ERIA Research Project Report 2009, No. 10

3 R
POLICIES FOR SOUTHEAST AND EAST ASIA

Edited by
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March 2010

Preface

This is the second interim report of the Working Group on 3R Policies for Southeast and East Asia. The working group conducted the second workshop in Jakarta in October 2009, the third workshop in Kuala Lumpur in January 2010, and the fourth workshop in Jakarta in March 2010. In this fiscal year, we focus on the roles of stakeholders, the significance of industrial standards for promoting recycling, the location of recycling infrastructure in the region, among others.

The working group organized two seminars in Indonesia in March 2010. The first workshop is co-organized with Bandung Institute of Technology in Bandung. We shared our research results with local and central government officials, researchers and students. The second seminar is held in the Eco Products International Fair at Jakarta Convention Center, organized by Asian Productivity Organization. Participants from private companies, industrial associations, non-governmental organizations, ministries, universities attended the seminar. We discussed recent issues and concerns on recycling with participants. We also visited 5 recycling related facilities in Indonesia and Malaysia.

Based on the discussion of the working group, and from our findings during site visits and seminars, we reaffirmed that it is very useful for each country to share information and policies in the region, because we are facing similar problems and challenges.

In the next fiscal year, we would like to continue our discussion in the working group on environmental statistics, international recycling and other 3R related activities. In addition, we are planning to share the information with other experts, businessmen, policy makers and citizens. We hope this report can serve as baseline information in formulating policies to promote 3R especially in the Asian region.

March 31, 2010

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Executive Summary and Policy Recommendation

Summary of Papers in the Report

Chapter 1 reviews the benefits of 3R from life cycle perspectives. Although the magnitude of benefits of 3R depends on the scenario settings, 3R can contribute to the reduction of GHG emissions.

Chapters 2 to 6 focus on the roles of stakeholders. These chapters show the importance of collaboration among various stakeholders and the significant roles of the government in coordinating stakeholders' activities. Chapter 2 shows the private sectors' efforts under voluntary agreement between government and private sectors in Singapore. Chapter 3 reviews the effectiveness of collection event, which is organized by malls, non-governmental organization and recyclers. Chapter 4 shows the flow of recyclable waste and roles of informal sectors in the collection in Indonesia. Chapter 5 focuses on the informal waste pickers and informal recyclers. It discusses some strategies on how this informal sector can be upgraded, in terms of working condition and pollution control measures. Chapter 6 shows the flow of recyclable waste in Vietnam.

Chapters 7 and 8 review the current situation and roles of industrial standard in recycling system. Chapters 4 and 6 also point out the importance of industrial standard in the context of Indonesia and Vietnam respectively. Limited number of industrial standard for recyclable waste, recycled materials and recycled goods are established in Southeast Asian Countries. It is recommended that action plan to establish industrial standard for promoting recycling should be developed in each Southeast Asian country. Regional cooperation to harmonize the standard is also proposed to reduce transaction cost and to avoid conflicts on the definition of waste.

Chapters 9 and 10 argue the indicators in recycling system. Chapter 9 compares the recycling indicators in e-waste recycling system in Japan, South Korea and Taiwan. Chapter 10 shows the use of material flow analysis in the formulation and evaluation of 3R policy in Japan.

Chapter 11 compares the pathways toward 3R-based waste management in Malaysia, Japan and the Philippines. Chapter 12 discusses the policy challenges on resource circulation faced by Asian countries. Chapter 13 reviews the location of recycling facilities for copper, lead and nickel containing scrap and discusses the necessity of transboundary movement of recyclable waste.

Revised "Mapping document on 3R-related Regulations, Ministries and Programs" is attached in the Appendix, which summarizes the legislations, ministries, and programs on 3R in the region.

Policy Recommendations

In the FY 2009, the WG focused on the implementation of the domestic 3R policies, the roles of and coordination among stakeholders, and the importance of various standards for promoting the recycling industry. In addition, we reaffirm the importance of 3R activities, from the review of studies on Life Cycle Assessment on recycling. The principles on international recycling were also discussed in the WG. Based on the results of the various studies conducted for this year and the discussion of the WG, the following policy recommendations are proposed.

1) The promotion of participation and coordination among stakeholders

Various stakeholders, such as waste generators, collectors, recyclers, users of recycled goods, academic institutions, non-governmental organizations and government agencies, should be involved in the policy making process of 3R and in the implementation of the 3R policy. It is observed that stakeholders in the upstream of waste flow, the waste generators and collectors, are well coordinated in the 3R policy, but only few governments have dialogue with stakeholders in the downstream such as the recyclers and users of recycled goods. Thus, it is proposed that central and local governments should organize stakeholder's meeting and facilitate dialogue among stakeholders both in the upstream and downstream to find a way to promote 3R and to encourage recycling industries.

2) The integration of the informal sector in the waste management system

Informal sector takes important role in recycling especially in developing Asian countries. However, despite their significant contribution in the reduction of waste especially in the urban cities, they have continued to work in an unsafe working condition and have remained in poverty. Also, due to lack of technical skills and financial capacity to invest for improved technology their activities often cause air, water and other waste related pollution. Hence, it is recommended that informal sector should be integrated in the 3R system and to improve their condition by forming them into organizations and or cooperatives and by providing legal, technical and financial support to upgrade their recycling activities.

3) The creation of economic incentives such as tax reduction and low interest loan

To encourage participation of the community in the implementation of the 3R programs and to promote the recycling industries, government should introduce tax reduction, low interest loan and other economic incentives for 3R activities.

4) The development of industrial standards of recyclable wastes and goods

Industrial standards for recyclable waste, intermediate material and recycled goods should be developed in each country, to promote consumption of recycled goods instead of natural resources. The standards should also be harmonized among countries, to boost international recycling especially in the Asian regions.

CHAPTER 1

Benefits of 3R: From a Life Cycle Perspective

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Abstract

Depletion of mineral resources such as petroleum, aluminum and steel is one of the major problems in the world. 3R measures including resource recycling are very important practices for community and industrial activities. Life cycle assessment (LCA) is a scientific-based tool and can be used for quantitative assessment or for comparison of the environmental burdens for processes, products and 3R system by considering the whole life cycle perspective. The objective of this study is to quantitatively illustrate the benefits of 3R, especially recycling (plastic, paper, glass and metal) by using LCA methodology. Related publications and database in several LCA software programs were reviewed and calculated. The results of the study clearly show that 3R measures including resource recycling had a net gain on environmental benefits. In almost all cases, they perform better than the end-of-pipe treatment methods such as landfill and incineration in terms of life cycle reduction of greenhouse gas emission, energy consumption, and other environmental impacts.

1. Introduction

In waste management, the critical environmental impact issues do not only refers to the safe treatment and disposal of wastes but also the system management of greenhouse gas (GHG) generation [1]. 3R measures are effective solutions for waste generation and depletion of natural resources caused by the mass production and mass consumption of the present highly civilized social system. The recycling normally offers immense potential to enhance resource management and reduce waste disposal. Resource recycling helps to prolong the lifespan of landfills and reduce the need for costly incineration. It also slows down natural resource depletion to ensure sustainable development of resource-intensive industries. The use of recycled materials as a substitute for raw materials also drives down the latter's costs [2]. Among 3R, reduce and reuse measures are obviously beneficial in all environmental aspects. However, recycling operations generally required additional processes which need more energy and/or resources before those recycled materials/products can be used again. In order to illustrate whether recycling is a good choice or not, Life Cycle Assessment (LCA) will be used to quantify the environmental burdens generated for the entire life cycle of the recycling system [3]. Various recent LCA studies on the benefits of recycling and recovered materials are reviewed. Several LCA software programs, namely SimaPro, GaBi, and JEMAI-LCA Pro, are also used for this study. The aim of this study is to illustrate the benefits of recycling by comparing the recycled materials (i.e. plastic, paper, glass and metal) to the virgin materials.

2. Framework of Life Cycle Assessment of Recycling

Recent publications related to LCA on recycling of materials showed some common characteristics on framework of analysis. These studies were used as examples to discuss the benefits of recycling and the usefulness of LCA for quantifying the environmental impact focusing on energy consumption and greenhouse gas emissions. LCA is a systematic method for evaluating the environmental burdens associated with a product, process or activity, by identifying and quantifying energy and materials consumed and wastes released to the environment [4].

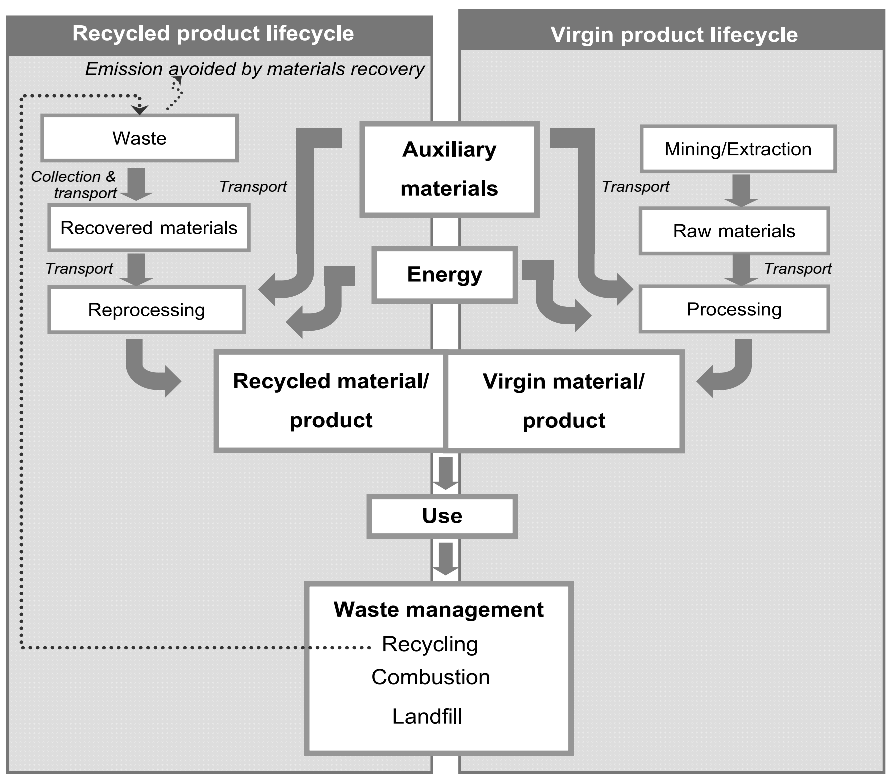


Figure 1: System boundary of the recycled and virgin material/product

Based on the scope of the LCA for recycled materials/products comparing to virgin materials/products, the system boundary for supply chain model is shown in Figure 1. In the recycled material/product, the life cycle stages for which the emission data will be gathered are recycled material collection, reprocessing (including auxiliary materials and electricity), transportation, use, and waste management. For the virgin material/product, the life cycle stages are raw material extraction, processing (including auxiliary materials and electricity), transportation, use, and waste management.

3. Benefits of Recycling

Based on the analysis of previous publications and various LCA software programs, this section presents the benefits of material recycling focusing on the greenhouse gas emissions and energy consumption reduction potential.

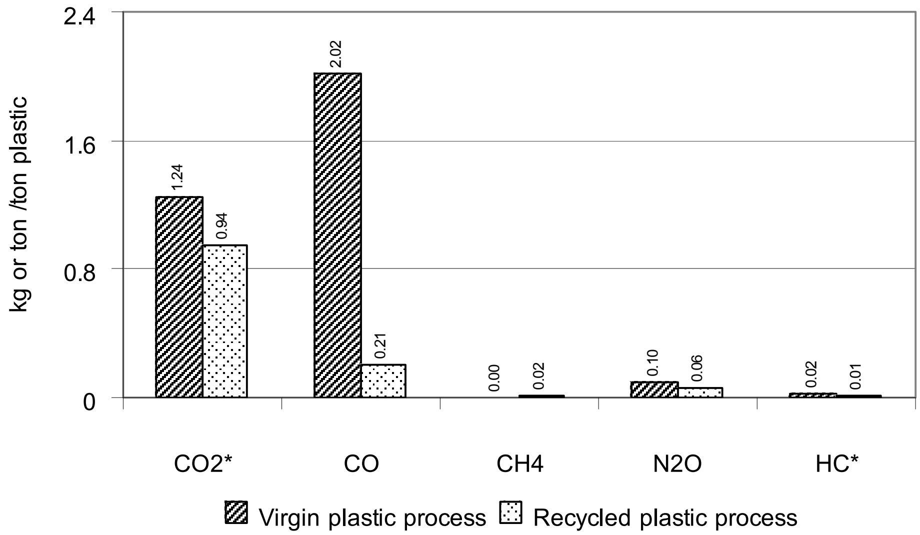
3.1 Benefits of Recycling: Based From Previous Publications

Recycling of material has been analyzed from a life cycle perspective in a number of studies over the past 15 years. Global warming impact and total energy consumption of recycled materials versus virgin materials (including plastic, paper, metal, and glass) are shown in the paragraphs below.

For plastic recycling Oil is the basic feedstock of plastics. About 4 % of crude oil is used in plastics manufacturing. Recycling of plastics can reduce the use of raw materials and energy in the virgin plastic production process and also the greenhouse gas emissions originating from waste plastics combustion. Littering problems arising from waste plastics would also diminish [5]. Some of the previous studies which have reported various benefits of plastic recycling are the following:

Molgaard C. (1995) studied the environmental impacts by disposal of plastic from municipal solid waste (consists mainly of HDPE, LDPE, PP, PS, PET and PVC). The investigation performed was the material recycling process containing a section for pre-washing, a section for separation of plastic into its generic types, a section for precutting (shredder), a section for cutting (grinder), a section for washing and purification, and a section for re-melting and palletizing. The greenhouse gases and other air emissions from virgin plastic process and recycled plastic process are shown in Figure 2. It was found out that recycling of plastic from municipal solid waste is only environmentally sound if it is separated from its' generic plastic types, which makes it possible to produce a recycled plastic with properties comparable to virgin plastic [6].

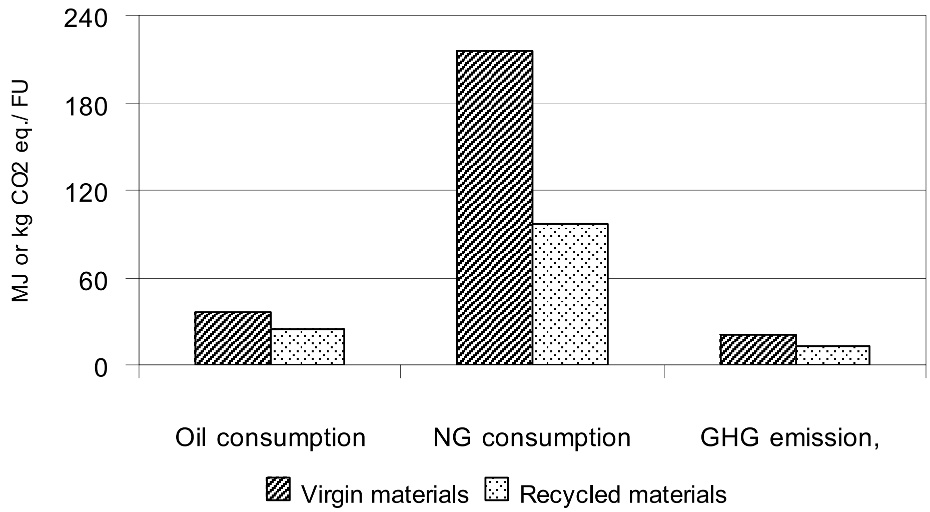
Figure 2 Greenhouse gases and other air emissions from Virgin plastic process and recycled plastic process



*Note: * Unit is ton pollutant /ton plastic*

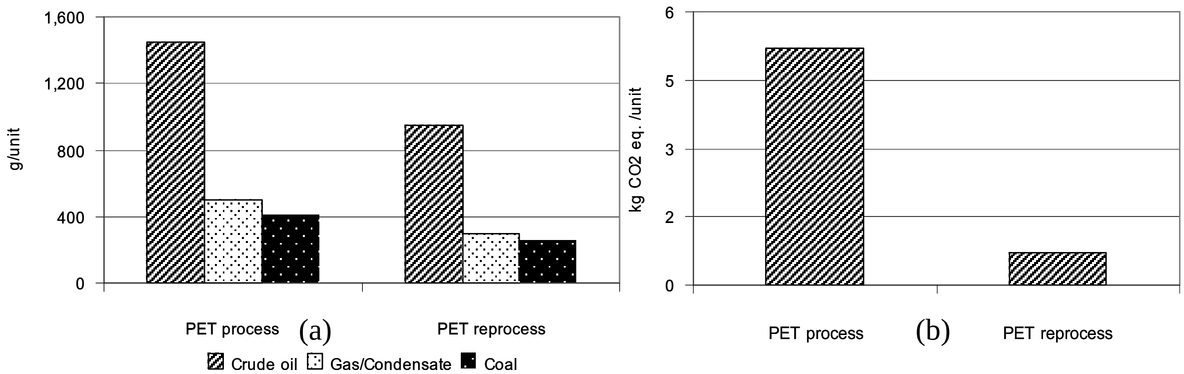
Ross S. and D. Evans (2003) investigated whether a recycle and reuse strategy for a plastic-based packaging system would substantially reduce also its overall environmental burden. The functional unit for this comparison was the packaging assembly for a 500 liter capacity refrigerator. This study compared the environmental performance of two plastic-based packaging systems, including (1) virgin material inputs, comprises moulded expanded polystyrene (EPS) components encased in a polyethylene (PE) heat-shrink wrap, and (2) recycling and reuse of materials, comprises moulded EPS components fused to a high-impact polystyrene (HIPS) coating sheet and encased in a PE heat-shrink wrap. Environmental burdens over the life-cycle of EPS/PE and EPS-HIPS/PE packaging is shown in Figure 3. Results showed that the oil consumption was lower for the EPS-HIPS/PE shrink-wrap packaging (recycled packaging) than for the EPS/PE packaging (virgin packaging). But the figure showed that for both assemblies it was quite small, being around 10% of the total energy consumption. This reinforces our earlier finding that the consumption of energy during transportation is not a major factor across the life-cycle of either packaging. Natural gas consumption is significantly less for the recycled packaging system because recycling avoids materials processing steps high in gas usage. The GHG emissions of the virgin package are more than 50% higher than for the recycled packaging. This is largely because of the reduced weight of the new package and the avoidance, by recycling, of some highly energy intensive processing steps [7].

Figure 3 Comparison of environmental burdens over the life-cycle of EPS/PE and EPS-HIPS/PE packaging for 500 L refrigerators



Arena U., *et. al.* (2003) studied life cycle energy used and GHG emissions of a plastic packaging recycling system. The object of the study was the Italian system of plastic packaging waste recycling, which was active in 2001. It collected and mechanically recycled the post-consumer PE and PET liquid containers. The phases of collection, compaction, sorting, reprocessing and refuse disposal were individually analyzed and quantified in terms of energy and material consumptions as well as of emissions in the environment as shown in Figure 4. The results indicated that the production of recycled PET requires a total amount of gross energy and GHG emissions less than what the virgin PET requires, depending on whether the process wastes (mainly coming from sorting and reprocessing activities) were sent or not to the energy recovery [8].

Figure 4 (a) Resource Consumption and (b) GHG Emissions Related to Each Selected Plastic Waste Management.

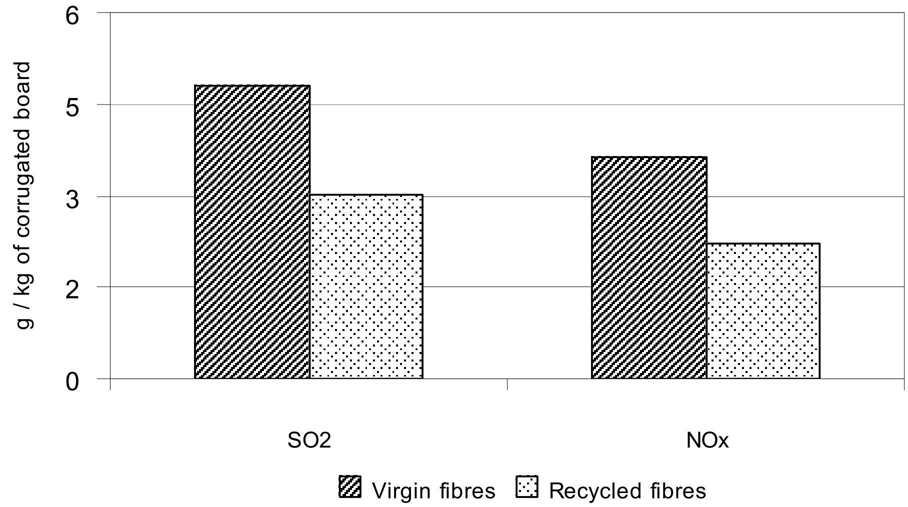


Note: All the data refer to the production of 1 kg of (recycled or virgin) PET flakes and 0.39 kg of (recycled or virgin) PE flakes

For paper recycling. Recycled paper has been typically used as a raw material in newspapers, tissues and core and packing boards. However, these traditional recovery methods as well as the utilization of wood-based construction waste have been intentionally left out of this study as the focus was on finding new concepts for the recovery of paper [5]. Previous studies have reported that the benefit of paper recycling as the following:

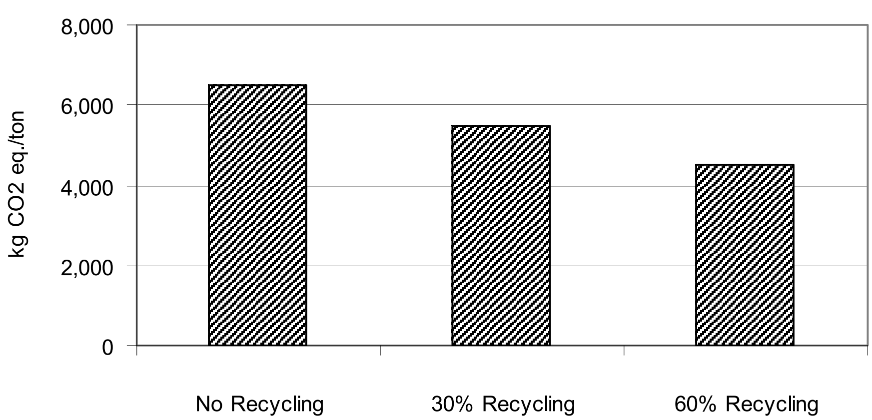
Ekvall T. (1999) demonstrated the potential importance of key methodological aspects in a Life Cycle Inventory (LCI) which is carried out to support decisions regarding waste management options for paper, board and pulp products, or regarding the choice between primary and secondary fibres as raw material in these products. Air emissions of primary and secondary fibres for corrugated board production are shown in Figure 5. It showed that the emissions from the life cycle of the corrugated board of recycled fibres were less than those of virgin fibres due to the avoided emissions from the production of material replaced by fibres from recycled cartons [9].

Figure 5 Air emissions of virgin fibres and recycled fibres for corrugated board



Pickin J., *et. al.* (2002) provided a comprehensive investigation of total GHG emission from the paper cycle in Australia, from forest through to landfill. He also assessed the effectiveness of various waste management options to reduce GHG emission from paper. Recycling is also beneficial, and is of particular interest from a management perspective because it can be controlled by the pulp and paper industry. This analysis modeled GHG emissions from the lifecycle of a ton of paper under a range of conditions for recycling (no recycling, 30% recycling and 60% recycling). Figure 6 demonstrates the effect of paper recycling at different rates. Results found that GHG emissions were reduced from 6.5 t of CO_2 equivalent per ton of paper with no recycling to 4.4 t with 60% recycling [10].

Figure 6 Total life cycle GHG emissions at different paper recycling rates.

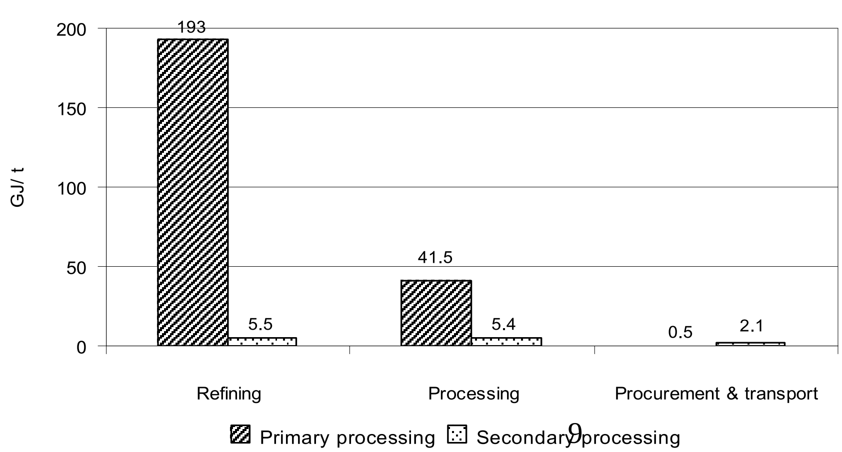


For metal recycling. Metal recycling has a long history. Scrap metal is a valuable raw material and its quality does not degrade during recycling. Nearly 98 % of the cans belonging to the deposit and refund system are recycled, but only about half of the metal packaging is recycled. Recycling of metal waste can reduce the environmental impacts from the mining industry, the space needed at landfill and the emissions originating from landfill sites. A lot of energy can also be saved by recycling metals compared with the use of virgin metals. The energy saving in steel- and sheet tin packaging manufacture is 75 % and in aluminium packaging it is 95 % [5]. Some of the previous studies on the benefit of metal recycling are the following:

W. Lea (1996) studied energy saving of recycled aluminum compared to primary aluminum. The focus of this study was to address these assumptions and to determine the degree of energy saving achieved through recycling. Comparison of unit energies for primary and secondary processing of aluminum is shown in Figure 7. The result showed that secondary aluminum had higher avoided energy value because it required much less energy to recycle than to newly produce from virgin material [11].

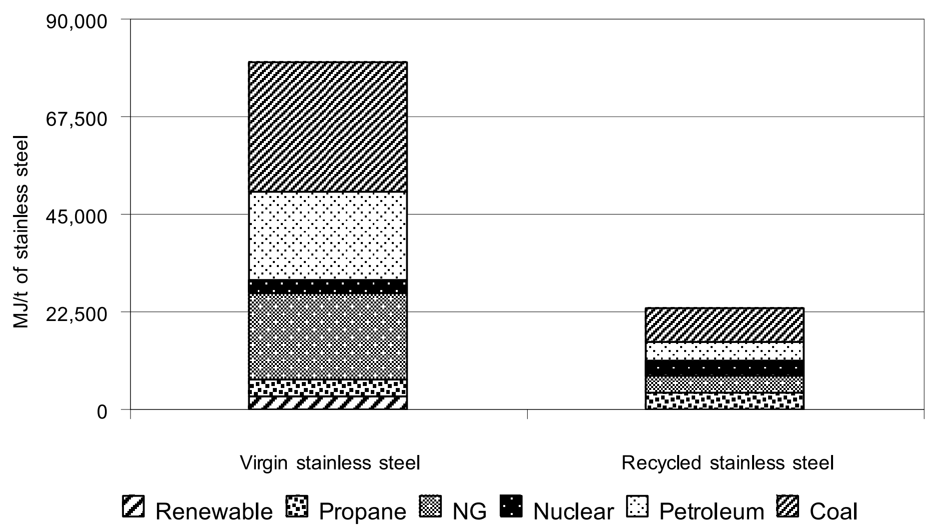
Gatti B., *et al.* (2008) studied the influence of aluminum recycling rate on the LCI of aluminum beverage cans in Brazil. The recycling rate of 36% (by weight) corresponded to the percentage of aluminum recycled from the domestic consumption of primary aluminum in 2004, while 89% (by weight) represented the rate of aluminum cans recycled from the total amount of cans produced in Brazil in 2003. Results showed that the recycling balance was always positive due to the importance of the stages that preceded the packaging production and the problem of increasing the municipal waste volume. The advantages of the recycling are obviously concentrated on the parameters related to the primary aluminum production and to the package disposal. The verified benefits of the recycling increase with the recycling rate enhancement [12].

Figure 7 Comparison of unit energies for primary and secondary processing of Al



Johnsona J., *et al.* (2008) studied the energy use to produce 1 ton of austenitic (i.e., nickel-containing) stainless-steel slab under two scenarios: (1) ‘‘Maximum Recycling’’ scenario: calculates the energy used if demand is completely met from recycled material, and (2) the ‘‘Virgin Production’’ scenario: examines stainless-steel production in the absence of scrap. Energy required to produce 1 ton of austenitic stainless steel throughout its entire life cycle is shown in Figure 8. The results showed that approximately 22,500 MJ/ton for recycled stainless steel, and 80,000 MJ/ton for virgin production. By comparing these results to the virgin production scenario, it was determined that the recycling of austenitic stainless steel required 33% of primary energy. If complete recycling of stainless steel is to occur (maximum recycling), which is not currently possible due to scrap availability, global energy use would be 67% less than the virgin production [13].

Figure 8 Energy required to produce austenitic stainless steel throughout life cycle



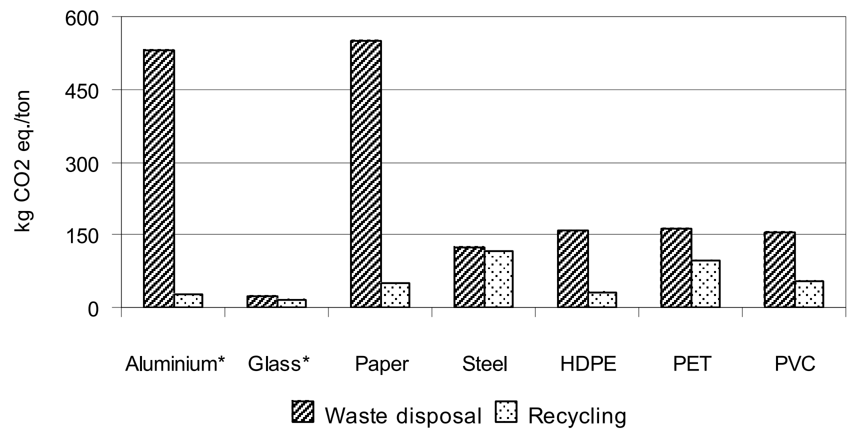
For glass recycling. The main raw materials of virgin glass are sand, soda, and lime in which all are melted into glass at 1500 degree C. Virgin glass is still widely used however it is increasingly being replaced by recovered glass. Almost all of the glass bottles belonging to the deposit system are recycled and end up being either refilled or crushed for reprocessing. There are many advantages of glass recycling. Glass can be recycled and used over and over without impairing the quality. Therefore natural resources and expensive raw materials are saved. The use of recycled glass also saves energy because it is easier to melt than the virgin raw materials [5]. Some of the previous studies conducted about the benefits of glass recycling are the following:

Vellini M.and M. Savioli. (2008) applied this methodology to a particularly energy-intensive production process, i.e. glass production for the manufacture of drink containers, in order to carry out a thorough environmental and energy analysis of the recycled and reused glass containers. The production of glass containers was compared to the production of polyethylene terephthalate (PET) containers to determine the optimal percentage of glass recycling for the minimization of energy consumption and pollutant emissions. Two cases were studied: Case 1 glass production and usage with 25% reuse and 60% recycle; and Case 2 glass production and usage with 80% reuse and 16% recycle. Based on the results, it clearly showed that the benefits of recycling were unquestionably good. It helped not only on the general improvement of the energy and technological processes but also it caused substantial reduction of the environmental impacts (with the exception of the carbon monoxide emissions which was not changed due to the increase of transport operation), which were even more valuable for those products that cannot be contained in PET bottles, such as wines and other alcoholic beverages. [14].

Some of other previous studies on the benefits of material recycling are the following:

Amelia L., *et al.* (1996) studied and compared the relative environmental impacts of a recycling system (incorporating the curbside collection of recyclable materials and their subsequent use by manufacturers), with a waste disposal system (in which the waste is disposed to landfill and primary raw materials are used in manufacture), using the LCA. GHG emissions of waste disposal and material recycling are shown in Figure 9. The result showed that the waste disposal systems generally made a larger contribution to global warming than the recycling systems. For aluminum, the recovery and use of secondary aluminum contributed to a saving of 95%, which was the largest for all materials, both in absolute and percentage terms. There were also large savings involved in recycling glass and paper, 44% and 91%, respectively. However, the difference is minimal for steel (5%). The savings for plastics are 80%, 40% and 66% for HDPE, PET and PVC, respectively [15].

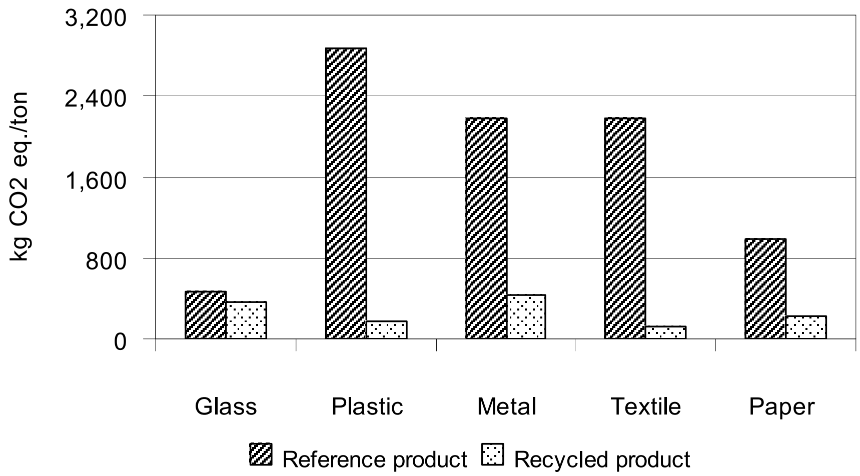
Figure 9 GHG emissions of waste disposal and materials recycling



*Note: * Unit is ton CO_2 eq./ton material*

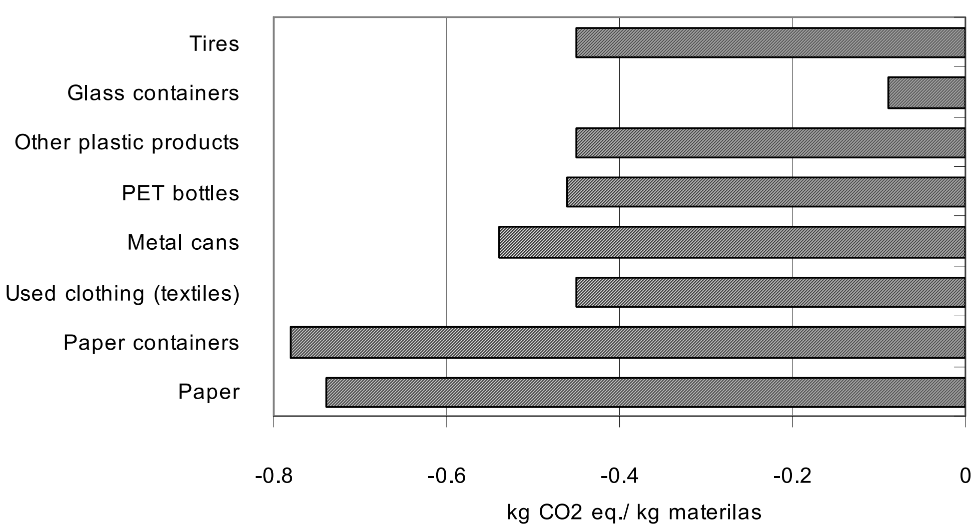
Korhonen M. and H. Dahlbo. (2007) presented the material recovery subproject and more precisely the GHG emission reduction potential results. The amount of GHG emission savings, calculated as carbon dioxide equivalent, for different waste recycling materials are presented in Figure 10. The results showed that material recycling had the potential to reduce GHG emission in all material groups. The highest potential for emission reduction existed for recycling of plastic, textile, metal, paper and glass respectively. However, the high GHG reduction potential for plastic waste recycling only existed when virgin plastics were replaced by recycled plastics. Replacing other materials produces less significant reduction [5].

Figure 10 GHG emissions of reference product and recycled product per ton of produced product.



Chen T.and C. Lin. (2008) quantified and assessed the level of GHG contribution for each type of treatment method being practiced in Taipei City's regional household waste management process. Reduction in GHG emissions from using recycled materials instead of raw materials were presented in Figure 11. Recycling created the least contribution of GHG emissions out of all waste management solutions. This is because of the usage of recycled materials instead of virgin materials in the manufacturing process. It greatly reduced not only the demand for energy but also the non-energy GHG emissions in the manufacturing process. Recycling of paper products in particular helped with forest carbon sequestration [1].

Figure 11 GHG emissions reduction from using recycled materials instead of raw materials.



DC-Environment (2008) determined the values of the main environmental indicators for each primary packaging material. This study aimed to compare the differences between the different primary package options for beer. Functional unit as defined "Beer production of 100 liter of beer and full life cycle of the packaging associated." The materials studied were PET bottles, glass long neck bottles, aluminum cans, and steel cans (all of them are 500ml beer packaging options). Results found that the production of raw materials for primary packaging production was one of the most important phases of the full LCA. A high recycling rate measurably reduced the impact on all indicators. At a recycling rate around 80% for each packaging material, aluminium cans, steel cans and PET bottles were roughly equivalent in impact reduction [16].

The benefits of materials recycling in terms of total energy use and GHG emissions as mentioned in the previous studies reviewed are summarized in Table 1. The results indicate that producing materials from recycled resources is less energy intensive and has less GHG emissions than from virgin resources. Material recycling can also decrease both the direct and indirect GHG emissions. Direct emissions are decreased when waste is neither disposed of at landfills nor treated by other methods such as combustion. Indirect emissions can be cut down by decreasing the energy consumption both in acquiring and producing raw materials and also in manufacturing the product itself [5].

3.2 Benefits of Recycling: Using Several LCA Software Programs

Manufacturing processes including recycling are often very complex and convoluted. Additionally LCA is often required input-output data intensively. LCA software program can help to structure the model scenario, display the process chains and also present and analyze the results [17]. Several commercial and public-domain LCA software programs are available. Among those are “SimaPro” from Pre’ Consultants, “GaBi” from PE International, and “JEMAI-LCA Pro” from Japan Environmental Management Association for Industry (JEMAI) which focus on the evaluation of industrial and agricultural production processes, while LCA design supporting tools such as “BEES” from National Institute of Standards and Technology (USA) and “ATHENA” from National Agency for Higher Education (Sweden) focus on the evaluation of specific building materials and components [18]. SimaPro, GaBi, and JEMAI-LCA Pro are available at National Metal and Materials Technology Center and several universities in Thailand. The databases in those three software programs include production processes of virgin and recycled materials. The details of the databases in those LCA software programs for materials recycling are summarized in Table 2.

Results of life cycle GHG emissions of plastics recycling (from recycling process), virgin plastics, and recycled plastics (including: PVC, PS, PP, PET and PE) obtained from LCA software databases are presented in Figure 12. Life cycle GHG emissions from recycling of others materials (including: glass, cardboard, paper, iron and aluminum) obtained from LCA software databases are presented in Figure 13.

As shown in Figures 12 and 13, the results demonstrated that recycling of materials has the potential to reduce GHG emissions and energy consumption. It is beneficial to substitute virgin material with recycled material because the emissions from virgin material acquisition and production can be avoided. In most cases, the replacement of virgin materials by recycled materials decreases the use of net energy and thus the GHG emissions originating from energy production and usage also decrease. GHG emissions can also be reduced by avoiding the use of virgin materials which produce emissions directly in the extraction phase. However, in some cases, the benefits of recycling are less if too much energy is required during transportation and recycling process [5].

Table 1: Overview of LCA studies for material recycling

Reference	Recycled materials	Virgin materials	Total energy[a]	GHG emissions[a]
Molgaard C. ,1995 [6]	HDPE, LDPE, PP, PS, PET, PVC	Virgin: (HDPE, LDPE, PP, PS, PET ,PVC)	-	R<V
Ross S. and D. Evans, 2003 [7]	EPS-HIPS/PE	EPS/PE	R<V	-
Umberto Arena, *et al*., 2003 [8]	PET	Virgin PET	R<V	R<V
Ekvall T., 1999 [9]	Paper	Virgin paper	-	R<V
Pickin J. ,*et al*.2002 [10]	Paper	Virgin paper	-	60%R<30%R <NR
W. Lea. 1996. [11]	Aluminium	Virgin Aluminium	R<V	-
Gatti B., *et al*.2008 [12]	Aluminium	Virgin Aluminium	89%R<36%R <NR	89%R<36%R <NR
Johnsona J., *et al*.2008 [13]	Stainless steel	Stainless steel	R<V	-
Vellini M. and M. Savioli. 2008 [14]	Glass (R1 and R2)[b]	Virgin glass Virgin PET	R2<PET <R1<V	R2<PET<R1<V
Amelia L., *et al*.1996 [15]	Glass, Paper, Steel, HDPE, PET, PVC	Virgin: (Glass, Paper, Steel, HDPE, PET, PVC)	-	R<V
Korhonen M. and H. Dahlbo.2007 [5]	Glass, Plastic, Metal, Textile, Paper	Virgin : (Glass, Plastic, Metal, Textile, Paper)	-	R<V
Chen T.and C. Lin.2008 [1]	Paper, Metal , Plastic, Glass, Tires, Metal	Virgin: (Paper, Metal , Plastic, Glass, Tires, Metal)	-	R<V
DC-Environment, 2008 [16]	Paper, Aluminium , Steel, Glass	Virgin: (Paper, Steel, Aluminium , Glass)	-	R<V

Note: [a] R = Recycled materials, V = Virgin materials, NR = No recycled
[b] R1: glass production and usage with 25% reuse and 60% recycle
R2: glass production and usage with 80% reuse and 16% recycle

Table 2: Databases of materials recycling in some LCA software programs

LCA software	Database	Materials recycling								
		PVC	PS	PP	PET	PE	Glass	Paper	Iron	Al
SimaPro 7.1.8	RER (Ecoinvent) [19]	✓	✓	✓	✓	✓	✓		✓	✓
	BUWAL 250 [20]	✓	✓	✓	✓		✓	✓		
	FAL (IDEMAT) [21]						✓			
JEMAI Pro [22]	Japanese database	✓	✓		✓		✓	✓		✓
GaBi 4.0 [23]	-									✓

Figure 12 Life Cycle GHG emissions from plastics recycling, virgin plastics, and recycled plastics ***(GHG***

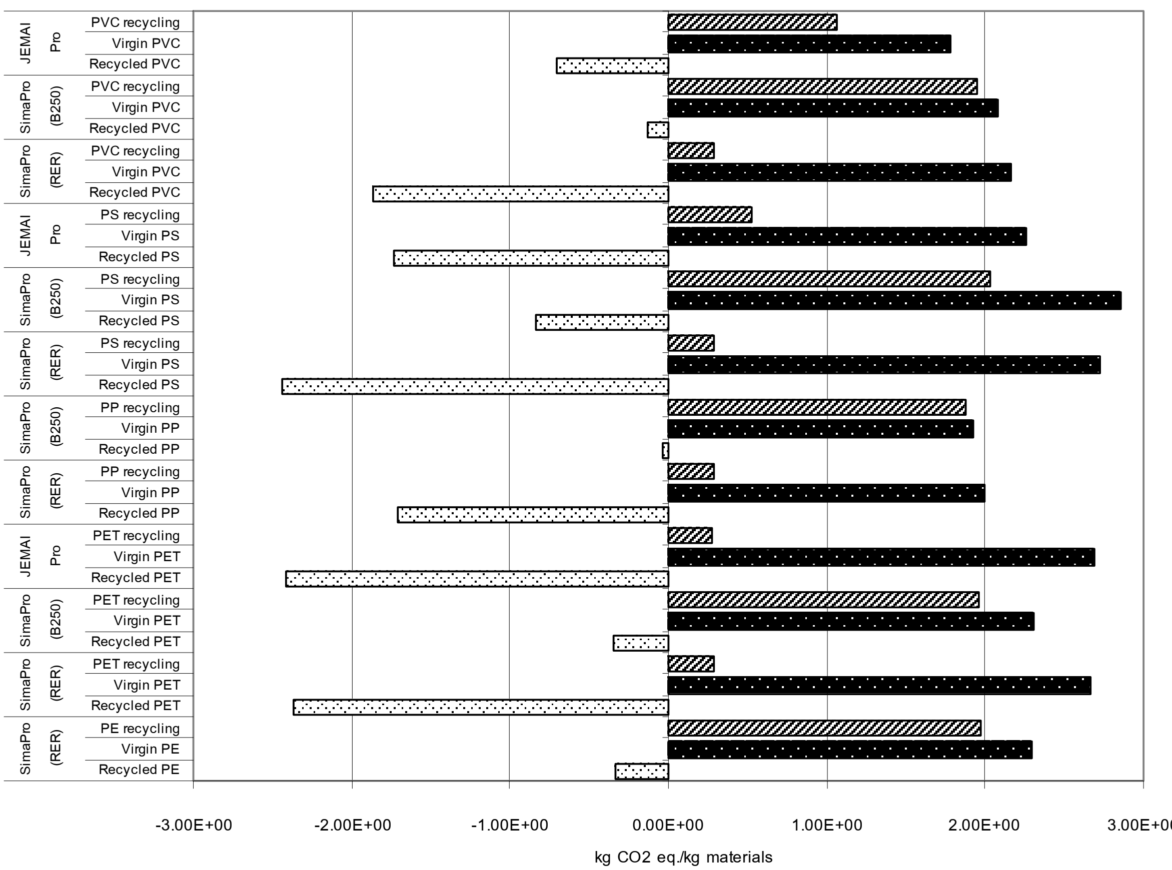
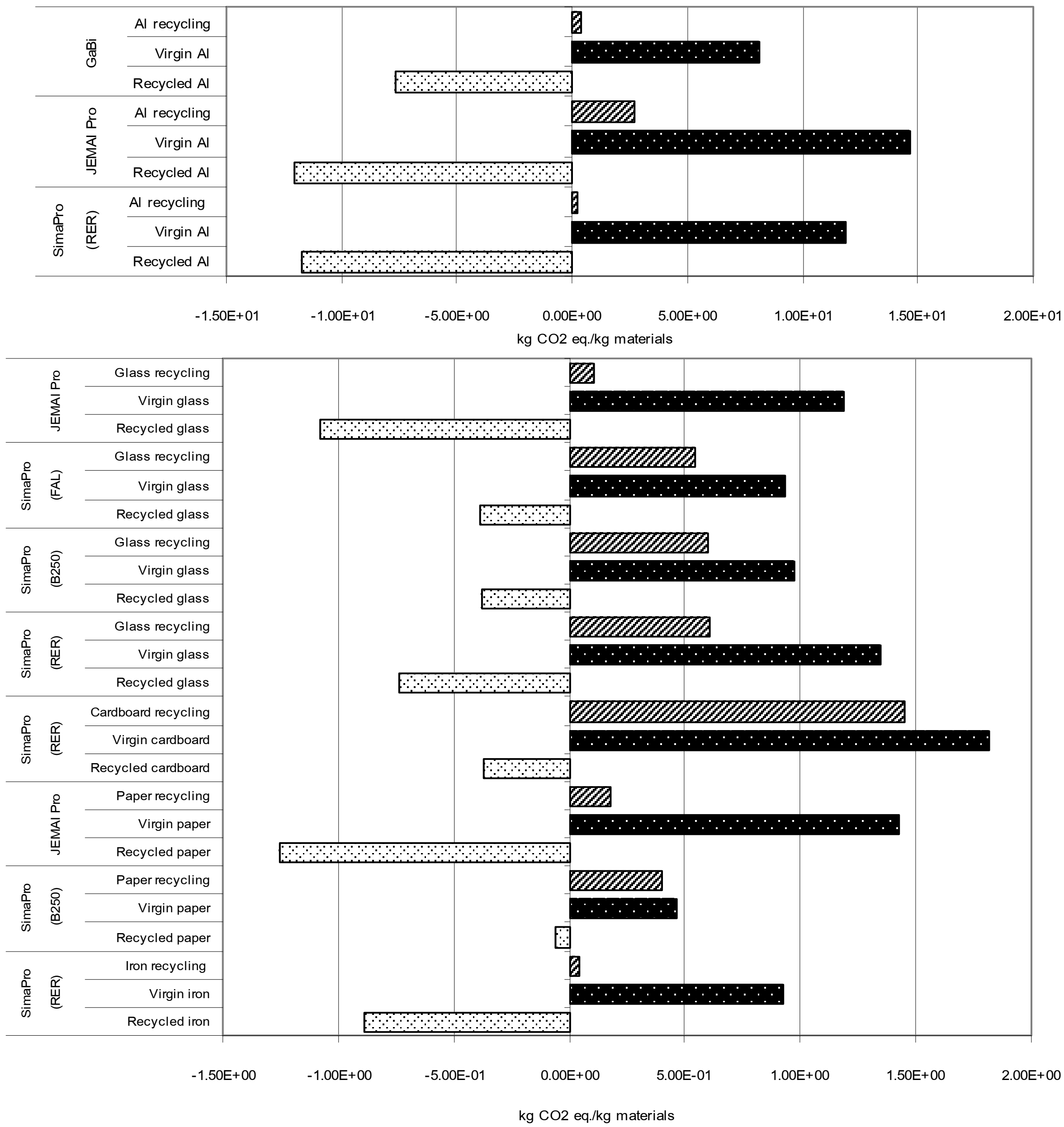


Figure 13 Life Cycle GHG emissions from materials recycling, virgin materials and recycled materials ***($GHG_{Recycled\ material} = GHG_{Material\ recycling} - GHG_{Virgin\ material}$)***



4. Conclusion

The 3R measures especially resource recycling of various materials are presented in this study. These can contribute greatly to the eco-image of waste management. The quantitative comparison using LCA study between each scenario shows that the recycling option is always environmentally preferable. Material recycling has the potential to reduce greenhouse gas emission, energy consumption, and other environmental impacts throughout the whole life cycle in all material groups. Due to the substitution of virgin materials with recycled materials, the emissions from extraction and manufacturing of products from virgin materials can be avoided. GHG emissions for the whole life cycle from raw materials extraction, materials processing, products manufacturing, usage, and disposal including transportation (cradle-to-grave approach) can be reduced in situations where the waste materials and/or waste products are recycled instead of being combusted, treated or disposed of at disposal sites. The results of the study clearly show that 3R measures including resource recycling have a net gain on environmental benefits and perform better than the end-of-pipe treatment methods such as landfill and incineration in terms of life cycle reduction of greenhouse gas emission, energy consumption, and other environmental impacts.

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Chapter 2

Singapore Packaging Agreement and the 3R Packaging Awards

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1. Introduction

Singapore is a relatively small country. Its land area in 2007 was reported to be about 707 sq km. Its population grew from about 2 million in 1970 to 4 million in 2000. The quantity of solid waste disposed per year grew from 1,200 tones per day in 1970 to 7,600 tones per day in 2000. It was quickly realized then that with such rapid increase in the volume of waste disposed, the waste management situation was not sustainable, especially with the limited land resource for waste-to-energy plants and landfills in the country.

Three strategies were adopted to reduce the quantity of waste going into the landfill. These are volume reduction through incineration, waste recycling and waste minimization. These strategies were explained in a previous report[1].

This report explains the Singapore Packaging Agreement in greater detail. This Agreement and the corresponding 3R Packaging Awards are part of the waste minimization strategy.

2. Singapore Packaging Agreement

In 2008, domestic waste constituted 57% of all waste disposed in Singapore[2]. Of this, packaging waste, comprising typically of paper, metal, plastic and glass, constituted about one-third of all domestic waste. It was therefore clear that there is potential to reduce packaging waste in the municipal waste stream.

During the review of the Singapore Green Plan (SGP) 2012 that was conducted in 2005, the Clean Land Focus Group (i.e. the focus group that was tasked to review waste management) had recommended that Singapore consider adopting the principle of Extended Producer Responsibility (EPR) to reduce waste, including waste from packaging, as this had proven to be effective in other countries. This was in line with an online survey conducted in conjunction with the review of the SGP2012 that 94% percent of the respondents shared the

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[1] ERIA Research Project Report 2008 NO 6-1; 3R Policies for Southeast and East Asia, Edited by Michikazu Kojima and Enri Damanhuri, Chapter 4.

http://app2.nea.gov.sg/topics_packagreement.aspx (accessed 10th April 2010)[3]
http://www.packaging.org.sg/index_detail.asp?id=25 (Accessed 10th April 2010)

opinion that there should be measures to reduce the amount of packaging by manufacturers. The National Environment Agency (NEA) then studied various packaging policies in several countries, such as Australia, Japan, and New Zealand. NEA also consulted with industries to understand their concerns. Then, industry felt that if legislation were used, it would increase cost and this cost would eventually be passed on to the consumer. Moreover, legislation would not provide industry with the flexibility for innovation.

Eventually, the stakeholders agreed that a voluntary programme be launched instead. It was to be modeled after New Zealand's Packaging Accord, with certain elements adopted from Australia's National Packaging Covenant. This program was to be based on product stewardship, where everyone in the entire chain of the product's lifecycle would share the responsibility for minimizing the product's environmental impact. Such a programmed was expected to have the following benefits; it would:

- foster government-industry partnership and promote government-industry-community interaction;
- engage the entire packaging supply chain and offer industry opportunities to assume greater corporate responsibility; and
- shift the focus from mere compliance to continual improvement.

The Singapore Packaging Agreement (SPA) was established on 5 June 2007. Its objectives are the following: to reduce packaging waste arising from consumer products, to raise community awareness on packaging waste minimization and to introduce supply chain initiatives that foster the sustainable use of resources in packaging. The Agreement has a five-year lifespan.[3]

For a start, the focus was on food and beverage (F&B) packaging as this was a major component of household packaging waste. There were 32 signatories when the Agreement was launched. These included 5 industry associations representing more than 500 companies, 19 individual companies, 2 non-governmental organizations, the Waste Management & Recycling Association of Singapore, the 4 public waste collectors and the National Environmental Agency. In October 2009, the scheme was extended to cover other packaging of other products such as detergents, household products, toiletries and personal care

[3] http://www.packaging.org.sg/index_detail.asp?id=25 (Accessed 10th April 2010)

products. By end 2009, the number of signatories increased to 95 with new signatories from various industries including building owners/managers of hotels and shopping malls.

A Governing Board oversees the implementation of the five-year lifespan of the Agreement. The Governing Board has 13 members comprising representatives from industry associations and companies, NGOs and the Government. The roles of the three stakeholder parties are shown below:

A. Roles of Industry
   a. Review or redesign packaging
   b. Reduce packaging material usage
   c. Use recyclable packaging material
   d. Reuse or recycle packaging waste
   e. Educate industry partners and customers on packaging waste minimization and recycling

B. Roles of Government
   a. Promote waste minimization and recycling at a national level
   b. Facilitate and provide support for building industry knowledge and technology capability to recycle and reduce waste
   c. Implement and enhance the existing recycling programmes to include packaging waste

C. Role of NGOs

a. Educate consumers and businesses on packaging waste minimization and recycling.

Signatories of the Agreement are allowed to use the SPA logo (Figure 1) on their stationery, websites, name cards, and publicity materials.

Figure 1. The Singapore Packaging Agreement Logo for signatories

In the first two years of implementation of the Agreement, about 2,500 tonnes of packaging waste (cumulatively) had been avoided. This translated into S$4.4 M worth of (cumulative) direct savings. Indirect savings not quantified are reduced storage cost, freight cost and fuel cost associated with the transportation of the final product.

3. Role of Singapore Packaging Council

The Packaging Council of Singapore (PCS) is an Industry Association Signatory to the SPA. PCS is a member of the Asian Packaging Federation (APF) which counts members from 14 countries in the Asia-Pacific region. PCS is also a member of the World Packaging Organization (WPO) which consists of 35 countries. Members of the PCS are mainly packaging designers, package structure manufacturers and material producers. Some members are in the packaging machinery related business as well as packaging related business. PCS encourages its members to be individual signatories to the SPA, as well as to exchange information on new green packaging technology with members of the APF and WPO, and to share the information acquired with other SPA signatories.

The PCS has taken the lead in reducing packaging waste because the main source of packaging waste comes from private sector companies. As a private sector organization, it should do its part in reducing the environmental impact arising from industrial activities within its sector. If the packaging can be reduced at source then the volume of packaging waste from the consumer will correspondingly be reduced.

Companies participate in the SPA because they feel that it is their corporate social responsibility to reduce packaging waste. The benefits that companies gain from joining this scheme is the networking and experience sharing with other signatories on how their packaging could be reduced. Through experience sharing sessions, SPA members can learn new packaging technologies from other members in the network and from APF and WPO.

In trying to reduce packaging, companies often face the challenge of maintaining the shelf life of the products and also ensuring that the new packaging does not adversely affect the packaging strength or the physical appearance of the packaging. Most of them enlist external help such as material suppliers and packaging designers.

To promote this scheme, PCS believes that more education campaigns among consumers and collaboration with packaging experts from other parts of the world such as Japan are needed. As an industry association, PCS provides assistance to its members by sharing packaging knowledge, new packaging development, today's status of green packaging & other matters related to packaging. Moving forward, PCS will continue to promote the Agreement to its members in non-F&B areas.

4. 3R Packaging Awards

The 3R Packaging Awards were introduced in 2008 to recognise the SPA signatories who have made notable achievements and contributions towards the goals of the Agreement. There are two categories of Awards – the Distinction Award and the Merit Award. In 2009, there were three Distinction Award recipients and nine Merit Award recipients.

4.1. Awards Criteria

4.1.1. Candidates were assessed on their efforts on the following

a. Packaging waste avoidance

b. Recycling or reuse of packaging waste

c. Consumer education

d. Use of recyclable/recycled packaging material

e. Reduction of other waste

4.1.2. Pre-requisites for 2009 Awards

a. Only signatories of SPA are eligible for the 3R Packaging Awards.
b. The initiatives assessed must have been implemented between 1 July 2008 to 30 Jun 2009.
c. Initiatives assessed were for packaging of products that are largely meant for local consumption.

4.2. Case Studies

4.2.1 Case Study 1 – Tetra Pak

Tetra Pak[4] is one of the three companies in the Tetra Laval Group – a private group that started in Sweden. The other two companies are DeLaval and Sidel. Tetra Laval is headquartered in Switzerland. The company operates in more than 150 markets with over 21,000 employees. Tetra Pak supplies more than 132 different types of carton packaging to 32 different markets. The products are tailored to suit the needs of their customers and the company developed its own processing solutions including design and service complete plants.

Tetra Pak's commitment to the environment is stated in their environmental policy.[5] The company has numerous environmental improvement initiatives. One of these initiatives aimed to reduce packaging waste by recovering polyethylene (PE) plastic used to laminate carton packaging for reuse in the packaging process.

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[4] http://www.tetrapak.com/about_tetra_pak/the_company/pages/default.aspx (Accessed 1 Dec 09)

[5] http://www.tetrapak.com/environment/policy_and_goals/pages/default.aspx (Accessed 1 Dec 09)

The beverage carton packaging material manufactured at the Jurong plant is made up of six protective layers consisting of paper board, PE plastic and aluminium foil materials. In the production process, excess PE used in laminating the carton packaging is trimmed off at the edges. In the past, this PE trim was previously compacted into bales, sold to a waste trader and subsequently sent overseas for recycling. In January 2009, Tetra Pak started on a continuous improvement project and invested in new equipment so that the PE trim could be recovered for reuse in the packaging production process. Tetra Pak found that it could reduce the net amount of PE resources consumed, and reduce plastic waste by about 380 tonnes of PE per year from just one machine. For their effort in reducing packaging waste, the company was given the Distinction Award in 2009.

Moving forward, Tetra Pak is replicating the recovery process in their second production line in Singapore as well as in other plants in other countries. The company is looking for other opportunities to reduce waste, e.g. reducing grammage of their packaging materials by replacing existing materials with others offering similar strength and stability.

Product development is done by a team of five staff. Their responsibilities include redesigning products, carrying out life cycle assessment (LCA) and engaging other experts to assist in the Research and Development (R&D). Reducing packaging material is not an easy task. Redesigning the product is not without its challenges. The development team has to address issues such as preserving product integrity without compromising the strength of the packaging. This involves experimenting with different designs using materials with different thickness.

4.2.2 Case Study 2 – Kentucky Fried Chicken (KFC)

KFC set up its first restaurant in Singapore in 1977 and has grown to become a popular fast food option for Singaporeans with 79 outlets in the country. Since being a signatory to the SPA in 2007, KFC Singapore implemented many key initiatives to reduce packaging wastage:

1. Reducing Dimensions of packaging boxes:

- KFC Thrift boxes was shrunk from 350 mm x 230 mm x 70 mm to 260 mm x 233 mm x 73 mm, saving about 17 metric tons of paper material annually as well as some $21,000 in cost.
- KFC Dinner Box was shrunk from 255 mm X 170 mm X 71 mm to 205 mm X170 mm X 71 mm, hence reducing the use of corrugated board material by 3 tons per annum.

The reduction in size of these 2 packaging boxes also meant that they will take up less space in the delivery bag, allowing more products to fit in.

Source: 3R Packaging Awards 2009 Booklet (Singapore Packaging Agreement, 2008)

2. Reducing thickness of its products:
   - In April 2008, small plastic bags used to pack small items for takeaway were reduced in thickness, from 18 microns to 15 microns. This 17% decrease in thickness avoided 2.9 metric tons in the amount of plastic packaging material used annually.
   - KFC Zinger box thickness was reduced from 240 gsm to 210 gsm since July 2008, saving 5 tons of paper material used per year.
   - Continuing from the Zinger box success, KFC also reduced the thickness of its turnover sleeve for dessert pies from 240 gsm to 210 gsm, saving about 300 kg of paper annually.
   - In February 2008, the thickness of KFC napkins was reduced from 18.5 gsm to 16.5 gsm, saving about 24 metric tons of paper material annually.

In trying to reduce packaging waste, meeting customers' demands as well as economic considerations are still at the top of KFC's priorities. For example, KFC switched from the thinner normal food board packaging to corrugated board material because it can better retain the temperature of its product as well as maintain the robustness of the box even when it is moist with condensation. This is especially important with KFC's home delivery when the products may take up to 20 minutes to reach consumers from the restaurants.

The majority of KFC reduction in packaging waste is the result of an in-house cross departmental team. Although external technical expertise is not needed, KFC has to ensure that the newer, smaller or thinner packaging materials meet operational and customers' functional requirements. Also, despite being a big player in local fast food market, due to limited size of the Singapore market, KFC is not able to request special designs from its packaging suppliers and has to work with existing suppliers.

Looking forward, KFC will continue to look for solutions that are win-win in both economic and environmental performance.

4.2.3. Case Study 3 - Boncafé

Boncafé International Pte Ltd is a local company producing gourmet coffee. The company was founded in 1962. Their customers include internationally renowned hotels, resorts, airlines, restaurants and foodservice establishments. Their coffee, in roasted beans and ground form, are packed in aluminum foil bags and distributed to their customers in South East Asia, Sri Lanka, Myanmar, the Maldives, the Philippines, Korea and Japan. Boncafé's products are also available in local supermarkets.

As their business grew, the company saw a significant 33% increase in usage of packaging material over the past 10 years (an annual 3.3% increase). This translated into an increase of between 900,000 – 1,000,000 packets each year. As a responsible company, Boncafé is concerned with the large amount of packaging waste generated as a result of its business. When approached by the National Environmental Agency in 2006, Boncafé agreed to be a signatory of the SPA.

The company has had challenges with their product packaging. The packaging material was made up of layers of polyester, foil and linear low density polyethylene. The composite layer was about 140 microns thick. Moreover, the seal deteriorated very quickly and product quality was affected. After being a signatory of the SPA, Boncafé embarked on a project to reduce the thickness of the packaging material.

Boncafé worked closely with the material supplier to reduce the packaging content. It was important that the package would still bear the premium quality appearance and attractiveness despite being thinner. Boncafé took the opportunity to create a new look for the product at the same time.

The company managed to significantly reduce the number of microns (thickness) of the material from 140 to 120 microns without compromising on the look and quality of the packaging. Despite of a thinner material, the package was able to stand firm when placed in an upright position. This was important as the product had to be displayed on shelves in supermarkets.

The change in material thickness amounted to a 14% reduction in material usage. With a projection of 900,000 packets produced per annum, the expected reduction in packaging material used would amount to 1516 kg per year.

In summary, this change would result in the following environmental and economic benefits:

Table 1. Summary of Changes and their Associated Material and Cost Reduction

Change	Reduction in Material Usage	Reduction in Cost
Packaging Material reduced from 140 microns to 120 microns	14% reduction or 1516 kg of packaging waste material per annum(in savings)	12.8% reduction in costs or approx $6160 per annum

Source: Provided by Boncafe

The 'old' material

The 'new' material

In another 3R initiative, Boncafé changed the delivery packaging for local customer orders in the retail sector from polyethylene carrier bags to woven bags.

During the past 15 years, Boncafé had experimented with different types of bag, colour, design and material from polyethylene to laminated paper bags. The table below summarized the challenges faced with the different types of bags.

Table 2. Summary of Environmental & Cost Benefits

Material	Usage per annum and spoilage	Environmental benefits	Cost Benefits
Polyethylene Bags	20,000 pieces (out of which about 3,000 pieces would deteriorate during storage)	The polyethylene and laminated paper bags are seldom reused as they could get torn or spoilt during delivery of the products. Moreover, a portion of the bags deteriorate during storage. The woven bags, on the other hand, do not deteriorate during storage and can be reused by the customers.	The woven bags are less expensive to produce, compared to the polyethylene and laminated paper bags, thereby saving the company about $14,000 per annum
Laminated paper bags	20,000 pieces (out of which about 1,000 pieces would deteriorate during storage)		
Woven bags	20,000 pieces (no deterioration in quality during storage)		

From polyethylene bags to laminated paper bags to reusable woven bags.

Woven bags banded together with Brazilian Instant Coffee 200gm at Sheng Siong outlets.

Source: Provided by Boncafe

4.2.4. Case study 4 – Suki Sushi Pte Ltd

Suki Sushi Pte Ltd was established in July 2002 with the opening of its first restaurant in Singapore. Today, the Suki Group of Restaurants has six concept restaurants, with more than 30 outlets scattered across the country serving sushi, sashimi, do-it-yourself steamboat, teppanyaki, shabu shabu as well as international buffet. Restaurants under the Suki Group of Restaurants are Suki Sushi, Yuki Yaki, Ishi Mura, Day29 Food Galore, Sakura, Nihon Mura and Sakura Charcoal Grilled, and Shabu Shabu.

The company signed the SPA in 2008 after attending a CEO luncheon organised by the SPA's Governing Board. As a large chain of restaurants, it uses huge quantities of resources for its operations and it wants to be a socially responsible corporate citizen. Suki Sushi was convinced of the need to take action to reduce the environmental impact of its business.

Suki Sushi has several environmental improvement initiatives. Its food waste, in the past, was disposed by incineration. Today, its food wastes undergo a biomethanisation process. It has replaced its incandescent light bulbs with energy efficient light bulbs and it is looking to switching to light-emitting diodes (LED) lamps. To reduce fuel consumption, its supplies are delivered at night when vehicular traffic is low thus avoiding traffic jams. It is currently exploring ways to improve its food packaging. It is looking at switching from styrofoam to paper boxes for its takeaway food.

Suki Sushi feels that the initial capital cost of implementing environmental improvement initiatives is high in most cases. Hence, the ability to do life-cycle costing is important. Environmental improvement initiatives should also not adversely affect product or service quality. Hence, time and effort are needed to conduct research, to carry out evaluation on alternative solutions. Suki Sushi thinks that companies are hampered by a lack of professional help. Most F&B companies do not have core competencies in environmental technologies and engineering solutions to evaluate various environmental technologies. Thus, SPA experience sharing sessions are very useful. It also believes that Type 1 ecolabelling[6] is helpful as the environmental impacts of eco-labelled products have been assessed by a team of experts.

Moving forward, Suki Sushi would like to see greater promotion of the SPA. With more companies taking steps to improve its environmental performance, certain environmental improvement initiatives would be able to achieve economy of scale and hence lowering the cost of implementation.

In the various case studies, we have seen how SPA has reached out to multinational corporations (MNC) like Tetra Pak and KFC as well as Small Medium Enterprises (SMEs) like Boncafé and Suki Sushi.

For MNCs such as Tetra Pak which already have a proven environmental record, the SPA serves as an opportunity to further highlight and showcase their efforts. For SMEs like Boncafé which have also taken significant strides in reducing packaging, SPA is also a platform to establish a branding beyond their size. Participation in SPA allows SMEs like Suki Sushi an opportunity to rapidly learn industry best practices.

5. Conclusion

Based on our interviews with the selected signatories of the SPA, this Agreement is useful in raising the environmental awareness of the industry. It was interesting to note that while it was industry's concern that new waste legislation would drive up business cost that prompted the creation of a non binding agreement like SPA, the SPA signatories that we interviewed said that the government should take firmer action or even introduce new laws to force companies to reduce their environmental impacts. Companies also believe that SPA could do more to publicise the SPA logo. This can be done through SPA's participation in environmental events or eco-product fairs. Consumers can be educated through exhibitions in supermarkets where such food and beverage products are sold. The media can also help to build awareness by having articles written about Packaging Award winners.

Another recommendation is for SPA to allow only companies which have taken specific improvement measures to use the SPA logo on their publicity materials. Currently, all signatories are allowed to use the logo without having to show proof that waste reduction efforts have been made by the companies, although a written application to the Governing

[6] ISO 14024

Board of SPA is needed for the use of this logo. Companies also express the need to simplify the SPA award application process because it seems that the current procedure is document intensive.

Given the economic and environmental benefits of SPA as shown in the cases discussed, SPA approach can be replicated in other countries. The concerns expressed by the Singapore companies such as the need for experience sharing sessions among members of the same business community, the need to provide technical support, in particular to SMEs to assist them in evaluating different options and to conduct cost benefit analysis should be addressed.

Acknowledgement

The authors would like to thank the following for their significant inputs to this paper:

Mr. Albert Lim, Chairman, Singapore Packaging Agreement Governing Board.

Mr. Alberto Tureikis, Supply Chain Director, South and South East Asia and Mr. Ong Lye Huat, Safety Health, Environment and Hygiene Manager, Tetra Pak Jurong Pte Ltd.

Mr. Eric Huber, Factory Manager, Boncafé International Pte Ltd.

Mr Kelvin Ong, Director and Patrick Teh, Business Development Manager, Suki Sushi Pte Ltd.

Mr Philip Ng, Senior Manager SCM/QA and Miss Shawn Quan, Purchasing Manager, Kentucky Fried Chicken Management Pte Ltd.

Ms Sharon Ong, Senior Scientific Officer, Resource Conservation Department, National Environment Agency.

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Interviews:

1. Mr. Alberto Tureikis, Supply Chain Director, South and South East Asia and Mr. Ong Lye Huat, Safety Health, Environment and Hygiene Manager, Tetra Pak Jurong Pte Ltd.
   Date of Interview: 20 November, 2009
   Place of Interview: Tetra Pak Jurong
   19 Gul Lane, Singapore 629414

2. Mr. Albert Lim, Chairman, Singapore Packaging Council.
   Chairman, Singapore Packaging Agreement Governing Board
   Date of Interview: 26 November, 2009
   Form of Interview: Email Interview

3. Mr. Eric Huber, Factory Manager, Boncafé International Pte Ltd.
   Date of Interview: 14 December, 2009.
   Place of Interview: Boncafé International Pte Ltd
   208 Pandan Loop, Singapore128401

4. Mr Kelvin Ong, Director and Mr Patrick Teh, Business Development Manager, Suki Sushi Pte Ltd.
   Date of Interview: 31 December 2009
   Place of Interview: Suki Sushi Pte Ltd,
   5 Kallang Way 2A, Singapore 347494

5. Mr Philip Ng, Senior Manager SCM/QA and Miss Shawn Quan, Purchasing Manager, Kentucky Fried Chicken Management Pte Ltd
   Date of Interview: 7 January, 2010
   Place of Interview: Kentucky Fried Chicken Management Pte Ltd
   17 Kallang Junction, Singapore 339274

6. Ms Sharon Ong, Senior Scientific Officer, Resource Conservation Department, National Environment Agency.
   Date of Interview: 13 November, 2009
   Place of Interview: National Environment Agency, Environment Building
   40 Scotts Road, #13 – 00, Singapore 228231

CHAPTER 3

Study on Recyclables Collection Trends and Best Practices in the Philippines

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[1] For the ERIA Research Project on 3R Policies in Southeast and East Asia, October 2009.

1. Introduction

In the Philippines today, the annual solid waste generation rate is about 10 million tons (36,000 cum), which translates to approximately 0.3 - 0.7 kg daily of garbage for each Filipino, which the World Bank estimates to grow by 40 percent by the end of the decade (Philippine Environment Monitor 2004, World Bank). Much of this is concentrated in the urban areas where up to 44 percent of this waste is recyclable. Recycling thus offers some of the most pragmatic solutions to reduce the volume of generated waste.

The Philippine Ecological Solid Waste Management Act of 2000, defines recycling as "the treating of used or waste materials through a process of making them sustainable for beneficial use and for other purposes, and includes any process by which solid waste materials are transformed into new products in such a manner that the original products may lose their identity…"[2] It is differentiated from *Reuse* in which there is no alteration of the physical or chemical characteristics of the recovered material.

Though not yet quite a pervasive practice, organized recycling in the Philippines has picked up in recent years. According to the National Solid Waste Management Commission (NSWMC), recycling rates have been increasing, particularly in Metro Manila, from 6% in 1997; 13% in 2000; and 28% in 2006 (Andin, Z; NSWMC, 2007)[3] . Among the major reasons for this improvement are the following: the implementation of RA 9003, the grassroots SWM/ recycling movement, and the market forces.

2. Drivers for Recycling

Many members of the older generation claim that recycling is not new to the Filipino. This is true at the individual household level where food jars are reused, old furniture are refurbished/transformed to other uses, and even leftover lunch is "recycled" into new dinner fare. The advent of modern day lifestyles and a consumer

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[2] Ecological Solid Waste Management Act of 2000 – Implementing Rules and Regulations of Republic Act 9003, Department of Environment and Natural Resources – Environmental Management Bureau.

[3] Atty. Zoilo Andin, Jr., Executive Director, NSWMC. *Philippine National Strategy on 3R,* paper presented at The 3R Workshop on Effective Waste Management and Resource se in Southeast Asia, February 15, 2007, Asian Development Bank, Manila.

/convenience– oriented society has however spawned a throw away mentality. But recycling is making a comeback.

2.1. The Legal Basis

One of the reasons for recycling is that the government has finally laid down a clear policy on solid waste management through the Republic Act 9003. This act essentially upgraded the cleanliness and anti–littering ordinances into a more cohesive national law to deal with the growing garbage crisis in the country. It defined a 3R Policy, Framework and Strategy for a systematic, comprehensive and ecological solid waste management program based on the waste management hierarchy which, in a nutshell, can be described as: Waste Avoidance, Reduction, Reuse, Recycling, Treatment and Disposal (Andin, Z; NSWMC, 2007).

The NSWMC, established under the Office of the President, is tasked to oversee the implementation of SWM plans for which the lead agencies are the LGUs, starting with the barangays (i.e., the smallest unit of government at the village level). The LGUs are mandated to develop their own Local Government SWM plans, based on the assessment of their local SWM situation and a characterization of their waste. They are required to achieve an initial 25% waste diversion target, through a combination of waste reduction, recycling and composting programs.

2.2. Grassroots SWM and Recycling Movements

While the law is not yet fully enforced and huge gaps exist with its implementation, grassroots movements driven by local governments and environmental organizations have helped provide impetus for community–level waste segregation, collection and recycling activities. The Department of Environment and Natural Resources (DENR) and the NSWMC lists fourteen government agencies and NGOs offering training on integrated solid waste management (ISWM) in its 2004 ISWM Source Book for Local Government Units[4]. In addition to this, the outreach activities of LGU–ESWM units, corporate foundations, and environmental groups such as the Recycling Movement of the Philippines, the Solid Waste Management Association of the Philippines (SWAPP), the Eco Waste Coalition and other school/church–based programs which conduct advocacy activities for sustainable

[4] Integrated Solid Waste Management Source Book for Local Government Units, Volume 2: Organizations Offering Training on ISWM, DENR – Philippine Environmental Governance Program, 2004.

waste management and community–level programs also provide livelihood opportunities from the transformation of post–consumer waste into functional as well as decorative items, like bags, belts, containers/ baskets, desk items, bricks/ hollow blocks. There is no comprehensive listing available for smaller, local level counterparts operating in the regions who conduct ISWM training on a continuing basis.

2.3. Waste Trade and Market Forces

A 2008 Japan International Cooperation Agency (JICA) Study on Recycling Industry Development in the Philippines[5] analyzed the macro scale material flow of scrap paper (newspaper, cardboard), scrap metals (iron, aluminum), glass bottles/ cullets, scrap plastic and electronic/electrical waste (i.e. cellphones, personal computers, junk TVs and refrigerators) for the period 2000–2004, using data from the Department of Trade and Industry (DTI) and the Bureau of Customs. The import/ export trend and recycling rate for these recyclables are summarized in Table 1.

The table above, shows high export volume for scrap iron/ steel, despite high domestic consumption requirements. This could be due to the relatively favorable buying price of scrap metals in the region, although actual export earnings are not indicated. Export of waste plastic is also high, possibly because there was not enough local capacity to recycle plastic during the period indicated. Hence the low importation and recycling rate for waste plastic at only 8.4%. High importation of waste paper and glass cullets help to meet the local recycling requirements which for paper is at 41.2%; and for glass at 48.5%. Low import volume of aluminum scrap may suggest that much of the aluminum recycling requirement scrap needed for local recycling may come from finished or semi-finished products.

Table 1. Macro Scale Material Flow of Selected Recyclables

	Import Volume (tons/yr)	Import Cost (million Pesos)	Export Volume (tons/yr)	Export Earnings (million Pesos)	Domestic consumption rate		Current recycling rate
					tons/ yr	(kg/cap/ day)	

[5] Study on Recycling Industry Development in the Philippines, Board of Investments – Department of Trade and Industry, and Japan International Cooperation Agency, 2008 .

Waste paper	388,553	2,446	7,542	51.6	1,559,510	0.049	41.2 %
Scrap iron/steel	22,000	not given	862,000	not given	3,137,000	not given	not given
Scrap aluminum	2,000	not given	19,000	not given	97,000	not given	not given
Glass cullet	2919	33,9	73	8.1	427,192	0.013	48.5%
Waste plastic	14,900	194	44,476	676.7	691,911	0.022	8.4%

**note: figures for imported finished products from which some of the waste is derived are not reflected in this table.*

Table 2, on the other hand, summarizes the major countries to which the recyclable wastes are exported to, or imported from.

Table 2. Recyclables Trade for the Philippines[6]

	Countries from which the Philippines Imports Recyclables	Countries to which the Philippines Exports Recyclables
Waste paper	Australia 22.7% Japan 17% Others: USA, HK, Germany, UAE, New Zealand, Netherlands, Singapore	Indonesia 46.2% China 22.7% Singapore 10.2 % Others: VN, India, Thailand, Taiwan, South Korea
Scrap iron	China 51.3% Others: Taiwan, Palau, HK, Singapore, Korea, VN, Japan	Taiwan 47% Thailand 14.2%, Singapore 13.8% Others: China, India
Scrap aluminum	Malaysia, 38.1%; Korea 21.7% Others: China, Japan, Taiwan, India, Thailand, Singapore, HK	Japan 45.7%; UAE 27.7% Others: Singapore, China, VN, India, Thailand, Korea, Italy, Australia
Glass bottles	China, 88% Others: Japan, Australia, Taiwan, Malaysia, UK	Japan 99.8% and UK 0.2%
Waste plastic	Germany 33.7%, India 13.75, Japan 12.5% Others: S Korea, Netherlands, S Africa, Singapore, Taiwan, USA, Malaysia	HK 44.8% China 35.2 % Others: Taiwan, Malaysia, S Korea, Tanzania, Nigeria, S Africa, VN

[6] Study on Recycling Industry Development in the Philippines, Board of Investments – Department of Trade and Industry, and Japan International Cooperation Agency, 2008

In most cases, the biggest export market of the Philippines for recyclable wastes appears to be to its neighbors in the region. Whereas the biggest source of its imports for waste paper and waste plastic are Western countries.

The global trade for recyclable material dipped considerably during the economic downturn in the past two years due to slowed down demand from manufacturers. Although this resulted in depressed buying prices and stockpiles of recyclables, the market has slowly begun to improve, and business has picked up for those involved in various aspects of recyclables trading, such as collectors, consolidators, bulk buyers, waste traders/ exporters.

Aside from its global market potential, more successful community–based recycling programs have shown that there is really money from recycling waste even by the small entrepreneur, and that a smaller yet promising market exists for finished products made from post–consumer waste. These entrepreneurs can take advantage of existing available technologies such as for laminates/ doy pack recycling, aluminum can/ tetra pak recycling, tarpaulin recycling, mixed waste recycling (e.g. into hollow blocks/ bricks) and others. Sales outlets for finished products tend to be limited (e.g. regional trade fairs, eco– products fair) and that large–scale marketing and commercialization, as well as quality control, continues to present challenges.

3. Overview of the Recycling Market and Recycling Industry

The 3Rs – Reduce, Reuse, Recycle – are strategies for dealing with generated waste, to reduce the volume that is needlessly thrown away and which takes up space in landfills. A sustainable SWM system however assumes that waste avoidance and reduction is priority before the 3Rs. In the Philippines, more headway is being achieved with the 3Rs than with waste avoidance since the latter requires an almost monumental shift in paradigm of the Filipino society and of the industry as a whole. While not ideal, this is welcome nonetheless, as recycling in itself brings many benefits.

3.1. Types and volumes of household and commercial recyclables

In Metro Manila, more than 50% of waste collected is organic/ biodegradable, and 44% is recyclable or factory–returnable. The latter is comprised mostly of scrap paper (19%), plastics (17%), iron/metals (3%), aluminum (2%) glass (3%) and special hazardous waste (1%). [7]

The JICA 2008 Study on Recycling Industry Development in the Philippines projected the volume of total recyclable materials based on its percentage in the waste stream, as follows:

There are some variances with data from Mindanao in Southern Philippines, where five major types of recyclables are traded: glass, plastic, paper, lead acid batteries and metals, with the latter as the largest in terms of volume traded as well as income generated (i.e. 94% out of 70 junk shops included in a REECS survey). [8] These, however, rarely come from households. Waste paper and plastics are the least traded and thus more likely to end up in the landfills/ dumps, suggesting that collection and recycling opportunities for these materials (such as PET plastics) remain untapped.

The volume of e-waste in the country (whether as post–consumer waste or imported as e–waste) is less discernable due to the abundance of cell phones, cell phone batteries, personal computers/ computer parts brought in as secondhand items, through surplus shops or through the black market (i.e. smuggled). Major sources are from Japan, Korea, Taiwan, China, Hongkong, United States, and Australia either legitimately or illegally imported.[9]

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[7] denr.gov.ph/nswmc/cbeswmp

[8] N. C. Lasmarias and R. S. Junio. "The Market for Recyclable Solid Waste Materials in Mindanao," Resources, Environment and Economics Center, 2006.

[9] Study on Recycling Industry Development in the Philippines, Board of Investments – Department of Trade and Industry, and Japan International Cooperation Agency, 2008.

Table 3. Recyclables Projection, 2006–2010

Materials	%	2006	2008	2010
Paper	19	3,601,317	3,856,274	4,129,280
Plastic	17	3,222,231	3,450,350	3,694,619
Iron	3	568,629	608,885	651,992
Aluminum	2	379,086	405,924	434,661
Glass	3	568,629	608,885	651,992
Total	44	8,339,891	8,930,318	9,562,544

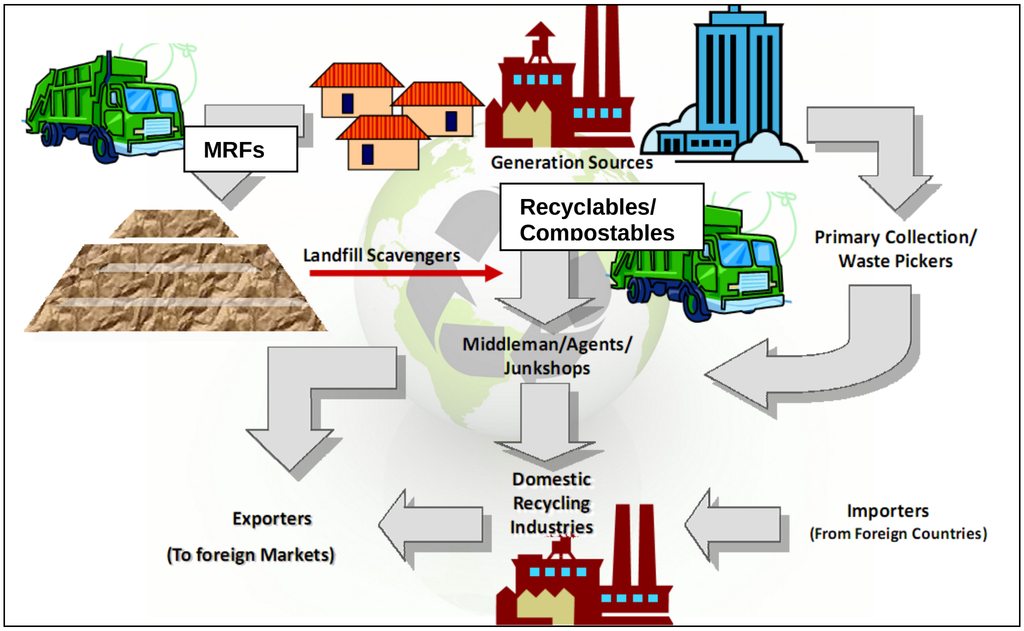
3.2. Methods/ mechanics of collection: LGU Collection and Voluntary Collection Schemes

Municipal solid waste from households is collected by garbage trucks either owned or contracted by the LGU through a bidding process. Waste are either disposed in the landfills or brought to waste facilities where they may be further sorted manually (by organized groups of scavengers as in the case of the Payatas, Clark and Montalban waste facilities) so that recyclables in the waste stream can be temporarily stored for eventual sale to private recyclers or for further processing or re- use. The most common practice is house-to-house collection and/or curbside collection of wastes placed in plastic bags or bins provided by the residents. Ironically, RA 2003 has resulted in negative impact to the organized waste picker groups, due to reduced volume of recyclables that reach the landfill and thus lowered their income too. . Nevertheless, landfill management is mandated to fully implement the law, but social preparation is needed to provide the waste pickers with alternative livelihoods when the landfills/ dumpsites finally close.

For some commercial–industrial waste, the collection service is tailored to individual requirements using large trucks/containers, or outsourced to accredited waste haulers. According to the NSWMC, average waste collection efficiency is 75% in urban areas and 40% in rural areas.

Segregated waste, including recyclables, is either collected separately (in some areas) or by junk shop cooperatives/ eco–aides and brought to barangay/ city MRFs. The MRF serves as a form of mini solid waste transfer or sorting station/ drop center, ideally having composting and recycling facilities. To date, there are 2,312 MRFs across the country, as mandated by RA 9003, with others still in the process of being set up by the majority of barangays.

Figure 1. Current Flow of Recyclables Collection



Source: Study on Recycling Industry Development in the Philippines, Board of Investments – *Department of Trade and Industry, and Japan International Cooperation Agency, 2008.*

At present, many informal, community-based and private sector collection and recycling projects also exist. The 2003 ADB Study surveyed existing community–based SWM activities in Metro Manila at that time. Its principal activities included the following:

- Recycling of non–biodegradable materials;
- Composting of bio–degradable materials; and
- Livelihood Projects;

Table 4. Surveyed CBSWM Initiatives, 2003 DENR-ADB SWM Project[10]

City/Municipality	CBSWM Pilot Site (Barangay)	Involved Organization*
Caloocan	Barangay 52	Barangay, MMDA,
Makati	Bel Air	Barangay, ZWRMPFI
	Forbes Park	Barangay, ZWRMPFI, ZKK
Manila	Barangay 833 (Pandacan-Shell)	Barangay, PiliPiñas Shell, ZWRMPFI
Mandaluyong	Barangka Itaas	Barangay
Muntinlupa	Tunasan: Sto. Nino/Park Homes	Homeowners, Barangay, City
Navotas	Tanza	Kaunlaran sa Kalikasan, Elem. School
Paranaque	Sun Valley	Barangay
	San Antonio	Barangay, City
Pasig	Ugong	Barangay, Kilus Kaunlaran
Quezon City	Bagumbuhay	Barangay
	Blue Ridge	Mother Earth, Barangay
	Escopa	Barangay, Mother Earth, ADB Staff
	Holy Spirit	Barangay
	Philam	PHAI, Barangay, Parish Church
	Talayan	Barangay, Mother Earth

*MMDA=Metro Manila Development Authority. ZWRMPFI=Zero Waste Recycling Movement of the Philippines Foundation, Inc. ZKK=Zero Kalat sa Kapaligiran Foundation. INC=Iglesia ni Cristo. PHAI= Philam Homeowners Association, Inc.

Voluntary waste collection schemes help to fill in the collection gap by capitalizing on the economic incentives to both waste generators and waste buyers and combining a business model with community livelihood projects. Many of these schemes are launched by NGOs, often in partnership with LGUs, and intended not only to recover recyclables but also to increase environmental awareness through public participation and partnerships. The examples of these activities are as follows:

3.2.1. For Household Collection

- *Households to Junk Shops* occur through LGU collection schemes which use *mobile MRFs* (in the city of Makati), or *eco–aides* (i.e., former street scavengers or cart–pushers/ *cariton boys* who have been organized and accredited by barangays or by the Metro Manila Federation of Multipurpose Cooperatives under the *Linis Ganda* Foundation to collect recyclable materials. The Federation includes 17 individual member multipurpose cooperatives representing the 17 local governments of Metro Manila; at least 572 junk shops, 2,500 junk shop workers, 1200 eco- aides and 132 waste truck drivers).[11] Outside Metro Manila, household collection is still most commonly

[10] Metro Manila Solid Waste Management Project, Department of Environment and Natural Resources/ Asian Development Bank, September 2003.
[11] The Garbage Book - Solid Waste Management in Metro Manila, Department of Environment and Natural Resources and the Asian Development Bank, 2004

done by individual cart–pushers who bring their collected recyclables to the junk shops.

- *Households to Junk Shops/ Recyclers* occur through *mall–based Waste Markets/Recyclables Collection Fairs* conducted regularly by two of the largest mall operators in the country, the SM Supermalls and the Ayala Malls. At these Waste Markets/ Recyclables Fairs, buying stations/ covered tents are set up to receive scrap paper or cardboard/ plastics/aluminum or tin cans; used ink/ toner cartridges, electronic waste/ "white" waste (such as junk appliances); and used lead acid batteries. Those who bring their recyclables are paid on the spot for the assessed value, based on prevailing market prices.

  These Waste Markets are part of the Corporate Social Responsibility (CSR) programs of the malls, who voluntarily provide portions of their commercial parking areas for the venue. Malls do not derive any profit or commission from the participating junk shops/ recyclers. The Ayala Malls hold their Recyclables Fair every Friday on a rotating basis at five of their malls in the Metro Manila area. The SM Supermalls hold their Waste Markets under their "Trash to Cash" program every first Friday and Saturday of the month at their 26 malls nationwide. Since they began their Waste Markets in 2007/ 2008, the Ayala Malls Group reported a collection of 46 tons equivalent to P267,000.00, and the SM Supermalls has collected 417 tons equivalent to P2.6 million.

  In addition, annual *Recyclables Collection Fairs* are held on Earth Day (April 22) and/or during Environment Month (June) in various parts of the country. These are part of environmental advocacy efforts of business groups/ chambers of commerce/ companies (e.g. Davao City Chamber of Commerce, MetroBank Group/ Manila Doctors' College, SMART Communications, Rockwell Land/ Lopez Group of Companies, ABS–CBN Broadcasting Network) in partnership with the Philippine Business for the Environment (PBE). To date, these Recyclables Collection Events (RCEs) have collected 2336 cu m. of recyclable materials worth P3,434,769.67 since they began in 2002, and channeled these to the local recycling industry. Extrapolated environmental benefits for the RCE collections thus far, are as follows:

Table 5. Summary of Environmental Benefits of RCEs

RCE Environmental Benefits	*2002-2009*
Number of trees saved:	3,154.20
Lead recovered (kgs)	329,134.78
Sulfuric acid treated (liters)	65,826.96
Base metals recovered (kgs)	88,165.82
Precious metals recovered (gms)	11,020.73
Toxic substances treated:	14,694.30
PET recovered (kgs)	6,502.76
Aluminum recovered (kgs)	2,835.02
Total Landfill space avoided (cu.m)	*2,336.32*
Total Equivalent (10 ton) dump trucks	*234*

Households to Manufacturing Companies –it mainly involves retrieval of special waste like used lead acid batteries, old/ broken cellphones / electronic devices, and used ink toners and cartridges.

The Philippine Recyclers Inc. (PRI), the only ISO 14001 certified used lead acid battery recycling operation in the Philippines, linked up in 2000 with the non-profit *Bantay Kalikasan* (Nature Watch) Foundation and the DENR for the *Bantay Baterya* (Battery Watch) program. This activity allows people to either turn in their used batteries for new ones at a discounted rate, or to donate the trade–in value to the *BK* Foundation for its environment projects, such as watershed protection and anti–smoke belching. The Program aims "to sustain public awareness on the health and environmental hazards posed by indiscriminate junk battery disposal, provide a long –term mechanism for reducing the number of improperly disposed junk batteries, and ensure a steady supply of raw materials for the production of new batteries. It targets to recover 20% of the estimated 200,000 batteries consumed each month nationwide, which goes underground to illegitimate smelters with limited lead recycling capabilities and improper handling of battery acid and powder form lead.[12] As of 2008, a total of 400,000 kilos of used lead acid batteries and

[12] 2008 Accomplishment Report, ABS CBN Foundation. www.abs-cbnfoundation.com

60,000 litres of sulfuric acid have been recovered through Bantay Baterya. This has also avoided 586 m^3 of landfill space.

Companies such as Globe Telecommunications, SMART Communications and Nokia Philippines have also organized *Used Cellphone Collection Programs* to enable the public to dispose their used units in cellphone collection bins in the malls and in Nokia Centers. These units are then shipped abroad for recycling. There is however competition with a thriving trade in used cellphones by which one can trade in an old unit for a newer model at over the counter cellphone repair shops that proliferate in commercial centers throughout the country and refurbish/ dismantle the old units for resale as secondhand mobile phones.

Ink Remanufacturers also abound in the cities nationwide, offering to buy empty cartridges and toners for refill or resale, at stalls they set up in public areas or during waste markets/ recyclable collection fairs.

3.2.2. For School–based Collection

- *Schools to Junk Shops/ MRFs* occur through one–shot RCEs similar to the one mentioned above. This is initiated by student councils, faculty or parent associations as part of their environment awareness campaigns; or through LGU-assisted continuing schemes such as those by the Makati City, Marikina City and Quezon City governments.
  - In Makati City, all of its 29 public schools have established their MRFs, and both public and private schools have partnered with the San Miguel Corporation for aluminum can and PET plastic bottle collection for a total of close to 2 million pieces from 2006–2008. The city government also organized a *"3B sa Pasko Program" (Bawasan, Balik – Gamitin at Baguhin ang Anyo*/ Reduce- Recycle and reuse) working with schools and livelihood cooperatives to recycle waste into holiday décor and gift items which are sold at Christmas bazaars. This

has raised about P200,000 from 2006–2008 and diverted more than 25,000 kg of garbage from the landfill.[13]

- Marikina City's Waste Management Office, in coordination with the Department of Education, introduced the Eco-Savers program in June 2004. This requires students to bring recyclable garbage from their respective households during an assigned Eco Day—the day when the garbage is going to be weighed and credited to their issued eco passbooks. Each of the 18 public elementary schools in the city is assigned a once a week Eco Day.

  Accredited junk shops weigh the recyclables, record these in the passbooks and haul all the recyclables collected. The recyclables are then valued according to the prevailing market price and reflected in the individual passbooks using a point system (PhP1.00 = 1 point). Points earned entitle the eco-saver to shop in the Eco-Savers Mobile Store, which visits the school twice within the school year. This mobile store carries educational materials such as dictionaries, books, school supplies and educational toys. An eco-saver only needs to present the passbook to purchase school supplies.[14]

  Records show that individual savings or points earned, within a school year period, ranged from PhP50.00 to PhP1,800.00, which helped reduce household expenses on school supplies. The Eco-Savers rogram has also decreased the cost incurred in the disposal of local solid waste. The 50 truckload-trips a day to the dumpsite went down to an average of 30 trips a day and has also contributed to traffic decongestion, less air pollution, and energy conservation. Moreover, the program has provided junk shops within the city with a regular supply of recyclable materials. Through this program, a total of 238,000 kilograms of waste with a monetary value of P1.3 million have been diverted from dumpsites. In 2007, the Eco–Savers Program of Marikina was recognized with a Galing Pook (Good Governance) Award, a joint

[13] Villas, D., Department of Env Services, City Govt of Makati, Presentation at SWAPCONN 2008

[14] www.galingpook.org/awardees/2007/2007_outstanding_marikina.htm

initiative of the Local Government Academy–Department of the Interior and Local Government (LGA-DILG), the Ford Foundation, and other individual advocates of good governance from the academe, civil society and the government.

- *Schools with Manufacturing Companies* – companies also partner with some schools to take back their used packaging/ discarded products in keeping with the concept of Extended Producer Responsibility (EPR), as follows:
  - The Coca Cola Bottlers Philippines, Inc.: launched several school–based schemes in partnership with the Department of Education (DepEd) and the DENR for the collection of both aluminum cans and PET bottles, using redemption schemes, school contests and trade–in programs.

    One such previous program dubbed as "Give a Can, Give Hope" involved a tie up of the Coca Cola Bottlers Philippines, Inc. (CBPI) (for the widespread collection of aluminum cans) with the Department of Education and the WG&A shipping company which shipped these cans from donors in the Visayas and Mindanao to Manila using its Superferry vessels. The cans were then turned over to the Reynolds Recycling Corporation, for conversion into aluminum tubings and sheets used for manufacturing low cost wheelchairs by the non–profit *Tahanan Walang Hagdan* / THC (House With No Steps) Foundation for Persons with Disabilities (PWDs).

    Another program was an incentives scheme in which schools racked up points for every kilo of PET bottles collected, which they could swap for school equipment (such as garden tools, school supplies, office equipment such as copiers and computers) from a pre– prepared menu of items. However, both Programs only ran for a limited period and were discontinued after CCBPI turned over the collection process to accredited consolidators.

  - Tetra Pak Philippines tied up with the non–profit *Linis Ganda Foundation* for the collection of used tetra pak cartons; and has also donated collection bins to about 100 partner schools for pre– arranged pick up by consolidators for delivery to partner paper manufacturers such as the Trans National Paper Corp which recycle these into composite boards. These boards are either donated to Habitat for Humanity Philippines to be used as doors/ furniture for housing units, or given to THC whose resident craftsmen turn these into furniture, home and office accessories and gift items. The schools which collect the most volume of used tetra pak cartons are awarded cash prizes or chipboard items. Tetra Pak also partners with Global Paper Corp to recycle the used cartons into brown paper.[15]

3.2.3. For Commercial/ Business Collection

Companies to Junk Shops: The Ayala Foundation, which is the corporate foundation arm of the Ayala Group of companies, initiated a Partnership Project with Junkshops in Makati City where it owns and leases out 26 commercial and residential buildings. They partnered with the Metro Manila Federation of Environment Multi-Purpose Cooperatives (MMFEMPC) which designated authorized junk shop members to collect recyclable materials from specific assigned cluster of buildings using 4-wheel vehicle such as jeep or pick-up at specified hours. Use of carts and pedicabs was strictly prohibited. Collectors are required to wear T- shirt uniforms provided for them, carry duly signed authorization papers, and attend monthly progress update meetings. Building managers kept a detailed record of collection days and volumes, and payment for collected recyclable materials is done on a cash basis using a standard minimum price list that was regularly updated. The Program organized training and orientations for both the Building Managers and MMFEMPC members, and resulted in the publication of a SWM Instructional Manual for Building Administrators.[16]

- *Companies to NGOs* - as part of their CSR, many companies have found ways to deal with wastes from their marketing activities like banners and tarpaulins,

[15] www.tetrapak.com.
[16] Licos, A. Building Partnerships with Junk Shops. Presentation at SWAPCONN 2008.

while at the same time providing livelihood opportunities for communities and NGOs who turn these into functional materials like shopping bags, folders and envelopes. Examples of these tie ups are: Globe Telecommunications to Bantay Kalikasan, SMART Communications and the Earth Day Network; Unilever Philippines and the Smoky Mountain Foundation, Cebu Furniture Industries with RIBA/ Recycling Initiative of Bais City (Negros Oriental); Ayala Corp and Shangri – la Hotels with the Gifts and Graces Foundation. The latter, for example, aims to “improve the quality of life of marginalized members of society by providing product development and global market access to livelihood communities under the Gifts and Graces brand.”

Companies to companies: Since 1996, the PBE has been managing the Industry Waste Exchange Program (IWEP), which operates as an Information Clearinghouse that matches waste generators and waste buyers, and promotes resource recovery through orientation sessions, company in–house seminars, Environmental exhibit/ trade fairs, case studies /publications, Waste Markets and RCEs, and IWEP ads in its quarterly *Business and Environment Magazine*. Manpower constraints make it difficult to track all possible waste exchange referrals, or offer services beyond referrals and promotion. Nevertheless, there have been several documented case studies of successful waste exchanges also being implemented as a geographic – specific program by the Davao City Chamber of Commerce and Industry in the Mindanao area, and the Eco-Industrial Exchange Network (Eco – Index) of industrial estates in the Laguna- Batangas area (north of Manila).

3.3. Recycling Technologies and Facilities

Upon reaching the recycling facility, the recyclables are transformed into useful raw materials or finished products through a variety of locally available technologies. There are large recycling facilities for paper, plastics, used lead acid batteries, scrap metals, electronics waste and glass. Cement plants also collect used tires for use as substitute fuel for their kilns (i.e. co–processing). Smaller, community recycling that are less capital–intensive also occur for laminates (“doy” packs) recycling and spent ink and toner cartridges. The Department of Science and Technology (DOST) – Industrial Technology Development Institute (ITDI) has helped to promote many of these technologies with help from the ADB. Other residuals are processed into non – load bearing concrete materials (e.g. hollow blocks, benches, perimeter walls, traffic barriers) – palingenesis, hydromex technologies. [17]

New business opportunities have resulted in more environment service providers for the treatment of special and hazardous materials such as fluorescent lamps and bulbs and industrial waste like sludge and spent solvents. However, there is still much room for expansion here, and treatment costs are not always within the reach of smaller companies, especially those in the regions outside of Metro Manila / Luzon where such facilities may be sparse or non–existent. Thus, the uptake for these environment technologies needs to be hastened through information sharing, technical and financial assistance, incentives and, most importantly, political will.

A Recyclers' Directory at the NSWMC website lists 56 recyclers as follows:

Table 6. Recyclers Locations (based on NSWMC database)[18]

Type of Recyclables	No. of Recyclers[19]	Locations (in Luzon / around MetroManila)	Locations (other than MetroManila/ Luzon)
Plastics (HDPE, LDPE, PP, PS, PET, HIPS, PVC, Others	24	Valenzuela (14) Manila (2) Quezon City (2) Caloocan Laguna Mandaluyong Muntinlupa Parañaque	Cebu
Paper (newsprint, office paper, other White grades, corrugated cartons, paper boxes)	14	Makati (2) Pasig (2) Quezon City (2) Caloocan Cavite Laguna Malabon Marikina Pampanga	Davao

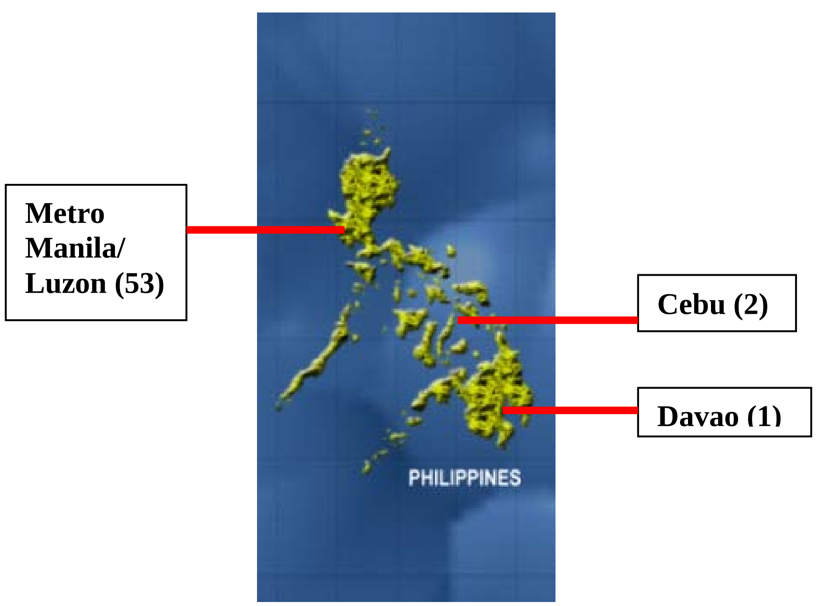
[17] www. denr.gov.ph; **www.dost.gov.ph**
[18] www.denr.gov.ph/nswmc.
[19] The PBE database lists 1 additional PET recycler in Pampanga, 2 additional electronics recyclers in Bulacan and Caloocan; and one additional tin can recycler.

		Parañaque	
Used Lead Acid Batteries	1	Bulacan	
Computers/ Electronics	1	Laguna	
Tin Cans	1	Mandaluyong	
Metals	2	Cavite Quezon City	
Container Glass	6	Cavite (2) Laguna Makati Manila	Cebu
Flat Glass	1	Pasig	
Tetra Pak	* usually also by paper recyclers		
Tires	6	Bulacan Las Piñas Manila Marikina Pasig Quezon City	
Totals	56	53	3

Note: Some locations (e.g. Makati) are those of headquarters rather than plant facilities.

The locations are visually depicted in the map below:

Figure 2. Location Map of Recyclers (from NSWMC database) - Philippines



The 2003 ADB Metro Manila SWM Study however states that there are about one hundred recycling companies and organizations in Metro Manila alone, with

Valenzuela City in the Bulacan province (north of Manila) having the largest concentration (as similarly reflected in the NSWMC database), mostly of plastics recylers.[20] This excludes junk shop operations which do more of waste segregation and trade rather than on–site recycling, with little investments in equipment, technology or trained personnel.

Some of these recyclers may have collection agents in the regions. However, the costs of transportation and shipping of recyclables from the provinces to Metro Manila where the recycling plants are located, can be a deterrent to sustained recycling programs in these areas. Also, many of the local recycling industries, in particular of paper, scrap metal, plastics are faced with stiff competition in the foreign market, especially China, which imports these at higher buying prices, and devours such materials to meet the demands of their growing economy.

4. Stakeholder Roles

From the reports mentioned above, we can summarize the various stakeholders in the recycling sector as follows:

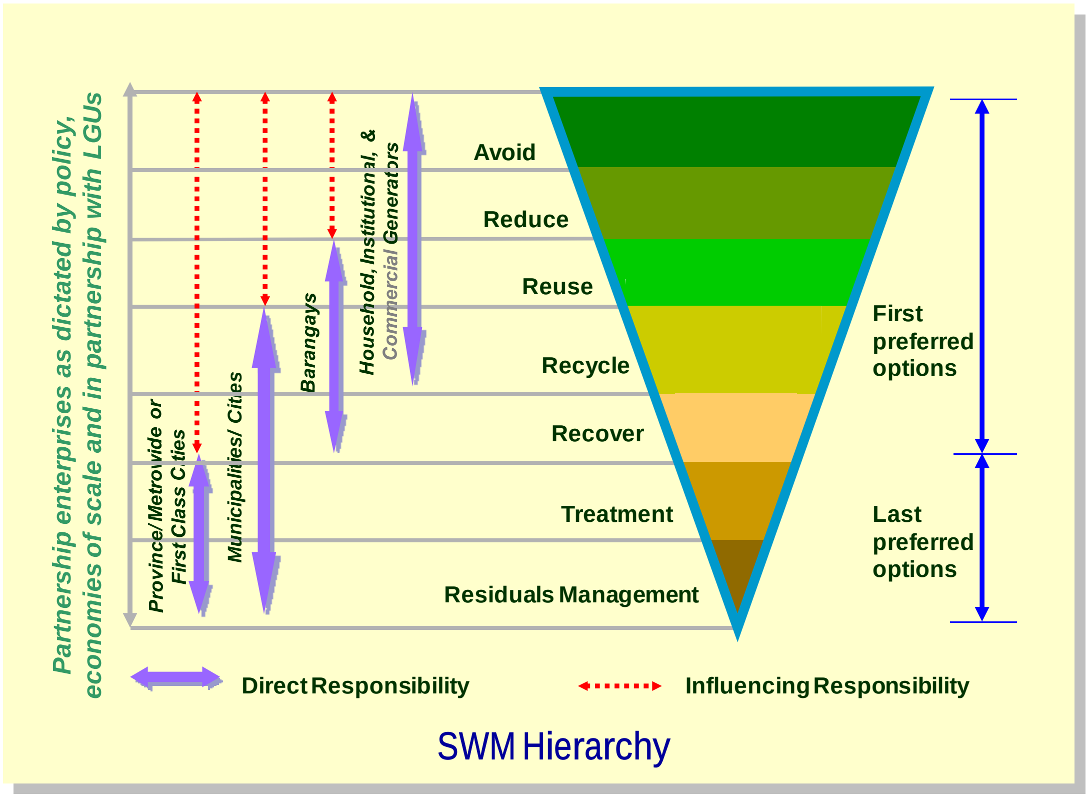
- *Consumers/Institutional & Commercial Waste Generators* – whether households; institutions like schools, offices; commercial/ business establishments including restaurants and malls where large numbers of people tend to congregate;
- *Collectors/ Consolidators* - whose role is to collect the waste generated at various collection points;
- *LGUs* - who are mandated by law to implement efficient SWM programs and to promote the 3Rs to achieve the minimum required waste diversion rate; and to enact and enforce the necessary local ordinances and policies to ensure compliance by domestic and commercial establishments;
- *Producers/ Manufacturers* – with the potential to help reduce waste through product/ packaging redesign; economic incentives, take back programs and process changes;

[20] Metro Manila Solid Waste Management Project, Department of Environment and Natural Resources/ Asian Development Bank, September 2003.

- *Buyers/ Traders* – who take advantage of domestic and global market forces to trade recyclables that can be used as raw material by major manufacturing industries;
- *Recyclers* – who invest in the technologies, facilities and infrastructure to make recycling a viable industry using a business model approach; and
- *Environmental/ Recycling Organizations/ Associations* - who mount advocacy programs and information programs to increase general awareness on the benefits of recycling and generate public support and participation; and who initiate/ provide technical assistance for community–based livelihood programs.

Using the SWM hierarchy as a guiding framework, the most preferred behavior is for consumers and waste generators to avoid creating waste by reducing at source (e.g. of packaging, leftovers, over spending on consumer goods), and then subsequently segregating/ sorting waste into reusables/ recyclables / non – recyclables, for which barangays establish MRFs where further manual sorting takes place. LGUs have the direct responsibility for collection of waste bound for the landfills, and for building treatment and disposal facilities for residuals. Municipalities/ cities (or, in the case of Metro Manila, the Metro Manila Development Authority). These roles are summarized in the figure below:

Figure 4 Stakeholder Roles and Responsibilities in the Solid Waste Management Hierarchy (NSWMC)



5. Continuing Issues and Lessons Learned

There are issues and concerns for the recycling industry as a whole and for each specific type of recyclable materials.

5.1. The general concerns of the recycling industry include

- o Lack of consistent ***enforcement of environmental laws***, allowing unregistered and unregulated competition from informal recyclers who not only unfairly compete with legitimate investors and businessmen, but also pose public health and safety risks in areas where they operate, particularly with respect to special recyclable wastes like electronic / electrical waste;
- o Absence of ***clear market data for the regions***, recycling facilities tend to be concentrated in Metro manila or Luzon urban areas, making it difficult to

sustain recycling programs in the provinces due to the large transportation/ shipping costs;

- o *Vulnerability of prices to world market fluctuations* brought about by global economic situation; and competition between the export market and the local recycling market sometimes leading to a decrease in locally available recyclables as production input for the local recyclers, notably with paper, scrap iron/ metals and PET plastics;
- o Lack of clear ***industry standards for recyclables*** – e.g. though tetra pak are 74% food grade paper board (4% aluminum, and 22% others), most paper recyclers remove them from the scrap paper pile, and they end up virtually discarded thus adding to the SW problem and losing out on commercial opportunities; and
- o Lack of ***investments*** to upscale/ commercialize some of the recycling technologies to bring down costs, such as for recycling of tetra pak cartons into fiberwood.

5.2. Some concerns of selected recycling industry sectors are

5.2.1. Paper

- o For many existing paper millers, there is need to update old or inefficient equipment and machinery**;** and to adapt newer technology (e.g. for the recycling of Tetra Pak into carton/ cardboard);
- o Related to the above concern is also the higher costs of water and electricity in relation to the efficiency of the equipment, as well as the operations itself; and
- o Domestic paper collection still needs to be improved, especially in the regions, not only with respect to volume but also with the handling process to ensure the quality of the used paper supply for the production of new paper (and to minimize “contamination” with other mixed waste).

5.2.2. Plastics

- o The use of scrap plastic for plastic production is very low compared to that of paper, glass and metals. Hence, waste plastics comprise a major part of the waste stream throughout the country. In part, this is due to the difficulty of separating plastic waste from mixed waste, for which more public education is needed;

- On the other hand, some types of plastic waste such as PET bottles, are being exported in large quantities where they fetch higher buying prices, thus affecting the local supply of the local plastics manufacturers; and
- For processing of PVC scraps to produce PVC flakes, there are some technology limitations (e.g. need to manually sort 28 types of scraps of PVC before crushing/ shredding); and no suitable size of extruder).

5.2.3. Metals

- There is severe competition between local scrap metals buyers (e.g. for iron, tin and aluminum) and the buyers for foreign markets due to the large export demand and higher export prices for them;
- The materials is also highly vulnerable to extreme price fluctuations; and
- Higher operating costs for local metals recycling result from the high cost of electricity (for electric furnaces in steel making), and shipping/ transport.

5.2.4. Glass

- Scrap glass fetches comparatively lower prices than the other recyclables due to its handling bulk (thus requiring large collection and storage areas); wide range of specifications (e.g. color, thickness, opacity); and high transport cost; and
- In the Philippines, there are also few glass recyclers and domestic users of scrap glass. Existing ones tend to be concentrated in one area (i.e., Laguna).

5.2.5. Used Lead acid batteries

- Informal backyard ULAB recyclers abound, creating unfair and unregulated competition to the legitimate business investor, giving the ULAB industry a negative image, as well as posing public health and safety risks. Also, despite ISO 14001 certification and strict importation guidelines and monitoring protocols by the DENR, some local environmental NGOs continue to oppose the importation of used lead acid batteries which can affect the optimal operating capacity of the ULAB recycling facility. PRI's tie–up with both the DENR and the *Bantay Kalikasan (BK)* has helped lend a measure of credibility to their ULAB retrieval program and influence positive public perception, to some degree.

5.2.6. Electronic Waste

- The sector is poorly regulated and many backyard operations exist which create problems for worker health, community safety and environmental contamination. This also gives the industry a bad reputation, to the detriment of the legitimate recyclers;
- Many mall – based electronics retail / repair shops are based in malls and commercial shopping centers that have no e- waste segregation; thus resulting in their inclusion with mixed waste. Very few (possibly none) have generalized or bulk disposal systems (e.g. for cell phone battery wastes or non – working units/ parts). In areas outside Metro Manila, disposal is via municipal waste, open dumping or burial, which makes retrieval difficult;
- While the e- waste stream is increasing in the country (e.g. junk computers and cellphones/ cellphone batteries), collection is hampered by the Filipino penchant to retain their old units for their perceived "residual" value or to pass these on to other users when they upgrade their own; and
- More public awareness is needed on the hazardous materials in these equipment and the need for proper recycling and/or disposal.

6. Recommendations

Recycling in the Philippines is in a relatively infant stage, but has a large potential for growth if the various stakeholders examine the lessons learned from the industry's experience or achievement so far.

For the collection process, in particular, this study suggests the following recommendations:

6.1. Improving the collection volume

- Although the collection schemes today are better organized today than in the past, ***LGUs should continue to support and strengthen*** the existing informal networks of collectors/ junkshops/ waste pickers as a ***secondary materials recovery system***, for both environmental and social reasons. The experiences of Payatas, Clark and Quezon City, as well of private sector schemes like those of the Ayala Group demonstrate that such successful schemes help to alleviate both the garbage problem and the collection burden of LGUs without additional costs to the taxpayer.
- The success of voluntary collection schemes, especially those jointly organized by the LGUs, private sector and NGOs, demonstrate that ***practical, convenient channels are needed to encourage more participation from the public***. Some of these schemes offer ***monetary incentives*** (such as trade–in value, or points –systems). Others offer ***non–tangible incentives*** (e.g. protecting the environment) such as polystyrene/ cellphone collection which does not give monetary incentives.
- A common denominator for successful collection appears to be with the use of ***widespread promotions*** which includes the benefits of recycling and feedback to the public of the value of their contributions; ***accessibility*** (e.g. at malls, schools or public places) and ***reliability*** (i.e. regular collection/ redemptioin schedules). Thus, collection channels should be well– publicized.
- In addition, more such ***collection points / collection sites need to be set up in places outside Metro Manila,*** although this, of course, can be seriously limited by the location of the recycling facilities themselves, due to the prohibitive costs of transporting the recyclable goods.

6.2. Improving the collection process

- It is equally important to provide proper guidance and training, to junk shops and secondary level collectors on the proper handling of recyclable materials to assure ***better quality of the supply to the recycling industries***, and avoid rejects. Thus, ***guidelines*** are needed not only for recycling but also for collection. These can be developed in consultation/ with the help of the different stakeholders.
- Assistance for ***start–up financing from the government or private sector*** (e.g. for small trucks, warehouses/ collection stations, payroll) would also help encourage small collection businesses.
- Collectors and consolidators appear capable of quickly networking with waste buyers and recyclers, but government can still provide further help in ***establishing market linkages***, especially for new such opportunities in the regions

Since the underlying assumption for improving collection is that the market for recyclables will continue to grow, the current study also offers some **recommendations for improving recycling practices as a whole.**

- Need for more ***reliable and comprehensive information on the recyclables market***, especially to attract more private sector investment to build recycling facilities or to commercialize recycling technologies;
- ***Importance of meeting environmental standards and of highlighting good industry practices*** - Recycling industries are generally perceived to be "dirty" and "unsanitary" in part because some did start out as such and many informal activities continue to operate. But new technologies and appropriate skills training can elevate recycling into a respectable industry, and the economic and environmental benefits they offer should be highlighted by the industry. Having local industry standards as well can improve the export chances of local recyclable materials;
- ***Importance*** of improving enforcement and regulation, to level the playing field and encourage legitimate investments in environmentally

safe, proper recycling operations; as well as to protect existing legitimate and environmentally compliant investors;

- ***Promoting community – level adoption and technology transfer of recycling technologies*** - examples of successful community – level collection and recycling efforts cited in this paper had a good start with support from foreign assisted donor projects which helped to establish the proper community–level structure, initial funding, technical assistance/ technology transfer and documentation of the project to serve as replicable models in other parts of the country. The availability of relatively newly developed ***recycling technologies which are not capital–intensive*** (such as doy pack/ laminates / mixed waste recycling into chipboards/ hollow blocks) created demand for waste materials that would otherwise merely have been discarded;
- ***Policy incentives and Economic incentives to recycling industries*** – Experience from other countries suggest that having national recycling targets can significantly boost the growth of recycling efforts and investments. In addition, some of the existing recycling facilities benefited from pioneer status accorded them by the Board of Investments (BOI) of the Department of Trade and Industry (DTI) to allow them to bring in equipment with lower/ no tax; and enjoy a tax holiday for initial years of operation to be able to establish a foothold and recover some of their initial capital investment;
- ***Partnership with other stakeholders*** – notably government (e.g. DOST/ DENR/ LGUs) and reputable NGOs (e.g. PBE/ BK) to help add credibility to company recycling efforts/ environmental programs, with the added benefit of having an advocacy/ education objective and, where possible, to find ways to integrate the informal sector so as to avoid social displacement and livelihood loss;
- ***Organized effort by the recycling industry-*** Local recycling industries can band together and form a professional association that can dialogue with government and other stakeholders, educate the public on the benefits of industry recycling and pursue programs to promote support for the recycling industry as a whole; and

- ***Stimulating demand for recycled products and promoting benefits of post–consumer recycled products*** – provides a larger market for recycling businesses and encourages the growth of more eco–entrepreneurs, noting that in the Philippines, as in many other countries, more than 90% of industry is small and medium in size. The success of the most recent eco–products fair held in Manila in early 2009, with plans already afoot for another one in 2010, suggest that these, combined with green procurement programs, are effective vehicles for generating interest and support for eco products, including recycled products. The government can further stimulate demand by enacting policy in favor of green public procurement. An example is the Executive Order 301, issued by the Office of the President in March 2004, requiring all departments, bureaus, offices and agencies of the executive branch to establish their Green Procurement Programs. Although implementation has been slow, one outcome of this is the inclusion of environmentally preferred criteria in the procurement guidelines of the Department of Budget and Manage

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CHAPTER 4

Informal Collectors
of Recyclable Waste and Used Goods in Indonesia

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1. Introduction

This report is the continuation of previous report entitled *Current Situation of Waste Recycling in Indonesia* [1]. The latter discussed the aspects of relevant regulations on hazardous wastes (HW) and municipal solid waste (MSW) in Indonesia. It addressed numerous constraints that have made HW and MSW in Indonesia under-performed. Waste and used goods collection activities, especially among informal sectors, serve as the most dominant recycling activities in Indonesia. For industrial wastes, especially hazardous one, most activities associated with recycling are performed by the formal sectors.

Every country recognizes the importance of recycling. In most countries, plastics, glasses, papers, and metals are well collected by either informal sectors or municipalities for recycling. In the case of the MSW in Indonesia, there are two main recycling flows. In the first flow, collectors, including those in the informal sectors, collect recyclable materials at sources. In the second flow, these materials are separated and recycled by the municipality after MSW collection.

This report will discuss used goods and wastes recycling activities, especially among informal sectors, in more detailed. This report emphasizes its discussions on the roles and the linkage of one informal sectors' stakeholder with another's in performing their activities as waste and used goods collectors, and how the materials flows and qualities are applied on the economic transactions by informal sectors in Indonesia.

2. Understanding Wastes and Recycling

Waste recycling in Indonesia is not a new activity. The Indonesian community has long been practicing used goods trading such as used clothes and the like, especially among waste traders (junkmen). So has industrial waste, they are not new at all.

As discussed in the previous report [1], according to Indonesia's regulation, there are three types of wastes associated with recycling:

- MSW and their equivalents: regulated under the Law 18/2008 on Solid Waste Management. It specifies that recycling is the key for a successful waste management. However, the detailed regulations on this waste recycling are not available yet until this time. Operationally, the stakeholders related to waste management, such as State Ministry of Environment Indonesia (MEI), Ministry of Public Works (MPW), most of local governments, NGOs etc. agreed to take these waste recycling efforts to be realized in Indonesia.
- HW: the Law 32/2009 on Living Environment Protection and Management superseding Law 23/1997 on Living Environment Management (superseding Law No. 4/1882), places the issues of hazardous materials and wastes as one of its main concerns. The more detailed regulation on hazardous waste management is the Government Regulation 18/1999 as amended by Government Regulation 85/1999. This regulation gives directions that recycling shall be one of the main efforts in managing HW. This regulation does not regulate radioactive wastes, because the latter is specifically regulated by the National Atom Power Agency.
- Any waste that does not belong to the above-mentioned schemes, such as non-hazardous industrial wastes, agricultural wastes etc. The handling of these wastes must comply to the Law 32/2009 and they are further regulated according to the effluent or emission standards issued by the MEI.

Waste definitions vary in different countries as well as the MSW definitions. Among developed countries, for instance, the definition of a MSW will encompass any goods that would be defined among developing countries as used goods that still have economic values. In developed countries, the elimination of used electronic appliances, furniture and fixture, used newspapers, used magazines, and used clothes, etc. incurs cost of disposal. Thus in developed countries, these goods are defined as waste and require further handling. On the contrary, in developing countries, these are regarded as valuable goods and could still be used after being repaired or by recovering their components in such a way that they could be reusable.

In developing countries such as Indonesia, one of the environmental problems faced in urban areas, particularly those in big cities, is improper waste management. Waste recycling efforts are strongly recommended in Indonesia. Therefore, the common practice is linking the waste recycling activities with waste handlers. There are three groups of waste materials in the country that serve as the main objects by the recycling economic actors:

- Wet waste, especially organic waste, to be converted into composts;
- Dry wastes, especially those with the potentials to be recycled, such as papers, plastics, aluminum, etc.; and
- Used goods that serve as the objects of trading among used goods traders.

3. Understanding the Informal Sectors

Many people interpret the informal sector engaging in used goods and wastes economic transactions or trading in Indonesia as scavengers. But actually, the latter is just only one of those multiple stakeholders in recyclable collections. Indeed, it is the group that has attracted most attention due to its association with social issues faced by most urban areas in developing countries such Indonesia.

Informal sectors' activities are not considered illegal in Indonesia. Many economic activities, especially of small businesses, are performed by this group. All parties in Indonesia, including the Government, appreciate its resiliency in facing global economic crisis occurred in the country and other regions during 1997-1998. It is documented that this sector has the ability to absorb many independent labors, because the formal sector has failed to provide good and adequate job opportunities. Many city inhabitants in Indonesia who have formal jobs also engage in informal sectors' businesses after their formal work hours to increase their income.

Informal sectors activities are done openly and have not been deemed as illegal activities so that they are not involved with any security or law enforcement officers. These types of activities can be found in the entire city's corners, either at their own homes (legal) or on the public streets or unoccupied lands (illegal). However in most cases, "raids" launched by municipality's officers also happened on accounts that these activities are disturbing city's order, such as using sidewalks for their businesses, or occupying the areas that have been forbidden for such activities, such as city parks and others. Many of these informal sectors go door-to-door, by offering goods or services directly to their prospective consumers. Usually, these activities can be found especially in the cities, such as house rental business, convenience and foods stores, electronic/electric appliance reparation/services, tailors, and other service sectors. It seems that the most dominant distinction between informal and formal sectors is that the objects of the latter are not taxation objects from their economic activities, including their billboards. In some cases, these informal sectors activities have some linkages with the formal sectors economic chains, and both of them are mutually dependent.

In recycling activities, the informal sectors engage primarily in using wastes generated by a household, especially dry wastes such as plastics, papers, metals, and the likes. Other categories of goods having potentials to be used are used goods. Wastes generated by an industry that belong to hazardous category are handled by the formal sectors.

The trading of dry wastes which are non-compostable has been the profession by choice or a profitable business among those people generally belonging to informal sectors [2]. Cycles of potentially recyclable and having economic values wastes start from their sources such as residential areas, industries and so on. These informal sectors activities are most attractive for businessman, involving main actors such as scavengers and waste traders, who collect wastes or used goods from door to door or their customers-partners. In addition to their contribution in reducing waste handling costs, other benefit is that they serve as one of generators of job opportunities.

4. Pathway of Recycled Used Goods and Wastes

Used goods trading in urban areas in Indonesia has long been practiced, such as at Cihapit (Bandung), as junk market that dated back since 1945 until this present time [3]. The types of junks that could be traded among junkmen, junk stores and junk market are as follows (Figure 1):

- Home appliances such as iron, blender, cake mixer, hair dryer, electric van, TV radio and tape recorder;

- Used fabrics and clothes;
- Shoes and bags;
- Used books;
- Used cassettes; and
- Woods from building demolition and furniture.

These used goods are usually placed at special locations, in forms of stores, street trading sites, and junk markets. In Bandung city for example, they can be found among others at Jatayu, Cihapit street electronic-junk market, junk-clothes market at Gedebage, used books and electronic junk markets at Cikapundung and lumbers trading businesses at Terusan Pasir Koja street. One of these used goods stores lies at Karapitan Street, Bandung. This store accepts varieties of useable objects under revenue-sharing scheme. Contrary to junk markets, these stores are actually belong to formal business, due to the fact that they display their stores as ordinary business stores, so that it could be ascertain that they should have been applied taxation obligations, including billboard taxes.

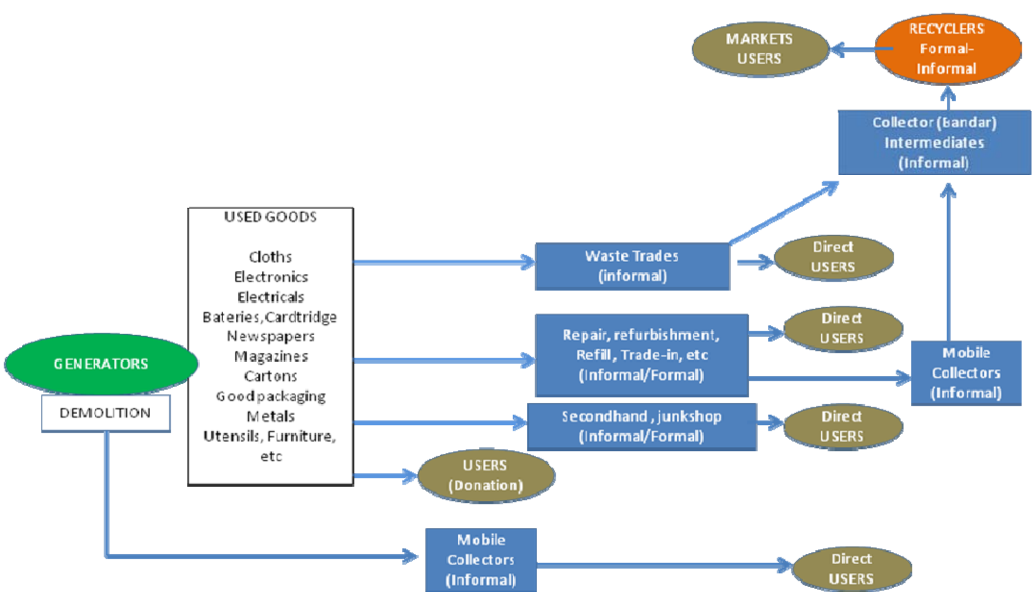

Figure 1. General pathway of recyclable used goods

In addition to used goods, such as electronic/electric appliance, lead battery and other objects that are considered as non-waste among Indonesians, the waste-category goods, or any goods that have been disposed by its owner and commonly found at public waste bins but still have potentials for trading are generally as follows (Figure 2):

- Hard plastic packaging (containers and cups/glasses);
- Transparent plastic sheets;
- Papers (blanks, magazines, books, newspapers, writing books);
- Cartoons;
- Metals (nails, irons, coppers); and
- Glass containers.

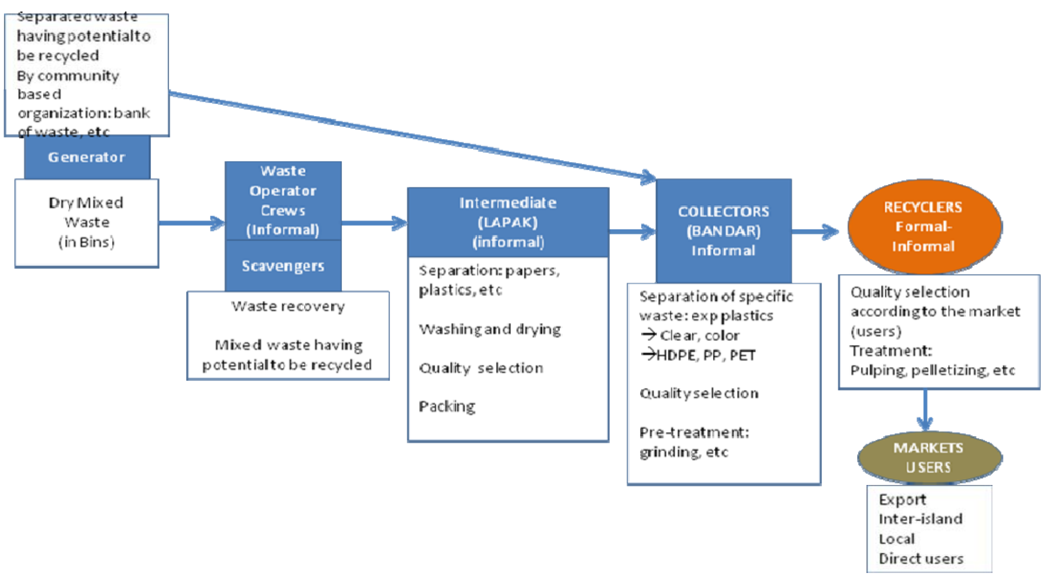

Figure 2. General pathway of recyclable wastes

These materials serve as economically valuable business objects among recycling actors from residential level, junkmen, scavengers, intermediates (*lapak*), dealers (*bandar*) to industrial level (recyclers). In general, the traded goods or wastes provided by 'sellers' such as junkmen would be suited with the most adjacent business scopes of the intermediates (*lapak*) who will buy those goods, and *lapak* should suit their business with their dealers (*bandar*). Generally, intermediates and dealers will not engage in one single category of goods, such as a *lapak* at Cimahi, neighborhood that collect hard plastic packaging, glass containers, zincs, metals, cardboards and papers that subsequently be sold to two major dealers in Bandung and Cianjur. Another example is one of major dealers at Cipamokolan (Bandung), that engages itself not only in trading plastic packaging, but also converts these goods into pellets, in addition to accepting supplies of used metals such as used trellis fences and copper wires, used drinking cans and used spoons.

The pathways of potentially recyclable wastes and used goods vary with their respective market circumstances and the availability of recycler as their end processor. Figures 3 and 4 depict briefly the pathways of potentially recyclable wastes, used goods trading, and wastes from their source levels through end actors, which is developed based on field information from related stakeholeders in Bandung and Cimahi cities.

Used goods and wastes trading start at settlement environments. Middle-income residential area or higher usually donate their used goods free of charge to door-to-door junkmen or to wastes transport crews in their areas, or to scavengers who pass by in their front yards. Among mid to low income residential area, used goods or wastes that still have economic values serve as their additional source of income by selling them to door-to-door junkmen or directly to junkmen or trading sites or small craftsmen in their vicinities. The difference between junkman and scavenger is that the latter get their valuable wastes free of charge, while the former have capital to buy these used goods.

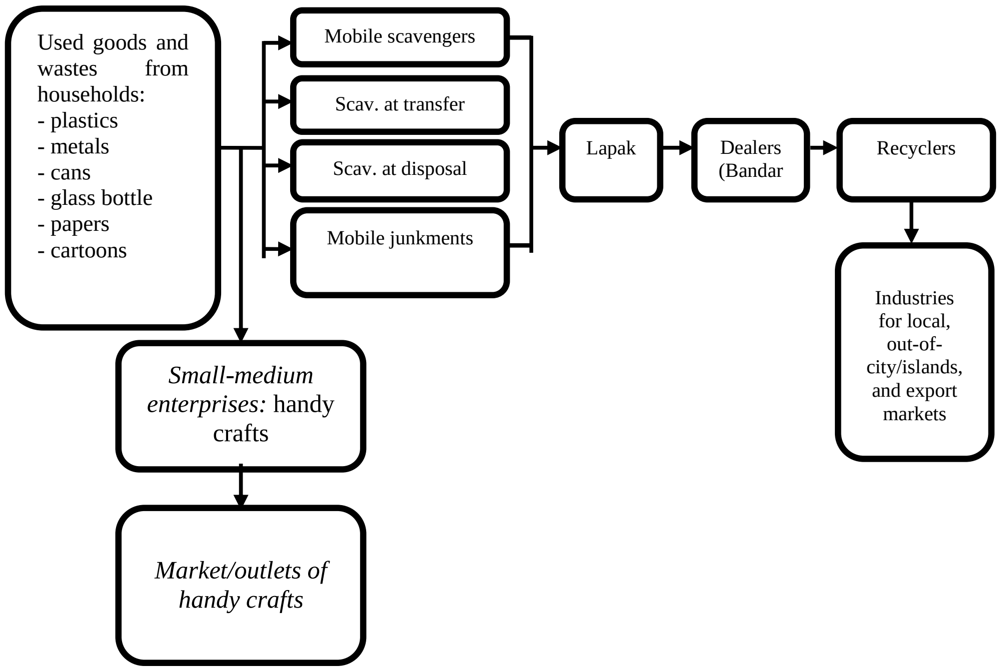

Figure 3. General path flow of recyclable used goods and wastes trading

The ranges of buying prices from junkmen or trading sites are affected by the condition of goods offered by the sellers. Prices flux occurred at wholesales level, and junkmen locations and trading sites. In general, however, these junkmen or trading sites are situated in the vicinities of the respective residential area. So, interdependent beneficial relationship occurred. Goods collected at junkmen and trading sites require initial processing to boost selling prices at the dealer level. For example, plastic packaging, glass containers and cans should be freed of its labels and covers, so that their prices will increase. Cleaned materials increase the selling value up to 40% to 50% from their base or dirty prices [4, 5]. Figure 4 demonstrates the pathway of second hand goods that attract most attention among urban areas.

Dealers as collectors of goods in mass-scales are usually have business scopes encompassing the processing of these goods, especially plastics, to be converted into goods available for recycling. Then the dealer will deliver these processed goods to the related industry/recycler within or outside their cities, or even according to them, they export collected recyclables to foreign countries such as China. At dealer level, goods categories such as iron, metal or glasses were not specially treated. As a common practice, a dealer has direct brokerage networks or sells them to any industry that will utilize them. Glass bottle with certain trademark will be reclaimed by their respective factory that initially produced these goods. These brokers will collect used iron and metals by their qualities and sell them to some automotive assembling companies in Jakarta areas, for instance. Recycling factories as end actors are not only producing products, but also processed goods such as chopped papers, chopped or granulated plastics and iron scraps. Bekasi City and its vicinities are widely known for trading exported products, goods in process or materialss, though most of recycling materials within these areas are absorbed by domestic markets.

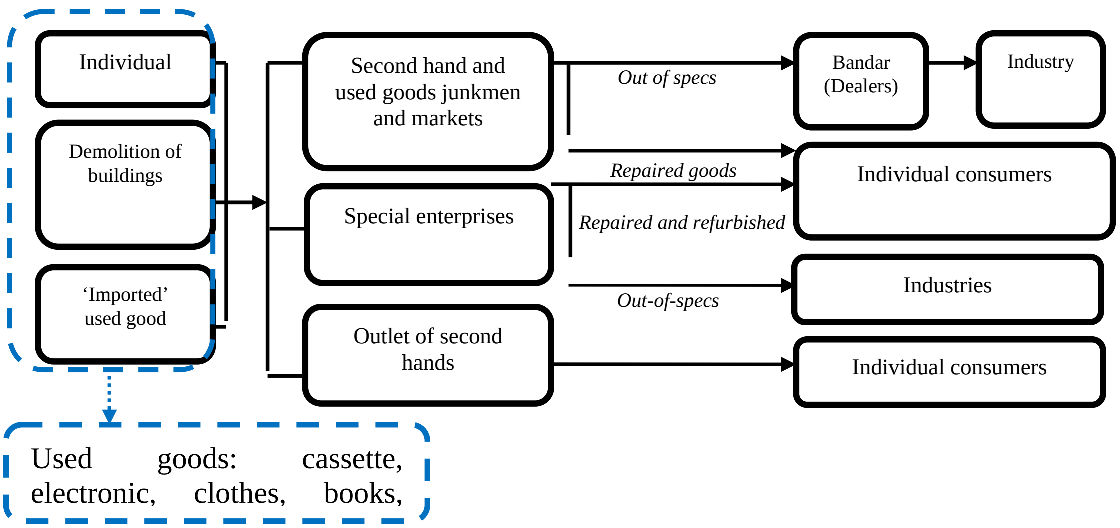

Figure 4. General path flow of used goods trading

Figure 4 above demonstrates the trading paths of used goods originated from several sources such as individuals who come directly to the junkmen, junk markets or used goods stores. This is the case for several types of goods such as used electronic appliances like second hand blenders, irons, mixers, tape recorders for automobiles, cassettes, shoes, bags, and books or magazines. The owners come directly to the junkmen or second hand markets and the buyer usually offers the prices according to the goods' respective conditions. The prices for repairable, out-of-order goods are normally 20%-30% below the market prices of the brand-new ones. The irreparable out-of-order goods are bought by junkmen in a much cheaper prices and even up to 5% - 10% of their market prices, and even, there are some sellers who give them free of charge to the junkmen. In the case of irreparable used electronic goods, the junkmen usually will disassemble them and take their valuable components that can be sold to dealers, such as copper wires, screws, and plastic hard covers, or other components [7]. These dealers will subsequently sell them to related industries.

Another source of used goods, such as used clothes, is found mostly in major cities. In Bandung, there are junk markets for used clothes at Gedebage Market of Eastern Bandung, that buy these goods from brokers of imported used clothes originated from Taiwan, Korea and China at low prices per sack or ball of 1 hundred kg weight for trousers, T-shirts, shirts and jackets. The contents are reopened to mix them with used sweaters and T-shirts, and then sold to junkmen in other regions or individual junkmen with higher prices.

Other types of goods such as automotive electronics and other used electronics are sold individually by their respective owners to junk markets such as Cihapit market. These junkmen will resell them to the visiting consumer in minimally repaired conditions.

5. Wastes and Used Goods/Wastes Collectors

Overall, the stakeholders interested in recycled wastes are divided into the following main groups (Figure 5). Stakeholders for the recycled used goods and waste in all sectors of Indonesia are presented in Figure 6. The main actors who play the important role in collecting recycled wastes and used goods are:

- Scavengers
- Waste collector crews
- Junkmen (waste traders)
- Intermediates (Lapak)
- Brokers
- Dealers (Bandar)

5.1. Waste pickers (scavengers)

Used goods and waste recycling actors usually start from searching and collecting used goods. The lowest group consist of valuable used goods hunters at the disposed wastes, and they are called as scavengers (waste pickers). Usually, they are coordinated by the *lapak* owners or gatherers who accept and buy their used goods. They are searching and collecting used goods rigorously, including those on the rivers. Usually, there are social ties between scavengers and *lapak*, such as similar hometowns. In general, these scavengers are immigrant to the cities and not the latter's inhabitants. Their existence are assumed to be one of the social urban problems, because they are usually have no permanent domiciles, and are just living at the unoccupied spaces in the cities. Actually, they do not want to be scavengers as their permanent jobs. However, they immigrate to the cities due to economic necessities. Since they are generally unskilled and have no capital, they are forced to be scavengers.

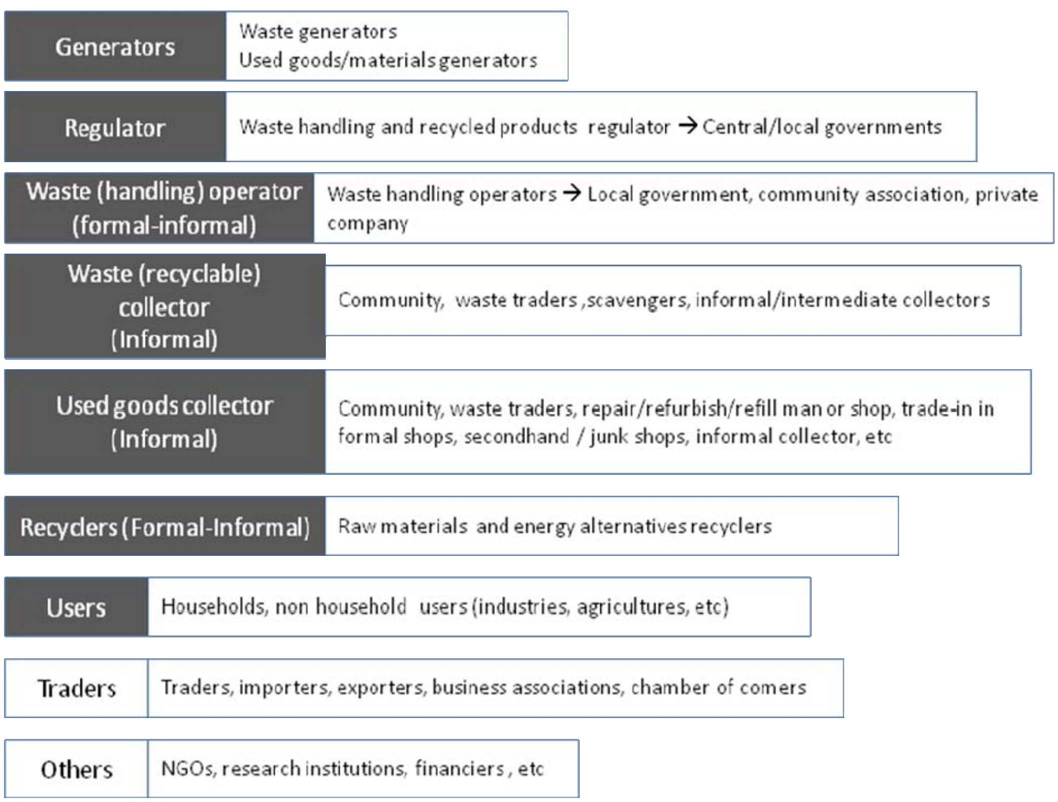

Figure 5. Stakeholder in waste/used goods recycling in Indonesia

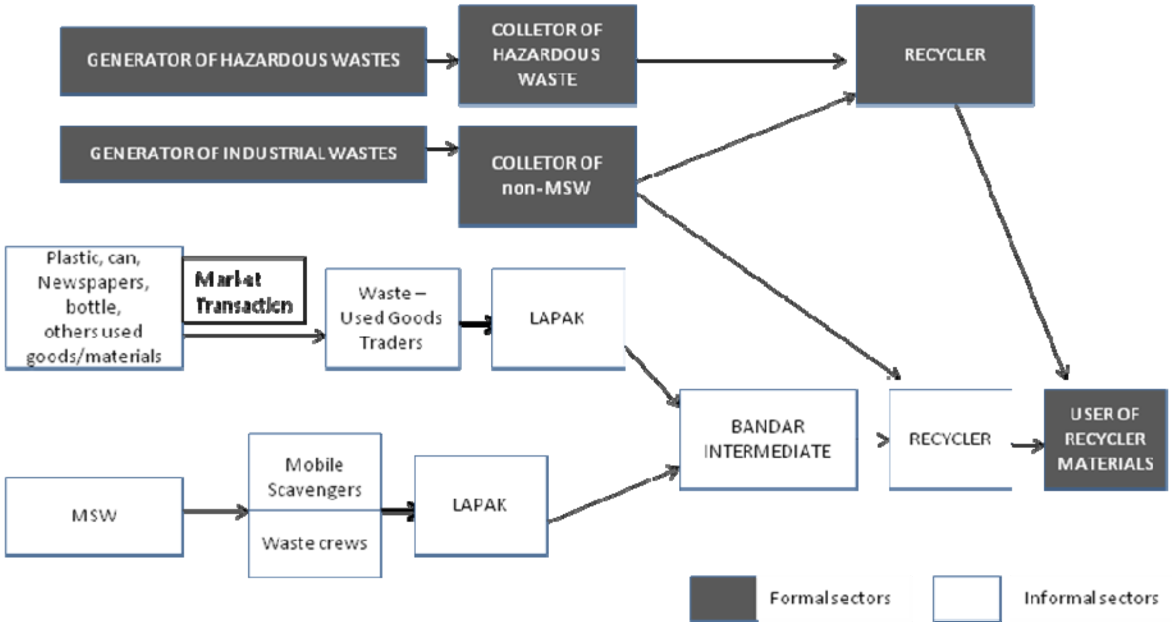

Figure 6. Formal and informal sectors in used goods/waste recycling in Indonesia

The existence of scavengers (waste pickers) in the waste management system brings about two different opinions. Some people consider that this activity do not only provide opportunities for the poor people who are working in this sector, but it also helps to reduce the amount of waste for disposal to the final dumping site. However, others consider that this activity bring a "bad" image to the country. So far, the role of informal sector in waste recovering activity has not been well organized.

Lapak lends money to the scavengers through credit sales for certain used items, similar to future trading, including provision of "shelters". Most of them involved in heavy debt conditions. Therefore, people who give them loans could serve as significant 'bond' and very influential, and their relationships in financial affairs could turn into the relationships between protectors and protectorates.

The scavengers usually start searching used goods in waste disposal bins from about 03:00–04:00 in the morning and ends at 4:00 in the afternoon over certain areas that have been controlled, usually at the crowded settlements, transfer waste sites, residential areas, market, commercial areas, and highways' sides. Based on their locations, they are divided into door-to-door, transfer waste sites, and final waste disposal areas scavengers [6].

Door-to-door scavengers are the most easily found than other types of scavengers. The varieties of goods types that are obtained in door-to-door manner, at houses, stores or markets are greater than the varieties of goods types they obtained by searching from the transfer waste sites. The latter scavengers should compete small collectors (waste traders) who stand by at the transfer waste sites to get their used goods or wastes, because these collectors are usually more able to control any waste who come in already separated conditions thanks to waste transport crews, and have already business relationships with *lapak* or dealers.

Based on interviews with some of the scavengers in Bandung City and Cimahi City [5], they sell their goods to the nearest *lapak* or junkmen in dirty condition without any further treatment. Most of them are cup and bottle packaging plastics, newspapers, blanks, cardboards, cans and glasses. Scavengers' selling prices are determined by the *lapak* based on the estimated selling prices to the dealers. The scavenger's income is ranging from Rp. 15,000–Rp.25,000 (1 US$ = Rp. 9,200) a day, depending on the volume and the types of goods received. In general, they prefer collecting plastic packaging wastes and cardboards than the other items due to their higher prices. Door-to-door scavengers also obtain their items from some houses that have separated their wastes into plastic, papers, cans and other non-perishable items. On the end of the day, they will deliver their collected items directly to their *lapaks* customers under direct payment scheme. Based on dealers' requests, *lapaks* frequently ask one type of item to the scavengers in certain quantities by providing them capital. Generally, the scavengers will try to clear their own ways to became *lapaks* or small collectors after 8 years engagement as scavengers, such as by borrowing capital from *lapaks* to open warehouses and to buy old cart as collecting vehicle operated by 4-5 local scavengers.

5.2. Waste collector crews

Recycling actors who also actively act as recyclable waste collector are waste collector crews. In general, city waste handling among urban areas in Indonesia adopts two groups of waste managers:

- Community self-help; and
- City's waste manager.

The lowest level community unit in Indonesia is single-neighborhood (Rukun Tetangga), i.e., a group consisting of 30–40 households and led by sub-neighborhood leader regularly elected from among their own community members, and voluntarily in nature. About 10–15 neighborhoods will form one multiple-neighborhood. Like sub-neighborhood, the leader of the neighborhood is elected regularly from among their own larger community and voluntarily in nature, officially unpaid from their local government. Several neighborhoods form village leader or lurah. Village leaders are civil servants under their local government and are appointed based on formal and official assignment or decree of their respective district leader (Bupati) or city major. Coordinated by multiple-neighborhood leader through neighborhood leaders, communication between their respective communities with their local government will run in reciprocal ways.

One of single-neighborhood or multiple-neighborhood tasks is associated with daily waste (garbage) collection of their inhabitants that should be handled. Subject to the agreed upon agreements, waste collecting from one household to another can be in form of either single-neighborhood scale, or multiple-neighborhood scale. The general practices are that these communities hire waste transport crews that transport their wastes from one household to another to waste transfer terminal that has been made available by their local government. It is from the waste transfer terminals points that the tasks of local government (cleanliness department) start, by transporting the already collected wastes over these points to waste processors or final disposal sites. These waste collectors crews usually serve as recyclable waste collectors as well, to be sold to intermediates (lapak) under current selling prices. In most cases, mid-to top level income groups will usually give up their used goods to these waste crews. Should they separate their wastes in their respective households; most of them will give up their already separated waste to these waste crews. Therefore, waste collectors in Indonesia get additional income from their waste collecting services, in addition to revenues from recyclable waste sales that generally give higher qualities from recyclable wastes obtain by the scavengers. In compare to junkmen, these wastes collectors have advantage in playing their roles as recyclable wastes collectors. To obtain handcart they need no money, because this vehicle has been made available from their communities they serve and they need not to buy these used goods from their original owners. The only thing that makes them different from waste scavengers are that these waste collectors reside in the area adjacent to the areas of communities they serve, they have clear identities and addresses.

In some Indonesian cities, such as Cimahi (West Java), some communities, sponsored by their city government, build simple recycling centers independently to manage their own wastes. In addition to financing their wastes collectors to collect their community' wastes, they process wet wastes to be transformed into compost. These centers are built at the cities over their surrounding environment, equipped by simple waste processing structures and facilities. Many of these centers are either local government or central government-subsidized centers. The major task of their respective communities are financing and maintaining the continuity of these centers. It is also in these places that their wastes are separated into dry wastes available for sale, wet waste available for processing into compost (biodegradable waste) and rejected wastes are transported to the landfill. Therefore, these waste crews get three types of income sources, i.e, from compost sales revenue, dry recyclable waste sales revenue and their official wages from handling the wastes of their communities. It is this model of waste handling that has been referred to under Law 18/2008 on Waste Management, where any waste handling should be implemented based on 3Rs principles.

5.3. Junkmen (waste traders)

Waste traders are generally found as door-to-door junkmen, who buy varieties of used items. They usually work for *lapaks* who lend them money or cart. Generally, they buy items from each house at a price 10% lower than their selling price to the *lapaks* [7]. In middle to high class residential area, they usually get their items free of charge from the items owners, such as out-of-order irons, blenders, kerosene stoves, shoes and clothes.

Standby junkmen get their items from used goods traders, who come to them directly. They tend to display their goods in fewer quantities than door-to-door junkmen. Based on interviews with standby junkmen in Cimahi [7], that have been displayed their items for 5 years at the location, they revealed that this used goods business is quite profitable, especially when they obtain the items free of charge and saleable as second hand items such as electric vans, irons, water pumps, and woodworking equipments. These standby junkmen start their business with certain capitals by door-to-door searching items. However, after obtaining more and more customers, their finally decide to standby in a fixed sites with the other junkmen (usually at junk markets). Most of them always have aspirations to extend their business to include dealers.

5.4. Intermediates (lapak)

Lapaks businesses are usually equipped with warehouses, with 3-4 workers, and collector/delivery vehicles such as pick-up cars, trucks or carts. The item types vary from cup and bottle packaging plastics, blank/HVS papers, cardboards, newspapers and cans. They obtain these items from scavengers, small gatherers and door-to-door junkmen from their adjacent areas and who serve as their customers based on trust among them.

After receiving items from scavengers, they will collect them in the warehouses that have been partitioned with plastic tarps for each type of item, equipped with several volume plastic drums to store used cans. The usual special treatments to these items before delivering them to the dealers are cleaning the packaging from labels and covers for cup and bottle packaging plastics, milk cans, and glass bottles. In cleaned conditions, their selling prices at dealer level are higher. For milk cans, *lapaks* sell them to the dealers in uncompleted conditions, but by opening these cans with bottle opener to form sheets to boost their selling prices 50% of their completed states. For other items such as papers and cardboards, *lapaks* pack them by sorting according to the types of papers and cardboards, to be subsequently tied in 1 kg size. They deliver their items on 3-6 days intervals. Total quantities of these items are not fixed, depending on the type obtained, usually in $3m^3$ truck volumes for cardboards, papers, plastics and cans. Their destinations are suited with the specifications of dealer that will accept them, such as plastic dealers, glass bottles dealers, iron dealers and metal or cans dealers, or papers and cardboards dealers. Some dealers domicile outside Bandung City, such as Cianjur and Bekasi for cardboards and cans dealers.

The relationship between *lapaks* as sellers and dealers as buyers are specified under contracts or agreement between both parties, specifying the details of related items, terms of cooperation and items quantities. Frequently, dealers grant *lapaks* loans as capitals to search their items, extend their warehouses, vehicle acquisition or other requirements when they are shortages of their inventories. Money loans are usually granted by dealers to their old customers, such as those who have more than 1-2 years business relationships with the former.

Generally, these *lapaks* businesses are the extension of a business started by someone from scavenger or junkman (small waste traders). Based on interviews over several *lapaks* in Bandung and Cimahi cities, these used goods businesses have started since 5-15 years ago without any legal status as a formal company. *Lapaks* usually are integral parts of the owners' houses or abandoned sites or rented lands. These *lapaks* owners wish that one day they can extend their business to include dealer business, so that they can always keep good relationship with any worker who help them searching their items, and dealers who accept their items to maintain "trust" and enhance sustainable cooperation.

5.5. Brokers

Broker in recycle path could be mostly found as the link between small and major dealer, or between dealers and raw materials processing industries. They work independently (individually) through their relatives or friendships networks, families, or listing by the phones to get buyers and sellers lists. They have authorization to determine the qualities of any item to be issued by the seller and to be offered to the buyers or vice versa. They search items based on buyer requests. For instance, they search these items on dealer's level, in form of colour and transparent PET plastic bottles in pressed conditions for pellet processing industries. Their income comes from commission based on the agreed-upon selling or buying prices.

5.6. Dealers (bandar)

The most easily found dealers in Bandung City are cup packaging plastics and glasses dealers. In addition to iron and metal dealers, and papers and cardboards dealers, there are many plastic dealers in Bandung City, because many plastic recycling factories are loc ated at Bandung City. There are some *lapaks* or dealers outside Bandung City, such as Cimahi, Garut, Subang and Tasikmalaya, who deliver their items to Bandung City. The recycled materials or recycled paper and metal processing factories who usually accept items from Bandung City and its vicinities situated at Bekasi City, Jakarta and Tangerang City. The business scopes of these dealers are not necessarily similar. In general, dealers do further processing for used goods up to the preparation stage of converting raw materials into materials, such as crushing, of cup packaging plastics (polypropylene, PP) and pressing of bottle packaging (polyethylene terephtalate, PET) and pressing and/or grinding food and beverage packaging cans. Papers and cardboards are not usually further processed, because after they have been collected and tied, they are delivered directly to the recycled papers processing factories outside Bandung City, i.e., Bandung District and Bekasi City.

Based on interviews with one dealer at Bekasi in 2009 [1] that serves as ex-packaging plastic dealer, and as owner and industrial manager of pellet and product recycling businesses who started his businesses in 2000s, the strength of dealers to survive and grow even during weak economic circumstances lies in having wide networks (inner city, outside the city, or even foreign countries), and the availability of supporting equipments such as press machineries, and/or chopping and pelletizing machineries to meet market needs and to secure the qualities of products available for sale. In general, these packaging plastic dealers will promulgate the minimum volume standards to accept items from their peers (dealers) or from *lapaks* inside or outside their cities. For instance, for PP-transparent and transparent/coloured PET of mineral water cups, they usually promulgate 2 tons/weeks minimum quantities, while there is no minimum quantity sandbars ever determined for used lubricant bottles. Due to the fact that these items are usually by-products of the PET or PP.

Based on information from one dealer, other items such as glass bottles are not the special objects of a dealer, because the prices of glass bottles are the lowest in comparison with other items. These glass bottles are collected by these dealers based on their respective trademark and their respective factories and subsequently bought by their original factories.

A used iron and metal dealer at Jalan Soekarno Hatta (Bandung City), revealed that the process of other irons and metals tend to fluctuate. Special treatment applied to irons before delivering them to the related industries are cutting and sorting by their respective qualities. Irons and others metals such as copper wires are obtained from intermediates and gatherers of irons or smaller dealers. The business that has been started since 8 years ago, tough with no legal incorporation, yields Rp. 5,000,000 (1 US$ = Rp. 9,200) monthly average profit or over 30–50 % of their gross revenues. These irons and metals are delivered to automotive factories in Jakarta based on their respective agreements and good, long term cooperation between the dealer owners and industrial workers who have special authorization to procure them. According to the dealer's owner, irons are the used items that have relatively constant selling prices than other products such as plastics.

5.7 Bandar as Recyclers

In some cases, dealers (bandar) in informal plastic recycling activity in Indonesia act as recycler for plastic material processing which is widely known as pelletizing industry. This bandar serve dual roles, both as dealers and as end users of recycled products, depending on their business scales and the completeness of their own production means (equipments etc) as shown by Padmi et al. (2008), and results of interviews with Baedowy (2009) in the 2009 ERIA Report [1]. It is documented that this pelletizing industry generally needs materials in the form of plastic scraps that should be homogenous by their respective types of packaging. Such PP scraps only or PET scraps only. However, if the industry has grinding machines, it prefers to accept items in pressed form because it will give more guarantee to the qualities of the resulting scraps as export commodities or domestic market special demands. According to Baedowy (2009), if he accepts scraps products from several dealers, then he will frequently find plastic contaminators that will reduce their net weight, such as PVC scraps, PS scraps, iron plates, glasses debris, and aluminium plates within the plastic scraps. If he doesn't resort them through filtering, then the pelletizing machine quality would be impaired, and more rejects occurs, in the form of breakdown of pellet ties. This will cause the entire production processes to be rerun several times and this will ultimately impair the end-products qualities.

In addition, Baedowy also mentioned that the product quality needed to make end product in the form of broom fibers frame are only green, red and blue PET pellet, depending on the broom fibers frames to be produced. To produce plastic balls or children piggybanks, he needs HDPE pellet from used lubricant bottles that he produces as well. Therefore, the most essential thing is that homogenous qualities by the types of packaging plastics originated from his trusted partners plays important role in his successful products and in maintaining his partnerships.

The similar views are expressed by another recycler from production department of one formal enterprise, situated in Cimahi City. This company makes zippers from transparent and collored plastic PET as its materials. It promulgates a criterion that any items it accepts from dealers as its partners should be in forms of PET bottles in pressed forms. The main reason is that its material inventory warehouses has limited areas and that self-processing will guarantee higher qualities of the resulting scraps products, so that it subsequently sort them by their colours, cleaning, chopping and washing through drying.

5.8 Dealers at lumber trading business

The other type of waste/used-goods recycling category is building demolition by-products in lumber trading business. This business is discussed as a separate topic from used item dealers above because it takes different pathway. The interviews with several actors of lumber trading businesses in Bandung City reveal that this business has distinct business scopes, ranging from their sources to their end products.

This type of trading business has been pioneered by lumber business people at Terusan Pasir Koja Street (Bandung) since 10-12 years ago [10]. Based on interview with one of the traders of these goods, items that serve as the objects of their business are used frame lumber from old buildings they obtain through two ways as follows:

- Selling and buying with the owners of old houses/buildings to be demolished in order to obtain lumber from wood frames, roofs, doors and others; and

- Cooperation with construction projects, most of them order wood frames in large quantities, or more widely known as party buyers.

The buying prices of lumbers at the project owner depend on the buildings to be demolished. They will refurnish the collected items by cleaning, repainting and displaying them in front of their stores, to be sold, and not to be delivered unless in job-order cases.

Other lumber businesses collect wood pellet and used frames from lumbers' wastes, to be processed into sofa/chair frames and then deliver them to sofa production factories and other subscribers in Bandung areas. One trading business explained that they have been operating their business since 10 years ago with 5 workers. Low quality and non-reusable lumbers are cut and sold to the tofu factories to be used as firewood. Another lumber businessman explained that he entered cooperation with tofu factories at Cibuntu Street, Bandung City and factories that need firewood, as their consumers. The collected lumbers are cut and converted into firewood.

6. Recycling Efforts and Waste Handling Quality

The problems with waste handling in developing countries like Indonesia are relatively more complex than those problems faced by developed countries. In many cases, non-technical aspects are to be resolved first, such as institutional, financial, and environmental aspects. Also, the local government appreciations in giving their priorities in resolving these issues. The technology used is generally still relatively simple, and in some cases face some barriers in its applications. Therefore, a holistic approach to resolve these issues is urgently required. The impacts of these aspects on the quality of waste services clearly vary, depending, among other thing, on income level and other socio-economic factors of the respective communities.

In Indonesia, waste recycling is an activity highly supported by the entire parties concerned. However, these efforts are not incorporated into actual and integrated activities. Municpal waste recycling activities are performed through community self-help and their local government schemes as mentioned above. The effort that should be performed by the entire parties are how these waste recycling activities in informal sectors could be the integral part of waste handling performed by local government (formal sector) and community's self-help. Simply speaking, the main target of municipal waste handling is how to arrange that any waste generated could be well-handled so that the overall city environment would be clean, and simultaneously any waste generated would not bring negative impacts either to human health or their living environment. Waste generators and their corresponding local governments would be satisfied if these recycling activities could contribute in decreasing their waste problems and at the same time could decrease the cost that should be provided, due to the existence of revenues from recyclable waste sales.

On the other hand, the main target of waste recycling done by people in recycling business activity is how to manage recovered materials to obtain as highest economic value as possible. Waste problems are not their problems. They will be satisfied if they can get as many parts of wastes as possible that have high economic value. They do not care about the remaining non-economic and non-salable part of these wastes. Speaking of wastes handling and waste recycling, we should find the linkage of these two diametrically opposed interests.

The 3Rs efforts in urban waste management are integral part of sustainable waste management concept. The main target of which is to drive community to minimize their waste as possible, and increase the quantities of reusable wastes, safe waste processing and disposal from health and human living environment point of views. On the other hand, recycled goods and wastes trading businesses are basically economic activities, where such factors as prices, product/material qualities, supplies continuity based on their demanded quantities, and the related profit follows current market mechanism. Both interests, i.e. interests in sound waste handling and recycled product business interests, should be well and proportionally bridged so that it would enhance the continuous growth of recycling efforts along with higher qualities of the resulted end-products, and ultimately improve their economic values. It is for these reasons that we need a mechanism that will guarantee the qualities of goods to be traded, through, for example, development of certain quality standards.

7. The Need for Product Standards

The dominant views among Indonesian people, including decision makers, in understanding the 3Rs concept have always been associated with any effort in urban waste management. Either during formal discussions, or in mass media discourses, the 3Rs are always linked with the roles of the community as waste producers, and how this community as wastes producers can participate in these efforts. Other sector that has been discussed in many occasions is the roles of scavengers in the efforts of using the economic values of the wastes. Only in rare cases that these efforts were been associated with sectors of industries and the roles of other informal sectors other than scavengers, such as junkmen, who actually more involved in this field. This is understandable, because we in Indonesia assume that used goods are not wastes at all, and that these goods do not pose any environmental issue.

The path flow mechanism of recyclable wastes and used goods between the seller and the buyer is actually pure market mechanism. These goods are moving from one hand into another due to the very existence of market demands. The sellers supply these goods because their buyers are there. In case of no market demand, then the actual occurrence is that these goods are moving from one hand into another's due to gifts to anyone who needs them (donation). If these needs do not exist, even for free of charge goods, then these goods would end as wastes and will create negative impact to the environment, because their owner thought that these goods are of no uses anymore and should be disposed.

To process the uses of wastes and used goods which ared mostly performed by informal sectors in developing countries like Indonesia, then it should consider at least the following standards and guidance:

- Market demands;
- Workers safety;
- Environmental standard compliance; and
- International trading.

7.1. The product quality should meet market demands

If these goods are flowing as economic goods, then their buyers will certainly have quality requirements on whatever goods they will buy, depending on their buying power. If they buy these goods to be resold to next buyers, then these goods should meet the quality requirements and buying power of their prospective buyers, and so on, so that it might need more general standards, following market standards that will apply on several locations and occasions. Within each of these chains, their resulted profits should be considered, so that it would be normal if the prices of the same goods will increasingly higher. Like market standards all over the world, recyclable waste trading will follow the same mechanisms. Should the seller is only one, then he or she will set the selling price as highest as possible, and it might be that the quality would not be prioritized by the seller. On the contrary, should only one buyer, then he or she will set the buying price as lowest as possible and set the quality as highest as possible. It is this phenomenon that occurs between scavengers and intermediates or between intermediates and dealers and so on.

In Indonesia, there are some products that have their own predetermined qualities, such as compost products from urban waste composting (SNI for compost criteria). But most of these existing standards are general standards in nature, associated with the uses of materials or as alternative source of energy. In this case, then recyclable products are thought to be materials or sources of energy. The ilustration below is the example by two following cases:

a. Fly ash and bottom ash: these products are most frequently generateed from coal burning. Chemically, these materials are silicate rich pozzolan. Therefore, these materials are strongly recommended to be used as building materials, such as concrete. In this case, the uses of this materials in Indonesia will be associated with a variety of standards and regulations to be complied with such as:

    - Fly ash and bottom ash belong to hazardous wastes. The storage, transportation and uses require special permission, while their operators should hold special license. Specifically for the uses of these materials, the recycler should first set study report to the State Ministery of Environment at Jakarta, proving that these products will not harm living environment. The common practice is that special discussions should be presented before a specialists team who will authorize and approve or not approve the recycling plan of these materials. There is no standard applies to the processes, including extraction standards of heavy metal (on waste) contents of these materials. The only existing standards are leaching standards.

    - From building materials point of view, fly ash belongs to any other binder materials such as cement etc., which have specified product quality such as silicate contents, cementing speed, and so on, as specified under this specific SNI, and normally will refer to international standards such as ISO or ASTM and the like.

    - In the view of mixed quality as material building in addition to another materials such as concrete, bricks, paving block and the like, then each of these product performance quality has its own standard, such as SNI for paving block, SNI for brick and SNI for mixed concrete.

    - From the overall performance test of the building performance, there is test standard that should be passed, such as concrete regulation of Indonesia.

b. Alternative fuel: the uses of alternative materials and fuel are one option that should be supported in terms of their uses. One of the industries actively involved in using this opportunity is the cement industry. This industry regulates the quality of materials to be accepted. One of the interesting cases is the use of fly ash and bottom ash from coal. While the actual processes within the blower of power generator to produce these by product were well functioning, then we could be certain that these by products could be used as alternative materials for cement producing. Otherwise, improper quality of by products would be resulted, because they will produce carbon residue containing a specified burning calories. If these burning calories are sufficiently high, then these bottom ashes will have double functions: as additional source of materials and as alternative source of energy. Within certain concentration range, however, the remaining carbon contents would be unwanted residues from cement industry point of view, so that they will reject to use this type of bottom ash.

Based on the above illustrations, it is clear that waste recycling as alternative materials or energy requires proper regulations and standards to enhance their added value. We need cross-sectoral coordination, especially among the parties that hold the responsibilities to regulate the uses and trading of these materials. In Indonesian case, we need not only the role of ministries in charge of wastes, such as the Ministry of Public Work and the State Ministry of Environment, but also the Ministry of Industry or the Ministry of Trade and so on.

7.2. Labor safety in product processing

In the case of recyclable and use goods pathways, efforts should be done to enhance their selling process, through selection, separation or reparation and so on. Activities performed in informal sectors in developing countries are pretreatments such as melting process, generally performed without considering labor safety and their impacts on their living environment. In the case of large industries, they usually guard their company images and accordingly comply with applicable regulations in Indonesia. But in the case of small industries, and most prominently among home industries, most of them belong to informal sectors, usually they have less attention to their labor safety aspects, due to their limitations of capitals and knowledge. It is this issue that should be specially considered by some parties, such the State Ministry of Environment, the Ministry of Human Resources and the Ministry of Health.

7.3 Standards associated with environment compliances

If these goods should have to be disposed off, it will certainly need environmental quality standards, such as emission standards and effluent standards, specifying any goods entering the corresponding environment, so that they will not create negative impacts. In this aspect, the role of MEI would be required. In some cases, however, the application of these regulations requires preparedness and willingness of the entire parties to implement them. It is important that the promotion of law-enforcement must be a priority.

7.4. International goods trading

The regulation of accepted standards on the qualities and performances of a product or goods should be applied in a country, including for recycled materials or products from these recycled materials. For developped countries, depending on their capacities, the experiences and appreciation level of their citizens, these standards will be easy to be set and to be implemented. To protect their consumers, the application of standards on products and goods among developped countries are common practices, not to mention the roles of powerful consumers association's monitoring and the like. This situation give the impetus for eco-labeling concept and similar concepts, that has even greater power in monitoring or judging whether or not a product has been produced from any materials that need processes that will not harm its environment and the human health. Consumers in developed countries have common practices in selecting and buying any product produced from materials, energy and production processes that environmental friendly according to their own standards. On the other hand, producer of similar products applies double-standards, in that they will export the product to meet the quality requirement of the country of destinations, while at the same time the same producers will export the similar product or goods with lower qualities or performances just because the country of destination have not well-regulated standards. In addition to competitive edge that should be prepared by each country in international free trade, it is also associated with the regulation of the traded products or materials.

8. Conclusion

Waste recycling is an activity that highly supported by the entire parties concerned such as the…..in Indonesia. However, these efforts have not been incorporated into actual and integrated activities. Waste recycling in Indonesia is not new activity. The Indonesian community has long been practicing used goods trading. This trading has been the profession by choice or a profitable business among some people generally belongs to informal sectors. These sectors' activities are done openly and not considered as illegal activities in a day-to-day economic activities in Indonesia.

It is clear that waste recycling as alternative materials or energy requires proper regulations and standards to enhance their economic value. To process the uses of wastes and used goods which are mostly performed by informal sectors, it is important to consider the development of standards, at least the standards and guidance related to market demands, workers safety and environmental compliance. The cross-sectoral coordination, especially among the parties that hold the responsibilities to regulate the uses and trading of these materials is also necessary.

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Abbreviations:

ASTM:	American Standard Testing Materials
GR:	Government Regulation
HDPE:	High density polyethylene
HW:	Hazardous waste
ISO:	International Standard Organization
MEI:	State Ministry of Environment of Indonesia
MPW:	Ministry of Public Works of Indonesia
MSW:	Municipal solid waste
NGO:	Non-Govermental Organization
PET:	Polyethylene terephtalate
PP:	Polypropylene
PS:	Polystyrene
PVC:	Poly Vinyl Chloride
SNI:	Standar Nasional Indonesia (Indonesia National Standard)
3Rs:	Reduce, reuse and recycle

Chapter 5

Sound Strategies to Improve the Condition of the Informal Sector in Waste Management

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Institute of Developing Economies

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1. Introduction

Over the past decades the significant role of the informal sector in managing waste especially in urban cities has been mentioned frequently in the literature. Due to limited resources, particularly in most developing countries, the government has usually failed to provide basic services to the community especially, the proper collection and disposal of waste in the city. Oftentimes, only waste from the commercial establishments and the residences of the middle class who are capable of paying for waste services are collected regularly. Thus, piles of garbage from the rest of the city, especially the slums and inner city areas, are left uncollected and are being dumped illegally in already congested and polluted places. Ironically, the urban poor that the government has been trying to remove from the area are the one who have been carrying out many of the duties that the government is supposed to provide, such as the collection and disposal of waste.

Because of extreme poverty and the lack of work opportunities, most of the urban poor in many cities end up in the so-called “informal sector.” This includes workers such as the street sweepers, vendors, messengers, night guards, and waste scavengers, among others. In this paper, I will focus my discussion on the working conditions of the informal sector whose primary source of living is scavenging, buying, and selling of waste. Previously, this sector was seen as a nuisance in pursuing development and that they should be removed from the waste management system because of their incapability or lack of education to manage waste. Their activities were considered illegal and that their operations were harmful to the environment and to the human health.

However, despite this negative notion on this sector they have continued to operate for many decades. Research findings showed that contrary to the previous statements, this group plays a significant role in the reduction of solid waste generated per day and that they are capable to manage waste if only they can be given support to improve their activities. Also, the informal recycling can be a potential source of income especially to poor urban migrants. But it seems that many governments are not giving much attention to improve the living conditions of this sector and to protect them from the hazards and harassment in doing this activity.

This paper consists of six sections. Section two presents the related literatures on the informal sector, the various definitions of formal and informal sector, and some examples of recent policies acknowledging the importance of the informal sector in waste management. The third section outlines the conceptual framework of this study. It describes the current condition of the informal sector, the proposed strategies to improve the condition of this sector and the elements that have to be considered for the effective implementation of these strategies. Section four deals on the discussion of the selected case studies from the Philippines and other Asian developing countries, which shows the positive impacts of recognizing the important role of this sector in waste management and the benefits of providing support to upgrade their recycling operations. The fifth section provides the conclusion, and the last section presents the policy recommendations on how the condition of this sector and their recycling activities can be improved.

1.1. Research Questions

a) Why there is a need to protect the conditions of the informal recyclers, specifically their source of livelihood without putting the public health and the environment at risk?

b) What are the possible approaches to recognize the role of the informal recyclers and to improve their conditions both economically and socially?

1.2. Objectives of the Study

a) To discuss the significant roles of the informal sector in waste management especially in urban cities;

b) To identify possible approaches on how the condition of the informal sector can be improved both economically and socially; and

c) To provide policy recommendations on how to upgrade the condition of the informal recyclers and their material recovery processes.

1.3. Significance of the Study

Based on literature, there are a significant number of informal sector workers in developing countries who are dependent on waste scavenging and waste picking as means of livelihood, so the issue of waste management is also related to poverty reduction. According to the World Bank report, it has estimated that at least 15 million worldwide make a living by recovering materials from waste recycling (Medina, 2009). In the United Nations (UN) Millennium Development Goals, the eradication of extreme poverty and hunger and environmental sustainability are two of the priority goals. In this paper, I will discuss how the upliftment of this informal sector in waste management can contribute in the achievement of these goals. The lessons learned from the experiences of the selected cases can provide inputs in formulating policies to address both poverty and environmental concerns especially on waste management.

2. Review of Related Literature

2.1. Defining Formal and Informal Sectors

In the general context, the International Labour Organization (ILO), based on its employment mission report on Kenya cited the differences between the informal and formal sectors as follows (ILO 1972: 6 as cited in Bromley 1977: 3):

"informal activities are a way of doing things, characterized by –

a) ease of entry;

b) reliance on indigenous resources;

c) family ownership of enterprises;

d) small scale of operation ;

e) labour-intensive and adapted technology

f) unregulated and competitive markets.

Informal-sector activities are largely ignored, rarely supported, often regulated and sometimes actively discouraged by the Government.

The characteristics of formal-sector activities are the obverse of these, namely-

a) difficult entry

b) frequent reliance on overseas resources;

c) corporate ownership

d) large scale of operation;

e) capital- intensive and often imported technology;

f) formally acquired skills, often expatriate; and

g) protected markets (through tariffs, quotas and trade licenses”.

In the waste management context, formal sectors refer to those operating with official business license for managing, handling, and utilizing waste. Their activities are regulated by laws, and often use high cost and advance technologies. On the other hand, informal sectors refer to waste scavengers, waste pickers, small buyers and recyclers of waste, in which activities are characterized as labor intensive, unregulated and uses traditional or low cost technology. Also, Medina (2009) cited that the use of terms for waste pickers, etc. varies depending on the local language, on the place they work, and on the materials they collect. However, it is really difficult to draw clear boundaries between formal and informal sectors as many of those working in waste related jobs are operating in the so-called “grey area.” For example, there are some formal organizations that are operating in an informal ways; or there are some members of the informal sector (waste pickers, etc.) who are formed into an organization and got recognized but still doing informal activities.

In the Philippines, the National Solid Waste Management Commission (NSWMC) characterizes the informal sector in waste management as those individuals, families, groups or small enterprises engaged in the recovery of waste materials with revenue generation as the motivation either on a full time or part-time basis; they work without any formal recognition by any government accreditation, licensing or regulatory agency; they have no social and economic security and work under substandard and unhealthy work conditions, and have limited access to basic services (NSWMC 2009).

2.2. Some of the Early Literatures on Informal Sector and its Activities

Important early contributions to the literature on the informal sector are those of Keith Hart (1971; 1973), Ray Bromley (1977; 1985), Chris Birkbeck (1978), and Ahktar Badshah (1996). Hart's very influential papers (1971; 1973) on urban employment in Ghana divided the economy into an "informal (analogous to traditional) and the formal (analogous to modern) sectors," emphasizing the significance of the informal sector (Bromley 1977: 2). In his paper, Hart describes how the informal activities can act as a buffer against unemployment or as an additional source of income given the inadequacy of the wages from formal employment in the cities especially for the poor migrants (Hart 1973). He analyzes the opportunities of finding supplementary sources of income to address the basic needs of the family or to improve their incomes.

In discussions of the informal sector, street trading is often seen as one of the most typical occupations within the sector. Thus, Bromley uses street trading as a case study to test the nature and significance of informality and to replace it with more exact and meaningful description. Due to their appearance and type of work, urban leaders and the community usually considered street traders as a nuisance in the city, causing problems such as traffic congestion, spreading diseases, and molesting passers-by (Bromley 1977).

Aside from this misjudgment about the street traders, Bromley describes how this group has been "exploited and marginalized" by the existing system. Due to lack of capacity to generate their own capital for trading, they become dependent on their suppliers of merchandise and most often on moneylenders. Their work involves low and unstable levels of remuneration, and frequently they often involved in activities classified as illegal. However, despite their hard work, a majority of workers in the sector remain in poverty, and experience economic and job insecurity, problems with authority, and continued dependence on suppliers of merchandise and capital. Thus, Bromley recommended the provision of cheap credit, technical training, and assistance to improve the conditions of this sector both socially and economically (*Ibid*.).

The role of the informal sector in managing waste especially in urban centers, is also shown in its contribution in reducing the volume of waste generated per day through recycling activities. Garbage picking is the oldest type of recuperative system in Cali, Colombia (Birkbeck 1978). Birkbeck describes the garbage pickers in Cali as a "self-employed proletariat" because they are "little more than casual industrial outworkers, yet with the illusion of being self-employed. They may be in a position to decide when to work and when not to, but the critical factor is control over the prices of the recuperated materials, and that control definitely lies with the industrial consumers. They are self employed yet in reality sell their labour power" (Birkbeck 1978: 1174).

Birkbeck noted that garbage pickers are "not unskilled, unorganized, unproductive or un-enterprising," and that their work not only provides income for this sector but it also gives valuable inputs for the industries (Birkbeck 1978: 1184). He also mentioned how a group of waste pickers organized themselves to work in the garbage dump in such a way that they managed "to defend their right to work" but seemed hesitant to do anything to improve their working conditions (Birkbeck 1978: 1173).

In addition, the type of payment system in garbage picking was based on "piece rates." It passed through various intermediaries in such a way that it created a big difference in the amount paid by the factory for recycled materials, and the amount paid to the waste pickers. Also, since the waste pickers did not control the price, the buyers were able to bully and take advantage of them. Thus, even though the pickers worked hard, they still remained poor. Recognizing the significant contribution of the garbage pickers in managing waste in the city, Birkbeck recommended policies or programs that would stabilize their work, raise their income, enable them to have better access to sources of garbage, negotiate to get better prices for the recycled materials, and improve their productivity through the use of simple machinery (Birkbeck 1978).

The experience of the Zabbaleen, a group of garbage collectors in Cairo, Egypt is a good example of how the lives of workers in this sector were improved through the provision of training and support from the different sectors of the community. The project primarily organized the workers in this sector, provided them with opportunities to turn the collected materials into marketable products, and assisted them in upgrading their living conditions. This experience has demonstrated the importance of developing the existing informal systems and human resources and making them adaptable to the new conditions and challenges instead of discarding the system and investing in expensive technological solutions (Badshah 1996). In addition, contrary to the view in the past that the informal sector is a nuisance or burden on society, this case showed that if only the informal sector workers could be given opportunities they are also capable of solving their own problems and can prove their worth both to society and the protection of the environment.

The findings of the Egyptian study are similar to those of the earlier ILO Kenya report (1972) which showed the important role of this sector in the employment in developing countries (ILO 2002). The group of waste-pickers or waste scavengers helped to save resources by recycling raw materials, reducing the cost of waste disposal by collecting the recyclable wastes, producing cheaper goods from recycled materials, and alleviating poverty through the creation of jobs to the poor (*New Straits Times*, 5 January 1997).

In discussing about the activities performed by the informal sector, another important issue that needs to be addressed is the accompanying negative impact of their operations not only to waste workers themselves but also to the surrounding environment. Most of these workers especially in developing countries are not protected from direct contact and injury. The extent of this problem has become more intense with the increasing volume of hazardous waste that needs special handling and treatment. To cite an example, in the case of electrical and electronic waste, Greenpeace International reported that in all stages in the processing of this type of waste, it has the potential to release substantial quantities of toxic heavy metals and organic compounds to the workplace environment and to surrounding soils and water courses (Brigden et al. 2005). Despite of the hazards posed by this type of waste, many informal recyclers have continued to engage in this activity because of higher profits. Thus, it is also important to study on how to encourage the informal recyclers of hazardous and toxic waste to upgrade their operation in such a way that their activity can be both beneficial to the workers and to the community.

Despite of some problems and challenges involved in the activities of this informal sector, previous studies still show that informal recycling can be a potential source of income especially to poor urban migrants if only they can be properly supported. But it seems that many governments are not giving much attention to improve their living conditions. Even though, there have been various studies of this sector in the past, it seems that the policy regulators have not placed much importance on it until recently, when the problems and hazardous effects of inefficient waste management becomes disturbing and led to the emergence of social pressure from various environmental NGOs and other concerned groups. Increasingly, governments have also realized that solid waste management is a very challenging task, especially in developing countries where there are scarce technical and financial resources.

2.3. Examples of Recent Initiatives/Policies that Recognized the Need to Improve the Condition of the Informal Sector in Waste Management in Some Countries

Recently, some countries have started to recognize the significant roles of the informal sector in waste management. They have initiated some programs that specifically included this sector in their waste management policy and have provided some interventions on how to improve their conditions. To give some examples, in the Philippines the NSWMC and the Solid Waste Management Association of the Philippines (SWAPP) in collaboration with other international organizations has just recently formulated the "National Framework Plan for the Informal Sector in Solid Waste

Management." It envisages the informal waste sector as an empowered and recognized partner of the public and private institutions, organizations and corporations in the promotion and implementation of the 3Rs (reduce, reuse, recycle) in the country with the end view of alleviating poverty. In doing so, it hopes to integrate this sector in the solid waste management system by "providing them with a favorable policy environment, skills development and access to a secured livelihood, employment and social services" (NSWMC 2009: 34).

To cite another example, the National Environmental Policy 2006 in India also cited to "give legal recognition to and strengthen the informal sector systems of collection and recycling of various materials. In particular enhance their access to institutional finance and relevant technologies (Section 5.2.8.iii.e).

Although many countries do not have a policy yet as of this time for the informal sector in waste management, but most of them have started to recognize the significance of this sector and are on the process/ planning stage of policy formulation.

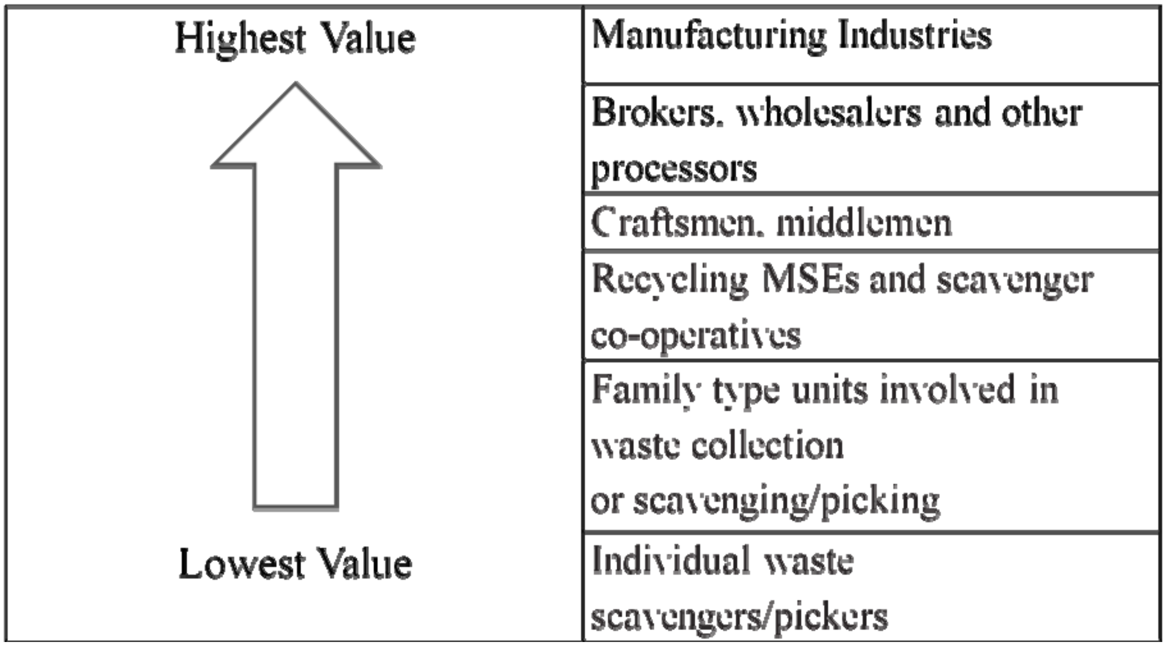
3. Conceptual Framework

3.1. Scenario Building: The Current Condition of the Informal Sector

For the past decades, many literatures have mentioned the significant roles of the informal sector in waste management. However, their condition remains unchanged and or even gets worse. They continue to operate in an unstable condition wherein their income is dependent on the prices of recyclables and their activities are often repressed by government regulations. With the economic crisis that hit the world, this sector is also greatly affected as the prices of recyclables has been reduced to 50% and thus their income too. In addition, as their activities are often considered illegal, they are prone to harassment by authorities, middlemen, and even the community. Despite of their significant contribution in the reduction of solid waste especially in the urban city, they are not often recognized as their “technology” is considered backward and that they are incapable to do the job due to their lack of education and technical skills. They are even considered as nuisance to development and that their operation has hazardous effects both to the environment and to the human health. Due to extreme poverty and lack of other available options for them, they continue to engage in this kind of job despite of their unsafe working environment.

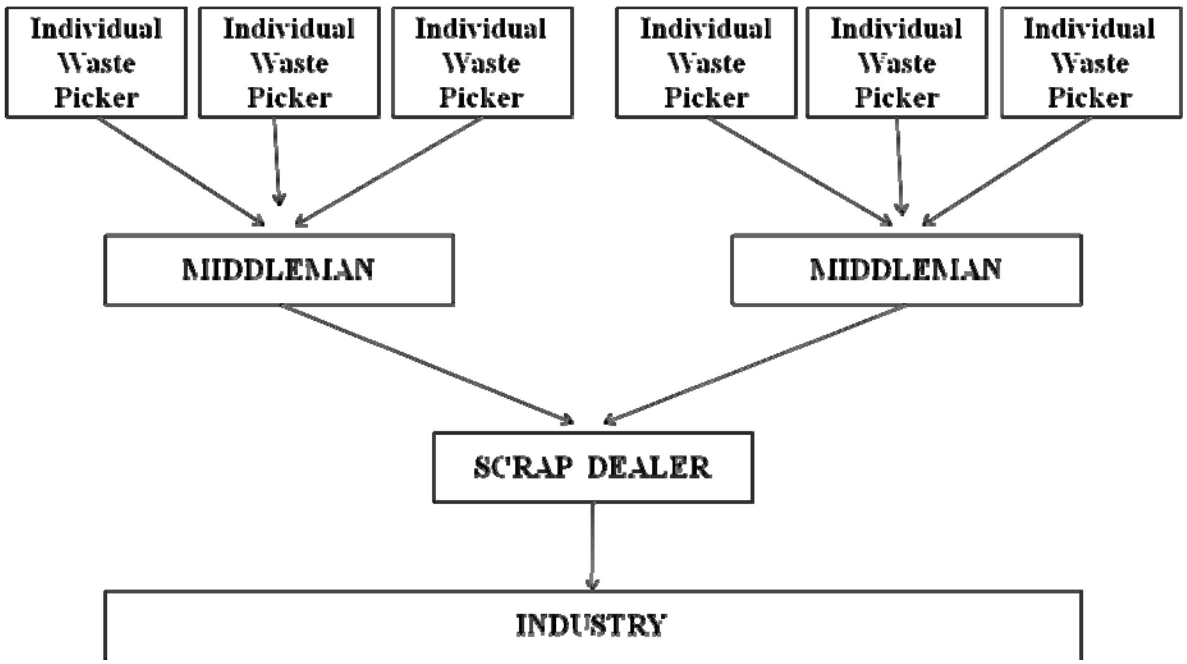
As shown in Figure 1, the less organize the informal sector the lower their capability to process the recyclable waste and the weaker their trading power too. Since most industries demand large volume of processed materials, they usually do transactions with middlemen and not directly from individual waste pickers (Figure 2). This condition makes the middlemen to earn much profits while waste pickers remains in poverty (Medina 2009). Figure 3 illustrates the typical power relations in waste scavenging in developing countries and the negative impacts of this condition to waste scavengers (*Ibid*). Thus, organizing the informal recyclers and providing them trainings can be an effective way to improve their ability to increase the value of their collected materials (Haan *et al*., 1998 as cited in Wilson *et al*., 2006).

Figure 1. Hierarchy of Informal Sector Recycling



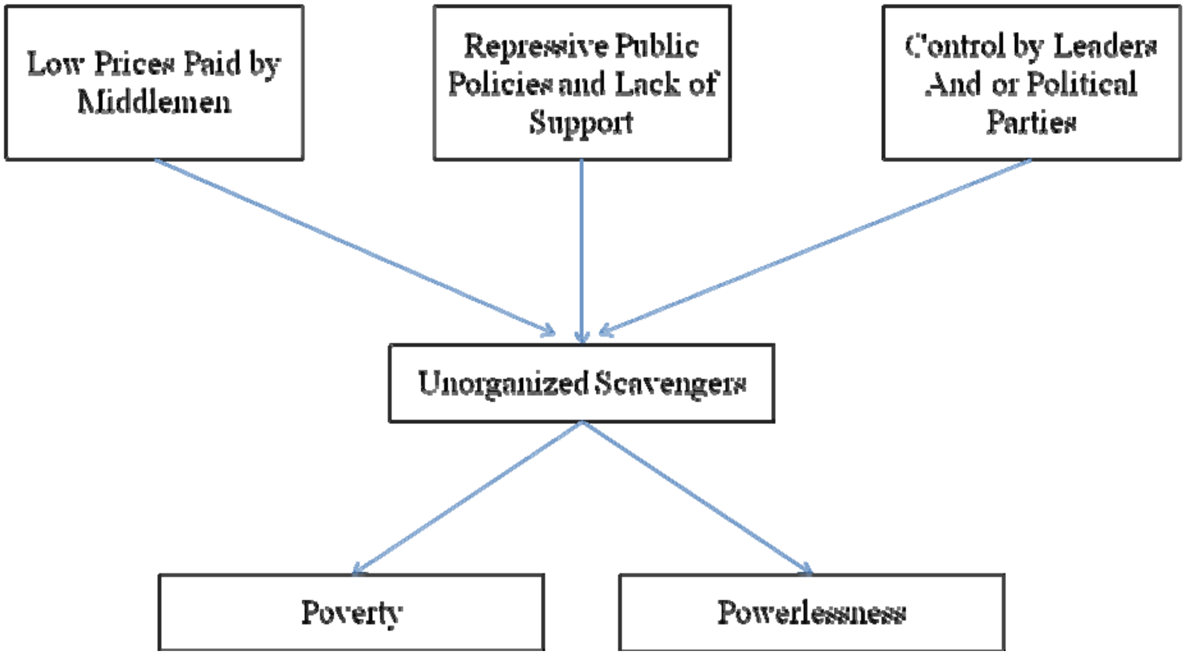
Source: Wilson, D.C., C. Velis, and C. Cheeseman. 2006. "The Role of informal sector recycling in waste management in developing countries," Habitat International, 30 (2006): 797-808.

Figure 2. Typical Supply chain for Recyclable Materials



Source: Medina, 2009. "Global Chains in Chinese and Indian Industrialization: Impact on Waste Scavenging in Developing Countries."

Figure 3. Typical Power Relations in Scavenging in Developing Countries



Source: Medina, 2009. "Global Chains in Chinese and Indian Industrialization: Impact on Waste Scavenging in Developing Countries."

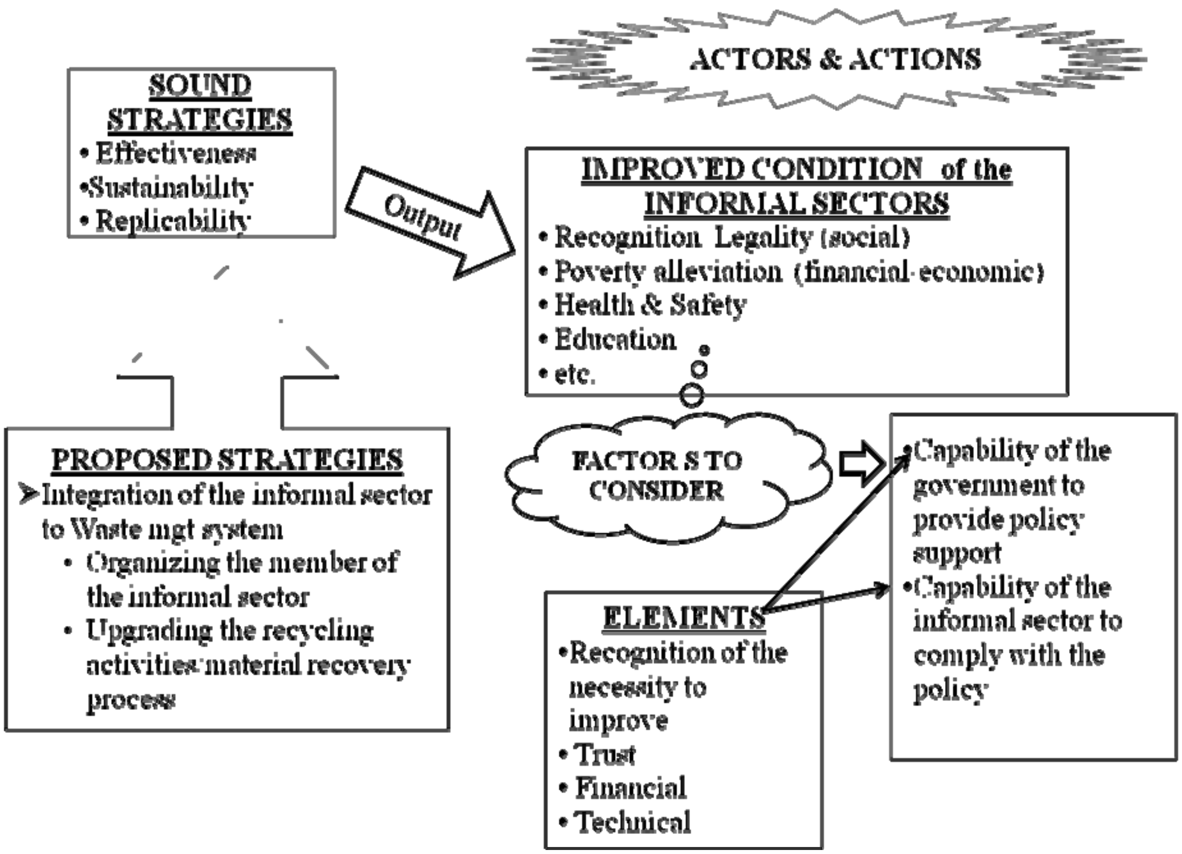
3.2. Proposed Strategies to Improve the Condition of the Informal Sector in Waste Management

This study shows how an economic base for waste disposal can be created through the development of micro-enterprises among waste disposal workers. Through turning these workers into stakeholders in the waste disposal process, not only can their incomes and standard of living be increased, but the waste disposal process can be made more sanitary and efficient. This win-win situation can become a model for other communities in the Philippines and other countries with similar economic and social conditions. The experience of the Zabbaleen in Cairo is one of the best examples of how the project was able to balance its concern for the environment with its concern for income generation and enterprise development (Badshah 1996).

As mentioned in the previous section, another important issue that has to be dealt with is the increasing number of informal recyclers of hazardous and toxic waste especially in this era of urbanization and modernization. Even with the implementation of various policies such as the Basel Convention and other regulations to control the handling and trading of hazardous waste, many informal recyclers have continued to operate in illegal ways and unsafe manners. The lack of awareness about the hazards of their activities and of the existing regulations, and the absence of or limited support from the government in both technical and financial aspects are some of the common reasons why many of these recyclers have remained in the informal sector. Also, the high economic potential from this activity has motivated these informal recyclers to engage in this work despite of the hazards in dealing with this type of waste. This condition poses a great challenge to the government on how to encourage this sector to shift from informal to formal recycling and or to upgrade their material recovery processes.

Given the above-mentioned condition of the informal sector and the pressing problems on waste, I will discuss some of the possible strategies on how the condition of this sector can be improved and at the same time address the waste management problems especially in the urban cities. Using the case study approach, I will also present the benefits for applying these strategies (Figure 4).

Figure 4. Sound Strategies to Improve the Condition of the Informal Sector



3.3. Factors/ Elements for the Effective Implementation of the Proposed Strategies

For the effective implementation of these strategies, there are some important factors that have to be considered (Figure 4). These include the following: the capability and willingness of the government to provide policy support to encourage and enable the informal sector to be organized and to formalize their activities; and the capability and the willingness of the informal sector to comply with the policy or regulations. In the first factor, the decision of the government is important while in the latter one, the decision of the informal sector is important.

In addition, there are other elements that contribute for the decision of these major actors, the government and the informal sector to improve the condition of the latter and its activities. First of all, both parties have to recognize the necessity or the benefits of upgrading the recycling operations of the informal sector in waste management. Also, the element of trust is also very important. Aside from the recognition of the significant role of the informal sector, the government has to believe that this sector has a great potential to manage the waste in the cities more effectively and efficiently only if they would be given support both in financial and technical aspects. On the other hand, the informal sector has also need to trust the government that upgrading their operations can really be beneficial to them by providing legal recognition and access to other benefits such as training, financial support, health services, among others. But these pre-conditions seem to be very difficult or nearly impossible to happen if these expectations are to be done only by these two actors. Both of them have their own limitations, thus their willingness is not the only consideration but also their capability to provide or to comply with the policy for proper or improved recycling. Thus, the participation and or collaboration with other stakeholders such as the NGOs, business sector, and other public and private organizations are deemed necessary.

3.4. Attributes of Sound Strategies for an Improved Condition of the Informal Sector

The soundness of the above mentioned proposed strategies can be assessed by using the following parameters:

- Effectiveness. This refers to the positive impacts of these strategies both to the informal sector, to the municipality and to the environment. This is manifested through improved and safe working condition of the informal sector, social recognition and poverty alleviation, effective waste collection and recycling, monetary savings for waste collection and disposal, cleaner environment, and others.
- Sustainability. This refers to the benefits of applying these strategies to address not only the present condition of this sector but also its potentials to meet the needs of this sector in the long run. This includes profitability, political and administrative support of the government, social acceptability, and others.
- Replicability. This refers to the characteristics of these strategies that can easily be replicated or adapted in other areas or regions experiencing similar conditions. As Badshah (1996) has noted, "In these times of severe resource constraints, citizens need to discover new ways to learn from each other's successes and to multiply the impact of policies, programmes and projects that work. It is through cross-cultural learning, replication and adaptation that effective urban practices can have a significant and sustainable impact on our cities" (Badshah 1996: 16).

4. Discussion of Selected Cases

As discussed in the earlier sections of this paper, the informal sector contributes a lot in the reduction of waste especially in the cities. This activity also contributes to the reduction of the waste management cost such as the collection fees, extends the lifespan of landfill, among others. Also, informal recycling is a source of livelihood to many especially poor urban migrants. However, until this time this sector remains unchanged and has continued to live in poverty. Also, some of the recent regulations in waste management have caused a negative impact to the condition of the informal sector and its activities.

To cite an example in the Philippines, the most recent and considered to be the most comprehensive law in solid waste management, the "Ecological Solid Waste Management Act of 2000", also known as the Republic Act 9003 (RA 9003) was enacted in January 26, 2001. This law mandates all, and specifically the local government units (LGUs) "to adopt a systematic, comprehensive and ecological solid waste management program." Two of the important regulations cited here that affects the informal sector are the mandated "closure of dumpsites" and the "segregation at source." Section 37 prohibits the establishment and operation of new open dumpsites upon the implementation of the act. It also mandates the closure of all open dumpsites and their conversion instead into sanitary landfills as a final disposal site. Section 27 states that the collection, segregation and recycling of biodegradable, recyclable, compostable and reusable wastes is the responsibility of the barangays[1]. On the other hand, the collection of residual and special wastes is the responsibility of the municipalities and cities, except in Metro Manila where disposal is within the mandate of the Metro Manila Development Authority (MMDA).

Although, this policy of the state aims to protect the public health and the environment, this has also caused a negative impact to the lives of the informal sector who are depending their livelihood in scavenging and selling waste. For example: In Payatas,

[1] Barangay is a smallest political unit in the Philippines.

Quezon City, before an individual scavenger could earn about ₱200.00-₱300.00[2] per day, but after the implementation of waste segregation at source they can only earn about ₱150.00 per day (*Personal Interview with Luis Sabatera, 25 August 2009*). This means that although this regulation may solve the environmental problem, but it may also creates another problem which is increasing poverty especially in the cities. This paper does not indicate that the mandated closure of dumpsites and the waste segregation at source should not be done. I agree that these initiatives are proper and necessary; however the government should not also ignore welfare of the significant number of informal sector depending in waste picking and scavenging for livelihood.

This situation is just one of those possible scenarios that call for the need to protect this sector and to recognize their contribution in managing waste especially in urban cities. Thus, the question is, "how to protect this informal sector especially their source of livelihood without putting the public health and the environment at risk?" This paper recommends to integrate (instead of removing) this sector in the waste management system and to improve their condition by: a) Organizing the members of the informal sector into an organization and or cooperative; and b) Upgrading the recycling activities/ material recovery processes.

In the succeeding pages, I will discuss the experiences of the selected case studies showing the benefits of integrating this sector in the waste management system. For the formation of the informal sector into an organization or cooperation, the cases will be from the selected cities in the Philippines: the experiences of the KILUS Foundation

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[2] ±₱50.00=1$.

Environmental Multi-purpose Cooperative in Barangay Ugong, Pasig City of Philippines; the Los Baños Solid Waste Organization (LB-SWO) of Los Baños, Laguna; the Payatas Alliance Recycling Exchange (PARE) Multi-purpose Cooperative and the “Linis Ganda” (Clean is Beautiful) Multi-purpose Cooperative of Quezon City. For the upgrading of the recycling activities or the material recovery processes, I will use the following cases: the Multi-Hanna Kreasindo of Indonesia; and the TexCycle of Malaysia.

4.1. Forming the Informal Sector into an Organization or Cooperative: The Philippine Experience

4.1.1. The KILUS Foundation Environmental Multi-purpose Cooperative, Barangay Ugong, Pasig City, Philippines

The first case that I am going to discuss is the experience of the KILUS Foundation Multi-purpose Cooperative of Barangay Ugong in Pasig City. Although the members of this cooperative are not formerly in the informal waste sector, I decided to include this case because their experience has provided a good example on the potentials of waste as a resource for alternative livelihood and the benefits of formalizing the waste recycling activities. This cooperative composed of women members was registered in the Cooperative Development Authority (CDA) in 2001 (KILUS 2009). Previously, most of these women belong to the jobless sector of the community, thus days passed for them without accomplishing anything.

In continuous search for livelihood, the then Barangay Chairman Alejandro Santiago initiated the development of various products from doy packs. Doypacks bags used for artificial juices are made of triple laminated cello foil. It is non-biodegradable and it is not bought in junkshops for recycling, thus it commonly ends up in dumpsites or sanitary landfills (APFED 2009). With doy packs and colored magazines as raw materials, the workers of the Cooperative turned them into fashionable products such as bags, shoes, office and school supplies, necklaces and other accessories. There are 7 Departments/Sections: Production, Slashing, Sewing, Beads, Sorting, Box-making, and Quality Control (Classic and Weaving).

As a beneficiary of the Philippines' Technical Education and Skills Development Authority (TESDA), KILUS can borrow tools and equipment from this organization. Also, with the loan granted by Mayor Eusebio's Cooperative Assistance Project and other financial loan from Senator Biazon, they were able to purchase additional high speed sewing machines to improve their operations (KILUS 2009). At present KILUS provides livelihood for more than 200 families. For in-house worker, the average salary is ₱2,000.00 per week (₱250– ₱300 per day); for those working at home, the income ranges between ₱3,000.00– ₱5,000.00 per week because other members of the family also help so they can produce more. They are also doing outreach livelihood program to neighboring barangays in Pasig. Their participation to some international trade shows has also helped them to have network with foreign markets. Most of their products are exported in about 17 countries: London, US, Japan, Australia, Belgium, Italy, Switzerland, etc. (*Personal Interview with Gina Santos, 26 August 2009*).

4.1.2. The Los Baños Solid Waste Organization (LB-SWO), Los Baños, Laguna

Just like in other communities, the members of the informal waste sector in Los Baños, Laguna was previously not recognized and they were operating in unsystematic and unsafe working condition. But in 2004, through the initiative of the Philippine Society for the Study of Nature, Inc. (PSSN) and with the implementation of its project funded by the Philippine-Australia Community Assistance Program (PACAP), the members of this sector was formed into a people's organization and their significance to the community has been recognized. This activity was in collaboration with the School of Environmental Science and Management- University of the Philippines Los Baños (SESAM–UPLB) and the Local Government of Los Baños.

The membership was open to every official resident of Los Baños whose main source of livelihood is waste picking, scavenging and buying of waste. After the necessary processes and criteria for selection, 54 beneficiaries became official members of the Los Baños Solid Waste Organization (LB-SWO). They were given an official ID signed by Mayor Perez and the LB-SWO president, and they were formally introduced to the different sectors of the municipality as the official waste collectors. By integrating the work of this sector in the solid waste management system, they are not negatively affected by the implementation of the waste segregation at source. With the recognition given to them, they have become official collectors of recyclable waste from households and establishments, and they can also operate in new areas to which they could not go before (Atienza 2009). The project also gave seed money amounting to ₱60,000.00, official uniforms, and pedicabs to the members of the LB-SWO. Members were given the right to borrow up to ₱1,000.00 from the seed money as starting capital for trading in wastes (PSSN 2005).

Through this activity, they were able to increase their income, their significant contribution was acknowledged by the community and they are now active partners of the local government in the implementation of the solid waste management programs in the municipality.

4.1.3. The Payatas Alliance Recycling Exchange (PARE) Multi-purpose Cooperative, Quezon City

After the Payatas dumpsite collapsed in July 10, 2000, that killed about 300 people mostly scavengers, the dumpsite was ordered to be closed by the National Government. But the waste scavengers conducted rallies to re-open the dumpsite. To address this concern, the alternative approach was to convert it as a Controlled Disposal Facility (CDF). Since November 2000, the Payatas Operations Group (POG) has implemented various measures and systems to improve the operations in CDF. About 2000 scavengers were organized into 13 associations and assigned them to designated dumping areas. They are given 20-30 minutes to pick through the garbage, thus only residual waste are being dumped at the facility (Jaymalin 2008).

However, with the implementation of the waste segregation at source, the volume of waste disposed to the dumpsite also decreased. This has also caused reduction in the daily income of scavenger from about ₱300.00 to about ₱150.00 (*Personal Interview with Luis Sabatera, 25 August 2009*). Given this condition, POG facilitates the development of networks to enable this sector to earn additional income and venture in alternative livelihood. Through the collaborative efforts of the government and NGOs, the Payatas

Alliance Recycling Exchange (PARE) Multi-purpose Cooperative was duly registered with CDA, through which scavengers can collectively obtain available assistance, whether financial or skills training, and other livelihood opportunities (Jaymalin 2008).

4.1.4. The "Linis Ganda" (Clean is Beautiful) Multi-purpose Cooperative Inc., Quezon City

The Metro Manila Linis Ganda Multi-purpose Cooperatives Inc. is an organized cooperative of junkshop dealers which aims to enhance recycling activities of junkshops and itinerant waste buyers (SWAPP 2006). As of now, there about 100 member junkshops (out of about 1,000 junkshops) in Quezon City and about 2,000 member junkshops in the whole National Capital Region (NCR), and each has their own eco-aides. Every morning, eco-aides are given capital for buying waste by junkshop owners. But they have to sell their waste to that junkshops and whatever profit they can earn from it in a day will be their income. (*Personal Interview with Michelle Cao, 28 August 2009*). Some of the benefits of being a member of the cooperative are the following: access to loan to be used as capital, avail of emergency loan with interest, and opportunity to participate in trainings for operating junkshops such as accounting and recording, entrepreneurship, etc. (SWAPP 2006). Through this activity, Linis Ganda also contributes to divert waste from the waste stream. Based on the data submitted by 50 active members in Quezon City, Linis Ganda is able to divert 2,779.85 tons of waste from January to June 2009.

4.1.5. Analysis: Benefits of Forming the Informal Sector into Organizations and or Cooperatives

- To Informal Recyclers

By forming the members of the informal sector into an organization and or cooperative, their activities have become more systematic, safer and more efficient and therefore have resulted to higher income. In addition, since they are now recognized workers in waste management they are protected from harassment and abuse from authority and other members of the community. With the recognition bestowed unto them, they can also access technical and financial support from the government and other organizations to enhance their skills and capabilities to improve their condition. Other social benefits include improved self-esteem and exposure to other opportunities and networks for a more sustainable livelihood.

- To the Municipality

With a more efficient and systematic waste collection and recycling performed by the members of the informal sector, the Municipality can also reduce its waste management cost by lesser collection trips and therefore more savings. The increase volume of waste diverted for disposal can also lengthen the lifespan of landfills. Since the members of the informal sector are now organized it is easier for the municipality to manage them. Also, they can also be partners in addressing waste management problem especially in urban cities.

- To the Environment

Unlike before when the activities of this sector had caused pollution to the working environment and nearby community, their operations are now systematic and conducted in a safe manner. Their effective handling and recycling of waste has also contributed for having a more beautiful and healthy environment.

4.2. Upgrading the Recycling Activities/ Material Recovery Processes: Selected Cases from Asian Developing Countries

The first four cases discussed above exemplify the potentials of waste as a resource and as an alternative source of livelihood if only the members of the informal sector engaged in this kind of work can be organized and be given support to upgrade their operations. For the non-hazardous waste, it is quite simpler or easier to manage. But for the toxic or hazardous waste, the handling and operation requires special skills and needs more capital intensive technologies. The next two cases are example of companies which formerly belong to the informal sector but have decided to shift to become a formal organization. The common question is, "*How to encourage informal recyclers to shift from informal to formal recycling, and or to upgrade their recycling operations?*" To answer this question, I will try to provide some analysis based on their experiences. With actual observation of their operations and conduct of open-ended interviews with some key informants, I looked on the *contributing factors* that affect their decisions to get formalized; and the *actors* involved and the *actions* done that motivated them to formalize or improve their recycling activities. Before I discuss the results of my findings, I would like to provide a brief background about these companies and their operations.

4.2.1. Multi Hanna Kreasindo, Indonesia

The Multi Hanna Kreasindo, Indonesia is engaged in waste management utilization since June 1997 (PT Multi Madya Niaga Miratama). The institution was formal but they were doing "informal activities." When the Indonesian government regulation came in 2000, they have shifted to formalize or upgrade their operation. On Sept 2004, the PT Multi Hanna Kreasindo was established; in 2006 it has completed environmental assessment; and in Sept 2007 it has obtained permission to utilize waste.

Its main activities includes collection, transportation and utilization of waste, reuse/recovery/recycle contaminated metal, reuse contaminated oil, thinner, solvent and dirty oil as substitute of alternative fuel. The certification by the International Standards Organization (ISO) is still on process.

4.2.2. Texcycle, Malaysia

The TexCycle in Malaysia started its operation in 1984, but it was only a small shop lot in Klang. They collected contaminated rag, gloves and wipes from 5 printing industries. In 1987, it started business with Singapore however in 1992, it encountered problems at Customs Malaysia about the legalities of their operation. With their desire to continue their operation, they communicated with the Department of Environment (DOE) on how they could legalize their activities and improvised their system. From 1992- 1997, they had conducted continuous Research and Development (R&D) activities to upgrade their system.

At present, the company has 1700 customers nationwide. It specializes in recycling and recovering scheduled waste (decontaminating rags, wipes and gloves for reuse). They are also doing "triple rinse system" container decontamination system; waste water treatment; developed new reusable products such as absorbent booms, pillows and wiper clothes. It has licensed collectors/transporters and uses GPS tracking system to monitor location and status of activity to assure their customers and the surrounding community about the safety of their operations.

In 2003, it has obtained ISO 14001 certification by SIRIM Malaysia and successfully implemented 90% of recovered waste from their operation for reuse in their process. They have received numerous awards and recognition such as the Selangor Environmental Award in 2004; listed in the Kuala Lumpur stock exchange, and was awarded the Special Prime Minister's Hibiscus Award for SME and Notable Achievement for overall in 2005; and received the Silver Award by The Canadian Business Council for Professional Services in 2006.

4.2.3. Analysis: Shifting from Informal to Formal Recycling

- Informal and Formal Sector Definition

In terms of definitions, both companies considered themselves as "informal" before because they were doing their recycling operations in a purely business manner and without careful consideration to the negative impacts of these activities to the environment and human health. Now, they considered themselves as "formal" because their activities are more controlled and regulated, and they are using improved and safe recycling technologies.

- Motivating factors

The strict enforcement of the law on waste management and proper recycling is one of the primary reasons why they have decided to formalize and or improved their operations. They have been doing the recycling business for many years but it is only recently that they have become aware of the existing regulations on waste management and the hazardous impacts of improper waste recycling. The potentials for higher profits of this type of business and the aspiration for a more sustainable operation have also motivated them to improve their recycling activities. They have realized that having a legal recognition is one of the important factors to move forward and or to compete in the business in a more sustainable manner.

- Struggles encountered

Based on their experience, getting formalized was not that easy. They had to go through tedious process in complying with the licensing requirements. Also, aside from the lack of financial and technical support from the government, they still had to convince or lobbied to the government about the possibility and safety of their operations before they could obtained the license. In addition, even now that they are considered legal recyclers of waste they still experience competition with informal recyclers.

- Advantages and Disadvantages

With regards to the advantages and disadvantages, I would like to cite first the disadvantages. The two main disadvantages or difficulties that these companies encountered for getting formalized are the need for high capital investment and at the same time the competition with the informal sectors. Since they have invested a big amount of money for recycling facilities and for other operating expenses, their buying price for recyclables are usually lower than those in the informal sectors. However, they have been able to overcome these difficulties because of their legal recognition which enable them to operate in a broader scope in terms of activities and customers. Also, since they have been operating in an improved and safe manner, they have been able to win the trust and confidence of the customers especially of the big companies. Thus, in the long run they can have more sustainable and higher profits. In addition, their legal recognition also protects them from harassment by authorities and from the pressures by the members of the community.

- Factors for Success

The success of these companies can be attributed to the following factors: legal recognition or acceptance by the government and members of the community; safe handling of waste or improved recycling operations and therefore avoid or lessen pollution to the surrounding environment; and conduct of continuous R&D activities for improved and sustainable operation.

- Benefits

Although shifting from informal to formal recycling or improved operations required tedious process and high investment, it is more beneficial in the long run in terms of safety of its workers, reduction of hazards to the environment, more effective recovery of resources, and higher profits.

4.3. Attributes of Sound Strategies for an Improved Condition of the Informal Sector

Using the experiences of the cases presented, I will discuss the soundness of the proposed strategies based on the following attributes:

- Effectiveness

In terms of effectiveness, the cases show that these strategies are effective as manifested in its economic, environmental, and social benefits both to the members of the informal sector and to the community (as discussed in IV-1-5; and IV-2-5).

o Sustainability

The cases show that if only this sector can be given adequate support in both technical and financial aspects and due recognition, their recycling activities can be a sustainable source of livelihood for this sector.

o Replicability

Although these approaches seem difficult, the cases show that it is possible if only there is a strong participation and collaboration among the different stakeholders such as the government, business, NGOs, and other public and private organization. Since most developing countries are experiencing similar conditions, these strategies can also be shared and replicated in their municipalities.

5. Conclusion

Based on the experiences of the cases discussed, this study shows the positive contributions of forming this sector into organizations and or cooperatives not only on the condition of the informal sector but also to the municipality and to the environment as well. Thus, instead of trying to remove their activities from the solid waste management stream, the local government and other concerned groups should create livelihood opportunities to improve their conditions through provision of trainings and financial support, to protect them from health hazards while dealing with waste, and to protect them from further exploitation and abuse.

Although encouraging the informal sector to shift from informal to formal recycling is really a big challenge both for the government and for the informal sectors, but as shown in the cases discussed, there is a possibility despite of some difficulties along the way. The strict enforcement of the law and the awareness of both the negative impacts of improper recycling and the benefits of improved recycling play a very important role in deciding to shift from informal to formal recycling, and or to improve their operations.

Also, these cases show that waste recycling has a big potential livelihood opportunities and environmental benefits if only the processes could be properly regulated and conducted in a safe manner. Thus, policy support of the government and the collaboration with other stakeholders (training and financial/ funding institutions, business sectors, research institutions, etc.) should be strengthened.

6. Policy Recommendations

- *Policy support to integrate the informal recyclers in the solid waste management team*

Since this sector depend on waste for their livelihood, trying to remove it from them without providing alternative source of livelihood will only cause increased poverty and will also force them to engage in illegal operations. Thus, instead of removing this sector from the waste management system, the cases show that it is more beneficial if they can be given support and recognition. Also, since they have the first hand experience in handling waste they can also be effective partners in managing waste in the cities.

- *Formation of the informal sector into organizations and or cooperatives*

As an organized group, they are easier to manage compared than dealing with them individually. The cases show that forming this sector into organizations makes their activities more systematic and efficient. In addition, as a group they can increase their "buying power" and can easily access other privileges such as trainings and financial support.

- *Provision of financial and technical support (linking them to financial and training institutions, financial incentives/ tax reduction, etc.)*

Since the members of this sector belong to the most marginalized sector of the community, most often they are incapable of supplying their own capital for buying waste. They have ended up in debt to businessmen or middlemen and have had to sell their waste to them at much lower prices. As a consequence, even though they do all the "dirty work," they remain poor while the middlemen become increasingly rich. Therefore, the government should do something to protect this sector from further exploitation and abuse by middlemen, through the provision of cheap credit and other technical assistance to support their operations.

With regards to handling hazardous and toxic waste that requires special skills and high investment to purchase advance technologies, the government should provide policy support such as tax reduction and other financial support to encourage informal recyclers to get formalized and upgrade their operations

- *Continuous protection of the informal recyclers from health hazards*

Since these workers are often exposed to infection from vectors and bacteria, they should be given health protection while dealing with waste through provision of masks and gloves, regular health check-ups, and access to medical support.

- *Policy support for education and other skills capability development activities*

To help this sector to really improve their living condition, they should also be given support to develop or explore their other skills through provision of trainings. In addition, the children involved in this activity should be protected and should be given support for their education.

- *Strict Law Enforcement*

One of the important for the policies to be implemented well is for the policy implementers to act consistently with what is written in the law. It is said that it is easy to formulate good policies but it is difficult to put them into practice. Sad to say, many of the lawmakers in most developing countries are also the lawbreakers. As shown in the cases, most members of the informal sector have decided to belong in an organization or cooperative, and or to upgrade their operations because of the strict implementation of waste management regulations in their countries.

- *Strong Information, Education, and Communication (IEC) Campaigns*

The conduct of information and education campaigns not only brings awareness but it also empowered the members of the community. This campaigns should not only deals on the negative impacts of improper waste recycling but also the benefits and potentials of recycling industries for alleviating poverty and for protecting the environment. Various means of promoting information should also be utilized such as television, radio, and newspaper, among others.

- *Continuous R&D on waste recycling technologies*

As shown in the cases, the conduct of various R&D activities is vital for an improved and sustained operation of the recycling industries.

- *Promotion of recycled products (creating a demand or market for recycled goods)*

The people's preconception that recycled goods comes from waste and their preference for branded goods hinders for the successful marketing of these products. Thus, the government should provide policy support to promote and create market for these products through information campaigns and provision of trainings to enable recyclers to make their goods competitive with other products.

- *Participation of the different stakeholders in the national, regional and international conferences, seminars, and other waste management related activities*

The participation of the different stakeholders such as the policy regulators, businesses, and other relevant stakeholders in various waste management related activities is very important to promote sharing or exchange of information, for capacity development and establish networks. This also helps to avoid repeating mistakes done by others in the past. In addition, participation in these activities can make the different stakeholders to keep abreast with the recent technologies and developments in the recycling industries.

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CHAPTER 6

INDUSTRIAL STANDARDS AND ROLES OF STAKEHOLDERS IN 3R IMPLEMENTATION IN VIETNAM

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1. Introduction

Socio-economic achievements in the past decades have caused environmental problems especially in most developing countries like Vietnam, including waste management. Improvement of living standards and the rapid urbanization have resulted in the increase of domestic wastes that consist of hazardous wastes such as electronic wastes. In addition, the economic growth has also led to the rise of industrial, agricultural, constructional and medical wastes. To deal with this problem, the 3R policy (Reduce, Reuse and Recycle) has been applied in many countries all over the world, in order to reduce pollution and the negative impacts on the environment. It also helps to enhance economic development through increasing efficiency in the use of natural resources, decreasing the amount of solid wastes to be landfilled and disposed, creating more jobs and improving income. In this report, the roles of stakeholders related to waste management are studied and analyzed. This paper recommends the application of the Extended Producer Responsibility (EPR) as an initial stage for implementing 3R in the waste management in Vietnam.

2. Situation of Solid Waste Management in Vietnam

Up to now, there has been no updated statistics of waste types in Vietnam. According to the estimation by Ministry of Construction [1], the country's solid wastes generation is about 28 million tons per year, of which urban solid wastes account for about 50%, rural wastes 30%, and the remaining percentconsists of industrial, medical and craft village wastes. This number excludes agricultural wastes, which is estimated at approximately 65 million tons per year. It is calculated that by 2015, Vietnam's solid waste generation will reach 43.6 million tons per year, with 22.1 million tons of domestic waste and 9.6 million tons of industrial waste. By 2025, these will be 91 million tons, 51.7 million tons and 27.7 million tons, respectively. The average growth rate of solid wastes is 0.7-1.0 kg/person/day and may even increase up to 10-16% per year. It would be a considerable challenge for the management of solid wastes in Vietnam in the coming years.

2.1. Wastes Reduction

The reduction in industrial, commercial and domestic wastes have not been paid due attention. There has been no policy to encourage, as well as no regulations to force people to reduce the solid waste generation. Furthermore, there are not many programs to protect and conserve the natural resources. The results of recent programs such as the project "3R implementation in Hanoi", which was implemented in 4 ward in Hanoi including Thanh Cong ward, Nguyen Du ward, Phan Chu Trinh ward and Lang Ha ward, or other similar projects has been done in Ho Chi Minh City (9 out of 14 wards in 6 District), Bien Hoa (Hoa Binh ward), Da Nang City (Nam Duong ward, Hai Chau district) in the period 2006-2008, are inconsiderable. Cleaner Production, an advanced initiative for environmental protection was introduced in Vietnam from 1998, was expected to reduce the waste generation from industrial enterprises. However, up to the year 2008, there are only 300 out of 400,000 enterprises, making up for below 0.01%, applying cleaner production, an efficient method to reduce wastes during manufacturing [2].

2.2. Collection

At the moment, collected solid wastes account for only 50-60% on average nationwide with 80-82% in large cities and 40-55% in rural areas. The collected rate increases following the class of cities (the classification of cities is as defined in the Decree 42/2009/ND-CP dated 2 Jul, 2009 by the Prime Minister, based mostly on the function of city, the number of living, infrastructure). For example, the IV-class cities (that have more than 50,000 people, density of population is more than 6000 capita/km^2) get the lowest rate with about 65% on average; and the highest rate is Hanoi (special urban class), which reaches out of 98%, acording to the Ministry of Construction [1].

The segregation of solid wastes at source is still unpopular in Vietnam or it is just applied in some few pilot projects in some individual big cities as listed in the previous part. Nevertheless, it is essential to make adjustments and provide time and financial support to implement these kinds of initiatives in other cities throughout the country. On the other hand, these are just preliminary practices of solid waste management besides the application and deployment of a comprehensive management system. Hence, the principle of 3R would remain huge challenge to Vietnam in the coming years. At present, in most places, wastes are usually disposed without segregation. This not only raises issues on environment and public health but also causes a waste of natural resources, especially non-renewable ones. It is assumed that although the collected rate can reach 100%, the treatment of such wastes even by landfill is still a big challenge to Vietnam, not to mention hazardous wastes requiring special measures to collect, transport and treat that can not have full investment within a short period of time.

Recently, some manufacturers of electronic components execute programs on exchange of old devices for new ones at individual scale. The treatment, renewal and recycling of packing now become major activities of many enterprises such as the Ngoc Tan Kien manufacturing and commercial Co., Ltd (operating in the fields of collection and renewal of barrels), Viet Xanh manufacturing, commercial and environmental services Co., Ltd (treating and recycling nearly 300 tons of packing, barrels and bags of all kinds).

Generally, the collection of solid wastes in Vietnam remains unsegregated and unsystematically. For this activity, the related authorities provide much support for the change of social awareness. However, the outcome of this support is not as expected and the participation of the community and economic sectors is still remained less. Besides, the dissemination and communication of this solid waste segregation stays limited, incompliant with Article 67, the Law on Environmental Protection 2005.

2.3. Reuse/Recycling

It is estimated that about 15-20% of total solid wastes generated can be reused or recycled. They are taken with a high rate during the collection stage, transport and treatment thanks to saving habits of people and the private collection system. Most of solid wastes are recycled by craft villages and most of them are popular materials such as metals (iron, bronze, aluminum and lead), paper and plastic. However, the recycling technology is almost obsolete and backward which causes numerous serious problems to the environment and public health, not to mention the poor quality of products. Just a small proportion of organic waste is processed into organic fertilizers with low efficiency due to poor segregation and limited users in some big cities. Some organic fertilizer plants in Vung Tau, Vinh and Viet Tri are operated ineffectively. Several proper technologies of solid waste treatment such as Seraphin, An Sinh – ASC and MBT-CD 08 are well admired domestically, but only on a small scale. Seraphin technology was first applied in Ninh Thuan province in 2001 to treat municipal waste without landfill. After disinfection process, the municipal waste is seperated into organic part and inorganic one. The organic is then used to produce compost and the inorganic is used to produce shaped construction materials. The ASC technology is composed of segregation activity, composting (for the organic part that is easily to compost), plastic recycling (for the plastic part), pressure curing (for the inorganic) and thermal treatment (for the organic part that is hard to compost). MBT-CD 08 (first applied in 2008) is the technology to produce fuel and construction materials from solid waste. The common disadvantage of these technologies is the quality of the segregation process and the output.

Industrial and medical wastes are managed better than domestic wastes due to availability of proper legislation. Industrial wastes are mainly materials or waste products arising from production processes, thus, it is easy to classify them for reuse and recycling. Normally, reusable wastes can be diretly used as materials for industrial production. Non-reusable wastes that can be useful for other manufacturing process will be collected, classified and sold to some recyclers. The remaining wastes are transported to store or collectors for further treatments. However, the systematic prevention and reduction of solid wastes in industrial sectors has just started recently by applying cleaner production on a moderate scale. Most medical wastes are categorized in compliance with the regulations by the Ministry of Health in all central hospitals. Medical and industrial wastes are normally concentrated and thus can be managed due to inconsiderable amount and strict regulations.

2.4. Final Treatment

Almost all solid wastes in Vietnam are landfilled. In most cities, there is at least one landfill and in big cities like Hanoi and Ho Chi Minh City, there are 2-3 landfills. However, landfill method remains unhygienic with about 82 out of 98 landfills nationwide [1]. Other treatment technologies such as composting or controlled burning are applied in some individual cities such as Ho Chi Minh City, Hanoi, Nam Dinh, Thai Binh, Vinh, Hue, Phan Rang and Vung Tau cities. The treatment of industrial solid wastes is taken cared by the manufacturers or urban environment companies and other lisenced enterprises. The most common treatment measures are: (1) landfill with domestic wastes; (2) burning or using as fuel; (3) selling to recycling units; (4) storing or landfilling in the plant area; and (5) dumping. There is still lack of specific treatment zones in the country for industrial solid wastes, especially hazardous wastes. In 2008, The Prime Minister has approved Project 07– Regional treatment zone of solid wastes in key economic regions under Decision No. 1440/2008/QD-TTg to deal with this problem. However, the effect of this initiative is still unclear.

In rural areas, domestic solid wastes are mostly collected to dumping areas without holes and banks to bury. Chemical packs used as containers for pesticides are not regularly collected into tanks. Other agricultural wastes are disposed in open field or just being burned. In the health care field, treatment process remains incomplete. Air and water pollutions from treatment process are not treated properly. Almost all hospitals burn these wastes in simple incinerators without air treatment systems. Some hospitals are equipped with modern incinerators; however, they are not put in use due to a near distance from residential area.

The recovery of methane and other gases from normal landfill is remained unpopular, except some modern landfills. This leads to waste of resources and increase greenhouse effect gases that is the main cause for the climate change.

2.5. Legislation

In terms of legislation, Vietnam has not yet launched any policy and regulation on reduction in domestic and service wastes. This remains a great challenge to Vietnam as many countries have applied already the integrated waste management system measures such as prevention, reduction, segregation, recycling, reuse, collection, transport and treatment. Out of these measures, most of them prefer an increased prevention, reduction and reuse to minimize wastes rather than landfill.

This report aims to further analyze responsibilities of stakeholders concerned to wastes in order to identify a base for an adequate waste management system in Vietnam and to enhance the launch of specific policies relating to the application of 3R in the management of solid wastes in the country.

3. Recycled Wastes and Products in Vietnam

3.1. Recycled Wastes and Products

With rapid socio-economic growth and the development of industry and service sectors in terms of quantity and proportion in national economic structure, the demand for materials is tremendously growing. In addition to domestic and imported materials, it is essential to mention a special kind of materials that comes from recycled wastes, domestic or imported, mostly consists of metals (bronze, lead, aluminum, iron and steel), paper and plastic. Domestic materials are usually more expensive than imported and recycled ones. There are many reasons for that, including the use of backward technology, low efficiency and highly-priced raw material processing. Therefore, while million tons of wastes pollute the environment, Vietnam also fails to make use of a remarkable amount of scrap that can be recovered with the proper application of the 3R system.

In Vietnam, legally, scrap material is defined in the item 1, Article 3 Decision No. 03/2004/QD-BTNMT dated 2 April 2004 by the Minister of Natural Resources and Environment. On the introduction of regulations on environmental protection for imported wastes used for input materials, it stipulates that "scrap materials are materials and output of manufacturing or consumption, compliant with demand for materials". The concept of wastes is also stated in the item 13, Article 3, Law on Environmental Protection, "scrap materials refer to all products and materials that are discarded from a specific process of production or consumption but are collected as input materials for other productions". Thus, scrap or recycled scrap materials can be: (1) output or materials to create themselves; (2) discarded from manufacturing (wastes) or consumption (products); and (3) recovery to be used as input materials (to create the original or the other products).

The difference between scrap materials and recycled products are not legally defined in Vietnam. However, it is possible to define recycled products as outputs produced from discarded products or scrap materials. The quality of recycled products is poorer than those of new ones, nevertheless, the economic efficiency of the former is higher than that of the latter thanks to the so-called unlimited source of wastes (scrap materials), which helps to reduce either directly and or indirectly the production costs, the treatment expenses and the end-product price. Aside from these, it has also other benefits like those from the economic priorities and policy to promote environmental protection. For example, according to the Institute for Scrap Recycling Industries (ISRI), the use of steel scrap helps to save 74% energy, 90% minerals, 40% water, can reduce air pollution by 86% and water pollution by 76% in comparison with that of exploited steel. Recycling of one ton of paper scrap helps to save 2,200 kWh of electricity [3].

Like other countries, Vietnam has to import materials including standard, secondary and scrap materials to meet the demand for production materials, in addition to domestic materials. The importation of scrap materials complies with the production demand of some industriy sectors dealing with the material scarce and formed the activeness for some major industrial sectors such as steel ingot, plastic and paper production. These industry sectors have huge demand for materials while being difficult to mobilize input materials. Besides, the supply fails to meet the demand and costs of domestic materials are higher than those of imports.

The importation of scrap materials (steel, plastic and paper) does not only help to solve the shortage of input materials but it also reduces product price and increase competitiveness of products. For example, imported plastic scrap reduces price of input material by 25% and reduces price of products by over 15%, thus enhances the competitiveness of Vietnamese products compared to Chinese and Indian [4] ones. Moreover, consumers in Europe, USA and Japan demand that Vietnamese products should use at least 10% of recycled plastic to reduce price and make it environment friendly.

Nevertheless, the other side of importing scrap materials is that if they are not paid attention or tightly controlled, they may cause negative impacts on the ecological environment or make Vietnam to become a big dumping area of the other countries. That is such an extremely serious consequence which requires huge costs to deal with.

Steel Recycling Market

In 2006, total steel production output reached 3.6 million tons, meeting over 80% of demand for round steel [3]. To meet the growing demand for steel, in 2007, Vietnam increased yield up to 4.3 million tons of end-products, out of which 250,000 tons of strip steel. With such growth rate, in the future, Vietnam's steel industry is able to fulfill domestic demand and tendentious to export round construction steel (in 2006, 160,000 tons of long, rolled and corner steel were exported).

In Vietnam, there are about 10 steel plants with capacity of 1.7 million tons per year by using mainly steel scrap. To limit steel ingot importation, between 2007 and 2010, Vietnam's steel plants focus on the use of steel scrap with capacity of 4.5 million tons per year. However, domestic steel scrap satisfies only 30% of demand and the remaining must be imported overseas (it is estimated 1.5 - 2 million tons steel-wastes per year and about 1 million ton of steel arising from old ship destruction). Steel scraps imported in 2006 were 536,000 tons, up to 1.05 million tons in 2007, and over 1.1 million tons in 2008. In fact, since 2000, with a view to meet demand for input materials, steel enterprises have found foreign sources of steel scrap (mainly from Russia, Japan and USA) with high price to add to domestic steel scrap of lower value to ensure that steel price is equal to that of imported steel [5].

Before 2007, there appeared some enterprises in the field of old ship destruction, importing overseas or domestic old ships for dismount, collecting plate steel and accessories of ships and selling the remaining to steel plants as materials. Nevertheless, the disassembling of old ships caused environmental pollution. In the recent years, the Government has banned importing old ships that contain pollutants. Therefore, this activity is reduced remarkably, failing to meet 30 % of market demand.

Plastic recycling market

In 2007, Vietnam's plastic sector produced and consumed nearly 3 million tons products. Plastic products per capita in 1990 reached 3.8 kg/year, up to 32.1 kg/year in 2007. In terms of intensive investment, in 2007, costs for importing plastic production machinery increased over 80% from a year earlier and first ever exceeded the benchmark 300 million USD [4].

Vietnamese plastic products now appear on markets of 48 nations and turnover 750 million USD in 2007 only (USA market is the biggest one with turnover of more than 95.2 million USD). In 2008, exports and export-oriented products of the sector were marketed in EU, America, Japan and ASEAN countries with turnover of nearly 1 billion USD, an increase of over 30 % from a year earlier. Export turnover in 2009 was an estimated increase of 39.8 % from a year earlier and by 2010 total turnover of the sector is predicted to rise up to 7 billion USD compared to 1.6 billion USD of 2002 [4]. Forecast about output and growth rate of each group of plastic products by 2010 is described in Table 1.

The forecast growth rate shown that the plastic industry is affected and trend to reduce due to the swing of world oil price. This impact would be minimized by the use of plastic scrap as a major input.

Table 1. Forecast on Output and Growth Rate of Plastic Product Groups by 2010 [4]

Field	Output (ton/year)	Growth in 2010
Packing	1,400,000	15%
Construction materials	600,000	15%
Household appliances	1,400,000	13%
Technical plastic	450,000	20%
Total amount:	3,850,000	

Nevertheless, at present the material demand of plastic sector is difficult to solve. In terms of material supply, just to satisfy 30% demand for domestic materials for an average output in recent years of the sector, it is vital to provide a supply of about 1 million ton materials. If the average import price is 1.800 USD/ton (clean materials like PE - polyethylene, PP - polypropylene, PS - polystyrene, PVC - polyvinylchloride, etc.), to meet 50 % of plastic demand nationwide, on the yearly basis, Vietnam has to spend over 2.5 billion USD to import materials. Another challenge is that almost all plastic materials are by-products from oil refinery process, so the material price is very sensitive to changes or it depends on the prices of these fuels, while plastic product price almost remains stable. For example, the price of 1 ton PVC in 2006 was 830 USD, in 2007 was up to 960 USD and now is 1,020 USD [3].

If plastic scrap is imported, this will meet 35 %-50 % of material demand, equal to over 1 million tons wastes of good quality (at the current price of 600 USD/ton); Vietnam can save about 1 billion USD each year from material import. However, up to now, there are only 2 PVC semi-product plants in Vietnam including TPC Vina with total capacity of approximately 250,000 tons PVC and LG Vina 150,000 tons DOP. Such domestic material is able to meet only 10 % of market demand; therefore, it is crucial to import 2–2.5 million tons other materials. Table 2 below described the value of plastic imports, finished and semi - products in recent years.

Table 2. Imported Plastic Materials of Vietnam [4]

(Unit: Million USD)

	2005	**2006**	**2007**
Plastic materials	1,357	1,669	2,471
Semi - products	336	361	453
End-products	243	278	330
Total	**1,936**	**2,308**	**3,254**

Paper wastes market

Vietnam's demand for import of paper scrap seems to remain at a high rate. According to statistic figures in 2008, scrap papers account for 70% of materials for paper sector and act as main source of materials in Vietnam whereas domestically collected papers make up 50% and overseas imports 50%. At present, the collecting rate of scrap papers in Vietnam remains low (15-25%) compared to 60-70% in developed countries. In recent years, the collection rate of scrap papers has decreased to 16-17% from 20-25% in the previous years. This trend has shown that the collection and recycling of wastes is discouraged in common [4].

Currently, five newly-invested production lines to manufacture pulp from paper wastes with designed capacity of 190,000 tons /year are put into operation.

3.2. Standards for Recycled Wastes and Products

In terms of Vietnam's legal regulations on management of wastes, the Law on Environmental Protection 2005 is a supreme law on issues relating to scrap material as well as import of scrap material.

Regarding the imported scrap, in the item 2, Article 43 of the Law on Environmental Protection, it is stipulated that organizations and individuals have to comply with the following conditions to import or delegate import wastes: (1) having warehouses and yards intended for wastes collection in accordance with environmental standards during storage; (2) be able to treat impurities accompanied with imported wastes; (3) having technology and equipment to recycle and reuse scrap in accordance with environmental standards.

Together with the Law on Environmental Protection, Vietnam issued regulations on criteria and conditions for wastes and importers, as follows:

- Regulations on forbidden businesses and banned imports as stipulated in Decree No. 59/2006/ND-CP dated 12 June, 2006 and Decree No. 12/2006/ND-CP dated 23 Jan, 2006 concretizing Article 25 of Commercial Law 2005.
- Decision No.12/2006/QĐ-BTNMT launching list of wastes imports, out of which 20 are imported to act as input materials as follows:
  - Group 1: iron or steel scrap;
  - Group 2, 3, 4, and 5: bronze, nickel, aluminum, zinc scrap;
  - Group 6-15: lead, tin, wolfram, molybdenum, Maggie, titan, zircon, antimony, manganese and chrome scrap;
  - Group 16: glass shatter and scrap;
  - Group 17: papers or carton of all kinds, including (a.) margin papers, unused carton scrap, (b.) papers and cartons collected from used or unused products;
  - Group 18: Plastic scrap;
  - Group 19: Gypsum;
  - Group 20: Small-sized slag (sand slag) of iron or steel processing

  Now, this Decision and Article 43 of the Law on Environmental Protection 2005 is major legal bases to permit or ban imported materials.
- Interministerial circular No.002/2007/TTLT-BCT-BTNMT by the Ministry of Industry and Trade, Ministry of Natural Resources and Environment (MONRE) on the implementation of Article 43 of the Law on Environmental Protection in terms of criteria and conditions of organization and individual to import scrap.

In addition, Vietnam is admitted to the WTO; therefore, in years to come, under WTO's regulations, Vietnam has to open its market to clean scrap. However, technical requirements and barriers to prevent importation of material scrap into Vietnam are not paid attention. This makes Vietnam at high risk of wastes. Although policy and legal framework have been formed, the importation of material scrap is discouraged. It is because imported scraps are diverse and difficult to control as well as the transport of wastes remains unsafe. For benefit, many enterprises have imported poor quality scrap, or even banned wastes [6]. In many circumstances, imported wastes are detained in customs warehouses for a long time to conduct verification procedure, and even re-export. The investigation of impurities contained in scrap by experts seems limited as the scrap is collected from different sources, resulting in difference in components and quality as well as different verification results among authorities and importers. Additionally, those scrap issue terrible threats to the environment. Despite of increased control and limitation of wastes spread by concerned authorities, it is impossible to absolutely overcome consequences. Furthermore, treatment measures taken by concerned authorities do not gain approval by enterprises, resulting in disapproval among enterprise circle and the society.

For recycling or manufacturing materials from recycled scrap, the quality and requirements for recycled materials (domestically collected or imported) and products are not governed by any legal documents. Table 3 listed some specific legislation issued for some kinds of products.

Table 3. Some of specific legislation for recyclable materials and products

No.	Type of documents	Title	Type of material/products	Issued under
1.	National Standard	Vietnamese Standards 7342:2004 – Steel scrap used for common carbon steel – Classification and technical requirements	Steel scrap	Decision No.35/2004/QĐ-BKHCN dated October 29, 2004 by Minister of Science and Technology
2.	National Standard	Vietnamese Standards 24 TCN 81-2000: for pulp and papers	Paper scrap	Decision No. 07/2000/QĐ-BCN dated 16 February 2000 by Minister of Industry
3	National Standard	TCVN 5946:2007- Paper scrap standards	Paper scrap	Decision No. 851/QĐ-BKHCN dated 24 May, 2007 by Minister of Science and Technology
4	National Standard	Vietnamese Standard TCVN 4315:2007	Arc-furnace cinder for the use in cement production	Decision No. 834/QĐ-BKHCN dated 23 May, 2007 by Minister of

No.	Type of documents	Title	Type of material/products	Issued under
				Science and Technology
5	National Standard	Vietnamese Standard TCVN 4316:2007	Portland blast furnace slag cement	Decision No. 834/QĐ-BKHCN dated 23 May, 2007 by Minister of Science and Technology
6	National Standard	Vietnamese standard TCVN 6069:2007	Low heat portland cement	Decision No. 3245/QĐ-BKHCN dated 31 Dec, 2007 by Minister of Science and Technology

Vietnam also issued Vietnamese standard TCVN 3164-1979 applicable to hazardous substances included in materials, products, semi finished products and wastes for production process and general requirements for safety, use and storage, hygiene and investigation of hazardous content at workplace. However, these standards are not specifically enough, compliant with some certain requirements for wastes used for production.

Thus, standards for recycled wastes are not only lacking but also scattered. Depending on sector and specific requirements, it is essential to refer to standards applied in such countries and regions as Canada, USA and EU. However, these foreign standards are not officially applied, but required by foreign importers for Vietnamese exports. There are no standards applied to recycled products.

This situation leads to various and serious difficulties for entities participating in recycling activity. Another problem is that recycling is performed mainly by medium and small-sized private companies using low technologies and often without environmental protection equipment. To balance demand for economic development and environmental protection, companies of this kind are acceptable at local government. Nevertheless, it is essential to launch standards and requirements for recycled wastes and products in order to form proper waste management system in compliance with 3R principle. In this system, recycling units are required to invest in new and high-efficiency technologies to protect the environment.

Therefore, MONRE prepared regulations on importation to adjust related activities and create consensus in the society (Regulations on the management of imported materials). Draft regulations were submitted by MONRE to Prime Minister for consideration and approval. Moreover, MONRE also prepared regulations on specialty management to improve and complete legal framework and control specific problems, such as the technical specification for imported wastes (steel, plastic and paper); list of importable wastes and instructions to pollution control for imported wastes. These are management instruments necessary for establishing a sustainable wastes management system in the principle of 3R.

Although legal regulations encourage the importation and recycling of wastes in Vietnam, it is nessessary to pay attention to hazardous components as described in Table 3. It is noted that iron and steel wastes may contain many pollutants, including metal and non-metal substances depending on collection sources. These pollutants exert serious impacts on the environment and public health during storage, transport and recycling depending on applied recycling technologies. The surveyed statistic has shown that the use of scrap as materials always causes environmental pollution at different levels. Causes of environmental pollution as analyzed are (i) hazardous nature of wastes and (ii) application of backward and outdated technologies incompliant with requirements for the treatment of impurities included Table 4 and 5 shows the collection sources and corresponding pollutants in the producing steel by arc-furnace.

Table 4. Iron and Steel Collection Sources and Corresponding Pollutants [3]

Source	METAL INCLUSIONS:											
	Al	Bi	B	Cd	Cr	Co	Cu	Pb	Ni	Sn	Zn	Brass/ Bronze
Foreign materials (often solid pieces)	✓						✓	✓		✓		✓
Electrical components				✓			✓				✓	
Bearings		✓					✓	✓		✓		✓
Galvanising	✓										✓	
Plating				✓	✓				✓	✓		
Paints, coatings & glazes				✓	✓	✓	✓	✓	✓	✓		
Solder								✓		✓		
Vehicle scrap								✓				
Vitreous enamels		✓	✓	✓				✓				

Source	NON-METAL INCLUSIONS:					
	Oil	PAH	PCBs	Cutting fluids *	Plastics	Dirt
Vehicle scrap	✓	✓			✓	
Combustion engines, cylinder blocks	✓	✓				
Capacitors from electrical & lighting fixtures			✓			
Scrap from sources involving oil use	✓					
Turnings from machining	✓			✓		
Any type stored on soil						✓

** May be chlorinated*

Table 5. Pollution Sources and Pollutants Arising from Arc [3]

Source	Metals/Metalloids & their Oxides	Persistent Organics			Other
		PAH	PCDD/F	PCBs	
Non-ferrous Alloy Constituents	***Alloy dependent:*** Al, Cr, Co, Cu, Pb, Mg, Ni, Sn, Ti, Zn ***Trace elements (Alloy dependent):*** Sb, Mn, Mo, Si, Th, V, Zr	N/a	N/a	N/a	N/a
Ferrous Alloy Constituents	***Primary:*** Fe, Mn ***Alloy dependent:*** Cr, Co, Cu, Pb,[1] Mo, Ni, V ***Trace elements (Alloy dependent):*** Sb, As, Bi, B, Ca, Mg, Nb, Si, Ti	N/a	N/a	N/a	N/a
Contaminants from scrap	***Common:*** Cd, Pb, Zn ***Possible:*** Al, Bi, B, Cr, Co, Cu, Ni, Ti	***Common:*** from incomplete combustion of organics, e.g., oil & plastics	***Possible:*** from chlorinated contaminants, e.g., Cl-cutting fluids & PVC plastics	***Possible:*** from capacitors	N/a
Furnace fuels: coal, coke, oil	Al, Sb, As, Ba, Be, Bi, B, Cd, Cr, Co, Cu, Pb, Mn, Hg, Mo, Ni, Ti, V, Zn[2]	Certain	Likely	N/a	***Certain:*** Sulphates
Refractories, fluxing agents	***Common:*** alumino-silicates	N/a	N/a	N/a	***Possible:*** Fluorides, chlorides

Hence, for regulations and rules on imported material scrap, it needs to formulate standard system for recycled material scrap and products and develop adequate technology standards.

4. Current Roles and Responsibilities of Stakeholders

4.1. Legal Documents Relating to 3R

At the present time, the Government has recognized the need of 3R strategy as an important basis for an effectiveness management of waste in the future. The thought of 3R shown in some directional legislation described as the followings:

Resolution No. 41/NQ-CT by Politburo on environmental protection in the period of enhanced industrialization and modernization legalized by decision No.34/2005/QĐ-TTg dated February 22, 2005 by Prime Minister highlights environmental protection policy in combination with socio-economic development, including Reduce, Reuse and Recycle wastes.

Particularly, *Resolution No.41/NQ-CT* launched a policy to allocate 1% of total Government budget for environmental protection activities since 2006.

Vietnam's sustainable development program (Agenda 21) sets goals of sustainable development by properly exploiting and saving natural resources. Agenda 21 issues principle that environmental protection and improvement in environment quality are an integral part of development process. In the fields to be prioritized, Agenda 21 gives priority to change in production model and technologies. Consumption model is environment-friendly and green by saving non-renewable resources and minimizing hazardous and difficult-to-disintegrate wastes.

National strategy for environmental protection by 2010, orientation towards 2020 sets goals of and measures for environmental protection, including reducing, reusing and recycling wastes.

Of *Vietnam's Law on Environmental Protection*, Articles 66, 67 specify that "Organizations and individuals engaged in activities that generate wastes, shall have the responsibility to reduce, recycle and reuse wastes so as to minimize the volumes of wastes required to be discharged and disposed of".

Neverthelss, up to present, there is not any specific guideline document for the application of the responsibility of the disposer, which is an important part of the 3R principle. Besides, from the oriented legislations, it is needed an appropriate legislation system to concretize the basis thought, that is still lacking in Vietnam. Without this system, the 3R policy would not be implemented harmoniously with stakeholder responsibility and economic benefit.

At the present time, Ministry of Construction coordinates with MONRE to build a draft of national strategy for the management of solid wastes by 2025, oriented towards 2050. This draft was presented by Mr. Nguyen The Dong, deputy director of General Environmental Office in 3R Forum held in November in Tokyo, Japan. It is under construction to submit Prime Minister for approval.

In addition to those legal documents and strategies, there are sub-law documents on the management of solid wastes as listed in Table 6.

Table 6. Some of major legislation related to the management of waste

No	Type of document	Title	Date of issue	Issued by
1	Decision	Decision No.1140/QĐ-TTg on the approval for 7 solid wastes treatment zones by 2020	6, Oct, 2008	Prime Minister
2	Decision	Decision No.155/1999/ QĐ-TTg on the management of hazardous pollutants	16, Jul, 1999	Prime Minister
3	Decision	Decision No. 2575/1999/QĐ-BYT on the management of medical wastes	27, Aug, 1999	Minister of Health
4	Decision	Decision No. 03/2004/QĐ-BTNMT on the issuance of Regulations on environmental protection for imported wastes used as input materials	2 Apr, 2004	Minister of Natural Resources and Environment
5	Decree	Decree No.59/2007/NĐ-CP on the management of solid wastes	9, Apr, 2007	Prime Minister
6	Decree	Decree No.174/NĐ-CP on charge of environmental protection for solid wastes,	29, Nov, 2007	Prime Minister

No	Type of document	Title	Date of issue	Issued by
7	Decree	Decree No.152/1999/ QĐ-TTg on the approval for solid wastes management strategy in urban and industrial zones	10, Jul, 1997	Prime Minister
8	Circular	Circular No.1590/1997/ TTLT-BKHCNMT-BXD on urgent measures to manage solid wastes in urban and industrial zones	3, Apr, 1997	Minister of Science, Technology and Environment and Minister of Construction

In terms of priority policies for the management of solid wastes: although the government has just issued Decree No. 04/2009/NĐ-CP supporting and prioritizing environmental protection activities, there are no concrete instructions for implementation.

Nevertheless, it remains shortages of specific instructions to the management of solid wastes and hazardous wastes. Almost all legal documents focus on the management of wastes in urban and industrial zones. Policies on wastes prevention, reduce, reuse and recycle are absent. Regulations on the expansion of responsibilities of manufacturer in collecting and treating some discarded products in order to minimize solid wastes are planned to be constructed in the coming time. Economic instruments such as tax reduction, environmental charge, take-back and re-fund system to encourage reduce, reuse and recycle of solid wastes are also lacking. Besides, it is impossible to implement these regulations as there are no regulations on product life cycle.

4.2. Roles and Responsibilities of Stakeholders in Execution of 3R in Vietnam

The summarized product life cycle and stakeholders relating to it, from the manufacturing to distribution, consumption and rejection is shown in Figure 1.Products or imported ones are supplied to consumers through distributors. In the life cycle of product, the service shop provider may be related to the repairing process of product through direct relationship with consumers. For consumers, end-of-life products may be discarded directly or indirectly (storage) or resold to collectors if they still have value. This relation is same with service shops. Valuable discarded products collected from consumers, service shops or landfill areas may be dismantled to classify into specific groups of material scrap to increase the value of waste and provided to the recycler. There may be a part of materials, components or accessories returned to service shop to be used in other activities such as in refurbishing or producing fake-new appliances, especially the electronic devices. Recyclers reproduce discarded products or wastes into new products or materials to be sold to other manufacturers.

The stakeholders relating to product life cycle are as follows:

- Administrators;
- Suppliers (including manufacturers, importers and distributors);
- Consumers;
- Service providers;
- Recyclers and final treatment units (including collectors).

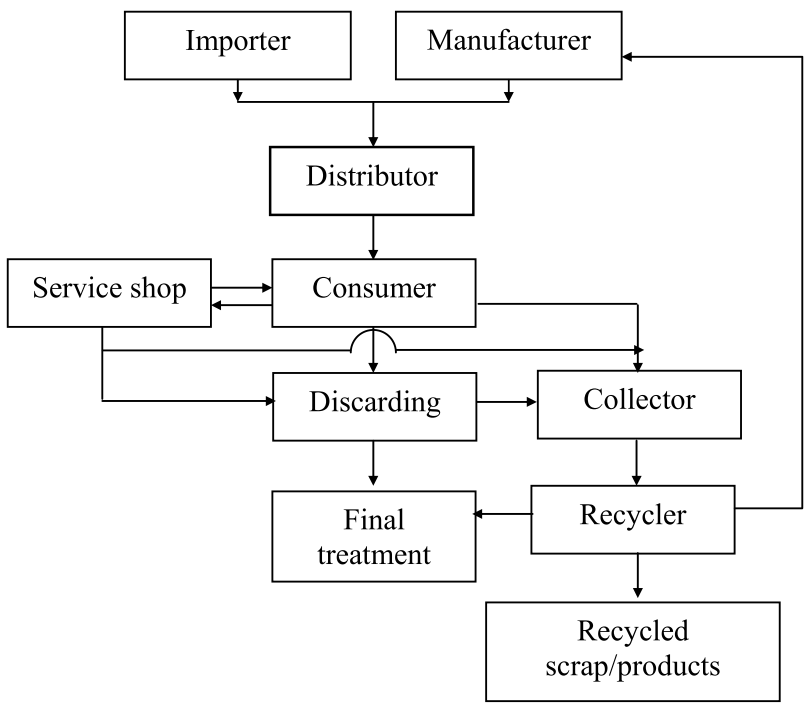

Figure 1. Summarized Life Cycle of Products

Generally, the consumer creates demand for products and supplier creates supply. These are main stakeholders of product life cycle. The other stakeholders take part in the product flow at different levels. With regards to economic benefits, manufacturer (in addition to importer and all-level distributors) gains benefit from consumer, who may get interests by selling discarded products. However, a bigger benefit of consumer is immaterial value that the consumer pays for their entertainment demand. Discarded products shall be handled by collector and recycler through collection network at all levels. Essentially, collector is in charge of transshipment between consumer and final treatment or recycler or manufacturer (in case of collecting delegation), or illegal manufacturer (for fake products). Economic benefits gained by collector are dependent on value of wastes or collected materials, and based on the differences between purchase and selling price of recycler, final treatment unit or manufacturer. In Vietnam, collector's benefits are dependent on level (retail or agent) and type of collected materials. Benefits are gained by the final treating units through existed differences between input costs and profit from processing (including expenses on wastes, normally financed by the state budget, profit of products and by-products, if any). Similarly, benefits are gained by recycler through differences between cost of collection and profit from recycling process.

The financial flow of stakeholders in product life cycle is shown in Figure 2.

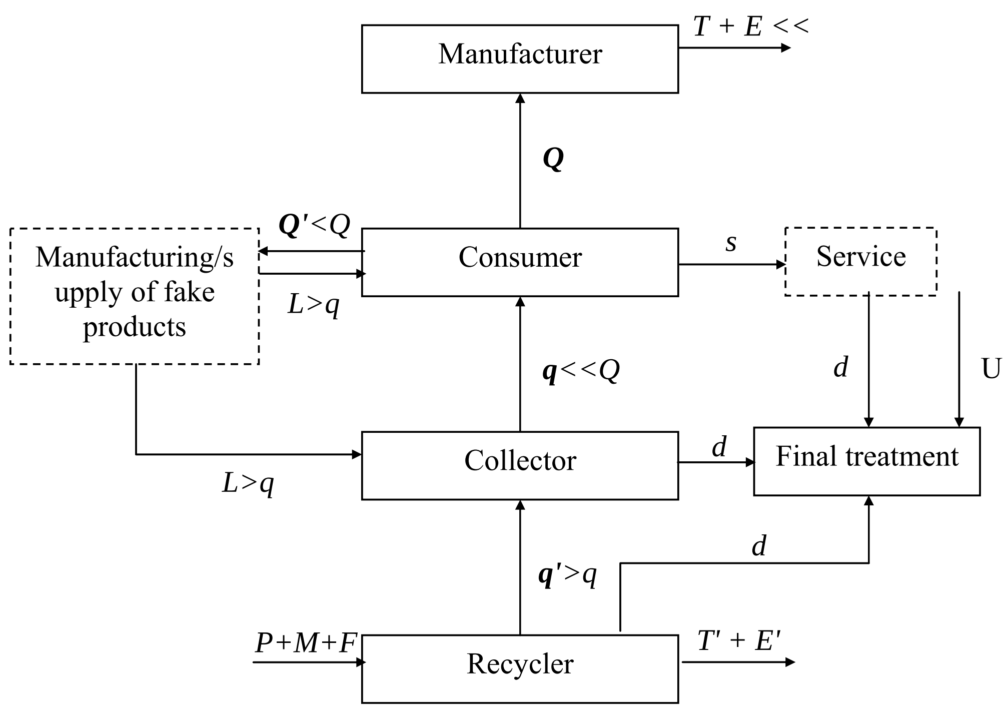

Figure 2. Financial Flow of Stakeholders in Product Life Cycle

Q and *Q'*: prices of products supplied to consumers; *q* and *q'*: collection costs for discarded product and collector; *L*: collection costs of illegal manufacturer paid to collector and consumers; *T* and *T'* tax-related costs; *E* and *E'*: costs of environmental protection; *P* priorities under applicable laws for recycling/treating units; *M*: benefits gained from recycled materials/products and *F:* cost of recycling covered by the state budget or manufacturer. *d*: fee for domestic waste and *U* : the goverment financial fund for end-of-life treatment of solid waste. In this diagram, production costs (operation, investment and advertising) are excluded.

Legally, responsibilities of stakeholders are stipulated in Vietnam's Law on Environmental Protection. Specifically, Article 66, item 1 stipulates that organizations and individuals causing pollutants are responsible for reducing, recycling and reusing to minimize wastes to be destroyed. Item 1 of Article 67 specifies that manufacturer and services provided are responsible for collecting end-of-life or discarded products as follows: (a) radioactive sources used in production, business and service activities; (b) batteries and accumulators; (c) home and industrial electronic and electric equipment; (d) greases, lubricants and packaging materials that are naturally persistent degradable; (e) medicine products and chemicals used in industry, agriculture, fisheries, and medicines for disease treatment in humans; (f) means of transport; (g) tubes and tires; and (h) other products in accordance with the regulations of the Prime Minister of the Government.

As a result, the Law on Environmental Protection stipulates specific responsibilities of manufacturer for discarded products. The Law on Environmental Protection and the other related legal documents (Decree 174, Decree 59 and other legal documents) stipulate responsibilities of organizations and individuals releasing pollutants. In reality, responsibilities of manufacturer remain ambiguous. It is impossible to require implementation of these responsibilities as they are not specified in sub-law documents.

The Law on Environmental Protection also specifies responsibilities of People's committee at all levels, Ministry of Construction, MONRE and environment management units at all levels for wastes in articles 69, 70, 74, 75, 76 and 80. Under this Law, People's committee at all levels have responsibility for arranging space for treatment units, building waste management works within their scopes of work, investigating and verifying these works before putting them into operation, issuing and deploying priority as well as supporting policies on the management of wastes. Ministry of Construction is responsible for introducing regulations on technical standards in partnership with MONRE, guiding the investigation and recognizing units treating hazardous wastes and areas to bury dangerous pollutants and normal solid wastes, setting up national projects on collection, treatment and burying of hazardous pollutants and normal solid wastes in cooperation with People's committee at all levels. Hence, concerned authorities are responsible for just encouraging, financially prioritizing the management of wastes, planning, construction, investigation and verification of treating units (including burying of wastes). Their responsibilities for the collection, collection and recycling are not mentioned.

According to the law, the waste disposer has responsibility for implementing 3R for discarded products and sharing costs for public domesic wastes only. Therefore, consumers take no responsibility for discarded products under laws and regulations. This is a huge challenge to the application and deployment of 3R relating to discarded products.

The responsibilities of stakeholders, their behaviors relating to product life cycle are analyzed in the succeeding paragraphs.

4.2.1. Authorities

Responsibilities of authority are stipulated in the Law on Environmental Protection and other relevant regulations. However, for wastes, the law only specifies responsibilities of the Prime Minister for issueing legal documents related to collection and treatment the above products in Article 67. In addition, the Government has not issued any clear policy stipulating responsibilities for collecting wastes. In many cases, there is an overlap of competent authorities' responsibilities, so it is difficult for defining responsibility of agencies. Moreover, resources (financial and human resources) for solid waste management are still limited and funded ineffectively annually. It causes difficulties in management of wastes under 3R rules leading to irresponsibility of managers in many fields of waste management, such as withdrawing discarded products, and preparing related legal, financial and technical policies. Governmental plannings and programs prepared and issued in a long time do not follow up with changes of the market. They are also adjusted by legal elements, so difficulties happen when deploying. Therefore, expenses for scientific and technological researches on recycling and treatment of discarded products are not considered and they do not encourage units to invest in this field. As a result, technology for recycling and treating wastes in Vietnam has been old and backward. Advanced technologies in Vietnam are not popular because they are mostly invested under the names of foreign aids.

Moreover, there are many shortcomings with regulations on waste in the Law on Environmental Protection 2005. In clause 9, Article 7, the Law on Environmental

Protection, it is forbidden to import, export and transit wastes by any form. According to clause 1, Article 43, the Law on Environmental Protection, "scarp materials to be imported must comply with the following requirements for environmental protection, that having been segregated, cleansed and unmixed with materials, products and goods that are banned from import in accordance with the provisions of the law of Vietnam or international treaties to which the Socialist Republic of Vietnam is a Contracting Party". However, when implementing the Law, competent authorities meet many difficulties because there is no stipulation on "clean" level for imported refused materials and it is not suitable to stipulating that imported refused materials should not contain impurities. The Law also stipulates refused materials "without containing hazardous wastes and impurities, except non-hazardous impurities mixed during loading, unloading and transport operations". However, it is difficult to comply with this regulation because in facts, wastes shall not be considered hazardous waste if contents of hazardous impurities do not exceed hazard level. Currently, there is no scientific and practical proof to define the content of impurities (hazardous and unhazardous impurities) in imported refused materials.

At present, the Vietnamese Government has assessed and acknowledged that the take-back, treatment and elimination of end-of-life products are necessary to protect the environment. A directorial Decision for this problem then is prepared to issue by the Government.

4.2.2. Manufacturer

As mentioned, according to the Law on Environmental Protection, manufacturer has responsibility for collecting and treating discarded products as required. However, there is no administrator agency in charge of supervising the performance of this responsibility and no specific instructions to its implementation and no policy relating to this responsibility (support and fine). In fact, the collection of discarded products is not conducted seriously by manufacturers. Economically, manufacturer has poor awareness of environmental protection. Almost all enterprises pursue goal of making profit and pay little attention to the application of environmental protection measures. This results in seriously polluted environment in many localities.

The diagram in figure 2 shows that at the moment, major costs of manufacturer are production fees, taxes and costs relating to environmental protection. Among these costs, production costs are the majority. The application of responsibilities for discarded products may cause extra costs in the context of which manufacturers pursue the maximum profit.

Therefore, manufacturers have no intention and ability to take their responsibilities for discarded products when they are not forced under legal regulations and laws, except some special circumstances where the collection of products is closely related to their economic interestes as analyzed in the case study later.

A pressing problem that Vietnam has to face with is used products from developed and other ASEAN countries that entered into Vietnamese markets illegally. These products have advantages over new products thanks to low price and acceptable quality. They meet a considerable demand of people in lower class urban and rural areas. However, it is difficult to require manufacturer and consumer to perform their responsibilities for discarded products since they are illegally imported. Now, in Vietnam, some enterprises have collected used products on small scale. Products such as empty bottles of beer, alcohol and beverage shall be collected by manufacturer or by delegation agents to reuse and reduce production costs (accounting for 50% product price).

Another type of product collection is the exchange of old products for new ones. For example, Sao Nam Stationery Co., Ltd. (in Ho Chi Minh City) is one of authorized distributors of photocopy machine branded Brother, Sanyo and Konica Minolta. Since the end of September this year, the company has deployed the program "exchange of analogue for digital" by purchasing old equipment from the customer on the condition that customer has to buy the company's new products.

In Vietnam, examples of product collection of used or end-of-life products show that manufacturer aims to: (i) gain economic interests (in case of empty bottles of beer and alcohol); (ii) respond to requirements by concerned authorities, (iii) and satisfy customer's claim in case of problem relating to quality or other parameters, not taking responsibility as stipulated under the Law on Environmental Protection. This is the same with foreign or joint-venture companies although they have done environmental protection measures well and actively participated in environmental programs.

Difficulties and shortcomings for collection of products for enterprises:

- In addition to benefits from the collection of used and out-of-date products, enterprises have to confront with difficulties in ensuring high efficiency in collection and minimizing damages and risks. It is so unpopular that showrooms and distributors withdraw old products;
- Manufacturer has to invest a big capital and workforce in establishing a network to collect discarded or used products. Furthermore, it is essential to invest in equipment,

technology and human resource to resuse and recycle the collected products. If these are not done, manufacturer will have to spend much money to complete their responsibilities through competent delegated recycling agents and units;

- In addition, units that purchase discarded or used products are unable to select and classify them to pick out components for recycling and reuse as well as bring them back to the manufacturer;
- Illegal manufacturers and fake product manufacturers have a great demand for discarded products. This leads to decrease in private units' capability to collect as manufacturer wants to take back their products. The prices of collected products sold to legal manufacturers are cheaper than that to illegal units;
- Furthermore, consumers have poor awareness of their responsibilities for products. This is a challenge to the collection of enterprises. To gether with that, the national management system on the conducting of collection system is still problematic.

4.2.3. Consumer

Obviously, consumers are responsible for 3R to minimize wastes. However, there are no legal documents or sub-law documents stipulating the performance of that responsibility. Now, consumers have to pay a general cost monthly while no responsibility is required for discarded products including battery. This discourages people to limit wastes. Besides, people have a habit of puting hazardous wastes together with domestic wastes. That causes various difficulties in treatment. A numerous pilot programs on segregation of wastes at the source have been run; however, no long - term positive results have been achieved. These programs are also difficult to be deployed on the large scale although consumers are responsible for minizing wastes.

Unlike consumers at anywhere, Vietnamese consumers are not only irresponsible for discarded products but also entitled to economic benefits when transferring discarded products to collector as described in figure 2. Therefore, it is hard to change traditional behaviours and improve awareness of people so that consumers have to hold their responsibilities for 3R principle.

These negative behaviours of consumers are mainly due to their lack of awareness about proper waste management. It is difficult to change conventional awareness among people. In addition, almost all people are unaware of the impact on the environment exerted by consumer and discarded products during and after use. They think that products are just for consumption. When products are end of life, they have a right to choose their own behaviours to treat them, including storage, reselling or disposing.

Many people do not realize the benefits of the segregation of wastes at source, as well as the reduction, reuse and recycling of wastes. Or they only only know the benefits of proper waste management for the community but they do not want to practice it since there is no private benefit that can be gained from this activity. Also, the private benefit even much smaller, is always put at a higher priority than the general benefit.

Certain proportion of discarded products is reused by households in Vietnam for many different purposes. In one aspect, this is a good behaviour of consumers to minimize wastes and make use for different purposes of discarded products. For instance, plastic boxes and packs are used as containers and tires are used as buffers. In another aspect, when products are used for different purposes from their designs, they may also be harmful to other family members or to themselves. It is because they do not know the safety benchmarks of products, especially used products and they just focus on their features.

Difficulties and shortcomings for collection of products for consumers

- Firstly, consumers are unaware of dimissing end-of-life products and they are not provided adequate information about the impact of waste dumping;
- Secondly, when disposing products, consumers can gain economic benefit and have no responsibility for discarded ones; and

  Finally, during collection of products, it is essential to pay attention to convenience for consumers (collection method and distance) as they care both their materials and entertainment interests.

4.2.4. Recycler

Like manufacturer and consumer, recycler (in addition to collecting and finally treating units) has no responsibility according to the Law on Environmental Protection. However, Article 68 of the Law on Environmental Protection stipulates that recycler as mentioned in Article 67 will be given priorities such as tax incentives, capital and land support to construct their facilities. Actually, recycler has to hold responsibility for their activities in compliance with regulations on environmental protection.

If there are no legal regulations and laws on responsibilities of manufacturer, it is hard to give the recycler priorities when they recycle and finally treat discarded products. This is a bottleneck. Although they may gain profit from recycled materials and products (in case of recycling), or receive treatment costs from the national agencies or manufacturer (in case of treatment). This benefit is so little compared to costs for collecting when manufacture has no responsibility for collection and recycling. Another problem is that almost all recycling activities causing environmental issues are privately owned. Most of these units pollute the environment and public health as they lack resources or even they prefer economic development. If these units comply with regulations on environmental protection, they cannot exist. Recycling enterprises face difficulties in collecting input due to intensive capital and compliance with legal regulations on environmental protection. Furthermore, poor management capacity of the authorities makes competitiveness of these enterprises limited.

Difficulties and shortcomings for collection of products for recycler

- Receiving favourite conditions from priority policies, recycler and treatment units have to ensure efficiency in technology, product quality and the environment. This leads to decrease in small-sized recycler and treatment units that have backward and outdate technology and increase in large-sized ones that have proper technology and comply with requirements for environmental protection. This makes a big change in the current recycling/treating system, especially to the informal sector;
- Recycler/treatment units should be financially and legally supported by the Government to change the current collecting system, otherwise it is hard to find input for production.

5. Proposed Responsibilities of Stakeholders

5.1 Major Viewpoints

In order to successfully apply and deploy system of solid waste management under 3R principle, at first, it is necessary to define and stipulate all responsibilities of stakeholders in the life cycle of products. The following opinions have been researched and proposed as a main foundation for the stipulation of responsibilities of the stakeholders:

1. 3R principle considers wastes as valued resources. This opinion must be affirmed and shared between stakeholders and community;

2. Solid wastes management system in general and recycling should meet international standards or at least regional standards;
3. In the system, responsibilities for discarded products should be shared between the two stakeholders including manufacturer and consumer.

   As analyzed, manufacturer and consumer are the most important factors relating to the life of a product. One creates demands and the other supplies to that demands. Therefore, responsibilities of the two stakeholders must be defined with the same importance in spite of the fact that the economic benefits of manufacturer seem to be more significant than of consumer;
4. Responsibilities of consumers should be considered to form 4R rule (Reduce, Reuse, Recycle and Responsibility) based on 3R rule, and Responsibility factor should be emphasized as a decisive factor for a success of the system;
5. Take back – refund should be considered as a main economic tool of the system, and each product shall have its own code of paying a security representing defined rate of expense for the collection, transportation, recycle and treatment of products when discarding. A fund of pay a security for recycle process should be established with the participation and control of Ministry of Finance, Ministry of Industry and Trade and MONRE. This fund should be separated from existing Fund of Environmental Protection;
6. The system should be connected closely to the changes of informal recyclers, from small scale and old technologies into new, modern and friendly-environmental technologies, because responsibilities of recyclers are to recycle safely;
7. Economic tool shall be the most important tool to impose responsibilities upon stakeholders and to change informal recycler into formal recycler;
8. There should be researches on a system of policy frame so that stakeholders can implement their responsibilities. Also in that system, the establishment of standards for recycled wastes and recycled products should be re-standardized and environmental standards for imported and exported wastes should be established;
9. The system should eliminate illegal manufacturers and smuggled goods by technical tools (standards and registration), economics (punishment) and control (controlling of goods origin);
10. The system should also be connected to an international fund for recycling with the participation of international and national manufacturers. This fund shall be connected to international functional centers for recycling focusing on small products and difficult

to collect in terms of physics such as: battery, hi-tech products: digital camera, iPod, etc;

11. In the first period of deployment, there should be an assistance of capital by the Government. The Government shall support both manufacturers and consumers in terms of sharing responsibilities for discarded products.

Based on these rules, the diagram of economic line is proposed as Figure 3.

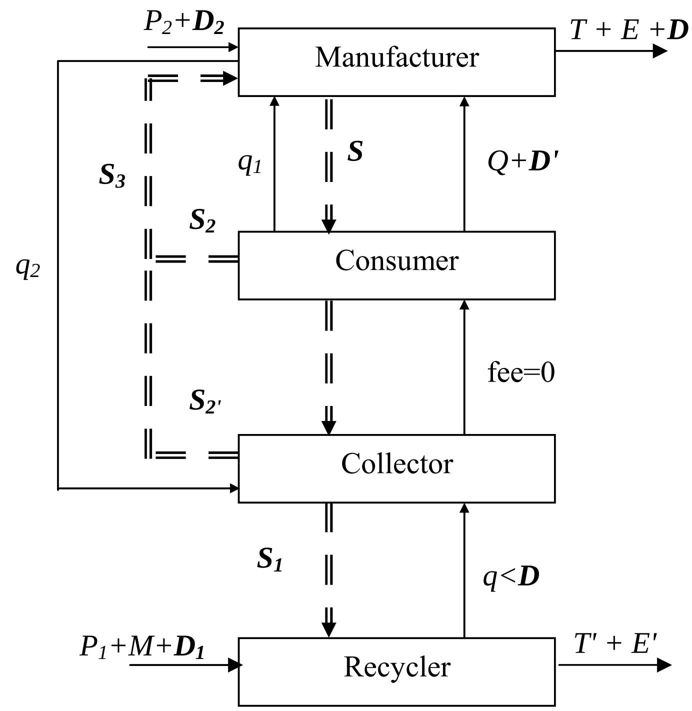

Figure 3. Estimated Material and Financial Flow in the New Management System

In the figure, S is the quantity of products which is provided for consumers and featured by particular recycled label for each type of product; S_1 is the quantity of products which is discarded to recycling enterprise; S_2 is the quantity of discarded products which is rendered to the manufacturer and therefore, received transport expenditure q_1, $S_{2'}$ is the quantity of discarded products which is rendered to the manufacturer by the system of collection with the condition that the manufacturer has the system of discarded product recycling and therefore, received the expenditure of transport and collection q_2 ($q_2 > q_1$), S_3 is the total quantity of discarded products which are collected from the consumers and the system of collection, accordingly $S > S_1 + S_3$ ($S_3 = S_2 + S_{2'}$). Q is the cost price of products provided for consumers, q is the collection expenditure of discarded products from the system of collection, T and T' are the expenditures related to tax, E and E' are the expenditures related to the environmental protection, P_1, P_2 are favors as per the current laws for recycling/processing factories and manufacturers (in case the manufactures have the system of discarded product recycling), M is the profit gained from recycled products/materials. D and D' is the responsibility contribution of manufacturers and consumers, and $D + D' \sim q + g + t$, of which g is the transport expenditure and t is the expenditure of recycling and processing activities. D_1 is the part of expenditure from recycling fund received by the recycling/processing factories in accordance with the quantity of discarded products which are recycled by such recycling/processing factories, D_2 is the rendered expenditure of the manufacturer if the manufacturer has the collection and directly recycling system of their discarded products, $D_1 + D_2 = \boldsymbol{D}$.

In the proposed system, the flow of products can be from the manufacturers to consumers and from the consumers to the manufacturers or recycling enterprises through the system of collection. The current flow related to manufacture of imitated or fake products must be terminated through the strict inspection and supervision and serious application of standards with respect to the recycled products. In the economic sector, the recycling expenditure of discarded products, including the expenditure of collection and transport of discarded products to the recycling center/enterprise, shall be shared by the manufacturers and consumers. The whole of such expenditure of the manufacture shall be collected immediately by the National agency (the consumers shall refund the manufacturer when purchasing products) under the form of exchanging recycled labels which each product is forced to have. Such expenditure shall be mainly used for the recycling enterprise as per the registered quantity of recycling, and determined by the number of collected recycled labels. Besides, the recycling enterprise shall be supported by the Government in terms of technology, policies and taxes through the relevant management agencies. In the initial phase of the system, the Government shall spend a part of recycling expenditure as a form of supporting the manufacturers and consumers to stabilize operation, avoid disorders during the application of lengthened responsibility.

Together with the strict application of standards of recycled materials and products, as well as the environmental standards, as forecasted, the informal recycler must transit their manufacturing line in the direction of investing new technology and expanding the manufacture in stead of remaining the state of small and backward technology as currently because the line of discarded and collected products shall belong to registered recycling enterprise or formal enterprise, that has ensured technology and capacity.(too long sentence, kindly paraphrase) The reason is that, here, the formal recycler which is supported financially from the recycling fund, and to increase the competitive level, shall increase the collection expenditure of products to the level that the informal cannot compete.

Based on the operation of the system, it is proposed the detailed responsibility of related stakeholders for discarded products as discussed in the next section.

5.2. Responsibility Proposal of Stakeholders

5.2.1. Authorities

Responsibility of authority agencies, in addition to specified matters in the Law of environmental protection and related legal documents, shall be as follows:

a. *Establishing, issuing and adjusting the framework of policies and institution:*

- Issuing and adjusting legal documents, stipulating the implementation and guiding the implementation of the new management system of wastes, of which classifying clearly responsibility of stakeholders as proposed, particularly the authority agencies;
- Investing in researching and issuing standards of recycled materials and products; focusing on common and particular materials such as metals (black and colored metals), paper, plastic (including rubber);
- Establishing the recycling fund with full functions and legal foundations, with the participation of related authority agencies in order to support and supervise financially the lengthening of responsibility of the manufacturers and consumers;
- Establishing and applying regulations of "greenization" of the supply chain of international materials as well as policies of "green" moral in the society;
- Increasing the capacity and establishing the human resources serving the system of waste management.

b. *Executing activities from the management agencies in the system of waste management*

- Controlling and supervising strictly the activities, including import declaration, manufacture declaration, manufacture registration, distribution registration, recycling registration as well as the implementation of standards of recycled materials and products by the manufacturer and recycler;
- Executing the green purchase, particularly, the application for public purchase as a part of 3R activities;

- Participating in supervision of input and output of discarded product cycle, of which imported products/refused materials and environmental protection in the recycling, processing as well as the inspection and supervision are focused in order to eliminate illegal activities harming the system of lengthened responsibility with respect to discarded products;
- Presiding programs and activities of information publication, increasing public knowledge and management capacity.

c. *Investment in improving technological capacity in the system of waste management*
   - Presiding, financing and supporting domestic units to research on technology and deploy technology;
   - Improving capacity and establishing research and traning system at universities and institutes;
   - Establishing communications system and propagating information in order to meet the demands of community's information query.

d. *Presiding and act as intermediary for international cooperation*
   - Acting as intermediary for international cooperation in the field of international recycleing, dialogue and share of policy, especially in the Southeast Asia and other countries;

     Participating in establishment and activities of investment of International funds for recycling, researching and transferring technology to countries in the region and establishing international functionally center for recycling (for special products).

5.2.2. Manufacturer

Manufacturer having the following responsibilities:

- Admiting and holding legal liabilities as required for products from manufacturing to recycling/final treatment processes;
- Actively forming recycling system for discarded products (entire or partial) to collect a part of materials for the production line or assigning this work to a competent recycling unit;
- Actively establishing collection system of discarded products in compliance with its production capability or legally authorizing a competent collector system;
- Cooperating with related national agencies and construction consultancy units to identify responsibilities (expenses on security payment to recycle discarded products) in costs for safe recycling of discarded products;

- Representing the Government to collect responsibility cost from consumers, (including product price);
- Co-ordinating with concerned national agencies in security payment to recycle;
- Directly participating in technology study and transfer to serve 3R activities for related products;
- Willing to provide information about products and other related information.

5.2.3. Consumer

- Admiting and holding legal liabilities as required for discarded products;
- Taking partially financial responsibilities for recycling of discarded products by incuring a part of cost included in product price;
- Being responsible for taking discarded products to collectors such as manufacturer's agents or authorized collectors and holding full responsibility for the pollution of discarded products;
- Actively receiving and studying related media information.

5.2.4. Recycler

- Registering capability and recycling processes with concerned agencies;
- Having responsiblity for complying with all standards for recycled wastes and products and other regulations relating to recycling of discarded products, especially environmental protection regulations;
- Cooperating with concerned national agencies, manufacturers in registration, report, investigation of discarded products to be recycled and participating in security payment – return relating to recycling funds;
- Actively co-ordinating with concerned national agencies in related overseas and domestic cooperation activities, proactively taking part in recycling technology study and transfer;
- Providing full information to stakeholders.

Based on these major responsibilities, it is possible to form and deploy an adequate management system of solid wastes in the principle of 4R as mentioned above to construct a sustainable developing society with less pollution.

6. Case Study

6.1. Case Study of the Use of a Thermo-power Plant Ash

Since 1954, Vietnam has operated power plants in small scale and capacity of 6-12 megawatt (MW) like: Hon Gai, Hai Phong, Nam Dinh, Yen Phu, Viet Tri, Thai Nguyen, Dam Ha Bac, Vinh, Lang Son, Uong Bi, Ninh Binh (25MW). In 1994, the electricity system in Vietnam was unified country-wide and the electricity production increased continuously from 8.7 billion kWh in 1990 to 80.7 billion in 2009 [7]. order to satisfy the demand, some plants have expanded their capacities for example, Uong Bi (expanded 1 - 50 MW), Pha Lai expanded 1 (110 MW), Pha Lai expanded 2 (300 MW), Uong Bi (expanded 2 - 300 MW), etc.

To meet the demand of electricity, the planning of National electricity development in the period of 2006 – 2015 with refers to 2025, thermo-power plant projects are expected to be built in the period shown in Table 7.

Table 7. Designed Thermo-power Plant Projects in 2006-2015 [8]

No.	Projects	Location	Designed capacity (MW)	Operation time
1	Duyen Hai 1	Tra Vinh	2 x 600	Assembly 1: year 2013
2	Duyen Hai 2	Tra Vinh	2 x 600	2014-2015
3	Long Phu	Soc Trang	2 x 600	year 2013
4	Vinh Tan 1	Binh Thuan	2 x 600	2011-2012
5	Vinh Tan 2	Binh Thuan	2 x 600	Assembly 1: year 2013
6	Vinh Tan 3	Binh Thuan	2 x 1.000	Year 2013
7	Vung Ang 1	Ha Tinh	2 x 600	Assembly 1: year 2013
8	Vung Ang 2	Ha Tinh	2 x 600	Assembly 1: year 2013
9	Hai Phong 3	Hai Phong	4 x 600	Assembly 1: year 2014
Total capacity			**12,800**	

Yearly, million tons of ash is generated from thermo-power plants causing serious impacts to the environment and community heath [9]. Counting out thermo-power plants belonging to EVN (Vietnam Electricity) in the North of Vietnam, emitted ash reaches nearly 1 million tons per year (Table 8).

Table 8. Amount of Coal Ashes From Thermo-power Plants in the North of Viet Nam

Plants	Capacity (MW)	Amount of ash (ton/year)
Pha Lai 1 [10]	400	188000
Pha Lai 2	600	249000
Ninh Binh	100	37000
Uong Bi	100	39000
Expanded Uong Bi plant	300	124600
Cao Ngan (2008) [11]	115	180000

Ash from thermo-power plants can be divided into two types: bottom ash and fine ash (chemical compositions are similar to clay). The bottom ash term is used for the heavy ash and slag found in the bottom of thermo-power furnace and the fine ash term is used for the ash accompanied with the exhausted gas. The ratio of bottom and fine ash (also called invert) is shown in Table 9.

Table 9. Ash Component [9]

Plants	Bottom ash	Fine ash (invert)
Pha Lai 1	27%	73%
Pha Lai 2	27%	73%
Ninh Binh	27%	73%
Uong Bi	29%	71%

Becaue the combustion efficiency in thermo-power plants is not high so untreated fine ash reaches only class F (1-12 % calcium and lower alkalis compared to Class C) according to ASTM International (American Society for Testing and Materials). Besides, they are lost remarkablely when igniting. That is the main reason for limiting the use of fine ash in Vietnam in the previous time.

Nevertheless, in the recent year, the fly ash from thermo-power plants has found its application in the cement production thank to the technology transfer from Japan. The use of fine ash, which was considered waste before, can change the conventional view on waste and it should trend the waste management in the future. The use of fly ash is discussed on detail in the next part.

Reusing ashslag of thermo-power industry in Vietnam

Previously, the ash slag of thermal power plants as Ninh Binh, Pha Lai was often given or sold at very cheap prices. Then, it was mixed with peat coal as a fuel for domestic appliances or for brick kilns. Late 1990s, some local thermo-power plants had started to salvage ash slag to produce non-baked bricks. However, salvaged ash slag is much less than generated ash.

Since 2000s, when Japanese technology on applications of ash from thermo-power plants was introduced, a lot of researches to develop these application in Vietnam have been carrying out in two ways: (1) puzzolan, contains components as same as clay (silicat oxide SiO_2, aluminum oxide Al_2O_3 and ferrous oxide Fe_2O_3), and (2) remaining coal (approximately 20%).

Ratio between these two components has a significant impact on objects that can use this type of ash. Brick manufacturing plants prefer to use ash with a high content of coal, while this content is too high can reduce the chemical properties leading to a limition in applications fine ash to produce cement and concrete. Vietnamese scientists, research institutions and enterprises have recognized that and quickly implemented researches to develop technology of separating two components into finished products.

Main applications of ash generated from thermo-power plants in Vietnam are:

- To use as a mineral additive for cement production or partial replacement of cement in concrete and mortar production to take advantage of cheap raw materials and constraint of cracking of concrete structures when using fly ash in concrete;
- To concrete in big blocks or roller-compacted concrete (RCC method) because it can help to improve the concrete quality, easier to executing the work, reduce breaking down, reduce the invasion of water, cut down the cost of concrete;

- To manufacture brick in tunnel kilns (use unburned coal and puzzolan in slag); and
- To manufacture unfired-brick, AAC brick, panel, asbestos-free cement, etc..

Due to the limited supply while the demand is increasing, at the beginning (2005-2006), the price of raw fine ash (unclassified fine ash) was only 3 USD per ton at Pha Lai thermal power plant. In 2009, the price of raw fine ash was about 11USD/ton in the North, and about 32 USD/ton in the South. In 2007, classified fine ash (to make unburned coal content to less than 6% of going down in accordance with technical requirements for cement additive) was sold at price of 25 USD per ton [12]. In order to improve economic effect and environmental pollution, thermo-power plants have equipped with particle collection systems.

The success in research and implementation of using fine ash in construction works increase the need of that waste (Table 10).

Table 10. Fine Ash Consumption in Vietnam [12]

Industries	Using purpose	Amount
Cement	active admixture with the minimum level of 5%	0.9 million ton/year
Concrete	to replace cement with the minimum level of 20%	342,000 ton/year
Hydro power industry	Admixture	1.8 million ton
— Son La Hydro power Plant		600,000 ton
— Hoi Quang Hydro power Plant		200,000 ton
— Nam Chien Hydro power Plant		200,000 ton
— Ban Ve Hydro power Plant		200,000 ton
— Cua Dat Hydro power Plant		180,000 ton
— A Vuong Hydro power Plant		150,000 ton
— C Ka Mang Hydro power Plant		300,000 ton

The standards related to the fine ash

Currently, Vietnam has not issued any legal documents on product standards or the use of thermo-power ash. The use of fine ash is currently based on the standards for active additive Puzzolan such as TCVN 6260: 1997; TCVN 6882 2001; TCVN 4033: 1995;

TCVN 7712: 2007 TCVN 7711: 2007 ; TCXDVN 395:2007; T4 BC 114: 2001. The Government is interested in reusing thermo-power ash. That is displayed in the investment of the Government for researches on the possibility of application of fine ash in the construction industry in recent years. A draft of TCVN 2682-2008 [9] specifying on analysis of fine ash composition is being seting up and this is the base for the other criteria for that kind of high demanded waste.

Although fine ash is not included in the list of waste imported into Vietnam, but when implementating commitments to WTO of which Vietnam is a member, Vietnam will be unable to prevent the import of wastes including fine ash from other countries. Therefore, the promulgation of the technical standards for this type of waste not only control the import of waste, but also promote the reuse of fine ash in the economic fields, reduce pollution, improve economic efficiency as well as promote regional and international integration.

The remarkable benefits and wide application scale of fine ash along with the self control capacity of technical factors in domestic establishments have led the reuse of thermo-power ash to be widely applied. Consumers also respond enthusiastically the use of these products. Economic benefit from the use of fine ash has promoted the implementation of the responsibilities of producers and consumers in implementing 3R effectively for this type of waste.

6.2. Case Study of Lead Battery Recycling

Batteries using in Vietnam mainly are open typed and close typed acid batteries for transportation means. Batteries not causing negative impacts to the environment when being deposed are expensive and unusual, so they are used mostly in specialized equipment with limited quantities. At present, collection and treatment for expired and out of work batteries are often done by private owned companies, craft-households. Treatment and recycling technologies added poor awareness on environmental protection lead to serious impacts to the environment and human health. Meanwhile, the legal system in Vietnam is still incomprehensive with lacking of policies, economic tools that specify clearly responsibilities of battery consumers, manufacturers, and importers as well as responsibilities of agencies for treatment and taking back out-of-work batteries.

Different from the fly ash case, even lead battery is recycled for a long time in Vietnam, however, there is still no specific regulation or standard for the application of this type of materials. The next part will discussed on detail this difference and try to find the cause.

Manufacturing and import acid batteries in Vietnam

Until the end of 2009, Vietnam had only five acid battery manufacturers (Table 11) and 20 companies importing that kind of battery.

Table 11. List of Acid Battery Manufacturers in Vietnam [13]

No	Name of Companies	Unit	Production	Export
1	Dry Cell and Storage Battery JS. Company PINACO (2008)	kwh/year	1,000,000	162,324
2	Vinh Phu Storage Batteries & Dry Cells JS. Company (2007)	kwh/year	60,000	none
3	Tia Sang Battery JS. Company	kwh/year	250,000 (2007) 207,329 (first 8 months of 2008)	25,899
4	GS Battery Vietnam Co. Ltd. (2008)	kwh/year	431,329	60,386
5	Le Long Vietnam Co. Ltd. (2007)	box	6,000	1,800

Import of used batteries and scraps are complicated in the recent years. Thousands tons of used battery are imported into Vietnam as scraps or brand new products. In the 3-year period of 2005-2008, Environmental Police (C36) had forced nearly 6,200 tons out-of-works acid batteries which were illegally imported to re-export [14]. In fact, most of imported scraps contain impurities, hazardous components although in customs declarations, they are "materials" or "cleaned matters". For example, Vu Hai Co. Ltd., (Quang Ninh) imported 63.040 tons acid battery electrodes; Hoang Phat Co. Ltd., (Hai Phong) imported 44 tons acid battery electrodes while they declared to the Customs those were lead ores; Long Giang Co.Ltd., (Quang Ninh) imported 257 tons used batteries with the declaration of brand new ones and Hai Thien international Carriage Service and Trading Co. Ltd transported 20 tons wasted acid batteries at Tan Thuan Port [15].

Status of using acid batteries in Vietnam

- Batteries for automobile and motorcycle

According to the report on National environmental status in 2007 – there were approximately 800,000 automobiles and 23 million motorcycles in Vietnam. The longevity of a 15 kilogram battery for automobile is two years and of 2.5 kilogram battery for motorcycle is five years on average. It is estimated that in 2007, about 19,600 tons acid batteries including 8,200 tons for automobile and 11,400 tons for motorcycle were used.

In 2008-2009, the number of automobile increased approximately 20% per year, of motorcycle increased approximately 15% per year. In total, used acid batteries were about 27,000 tones in 2009 [16].

- Batteries for other purposes

Specialised batteries are mainly used in mine, telecommunications and electronic sectors. Previously, in Mine sector, many Fe-Ni batteries imported from China were used however, at the current time, big equipment trends to run by acid batteries because they are easy to be replaced by domestic products.

Since the supply of electricity in rural and mountainous areas does not satisfy the demands, people often buy cheap acid batteries or used automobile batteries that had been repaired for domestic use purposes or for production activities. Up to now, a number of those batteries have not been counted yet but it is found that all of those batteries after use are bought to the collection system, not discarded.

Status of wasted and end-of-life battery collection and recycling

- Collection

According to the survey results in some garages in Hanoi, Ho Chi Minh city, Viet Tri, Nam Dinh and Hai Phong, almost transportation mean batteries are replaced in garages. Those batteries after being replaced are collected at garages then sold to scavengers. That kind of collection shows its high effect because few batteries are discarded into the environment.

Besides, manufacturers and importers only have responsibilities for replacing (taking back) under provisions of warranty for their batteries. However, the rate of that activity is low because usual technical errors only reduce productivities and longevities of equipment while consumers do not have enough knowledge and tools to check on exactly product quality whether it matches technical characteristics declared by manufacturers.

- Recycling in craft villages or craft households

A big amount of lead batteries is recycled in craft villages, typically lead recycling craft village Dong Mai (Hung Yen). That used to be a traditional bronzing village, since 1985-1986, hundreds of craft households in Dong Mai village have changed to recycling activities due to high benefits, cheap materials (wasted batteries) and simple techniques.

Lead recycling craft households in Dong Mai order materials to scavenger nets in provinces. Those scavenger nets collect end-of-life batteries from garages or buy from smaller scavenger groups or buy batteries failed to finished conditions from battery manufacturers. Materials even come by illegal import activities of lead batteries through national borders.

On monthly average, hundreds of tons of discarded batteries are collected to come to Dong Mai where recycling organizations use backward and manual technologies causing serious environmental problems. In 2008-2009, environmental management authority in Hung Yen had monitored environmental impacts and suspended many households in the area, so recycling activities had decreased significantly. However, some organizations in the village still carry out recycling activities as Ngoc Thien Co.Ltd., with capacity of 15-20 tons raw lead/day; Minh Quang Co.Ltd., with capacity of 2.5 tons recycled lead/day, etc.,

In the southern areas, some organizations recycle lead with out registrations such as: Kim Thang Long Co.Ltd., (a professional waste treatment) in Le Minh Xuan small scale industrial area, Village No.1, Tan Nhut Commune, Binh Chanh District (Ho Chi Minh City), households in Quang Trung road (Go Vap District), Hung Vuong road (District 5), Lac Long Quan road (Tan Binh District) etc.

Due to backward technologies and equipment, recycled lead quality does not satisfy domestic production demands. Most of them are exported to refine while Vietnamese manufacturers have to import lead as a material for their processes.

Recycling at industrial scale

With high economic effect of lead battery recycling in Vietnam, since the end of 2007, in the South of Vietnam, some private establishments have invested to lead recycling activities. These establishments have bigger scale and more advanced technology than craft villages although they are scattered (Dung Ngoc Co.Ltd., in Tan Thanh district, Ba Ria – Vung Tau province with a scale of 2,000 tons/month). Most of recycled leads from these establishments are exported because they do not meet the requirements for materials of domestic battery production. In the near future, a factory belonged to Thye Ming Vietnam Company in Binh Duong is going to operate with main function of lead battery treatment and recycling.

Lead battery collection and recycling system in Vietnam is summarized on Figure 4.

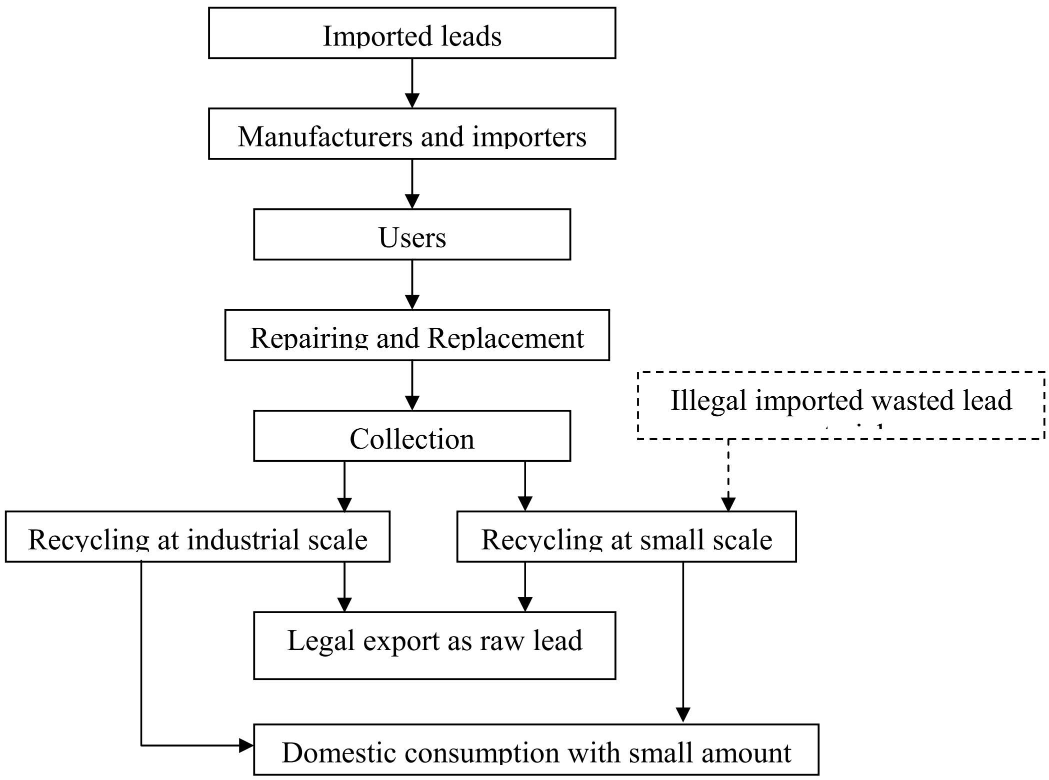

Figure 4. Diagram of Lead Battery Collection and Recycling System in Vietnam

In summary**,** according to the Law on Environmental Protection 2005, Article 67, battery is one of products that manufacturers have responsibilities for taking back after use however there are no detailed regulations about these responsibilities of manufacturers as well as importers and distributors in Vietnam. The management only conforms to regulations on hazardous wastes such as Basel Convention, Circular 12/2006/TT-BTNMT dated 26 December 2006 by MONRE providing guidance of professional conditions and procedure for documenting, registering, licensing, coding of practice and hazardous waste management. There are no detailed regulations on responsibilities of manufacturers as well as importers and distributors of battery products in Vietnam.

Import wasted lead batteries into Vietnam faces many difficulties due to incomprehensiveness of legal system as well as lack of detailed standards relating to wasted lead batteries in spite of that illegal import of wasted lead batteries is existing due to economic profits.

Collection of lead batteries is done by recycling establishments through scavenger net with a high effect (approximately 100%). Environmental protection aspect is not concerned in lead recycling activities in particular and recycling acitivities in general so economic effects of these activities are high. That is a main factor to make the collection system operate effectively.

Because standards for recycled lead are lacked so lead recycling establishments still remain backward and limited technologies and equipment, small sizes leading to poor quality of recycled lead and environmental pollution. National management authorities monitor ineffectively so recycling establishments do not have to pay much for pollution treatment. People‘s awareness on that field is not high, and often focus only for economic profits. Neither environmental protection nor human health is underestimated. That is why even recyling lead batteries can bring high benefits,recycling rate is still low.

Beside preferences regulated in the Law on Environmental Protection, detailed responsibilities of relevant partners to lead battery (manufacturers, importers, distributors, consumers, recycler/final treatment) as well as detailed standards on that kind of scrap promote informal recycling acitivities to become formal activities and create a good condition for the performance of 3R to that kind of such hazardous waste.

From this two different case studies, it is found that economic benefit should be closely tied with the responsibility, in order to successfully apply 3R strategy. In the first cases, all of the stakeholders are big enterprises and their benefit is secured (and controlled) by the standard and legislation. In the second case, the stakeholders (all of them are small and medium private enterprises) found that their benefit is opposited with the standard and legislation. They would be suffered when the industrial standard for recycled lead is applied, unless they improve themself in both of the scale and technology immediately. Of course, the view point on their responsibility to the environment also should be changed. This is a very important point for the application of 3R strategy in Vietnam.

7. Conclusion

The increading waste generation, as the result of the economic development, has become one of the most important environmental issues in Vietnam. Due to many reasons, the amount of wastes has tremendously increased within the past few years and thus, has caused much difficulty for Vietnam to address this problem. Until this time, Vietnam does not have a proper system to manage it.

The waste collection system is not organized and still scattered over the country. For the valuable waste such as metal, plastic or paper, the system can collect most of them with a very high efficiency. But for the other type of waste, the efficiency is still low, not only due to the lack of economic benefits but also due to the lack of awareness of its negative environmental impacts to the community.

At the present time, Vietnam does not have proper recycling and treating system for the waste. A lot of waste is landfilled without proper environmental protection solution. There is a large amount of waste being dumped or disposed yearly without control. It leads to great harmful effects to the environment and public health that can also reduce the economic achievement through the increase of environmental cost. Furthermore, when disposing wastes, Vietnam has lost a remarkable amount of secondary material sources that can be reused or recycled in many production sectors, and thus, lost an important benefit source for the development.

There are not much industrial recycled materials and products standards, and the existing ones are still scattered that can not encourage the 3R implementation. Due to this reason, Vietnam also does not have the proper technology and the market using recycled materials, especially plastic, glass and precious metals. They are a very important factor to drive the stakeholder's trend from the existing waste management system into the proper system for the development in future. Besides, for the improvement of the small private enterprises on the material recycling sector, standards for recyclable waste as well as recycled products are needed. As mentioned before, one common dilemma for waste management system in Vietnam is the existence of the private recycling enterprises. This sector can bring benefit to the poor agricultural areas without much investment cost; create more direct and indirect jobs to the peasant at free time of cultivation. Nevertheless, it also causes serious problems to the environment and public health as evident in many craft villages that need to prevent for the sustainable development. The standards for recyclable waste and recycled products then must be a key factor to restrict the operation of small recycler, and force them to change technology and equipment and enter in the new stage. Besides, the standards for recycled products also can limit the development of the fake-new appliance at the acceptable level, to avoid the uncontroled expanding of this sector. In the near future, due to the integration into the world economy, the waste management system in Vietnam should meet the international or at least, the regional standards.

The role of stakeholders is still unclearly defined to promote 3R policies and activities. Therefore, it reduces the effectiveness of the waste management system, and creates unclear conditions to define the responsibilities for stakeholders. Thus, for an improved waste management system, it needs to draw clearly the role of stakeholders, with a proper framework of regulated and guideline policies. More importantly, responsibilities of the society (including manufacturer, consumer and recycler) should be considered to form 4R rule (Reduce, Reuse, Recycle and Response) based on the 3R principle, and should be emphasized as a decisive factor for the success of the system.

Based on the experiences of case studies discussed, it is shown that the provision of economic benefits is one of the most important tools to impose responsibilities upon related parties and to change informal recycler into formal recycler. In which, take back–refund should also be considered as a main economic tool to form the appropriate waste management system, along with the legislation tool.

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CHAPTER 7

Establishing Industrial Standard for Recycled Waste: The Case of Malaysia

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1. Introduction

Mass production of products which escalated with increasing demand triggered industrial activities. Industrial revolution especially during 18th and 19th century created many manufacturing wonders. Enduring good quality of products, standards were used to ensure certain level of acceptance for the products. Standards existed since the beginning of recorded history of industrialization. Early example of standard was the creation of calendar. Five thousand years ago the Sumerians in the Tigris/Euphrates valley devised a calendar which was very similar to the one we are using today. Later the Egyptians were the first to develop the 365-day calendar and can be credited with logging 4236 BC as the first year in recorded history.

The application of standards continues and in modern day standard being established during World War 2 by British Government. The standards was introduced during the war as there were quality problems in many British high-tech industries such as munitions. The solution was to require factories to document their manufacturing procedures and to prove by record-keeping that the procedures were being followed. The name of the standard was BS 5750, also known as a management standard because it did not specify what to manufacture, but how to manage the manufacturing process. The development of standards continues with increasing complexity and demand and supported with advance technology development. Recently, each country in the world developed their own standards for products, services and activities. Furthermore, to ensure the level of playing field for international trade, international standards have been established. The International Organization of Standardization (ISO) plays an important role, focusing at early years of its establishment on manufacturing products. Although ISO standards is technical, their implementation goes beyond solving technical problems to delivering positive results in economic, environmental and societal spheres (Bryden, 2008). The ISO has a membership of 157 national standards institutes from countries large and small, industrialized and developing, in all regions of the world. ISO develops voluntary technical standards which add value to all types of business operations. They contribute to the dissemination of technology and good business practices. They support the development, manufacturing and supply of more efficient, safer and cleaner products and services. They make trade between countries easier and fairer.

ISO standards also safeguard users and consumers, and make many aspects of their lives simpler.

Standards play an important role for industry development. Standards are critical for international trade because incongruent standards can be barriers to trade, giving some organizations advantages in certain areas of the world. Standards provide clear identifiable references that are recognized internationally and encourage fair competition in free-market economies. Standards facilitate trade through enhanced product quality and reliability, greater interoperability and compatibility, greater ease of maintenance and reduced costs. As for the waste recycling industry, availability of standards is important to ensure sustainability of the industry and minimizing impacts to the environment and human health.

For the waste recycling industry, there are important drivers or factors which play important role in establishing and implementing standards. A standard requires stakeholders and institutional support. The governments of a country, the main implementer and enforcer of standards need important inputs from industries, business sectors, financial institutions and consumers. Legislation must also be established along with standard to ensure effective applications and compliance. Standards should be developed in line with technological development, thus it requires human resources for many important activities especially for enforcement and technology development for standards enhancement. This is important and thus, technology development for product should be handled immediately and competitiveness of products technology should not be slowed down by lack of standards. Compliance for standards must be supported not only by the government and its legislative role, but other support system must be also be in place. This support system must come from industry and business entity which will ensure trade and market suitability in applying the standards. Financing and insurance scheme should also be developed and be established to facilitate standards compliance by industry and business. These drivers or factors should be integrated to ensure that the standards for waste recycling industry are able to deal with the increasing demand of recycled materials for industry in many parts of the world. Hence, many countries especially the developed countries have established their own waste recycling standards.

2. Country Experience in Establishing and Implementing Standards for Waste Recycling

The need for good waste recycling scheme requires a system which includes effective management regime. In addition, there should also an assessment and monitoring program or system in place to ensure the sustainability of the waste recycling industry. Therefore standards play an important role. Many countries have developed or have established their own waste recycling standards. The standards are developed according to the needs of its local industries and of other countries. As the demand for recyclable materials increases, these standards are reviewed to ensure ability of these materials to be exported or imported. Most of the waste recycling standards available have been developed by developed countries. This section highlighted examples of the establishment and development of waste recycling standards of selected countries and region.

2.1. European Union Waste Recycling Standard

One of the main regions which developed early its standards for waste recycling is the European Union (EU) countries. EU has established its environment policy which has evolved significantly since the 1970s. This policy provides the EU countries a cleaner air and water, and a better understanding of the importance of a healthy environment. It is one of the policy areas that is most supported by EU citizens, who recognise that environmental problems go beyond national and regional borders and can only be resolved through concerted action at EU and international level (European Commission, 2005). One of the critical environmental issues in Europe has been waste. Increasing problem in managing waste by its member countries, drove them to undertake national measures to control and manage waste efficiently. This led to the creation of the Waste Framework Directive (75/442/EEC), and the Hazardous Waste Directive (91/689/EEC) both adopted in 1975, and later to the Waste Shipment Regulation. The Waste Framework Directive establishes a framework for the management of waste across the European Community. It defines important terms, such as '**waste'**, '**recovery'** and '**disposal'**, to ensure that a uniform approach is taken across the European Union. The directive requires Member States to:

- give priority to waste prevention and encourage reuse and recovery of waste

- ensure that waste is recovered or disposed of without endangering human health and without using processes which could harm the environment
- prohibit the uncontrolled disposal of waste, ensure that waste management activities are permitted (unless specifically exempt)
- establish an integrated and adequate network of disposal installations
- prepare waste management plans
- ensure that the cost of disposal is borne by the waste holder in accordance with the polluter pays principle
- ensure that waste carriers are registered

The Hazardous Waste Directive framework legislation complements the Waste Framework Directive by providing a framework for the control of hazardous waste. It lists a number of properties of waste which render it hazardous (such as explosive, flammable, carcinogenic, or corrosive). Although the Directive does not substantially augment the requirements of the waste framework directive as regards permitting and registration of waste management facilities, it contains additional requirements concerning the mixing of hazardous waste, record keeping and international shipments of waste. The Directive requires Member States:

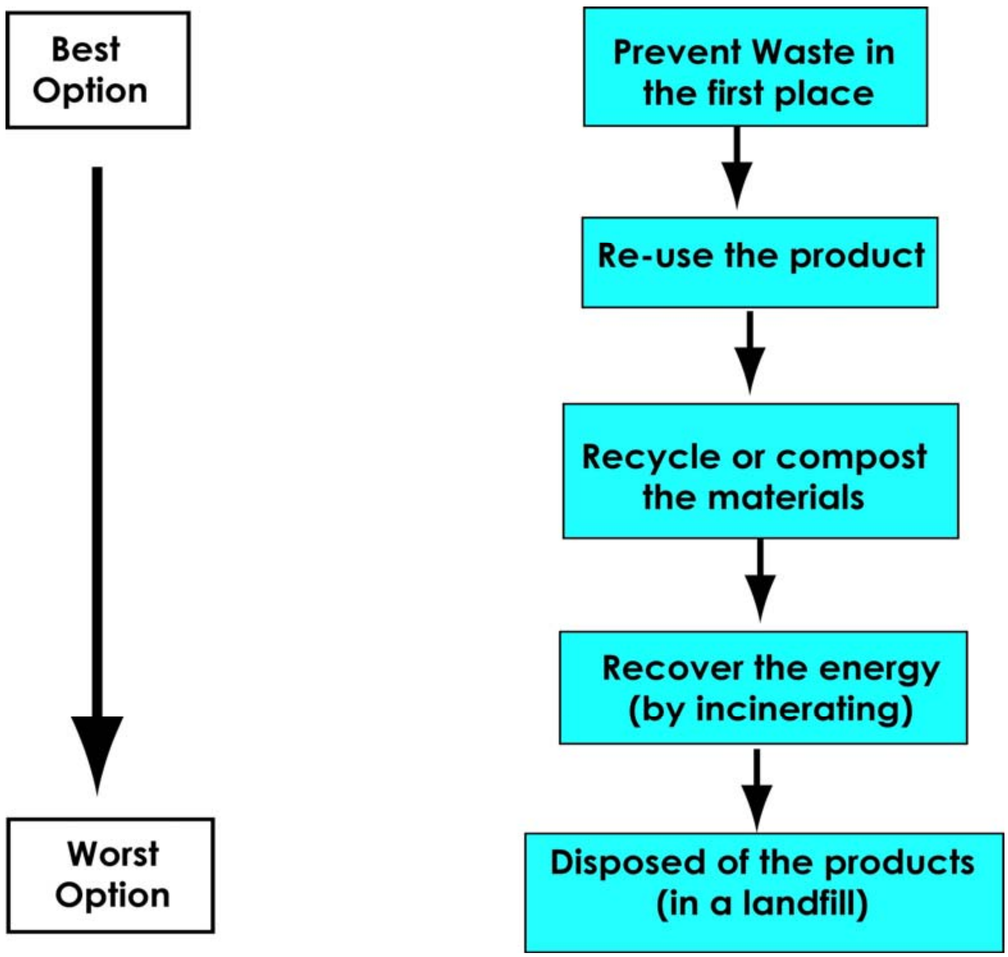
- a record of every site where tipping of hazardous waste takes place
- the prevention of the mixing of non-hazardous and hazardous waste
- the separation of hazardous waste from other waste where technically and economically feasible
- hazardous waste to be transported, packaged and labelled in accordance with international and European Union standards
- waste to be transferred with an identification form
- producers and disposal sites to be inspected
- permitted sites to keep records for three years

In 1996, the Waste Strategy Communication from the European Commission (EC) identified three strategies to improve the waste management regime:

- Reinforced the notion of a waste hierarchy (Figure 1)
- Re-affirmed the "polluter pays" principle with regards to waste (so that those who produced waste should have to pay the cost of treatment)
- Developed the concept of priority waste streams.

The improvement also prioritized waste recycling, re-use and energy recovery over the disposal of waste. EU legal framework for waste management has been strengthened to ensure recycling of waste. This includes the EU–European Council Regulation (EEC 880/92), Directive of Packaging and Packaging Waste (94/62/EC), and the Waste Framework Directive (WFD 75/442/EEC) of 1975 (revised in 1991 and codified in 2006)

Figure 1 Waste Hierarchy for Management in European Union



Source: European Commission, 2005.

Development of common reference standards for recycling in EU become important as the Commission's position is that common EU standards are a better solution for the EU both environmentally and economically. To ensure the proper functioning of the internal market for recycling and the high level of environmental protection and to prevent the threat of "eco-dumping", it is proposed to set minimum standards across the community for recycling activities and recycled materials. Establishing standards for waste recycling in EU is not an easy task. Several Member States, and regional or local authorities of EU, tend towards protectionism in the area of waste. Hence the notion of waste treatment standards for EU is multi-faceted. It depends on the following conditions:

- Which process is the most appropriate for a given waste;
- The pressures exerted on the environment by a waste management facility;
- The efficiency of a recovery process; and
- The quality of the output of a recycling operation.

Therefore the existing European Ecolabel will help in supporting waste recycling and recycling standards and its process. The European Ecolabel established in 1992, is a voluntary scheme. The scheme objective is to encourage businesses to market products and services that are kinder to the environment. Products and services awarded the Ecolabel carry the flower logo, allowing consumers - including public and private purchasers - to identify them easily. Today the EU Ecolabel covers a wide range of products and services, with further groups being continuously added. Product groups include cleaning products, appliances, paper products, textile and home and garden products, lubricants and services such as tourist accommodation. The European Commission manages the scheme at EU level to ensure correct implementation of the Ecolabel Regulation (EC) No 66/2010. The Ecolabel Helpdesk assists the Commission on a number of different matters, including marketing. Collaborating with EU Commission is the The European Union Ecolabelling Board (EUEB) responsible for developing, publishing and promoting criteria for product groups in order to minimise the environmental impacts of a wide range of products and services over their whole life-cycle. EUEB is made up of the Competent Bodies from each Member State and the interested parties that form the Consultation Forum. The Competent Bodies are independent and impartial organisations, responsible for implementing the EU Ecolabel scheme at national level. They are members of the EUEB responsible for drafting Ecolabel criteria, assessing applications and awarding the Ecolabel to companies that apply. They play a central role in the operation of the EU Ecolabel scheme and should be the first point of contact for any questions.

With support of EU ecolabel scheme, it promote the establishment of common standards for waste recycling for EU countries, which help to protect the environment in the whole of the EU. For long term requirements, it will reduce the complexity of the legislation that controls shipments of waste destined for recovery. The common standards will help to build a strong internal market for recycling and recovery and good for economic development as well.

2.2. The Federal Republic of Germany Waste Recycling Standard

The Federal Republic of Germany has experienced industrial development since the 17th century. As one of the most important industrial and developed countries in Europe and the world, Germany has become an important country to be considered, in its experience in managing industrial waste. Waste has become a critical issue in Germany, thus for the past three decades, the government has been taken steps to better manage the waste.

Legislature plays a key role in waste management. The Waste Disposal Act was enacted in 1972 with the primary aim to shut down the uncontrolled refuse dumps and replace them with central, regulated and supervised landfill sites under the responsibility of regional and local governments. This act was established as a response to the increasing illegal disposal of waste (Schnurer, 2002). However this Act was not able to control waste generation and disposal. In the 1980's, the critical waste disposal crisis prompted calls for a drastic reduction in waste generation to reduce waste disposal problems. The government of Germany has determined the importance of controlling waste generation, and in 1986, the Waste Avoidance and Management Act, was introduced.

The Act introduced the principle that the avoidance and recycling of waste had to be given precedence over waste disposal. It also established a foundation of product responsibility. To strengthen this Act, the Packaging Ordinance, was introduced in 1991. This ordinance has become key product of waste policy based on the Waste Avoidance and Management Act of1986. The Packaging Ordinance applied the carrot and stick principle, to promote waste avoidance and recycling. The responsibility shifted towards industry and business and encourages them to design products and packaging for waste avoidance. Essentially, the rule was that manufacturers of packaging, and distributors of packaged products, were to accept the return of empty packaging from its most recent owner and to recycle it (Schnurer, 2002).

The packaging ordinance has led to the establishment of the Dual System (Duales System Deutschland, DSD) which also called Green Dot System (Rousso and Shah, 1994). The DSD dual system in Germany, is run by a stock corporation owned by a large number of packaging manufacturers, product manufacturers, retail companies and waste management companies. The stock corporation organizes nationwide collection and transportation of packaging waste and sorts it into individual, recyclable fractions. The system contracts private and public waste management companies to provide these services on its behalf. The DSD scheme cooperates with guarantors to ensure and verify the adequate recycling of the individual packaging materials (glass, metals, paper/board, plastics and composites). The system is financed by the so-called "green dot", a license fee which manufacturers or users of packaging must pay to the dual system. This system implementation control by specific standards ensures that the recyclable materials recovered or collected is up to the requirements.

Germany emphasizes the need for resource conservation and recovery, and identified waste as a resource. In 1994, the Closed Substances Cycle and Waste Management Act was introduced to promote the close substance cycle in waste management in order to conserve natural resources. The Act pursued hierarchy targets of waste avoidance – recycling – disposal and to ensure environmentally friendly waste disposal. Later the legislation for waste recycling in Germany was strengthened by the establishment of Ordinance on Waste Recovery and Disposal Records (Nachweisverordnung - NachwV) in 2006. This enabled Germany to achieve the highest recovery quotas worldwide. Already over half of both municipal and production waste now undergo recovery. For some waste types, recycling quotas are even higher - e.g. packaging (82%), batteries (66%), and graphic paper (81%). With such achievements the needs for responsive standards is important. These standards will ensure that the recycling industry in Germany is sustainable.

In response to the EU's WFD and the Thematic Strategy on prevention and recycling of waste, Germany has enhanced its existing legislation regime to ensure sustainable implementation of the waste recycling program. The Germany legislative and standards have been synchronized to support EU WFD, as well as adhere to the EU's directive on waste, as follows:

- EC Framework Directive on Waste (75/442/EEC), 1975.
- EU Directive on the Landfill of Waste, 1990.

- EU Directive on the Incineration of Waste, 2000.

The key to waste management in Germany is *Product Responsibility* (Schnurer, 2002). This includes taking into account the responsibility of key stakeholders. The stakeholders involved the commitment of government agencies, including the Federal Environment Ministry, regional and local governments. Other important stakeholders were industries, businesses and consumers. These stakeholders also play important roles on the establishment and development of standards for waste recycling industry in Germany. With increasing demand for recyclable materials, Germany has developed and established waste recycling and recycling standards. Currently, there are 57 waste recycling standards and 128 recycling standards developed by Germany (Table 1). The waste recycling standards were used for recycling of waste while the recycling standards were used for materials, process and supporting activity which will be used for recycling activity or manufacturing i.e. includes virgin materials, intermediate products and transportation. These standards focus on many aspects of the waste recycling industry from collection and recovery, process of recycling, additional materials use, manufacturing of new products, testing, sampling, pollution emission control, transportation and support service.

Table 1 Waste Recycling and Recycling Standards Applied in Germany

Standards	Germany	Foreign
Waste recycling standards	57	157
Recycling standards	128	469

Source: German Institute for Standardization (Beuth), 2010

To assure good waste management, the Federal Republic of Germany emphasizes avoidance and recovery of resources from waste. The political credo of modern waste policy for Germany is: Avoidance, recycling, environmentally sound disposal (Figure 2). It also promotes industries and businesses to design production systems, products and packaging to reduce waste and allow for recovery (recycling or reuse) as well as environmentally safe disposal. Product responsibility implements both regulatory measures and commitment by the producers and distributors (The Federal Environment Ministry, Federation of Germany, 2003).

Figure 2 Avoidance, Recycling, Environmentally Sound Disposal

Source: The Federal Environment Ministry, Federation of Germany, 2003.

2.3. The United States of America Waste Recycling Standard

The need for good management systems for waste is critical. Environmental disasters such as the incident in Love Canal, New York, (1954 – 1980) required more attention on waste management. The wide spread of pollution generated from waste resulted in environmental damage and impact to human health and livelihood. In response to this, the Congress of USA passed the Solid Waste Disposal Act (SWDA) in 1965. SWDA established a framework for all states to better control the disposal of waste from all sources and set minimum safety requirements for landfill at local settings. However, the SWDA failed to control increasing waste generation. In addition to domestic and solid waste from industry, hazardous waste generated from industries was increasing. More than four million tons of chemicals were produced and synthetic chemicals production was increasing in 1965 (USEPA, 2002). The United States Environmental Protection Agency (USEPA) was formed in 1970 to better handle waste management. Recognizing the failure of the SWDA, which was found to be not strong enough to address the hazards posed by increasing waste generation, the Congress passed the Resource Conservation and Recovery Act (RCRA) on 21st October, 1976. The goals of the RCRA included the following:

- To ensure that waste is managed in a manner that protects human health and the environment;
- To reduce or eliminate, as expeditiously as possible, the amount of waste generated, including hazardous waste; and
- To conserve energy and natural resources through waste recycling and recovery.

The RCRA was intended to depart from the end-of-pipe solutions previously used in the SWDA approach. Federal and state governments work together with basic programs provided by the federal government while the state governments implement the programs according to their needs and strength. The RCRA banned open dumping and provides a comprehensive national program to encourage source reduction, recycling and safe disposal of solid waste. As for hazardous waste, the RCRA mandated very strict requirements for the treatment, storage and disposal of waste to minimize present and future risks.

The USEPA shifted its approaches from a regulatory focus to fewer regulatory and more voluntary actions. These approaches were implemented through the Waste Wise Program, launched in 1994. The waste management hierarchy prioritized reuse, recycle and last disposal of waste. The program cultivated and recruited partners from businesses, tribes, state governments, universities and corporations to reduce waste generation. The aim of the program was to reduce by half the amount of waste generated by 2005. The program emphasized source reduction and environmentally sounds recycling over treatment and disposal (USEPA, 2002). In 2002 there were 1,200 partners who gave their full commitment to reduce waste. Since the enactment of the RCRA, many achievements have been acknowledged thus minimized impact of waste on human health and the environment. Hazardous waste generation has been reduced from nearly 300 million tons to 40 million tons from 1976 to 2002. The recycling program managed to reduce 62 million tons of waste a year from being disposed in landfills. The USA national recycling rate has increased to 28% in 2002.

Waste recycling in USA has achieved a significant target. However, the recycling activities require specific standards for the recyclable materials and intermediate products. There are currently 45 national standards for waste recycling in USA (ANSI, 2010). The USEPA Responsible Recycling (R2) guidelines show the importance of guidelines and standards for electronic waste recycling requirement illustrate support the enforcement of the legislative system for waste management and recycling in USA. The R2 provide waste recycling guideline for electronic waste recycling. The USEPA R2 practices for use in accredited certification programs for electronic recyclers. The purpose of this document is to take a first step in addressing the need for effective and business friendly guidelines. This situation lead to development of a commonly accepted set of R2 practices for the electronics recycling industry. The R2 is a means of verifying if an electronics recycling company is forthright and responsible about how it manages used of end-of-life electronic equipment. At the same time, responsible electronics recyclers want a means of highlighting their values and performance to customers. This includes a process where industry, business and government agency work together to develop and establish electronic waste recycling standards. Moreover, the Consumer Electronics Association (CEA) of US pursues for the need for a national recycling standards that will soon transform businesses and what these changes mean for the consumer electronics industry in the future.

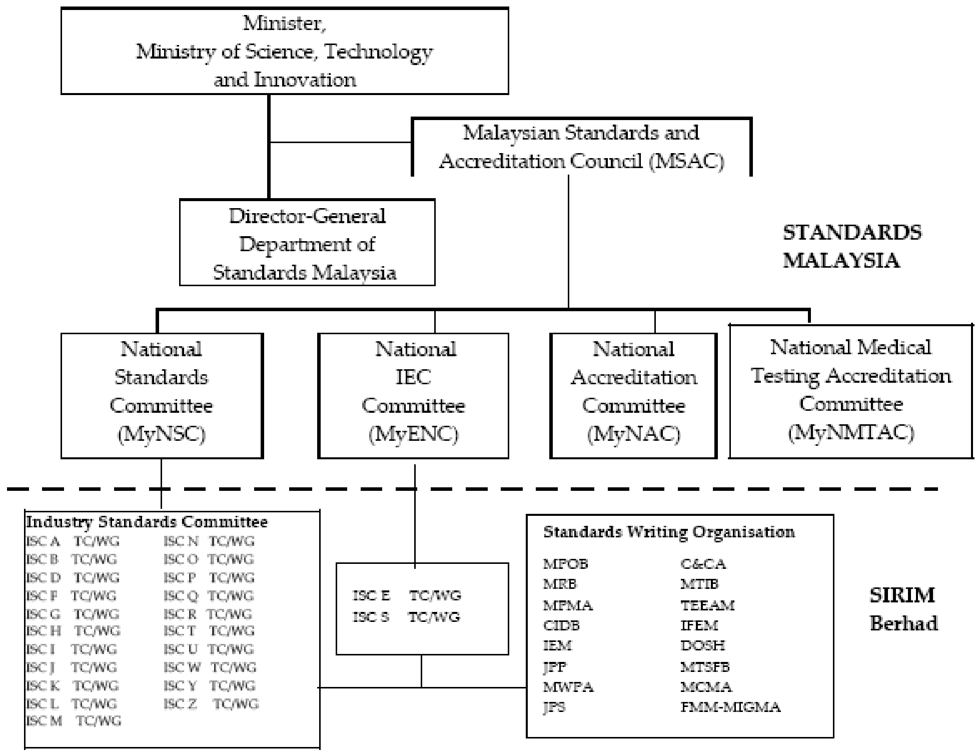
The three case studies shows that in developing and establishing standards for waste recycling industry there is a need to have an institutional system and structure which includes government, research institution, business, industry, recycler and consumers. The institutional system play important role in determining type of standards need to be develop, how it will be implemented and what need to be done in order to enhance the standards for future needs. Example of institutional system and structure is the EUEB of European Union where the eco-label board play important role to determine the best approach in developing and implementing standards. Technology knowledge and development is one of the important factors. Therefore input from industry, business, recycler and research institution help in developing technological information for waste recycling standards. Responds from standards users is critical as to ensure the effectiveness of the standards. Bottom-up approach is an important mechanisms and process for feedback which will ensure the effectiveness of standards application. The mechanisms could be embedded within the institutional system and structure. Here industry, business and consumers input play important role in providing responds towards effective and accepted standards. Countries in the process of developing its national standards must take into consideration on the requirements and development of standards in other country. There should be mechanisms to accommodate the process of converging of standards from other countries for inclusiveness of individual national standards to be easily accepted by many countries e.g. European Union countries.

3. Initiative Towards Development of Standards for Sustainable Industrial Waste Recycling Industry in Malaysia

The need for waste recycling standards has become critical as the industry expands. The industries and businesses as well as the enforcement agencies require standards to ensure effective performance, responsibility, sustainability of industries and environmental protection. In developing such standards, the process needed must be addressed. Malaysian standards development and establishment process is discuss as follows.

Legislative requirements through The Standards of Malaysia Act 1996 (Act 549) is the law which governs matters relating to standardisation and accreditation activities in Malaysia. The Act establishes the Department of Standards Malaysia (STANDARDS MALAYSIA) as the National Standards and Accreditation Body. The Act additionally establishes a Standards and Accreditation Council (MSAC) as the highest body to advise the Minister of Science, Technology and Innovation on standardisation and accreditation. The Council has established four advisory committees on standardisation and accreditation in order to discharge its duties and functions related to standardisation and accreditation in accordance with the provisions of the Act. The four committees are the National Standards Committee (MyNSC), the National Accreditation Committee (MyNAC), the National IEC Committee (MyENC) and the National Medical Testing Accreditation Committee (MyNMTAC). MyNSC and MyENC have established sector based Industry Standards Committees (ISC) to oversee the technical work related to standardisation for the specific sectors. As provided for by the Act, STANDARDS MALAYSIA has appointed SIRIM Berhad as the sole national agency to coordinate standards development activities in Malaysia and to represent Malaysia in international standardisation activities. SIRIM Berhad has in turn appointed other organisations and associations as Standards Writing Organisations (SWO) to assist in the task of developing standards for specifically defined scopes. Figure 3 shows the Malaysian Standards and Accreditation Institutional Structure.

Figure 3 Malaysian Standards and Accreditation Institutional Structure



Source: Department of Standards Malaysia, 2009

The process of developing a Malaysian Standard can be summarised into a four-step process as illustrated in Table 2. Figure 4 below shows the stakeholders involved in the process of developing Malaysian Standards.

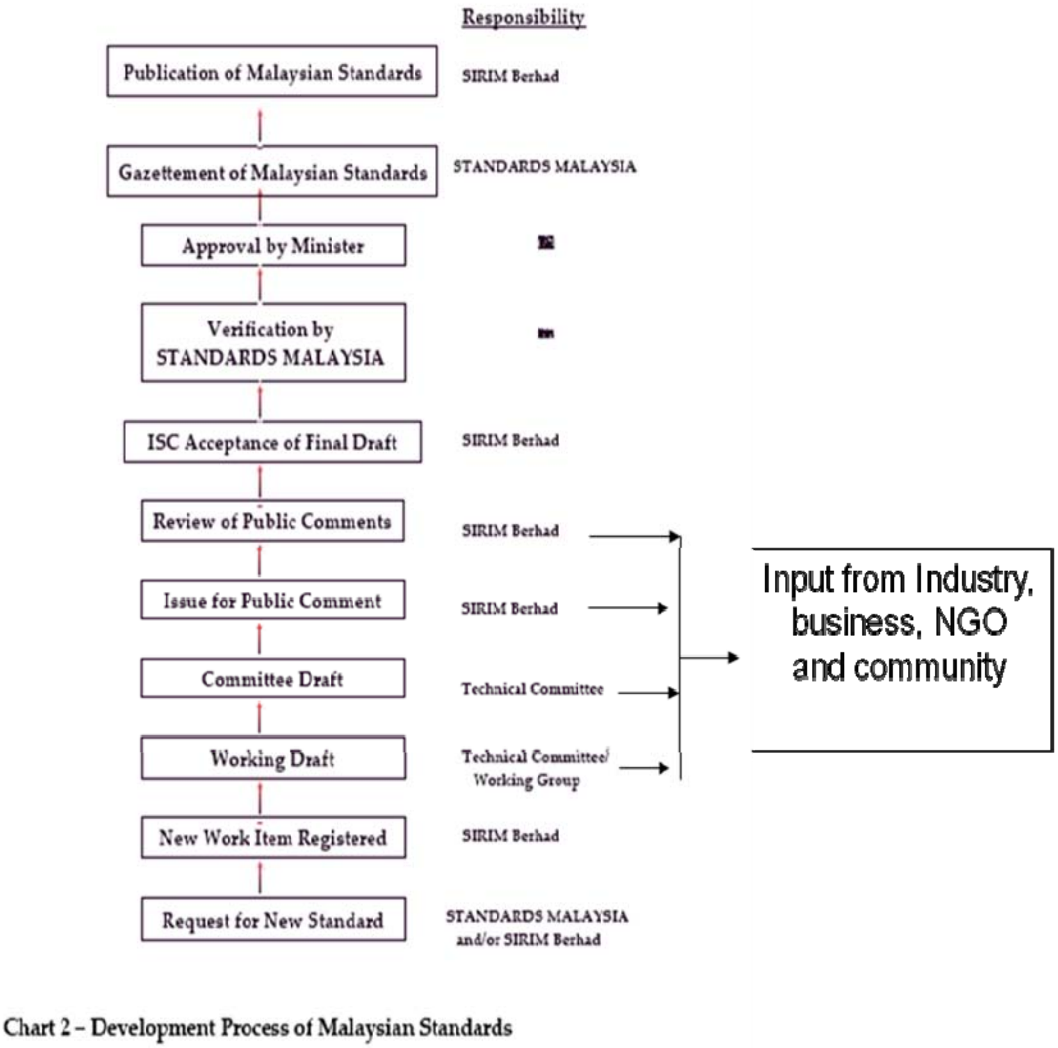
Table 2 Stage and Process for Developing Malaysian Standard

Stage	Process
Proposal stage	The first step in the development of a Malaysian Standard is to confirm that a particular Malaysian Standard is needed. A new work item proposal (NP) is initiated from external and internal (SDCs) requests or from internal reviews including the Periodic Review. The request is then submitted for formal approval by the relevant Industry Standards Committee (ISC). Upon approval of the proposal, the project is assigned to the relevant existing technical committee (TC) or working group (WG), or a new TC or WG may be established to undertake

	the project.
Preparatory stage	Deliberation of a project is carried out by the TC or WG taking into account the operational policies for standard development. Upon finalisation of the draft and consensus is reached within the TC/WG, the Draft Malaysian Standard (DMS) is issued for Public Comment for a period of 60 days. Information regarding DMS for Public Comment is circulated to ministries, government departments, quasi-government bodies, professional or scientific bodies, trade or industrial associations and etc. Upon the closing date of the Public Comment, the DMS is reviewed by the TC or WG to address comments received (if any). All comments are responded to. The DMS incorporating comments received and accepted (if any) during the Public Comment is then finalised for submission to the ISC.
Approval stage	Upon acceptance by the ISC, the Final Draft Malaysian Standard (FDMS) is submitted to STANDARDS MALAYSIA to be forwarded to the Minister of Science, Technology and Innovation for final approval as a Malaysian Standard and gazetted.
Publication stage	Once a Malaysian Standard has been approved, it is sent for publication and listed in the Malaysian Standards Catalogue.

Source: Department of Standards Malaysia, 2009

Figure 4 Development Processes of Malaysian Standards



Source: Modified from Department of Standards Malaysia, 2009

In response to the environmental requirements, Malaysia has established the Eco-Label regime in 2005. SIRIM Malaysia Bhd is the agency responsible in developing and enforcing eco-label. Eco-label plays an important role towards establishment of recycling waste or materials standards in Malaysia. The scheme helps to provide important criteria for recycling of waste in Malaysia. The four eco-labelling criteria identified (on the product, packaging or letterhead) are as follows:

- Environmentally degradable and non-toxic plastic packaging material
- Hazardous metal-free electrical and electronic equipment

- Biodegradable cleaning agents
- Recycled paper

These criteria claim on 18 products.

- Environmentally degradable & non-toxic plastic packaging material
- Hazardous metal-free electrical & electronic equipment component & parts
- Biodegradable cleaning agents
- Recycled paper
- Biofibre composite construction material
- Food-grade lubricants
- Floor mat
- Fabric care product
- Tableware from biomass
- Adhesives
- Water-based adhesives
- Paper-based packaging products
- Organic fertiliser
- Recycled rubber products
- Shampoo
- Shower liquid products
- Solid body soap products
- Recycled plastic products

All of these products with eco-label promote recycling or have information that the products are recyclable after use. However it did not provide any specific standards on how to recycle.

4. Establishing Standards for Waste Recycling in Malaysia

Waste recycling has become an important economic industry in Malaysia. With increasing amount of industrial waste generated daily by domestics and industry, recycling helps to minimize problems related to the need for more land to disposed wastes. With the reduction of natural resource availability, recycling provides alternative resources. This creates opportunities to establish resource recovery for industrial waste. With the Government support through policy, legislation and pro-active role, waste recycling industry will become major industry soon. As of 2004, 55 industrial solid wastes recyclers were licensed by the Ministry of Housing and Local Government Malaysia. While for hazardous wastes, 122 recyclers were licensed by the Department of Environment Malaysia in 2006 to recover the wastes. Estimation made has found that 70% of total industrial solid wastes generated and about 5 to 10% of domestic waste were recovered. Industrial solid wastes recovery increased from 5,405.1 ton/day in 1994 to 8,063.47 ton/day in 2005. Approximately 45.75% of hazardous wastes have been recovered from total wastes generation from 2000 to 2005. Thus increasing trend of wastes recovery observed, from 35% in 2000 to 58% in 2004. Between 2000 to 2005, 1.12 million metric tons of industrial hazardous waste have been recovered (DoE (2001, 2003, 2006)).

With such demand for waste recycling industry the need for industrial waste recycling standards is crucial. Current practice for waste recycling industry is based on demand supply requirement. In Malaysia, waste recycling monitored by the existing legal requirement which focusing more on promotion for waste recycling. Two important legislative are:

- The Solid Waste and Public Cleansing Management Act (SWPCMA) 2007; and
- The Environmental Quality Act 1974, Schedule Waste Regulation 2005.

Specific standards for waste recycling industry in Malaysia are not available and standards for recyclable material and recycled products are not well addressed in the waste minimization plan or strategy in Malaysia. Compliance of standards for recyclable materials happen only for export requirements, adheres to import country standards. With the increasing number of recyclers and materials being recycles the need for waste recycling industry standards are urgently needed. This will guarantee the quality of recyclable materials as demand by consumers. The Standards will play an important role in supporting enforcement of legislation. With establishment of the standards, it will help to ensure fair practice on waste recycling industry. It will also stabilize fair value of recycled goods and will strengthen market and trade mechanism for both local and international. Implementation of the standards will also minimize environmental and human health impact caused by the industry.

Availability of standards for waste recycling industry in Malaysia will help to ensure the sustainability of the industry in the future. However, prior to the development of standards there are many factors that need to be addressed. First, Malaysia needs to have common definition of recyclable materials and intermediate products. The definition is critical as this will ensure effective and acceptable standards for waste recycling industry in the country. In implementing standards, legislative support must also be in place. The existing legislative structure need to be enhanced to include waste recycling industry needs. The recycling industry requires general and specific waste recycling guidelines. Data from technical information of wastes characteristics need to be developed. This database is important to support waste recycling standards maintenance and enhancement. Therefore, valuation or assessment tools of standards for recyclable goods or intermediate products must be identified. The standards also need to be supported by technology development and innovation to understand the processes involve in waste recycling. This should include the handling and transportation of recyclable goods or intermediate products as well as possible impact to the environment and human health. Currently, there are 21 standards that have been established for the recycling industry in Malaysia (Table 3).

Flexibility of standards must be in place. Standards should not start as mandatory; hence voluntary must be the first action to be introduced to the waste recycling industry. It is difficult to make mandatory new standards which are not familiar to the recycling industry in Malaysia. Voluntary process must be supported with awareness and education process to ensure that all key stakeholders in waste recycling industry understand and able to accept the use of the standards. However, as the situation improves and when there is an increasing acceptance and capability of stakeholders, the standards could be enforced as mandatory. Standards for recyclable materials and intermediate products must focus on quality and adhere to specification demanded by industry. The manufacturing and recycling process guidelines will ensure key recycling players to achieve this condition.

Table 3 Malaysian Standards (MS) for Recycling Industry

	MS Number	Title
1	MS ISO 22628:2009	Road vehicles – Recyclability and recoverability – Calculation method (ISO 22628:2002, IDT)
2	MS 2080:2008	Ecolabeling criteria for recycled paper
3	MS 1904:2006	Specification for polyethylene plastics moulding and extrusion materials from recycled post consumer (HDPE) sources.
4	MS 1388 : 1995	Specification for high slag blastfurnace cement.
5	MS 1389 : 1995	Specification for Portland blastfurnace cement.
6	MS 1387 : 1995	Specification for ground granulated blastfurnace slag for use with Portland cement.
7	MS ISO 3037:2008	Corrugated fibreboard – Determination of edgewise crush resistance (unwaxed edge method) (ISO 3037:2007, IDT)
8	MS ISO 3034:2007	Corrugated fibreboard – Determination of thickness (ISO 3034:1975, IDT)
9	MS 1912:2006	Wood-based panels - Fibreboards - – Specification.
10	MS 1786:2005	Woodbased panels – Fibreboard, particleboard and oriented strand board – Terminology (ISO 17064:2004, MOD)
11	MS ISO 13820:2004	Paper, board and corrugated fibreboard – Description and calibration of compression – Testing equipment.
12	MS 398:1976 (CONFIRMED:2004)	Specification for corrugated fibreboard boxes.
13	MS ISO 186:2003	Paper and board – Sampling to determine average quality (ISO 186:2002, IDT)
14	MS ISO 535 : 2001	Paper and board – Determination of water absorptiveness – Cobb method
15	MS 1226 : PART 1 : 1991	Pulverized-fuel ash part 1: Specification for pulverized-fuel ash for use as cementituos component in structural concrete.
16	MS 1494:2000	Specification for billets for hot rolled non-alloyed steel bars and rods

17	MS 1495:2000	Specification for blooms for hot rolled non-alloyed structural steel sections
18	MS 224:2005	Retreaded pneumatic rubber tyres for cars and commercial vehicles – Specification
19	MS 571 : 1991	Specification for ingot tin
20	MS 18:1971	Specification for toilet tissue paper
21	MS ISO 15270:2008	Plastics – Guidelines for the recovery and recycling of plastic waste (ISO 15270:2008, IDT)

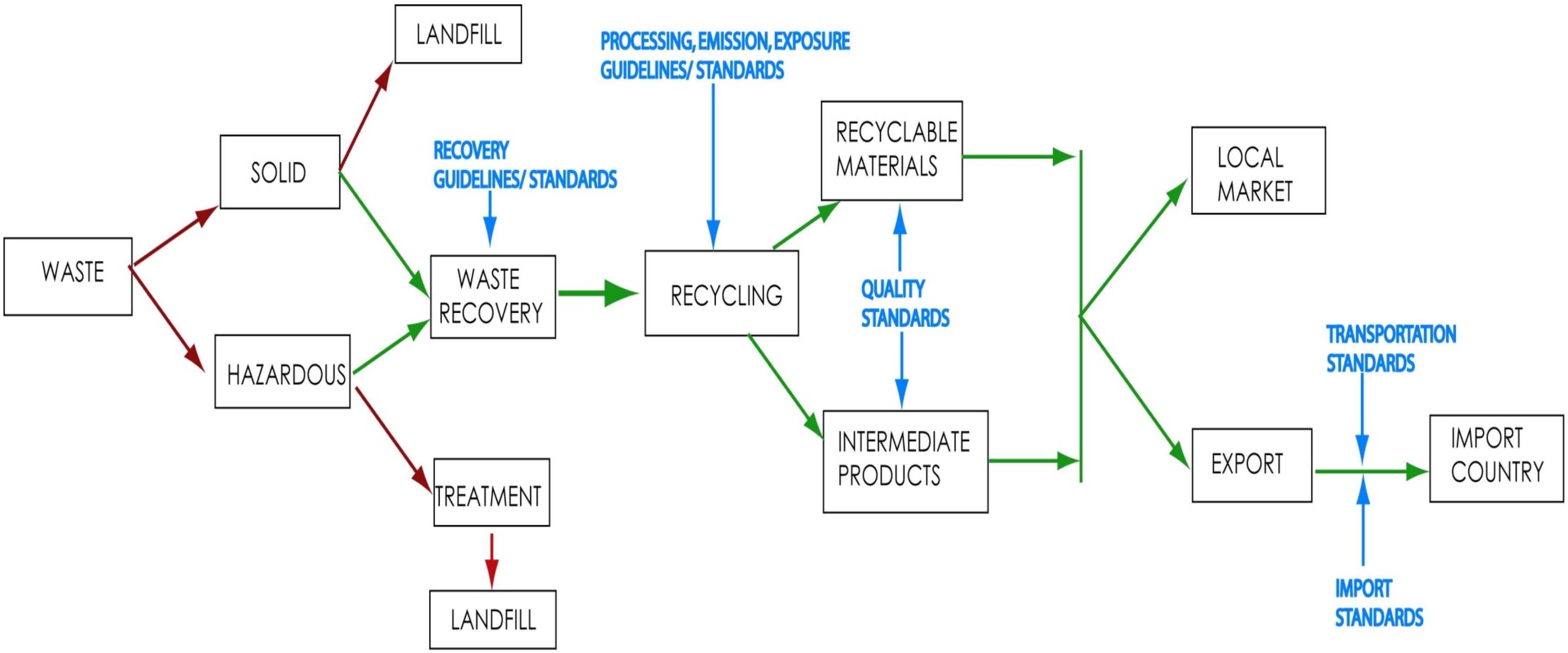
Source: SIRIM, 2009

Inculcating life cycle thinking in manufacturing and recycling process helps to ensure good quality and minimized impact to the environment. Hence, standards for emission or exposure of materials process need not to be established as long as the recycling process complies with the existing country environmental standards. As for the movement of the recyclable materials and intermediate products, the standards for transportation of recycling materials which might be considered as toxic or hazardous materials, must comply with the Basel convention procedures. Figure 5 illustrate how the roles of standards should engage in each process of waste recycling industry in Malaysia. The recovery guidelines and standards determine type of waste suitable for specific recycling purpose. This guidelines and standards must be supported with separation at source methods. As for the recycling process and activity, guidelines and standards must be in place to ensure that the recycling process and activity have minimum impact to the human health and environment which also includes guidelines and standards for emission and exposure. The quality standards are critical as to ensure that the recyclable materials meet the requirements needed by the consumers. Transporting recyclable materials which are considered as hazardous require specific transportation standards. This is important since most of the recyclable materials are export and import products. The standards which monitored the waste recycling industry play important role to ensure that the recyclable materials comply with legal requirements of imported country.

5. Conclusion and Recommendation

Malaysia's waste recycling industry has grown significantly in the past two decades. Demand for greater market of recyclable materials and intermediate products for local and international requires standards to ensure good quality. Hence, the need for standards for sustainable waste recycling industry is crucial. The current practice will need dynamics and flexible standards which are supportive to recycling industry and sustainable development. To ensure that the country's waste recycling industry can penetrate to the international market, there is a need to synchronize Malaysian standards with other countries' standards for easy use or for compliance for recyclable materials and intermediate products to be exported or imported. Thus, the mechanisms and infrastructure for synchronization of standards need to be established. However, the concern for protection of sovereignty especially for local industry against the need for regional and global compliance or safety must also be seriously addressed.

Figure 5 Role of Standards in Waste Recycling Industry in Malaysia



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Acronym

IEC: International Electrotechnical Committee

ISC: Industry Standards Committee

TC: Technical Committee

WG: Working Group

CIDB: Construction Industry Development Board

MPOB: Malaysia Palm Oil Board

JPS: Department of Irrigation and Drainage, Ministry of Natural Resources and Environment

DOSH: Department of Occupational Safety and Health

FMM-MIGMA: Federation Of Malaysian Manufacturers – Malaysian Industrial Gases Manufacturers Group

MCMA: Malaysian Cable Manufacturers Association

MRB: Malaysian Rubber Board

MPMA: Malaysia Plastic Manufacturing Association

IEM: The Institution of Engineers Malaysia

JPP: Department of Sewerage Services

MWPA: Malaysian Wood Preserving Association

C&CA: The Cement & Concrete Association of Malaysia

MTIB: Malaysia Timber Industry Board

TEEAM: The Electrical and Electronics Association of Malaysia

IFEM: The Institution of Fire Engineers (UK) Malaysia Branch

MTFSB: Malaysian Technical Standard Forum Berhad

MCMA: Malaysian Cable Manufacturers Association

CHAPTER 8

Industrial Standard for Recycled Goods in Japan and South East Asian Countries

Michikazu KOJIMA and Vella ATIENZA

1. Introduction

To promote market transaction of recyclable waste, recycled material and recycled goods, various standards have been developed. This chapter reviews the current standards for promoting recycling, especially in industrial standard for recycled goods in Japan and South East Asian Countries. In Section I, the roles of industrial standards for promoting recycling are explained. Section II presents some types of standards related to recycling. Section III reviews the industrial standards for recycled goods. In Section IV, the necessity of action plan to identify the priority of standard development for promoting recycling is emphasized.

2. Roles of Standards for Promoting Recycling

Every stakeholder can make their own quality requirement for input and output. But if there are various standards for the same type of recyclable waste, recycled material and recycled goods, transaction cost between stakeholders becomes expensive. Development of a common standard based on the existing different input and output requirement can help to reduce this cost and can make the operation easier and more efficient.

As mentioned in the previous chapter, standards are developed to assure the quality of goods in the market. In recycling, many stakeholders such as waste generator, recyclable waste collector, intermediate processor, material recycler, producer using recycled material are involved.

The transaction among these stakeholders can become smoother, if standard is provided. For example, the classification of used paper is used as a standard for paper recycling. There are various types of paper (Table 1). If various types of used paper are mixed, it is difficult to produce high quality paper. Used carton paper should be collected separately from other used paper, with some allowable level of mixture of other waste to produce carton paper. The presence of impurities also degrades the quality of paper and causes trouble in processing and production control, which include damage of production facility, increase burden for cleaning, poor appearance of paper and odor adherence to paper.

Oftentimes, consumers hesitate to purchase recycled goods because the quality of recycled goods are not ensured. Thus, the quality standard for recycled goods, with standardization of testing, can make consumers confident in the quality of recycled goods. Standard is also a basis for a smooth market transaction especially among countries. Therefore, to promote international recycling various standards should be developed.

Table 1 Group and Major Grades of Recovered Paper

Group	Major Grade
Hard white shavings; cards	White shavings
	Cream shavings
	Ruled-paper shavings
White woody shavings; white manila	High-grade white wood-containing shavings
	White wood-containing shavings
Fine printed paper	White ledger
	Color ledger
	Wood-free shavings with partial color print
	Coated white shavings
	Polycoated milk carton stock
	Sorted office paper
Woody printed paper	High-grade color-printed wood-containing shavings
	Color-printed wood-containing shavings
	High-grade wood-containing waste
Old newsprint	Old newsprint
Old magazines	Old magazines
Kraft browns	New brown kraft cuttings, unprinted brown kraft
	Used brown kraft sacks
	Kraft lined corrugated container

Old corrugated containers	Corrugated container
	New double-lined kraft corrugated cuttings
Boxboard cuttings	Mill wrapper
	White paperboard cuttings
	Chipboard cuttings (Carton)
	Sorted residential old paper and paperboard

Note: The table is based on the revision in September 2009. Original version was made in March, 1979.

Source: Paper Recycling Promotion Center, "Paper Recycling in Japan," April, 2009. <http://www.prpc.or.jp/menu05/pdf/english-paperrecycling.pdf> (accessed 30 March 2010).

3. Types of Standards for Promoting Recycling

3.1. National Standard and Industry's Voluntary Standard

Standards are made by national standardization organization and industry association. National standard is authorized by governmental agency. Government research institution and industry association organize committees to make a draft of national standard. Draft national report is usually scrutinized by experts, industries and other stakeholders. Based on comments from other stakeholders, draft national standard was amended and approved by government organization.

On the other hand, associations of industries often make their own standard, without approval from governmental organization. Standard developed by associations of industries are basically a voluntary standard.

3.2. Mandatory and Voluntary Standard

National standard can be mandatory or voluntary standard. Mandatory standards should be satisfied by all the concerned products in the market. If not, goods cannot be sold in the country. Voluntary standard is used by producer and consumer in voluntary basis. Producer and consumer are free to sell and buy products which are not satisfying the voluntary standard.

3.3. Import and Export Standard

Recyclable waste, recycled material and recycled goods are not only traded in a country, but also traded internationally. Some countries impose some trade restriction on recyclable waste. Major background of the trade restriction is environmental concerns. Non-recyclable waste may be imported under the name of recyclable waste. Recyclable waste with hazardous substances may cause pollution problem. To prevent negative impact of these said scenarios, trade restrictions such as import ban and prior notice and consent have been introduced by some countries.

To implement the regulation effectively, the standard to clarify regulated material and freely traded material should be developed. Some countries developed the standard for imported and exported recyclable waste.

3.4. Eco-labeling

Eco-labeling is labeling to distinguish environmentally friendly products from other goods. The types of eco-labeling are defined in the International Organization for Standardization (ISO). Type I of Eco-label is defined in ISO 14024, which can be used with certification of third party and satisfaction of multiple criteria, including use of recycled materials. Type II of Eco-label is defined in ISO 14021, which is informative environmental self-declaration claims. Type III is defined in ISO 14025, which is information disclosure of quantified environmental data based on life cycle assessment (LCA).

Some East and Southeast Asian countries introduce eco-labeling scheme, in which recycling is a part of criteria. For example, the Standards and Industrial Research Institute of Malaysia **(**SIRIM), an organization to support standard development in Malaysia, issues criteria for eco-labeling such as Recycled Rubber Products, Paper-based Packaging Products and Recycled Plastics Products.

4. Industrial Standards for Recycled Goods in Japan and Southeast Asian Countries

Japan and South East Asian countries have established some industrial standards for recycled goods in the national standards. This section shows the initial survey on the industrial standards for recycled goods in Japan and selected Southeast Asian Countries. The lists of industrial standards are compiled, based on the internet search of websites of standardization body in each country. It should be noted that further investigation is needed to verify the content of each standard to identify the characteristics of each standard.

It can be observed that some items are also listed in international standardization body, such as ISO and the International Electrotechnical Commission (IEC).

4.1. Japan

According to data submitted to Environment and Resource Circulation Committee in Industrial Structure Council, 83 standards have been established until 2006. Some standard deals recycled products and goods made from virgin resources together.

Table 2 Selected Japan Industrial Standards (JIS) for Promoting Recycling

JIS Number	Name of Standard	Content
JIS A5021	Melt-solidified slag aggregate for concrete derived from municipal solid waste and sewage sludge	Quality standard and maximum leachate level
JIS H2109	Classification standard of copper and copper alloy scraps	Classification
JIS R5214	Ecocement	Cement made from ash generated in municipal solid waste generator
JIS K6999	Plastics – Generic identification and marking of plastics products	Mark for plastic products to identify the type of plastics.
JIS P8231	Recycled pulp – Estimation of stickies and plastics – Image analysis method	Identify stikies and plastics in recovered pulp.
JIS Z7302-1	Densified refuse derived fuel (RDF)– Part 1 General principles of testing method	General principles of testing methods for RDF

Source: Compiled from various sources.

4.2. Philippines

Bureau of Product Standards (BPS) is a governmental agency under the Department of Trade and Industry (DTI), established by Republic Act No. 4109 (Philippine Standardization Law) and Executive Order No. 133. As the National Standards Body, BPS is mandated to develop, implement, and coordinate standardization activities in the Philippines. It is primarily involved in standards development, product certification, and standards implementation and promotion to raise the quality and global competitiveness of Philippine products at the same time to protect the interests of consumers and businesses (BPS-DTI 2009). Philippine National Standard (PNS) is the name of national standard in the Philippines.

Table 3 Philippine National Standard for Promoting Recycling

Standard Designation Number	Title
PNS IEC 60335-2-104:2006	Safety of household and similar electrical appliances - Part 2-104: Particular requirements for appliances to recover and/or recycle refrigerant from air conditioning and refrigeration equipment
PNS ISO 15360-2:2002	Recycled pulps - Estimation of stickies and plastics -Part 2: Image analysis method
PNS 1269:1995	Pin adhesion test of corrugated fibreboard
PNS ISO 12460-4:2009	Wood-based panels - Determination of formaldehyde release - Part 4: Desiccator method
PNS 1894:1999	Particle boards - Definition and classification
PNS 230:1989	Particle boards - Specification
PNS ISO 9425:0000	Wood-based panels - Determination of moisture content
PNS ISO 9426-1:0000	Wood-based panels -Determination of dimensions - Part 1: Determination of thickness, width and length
PNS 63:2006	Blended hydraulic cement with pozzolan - Specification
PNS 69:2005	Blended hydraulic cement with slag - Specification
PNS 115:1987	Fly ash for use in concrete - Specification
PNS 749:1992	Cement - Fly ash or natural pozzolan for use as a mineral admixture in Portland cement concrete - Sampling and method of test
PNS ASTM A 593:2004	Standard specification for fly ash and other pozzolans for use with lime

PNS ASTM A 618:2004	Standard specification for coal fly ash and raw or calcinated natural pozzolan for use as a mineral admixture in concrete
PNS ASTM C 618:2003	Standard specification for coal fly ash and raw or calcined natural pozzolan for use as a mineral admixture in concrete
PNS ASTM C 618:2004	Standard specification for coal fly ash and raw or calcined natural pozzolan for use in concrete
PNS 211:2000	Rerolled steel bars for concrete reinforcement - Specification
PNS 211:2002	Rerolled steel bars for concrete reinforcement - Specification
PNS 555:1991	Retreading pneumatic tires - Specification
PNS 1065:2006	Compounded rubber for retread and repair - Specification
PNS ISO 11650:2005	Performance of refrigerant recovery and/or recycling
PNS 73:1997	Paper, board and pulps - Toilet tissue paper - Specification

Source: Bureau of Product Standards- Department of Trade and Industry (BPS-DTI). 2009. "Philippine National Standard (PNS) Catalog." <http://www.bps.dti.gov.ph> (accessed 28 October 2009).

Philippines utilizes the American Society for Testing and Materials (ASTM) standards in addition to ISO standards.

4.3. Vietnam

Directorate for Standards, Metrology and Quality (STAMEQ) is the national standards body of Vietnam. It is attached to the Ministry of Science and Technology, which performs the function of State management over standardization, metrology as well as product and goods quality according to law provisions (STAMEQ 2009). Vietnamese National Standards (TCVN) is the name of standard.

Table 4. Vietnam National Standard for Promoting Recycling

TCVN number	Title
TCVN 4316 2007	Portland blast furnace slag cement
TCVN 4315 2007	Granulated blast furnace slag for cement production
TCVN 4033 1995	Portland puzzolan cement – Technical requirements
TCVN 6260 1997	Combined portland cement
TCVN 6882 2001	Mineral admixture for cement
TCXDVN 395:2007	Mineral admixtures for roller-compacted concrete
T4 TCN 114 2001	Cement and additives in irrigational construction.
TCVN 7712 2007	Low heat blended portland cement
TCVN 7711 2007	Sulfate resistance blended portland cement
TCVN 5946 2007	Waste paper
TCVN 7342 2004	Carbon steel scrap used as charge material for ordinary carbon steel making – classification and technical requirements

Source: Vietnam TCVN Brochures.

4.4. Thailand

Thai Industrial Standards Institute (TISI) was established in the Ministry of Industry as the national standards body of Thailand. It is tasked to develop national standards and monitor quality of products and services in accordance with the requirements and international practices, to develop community product standards and provide certification service, to promote and develop national standardization activities, to cooperate with foreign standardization organizations both bilateral and multilateral levels, and to provide information on standardization (TISI 2009). Thai Commodity Product Standard (TCPS) is the name of the national standard.

Table 5. Thai Commodity Product Standard for Promoting Recycling

TCPS Number	Title
809/2548	Recycled paper
627/2547	Ash glazed porcelain
441/2547	Coconut fibre broom
782/2548	Coconut fibre mattress
77/2546	Corn husk doll
433/2547	Corn husk paper
437/2547	Corn husk paper products
229/2547	Elephant dung paper
230/2547	Elephant dung paper products
440/2547	Palm fibre broom
186/2546	Palm fibre products
411/2547	Palm fruit shell products
428/2547	Paper-mache products
650/2547	Products made from recycled paper
581/2547	Products made from recycled paper coated with resin
636/2547	Products made from used spare parts
823/2548	Products made from waste

Source: Thai Industrial Standards Institute (TISI). 2009. "Thai Community Product Standards," <http://www.library.tisi.go.th> *(accessed 30 October 2009).*

4.5. Malaysia

Standards and Industrial Research Institute of Malaysia (SIRIM) is a wholly-owned company of the Malaysian Government under the Minister of Finance Incorporated. It was registered on 15 November 1995, and in full operation as a corporate entity on 1 September 1996.

Since then, it has successfully delivered its role as the national agency for industrial development (SIRIM Berhad 2009). Malaysian Standards (MS) is the name of national standards in Malaysia.

Table 6. Malaysian Standards for Promoting Recycling

MS Number	Title
MS ISO 22628:2009	Road Vehicles – Recyclability and Recoverability – Calculation Method
MS 2080:2008	Ecolabeling Criteria for Recycled Papper
MS 1904:2006	Specification for Polyethylene Plastics Moulding and Extrusion Materials from Recycled Post –Consumer (HDPE) Sources
MS 1388 : 1995	Specification for High Slag Blastfurnace Cement
MS 1389 : 1995	Specification for Portland Blastfurnace Cement
MS 1387 : 1995	Specification for Ground Granulated Blastfurnace Slag for Use with Portland Cement
MS ISO 3037:2008	Corrugated Fiberboard – Determination of Edgewise Crush Resistance (Unwaxed Edge Method)
MS ISO 3034:2007	Corrugated Fiberboard – Determination of Thickness
MS 1912:2006	Wood-Based Panels - Fibreboards - Specification
MS 1786:2005	Wood-Based Panels - Fibreboard, Particleboard and Oriented Strand Board - Terminology
MS ISO 13820:2004	Paper, Board and Corrugated Fibreboard – Description and Calibration of Compression – Testing Equipment
MS 398:1976 : 2004	Specification for Corrugated Fibreboard Boxes
MS ISO 186:2003	Paper and Board – Sampling to Determine Average Quality
MS ISO 535 : 2001	Paper and Board – Determination of Water Absorptiveness – Cobb Method
MS 1226 : PART 1 :	Pulverized –Fuel Ash Part 1 : Specification for Pulverized-Fuel Asha

1991	for Use as a Cementitious Component in Structural Concrete
MS 1494:2000	Specification for Billets for Hot Rolled Non-Alloyed Steel Bars and Rods
MS 1495:2000	Specification for Blooms for Hot Rolled Non-Alloyed Structural Steel Sections
MS 224:2005	Retreaded Pneumatic Rubber Tyres for Passenger Cars and Commercial Vehicles - Specification
MS 571 : 1991	Specification for Ingot Tin
MS 18:1971	Specification for Toilet Tissue Paper
MS ISO 15270:2008	Plastics – Guidelines for the Recovery and Recycling of Plastics Waste

Source: SIRIM Berhad 2009. "Malaysian Standards (MS) Online," <http://www.msonline.gov.my/msonline> (accessed 2 November 2009).

4.6. Singapore

SPRING Singapore is the national standards and accreditation body. SPRING develops and promotes internationally-recognized standards and quality assurance to enhance competitiveness and facilitate trade. It is the enterprise development agency for growing innovative companies and fostering a competitive SME sector. They work with partners to help enterprises in financing, capabilities and management development, technology and innovation, and access to markets. Singapore Standards (SS) is the name of the national standard, which is a nationally recognized documents established by consensus. They are functional or technical requirements in the form of specifications for materials, product system or process, codes of practice, methods of test, terminologies, guides etc. (SPRING Singapore 2009).

Table 7. Singapore Standards for Promoting Recycling

SS Number	Title
SS EN 12620: 2008	Specification for aggregates for concrete
SS EN 15167 - 1 : 2008	Ground granulated blast furnace slag for use in concrete, mortar and grout - Definitions, specifications and conformity criteria
SS EN 15167 - 2 : 2008	Ground granulated blast furnace slag for use in concrete, mortar and grout - Conformity evaluation
SS 476 : 2000	High slag blastfurnace cement
SS 477 : 2000	Portland blastfurnace cements
SS 397 - 2 : 1997	Methods of testing cement - Chemical analysis of cement
SS 397 - 21 : 1997	Methods of testing cement - Determination of the chloride, carbon dioxide and alkali content of cement
SS 321 : 1987	Corrugated fibreboard containers for general purposes
SS ISO 15270 : 2008	Plastics -- Guidelines for the recovery and recycling of plastics waste

Source: SPRING Singapore. "Singapore Standards (SS) eShop," <http://www.spring.gov.sg> (accessed 30 October 2009).

4.7. Indonesia

Badan Standardisasi Nasional (BSN) or National Standardization Agency of Indonesia is a non-departmental government institution with main responsibility to develop and conduct standardization activities in Indonesia. The implementation of standardization within the national scope is carried out to build a national system that will be able to support, increase, and guarantee product's quality and/or services as well as to facilitate national products acceptance in global market transactions. Indonesian National Standard (SNI) is the only standard nationally applicable in Indonesia. SNI was formulated by the Technical Committee and defined by BSN. As a national standard for Indonesia, it envisions to reinforce national competitiveness, improve market transparency and efficiency, and protect consumer safety, public health, environment conservation and safety (BSN 2009).

Table 8 Indonesia National Standard for Promoting Recycling

SNI Number	Title
SNI 15-3781-1995	Abrasive slag for blasting process
SNI 03-2105-2006	Particle board
SNI 01-4449-2006	Fibre boards
SNI 15-3500-2004	Mixed cement
SNI 03-6863-2002	Methods of sampling and testing for fly ash or raw pozzolan as a mineral admixture in portland cement concrete
SNI 03-6468-2000	Methods for planning of high-strength concrete mixture with portland cement and fly ash
SNI 06-3768-1995	Retreading of tyres passenger cars and commercial vehicles
SNI 19-7188.1.1-2006	Ecolabelling criteria - Part 1: Category of paper products - Section 1: Wrapping paper
SNI 19-7188.1.2-2006	Ecolabelling criteria - Part 1: Category of paper products - Section 2: Sanitary tissue

Source: BSN 2009. "Standard National Indonesia," <http://www.bsn.go.id> (accessed 28 October 2009).

5. International Industrial Standard on Recycling

List of industrial standards in Japan and Southeast Asia refer some international standard made by ISO and IEC. International standard is a base for economic integration. International recycling is promoted by standardizing recyclable waste, recycled materials and recycled goods.

Table 9 International Industrial Standard for Promoting Recyling

Code	Name	Country
ISO 15360-2:2002	Recycled pulps -Estimation of stickies and plastics - Part 2: Image analysis method	Philippines
ISO 12460-4	Wood-based panels - Determination of formaldehyde release - Part 4: Desiccator method	Philippines
ISO 11650:2005	Performance of refrigerant recovery and/or recycling	Philippines
ISO 15270:2008	Plastic – Guidelines for the recovery and recycling of plastics waste	Malaysia, Singapore
ISO 22628:2002	Road vehicles – Recyclability and recoverability – calculation method	Malaysia
IEC 60335-2-104:2006	Safety of household and similar electrical appliances - Part 2-104: Particular requirements for appliances to recover and/or recycle refrigerant from air conditioning and refrigeration equipment	Philippines

6. Action Plan for Establishing Industrial Standards for Promoting Recycling

Japan has speeded up the establishment of a Sound Material-Cycle Society in the latter half of 1990s. After some new recycling technologies were developed and new recycling regulation was introduced, the Japanese Industrial Standards Committee developed an Action Program for Promoting Formulation of Environmental JIS in 2000. The committee consists of experts from universities and research institutes and representatives from industrial associations and consumer unions. The Action Program covers standards related to various environmental issues including recycling such as testing method of RDF, oil made by thermal treatment of waste plastics and testing method for recycled construction materials. Some of the items specified in the Action Program have been requested by local governments which wished to promote the use of recycled products in their green procurement program. One of the obstacles to the use or acceptance of recycled products was the fact that there was no clear standards existed to ensure the quality of these products. After JIS for recycled products was established, government could easily schedule the recycled products in their procurement tender and contract. The action plan was submitted to related technical working groups, which develop draft of industrial standard.

On the other hand, in Southeast Asian countries, action plan nor program to establish industrial standard for recycled goods was not observed. To mobilize the resource to establish such industrial standard, each country should make action plan which prioritize future industrial standard for recyclable waste, recycled material and recycled goods.

The effort to establish industrial standard for promoting recycling should be linked with R&D activities in recycling technology and newly developed recycling technology. For example, Japan made industrial standard for ecocement in 2003, after the demonstration project in 1995 plant and operation in 2001.

7. Conclusion

This paper reviews industrial standard for recyclable waste, recycled materials and recycled goods in Japan and selected Southeast Asian Countries. Each Southeast Asian country has some industrial standards for recycled materials and goods. Compared to Japan, the number of industrial standard for promoting recycling is limited. Japan has speeded up the standardization for promoting recycling since 2000, based on the action plan made by expert committees. This paper recommends to Southeast Asian countries that similar action plan should be developed.

Some countries also made standard along with international standard such as ISO. From the view point of promoting recycling internationally, international standard should be developed further. It may be beneficial to prioritize some standard for promoting recycling in Southeast Asia, to develop common standard and to propose the standard in ISO.

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CHAPTER 9

Design of E-waste Recycling Indicators in East Asia

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1. Introduction

Until this time, considerable research has been carried out on the issue of e-waste recycling performance in East Asia which has implemented the Extended Producer Responsibility (EPR) policies (Tasaki Tomohiro 2006; Chung 2008; Lihchyi Wen et al. 2009). Recently, many developing Asian countries have actively begun preparing the introduction of EPR-based policy to effectively tackle the current e-waste-related policy challenges.

However, most research does not pay sufficient attention to the fact that the definition of “recycling” and the actual implementation of recycling-related indicators differ substantially throughout East Asia. In consequence, this leads to the difficulty of elucidating substantial policy implications from the individual policy experiences of each of the advanced countries of East Asia.

In this paper, the authors present a brief review of the legal situation and compare the recycling-related indicators in East Asia, specifically Japan, Korea, and Taiwan. In section 2, the features of the e-waste recycling system designs in Japan, Korea, and Taiwan are provided. Section 3 compares e-waste recycling indicators which are designed to evaluate the recycling performance in their respective recycling systems. In addition, the issue of formulating domestic regulation is discussed in relation to the global reuse and recycling of e-waste as well. The authors hope that the result of this study will be used as reference material for countries which are interested to introduce EPR-based policies in order to manage e-waste more effectively.

2. System Designing on E-waste Recycling in East Asia

2.1 Japan

In Japan, municipalities demanded that e-waste discharged from households should be designated as "goods difficult to treat properly" (*Shori konnan butsu* in Japanese) in the 1970s. At that time most municipalities resorted to landfill treatment because they did not have sufficient facilities for proper e-waste recycling, which only caused the landfill situation to worsen.

In this context, Japan implemented the Law for Recycling Specified Home Appliances (RHA) as an EPR-based law for managing e-waste in 2001. Under the RHA, municipalities are no longer responsible for e-waste collection and recycling. In their place, manufacturers have come to play a major role in e-waste management in Japan. In this respect, Japan's RHA is marked by the transfer of the responsibility for -waste from the municipalities to the manufacturers.

According to the RHA, consumers have to pay a fee for the transportation and recycling to the retailers and manufacturers respectively when they discharge e-waste such as TV sets (braun tube/ liquid crystal/ plasma), refrigerators (including freezers), air conditioners and washing machines. The recycling fee ranges from 1,700 yen (kindly provide also the equivalent in USD) (TV sets under 25 inches) to 3,600 yen (refrigerators). Retailers are obliged to take back e-waste upon the request of consumers. With the transportation fee paid by consumers, retailers should transport e-waste to the manufacturer-furnished collection sites. It is a violation of the RHA if retailers dispose of e-waste for which the recycling fee has been paid.

Under the provision of the RHA, manufacturers must recycle all e-waste transported to collection sites. However, manufacturers do not have any compulsory target for e-waste collection. This can mean that Japan's manufacturers can fulfill their legal obligation by recycling only e-waste transported by retailers. In this regard, Japan's manufacturers do not have a strong incentive to increase the collection and recycling of e-waste. In addition, manufacturers should clear Recycling Standards Rates (RSR) which is required per unit level. These rates are: 50-55% for TV sets (50% for liquid crystal and plasma TV sets and 55% for Braun tube TV sets), 60% for refrigerators (freezers), 70% for air conditioners and 65% for washing machines on the basis of weight.

Based on its interpretation of the EPR principle, Japan places physical responsibility on manufacturers and financial responsibility on consumers separately for e-waste recycling. This reflects the fact that when it comes to the cost sharing, the mode of payment and ease of fee collection are essential elements to be considered (FLMS 2000).

2.2 Korea

Strongly influenced by the Organization for Economic Co-operation and Development (OECD)'s Government Manual on the implementation of EPR principle, Korea started implementing the EPR-based law by revising the Recycling Act of 2003. This act comprehensively regulates 18 items out in 7 categories including packaging and products, e-waste representing one category. In 2008, the Law on Resource Circulation of Waste of Electrical and Electronic Equipment and End of Life Vehicles (LEV) was enacted for e-waste and end of life vehicles considering both of them to be durable goods. There are 10 e-waste items covered under the LEV (TV sets, refrigerators, air conditioners, washing machines, personal computers, mobile phones, audio equipment, printers, copy machines, and fax machines).

Under the LEV, consumers can discharge e-waste by means of turning it for free to the dealers when they purchase a new home appliance. Manufacturers have a compulsory target for e-waste collection, which is calculated on the basis of a mandatory collection rate (MCR). MCR is announced by the Ministry of Environment (MOE) on an annual basis who considers current recycling performance, the amount of import and export, and the recycling capacity in Korea. In addition, the average weight of e-waste collected in the previous year (kg) and shipment of the target year (unit) are also taken into consideration to compute the exact amount of e-waste collection. A manufacturer's collection target is calculated by multiplication of MCR, the average weight of the e-waste, and the amount of shipment. In the event that the manufacturers do not meet the collection target, they are obliged to pay a recycling charge for the unfulfilled e-waste collection and surcharge in proportion to the unperformed collection target.

As for setting the target amount of collection by manufactures, the MOE promotes increasing e-waste collection under the LEV by announcing mid-to long-term goals in 2012. The goals in 2012 are from 1.7 times to 2.0 times higher than those of 2005. However, Korea's manufacturers do not have a compulsory target for e-waste recycling, which is significantly different than in Japan. In this respect, Korea's LEV puts higher value on increasing the amount of e-waste collected by manufacturers rather than the proper treatment of e-waste. For example, proper treatment of Chloro-Flouro-Carbon (CFC) in refrigerator was not required until 2009. In addition, manufacturers need to clear the Reuse and Recycling Rates (RRR) which correspond to the RSR of Japan. These rates are: 65% for TV sets and personal computers, 70% for refrigerators, audio equipments, and mobile phones, 75% for printers, copy machines, and fax machines, and 80% for air conditioners and washing machines on the basis of weight.

In the meantime, municipalities dissimilar to those in Japan still collect and recycle considerable amounts of e-waste discharged by households. The e-waste in this case is treated as municipal wastes under the Waste Management Law (WML). However, because in reality most municipalities do not have facilities sufficient to properly treat e-waste, recovery of recyclable resources and proper treatment of e-waste are not guaranteed (Chung 2008).

2.3 Taiwan

In Taiwan, the EPR-based Waste Disposal Law (WDL) was enacted in 1998 against a background of environmental pollution caused by mixed metal scrappers in the 1980s. They burned non-metal parts or refined metals with hazardous chemicals to extract metals, which led to water and soil pollutions by heavy metals. Furthermore, burning mixed metals in the fields contaminated the air. In the late of 1980s, even though mixed metal scrappers were managed by limiting their locations to two areas, environmental pollution did not cease and incessantly repeated, which water pollution expanded to the neighboring sea (Terao 2008).

As a government-led recycling scheme to prevent environmental pollution, the Recycling Fund Management Committee (RFMC) was established on the basis of WDL. Under the RFMC system, manufacturers assume only financial responsibility for e-waste recycling. The specific amounts of the recycling fees are determined by the Fee Rate Reviewing Committee (FRRC), which is composed of representatives of government, academia, consumer groups, and manufacturers. The recycling fees, which are managed by RFMC, are diverted as a subsidy to the commercial recycling companies which carry out proper recycling of e-waste. In order for them to obtain a subsidy, commercial recycling companies must be registered with the Environmental Protection Administration (EPA) and their recycling performances must also be monitored by a public auditing institute. These regulations signify that commercial recycling companies should compare the merits (obtaining subsidy) and demerits (taking environmental measures) when it comes to becoming registered recyclers under the RFMC system.

As for e-waste recycling, registered recyclers do not have any compulsory target for collection. However, it can be said that they have a target for e-waste recycling in that they are subsidized by the EPA only for the e-waste they recycle, which is quite different than in Korea. In addition, registered recyclers need to clear the Compulsory Recycling Rates (CRR) which is required per unit level. These rates are 70% for all covered items since 2007. Using the criteria of Japan or Korea, RFMC handles approximately 7 items. Unique to the policy of Taiwan, separate subsidies are set for each 5 parts of computers (main bodies, monitors, liquid crystal monitor, mother board, and note book computers), the purpose of which is to make sure they are treated properly.

In Taiwan, it is not common for consumers to discharge e-waste to the retailers or manufacturers because e-waste usually has some value. Registered recyclers normally purchase e-waste from collection firms which buy these items from households. In this respect, the recycling system of Taiwan does not pay attention to the collection and transportation stage but concentrates on the recycling stage which has a high probability of bringing about heavy environmental impact.

2.4 Summary

Japan, Korea, and Taiwan, have enacted EPR-based policies to effectively manage e-waste by considering their own policy backgrounds. Historic policy of differences and region-specific problems have caused them to establish characteristic e-waste recycling systems, differing particularly in which items are covered and how to set indicators for recycling performance.

Firstly, with regards to coverage: 4 items are managed in Japan, 10 in Korea, and about 7 in Taiwan by their respective EPR-based laws. However, it is quite hard to determine the exact number of covered items because these three systems utilize different ways of counting the items (Table 1).

As for TV sets, there are three types which are explicitly provisioned for as one of the covered items in Japan, and accordingly for all of them the respective RSR is required. In contrast, Korea's LEV does not specify types of TV sets. This can be understood from Korea's quantification-centered approach to imposing compulsory collection targets on manufacturers for the management of e-waste recycling. Only CRT and liquid crystal TV sets are included in Taiwan's RFMC system.

A variety of approaches to managing used computers are employed in these three systems. In Japan, used computers are regulated by the Law for the Promotion of Effectiveness in the Utilization of Resources (PUR), which collection and recycling system were developed by manufacturers themselves. Under PUR, retailers do not have any responsibility to take back used computers from consumers. In Japan, it is rare for retailers to deliver a new computer to the purchaser's home. This is also a major reason why specific waste home appliances and waste computers are managed by separate laws. In Korea, personal computers accounts for one of 10 covered items. By comparison, as the authors mentioned in the former section, computers management is divided into 5 parts in Taiwan. Additionally, liquid crystal monitors and computer keyboards were added in 2007.

Unlike TV sets and computers, audio equipment, mobile phones, copy machines, and fax machines are controlled only under the LEV in Korea. Printers are commonly covered items in Korea and Taiwan. Electric fans were new items included in 2007 under the RFMC system in Taiwan.

Table1 Covered Items under the EPR-based Policy in Japan, Korea, and Taiwan

		Japan	Korea	Taiwan
TV sets	Braun tube	○	○ (TV sets)	○
	Liquid crystal	○		○
	Plasma	○		×
Refrigerators	Refrigerator	○	○	○
	Freezer	○	×	×
Air conditioners		○	○	○
Washing machines	Washing machines	○	○ (only for household)	○
	Clothing dryer	○	×	×
Computers	Main body	Managed by Law for the Promotion of Effectiveness Utilization of Resources	PCs (including monitors and keyboards)	○
	CRT Monitor			○
	Liquid crystal monitor			○
	Notebook			○
	Mother board			○
Audio equipments		×	○(excluding portable)	×
Mobile phones		×	○(including battery and charger)	×
Copy machines		×	○	×
Printers		×	○	○
Fax machines		×	○	×
Electric fans		×	×	○
Total		4 items	10 items	About 7 items

Secondly, it has been pointed out that there are significant differences in the details of recycling indicators in these three systems (Table 2). Japan and Taiwan have in common that they put much emphasis on quantitative recycling targets when it comes to e-waste collection. However, they place manufacturers and registered recyclers respectively as the main actors in e-waste management. In contrast, Korea sets collection targets as the main policy goal, which should be cleared by manufacturers.

As for qualitative recycling indicators, all three systems set up their own indicator to evaluate the quality of e-waste recycling. However, full attention should be paid to the fact that the details of quality-side recycling targets in the respective systems indicate substantially different things. Grasping the similarities and differences between recycling indicators is essential because they may be a decisive clue in comprehending the fundamental aspects of the e-waste recycling system in East Asia. The authors provide the details of the respective qualitative recycling indicators in the next section.

Table2 Details of Recycling Indicators in East Asia

	Recycling Indicators		
	Collection target	Recycling target	
	Quantity	Quantity	Quality
Japan	×	? (Manufacturers)	? (Manufacturers)
Korea	? (Manufacturers)	×	? (Manufacturers)
Taiwan	×	? (Registered recyclers)	? (Registered recyclers)

Source: Compiled by the authors

3. Comparison of Recycling Indicators in East Asia

3.1 Japan

3.1.1 Recycling Standards Rates in Practice

As mentioned in the former section, Japan has adopted the RSR as the indicator with which to evaluate qualitatively the recycling of e-waste. As a supplement indicator to RSR, RSR etc. was also laid down in the RHA. While RSR only includes material recycling, RSR etc. is a more comprehensive indicator in that it includes material recycling and thermal recovery. In reality, clearing the RSR is a stricter standard than RSR etc. in terms of e-waste recycling because the same degree of recycling is required for each of them. The concrete rates for the RSR and RSR etc. for the 4 covered items are illustrated in the Table 3.

Since April of 2009, new targets of RSR and RSR etc. have been imposed on manufacturers. This is a reflection of improvement in recycling technology and the increasing amount of waste plastic recycled against the price hike of resources at the global level (AEHA 2009). The main change is a new target ratio for TV sets (liquid crystal and plasma). As for the Braun tube type of TV set, no increase in the RSR and RSR etc. is apparent, which is affected by decreasing demand for recycled glass cullet from TV sets and technological difficulties in directing it toward other usage. For the remaining 3 items with the exception of TVs, higher target in RSR and RSR etc. than before April 2009 are required.

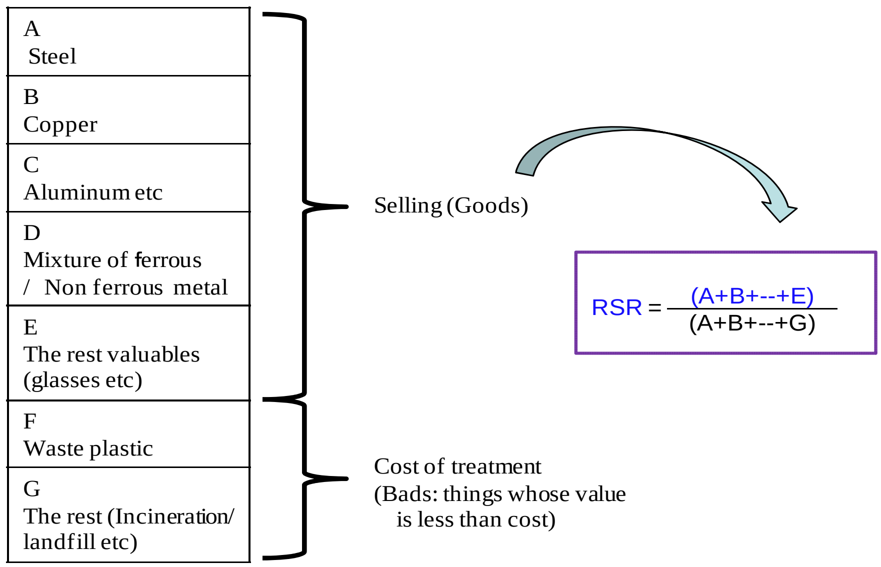
Table 3 The Target Ratio of Recycling Standards Rates and Recycling Standards Rates etc. in Japan

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="2">Before April. 2009</th><th colspan="2">After April. 2009</th></tr>
<tr><th>Recycling Standards Rates</th><th>Recycling Standards Rates etc.</th><th>Recycling Standards Rates</th><th>Recycling Standards Rates etc.</th></tr>
<tr><td rowspan="2">TV sets</td><td>Braun tube</td><td>55%</td><td>55%</td><td>55%</td><td>55%</td></tr>
<tr><td>Liquid crystal/ Plasma</td><td>–</td><td>-</td><td>50%</td><td>50%</td></tr>
<tr><td rowspan="2">Refrigerators</td><td>Refrigerators</td><td rowspan="2">50%</td><td rowspan="2">50%</td><td rowspan="2">60%</td><td rowspan="2">60%</td></tr>
<tr><td>Freezers</td></tr>
<tr><td colspan="2">Air conditioners</td><td>60%</td><td>60%</td><td>70%</td><td>70%</td></tr>
<tr><td colspan="2">Washing machines</td><td>50%</td><td>50%</td><td>65%</td><td>65%</td></tr>
</table>

However, regarding the issue of recognition of RSR and RSR etc., special attention should be paid to the definition of RSR. On the basis of the Waste Treatment Law (WTL), only recycled materials being sold or taken back free of charge are counted as being legally recycled in Japan. The RSR in practice is provided in case of TV sets. However this does not reflect the real recycling situation but shows imaginary situation for the purpose of comprehension and speculation.

According to figure 1, TV sets are basically composed of 7 parts (A to G) including steel, copper, and so on. In Japan, aluminum and nonferrous metal etc (A to E) are usually traded at a profit. However, in the case of waste plastic and the rest (F and G), it is common that the manufacturers pay treatment fees to the recyclers for final treatment. This is not recognized as recycling by definition under the RHA. Consequently, RSR can be expressed as the amount of parts sold or taken back for nothing divided by the total weight of the TV sets. In 2008, the RSR for TV sets was reported to be 89%, which is far higher than what was legally required. However, the glass occupies more than 60% of the total weight, which means that the trade relation concerning CRT glass is the most influential factor by which to decide the RSR for TV sets.

Figure 1 The RSR in Japan in Practice (TV sets)



Source: Compiled by the authors

3.1.2. Issues Related to the Recognition of Recycling Standards Rates

Regarding the recognition of RSR, there are several issues in connection with international recycling and reuse to be reviewed. This topic is worth looking at in detail as it pertains to the design of domestic regulation in harmony with current global reuse and recycling situation.

The first issue pertains to reuse. Under the RHA in Japan, domestic reuse of e-waste as secondhand goods is not included in the RSR. This does not mean that reuse of e-waste is illegal in Japan. RHA only regulates recycling by manufacturers. Manufacturers are not allowed to reuse e-waste as a means of clearing RSR. In addition, reuse of e-waste as parts is included in the RSR.

The second issue is related to export. When e-waste is exported as secondhand goods it is not included in the RSR. As the authors mentioned before, manufacturers must recycle all the e-waste that consumers have paid a recycling fee for. It is also illegal for manufacturers to export e-waste to be sold by retailers as secondary goods. When e-waste parts are exported for reuse, they are actually included in the RSR. The RHA does not have a specific stipulation on this issue. It has not yet been reported that manufacturers have exported the parts of e-waste on their own behalf for reuse. However, it is undeniable that the portion of e-waste sold by manufacturers is exported for reuse in the long run.

The third issue concerns with the management of hazardous e-waste substances. A variety of hazardous substances are evident in e-waste (IGES 2009). In relation to global warming, CFCs are noteworthy substances that immediate measure should be taken at the global level. In Japan, CFCs exist as refrigerant in air conditioners, refrigerators and freezers which should be collected and destroyed. Furthermore, CFCs in the insulator of refrigerators and freezers should also be collected and destroyed. The RHA does not prohibit the reuse of CFCs as goods; however, Japan's manufacturers destroy all the CFCs transported to them.

3.2 Korea

3.2.1 Reuse and Recycle Rates in Practice

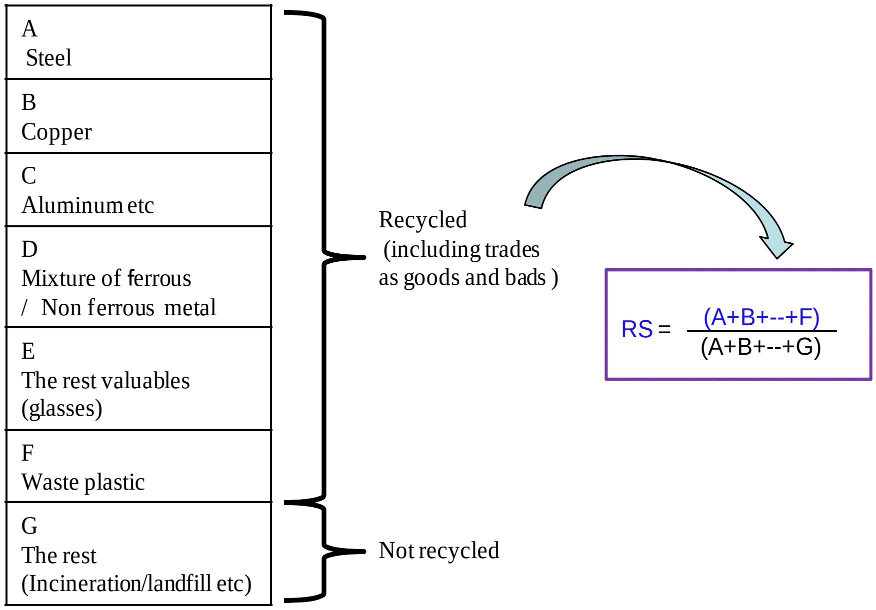
As a qualitative indicator for e-waste recycling, RRR has been adopted in Korea. RRR was revised in 2006. Compared with RSR of Japan, RRR is defined as a comprehensive term which includes thermal as well as material recovery. As for the specific target rate for e-waste, in contrast to Japan, there is no explicit stipulation about the liquid crystal/ plasma types of TV sets in Korea. While the lowest rate of RRR is required for TV sets and personal computers, 80% of RRR is imposed on air conditioners and washing machines. Three items such as copy machines, printers, and fax machines have been listed on covered items since 2006.

Table 4. The Target Ratio of Reuse and Recycling Rates in Korea

		Before2006	After2006
TV sets		55%	65%
Refrigerators		60%	70%
Air conditioners		70%	80%
Washing machines		70%	80%
PCs	Lap top	55%	65%
	Note book		
Audio equipment		60%	70%
Mobile phone		60%	70%
Copy machines		65% (Before 2008)	75% (After 2008)
Printers			
Fax machines			

As for the recognition of RRR, there are significant differences between Korea and Japan. Korea's RRR weighs heavily on the state of the recyclable resources, not the financial relation between the discharger and recipient. According to figure 2, 6 (A to F) of 7 categories are recycled on the basis of Korea's definition of recycling. What is most notably different in Japan is that, waste plastics (F) are additionally counted as recycling. Roughly speaking, all types of treatment except incineration and landfill are considered to be recycled. Consequently, RRR can be expressed as the amount of recycled e-waste divided by the total weight of TV sets. In 2005, it was reported by manufacturers that about 98% of TV sets are recycled. This may indicate that only 2% of the TV sets are treated by means of incineration or landfill. Wooden covers are typically the part of the TV set that are disposed to landfill.

Figure 2. The RRR in Korea in Practice (TV sets)



Source: Compiled by the authors

3.2.2 Issues Related to the Recognition of Reuse and Recycle Rates

With the recycling standard in Japan, Korea's e-waste recycling system is reviewed. The first issue pertains to reuse. Under the LEV in Korea, domestic reuse of e-waste as secondhand goods is not included in the RRR. The LEV does not address reuse of e-waste. In addition, reuse of e-waste as parts is explicitly included in the RSR as the title of the indicator implies.

The second issue is related to export. When e-waste is exported as secondhand goods it is not included in the RRR, with the exception of personal computers. It is not an easy task to collect personal computer e-waste directly from households even under the implementation of take-back. The MOE announced a governmental notice related to the collection situation of used personal computers so that the export of used personal computers for reuse could be recognized as a part of manufacturers' recycling performance. In 2009, manufacturers still fulfill their legal obligations by contracting with the commercial recycling companies. Manufacturers provide subsidies to these recyclers relative to the amounts of used personal computer collected.

By contrast, Korea takes considerably different positions on e-waste export for recycling. As the author mentioned in the previous section, it is illegal for Japanese manufacturers to export e-waste for recycling. However, in Korea under the monitoring of proper treatment by manufacturers, the export of all covered items for recycling has been accepted as a means of accomplishing collection targets since 2007. Submission of related documents to prove proper treatment in the importing countries is necessary to assure the monitoring process. In addition, when the parts of e-waste are exported for reuse they are also included in the RRR.

The third issue is regarding the management of hazardous e-waste substances. In Korea, under the LEV, CFCs as refrigerant in air conditioners and refrigerators are to be collected. However, no stipulation is established after the collection. Most of collected CFCs are actually reused as refrigerant for cars. Furthermore, in reality, CFCs in the insulator of refrigerators are not collected at all.

3.3 Taiwan

3.3.1 Compulsory Recycling Rates in Practice

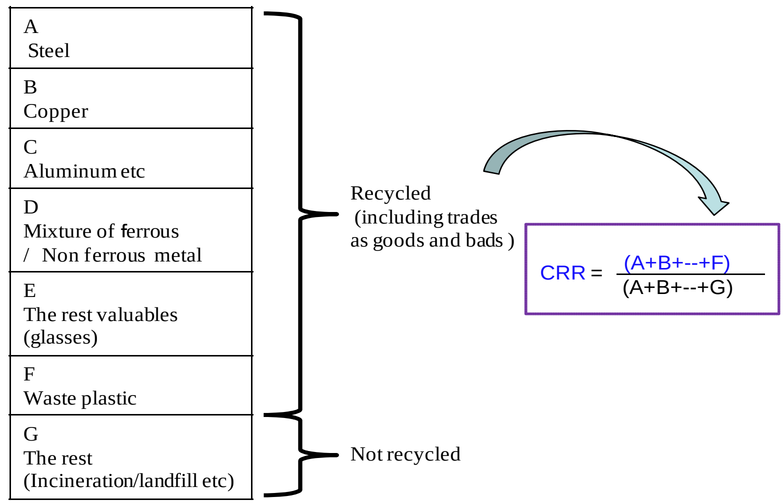
Taiwan introduced CRR as a qualitative recycling indicator under the RFMC system. The rates of CRR for each covered item are illustrated in Table 5. In 2007, there was a revision of CRR for covered items. Since that year, 70% of CRR has been required for all items across the board. As for TV sets and washing machines, higher CRR are imposed on registered recyclers. During that time, CRR for refrigerators and air conditioners decreased. According to high-ranking governmental officials, 70% has been the real average recycling rate in the current years in Taiwan.

Table 5 The Target Ratio of Compulsory Recycling Rates in Taiwan

<table>
<tr><th colspan="2"></th><th>Before Feb.2007</th><th>After Feb. 2007</th></tr>
<tr><td rowspan="2">TV sets</td><td>Braun tube</td><td>60%</td><td rowspan="2">70%</td></tr>
<tr><td>Liquid crystal/
Plasma</td><td>N/S</td></tr>
<tr><td colspan="2">Refrigerators</td><td>80%</td><td>70%</td></tr>
<tr><td colspan="2">Air conditioners</td><td>80%</td><td>70%</td></tr>
<tr><td colspan="2">Washing machines</td><td>60%</td><td>70%</td></tr>
<tr><td rowspan="2">PCs</td><td>Note book</td><td rowspan="4">N/S</td><td rowspan="2">70%</td></tr>
<tr><td>The rest</td></tr>
<tr><td colspan="2">Audio equipment</td><td>70%</td></tr>
<tr><td colspan="2">Electric fan</td><td>70%</td></tr>
</table>

As for the recognition of CRR, a standard similar to that of Korea is applied. However, there is a significant difference regarding the international reuse and recycling issue (details in the following section). According to figure 3, 6 (A to F) of 7 categories are recycled according to Taiwan's definition of recycling. In consequence, CRR can be expressed as the amount of e-waste recycled divided by the total weight of the TV sets. In Taiwan, e-waste control is divided in two groups: household appliances and it (?) objects. It has been found that the CRR for used household appliances and it (?) objects reached 71% and 86% respectively in 2007 (Ya-Yun 2009). If recalculated according to the Korean standard, they both increase to 87% and 86% respectively, which are slightly lower than those found in Korea. This difference comes from their disparate attitudes toward the export issue between Taiwan and Korea. The details are presented in the next section.

Figure 3. The CRR in Taiwan in Practice (TV sets)



Source: Compiled by the authors

3.3.2 Issues Related to the Recognition of Compulsory Recycling Rates 0.5

Taiwan, compared to Japan and Korea, has the most rigid attitude about the international reuse and recycling issue in relation to what is recognized as recycling. The first issue pertains to reuse. Under the RFMC system, domestic reuse of e-waste as secondhand goods is not included in the CRR, nor is reuse of e-waste as parts. This does not mean that it is illegal to reuse or sell e-waste as parts, as long as the recycling carried out is of higher quality than what is stipulated by CRR.

The second issue is related to export. When e-waste is exported as secondhand goods it is not included in the CRR. Export of e-waste as parts for reuse is not included in the CRR. Taiwan’s cautiousness toward what they recognize as recycling can be understood against the policy background of the RFMC system. As the authors mentioned in the previous section, serious environmental pollution in the 1980s greatly served to drive policy designed to thoroughly monitor recycling activity.

The third issue concerns with the management of hazardous e-waste substances.

Under the WDA (Waste Disposal Act), CFCs as refrigerant in air conditioners and refrigerators need to be collected and destroyed. If CFCs are not properly treated, the registered recyclers cannot receive subsidies for their recycling performance. However, as in Korea, no stipulation is made regarding CFCs in the insulator.

3.4 Summary

In this section, the authors review the definition of recycling and the actual recycling indicators and practice in East Asia. Table 6 illustrates mandatory rates and revisions of the recycling indicators in Japan, Korea, and Taiwan. Overall, the Korea's mandatory rates are the highest out of these three systems; however, this does not necessarily indicate that the highest quality of e-waste recycling is carried out in Korea. This is primarily because reuse and recycling as secondary goods or parts are comprehensively recognized as performances of recycling in Korea.

Between Japan and Taiwan, it is quite difficult to conclude which standard is stricter than the other when it comes to the management of qualitative recycling. Special attention should be given when discussing the target rate of recycling in connection with the quality of recycling in East Asia. Furthermore, it has also been confirmed that the difference in target rates of recycling in East Asia come from differences in their definitions of recycling and their attitude toward international reuse and recycling.

Table 6 The Target Rate of Recycling in East Asia

		Japan		Korea		Taiwan	
		Before April. 2009	After April. 2009	Before 2006	After 2006	Before Feb.2007	After Feb.2007
TV sets	Braun tube	55%	55%	55%	65%	60%	70%
	Liquid crystal/ Plasma	–	50%				
Refrigerators		50%	60%	60%	70%	80%	70%
Air conditioners		60%	70%	70%	80%	80%	70%
Washing machines		50%	65%	70%	80%	60%	70%
Computers	Note book	20%	Voluntary (Since 2003)	55%	65%	N/S	70%
	Desk top	50%					
	Liquid crystal	55%					
	Braun tube	55%					
Audio equipments		N/S		60%	70%		70%
Mobile phones				60%	70%		N/S
Copy machines				65% (Before 2008)	75% (After 2008)		
Printers							
Fax machines							
Electric fans				N/S			70%

Note: N/S signifies no stipulation

Differences between the three systems' recognition of domestic and international reuse and recycling are illustrated in Table 7. They are identical in that domestic reuse of e-waste as a secondary good is not recognized as recycling. While reuse of e-waste for parts is regarded as recycling in Japan and Korea, it is not recognized as such in Taiwan.

As for the relationship between reuse and recycling recognition, Taiwan takes the most rigid stance on the issue of reuse. Regarding the management of hazardous waste, it can be pointed out that Korea's insufficient treatment of CFCs is a challenging policy issue that Korea should tackle.

Table 7 The International Reuse/ Recycling and Recognition as Recycling in East Asia

		Japan	Korea		Taiwan
Covered Items		4	9	1 (PCs)	7
(Domestic) Reuse	Secondary good	Not included	Not included	Not included	Not included
	Parts	Included	Included	Included	Not included
Export	Secondary good	Not included	Not included	Included	Not included
	Parts	Unclear	Unclear	Unclear	Not included
Management of hazardous substance	CFCs as a Refrigerant	Regulated (CFCs in air conditioners, refrigerators and freezers should be collected and crushed.	Regulated (CFCs in air conditioners, and refrigerators should be collected) However, no stipulation after collection		Regulated (CFCs in air conditioners and refrigerators should be collected and crushed)
	CFCs in a Insulator	Regulated (CFCs in refrigerators and freezers should be collected and crushed)	Unregulated		Unregulated

Source: Compiled by the authors

4. Conclusion

This paper presents the current legal situation on e-waste recycling and the actual recycling indicators applied in Japan, Korea, and Taiwan. The following are implications elucidated by the authors' analysis.

Japan, Korea, and Taiwan began to conduct EPR-based policies around 2000 to establish more efficient e-waste systems. A few parameters for evaluating e-waste recycling performance were also introduced; however many component parts of these parameters differed remarkably.

As a quantitative recycling indicator, Japan and Taiwan focus on the recycling target, whereas Korea is centered on the collection target. Unlike in Japan and Korea, registered recyclers are designated in Taiwan as the main actor for attaining the target.

With regards to qualitative recycling indicators, all three systems have their own recycling indicator; however, the details of their calculation methods are significantly different. In particular, they take individualized approaches to the issues of reuse, export and hazardous waste, which are shaped in accord with existing historical policy backgrounds.

Specifically, domestic reuse of e-waste as second hand goods is not counted as recycling performance in any of three systems. They differ in that the reuse of e-waste as parts is counted as recycling performance in Japan and Korea. However, it is not regarded as such in Taiwan. As for used computers which are the most actively reused at the global level, export of used computers for reuse is exceptionally evident in Korea. As for the proper treatment of CFCs, Japan takes the strictest position toward collection and destruction. However, CFCs in the insulator are not mandated for in Korea and Taiwan.

It is hard to judge which of these three systems is superior to the others. However, what should be clarified first when it comes to the design and revision of e-waste recycling indicators is that the definite relationship with recognition issue as recycling and the global reuse and recycling aspects should be established. This is the first step to realizing a more sustainable e-waste recycling system.

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CHAPTER 10

Utilization of Material Flow Analysis in 3R Policy in Japan

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1. Introduction

Utilization of material flow analysis in 3R policy is expected toward establishing a Sound Material-Cycle (SMC) Society. In Japan, the “Basic Law for Establishing an SMC Society” and other various individual recycling laws have their own targets for recycling depending on their objectives. In this paper, the targets for each recycling law are reviewed and the utilization of the material flow analysis is discussed.

2. Basic Plan for Establishing an SMC Society in Japan

2.1 Material Flow Indicators in the First Basic Plan for Establishing an SMC Society

Japan has the “Basic Environment Law” and the “Basic Law for Establishing an SMC Society” which came into force in 1994 and 2001 respectively. The Second Basic Environment Plan of 2000 based on the Basic Environment Law described the need for quantitative indicators (or targets) in the Basic Plan for Establishing an SMC Society.

The Central Environment Council from the Ministry of the Environment (MOE) provided their opinion in the formulation of concrete guidelines for the Basic Plan for Establishing an SMC Society in 2002. That opinion illustrated various indicators such as total material input, reused amount, recycled amount, waste generation, collected/recycled rate for major recyclable resources for each year, based on the material flow. As a result, the First Basic Plan for Establishing an SMC Society was formulated on March 2003. Three phases were set for material flow indicators of this plan; inlet, cycle and outlet.

As inlet indicator, resource productivity was adopted, that is defined such as Gross Domestic Product (GDP) divided by Direct Material Input (DMI). It expresses dematerialization of total economy in the country.

For cycle, the cyclical use rate in the input basis was utilized with recycled amount divided by material input (DMI and recycled amount). Although either input- or output-based cyclical use rate has merit and demerit, the former can negatively evaluate improper recycling with larger input of energy and material. Currently, recovered amount in the output phase can be used in many cases due to the statistical constraints, but how to measure the "replaced" input would be the future task.

As outlet indicator, final disposal amount was adopted simply. Comprehensive environmental indicators with weighted multiple impacts using Life Cycle Impact Assessment is not used for policy at this moment.

2.2 Material Flow Indicators in the Second Basic Plan for Establishing an SMC Society

As the material flow indicators, the same three indicators with revised targets are used in the Second Basic Plan for Establishing an SMC Society which was formulated in March 2008. The resource productivity excluding earth and rock input, and the coordination toward low-carbon society were added as supplementary indicators. In addition, indicators to monitor changes, for example, resource productivity of fossil resources, biomass resource input rate, and Total Material Requirement (TMR), were also set without targets. In the Second Basic Plan, the following issues to be examined are shown; material flow in each region, material flow indicators that allow international comparisons, primary resource equivalence conversion weight, environmental efficiency and resource productivity, establishment of a standardized conversion factor that can be used internationally, and 3R indicators based on the amount of reuse, material flow by individual items, and a common calculation method.

Besides the above material flow indicators, various effort indices were set both with and without targets. As the indices with target, "Reducing the quantity of wastes", "Changes in thoughts and actions to establishing an SMC Society", "Promoting SMC society business", and "Steady implementation of individual recycling laws" were set. Also, indices to monitor changes are adopted without targets, such as the size of rental and lease business market and the shipping rate for refill products.

2.3 Quantitative Targets and Evaluation

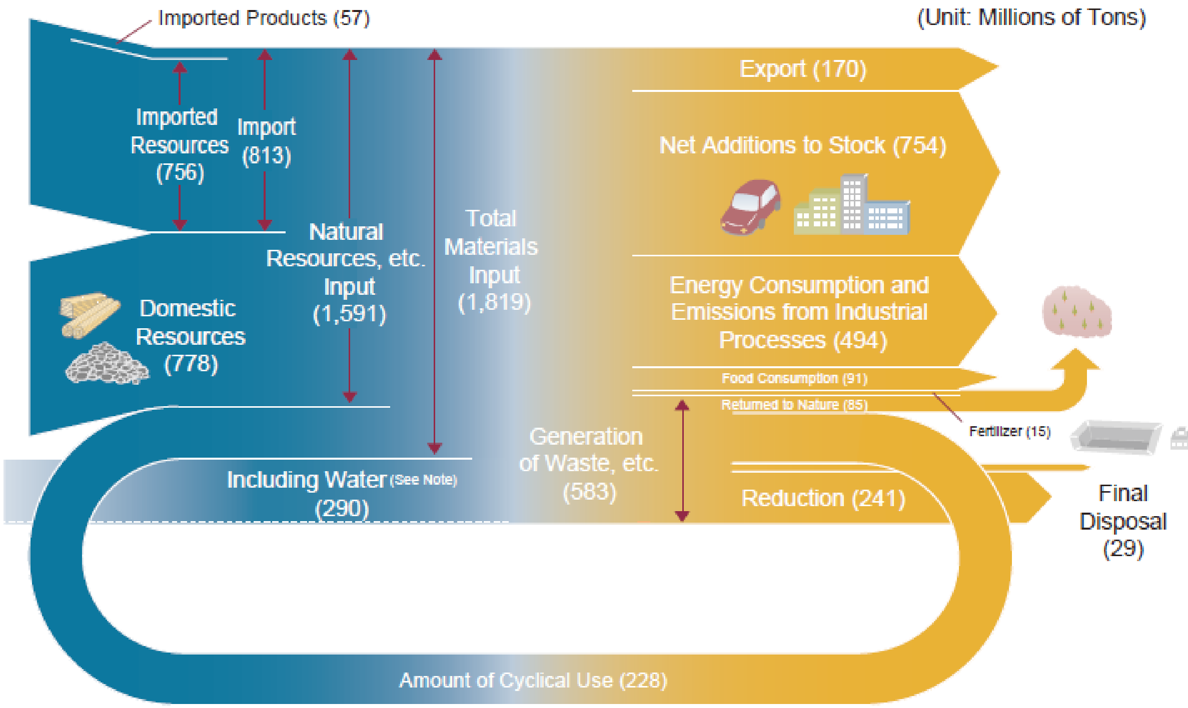
The Japan's Ministry of the Environment illustrates the total material flow in the country used as reference in the Second Basic Plan for Establishing an SMC in 2008 (Figure 1). Quantitative targets for the three material flow indicators are shown in Table 1 and in Figures 2 to 4.

The First Basic Plan requested the Central Environment Council to evaluate and review the progress of policies based on the plan every year. According to the evaluation by the Council, three indicators of recent years have been improved to achieve the targets. At the same time, the needs for supplemental indicators and the consideration of international trade of recyclable resources were indicated. Some of the improvement has been realized in the Second Basic Plan.

Furthermore, the Council indicated that relationship between micro information for individual policy and macro information with these indicators should be linked properly. This issue still remains at the Second Basic Plan. Since various recycling laws and plans in the individual fields such as packaging and home appliances have set various individual targets prior to the First Basic Plan, those individual targets and macro material flow targets are not directly linked each other. Those indicators for micro and macro targets should be harmonized for future consistency.

The detail of above process and discussion on material flow indicators in the Basic Plan for Establishing an SMC is presented well by Moriguchi (2009).

Figure 1. Total Material Flow in Japan in Fiscal Year 2006



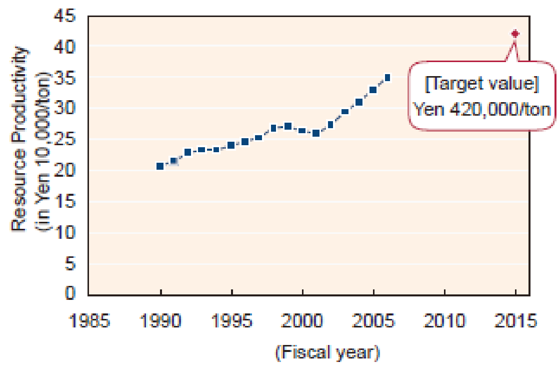
(Note) Including water: Input of water included in waste and the like (sludge, animal manure, human waste, waste acid, and waste alkali) and sediment and the like associated with economic activities (sludge from mining, building and water works and tailing from mining).

Source: MOE, "Material Flow in Japan 2006", 2009, http://www.env.go.jp/en/recycle/smcs/material_flow/2006_en.pdf

Table 1 Quantitative Targets for Material Flow Indicators

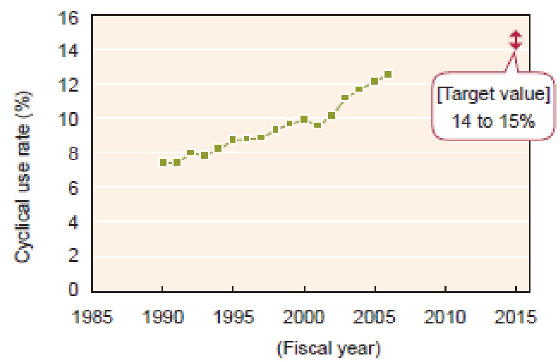
Indicators	Targets		Base year: 2000
	First Basic Plan (Target year: 2010)	Second Basic Plan (Target year: 2015)	
Resource productivity	app. 390,000 JPY/ton (40% up)	app. 420,000 JPY/ton (60% up)	app. 280,000 JPY/ton
Cyclical use rate	app. 14%	app. 14-15%	app. 10%
Final disposal amount	app. 28 million tons (50% down)	app. 23 million tons (60% down)	app. 56 million tons

Figure 2. Trend of Resource Productivity



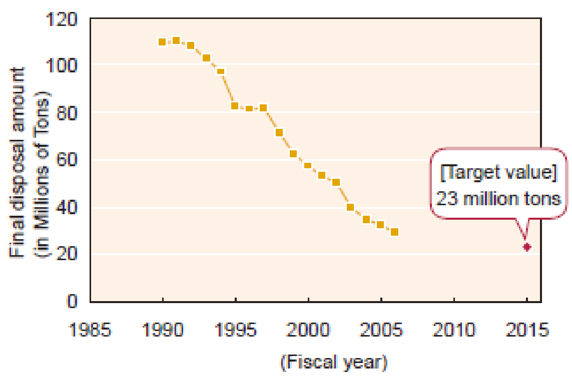
Source: MOE, "Material Flow in Japan 2006", 2009

Figure 3. Trends of Cyclical Use Rate



Source: MOE, "Material Flow in Japan 2006", 2009

Figure 4. Trends of Final Disposal Amount

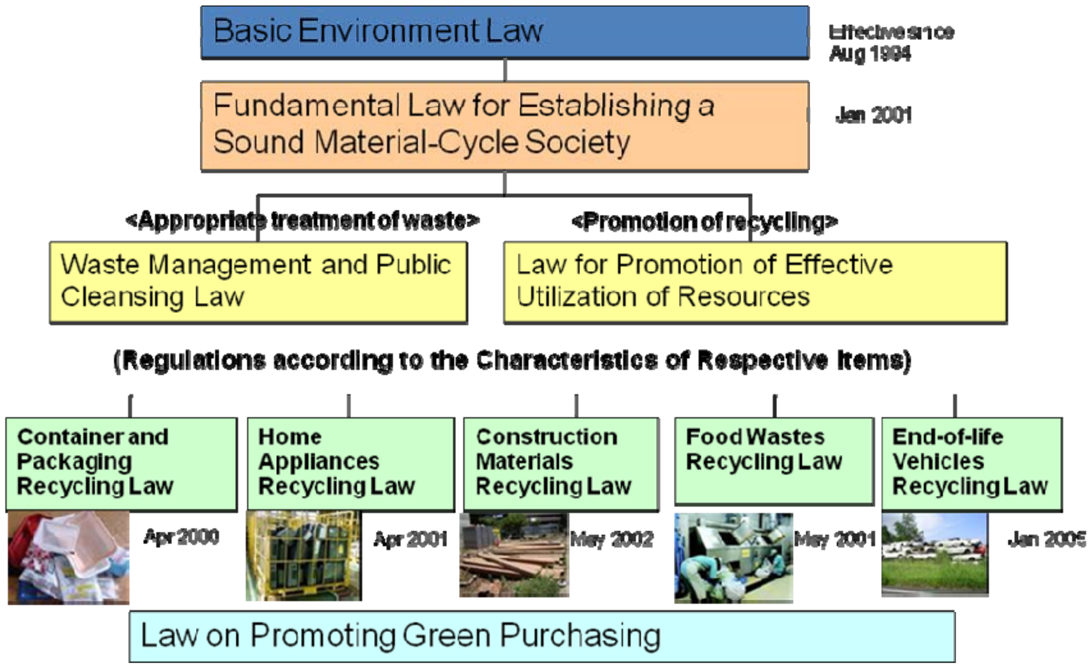


Source: MOE, "Material Flow in Japan 2006", 2009

3. Individual Recycling Laws

Legislative framework to establish an SMC Society in Japan is shown in Figure 5. This paragraph discusses the recycling targets of the four recycling laws for packaging, home appliances, personal computers and vehicles, considering the objectives described in each law.

Figure 5. Legislative Framework to Establish a Sound Material-Cycle Society in Japan



3.1 Container and Packaging Recycling Law

3.1.1 Objectives

The Container and Packaging Recycling Law for PET bottles, glass bottles, and steel and aluminum cans went into force in 1997, and for all packaging including paper and plastic in 2000. The objectives of this law include the reduction of municipal waste to be landfilledand efficient use of recyclable resources.

3.1.2 Definition of Recycling and Roles of Stakeholders

The definition of recycling ("*Sai-shohin-ka*" in Japanese) under this law is to make economically valuable (0 or more) materials that can be used by themselves or others. With regards to the roles of stakeholders, municipalities are in charge of the collection and transportation. On the other hand, the producers and retailers have monetary responsibility for recycling. They provide the recycling fee and the designated business body consigns the recycling to appropriate recyclers for each municipality using the fee.

3.1.3 Recycling Rate

This law has no target of recycling rate. Material flow (collected and recycled amount), and monetary flow are, however, reported annually to the Ministry of Economy, Trade and Industry (METI) and MOE.

3.2 Home Appliance Recycling Law

3.2.1 Objectives

Home Appliance Recycling Law went into force in 2001. This law aims to contribute in the reduction of municipal waste to be landfilled and the efficient use of recyclable resources. Previously, iron and steel was only recovered at municipal facilities. However, due to the content of valuable resources in the product, copper, aluminum and recently plastic as well were expected to be recovered and recycled.

3.2.2 Definition of Recycling and Roles of Stakeholders

The definition of recycling ("*Sai-shohin-ka*" in Japanese) under this law is to make economically valuable (positive, or at least zero) materials that can be used by themselves or others. Energy recovery is recognized as one of "broad" sense of recycling, but not as the recycling with target.

Regarding roles of stakeholders, the collection and transportation are entrusted to retailers and producers. Producers have the physical responsibility for recycling at their recycling plants. But the cost is paid at discharging by final consumers, for collection (from retailers to designated stock yard) to retailers and for recycling to producers.

3.2.3 Recycling Rate

Recycling rate is set as the rate of recycled amount, i.e., derived amount with economically valuable materials that can be used by themselves or others, divided by collected amount at recycling plants under this law. Targets and trends of recycling rate are shown in Table 2. These targets have been achieved since 2001, and recent recycling rates are gradually increasing due to the efficient separation and the value of materials. Thus, targets were elevated with 5 to 10% for air conditioners, refrigerators and washing machines, while that remains with 55% for CRT TV because of the difficulty of CRT recycling.

The material flow of collected and recycled amount and monetary flow are reported annually to METI and MOE.

Table 2. Targets and Trends of Recycling Rate

	Target	**FY2006**	**FY2007**	**FY2008**	**Remarks**
Air conditioners	70% (60% until Mar 2009)	86%	87%	89%	
TVs	50% (LCD, PDP) 55% (CRT)	77%	87%	89%	FY2009, LCD and PDP added
Refrigerators and freezers	60% (50% until Mar 2009)	71%	73%	74%	
Washing machines	55% (washing machines, 50% until Mar 2009) 65% (clothing dryers)	79%	82%	84%	FY2009, clothing dryers added

3.3 Law for Promotion of Effective Utilization of Resources (Personal computers)

3.3.1 Objectives

The Law for Promotion of Effective Utilization of Resources went into force in 2001 for business-use personal computers (PC), and in 2003 for home-use PC. This law covers various sectors and products. PC and small-type secondary batteries are set as designated products to be recycled. The objectives of this law include the reduction of municipal waste to be treated and landfilled, efficient use of recyclable resources, and environmental preservation considering toxic substances.

3.3.2 Definition of Recycling and Roles of Stakeholders

The definition of recycling ("*Sai-shigen-ka*" in Japanese) under this law is to make use as parts or secondary materials. This law does not necessarily request economical value of recovered materials, unlike the above two laws.

Concerning the roles of stakeholders, collection and transportation are entrusted to producers. Producers have the physical responsibility for recycling at their recycling plants. The cost for collection and recycling is paid by final consumers. This cost is incorporated in the product price since the enforcement of this law.

3.3.3 Recycling Rate

Recycling rate is set as the rate of recycled amount divided by treated (almost the same as collected) amount under this law. The target recycling rates are 50%, 20%, 55% and 55% for desk-top PC, notebook PC, CRT display and LCD display, respectively. Recycling rates (treated and recycled amount) and collected amount are disclosed.

3.4 Law for Promotion of Effective Utilization of Resources (Small-type Secondary Batteries)

3.4.1 Objectives

Law for Promotion of Effective Utilization of Resources went into force in 2001 for small-sized secondary batteries (Pb, Ni-Cd, Ni-MH, Li-ion). The objectives of this law are the same as that with PC.

3.4.2 Definition of Recycling and Roles of Stakeholders

The definition of recycling is to make use as parts or secondary materials. Regarding the roles of stakeholders, collection and transportation are entrusted to producers. Recycling is also charged to producers but implemented by Japan portable rechargeable Battery Recycling Center (JBRC), Mobile Recycling Network (MRN) and other producers. The cost for recycling is incorporated in the product price.

3.4.3 Recycling Rate

Recycling rate is set as the rate of recovered metal content divided by treated (or collected) amount under this law. The targets recycling rates are 50%, 60%, 55% and 30% for Pb, Ni-Cd, Ni-MH, Li-ion, respectively. Collected, treated and recycled amount, and calculated recycled rate are disclosed.

Collected rate representing collected amount divided by sold amount is not set under the law. The Industry Structure Council of METI had set the target of collection rate with 75% and 45% for Pb and Ni-Cd, respectively, in their guideline for waste management and recycling before. However, there seemed the difficulty of data availability and the recent revised guideline of 2005 did not set that target.

3.5 End-of-Life Vehicles Recycling Law

3.5.1 Objectives

End-of-Life Vehicles Recycling Law went into force in 2005. The objectives of this law include the reduction of (industrial) waste, efficient use of recyclable resources and reusable parts. Previously, iron and steel was only recovered at conventional recycling facilities. However, due to the content of valuable resources in the product, copper and aluminum were also expected to be recovered and recycled.

3.5.2 Definition of Recycling and Roles of Stakeholders

The definition of recycling ("*Sai-shigen-ka*" in Japanese) is to make use as parts or secondary materials. Energy recovery is recognized as recycling for automobile shredder residue (ASR). With regards to the roles of stakeholders, dismantlers and recyclers (with shredding facilities or electric furnace) have physical responsibility, while consumers pay the fee for appropriate treatment of Chlorofluorocarbons (CFCs), airbags and ASR during purchasing.

3.5.3 Recycling rate

Recycling rate is set as the rate of recycled amount divided by collected amount under this law. The target recycling rates are 50% (2005), 70% (2010) for ASR, and 85% (year not specified) for airbag. In case of ASR, thermal recycling and amount of residue is considered. Recycling rates are disclosed by producers.

4. Discussion

4.1 Overall Material Flow Including Non-legislative scheme

The flows of material, monetary and information are interactively linked. But in general, material flow is concerned when it is linked with monetary flow. It is hard to estimate overall material flow. Exception is automobiles (All the vehicles are registered and recycling fee is paid at purchasing). For containers and packaging (short life products), shipping amount to the market is estimated as discarded amount. For long life products such as home appliances and PCs, estimation of discarded amount is not easy due to the need for life time and the storage at home. Collected and recycled amount only under the legislative scheme is officially reported.

Government (MOE and METI) have tried to understand the overall material flows including the flows not covered by the legislative schemes, using questionnaires for the case of home appliances. Especially, invisible flow for export from Japan is of high concern. But the main approach is implemented with research basis.

4.2 Relationship between individual recycling and SMC Society

Individual recycling laws have their background and objectives for municipal and industrial waste. To achieve those objectives, the laws have their own definitions and targets of recycling. At this moment, the relationship between micro information for individual policy and macro information with these indicators should be linked properly, as described above. Since various recycling laws and plans in the individual fields such as packaging and home appliances have set various individual targets prior to the First Basic Plan for Establishing an SMC Society, those individual targets and macro material flow targets are not directly linked to each other. Those indicators for micro and macro targets should be harmonized for future consistency.

4.3 Toward the Promotion of 3R

Basic Law for establishing an SMC Society stipulated the priority of 3R (reduce, reuse, recycle). Reduced amount, however, may be hard to estimate. Reuse is less focused under individual laws. Recycling and proper disposal are reported officially. How to monitor the overall material flow and to promote 3R with material flow analysis would be the future challenge.

5. Conclusion

Various individual recycling laws in Japan set recycling target for each item. This reflects the individual background and objectives for municipal and industrial waste. This does not have direct link with the Basic Plan for Establishing an SMC Society. The objectives of individual recycling laws are mainly waste reduction and cyclic use of materials. Targets of recycling rate are mainly set as recycled (utilized) amount divided by collected amount in the legislative scheme, in general. Current monitoring is applied for evaluation of legislative scheme. But with the increasing international trade of recyclable resources, material flow analysis is expected for understanding overall flows and improvement of legislation. Furthermore, those indicators for micro and macro targets should be harmonized for future consistency.

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CHAPTER 11

Toward 3R-Based Waste Management: Policy Change in Japan, Malaysia and the Philippines

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1. Introduction

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 in turn also affects the management style of the waste generated. Over the years, modern waste management has shifted from conventional, single-choice reliance on landfills to a more flexible waste hierarchy concept, also known as 3R (reduce, reuse, recycle) policies (Tanaka 1999; Wilson 2007).

Asia consists of two groups, developing and developed countries. Generally, the higher income countries generate more waste, recycle more and have the money to employ advanced 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. The developing Asia counts as the fastest and largest waste generator globally. In recent decades, however, type of waste also changed (including recyclables) even in developing countries due to increased urban migration and modern lifestyle. These facts present a complex policy challenge for governments to manage waste generation, especially when funding is scarce, and infrastructure is limited. A closer inspection reveals a mix of general and specific elements of policy dynamics in the evolution and adoption of waste management policies (UNCRD et al. 2009). A comparison of waste management across history and countries in Asia is a useful first step for policy learning to take place between both the developed and developing regions.

This chapter compares the pattern of policy development in selected countries in Asia, namely Japan, Malaysia and the Philippines. Section 2 outlines a simple framework for analyzing the process of policy change based on the case of Japan. Section 3 compares policy development in Malaysia and the Philippines against the stated framework. In Section 4, the progress of Malaysia's waste management is discussed in relation to the principles of 3R policies. The concluding remark reiterates key themes from the chapters discussed.

2. Policy Change in Waste Management

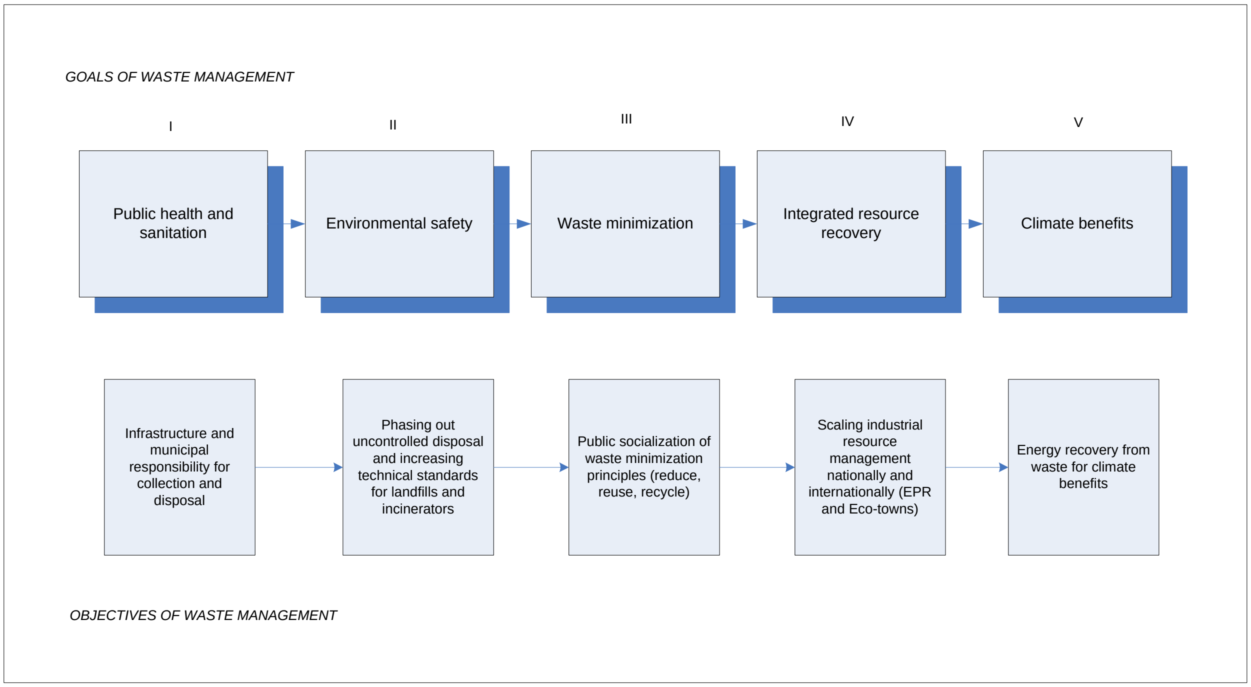
It is generally acknowledged that history matters in understanding policy development (Kraft & Vig 1994; Hezri & Hasan 2006; Cashore & Howlett 2007). More often than not, the elements of policy development differ from one jurisdictional context to another, be they sector- or country-based. Nevertheless, a generalization is still useful to explain patterns of policy development.

Instruction on how to study the process of policy development is available from the work of Hall (1993) and Cashore and Howlett (2007). In a simple term, policy content can be categorized into three main components. First is the abstract 'goals', demanding clarification on the types of ideas that govern policy development. The second component is 'objectives' to implement a goal in general terms. Underlying questions include what specific requirements are operationalized into formal policy, and what specific types of instruments are used? The third component is the 'settings' that specifically calibrate the requirements to implement those objectives in practice. This demands specification of on-the-ground aims of policy, and knowledge of the specific ways in which the policy instruments are utilized.

In the area of waste management, policy has evolved from a single-choice reliance on landfills to the waste hierarchy concept, also known as 3R policies. Essentially the 3R approach is based on the idea of using resources fully before its final disposal. Waste hierarchy is basically a precautionary principle that prioritizes the prevention and reduction of waste, then its reuse and recycling, and lastly the optimization of its final disposal. The ensuing discussion applies the disaggregated components of policy content in the waste management context, using the case of Japan as an example.

From historical perspective, the drivers of waste management have neither been static nor fixed (Wilson 2007). The changes depend to a great extent on economic structure of countries and the lifestyle of their growing populace. This section explores the case of Japan in order to trace the process of waste policy development. Figure 1, outlines five distinct types, or stages of solid waste management goals and objectives in Japan. These are, essentially: public health and sanitation; environmental safety; waste minimization; integrated resource recovery; and climate benefits. The first two goals can be considered health-related, while the last three are sustainability-related. Although these goals evolved in stages, their utility for analysis is limited as only heuristic, as the actual expression of these goals in public policy varies between countries.

Figure 1 Changing Goals and Objectives of Waste Management Policy



2.1 Public Health and Sanitation (1900 – 1960s)

In pre-modern societies, small communities could bury solid waste just outside their settlement. As population density grew, a more organized form of waste management was needed to avoid odor and disease. The earliest goal in waste management action was driven by public hygiene measures in cities to prevent infectious diseases. In London, the Sanitation Commission made the first clear linkages between poor sanitation and cholera as early as in 1839, leading to the promulgation of the 1848 Public Health Act (Wilson 2007). Japan was a pioneer in Asia, initiated the municipal solid waste disposal by municipalities and regional governments in 1900 with the formulation of the Dirt Removal Law. The driver for this law was mainly the poor sanitary conditions of Japanese cities, which had caused epidemics of dysentery, plague, and other infectious diseases (Tanaka 1999). These laws prescribed the objective of cleaning up the city streets using organized waste collection and disposal. Maintenance of urban functions by preserving a living environment was the next objective in Japan with the introduction of the Public Cleansing Law in 1954 to secure a hygienically sound living environment. This legislation constitutes the main framework for managing waste in Japan based on the sanitation goal and objectives.

2.2 Environmental safety (1970 – 1990s)

The 'sanitation movement' of the first goal focused on personal health. Once that is addressed and stabilized, the focus shifted to the health of communities (e.g., the proliferation of landfills, the odor problems associated with sewage treatment plants and the health-impacting air emissions from industrial and domestic sources). Therefore, environmental safety is the essence of the second goal of waste management. During this phase, which in some developed countries started sometime in the 1980s (and continues today), an emphasis was given on the objectives of phasing out uncontrolled disposal and increasing technical standards in the operation of waste facilities (Wilson 2007).

The increasing post war affluence and consumption led to the first landfill-related legislation in Japan, the formulation of the Waste Disposal and Public Cleansing Law in 1970. It was passed by the Diet during its "Pollution Session," extending the regulatory coverage, from municipal solid wastes to industrial solid wastes generated by industrial activities (Tanaka 2007). The Ministry of Health and Welfare encouraged construction and retrofitting of waste treatment facilities through subsidies made available under the National Program for Construction of Waste Disposal Facilities. However, stipulation of pollution prevention from leachate from landfill was not supported by detailed equipment and standards requirements. Further instructions for the setting up of barrier systems and treatment facilities for leachate were outlined in 'Instructions for Technical Standards on Landfill Facility for Municipal and Industrial Solid Waste' 1977 (Asakura et al 2009). More stringent standards followed suit in 1989 and 1998. For concerns over the danger of dioxin from incinerators, the Law Concerning Special Measures Against Dioxins was promulgated in July 1999 and enforced in January 2000. The objective of strengthened environmental standards was deemed necessary in response to land scarcity and the not-in-my-back-yard (NIMBY) attitude of the Japanese public. Opposition to the sitting of new landfills near their homes is a common movement (Asakura et al. 2009).

2.3 Waste Minimization (1995 – present)

The ever increasing per capita waste generation and the changing nature of the waste stream created doubt on whether disposal is a sustainable solution. As a result, an alternative thinking based on the principles of waste hierarchy, that is the options of 3R, became more popular as a policy goal. As the concept of sustainable development was being mainstreamed into public policy discourse, so was the agenda of 3R. Since the early 1990s, the discourse of recycling has found a new salience as part of a wider environmental sustainability agenda. This marked the shift from the 'end-of-pipe' waste management to sustainable consumption and production. As a policy objective, the waste minimization goal requires socialization of the 3R idea on a big scale. This urged governments to increasingly focus their activities towards the top of the waste hierarchy. Information campaigns were staged to promote 3R aiming to increase awareness and to change attitude and behavior.

Culturally in Japan, the 3R approach reflects the spirit of 'mottainai', a term conveying a sense of regret for resources that turn into waste without reaching its full usefulness. During the 1990s, recycling was legally mandated in Japan. In 1995, the Packaging Waste Recycling Law was formulated to respond to increasing packaging waste which accounts for approximately 60% of the total quantity of Japanese domestic waste. Under this law, business enterprises were requested to take back and recycle the packaging of their products. However, some of the electrical appliances were still disposed at the landfill sites (Tanaka 2007). In 1998, another policy innovation was put forth with the formulation of the Home Electric Appliance Recycling Law (Tanaka 1999, Yoshida et al. 2007). This law features the Extended Producer Responsibility (EPR) principles for four designated items namely air-conditioners, televisions, refrigerators, and washing machines. The recycling rates of the four items had been impressive with 11.62 appliances recovered in 2004 compared to 8.55 million in 2001 (Yoshida et al. 2007). In the year 2002, basic laws for waste management came into force to promote a recycling-focused society. The move was driven by the broader policy goal of sustainable development. The Basic Law for Establishing a Sound Material Cycle Society was supported by timeline target (baseline 2000) of waste generation reduction by 20%, recycling rate increase by 40%, and solid waste disposal reduction by 50%. It was reported that, in 2005, out of 53 million tones of solid waste managed, 19% was recycled (Shekdar 2009).

2.4 Integrated Resource Recovery (1997 – present)

Resource value of the waste has always been the driver for recycling. Earlier on, the underlying concept of recycling was a utilitarian one with a focus on the economic recovery from waste. Contemporary expression of resource recovery, however, is also driven by environmental conservation purposes. In other word, recycling is both essential, economical and environmental. Compared to the previous goal of waste minimization, the objective of the resource recovery stage is to target industrial scale resource management. Leading countries include Germany and Japan. The former aims for 'Factor 4' development, that is doubling wealth while halving resource use. The latter uses quantitative targets for material flow indicators to develop a recycling-based society. However, it must be recognized from the outset that there is a fundamental tension between the objectives of recycling and disposal of waste. The urban poor in developing economies are still relying on disposal site for livelihood. The integrated resource recovery stage marks a juncture where recycling is combined as a component of solid waste management, with conscious policy efforts to reconcile the said tension between recycling and disposal.

Japan has articulated the need for sustainable production and resource efficiency, in order to preserve natural resources and to minimize negative impacts on the environment. Two policy instruments from Japan are worth mentioning here for their pioneering quality. First is the EPR policy principle (Hotta et al. 2009), developed over concerns with new stream such as the polluting e-waste. Second is the strategy linking two new interconnected spatial organizing concepts by promoting the principles of regional self-sufficiency and proximity for recycling through the Eco-Town program (Van Berkel et al. 2009). The program was launched with the twin objective of encouraging new industry development (i.e. the recycling industry) and addressing the shortage of landfill sites. In recent years more than 60 innovative recycling facilities have been established with a combined capacity of 2 million metric tones of waste per year.

This policy goal also features Japan leadership in promoting '3R Initiative' on the global level. The increasing volume of internationally traded recyclables raised concerns in Japan about the need for an international regulation. The '3R Initiative' was proposed to G8 Summit by Japanese prime minister in 2004 and adopted by G8 leaders. The initiative encourages the members of the G8 to promote the 3Rs internationally and to outline the future directions for 3R approaches. Following up on this development, the high level meetings were held in Japan in April 2005, in March 2006, and in November 2006, respectively to give shape to this policy goal.

2.5 Climate Benefits (2000 – present)

The most recent goal in waste management is co-benefits from climate change. An increased focus on climate change as well as the introduction of reduction targets for greenhouse gas emissions in the Kyoto Protocol have within recent years brought attention to the contribution to climate change (positive or negative) from management and treatment of waste (Sang-Arun & Bengtsson 2009). The corresponding objectives include the move away from landfill of biodegradable wastes (releasing methane) and energy recovery from waste. The Clean Development Mechanism (CDM) is an increasingly important international policy instrument that promotes climate benefits from waste management.

3. Comparison with the Philippines and Malaysia

To understand the applicability – and the limits – of the five stages of policy development described for Japan, this section compares waste policy development in industrializing Asian countries. Malaysia, a high middle income country with a population of 28 million, generates 0.8 kg. waste per capita per day. A low middle income country with close to 100 million populations, the Philippines generates 0.34 kg. municipal solid waste per capita per day (UNCRD et al. 2009). Waste composition in both countries is high on organic content, leading to comparable management challenges. The difference in economic structure results in the Philippines promoting community-based management while Malaysia favors a State-led approach to waste management. The following compares waste policy development in both countries in relation to the five stages outlined in the preceding section.

3.1 Public Health and Sanitation

The concern over public health and sanitation is also a key driver in the formulation of waste management policies in developing countries. The Philippines responded to the solid waste issue as early as 1938 with its Anti Dumping Law. In the ensuing years, greater clarity for the objective of waste collection and disposal was given to municipal waste management with the establishment of more legislation such as the Garbage Disposal Law of 1975, the Sanitation Code of 1975, and the Local Government Code of 1991. In Malaysia, the policy response to municipal solid waste management came later than its Asian counterparts. Until the late 1960s, city streets were cleaned by the local district health office which also hauled away household wastes to municipal disposal sites assigned as authorized dumping ground. By the mid 1970s, the objective of urban function maintenance was introduced by the government through restructuring of local authorities. The Local Government Act 1976 and the Street, Drainage and Building Act 1974 provided for public cleansing services and sanitary disposal.

Malaysia and the Philippines shared a common problem with other rapidly developing countries. The laws enacted tended to be too general and open ended, promoting operation arbitrariness. Consequently, law enforcement record was far from satisfactory. Lack of resources and inadequate institutional facilities proved to be major hurdles. In addition, Malaysia, like most developing economies, was faced with municipal budget constraint. The waste collection budget ranged between 20% and 70%, depending on the size of the municipality or city, and roughly only 76% of generated wastes were collected (Hassan et al. 2000).

Dumping of wastes in open fields and rivers by industries and households is also common in both countries even until today. A study of waste disposal behavior in the squatters area in Kuala Lumpur disclosed that 31.9% of waste were disposed by open burning, while 6.5% were thrown into the river system (Murad & Siwar 2007). This situation is different to developed countries where the goal of sanitation and the objective of collection and disposal, even though not infallible, are generally considered as a thing of the past. Thus, the goals to ensure public health and sanitation are still considered a big challenge in managing solid waste in developing countries.

3.2 Environmental Safety

Unlike Japan, the concern with environmental safety in Malaysia and the Philippines was secondary compared to disposal priority and human well-being. Most municipalities in Malaysia were facing the problem of getting new disposal sites as most of the existing disposal sites were 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 (Idris et al. 2004). Although land scarcity situation is not as serious compared to

Japan, landfills may not continue to be a feasible option in the future. As population density increases, the land-filling of wastes, becomes 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 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 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’.

The safety of waste disposal in the Philippines’ cities had reached the point of crisis more than once. In the late 1980s, the case of Smokey Mountain epitomized the connection between poor waste management and urban poverty. Closure of operation at San Mateo landfill also stirred up national debate on waste management. Options for managing waste were further narrowed down when the 1998 Clean Air Act stalled plans to build incinerators. These culminated in the 2000 Payatas open dump tragedy whereby 234 people living or working on a dumpsite perished because of landfill failure.

3.3 Waste Minimization, Resource Recovery and Climate Benefits

Waste management practices in Malaysia and the Philippines indicate that both countries are looking towards innovative solutions to the problems of inadequate and inefficient services provided by local authorities. There is evidence of both countries gradually incorporating the principles of 3R policies, albeit only in a haphazard fashion.

In the Philippines, contrary to the past solid waste management legislations which have all taken a piecemeal approach, the groundbreaking Ecological Solid Waste Management Act of 2000, also known as theRepublic Act (RA) 9003 specifies the following activities: the achievement of a recycling rate of 25% or above by 2006 and increasing thereafter; segregation at source and collection; establishment of material recovery facilities (MRFs); and eco-labeling and green procurement. The law targets closure of open dumpsites by January 2007, but more than 850 (open and controlled) are still operating in 68 out 81 provinces, only 2,500 out of 43,500 *barangays* (villages) have MRFs. In Metro Manila, all of the 8 major disposal facilities had been converted into controlled disposal facilities (Serrona & Yu 2009).

According to the Philippine Legislators Committee on Policy and Development (2002), it is the most comprehensive piece of legislation addressing the country's waste problems that has ever been passed. The implementation of this law in the Philippines steadily increases recycling activities in major cities and municipalities. The law promotes the idea of waste as a resource and orders the diversion of at least a quarter of the waste generated through recycling, reuse and composting. To support this, the Department of Trade and Industry (DTI) was mandated to create local markets for recyclables. Since its enactment, the recycling rate has increased 300%, that is from 8% initially to 23% recently (Lisa C. Antonio, personal communication). The enactment of Republic Act 9003 reinforced the local government units' responsibilities for the collection of residual or non-biodegradable wastes. Because funds are not always available for waste management, waste collection and disposal are now driven by community initiatives. The *barangay* units are given the responsibility of segregating and collecting biodegradable, compostable, and reusable wastes (DENR 2003).

Institutionally, the Republic Act 9003 also called for the creation of the National Solid Waste Management Committee (NSWMC), a central body governing all aspects of waste management comprised by representatives from the government, the private sector and non-government organizations (NGOs). The NSWMC is mandated to create a national solid waste management framework that emphasizes community based approaches in waste reduction. However, some fundamental challenges remained. In December 2007, the Philippines Senate resolved to investigate NSWMC for failing to develop the Solid Waste Management Framework. Furthermore, appropriate policy design alone is not enough without adequate funding. Solid Waste Management Fund, remains underfunded. An annual fund of P7 million pesos (US$ 157,821) only is being received by the Environmental Management Bureau. The earlier target was P20 million pesos (US$ 451,365).

Similarly in Malaysia, efforts have been incrementally stepped up to embrace the waste minimization principles. Be that as it may, waste minimization programs cannot be carried out effectively without having reliable waste composition and generation rates data. Such information was absent in Malaysia until the 1990s (Hassan et al. 2000)[1]. In 1992, the amount of Malaysian solid waste being separated at source or by waste pickers for recycling purposes was

[1] The first nationwide compilation of waste generation and composition was carried out in May 1987 and published in 1988 by the Ministry of Housing and Local Government.

less than 2%. A recent estimate records the value of 5%, while a number of senior government officials believe that the actual rate could be as high as 15%. The ‘National Recycling Program’ was initiated in 2000 as a follow up to the first recycling program launched in 1993. In 2005, Malaysia released the ‘National Strategic Plan for Solid Waste Management (2000-2020)’, whereby waste minimization is recognized as one of the priorities. More recently, the government has carried out a pilot project on waste separation at source in Putrajaya. It aims to improve public awareness on recycling and to reduce the volume of waste to be disposed. The effort aims to reduce the volume of garbage sent for disposal by 40 per cent involving 170 apartments at 481 houses.

Beyond the waste minimization goal, lacking in Malaysia and the Philippines is a functionally differentiated stage of waste recovery at an industrial scale. This demands a parallel transition in industrialization process which is greener; or an ‘ecological’ modernization process akin to what had taken place in Japan. 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 Development Corporation in 2007. There is a target of 22% recycling by the year 2020. The Solid Waste and Public Cleansing Management Act (Act 672) also features EPR principles, whereby the government can specify which kinds of products shall be collected by manufacturers. Article 102 of the Act stipulates that the government can place responsibility for the collection of products on the manufacturer, assembler, importer, or dealer.

For the goal of climate benefits, a number of CDMprojects to reduce methane emissions from sanitary landfills are currently being developed in Malaysia (Pedersen 2008).

4. Discussion: Are the Stages Applicable to Malaysia?

From the preceding discussions, developing countries such as Malaysia and the Philippines are both struggling with the earlier goals of waste management, while concurrently trying to embrace the newer goals. In these countries, the dynamics of policy development process, are constrained from attaining a “paradigmatic” change, or graduating onto the 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 word, this can only occur only when the policy institutions themselves are transformed. 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 hypothesized to follow “incremental” patterns (Cashore and Howlett 2007). 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 ‘federalization’ 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 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 privatization, which in the past has proven to cause more problems than engender solutions (Milne 1992; Sun & Tong 2002). The political economy of public finance and fiscal regimes is complex and mirrors the various stakeholders and political interests present in contemporary Malaysian society. The high and increasing costs of waste collection and disposal provided the ground for the privatization of waste management in Malaysia. Therefore, the government opted for the privatization 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 privatization was to provide an integrated, effective, 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 a lack of proper solid waste disposal sites). However, privatization 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 is 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 mildly alert to solid waste issues (Hassan et al 2000). This may come as a surprise to some because as much as 50% of public complaints lodged to the government are on waste and cleanliness issues.

In comparison to the Philippines, Malaysia's policy style exhibit characteristics of a strong state. More research is needed to ascertain how does this preference affect the calibration of 3Rs instruments, for instance in terms of recycling targets (Malaysia 22% by 2020; Philippines has now reached 23%, Japan, 40% by 2010). 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, Department of Local Government. Efforts are currently underway at the Department to prepare a detailed regulations 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. The government has encouraged 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. In a nutshell, it remains to be seen in the forthcoming years if these efforts would enable

Malaysia to upgrade from the stages of waste management that focuses on public health to one that is sustainability-oriented.

5. Concluding Remarks

Two conclusions of pertinence can be drawn from preceding discussions. First, although pathways of mainstreaming 3Rs may differ between countries, some common denominators are apparent. The chapter identified five phases of waste management policy development. Japan, as a case of policy system with a long and diverse experience with waste management, serves as a distinctive example of a desirable policy evolution and by extension, a general guide as heuristic. The transfer of lessons to developing economies is possible although difficult, given the country-specific constituent and volume of waste.. As an environmental frontrunner country (Revell 2003), Japan plays a leading role exemplified by its shift in focus from a mere attention to basic regulatory problem within the country to the internationalization of 3R issues and goals. Through its bilateral mechanism, Japan is well on its way in building the capacity to implement 3R in countries such as Vietnam and Malaysia (Yoshida et al. 2007). This is a step in the right direction for widening the purchase of 3R policies in East and Southeast Asia. Policy makers in the developing countries, on their part, must develop the institutional capacity to respond in long-term policy development. The pathways and stages how 3R was mainstreamed in Japan can be emulated in rapidly developing economies.

Second, State, community, and business must all learn to integrate their goals and objectives. Integration requires the coordination of governmental bodies, businesses and the community, each of which is an agent for change. Each of the change agents comes from a different perspective and the ability to communicate between them is a crucial factor in achieving success. Process-wise, although the role of international trade is still a contestable idea, developing countries may want to combine back-to-basics strategy of developing domestic waste management capacity together with the promotion of international cooperation to ensure the upgrading to 3R-based policies.

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CHAPTER 12

Policy Challenges and Research Needs for a Sustainable Resource Circulation in East and Southeast Asia

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1. Introduction

Developing Southeast Asian countries face environmental problems on associated with improper waste management. This paper overviews policy challenges and possibility to facilitate further regional cooperation in waste management and recycling in the region, and discuss the future research topics to formulate regional policies to establish sound waste management and improve resource efficiency.

2. Policy Challenges in Waste Management and Recycling

2.1 Common Problems in the Region

Most of cities in low and middle income East and Southeast Asian countries suffer open dumping and other solid waste problems, due to undeveloped systems of waste collection and treatment. On the other hand, the demand for resource materials in these countries is increasing as the region continues its growth as the “factory of the world” accompanied by rapid urbanization. The escalating rate in materials consumption and solid waste generation increases the potential risk of serious pollution of air, soil and water in the future, aggravated by the absence of an effective regulatory regime, insufficient capacity of the 3Rs on the part of the industry, lack of information and economic fluctuations (ADB and IGES 2008;ADB, IGES and UNEP 2006; MOEJ and IGES 2008).

In terms of a regulatory regime, for instance, the absence of environmental and labor standards has led to the use of strong acid for metals recovery, open burning recycling and waste treatment practices that are inexpensive but with very high environmental risks and are harmful to human health. There are no social or economic incentives that would induce to practice sound waste management or environment-compatible recycling. Implementation of environmental regulations and the concomitant construction of formal infrastructures and systems for improved waste collection and treatment calls for, as a prerequisite, a consistently high level of regulatory capacity on the part of municipal authorities. This in turn gives rise to the indispensable need for financial support as well as guidance by the central government in terms of indicating policy priorities and direction. The cooperation of citizens is equally important for the achievement of a sound recycling of resource materials.

A strong industrial base is also important to build up a system for a sustainable circulation of resource materials(ADB and IGES 2008). The material flow of e-waste and other waste products that contain rare or precious materials can be both useful and harmful. Industrial waste discharged from manufacturing processes, which accounts for a large majority of total waste generated, is hazardous or harmful; but in many instances this waste can also be potentially useful as resources (recovered as a by-product). However, the treatment of such waste is often beyond the capacity of the waste-generating manufacturer. Thus, there is the need for reliable waste management/recycling contractors. There should also be technologies and facilities that would ensure sound treatment and efficient recovery operations. This translates into the need for policies that would encourage the development of the recycling industry sector on an industrial scale and a solid financial base.

E-waste, end-of-life vehicles and other used products that are made of a complex variety of raw materials and parts contain a large number of substances that are both harmful and useful at the same time (Oyuna and Bengtsson 2009). This duality of material circulation is seldom recognized to the proper extent in the market. The recycling market looks at the economic value aspect of used products and handles them accordingly. Attention is paid only to the potential usefulness as a resource and not to the potential environmental risks (Wong 2006; Hai 2008; Oyuna and Bengtsson 2009). Lack of information on the hazardous substances contained in used products and recyclable resources and the insufficient knowledge and information required for their appropriate treatment pose a risk to the environment.

One-sided attention to the usefulness of used products and recyclable resources is an incentive to recover costs through the choice of inappropriate and inexpensive treatment methods. At the time of the turbulent ups and down in the international resources market during the latter half of this decade, recycling activities moved away from industrialized countries to developing countries with rising resource prices, and then turned sluggish when the situation reversed (Damanhuri and Padmi 2009). As far as the supply/demand adjustment is left to market forces alone, a sustainable circulation of resource materials is not likely to be achieved in some cases. For example, a case by Honda (2005) showed the market-based incentives of export of low quality plastics. Waste plastics in Japan were bought in 10.3 yen/kg from an emitter and will be bought in 30 yen/kg in China. This counts 20 yen/kg benefit for the waste plastic dealer At the same time, if this waste plastics is recycled in Japan, it will cost more than 31 yen/kg for the emitter. This means that the emitter will save at least 41 yen/kg (31 yen/kg saving plus 10.3 yen/kg by sales) by exporting the plastics waste. However, this buying capacity of China is based on low labor cost as well as low standard in environmental and health standards.

To eliminate such risk factors,, capacity development of the central and local governments through international cooperation in terms of regulatory framework, industrial base, information availability and stabilization of recyclable resources market is needed.

2.2 Japan's Experience and Lessons in Policy Development and Reform

Japan has been at the frontline of such efforts by advocating the policy objective of "establishing a sound material-cycle society" since the end of 1990s and by designing and implementing domestic systems to address such problems.

Behind this policy shift, there is a wide-spread notion that waste issues became social structural problems. The Japanese economy of the 1980s has been characterized as a "bubble economy" and as one which resulted in increases in consumption and more and more urbanization of Japanese society. This caused the classic environmental problems of urban life style: waste, lack of waste disposal facilities, water quality, and chemical components in the products of every household, transportation and destruction of natural environment. The life style of modern society itself, such as prevalence of electronic appliances, automobile, package, instant foods, and using of chemicals, has become the source of problem (IGES 2000: 19). For example, in Japan, household waste has increased from 44 million tons in 1980 to 50 million tons in 1990. Industrial waste emissions increased from 292 million tons in 1980 to 395 million tons in 1990 (Environmental Agency, Quality of the environment in Japan 1981, 1991, and 2001). The waste generation amount continued to be in high level every year. At the same time, local governments faced difficulties in constructing final disposal site due to increasing awareness of citizens. Also, there was a rising public criticism to the dioxin pollution from waste incineration facilities in the early to mid 1990s as seen in the case of Tokorozawa city, Saitama, Japan. In the late 1990s, Japanese government responded to face these challenges by reforming waste management and recycling mechanisms fundamentally along the following principles: Extended Producer Responsibility (EPR), Polluter Pays Principle (PPP), and collaboration of central and local governments.

Through the late 1990s to early 2000s, product-oriented legislation and mechanisms for recycling based on EPR principles, such as Containers and Packaging Recycling Law in 1995; the Law for Recycling of Specified Kinds of Home Appliances (or Home Appliance Recycling Law) in 1998, the Construction Materials Recycling Law in 2000, the Food Recycling Law in 2000 and End of Life Vehicle Recycling Law in 2000, were introduced for aiming to motivate producers to promote design for the environment and recycling activities by shifting burden in waste management and recycling from local authorities to producers. Also, Japan experienced several huge illegal dumping incidents of industrial wastes in the 1990s such as Teshima Island Problem widely known in the early 1990s. For this, polluter pays principle (PPP) was applied to prevent illegal dumping of industrial waste by introducing manifesto to track industrial waste or cost bearing for recovery of situation. These shifts in policy have been promoted through collaboration of central and local governments. For example, central government has financially supported local government to introduce dioxin-free large-scale incineration plant as well as recycling facilities under Eco-town program to construct infrastructures to support this policy shift.

Some of the lessons from Japan's experience of development and reform in waste management and recycling policy for developing Asia can be summarized into the following three points. Firstly, successful policy to promote waste management and recycling involves an aspect of socio-economic reform. Thus it is crucial to identify clear and specific social and economic needs to motivate reform in waste management. Secondly, to establish a comprehensive mechanism, Japan has employed a step-by-step approach to introduce new legislations along with domestic recycling and waste management capacities. Once, Japan decided to introduce reform in waste management and recycling policy in mid 1990s, it took about 10 years for developing comprehensive mechanism including framework legislation such as fundamental law and plan for establishing a sound material cycle society in 2001 and 2003 or product-specific recycling laws mentioned above started to be introduced in the 1990s. Thirdly, influence of economic globalization reached not only to production chain but also to waste and recycling chain. This will be briefly discussed in the section (4) below.

2.3 Needs for International Cooperation

In addition, China and Korea, in particular, have each given material circulation high priorities in their national policies. Dissemination of experiences of these three countries (plus Taiwan, which is well-known for its advanced initiative in solid waste management) should be considered as an essential element for international cooperation in this sector in Asia.

For effective implementation of policies, it is not sufficient to establish well-designed legislative and regulatory frameworks and physical infrastructures such as advanced sorting or recycling facilities, but it is also needed to develop an extensive capacity and multi-lateral cooperation in addition to bilateral partnerships. A response to meet this challenge is for developing countries to share their experiences with each other, as an increasing number of countries are shifting to the status of emerging economies (Hotta et. al. 2009). There are no textbook solutions in waste management and recycling; the process of learning from each other through exchange of experiences both success and failures is the key.

2.4 Internationalization of Downstream Resource Circulation

In industrialized countries, on the other hand, waste management and recycling policies have been established, and mechanisms for domestic circulation of resource materials are in place; but recyclable resources are flowing out to other countries because of the high costs of collection and treatment and the increased demand for resources in developing countries (Terazono et. al. 2004; Kojima 2005; Hotta and Elder 2009). This flow, although meeting the need for such resources in developing countries, has given rise to environmental concerns over inappropriate treatment and residues (Wong 2006). In short, problems associated with waste management and recycling have acquired international dimensions (Hotta and Kojima 2008, Hotta and Elder 2008, Hotta and Elder 2009). It is also expected that the domestic generation of e-waste and other hard-to-treat waste and recyclable resources will increase rapidly in developing countries as well.

With economic integration making steady progress in East and Southeast Asia and the resulting rise in demand for resource materials, it is very important that sustainable material circulation flows be ensured through regional cooperation. Implementation and enforcement of adequate regulatory measures and building of policy development capacities in developing Asian countries are called for to ensure a smooth flow of recyclable materials through appropriate treatment routes and healthy markets.

If the issue of international resource circulation is essential trade-and-environment issue, regional cooperation should also be considered from the perspective of filling the inevitable gaps in the policies of national governments.

3. Current situation of International Cooperation in East and Southeast Asia Toward Sustainable Resource Circulation

Previous section shows international information sharing and cooperation are imports to bring about sustainable resource circulation in Asia. International assistance and cooperation in terms of capacity building for policy development and networking of stakeholders should be promoted in addition to technical assistance (ADB and IGES 2008, IGES, UNCRD, and UNEP/RRCAP 2009). International cooperation for environmentally sound international circulation should be strengthened.In East and Southeast Asia, various international cooperation initiatives have been taken in response to the need for the internationalization of waste management and recycling issues and for the capacity building of the countries concerned. At the core of such efforts are the policy dialogues and international cooperation programs that were triggered by the 3R Initiative launched in 2005 (ADB, IGES, and UNEP 2006, ADB and IGES 2008, MOEJ and IGES 2008). Asian countries have been engaged in ongoing discussions on waste management and recycling issues as well as resource efficiency questions from the Asian regional perspective. In 2008, the Kobe 3R Action Plan was adopted as one of the agreement documents of the G8 Environment Ministers Meeting in Kobe. The Action Plan emphasized "that an international point of view for efficient use of resources through the promotion of the 3Rs is required to respond to the advancing interdependence of the world economy, expansion of trade in materials and products, and resource constraints due to increasing demands," (Kobe 3R Action Plan, *G8 Environmental Ministers Meeting 2008, Kobe, Japan, 24-26 May 2008*: P. 2) and went on to declare that the G8 environment ministers will "collaborate to improve 3R capacity in developing countries by helping to develop databases, information sharing and monitoring mechanisms, 3R-related institutional design and policy planning, and supporting the formation of development projects, by utilizing frameworks and initiatives of multilateral cooperation in an effective manner, and capacity and expert knowledge of international organizations."(*ibid.* P. 6)

Some major examples of such international collaboration are listed in Table 1.

Table 1. Examples of Multi-lateral Collaboration on Waste Management and Recycling in Asia and the Pacific

Regional 3R Forum in Asia	Inaugurated in November 2009, this Forum promotes policy dialogues and facilitates 3R project implementation in alliance with international aid organizations and in cooperation with 3R research network.
TEMM and policy dialogue on 3R and circular economy	Following the agreement of the Seventh Tripartite Environmental Ministers Meeting (TEMM) between Japan, China and Korea in October 2005, annual seminars on waste management and recycling, 3R and the circular economy, as well as bilateral policy dialogues are held, promoting information exchange and sharing among the working-level officials of the three countries.
The Asian Network for Prevention of Illegal Transboundary Movement of Hazardous Wastes	Operating since 2004, this Network provides a forum for officials in charge of the Basel Convention in Asian countries to get together and share pertinent information.
The Asia Pacific E-waste Project	With the Secretariat of the Basel Convention as the main driving engine, activities such as the development of an E-waste inventory in Asian countries, training and regional workshops have been established since November 2005. In addition, pilot projects on E-waste management have been implemented.

Thematic Working Group on Solid and Hazardous Waste of the Regional Forum on Environment and Health in Southeast and East Asian Countries	As part of the Regional Forum on Environment and Health in Southeast and Asian Countries for which the World Health Organization (WHO) and the United Nations Environment Programme (UNEP) function as secretariat, government officials and experts gather together and review best practices and challenges in the management of municipal waste and medical waste. This working group was established in February 2008.
UNEP International Panel for Sustainable Resource Management	This international panel was launched by UNEP in November 2007, inviting world-renowned scientists and experts. The panel gathers the latest information and builds a knowledge base regarding the utilization of natural resources and environmental impacts. It also makes policy recommendations.

4. Directions of International Cooperation Toward Sustainable Resource Circulation in East and Southeast Asia

Today, more and more Asian countries are working to create 3R systems, circular economies and sound material-cycle societies. In addition to international frameworks which are shown in previous section, bilateral collaboration is actively promoted in this direction. For example, between China and Japan, collaboration between eco-towns and ecological industrial zones is taking place in the form of the partnership of Kitakyushu with Qingdao and Tianjin and that of Kawasaki with Shenyang (Liu et. al. 2008, Matsumoto and Liu 2008), that promote city-level and enterprise-level sharing of experiences under the auspices of national research institutes and governments. With the outcomes of such partnerships and collaboration, Asian countries and international organizations should be able to share their mutual experiences in this sector, which in turn will be reflected in international cooperation projects and initiatives in East and Southeast Asia (Hotta and Elder 2008).

Asian countries have begun to enact specific recycling laws and build pertinent recycling mechanisms into their own structures, based on the principle of extended producer responsibility (EPR) and through a mix of regulatory, economic and information-based policy tools (Hotta et. al. 2009). It is hoped that the experiences gained by each country will be shared through the Regional 3R Forum in Asia and other frameworks such as the ERIA 3R Working Group, and facilitate the construction of mechanisms for proper reflection of resource utilization costs at the upstream sectors and equitable allocation of necessary treatment costs(UNESCAP and IGES 2006).

For the development of industrial capacity for resource circulation at the national level, a proper infrastructure should be built, adequate technologies should be transferred and mechanisms for technological innovation that link regulatory regimes with infrastructure should be developed (ADB and IGES 2008). In this respect, Asia has accumulated experiences in the forms of a Japanese eco-town (a recycling industry complex) and Chinese ecological industrial zone that are being developed, building upon the concept of industrial ecology. There have been active exchanges at the local government, business and academic levels. There is also a need in Asia to formally organize the informal waste sector.

For the construction of appropriate resource circulation systems, the need for information sharing, particularly the information and data relating to the properties of waste (on its potential usefulness and harmfulness) has increased against the background of increased concern over environmental contamination in developing countries and the stronger interest in metals recovery(Mori et. al.2009). In view of the growing transboundary movement of products, it would be necessary to explore mechanisms for communicating product environmental information and data in Asia, while paying attention to differences in national stances on this issue(Mori et. al. 2009). This is another area in which international cooperation in Asia would be able to play an important role.

International collaboration is believed to have the important function of communicating experiences of pioneer efforts (not only success stories but also lessons learned in terms of hurdles and obstructions) in a multilateral context beyond the conventional one-way transfers. Such international collaboration is expected to make positive contributions rather in the upstream challenges of energy efficiency, resource saving and other forms of sustainable resource utilization as well as resource efficiency or reductions, than in the downstream issues of waste management and recycling

5. Research Needs for Sustainable Resource Circulation in Asia

As discussed above, challenges to be overcome to achieve sustainable resource circulation is not only technical ones but also more fundamental institutional challenges which needs proper policy implementation. Especially, there is a rising needs for policy research on how to improve governance and implementation of resource circulation policy in Asia. For example, more careful analysis is needed on different policy tools/measures, which were successful for improving unit-level improvement in eco-efficiency in Organization for Economic Co-operation and Development (OECD) countries in the context of developing Asia. Also, more research shall be conducted on how to improve coordination between infrastructure, financial mechanisms, human resource development, and technology transfer required for a sustainable resource circulation. Another aspect that needs to be studied is how the different types of governance, or role sharing among central and local government affects efficiency in resource circulation and waste management.

In East and Southeast Asia, a further increase in waste generation and resource consumption is expected due to the progress in economic development and urbanization. Therefore, it is crucial to expand and prioritize 3R and resource circulation policies in these regions. Therefore, the policy perspective to improve resource productivity is needed in addition to improving waste management. This needs for developing indicators in assessing resource circulation in these countries. In the context of rapidly developing Asia and the rising concerns on global sustainable resource management, such indicators may be different from those of OECD countries to meet the needs of policy makers in developing Asia.

Also, for policy discussions on international resource circulation, introduction of researcher's view is desirable for balanced and constructive discussions among policy makers. Considering the efficient allocation of strategic materials needed for low carbon society, the international resource circulation may not be limited in the issue of transboundary movement of wastes and used products.

From the above perspectives, it shows that there is a continuous and rising need for policy research on how to achieve sustainable resource circulations and to improve

3R policies in Asia to support international cooperation.

6. Conclusion

This paper first overviewed the potential risks which can severally worsen waste and recycling-related challenges faced by developing Asia. By doing so, the paper discussed the necessary policy approaches, international cooperation, and relevant policy research to eliminate such risks. Especially, since waste and recycling-related challenges are now internationalized along globalized material flows, the paper emphasized the needs for closer international collaboration among Asian countries. Along the rising awareness on the needs for 3R approaches among policy makers, it is desirable to share useful knowledge and experience for effective policy implementation. Towards these ends, it is important to analyze experiences of different countries with proper understanding of economic and social backgrounds. In addition, to establish sustainable resource circulation in Asia, the indicators and methods to evaluate effectiveness of policies shall be established in these countries. Regarding international resource circulation, common understanding of the current situation should be generated by further studies.

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CHAPTER 13

Location of Recycling Facilities and International Trade of Recyclable Waste

Michikazu KOJIMA

1. Introduction

There are many types of recycling facilities. The recycling facilities for some specific items are not located in a country. If there are no recycling facilities for specific items in the country, the collected specific recyclable waste may need to be exported for recycling. For example, paper mill and lead recycling facility are not located in Singapore. All collected use paper and lead acid batteries are sent to other countries for recycling.

This paper reviews the location of recycling facilities for selected recyclable wastes, such as copper scraps, lead scraps, nickel scrap and others. There are no complete lists of recycling facilities in the region. Especially, the location of informal recycling facilities is not well reported. But some lists shows that the facilities are unevenly located. The statistics of international trade for the selected waste are used as complementary resource in searching for information. The trade flow of a specific waste from a country to another country may indicate the lack of the recycling facility in origin, and the existence of the recycling industry in the destination. It is also possible that some recyclable waste are internationally traded because of other reasons, such as the demand and supply gap of recyclable waste, the differences of cost or product price between exporting country and importing country, among others. To identify the reason of international trade, interviews to waste generators and experts were conducted.

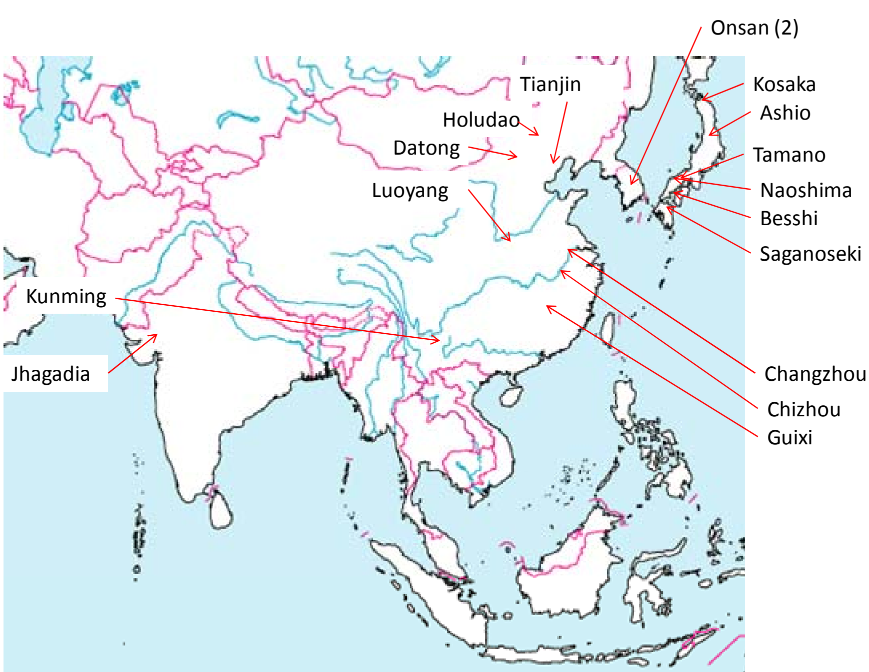
Section 1 shows the case of copper recycling. Section 2 deals with location of lead recycling facilities in Asia. Section 3 shows the trade of waste nickel cadmium and nickel metal hydride batteries. In conclusion, the relationship between location of recycling industries and international trade of recyclable waste is discussed.

2. Recycling Facility for Recovering Copper

Copper is used in various electrical equipment and electronics. It is widely use in cables. Copper waste is recycled and re-used in many places. Especially, copper waste with high concentration rate of cooper is often directly recycled without refinery and electrolysis treatment in developing countries. To recycle copper waste with low concentration of copper, or to use copper in highest grade, the refinery and electrolysis treatment has to be conducted.

Figure 1 shows the location of copper smelter and copper refinery in Asian countries. Based on International Copper Study Group (2009), copper smelter and refinery are basically located in Japan, South Korea, China and India. In Southeast Asian countries, there is no smelter and refinery using copper scrap, while some smelter and refinery using copper ore exist.

Figure 1. Copper Smelter and Refinery using Copper Scrap



Source: Compiled from the data in International Copper Study Group (2009), "Directory of Copper Mines and Plants."

International trade statistics support the information of the location of copper smelter and refinery are unevenly located (Table 1). China and India is net importer of copper scrap. Especially, China imports nearly 4 million to 6 million tons of copper scrap. But copper scrap imported by China may include mixed scrap, which contains copper scrap, ferrous scrap and other metal scrap. According to China Environmental Yearbook, copper content is about one third of the total amount. Philippines, Thailand, Singapore and Indonesia are also net exporter of copper scrap, but the import amount is less than ten thousand tons.

South Korea and Japan have both import and export of copper scrap. The quality of imported and exported one is different. The average price of imported copper scrap by Japan is 4.95 US dollar in 2009, while exported one is 2.03 US dollar (calculated from trade statistics. The quality of imported one is higher than imported one. It suggests that even in copper scrap recycling, Japan has comparative advantage to recycle high grade copper scrap.

Table 1 Import and Export of Copper Scrap by Selected Asian Countries, 2008-2009 (Unit: thousand tons)

	Import		Export	
	2008	2009	2008	2009
Japan	138	97	395	359
South Korea	217	163	191	186
China	5,577	3,998	3	2
Philippines	3	4	18	22
Thailand	7	9	76	69
Singapore	4	2	16	8
Indonesia	9	6	40	34
India	103	61(Jan-Oct)	1	1(Jan-Oct)

Note: Export of Singapore is domestic export, not including re-export.

Source: International trade statistics of each country.

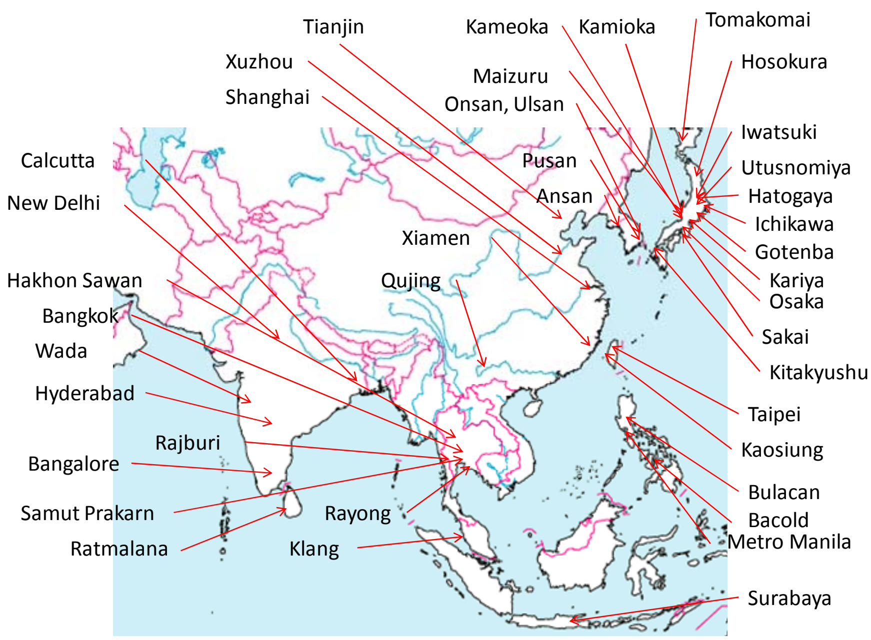
In Southeast Asian countries, there are some smelters and refineries to extract copper form copper ore. Copper mines are also being operated in Indonesia, Philippines and other countries. Copper smelters and refineries concentrate on virgin resources rather than scrap, because they have comparative advantage in extracting copper from copper ore. As a result, Southeast Asian countries are net exporter of copper scrap.

3. Recycling Facility for Recovering Lead

The most demand for lead is for the production of lead acid batteries. Recovered lead is also used for lead acid batteries, mainly. Other minor types of lead usage are for solder, CRT glass, among others. Major input of lead recycling facilities is waste lead acid batteries.

Contrary to copper, lead recycling facilities are located in most of Asian countries. Figure 2 shows the locations of lead recycling facilities, which are formal recycling facilities and relatively big one. In China it is said that more than 300 lead recycling facilities exists. Informal lead recycling facility which has no pollution control equipment has been observed also in some Asian countries. For example, in Figure 1, although no recycling facility is mapped in Vietnam, but several small-scale lead recycling factories are located in Hung Yen province.

Figure 2 Location of Lead Recycling Facility



Source: Made from the data in International Lead and Zinc Study Group (2007) World Directory 2006; Primary and Secondary Plants.

Most of lead containing wastes, such as waste lead acid battery is regarded as hazardous waste under the Basel Convention. The parties of the Convention should follow the prior notice and consent procedure defined in the Convention. Table 1 shows the international trade of lead scrap, based on the national reporting to the secretariat of the Basel Convention by each country.

China basically prohibits import of hazardous waste. Although there are many lead recycling facilities in China, lead recycling factories cannot import lead waste in national reporting. Japan also has many lead recycling facilities, but they do not have comparative advantage in lead recycling. Export of lead scrap to South Korea has been increasing recently. In Asia, South Korea and Philippines are major importers of lead waste. Imported lead scrap fills the growing demand of lead in domestic market and export demand of final goods.

Table 1 International Trade of Lead Scrap for 2005

Import Export	South Korea	Philippines	Singapore	Belgium
Japan	5757 (64000)			954
Taiwan	(600)			
Philippine	1000 (3000)		120	
Thailand		(870)	(120)	
Singapore	100 (7000)	6913 (10000)		
Sir Lanka	(18500)			
Others	(60500)	(18720)		

Notes: Without ( ) : Report from exporting countries

With ( ) : Report from importing countries

Source: Based on the data of national reporting to the Secretariat of the Basel Convention for 2005*r.*

It is not clear the reason of differences between statistics of importing and exporting countries. One of the possibilities is the gap between the actual volume of trade and the permitted maximum volume. Based on the interview with Ministry of Environment in South Korea, South Korean government reports permitted amount of hazardous waste export and import in national reporting.

4. Waste Ni-Cd and Ni-Mh Batteries

International trade of waste Nickel Cadmium (Ni-Cd) battery and Nickel Metal hydrid (Ni-Mh) batteries are reported in national reporting of the Basel Convention. Since Cadmium is a hazardous substance, Ni-Cd battery is regulated under the Basel Convention. In Asia, Japan and South Korea are major importers; and China, Taiwan and Indonesia are major exporters.

Based on the interviews to recyclers in Japan, nickel recovering facilities are located in Japan and South Korea. On the other hand, China and Indonesia are production center of Ni-Cd and Ni-Mh batteries. For example, China exports 739 thousand unit of Ni-Cd battery. Indonesia also exports 60 thousand unit of Ni-Cd battery. Based on the interviews to waste generator and recycler, the waste Ni-Cd and Ni-Mh batteris traded can be regarded as factory waste from Ni-Cd and Ni-Mh batteries.

Table 2 International Trade of Waste Ni-Cd and Ni-Mh Batteries in 2006

Import Export	Japan	South Korea
China	(1404)	28 (1530)
Hong Kong		(60)
Indonesia	150 (85)	
Malaysia		(150)
Australia		(150)
New Zealand		(100)

Notes: Without ( ) : Report from exporting countries
With ( ) : Report from importing countries
Sources: Based on the National reporting to the Secretariat of the Basel Convention for 2006

5. Conclusion

Scale economy can be observed in many production processes, including recycling process. If the size of a national economy is small, a recycling plant cannot collect enough waste to operate. As shown in Sections 1 and 3, recycling plants for specific waste are unevenly located in Asian countries. In such cases, international trade is inevitable to recycled specific waste.

Even there are many recycling facilities across the region, as shown in the case of lead recycling in Section 2, international trade occurs due to the gap between supply and demand, and comparative advantage in recycling process and final product. On the other hand, transboundary movement of hazardous waste may cause pollution in importing country (Center for Investigative Reporting and Bill Moyers(1990), Basel Action Network(2002)). Thus, international trade of hazardous waste should be regulated to prevent pollution from informal recycling. On the other hand, international trade of hazardous waste by formal recyclers with environmentally sound technology should not be prohibited. Based on the location of recycling facilities, the demand and supply gap, the existence of informal recycling, appropriate policies on international trade of recyclables waste should be identified.

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