1,121,156.99

Source: Modified from DOE 2003, 2004, 2006

However, waste recovery for resource in Malaysia is still at an infant stage. To ensure sustainability of industrial waste recovery, government support through policy, legislation and pro-active role is needed. Since technology for industrial waste recovery is ready and continuously being developed along with increasing demand for recovered industrial waste for other uses, it will become an important activity for economy and environmental need. Industrial waste recovery is an emerging economic activity. Recovery of industrial solid wastes, such as plastic, steel, paper and glass has become an important support industry. It provides alternative resources and reduces dependency on natural resource such as oil for plastic. Moreover, it also helps industry to reduce manufacturing process costs, increases efficiency of resources utilization, promotes environmental friendly product design and reduces impacts on the environment and human health.

IV. The challenges for a Sustainable Industrial Waste Recycling in Malaysia

Most of industrial waste recovery was conducted in a small scale input. Earlier from 1980s to 1990s, scavengers were the main operators in recovering waste (Nasir et.al. 1998). However, with the increasing demand of waste for alternative resources, waste recovery is now being done by companies. There are now many companies that have been issued license for industrial wastes recovery. However, the existing practice was not supported with a good infrastructure to ensure that this activity is conducted in a sustainable and environment friendly manner. This is one of the challenges of industrial waste recovery in Malaysia. The infrastructures required for a sustainable industrial waste recovery could be divided into three sectors: the governance, the physical and the economic infrastructures.

The governance infrastructure plays an important role, as it provides the infrastructure for good management to minimize impacts on the environment and human health. Governance infrastructure for managing industrial waste recovery in Malaysia has provided a good foundation that is based on legislation. As shown in Table 2, the key legislations and stakeholders listed were directly or indirectly involved in governing industrial waste recovery in Malaysia. The legislation for industrial wastes recovery in Malaysia focuses on two types of wastes; industrial solid wastes, and industrial hazardous wastes.

The key stakeholders in managing industrial solid waste generated by industry are the Ministry of Housing and Local Governments and its two departments, namely the Department of National Solid Waste Management and the Department of Local Government, governing the law. The solid wastes contractors companies, industries and solid wastes recyclers have also become key stakeholders as governed by the law (Table 2). Recovery of industrial wastes has become an important supporting activity for manufacturing industries. Wastes recovered and recycled by factories in Malaysia are turned into basic materials to produce other products. Paper and aluminium cans recycling has been achieving good responses and found to be successful in Malaysia. Other materials recycling scheme is in the process of research and development, and hope that it will start off soon. Moreover, the industrial solid waste recovery through recycling program has been the main agenda in Malaysia. The National Strategic Plan for Solid Waste Management (Strategic Plan) 2007 prioritizes reduction, reuse, recovery and recycling of waste as well as greater use of environment friendly materials (Malaysia 2006).

Legislation for recovery of hazardous wastes in Malaysia was done through Environmental Quality Act (EQA) 1974. The Local Government Act 1976 and the Customs and Excise Act are two laws that support the EQA 1974 enforcement. The EQA 1974 defined hazardous wastes as scheduled waste and referred to 58 categories and 107 types of wastes. Recovery of scheduled wastes was given priority in 2005, when an amendment was made under Part IV of EQA 1974. There was no significant impact of changes since the definition of scheduled waste was changed. However, the categorization and code for the waste was changed. Previously, under the 1989 regulation, scheduled waste was categorised by specific source or non-specific source. This was changed in 2005 regulation by focusing on waste type and industrial process. On top of these, changes made in 2005 regulation amendment were made to detail out how waste and recycled waste should be transported and emphasized the need for reporting and

enhancement of database for management purpose. The key stakeholders involved for recovery of industrial hazardous waste are the Department of Environment (DoE) and supported by the Department of National Solid Waste Management.

Legislation enforcement will require good governance infrastructure for effective enforcement. The involvement of many stakeholders is required to ensure effective governance. This includes understanding the boundaries of responsibility and actions for each enforcement agency. Synchronization of acts and regulations by relevant agencies is necessary. Strong institutional support has been identified as a critical factor in the future of legislation enforcement (Sham 1997). Hence, institutional structure is important for achieving effective governance infrastructure and good management system in establishing other supporting systems.

The physical infrastructure is also important for recovery activities by the wastes generator, the transporter and the recycler. The existing infrastructures available which support industrial wastes recovery are transportation system, recovery centres, treatment centres and landfills. Industrial solid wastes recovery in Malaysia has been done with lack of environmental concern. Recycling facilities available run as a junk yard. However, there are companies with better facilities which prioritize modern and clean process, but the number is small. On the other hand, hazardous waste recovery facilities and its collection system are monitored by the Department of Environment (DoE). Hazardous wastes recovery is controlled and done in environmentally friendly approach. The critical issues in the physical infrastructure identified are supports system for the collection of wastes, modern and environment friendly recycling facilities and human resources. Technology development and application is required to improve the physical infrastructure. The most important technology is to enhance the capability of recovery facilities to recycle more types of industrial waste, especially the hazardous wastes. In this way, this will help to supply more alternative resources, and will reduce dependency on natural resources.

The financial and economic infrastructure includes mechanisms and tools to ensure efficient wastes recovery activities. This is important to ensure that industrial wastes recovery is economically viable, and that it recycles virtually all of the materials use, emitting only micro amounts of waste and pollutants, while providing increasingly high quality services. Thus, the mechanisms and tools should be placed into policy options for resource conservation to facilitate the sustainability of affordable environmental investment through waste management and cleaner production (Marans and Lee 1993; Kjaerheim 2005). To ensure effective mechanisms for financial arrangement, it is important that the strategy for the mechanisms be institutionalized within the management regime of key stakeholders. The mechanisms should not be introduced or used as a voluntary action especially by the business and industrial players. Thus, financial and economic tools should also include financial support, insurance services, market system and trade promotion (Table 6).

Table 6: Financial or Economic Tools for Industrial Waste Recovery in Malaysia

Economic Tools	Financial Tools
▪ Market incentives ▪ Labour levy ▪ Tax reduction for cleaner production ▪ "Polluters pay" principle ▪ Market promotion for environmental friendly products	▪ Deposit and refunds system ▪ Rebate mechanisms for purchasing cleaner technology or equipment ▪ Low insurance premium for environmental friendly industry and products promoting waste recovery ▪ Finance or loans to produce cleaner products ▪ Finance or loan for waste recovery and recycling of waste as a resource

V. Role of Malaysian Government Agencies and Industries for Waste Recycling in the Southeast and East Asia Region

Industrial waste recovery has become an important economic activity in Malaysia. Industrial Master Plan 3 for Malaysian industry clearly stated that the importance of industrial waste recycling, and this activity was supported through incentives mechanism under the Promotion of Investments Act 1986. Therefore, Malaysian authority and industries will also play an important role for the future of the industrial waste recovery. With increasing demand for industrial waste recovery activity in the South East Asian and East Asian region, it is critical that Malaysian government and its industries play a key role towards ensuring sustainability of industrial waste recovery in these regions.

There are existing mechanisms where government of Malaysia, business and its industries could be involved directly or indirectly. The most common mechanisms are by utilizing the Government to Government agreement between two countries. This mechanism is suitable for the need of the two countries involved, but the mechanism might not be accepted by other countries in the region. However, in Southeast Asian region, there is an existing ASEAN mechanism where current politic, economic, cultural and social relationships have been established for more than three decades. On top of this, there are specific economic and trade agreement especially under the Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT) and Brunei, Indonesia, Malaysia and Philippines East Asian Growth Area (BIMP-EAGA).

The government of Indonesia, Malaysia, and Thailand recognized the potential of the IMT-GT sub-region. In 1993 the IMT-GT program was launched. The IMT-GT cooperation aimed to accelerate the sub-region's economic transformation, through the following activities:

- exploiting complementarities and comparative advantages;
- enhancing competitiveness for investments and exports, and promoting tourism;
- lowering transport and transaction costs; and
- reducing production and distribution costs through scale economies.

The establishment of the IMT-GT sub-region was characterized by many economic complementarities, geographical location, long historical, cultural and

linguistic ties. IMT-GT includes area of 14 provinces in Southern Thailand, 8 states of Peninsular Malaysia and the island of Sumatera consisting of 10 provinces. There are many activities that have been achieved in the IMT-GT since its establishment in 1993. The cooperation has expanded its geographical coverage and has witnessed the establishment of many partnerships and alliances, with the private sector playing the main role. Key achievement of IMT-GT includes the following:

- travel and tourism, with robust growth in the number of travellers within and from outside IMT-GT, the operation of more airlines, increase in frequency of flights to the sub-region, operation of more hotels, and improvement in mobility of people in the sub-region;
- sea transport, in which four new routes were opened;
- land transport, with the improvement in road linkages between Penang and Songkhla, and construction of Trans-Malaysia-Thailand Bridge;
- telecommunications, with construction of submarine fibre optic cable link between Malaysia and Sumatera;
- energy, with the conclusion of inter-country power sharing agreement between Malaysia and Thailand;
- trade and investment, with the development of border markets and barter trading within the sub-region; and
- human resource development, with the establishment of UNINET, a cooperative form of education, research and exchanges among research and training institutions in the IMT-GT.

The Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA) sub-regional cooperation initiative was formally launched in 1994 as a key strategy of the participating governments to address the social and economic development of their less developed and more remote territories. (BEMBC 2009). The immediate objective is to encourage increased trade, investments and tourism in the sub-regions which cover the island economies of Brunei; North, Central, South and Southeast Sulawesi, Central, East, West and South Kalimantan, Maluku and Irian Jaya in Indonesia; Sabah, Sarawak and Labuan in Malaysia; and Mindanao and Palawan in Philippines. Its long-term goal is to change the economy of BIMP-EAGA from resource based extraction to higher order processing and non-resource based activities. Significantly, development of this sub-regional grouping rests on the private sector as the engine of growth, with the governments providing the facilitative environment that will allow the promotion of private sector investments. BIMP-EAGA cooperation aims to increase trade, tourism and investments within and outside the sub-region by:

- Facilitating the free movement of people, goods, and services;
- Making the best use of common infrastructure and natural resources; and
- Taking the fullest advantage of economic complementation.

This cooperation mechanism can be use for supporting industrial waste recovery in the South East Asian region. However, there is a need to establish policy and strategy shared and agreed by member's country which includes monitoring regime and enforcement agreement for movement of waste. The policy and strategy will drive the process of cooperation between government agencies and industries in the region. This will include harmonizing standards use for enforcement, trade and transportation of

wastes as a resource. Towards ensuring industrial waste recovery, the cooperation mechanism also must determine the role of government agencies, business and industries of the country. Market mechanism and financial support system must be established. Along with increasing demand, there is a need for technology and human resource development to ensure sustainability of the industrial waste recovery. Upon success of this cooperation mechanism, it can be expanded to other countries in the South East Asian and East Asian Region.

VI. Conclusion

Industrial waste recovery in Malaysia has emerged as an important industrial and economic activity. It has good potential because managing industrial wastes as a resource through wastes recovery activity will create alternative resources and will minimize the negative impact of waste to the environment and human health. This activity will also provide jobs and business opportunities. The challenges to ensure sustainability for industrial waste recovery in Malaysia as discussed above require full commitment of all key stakeholders. Political will and business commitment will promote establishment and effectiveness of infrastructure especially the governance, the economy and technology development. These infrastructures should be put in place to achieve sustainable industrial wastes recovery in the country. The requirement for recovery of industrial wastes as a resource is an important activity especially for resource efficiency, and contributes towards achieving sustainable industrial development which has been highlighted in the National Policy on the Environment 2002 and in the statement of the Eight Malaysia Plan (Malaysia 2001). Moreover, the Malaysian government agencies, business and industries can also play an important role in the Southeast Asian and East Asian region. Through cooperation mechanism especially with the ASEAN, BIMP-EAGA and IMT-GT as well as with countries like Japan, China and South Korea will help to promote the development and sustainability of industrial waste recovery in the region.

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