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Managing Wastes in Asia: Looking at the Perspectives of China, Mongolia and the Philippines

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1. Introduction

The state of solid wastes in Asia reflects a situation where poverty and inefficient resource management are intertwined. Urban centers continue to grow and so with population. Consumption of resources necessarily goes up and generation of wastes is increasing at an alarming rate. Consequently, methane and carbon dioxide emission are rising. In the global landscape, greenhouse gas emission is being felt strongly with the melting of ice in the North Pole, changing seasonal patterns, and the imminent threat to the submersion of small islands. The effects of climate change as a result of man-made activities threaten everyone across social classes and geographical location. But developing countries are more exposed to vulnerability in view of poor resources and technology to cope with it. Poor planning, limited financial capacity, lack of technical know-how and toothless laws are some of the barriers that do not permit them to implement environmentally-sound, economically-viable and socially acceptable waste management programs. Among the serious problems needing serious attention is what to do with end-of-life (ELV) or used vehicles and the accumulation of non-biodegradable wastes like plastic that are left on the streets, drainages and water bodies.

A number of countries in Asia have jumpstarted the campaign to reverse the problem of ELV accumulation. The European Union (EU) pioneered an ELV law in September 2000. Japan and Korea followed suit with the former passing an Automobile Recycling Law in January 2005. Korea, on the other hand, passed the Resources Recycling Law in January 2008. These countries recognized that a distinct ELV law is necessary within the framework of the extended producer responsibility (EPR) system. An international cooperation is being pursued by the Japanese government in partnership with Tohoku University and car manufacturers like Hyundai, Kia Motors, Shanghai GM and Volkswagen through the Asian Environment-friendly Automobile Forum to promote knowledge and awareness on ELV recycling in Asia. Experts from the academe, government and the private sector converge annually to exchange ideas and technical know-how on how to best address accumulated

Source: Waste Management, Book edited by: Er Sunil Kumar,
ISBN 978-953-7619-84-8, pp. 232, March 2010, INTECH, Croatia, downloaded from SCIYO.COM

used vehicles and assist in crafting policies that will mandate recycling. To realize this, the first forum was held in China in 2007 and in Korea in 2008. This year, it will be held at Tohoku University in Sendai, Japan.

In another front, unregulated municipal wastes have led to tremendous problems like air, water and land pollution. Recycling in developing countries is poorly implemented. In fact, the absence of a mainstream recycling system has led to the emergence of an informal sector consisting of wastepickers and small junkshops who recover wastes at disposal sites. Lack of jobs and poverty are the main reasons for this scenario. However, small communities have been creative and proactive to address the problem. In Manila, Philippines, a women-led and community-based recycling project is being implemented where used plastics are converted into handicrafts and are exported and sold locally. Most important aspect of this undertaking is that women gained jobs and are able to contribute to the family income. The project has empowered them through economic and social means and the community benefitted from this environmental initiative.

This paper discusses the state of ELVs in China and Mongolia with reference to the experience of Japan and Korea as far as car recycling is concerned. In addition, a community-based plastic recycling initiative in Metro Manila, Philippines is discussed and analyzed. The marriage of the above in this paper points to the importance of highlighting recovery of usable ELV parts and reducing plastic wastes in the municipal solid waste stream in the case of developing countries.

2. End-of-life vehicle recycling: the forerunner

The EU first passed a law on ELV recycling in 2000 which became the precursor for other countries like Japan and Korea to implement similar legislation. Europe has witnessed an exponential increase in the number of vehicles produced starting from the 1990s. About 14.5 million cars per year have been manufactured since 1998 with about 17 million in 2002. The impact that the industry created to the environment is huge in terms of energy and resource consumption, hazardous emissions, waste generation of toxic substances and disposal. It is estimated that about 75% of ELV in EU are recyclables while the remaining 25% are disposed of in landfills (Kanari et al., 2003). This prompted the passage of a recycling law that caters to ELVs in Europe.

In Japan, the "Law for the Recycling of End-of-life Vehicles" was implemented in 2005. The main feature of the law is that automobile manufacturers and importers have the responsibility to collect and recycle air bags and shredder residues generated during the treatment process of ELVs. End users, on the other hand, pay the appropriate recycling fee for car owners during the first car inspection.

Korea passed into law the "Act for Resource Recycling of Electrical and Electronic Equipment and Vehicles" in April 2007. The main purpose is restrictions on the use of hazardous substances and manufacture of products that facilitates recycling. A manufacturer or importer is required to develop recycling technology and provide technical support to vehicle scrapping business and dismantled recycling business. The target recycling rate is 85% by 2014 and 95% by 2015 with an energy recovery of not more than 5% by the former and no more than 10% by the latter.

Overall, the ELV recycling laws mentioned above can be summarized as follows:

	European Union	Japan	Korea
Timeframe	September 2000	January 2005	April 2007
Vehicle covered	Passenger cars with seating capacity of nine or less and commercial vehicles with gross value weight of 3.5 tons or less	Four-wheeled passenger cars and commercial vehicles	Passenger cars with seating capacity of 9 or less and trucks with maximum weight of 3.5 tonnes
Center of responsibility	Manufacturer e.g. establishment of ELV collection and recycling network	End user e.g. surrender of ELV and payment of necessary fees	Manufacturer e.g. development of recycling technology and technical support to vehicle scrapping business
Costs	Borne by the manufacturer	Borne by end users through a fund management corporation	Borne by the manufacturer (zero cost to the end user)
Information system	Monitoring and inventory of ELV samples are done. Same with Korea.	Monitoring focuses on airbag, freon gas and automobile shredder residue (ASR) only	Every ELV is checked including weight and type, etc.

The ELV laws passed by Japan and Korea have significant impacts on Asian countries. Skyrocketing prices of scrap irons, global warming and cross-border shipment of waste are some of the factors that are shaping up the automobile recycling industry. Vehicle recycling has revolutionized recycling technologies and fueled economic gains. At the same time, it has also uncovered the social aspect of automobile recycling. In developing countries, poor people are engaged in the recovery of metals and used automobile parts and a source of profitable income for small-scale used car dealers.

3. Current situation of ELVs in China and Mongolia

3.1 China today

China is, undoubtedly, a fast growing economy in the world. At the same time, it has also overtaken the United States as the largest emitter of greenhouse gas which is casting a serious shadow under the ray of global warming. The figures are staggering as far as the volume of vehicles and ELVs are concerned in China today. It was projected that by the end of 2006, the volume of vehicles running on the road had reached 32 million while that of ELVs were more than 1.5 million by the end of 2005. In 2003, the volume was 23.82 million while ELVs were 3-5% of the total. China passed a law regulating the disposal and recycling of ELVs in 2001, a year after the EU made its own ELV law. However, progress has been slow as far as the rate of dismantling is concerned – only 10% at the onset of 2004 (Chen, 2005).

The main feature of the law dubbed as "Statute 307" is the declaration of a vehicle as ELV based on some technical specifications like mileage accumulation and service rendered in

years. For example, a passenger vehicle with a mileage of up to 500,000 kilometers classifies it as an ELV. In China, commercial vehicles comprise the most number of ELVs while personal cars are only a small portion. Obsolete imported cars are also increasing which came from the US, Germany, Japan, Korea and the rest from other countries. These used vehicles are usually dismantled for their valuable metal parts. In addition, the law stipulates that vehicle owners sell their ELVs to a vehicle recycling enterprise. Sale to unregistered or unqualified individuals and even donations are not allowed.

The law also requires the establishment of an information system to monitor, manage and administer the entire vehicle life cycle from design to dismantling and recycling. In this regard, local administrative districts are the focal point in partnership with auto manufacturers. To further strengthen the law, a supplementary regulation was issued in 2006 called the "Motor Vehicle Product Recovery Technology Policy" in which one of the salient features is that manufacturers together with material and equipment manufacturers take the responsibility of sustainable recycling. It requires vehicle producers to work in tandem with operators doing component production, dismantling, remanufacture and recovery of ELVs and material recycling. The target is, by 2010, vehicle producers and agents of imported vehicles will be responsible for the recovery and treatment of their vehicles with the necessary fees involved. And they shall establish tie-up with enterprises involved in the dismantling and shredding of ELVs by providing technical information e.g. vehicle dismantling manual, etc.. In other words, the whole gamut of a vehicle will be considered to facilitate dismantling and recycling.

Imported vehicles account for a large volume of cars in China. A breakdown of countries importing vehicles to China is shown below:

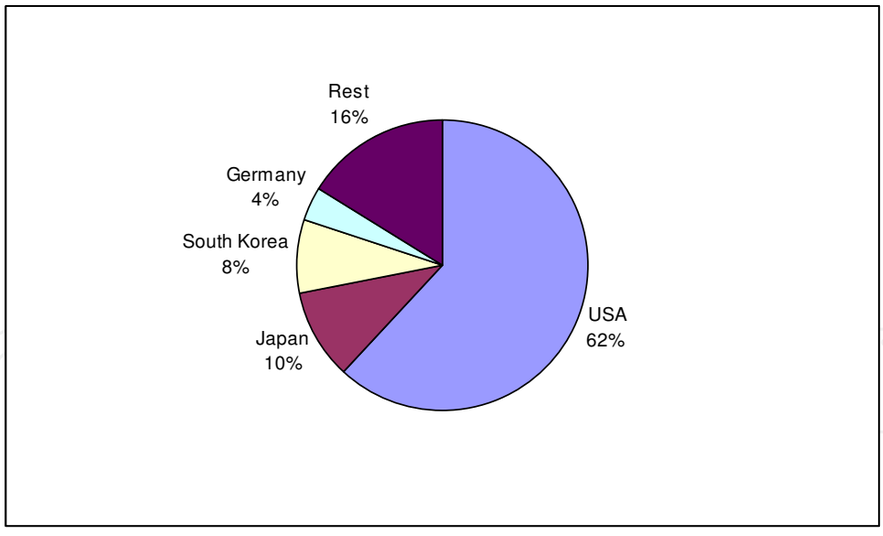

Fig. 1. Imported vehicles in China

The United States imports the most number of vehicles followed by Japan, South Korea and Germany. The rest represents various origins. Large importation of cars occurred in the 1990s with passenger cars accounting for the biggest proportion. In 2000, for example, it constituted 51%. Metal parts of imported ELVs are the ones recycled. On the other hand, table 1 shows sales, car possession shows sales, car possession and used car generation for the period 2005-2007:

Year	Sales	Car possession	Used car	Rate of used car generation (%)
2007	8.88 million	43.58 million	1.97 million	4.5%
2006	7.16 million	36.97 million	1.79 million	4.8%
2005	5.7 million	31.6 million	1.05 million	3.3%

Table 1. Vehicle sales and used car generation in China

Looking at car production, there has been a steady increase in the volume of cars manufactured in China representing different automakers as shown below:

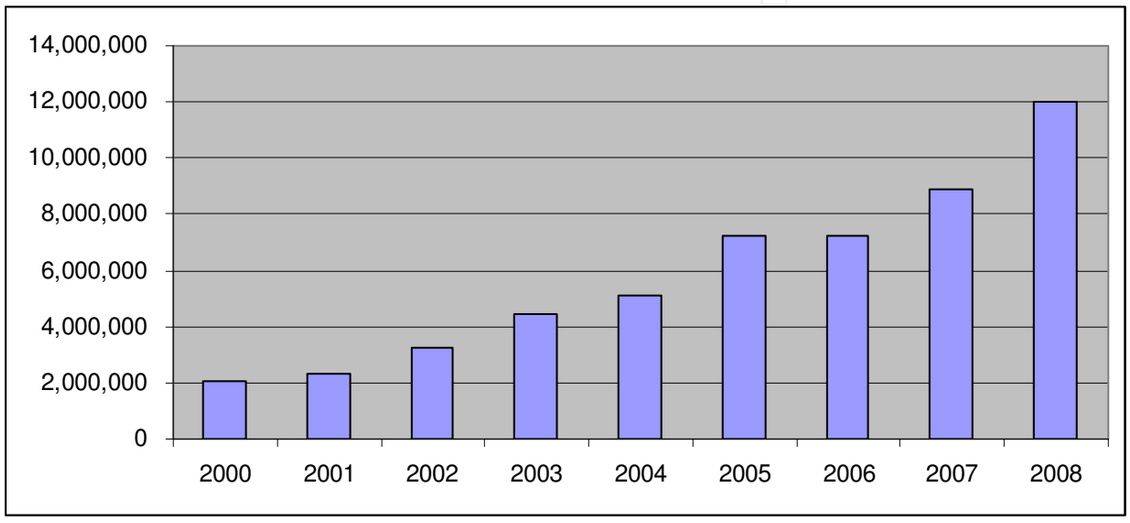

Fig. 2. Volume of car production in China (2000-2008)

ELV recycling in China faces many challenges. Lack of professional equipment, low dismantling efficiency, low recycling rate and environmental pollution are some of the issues confronting the industry. The dismantling aspect is described as "manually-based" due to the low cost of labor. In addition, they are outdated and environmental measures are poor. A situation too far when compared with the dismantlement technology in Japan. The roads are not paved and in the factory sites, wasted oil and fluids are left dripping into the ground. Fluorocarbons that pollute the air are neither collected. Iron and metallic resources are dismantled manually. It is said that the amount of automobile shredder residue (ASR) generation is near zero in China due to the manual dismantling scheme. An example of a dismantled car in Shanghai City is shown in figure 3.

Shanghai City was made as a pilot industrial demonstration of ELV dismantling and disposal in 2005 by virtue of Stature 307, the law which regulates the disposal and recycling of ELVs. The objective is to disassemble used commercial vehicles to be used as spare parts and recycle rubber, plastic and metal materials. The overall goal is to "establish an ELV recycling engineering system and remold the ELV recycling industry from an extensive to intensive and environmentally benign industry." Based on the initiative, significant achievements were made in terms of metal retrieval from ELVs as shown in table 2.

Fig. 3. Dismantled used vehicle in Shanghai City

Year	In-Use Vehicles	ELVs	Rate of ELVs In Use	Volume of Metal Recycling (tones)	Ferrous Metal (tones)	Nonferrous Metal (tones)
1995	308,258	9,171	2.98%	23,315.12	22,949.06	366.06
1996	343,815	8,630	2.51%	17,805.24	17,393.14	412.10
1997	387,538	11,194	2.89%	23,593.35	23,112.54	480.81
1998	404,491	13,783	3.41%	28,958.14	28,440.20	517.94
1999	451,419	11,774	2.61%	24,706.55	24,233.99	472.56
2000	492,025	11,119	2.26%	20,517.14	20,086.86	430.28
2001	518,693	13,773	2.66%	21,185.07	20,836.97	348.10

Table 2. Volume of in-use and end-of-life vehicles in Shanghai Administrative District and metals reclaimed from ELVs

3.2 Mongolia

Mongolia is a country in progress. It has vast natural resources but population is relatively small. As of 2009, its population is about 2.6 million (World Bank, 2009). About 61% or 1.58 million are living in urban areas. Ulaanbaatar, the capital city, accounts for the majority of the urban population estimated at 994,000. As such, motor vehicle possession is also concentrated in urban areas. In the capital city, car ownership rose from 28,119 in 1995 to 104,539 in December 2007. The origins of these vehicles vary as shown in figure 4.

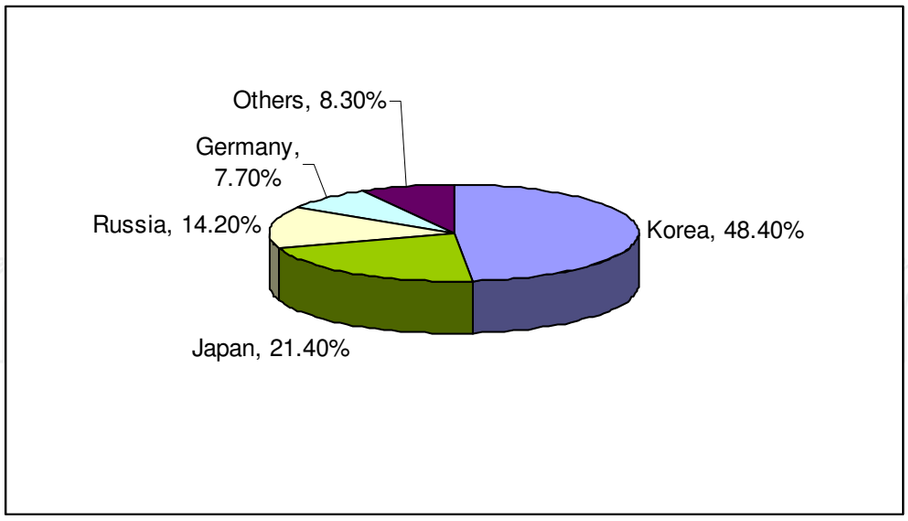

Fig. 4. Breakdown of countries exporting cars to Mongolia

Korea is the top exporter of cars to Mongolia with almost 50% of vehicles followed by Japan then Russia. European cars constitute a small portion of cars in Mongolia. A detailed breakdown of vehicles coming from various countries is shown below:

	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Russia	3914	1393	290	2288	3025	6190	2370	1944	1086	541	448
China	77	137	114	28	27	23	-	5	8	14	21
Germany	79	215	273	588	291	564	456	333	182	133	142
Korea	472	607	455	1910	737	1752	2512	1064	2230	3080	3227
Japan	110	421	493	765	716	2808	2747	3717	6666	8987	9289
Others	1558	223	112	111	66	172	224	124	150	178	195
Total	**6210**	**2996**	**1737**	**5690**	**4862**	**11509**	**8309**	**7187**	**10322**	**12933**	**13322**

Table 3. Countries importing cars to Mongolia

The above table shows the increase in the volume of vehicles from 1995 up to 2005. From 6,210 vehicles in 1995, the total number of vehicles in 2005 was 13,322. A study made by the Asian Development Bank (ADB) showed that as of December 2007, a total of 196,332 vehicles were registered nationwide (ADB 2008). Out of this, eighty percent (80%) of vehicles inspected did not pass national or international emission standards. The study further revealed that more than 50% are over 11 years old and 30% are 7-10 years old. This situation has worsened the ambient air in Mongolia with pollutants being emitted by old vehicles.

ELVs in Mongolia, therefore, abound with used cars still on the road. The absence of technology to recycle is one factor for the large volume of ELVs. Figure 5 reflects the age of vehicles in Ulaanbaatar where the largest concentration of vehicles are located.

Mongolia does not have a legislation on ELV recycling and as a result, used vehicles accumulate. There is manual recovery and sale of used parts but there is no recycling in the absence of recycling technologies.

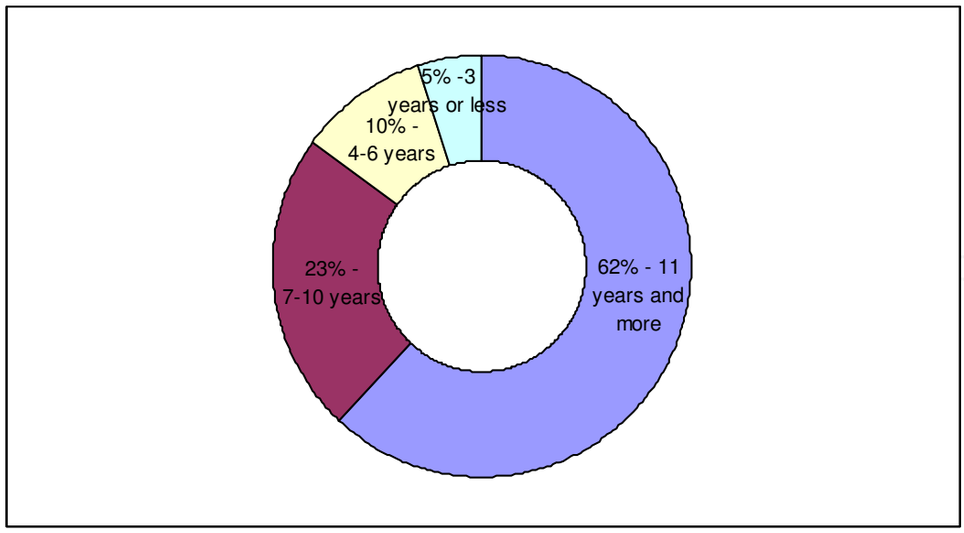

Fig. 5. Vehicle usage by years in Ulaanbaatar, Mongolia

Fig. 6. ELV in Mongolia

4. ELV dismantling: Efficiency and costs

The drive towards ELV recycling resulted in two (2) methods, namely: manual and machine-based dismantling. In China, where manual dismantling is usually involved, a comparison was made between the two. Figure 7 shows that machine dismantling results in more weight than manual dismantling.

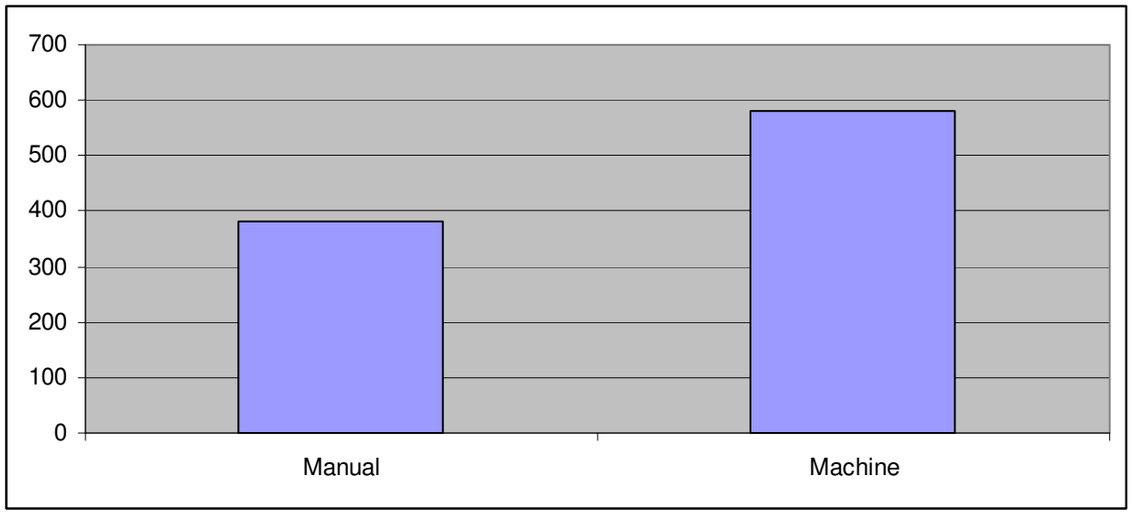

Fig. 7. Weight of pressed block from a dismantled ELV (kg)

Manual dismantling takes longer time than machine dismantling. However, more valuable parts are recovered in the former which translates into more parts to be sold or recycled. In the latter, there is more waste since the machine destroys some useful parts. On the other hand, the figure below shows a comparison in terms of the value of recovered parts using both manual and machine-based methods:

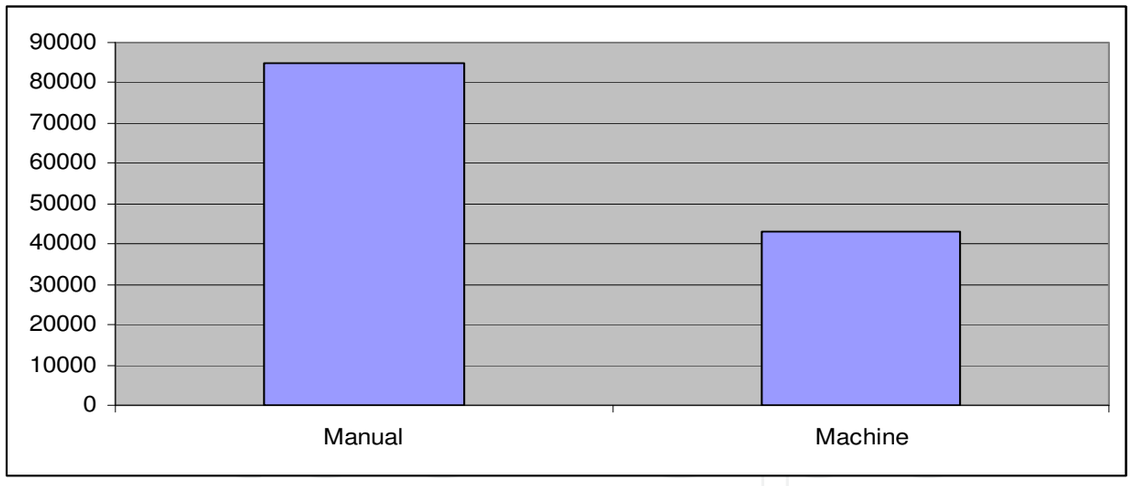

Fig. 8. Value in terms of ELV recovered parts in Japanese Yen (million)

As explained earlier, manual dismantling recovers more useful parts than machine mechanical dismantling. This translates into more monetary value for recovered parts.

5. Community-based recycling in the Philippines: From small to big steps

The state of solid waste management in the Philippines, particularly, in urban areas like Metro Manila is a microcosm of the prevailing situation in developing countries. Problems abound such as unregulated disposal, poorly maintained disposal sites, prevalence of informal waste recovery and low recycling rate. These are complemented with lack of data

on volume of waste, generation rate and composition of waste. This situation prevents a scientific approach and a practical resolution of the problem of garbage disposal. Nonetheless, a basic tenet in community development states that communities will continue to survive and evolve amidst the enormity of environmental problems. Initiatives will emerge and best practices will unfold as people try to solve environmental problems like solid waste.

Metro Manila is a metropolis with about 12 million people and comprising of 17 cities and municipalities. Quick facts are shown below:

	Philippines	**Metro Manila**
Population (2009)	92.23 million	11,553,427 (13%)
Unemployment (2009)	7.5%	13.5%
Annual per capita	US$330	US$6,827
Average family income (2006)	US$3,798	US$6,827
Literacy rate (2003)	84%	94.6%
Poverty incidence	32.9%	10.4%

Table 4. Quick facts about the Philippines

Unemployment rate in Metro Manila is high at 13.5%. Poverty incidence is likewise soaring with 33% nationwide and 10.4% in the Metropolis. It can be said that poverty is related to environmental problems like solid waste. People who do not have or cannot find a job resort to wastepicking to survive. Wastepickers are present in almost all the major disposal sites in Metro Manila. In the absence of a formal recycling system e.g. EPR, informal recycling thrives. But the plight of those in the informal waste sector is deplorable considering that a typical wastepicker earns only US$2-3 per day (Serrona, 2009). It is further aggravated by the fact that they are exposed to health hazards as they don't have the necessary protection e.g. gloves and mask while at work.

Community-based recycling initiatives are not new in the Philippines. There are various people's organizations in local communities as well as non-government organizations that are into advocacy of certain issues. There is the local government structure which plays an important role in local governance. In some communities, the people are organized by sector e.g. women, youth, farmers, etc.. The community exemplifies a heterogeneous conglomeration of individuals and groups interacting with each other. One typical example is a community in Ugong, Pasig City, Metro Manila which has a women-led community – based recycling project. The name of the organization is KILUS or "Kababaihang Iisa ang Layunin para Umunland ang Sambayanan" (Women Who Are United for the Progress of Society). Formed in August 1997, the group was then called "Samahan ng mga Kababaihan ng Ugong" or Women's Group of Ugong. Its vision was for the cleanliness of the community. It became the partner of the local government in solid waste management. It was a partnership which earned the title "Cleanest Barangay along Pasig, Marikina and San Juan River. Then, it expanded and was formally registered in 1999 as KILUS. Presently, it is composed of 500 women members.

The path that KILUS took was unique. It focused on livelihood opportunities from garbage. As it evolved, the organization underwent skills training on handicraft making. They discovered a plastic material called "doy pack" which is sourced from a discarded juice container popular in schools and social gatherings. Anticipating a good business out of this

material, the group pursued to find creativity in the material. Handicrafts such as bags, home furnishings, footwear, and fashion accessories came into existence as a result of product development. With funding support (loan) from the government, it purchased sewing machines and other equipment for the members to use. The doy packs are sourced from within and outside the community by designated members and are bought at US$0.10 apiece. Some are also collected from manufacturers of doy packs which are usually "rejects." With expanding members and services, KILUS has metamorphosed into a multi-purpose environmental cooperative producing handicraft products and promoting cooperativism as a social vehicle to empower women. The bulk of its products are sold abroad like Japan, USA, Canada, Germany, Los Angeles, and London. The organization has an interesting program for its members like conflict-resolution meetings and the absence of vertical bureaucracy. Any member can directly talk to the manager and vice-versa. This makes KILUS an informal group but with an effective communication strategy among members. The result is smooth leadership and easy resolution of conflicts.

6. From doy packs into handicrafts: Sustaining lives

The process of converting used doy pack into handicrafts involves low-technology and is labor-intensive. KILUS is not really intent on modernizing its process as it exists on the creativity and dedication of its workers. Replacing people with equipment would just translate into loss of jobs and security of its members. It has four (4) product categories:

Products	Items	Price
1. Bags	Shoulder bag	Price ranges from US$5-19
2. Home furnishings	Book shelf, fruit tray, placemat, lunch box	
3. Fashion accessories	Belt, beltbag, jewelry box, beads	
4. Footwear	Sandals	

Table 5. KILUS products by category

The above reflects the experiments that the organization did to suit the needs of its customers. Based on the data, sixty percent (60%) of its shipment abroad consists of bags. On the other hand, the process of creating handicrafts requires major steps.

The first step involves the collection of doy packs from schools, factories, funeral parlors and other establishments. Each used doy pack is brought at US$0.002. Those coming from factories which are considered "rejects" are bought by KILUS at US$0.17 per kilo. Factory rejects require less time and effort to clean compared with those coming from schools which have to be washed up. Production is done at KILUS office and at the home of its workers. This arrangement is to give them time to take care of household chores and at the same time work on their assignment. Tasks done at home are those associated with washing, strip-making and beads-making. Once finished, they go to KILUS to submit their outputs. These are then recorded for payment purposes.

Quality control comes next where necessary corrections are made. Interestingly, quality control is done using only a lamp and a scissor to remove imperfections. After quality control, an inventory of finished products is made and preparation for packaging and subsequent shipment is made. The organization makes sure that they meet the timetable

Fig. 9. A bag made out of doy pack (inset photo)

requirements of their customers. Shipment delays are tantamount to losing loyal buyers. Air and sea freight are used as mode of shipment with the former taking one (1) week to deliver while the latter takes a month. International buyers have to pay a down payment fee of 50% upon ordering. There is no established peak and off-peak seasons as demand depends on the buyers.

Orders from abroad serve as the lifeblood of KILUS operations. In this regard, it ensures that quality products are produced. For the workers, creating a single handicraft is all about pouring their hearts into it. The production stage might be repetitive but they treat every single product as unique that will be cherished by customers.

Markets and sales

KILUS started selling products in 2002. It earned its customers through networking and showcasing its products in product exhibitions. Over the years, countries which have patronized its products are shown in the following figure:

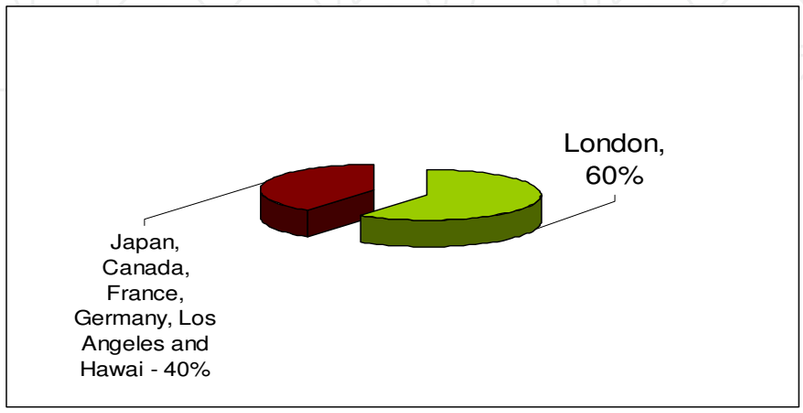

Fig. 10. KILUS International Markets

It will be noted that London is the main market of KILUS with 60% of its market. This can be attributed to the increasing consciousness among Europeans to recycle waste and be an advocate of an environmentally-sound lifestyle. Japan, Canada, France, Germany, Los Angeles and Hawaii comprise 40% of the market. Locally, it has one (1) shop in a shopping mall. To reach out to more local customers, it participates in bazaars. Still, international buyers dominate their sales. The sale of KILUS from their international buyers is shown below:

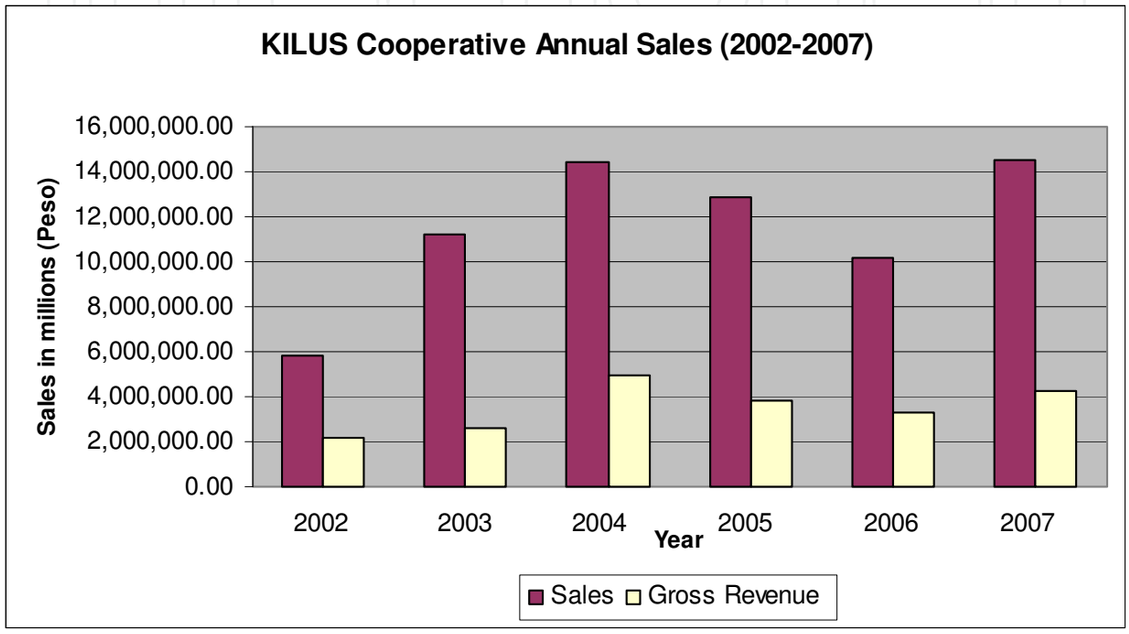

Fig. 11. KILUS annual sales

The above figure is indicative of the profitability of KILUS products. In 2002, sale reached approximately US$126,000. Subsequent sales went up in 2003 and 2004 and a slight decline in 2005 and 2006. However, sales went up again in 2007. The gross revenue reflects the net amount as a result of payments made to overhead costs and salaries for KILUS workers.

Salaries and benefits

Women workers are employed by the Cooperative. Payment is made based on the type of work that one does. As stated earlier, there are office-based and there are home-based workers. Home-based workers are paid apiece and are required to remit their outputs to the KILUS office on assigned dates. Submission of outputs is strict as international buyers set deadlines for shipment. What sets apart KILUS from other enterprises is there is no age limit if one desires to work. In an interview with Ms. Carmelita Elec, Business Manager of KILUS, as to the reason why women workers are preferred than men, she said that women are easy to talk with. "We can talk with women without a bottle of beer unlike men," according to Ms. Elec. Firm decision-makers are what characterize women and that is why the Cooperative hires them.

In terms of salaries, the following table shows the compensation of workers based on tasks:

Job category	Income
Sewers	US$278/month
Designers	US$204/month
Production manager	US$204/month
Raw materials	US$139/month
Receiving	US$93/month
Quality control	US$5/day
Cutter and sorter	US$3/2,500 pieces
Washer	US$3.2,500 pieces

Table 6. Jobs and salaries at KILUS

KILUS is not an ordinary enterprise. On top of their regular salaries as stated above, members also get benefits like rice, health insurance, groceries, free medical check-up, dividends and patronage refund. In addition, they also can avail of marriage counseling services. As an outreach program, the Cooperative provides scholarship to the children of workers numbering about 20. Each student is given an allowance of US$25 for school-related use. With the high unemployment rate in Metro Manila, KILUS provides the necessary support to women in the community.

KILUS replicability: Cost-benefit analysis

KILUS appears to be a boon to the community from the social and economic standpoints. However, to prove this requires a cost-benefit analysis (CBA) as a tool for decision-making. To do this, a simple CBA was made where the benefits and costs of operating KILUS are made from the perspectives of Metro Manila and the host community. There are two scenarios: with KILUS and without KILUS project. In the analysis, the net present value (NPV) which pertains to the benefits less costs was determined. Based on the study made by the Asian Development Bank (ADB), Pasig City where the Cooperative operates, spends about US3,611 on municipal waste management expenses which is nine percent (9%) of the total local government expenditures. This is lower compared to the average expenditures of a local government unit (LGU) in Metro Manila which is US$3,558,345 or 13% of the total LGU expenses.

The table above reveals that KILUS is beneficial for replication. The first two columns shows that benefits exceed costs. The net social benefits are higher with the project and significantly lower without the same project. On the fourth column (Pasig City perspective), the net social benefit is negative. It is worth to note that a project is worth recommending if the NPV is positive. As such, a negative NPV like the one in the fourth column (US$-511) is not worth recommending. Based on the above, KILUS is beneficial for the community from the perspective of providing jobs, reducing SWM costs and in cleaning up the environment.

7. Local government savings from recycling

The operation of KILUS directly benefits the LGU in terms of reduced SWM costs. Less doy packs on the streets and in street canals means less expenses for the LGU in terms of collection, transportation and disposal. To quantify the savings, a CBA was made to determine the savings of Pasig City in terms of tipping fees collected from the residents and subsidies from the government with doy pack recycling.

Impacts[a]	With KILUS		Without KILUS	
Project benefits:	Metro Manila perspective	Pasig City perspective	Metro Manila perspective	Pasig City perspective
Revenue from sales	270,216[b]	270,216	0	0
Reduced SWM cost[c]	75,739[d]	377.52	76,116.77	3,432
Reduced transportation cost to landfills	3,720	85.8	3,806	171.6
Livelihood for the poor/unemployed	116	116	0	0
Less doy pack on streets and elsewhere	76,117	343	76,117	343
TOTAL BENEFITS	425,908	271,138	156,039.77	3,947
Project Costs:				
Construction costs[e]	42,782	42,782	0	0
Operational costs (e.g.salaries, utilities, maintenance, etc.)	75,022	75,022	0	0
Per capita SWM cost	8	6	8	8
Waste disposal costs	74,836.77	$1,280	76,116.77	3,450
TOTAL COSTS	192,648.77	1,286	76,124.77	4,458
Net social benefits = NPV	**233,259**	**269,852**	**79,915**	**-511**

[a] refer to inputs (required resources and outputs)
[b] average KILUS sales
[c] obtained by multiplying the annual SWM cost (US$3,432) of Pasig City by 11% which is the percentage of used doy packs
[d] obtained by subtracting the total SWM costs of LGUs in Metro Manila from US$377.52 which is the amount reduced in SWM cost by Pasig City with daypack recycling
[e] assumes that space is provided by the local government but construction costs are shouldered by the project

Table 7. Cost-benefit analysis for KILUS project (in US$)

	2002	2003	2004	2005	2006	2007
Operating costs*	**75,021.73**	75,021.73	75,021.73	**64,564**	**75,940**	**84,561**
Sales**	**270,322.74**	270,322.74	270,322.74	**277,677**	**219,960**	**312,690**
Average sale price***	**5**	5	7	**7**	**11**	**11**
Gross revenue from sales	**81,965**	81,965	81,965	**82,366**	**70,754**	**92,725**
Per capita SWM (US$)****	**8**	8	8	**8**	**8**	**8**
Benefits	**10,246**	10,246	10,246	**10,295**	**8,844**	**11,590**

* 2002, 2003 and 2004 were assumed average costs based on 2005, 2006 and 2007 available figures
** 2002, 2003 and 2004 were assumed average sales based on 2005, 2006 and 2007 available figures
*** price of KILUS products range from US$5 to US$18 based on 2007 data
**** Average per capita SWM cost in Metro Manila (ADB)

Table 8. Cost-benefit analysis of KILUS operations (in US$)

The above table shows the benefits in US dollars from KILUS operations which were obtained by dividing the gross revenue from sales over the tipping fee which is US$8/ton. The tipping fee refers to the disposal fee where Pasig City dumps its waste. With doy pack recycling, the average yearly savings of the City amounts to US$10,244 as against the US$3,450 yearly expenses based on 2001 figures (Westfall & Allen, 2004). This is a significant savings considering that the per capita contribution to SWM expenses is only US$0.50 which is merely six percent (6%) of the total SWM expenses of the City. The recycling project allows the City government to save money and channel the savings to social services needed by the community. The amount of plastic going to landfills is also reduced. Further, the following table shows a comparison of the cost-benefit involved under two scenarios: waste disposal or business-as-usual and doy pack recycling:

	Waste disposal (business-as-usual)	With doy pack recycling
KILUS Income	US$0	US$10,244
LGU expenses (annual)	US$3,450	US$1,280

Table 9. KILUS contribution to reducing LGU SWM expenses

Savings in LGU expenses amounting to US$1,280 was computed by dividing the income of KILUS over US$8 which represents the tipping fee. Baseline figures show that without KILUS, the LGU will be spending US$3,450 annually for SWM related expenses. Moreover, plastic composition is 21% of the total MSW generation in Pasig City based on the ADB study. By weight, daily waste generation by the City is around 273 tons. Plastic constitutes 57 tons out of 273 tons. Assuming that doy pack is 50% of the plastics generated in the City, and KILUS recycles 100% of the doy packs, the reduction in volume is 29 tons. Thus, only 244 toms are left for disposal or further recycling.

8. Success factors

KILUS enterprise shows the feasibility of having community-based recycling at local communities in Metro Manila and elsewhere. The replicability of KILUS depends on a lot of factors such as social and economic situation, political dynamics and the presence of community groups. The role of the latter cannot be disputed since local organizations serve as catalyst for community development. They provide services beyond what the local government could provide such as livelihood and awareness-raising.

In a focus group discussion (FGD) with KILUS workers, five success factors were articulated, namely: good leadership, ability, time, unity and trust (Serrona, 2009). KILUS is championed by vision-oriented leaders and the positive response from the community indicates that when someone sincerely leads, the people will certainly act. The role of the local government is also vital through strong political will and sound legislations.

The FGD also gathered the following needs: product development, more markets and capacity-building for the workers. Product innovation is something that the project needs to embrace because of the evolving preference of its customers. The participants stated that they still lack innovative designs to make products out of doy pack. In this regard, they are coordinating with non-government organizations and other networks for possible trainings on product development. They are also in search for potential partners who can teach them

new designs. Market is also a key for their sustainability. On top of their current buyers, they need more to provide more jobs to the needy and more income for the organization.

9. Summary and recommendations

Waste management in Asia poses critical challenges as it grapples with urbanization, increasing population, unregulated greenhouse gas emission and heavy pollution. The threat to the environment is enormous and it goes further to the detriment of people's health and well-being. Actions cannot be deferred as far as reducing GHG is concerned. ELV recycling provides a framework for both developed and developing countries to act together in ending the cycle of pollution that it creates. But there should be equal partnership; one that does not make developing countries the basket for surplus vehicles and parts.

From the economic standpoint, ELV recycling is a sound practice because it meets the demand for scrap iron in the world market. The methodology to dismantle ELV, however, is a tug-of-war between manual and machine. Based on experience in China, more useful parts are recovered from manual dismantling and this translates into money. Cheap labor allows manual dismantling to be sustainable and markets for used parts are always present. As a recommendation, it is worth to look at ELV and plastic recycling as a boon to the government, local communities and the society in general. The use of local technologies is worth sustaining in light of efficiency and resources recovered as in the case of ELV dismantling and doy pack recycling. Manual recovery helps in providing jobs in developing countries. ELV laws must be put in place in Mongolia and in the Philippines as well to hasten ELV recovery.

In the case of plastic recycling, KILUS utilizes low-technology to make handicrafts. An approach which allows jobs to be generated for housewives and to raise awareness on the need to recover plastic materials. In addition, it allows the promotion of a cooperative where resources and gains are shared by community members. The community spirit of helping together address environmental problems through innovative approach is clearly manifested in the KILUS project. There is valid reason for KILUS to be replicated in other communities citing its social relevance and economic gains.

Future research on ELV may focus on enhancing life-cycle assessment (LCA) of vehicles to ensure that every aspect of it is recovered and there is very little that goes to landfills. Developing countries like Mongolia and the Philippines are rich subjects for research on ELV and plastic recycling. In the case of KILUS, there is a need to do an evaluation impact of the project to assess tangible benefits that the members and the community have received from the initiative. Lessons learned need to be identified as well as best practices in the area of community-based environmental enterprises.

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Waste Management

Edited by Er Sunil Kumar

ISBN 978-953-7619-84-8
Hard cover, 232 pages
Publisher InTech
Published online 01, March, 2010
Published in print edition March, 2010

Solid Waste Management is one of the essential obligatory functions of the Urban Local Bodies/Municipal Corporation. This service is falling too short of the desired level of efficiency and satisfaction resulting in problems of health, sanitation and environmental degradation. Due to lack of serious efforts by town/city authorities, garbage and its management has become a tenacious problem. Moreover, unsafe disposal of garbage and wastewater, coupled with poor hygiene, is creating opportunities for transmission of diseases. Solutions to problems of waste management are available. However, a general lack of awareness of the impact of unattended waste on people's health and lives, and the widespread perception that the solutions are not affordable have made communities and local authorities apathetic towards the problems. The aim of this Book is to bring together experiences reported from different geographical regions and local contexts. It consolidates the experiences of the experts from different geographical locations viz., Japan, Portugal, Columbia, Greece, India, Brazil, Chile, Australia and others.

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