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**BEST PRACTICES AND INNOVATIVE APPROACHES FOR SUSTAINABLE  
WASTE MANAGEMENT**

**(Plenary Session 2(a) of the Provisional Programme)**

**Final Draft**

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This background paper was prepared with inputs from Dr. P. Agamuthu and Dr. S.H. Fauziah from the Institute of Biological Sciences, Faculty of Science, University of Malaya, for the International Consultative Meeting on Expanding Waste Management Services in Developing Countries ahead of the eighteenth session of the Commission on Sustainable Development. The views expressed herein are those of the authors only and do not necessarily reflect the views of the United Nations.

## **Introduction**

Anthropogenic activities have always imposed threats to the environment. Among the most evident products of human activities are wastes. Daily global generation of municipal solid waste in 2006 was reported as 2.02 billion tonnes (UNEP, 2009). The rapid increase of waste generation has exceeded the earth's carrying capacity by 30% in catering the pollution intensity (Odum and Odum, 2006). As a consequence, the environment undergoes degradation as reported in various parts of the world, particularly in developing and under-developed countries (Rahji and Oloruntoba, 2009; Ngoc and Schnitzer, 2009). Since waste materials become more and more complex with the advancement in technology and human civilization, the environment needs to deal with chemical wastes, hazardous wastes, electronic-waste or e-waste and many more. Therefore, this calls for an urgent need for an appropriate waste management system. A waste management system is essential in order to cater the vast transformations of human civilization, as well as, developing the environment in the most sustainable approach (Odum and Odum, 2006).

Sustainable development becomes the target of modern society where economic progress is in tandem with environmental preservation. In order not to jeopardize the environment, various technologies approaches have been introduced. The necessity of proper mechanism in managing waste becomes more crucial in urban areas where dense population results in more complex composition and rapid waste generation. Approximately 47% of the world's populations is in urban areas with urban population growth capacity at 2% for 2000-2015 and 65% by 2050 (UNEP, 2009). The consumption trends, economic activities and perception of urbanites impact the waste management activities. As a result, municipal authorities hold the highest responsibility to manage the ever increasing waste. In developing countries where technologies and expertise are lacking, pollutants continue to contaminate the environment due to the failure of waste management authorities to deal with waste management issues. World Bank had identified waste management as one of the three sources of environmental degradation in many developing nations in Asia and Africa (Fauziah et al, 2009). Waste management incurs high cost due to the complexities of the waste. Most municipalities in Asia utilized more than 70% of the income raised. The richest cities in Malaysia such as Kuala Lumpur, Petaling Jaya and Subang Jaya spend approximately 40-70% of the town council's earnings for waste collection and waste disposal (The Star, 2009). Selangor state i.e. the fastest developing state in Malaysia spends RM500million (USD150million) annually to cater the waste disposal cost of 6,000 metric tonnes of waste everyday (The Star.com, 2010). Similar situations were reported in Jakarta, Indonesia (Firman, 2009).

The seriousness of this financial issue is more evident among authorities with lower income level. As a result, the quality of the waste management is questionable and in most cases below the satisfactory level. In poorer part of the world, a waste collection system does not exist that waste are dumped at illegal site creating nuisance and health risk to the people and environment (Agamuthu et al., 2009). In Nepal cities, the withdrawal of foreign waste management companies from managing the waste in the cities caused deterioration of the waste management system, and was reported to be at a level worse than its original trajectory (JICA, 2005). In many developing countries such

as Indonesia, the Philippines, Malaysia and Thailand, recycling activity are not mandatory that recyclable materials are disposed off into the waste stream (Agamuthu et al., 2009a). In Accra, Ghana, disposal of plastic sachets contributed 85% of the total waste generated in the city which clogged the drains resulting with more frequent flash flood incident (The Chronicles, 2010). On the other hand, areas where appropriate waste management has taken its momentum, waste collection and disposal become a profitable sector where the economy drives its success towards sustainable waste management system. This paper aims to discuss the best practices and innovative approaches towards a sustainable waste management system.

### **Effective waste management strategies by municipalities and local authorities**

The implementation of appropriate policy is very crucial in ensuring an effective waste management strategy in any country. The failure will impede the accomplishment of an improved sustainable waste management system. It also will impact the environment negatively. Appropriate drivers will emerge together with effective waste management strategies leading to a more sustainable management system. Among the drivers are political, environment and economy. Various successful cases of effective waste management strategies have been reported. Among others are in Japan and Denmark. The existing drivers towards sustainable waste management in these countries enable the possibility of further improvement via innovative technologies. In Japan, when the Japan Home Appliance Recycling Law came into effect in 2001, the country recorded 20% increase in collection of air conditioners, TV sets, refrigerators and washing machines for recycling (United Nations Department of Economic and Social Affairs 2004). The European Union (EU) has established three directives on electrical and electronic equipment: 2002/95/EC on restrictions on the use of certain hazardous substances in electrical and electronic equipment (RoHS); 2002/96/EC on waste electrical and electronic equipment (WEEE); and 2005/32/EC on the eco-design of energy-using products (Aizawa et al, 2008). As a result the recycling of electrical appliances increased tremendously.

The legislative framework on recycling is also very important in order to ensure that all stakeholders participate in recycling activities at the maximum level. Implementation of legislation alone might not be able to produce high recycling rate, but by imposing similar requirement onto the manufacturer could result in enhanced recycling. An obvious result of this approach is seen in Denmark where the deposit-refund system resulted with 85% of the total glass bottles generated are recycled. The deposit-refund scheme was successful in recycling as well as in reducing the littering rate in EU and the United States of America by 80% (BottleBill.co.uk, 2010). The effective waste management implemented by the Scottish Government is also expecting further improvement that the target of 80% recycling and only 5% landfilling can be achieved in 2025 (The Scotsman, 2008).

The scenario in many Asian developing countries such as India, Indonesia, Malaysia, Thailand and Vietnam sees very slow improvement in the waste management, unlike countries like Singapore and Korea where significant improvement in waste management resulted with more effective system. The implementation of National Recycling

Programme in 2001 and Zero Waste Singapore in 2003 managed to reduce the waste generation in the country from  $7.7 \times 10^6$  kg/day in 2001 to  $7.0 \times 10^6$  kg/day in 2005 (National Environment Agency, Singapore, 2006). The introduction of a volume-based fee system for the treatment or disposal of wastes in 1995 in the Republic of Korea also managed to reduce 22% of waste generated in 2003 as compared to 1994 (Ju, 2005). On the other hand, in Bhutan, the strategy of the Department of National Properties which collect unwanted materials including cars and electronic appliances from the government agencies and sell it off to private buyers who will repair and resell the items as reused items, managed to improve the waste management efficiency in the country positively.

In 1990s as a response to the global action plan of the Earth Summit in Rio in 1992, Agenda 21 was launched in many Asian countries, aimed towards capacity building, education, training and awareness raising. Additionally, national plans were implemented in some countries to promote economic growth and socio-economic development. In Malaysia, promotion and allocation were included in the Seventh Malaysia Plan to reflect on-going efforts of efficient management of the public sector for infrastructure, human resources development and poverty eradication where strategies concerning environmental issues are mainly aimed to create more environmental friendly environment for Foreign Development Investment (FDI). As a result, formulated policy offers various incentives for FDI in order to promote economic growth in the country which boosted Malaysian recycling rate to 5% (UNDP, 2009). The privatization of urban solid waste management in many countries proved to provide an integrated, effective, efficient, and technologically advanced solid waste management system. It shifted the responsibility to manage MSW from the government to the appointed concessionaires. This managed to improve the waste management system where waste collection and disposal service expanded to cover areas and reduce incidents of illegal dumping as reported in Accra, Ghana and Cairo, Egypt (Fahmi, 2005). Malaysia's achievement in the privatization of the waste management in the country is the increase in waste collection to approximately 90% of the waste generated in the country by 2000.

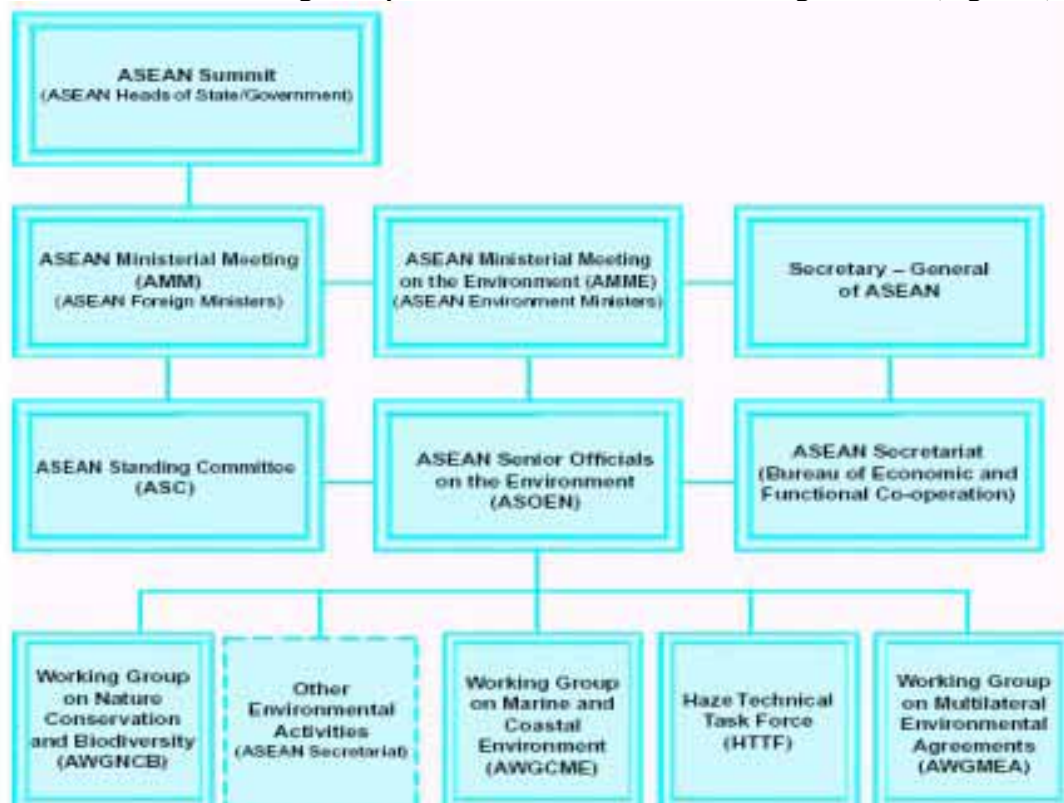
The most successful story is the implementation of various policies is as reported in Singapore. The implementation resulted with the increase in recycling rate, high awareness among the Singaporeans, effective incineration rate, and the drastic reduction of waste for landfilling. With the assistant of World Bank, new incinerations were constructed and landfills become more than just disposal site. To date, the small country is able to be proud with their Semakau Landfill which is a scenic and ideal recreational center appropriate for sport fishing, intertidal walk, bird watching and others (<http://www.nea.gov.sg/cms/wmd/SL%20Brochure.pdf>). Internationally, this unique landfill has been acclaimed as an engineering accomplishment which provides waste disposal needs yet protecting the rich biodiversity (National Environmental Agency of Singapore, 2009). Other success throughout the globe can be observed in many World Bank projects inherited by the Healthy City Project by WHO/UNDP. The implementation involved many cities in Asia, Africa and Latin America targeting to reorganize and revitalize individual urban environmental operation in improving public hygiene and health (JICA, 2005). Privatization in Helanda and Biratnagar, Nepal managed to solve

some solid waste management issues in the cities. As a result, waste collection coverage increased significantly.

### Regional Cooperation

Another effective waste management strategy is the regional cooperation. This is where regions are entering into cooperation for investment and operation of waste management in order to optimize the treatment facilities. This practice is becoming popular in EU as a positive consequence of a harmonized policy as observed in the Republic of Croatia, Hungary and Italy where effective waste management is achieved via a regional cooperation. In Portugal the regional cooperation between municipal authorities resulted with improved waste collection coverage and efficiency, and increased the recycling rate in the country to 18.5% in 2003 which indicates significant positive evolution in MSW prevention, reduction and recovery.

Regional cooperation is also important in the Asean region where it resulted with the implementation of a number of environmental instruments including the Meeting of the ASEAN Heads of Government, the ASEAN Ministerial Meeting on the Environment (AMME), ASEAN Senior Officials on the Environment (ASOEN) and its subsidiary Working Groups. ASOEN is formed to formulate, implement, and monitor regional programmes and activities on environment via three Working Groups namely Working Group on Nature Conservation and Biodiversity, Working Group on Coastal and Marine Environment, and Working Group on Multilateral Environment Agreements (Figure 1).



*Source: ASEAN State of the Environment Report 2000*

Figure 1: Three Working Groups under the regional cooperation among ASEAN via the ASEAN Senior Officials on the Environment (ASOEN).

The Joint Co-operation Committee (JCC) was established under the EC-ASEAN Co-operation Agreement envisaged action under Sectoral Aspects of 'Energy, Environment, Development Co-operation'. This cooperation is delivered through EU financial cooperation of €1.3 billion granted to individual ASEAN Member States. The EC is also providing €70 million at the regional level through the ASEAN Secretariat in the period 2007-2013 including for capacity building within the environmental sector. In 2007, under the auspices of the anniversary of 30 years on relations the Sixteenth EU-ASEAN Ministerial Meeting adopted the Nuremberg Declaration on an EU-ASEAN Enhanced Partnership to promote environmentally sustainable development and action on climate change.

### **Turning wastes into valuable resources and 3R**

The disposal of waste into its final destination definitely is the last option in waste management. This is due to the fact that once waste is landfilled, all 'resources' will be totally lost. As a result, various alternative strategies have been proposed and these alternative approaches are placed at a higher hierarchy in the waste management system. The implementation of 3Rs strategies among others has been actively incorporated into the waste management system in many nations. When waste management strategies are aimed to maintain public health and sanitation, many cities in developed countries including Japan, Germany and South Korea view waste management more from the economical perspectives. This is due to the fact that waste management has been proven worldwide to be a benefiting business. Thus, more and more countries are applying this concept into their waste management strategies (JICA, 2005). The successful story indicated that countries are able to generate income resulting with positive economic growth within the waste management sector. The basic foundation of the strategies is the conversion of waste into value-added products to be considered as valuable resources.

In Denmark, the combined environmental and energy policies records the country as the nation with the most efficient waste management system in Europe (Ramboll, 2006). 13 organic household composting plants, 33 incinerators, 134 garden waste composting plants and five biogas facilities had been established to process approximately 37.000 tons of organic household waste and 615.000 tons of garden waste to produce 388.000 tons of compost in 1999 alone (Petersen, 2001).

In India, recycling is highly participated by the public where it was reported that for every hundred Indian, one is involved in recycling. This recycling fact is driven by the economic gain that Delhi, being the capital, is the biggest and most vibrant recycling base in the country and has more than 100,000 waste pickers dealing 9-15% of the waste generated in the city. Figure 2 illustrates the typical routes in recycling where economy is the main driver. The informal labor forces saves the three Municipalities a minimum of USD12,000 daily, beside generating substantial income to the waste pickers. In addition, it is reported that a piece of plastic, for example, increases 700% in value along the recycling chain, before it is even reprocessed.

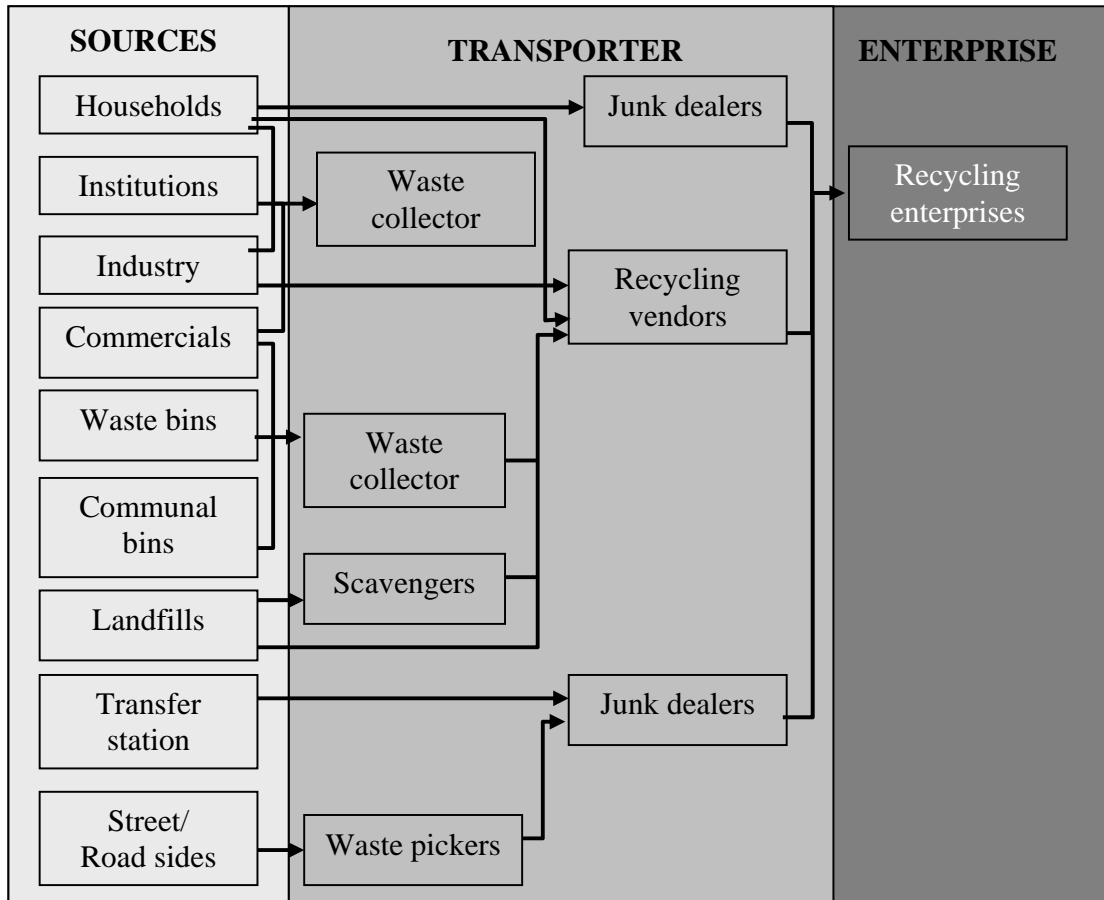


Figure 2: General routes in material recycling in many developing countries in Asia.

In the Philippines, the Ecological Solid Waste Management Act (2000) mandates the strategies to promote 3R by establishing Material Recovery Facilities (MRFs), conducting recyclables collection events, partnership and networking with various parties in marketing waste, promoting products from recycled materials, launching eco-labelling programs, and encourages ISO14001 implementation. The strategies also include the dissemination of information and phase out non-environmentally friendly products and establishment of linkages for industrial waste exchange program. With the eight strategies implemented, recycling rate in the Philippines grew from 13% in 2000 to 28% in 2006 (Andin, 2007).

In some countries, conversion of waste to value-added product is achieved via composting or anaerobic digestion for energy production. In India for example, organic waste is utilized to generate biogas for energy production while food waste is converted into compost. The installation of a composting plant in Dhaka, Bangladesh with a capacity of 700 tonnes has managed to produce 50,000 tonnes of compost by including a community-based decentralized composting project. Similarly, in Vietnam approximately 1000 tonnes of organic waste is composted everyday. The country has established eight centralized composting facilities with the capability to compost 30-250 kg of MSW,

market waste and street waste since 1982 (Nguyen, 2007). In Laos, The recycling strategies are implemented via the establishment of 30 recycling banks and composting under the Integrated SWM Project and the Lao Chareon Recycling Center (Khanal and Souksavath, 2005). In Malaysia the RDF conversion option is indicating higher potential with the capability to process 1,000 tonnes of solid waste a day to generate nine megawatts of electricity.

In other part of the world, Sweden for example, Swedish National Association of Waste Management (RVF) and the Swedish EPA initiated a project to develop voluntary quality assurance systems for compost and digestate from organic wastes as a response to the banning of landfilling organic waste by 2002. As a result, recycling of organic waste is promoted and the capacity of biological treatment is increasing. With 35% of the Swedish municipalities sending compostable household waste to a central treatment, 344 500 t of organic waste (105,000 tons household and restaurant waste + 239,500 tons green waste) was recovered in 2004. In addition to approximately 125 composting plants, Sweden also established 12 anaerobic digestion plants. The latter generates biogas as fuel for vehicles while the former produces high quality organic fertilizer.

In Japan, 74% of the wastes generated are incinerated to generate energy. The biggest waste incineration facility in Tokyo, the Shin Koto Incineration Plant has a capacity to process 1,800 tonnes of waste a day. The total power generation is estimated at 5.5 mil kL oil equivalent in 2010 via the uses of state-of-the-art technology which also prevent air pollution (Horio et al, 2009).

### **Public-Private-Partnership (PPP) for waste management**

Public-private-partnership (PPP) is an approach involving the private sector to participate in providing public infrastructure. Most countries encourage the private sector to invest in green technology in the effort to boost efficiency of more environmental-friendly energy usage towards facing the changes in the global climate. It is achievable as public sectors have higher capability to provide service with their sufficient resources and available expertise. Implementation of PPP in EU for example requires four main factors to be fulfilled. These factors are a selection of a value-for-money project, identification of risks (description and allocations) between public and private sectors, effective performance monitoring strategies via quantitative performance indicator, and its affordability level to users (ISWA Report, 2009). Among some of the successful efforts reported are in the United Kingdom, Jordan, Malaysia, Brazil, Laos and South Africa.

The main players in capacity development through the PPP strategies are the World Bank, International Solid Waste Association (ISWA), JICA, IWWG, Danida and many more, which act as the Expert-Group Organizations. This is made possible where the organization gather distinguished authorities and experts in various sector within the organization to provide assistance in terms of expertise, as well as, financial assistance. Among the most significant contribution is by providing training to developing countries and loaning of experts. The organization of conferences, seminars, dedicated discussions, workshop and industrial training were found to assist many developing countries to



improve their existing waste management system. Similar to the developing nations, developed countries too benefits from the capacity development provided by the Expert-Group Organization.

With the assistance from the European Investment Bank (EIB), Greater Manchester Waste Disposal Authority was able to build and maintain an integrated waste management service for the treatment and disposal of municipal waste. The PPP strategy is a partnership between the local authority, and Viridor Laing (Greater Manchester) for the refuse-derived-fuel conversion strategy and Ineos Runcorn TPS for the incineration project. Both latter companies act as the loaners of EIB. The implementation of the Greater Manchester Waste project brings about positive environmental impact to the communities in Manchester with the adoption of an integrated waste management service. The project is successful in increasing the recycling and composting levels in the region to 50% and currently moving towards the target to divert 65% of the waste from landfill as required by the EU standard by 2020 (Europa.eu, 2009).

In Jordan, a USD25 million financial assistance was provided by the World Bank to assist the government's effort in improving the operational, financial and environmental performance of its municipal solid waste system. It is currently undergoing environmental upgrading and expanding the existing municipal solid waste landfill to meet Amman City's disposal needs and generate electricity while mitigating green house gases. Also, it is targeting to improve the cost effectiveness of the existing municipal solid waste collection and transport systems while improving the overall cost recovery (World Bank, 2008).

In Malaysia, the emergence of PPP for waste management managed to improve recycling rate in the country. This includes the launch of recycling strategies by various organizations such as INTEL Malaysia (The Star.com, 2009). The achievement recorded a collection of more than 200 tonnes of recyclable waste over the last two years. Another example of PPP in Malaysia is the introduction of RM5000 refund scheme in 2009 by Proton (P) Ltd, the national car manufacturer to reduce the abandonment of junk cars on vacant land. In regards to waste disposal companies, Jeram sanitary landfill and Bukit Tagar sanitary landfill which are a state-owned company and private-owned, respectively, play significant roles in providing disposal services to the country. It caters the cost of Kuala Lumpur waste disposal i.e. RM33 for each tonne and an average of RM140million per year (The Star.com, 2009). The private company's initiatives to set-up sanitary landfill reduced the risk of pollution from dump site to water bodies and soil. In order to move towards a sustainable waste management system, the government had indicated their planned to upgrade of 30 of the 175 existing waste disposal dumps into sanitary facilities by the end of 2010 (The Star.com, 2010). With the assistance and partnership with private companies, nine sanitary landfills are expected to be constructed in the country.

In Sao Paulo, Brazil, the PPP strategies aimed to eradicate poverty via the strengthening of the city's waste management informal sector. The strategies formed 'Coopamare' where eight waste pickers and a NGO initiated the privatization of informal recycling

activities. The privatization has successfully registered more than 100 members to date to enable the improvement of the recycling rate in Sao Paulo by formalizing the informal recycling while lowering the poverty line (JICA, 2005). JICA PPP efforts in Vientiane, Laos, has successfully improved the volume in waste collection from approximately 9,000 tons in 1998 to 33,600 tons in 2003. The success factors include the implementation of an integrated organization system by a single agency, appropriate inputs of financial aids and expertise at the appropriate time line, improvement in the capacity development, proper placement of financial base system (service fee collection system) and securing suitable landfill by remodeling the existing open dump. While in the city of Joburg in South Africa, PPP is dealing with the challenge of ever-increasing waste in the city. Pikitup, the city's private waste management entity in Johannesburg aims to improve the municipal waste management via alternative waste technology plant. The project will drastically reduce 80% of the waste sent for disposal via the waste to energy program. The potential to generate electricity for sale to residents enable the city to earn additional revenue (sagoodnews.com.za, 2010)

Other successful PPP practice worldwide involved mainly the products of specific companies such as Hewlett Packard and Canon where customers are encouraged to recycle their used printer cartridges. Hewlett Packard also has extended their PPP by introducing the return-refund strategy where customers will be refunded with the returned of printers. Customers will be discounted when purchasing new printer when they return the old HP product. Similar global initiatives to reduce waste generation are conducted by Nokia, Dell Electronics, Sharp Electronics, and other multinational companies.

Aside from PPP strategies, the improvement in waste management is also achievable via community based program. The consecutive sections discuss the various community based waste management scheme which have played significant role in promoting sustainable waste management in many countries.

### **Community based waste management**

The main focus in the community based waste management (CBWM) schemes is employed in recycling strategies, composting program and awareness raising. CBWM community based waste management strategies is very crucial to support the waste management institution failure to satisfy the waste management level. It can be categorized into three main types namely type 1, the CBWM-community activist set-up identifying service provider, type 2, the private entity community service provider, and types 3 the CBWM-community activist set-up planning and managing the services. The success of type 1 is observed in Dhaka among the community based organizations (CBO) while type 2 and type 3 are reported in Manila (within the community) and NGO in Dhaka, respectively.

In Malaysia, Putrajaya was selected as the national model for a recycling project that in 2008, recyclables statistics revealed that government and private sector buildings contributed 48%, housing 22%, recycling centres 18% and schools 11%, higher than other cities in Klang Valley (The Star.com, 2009). The pilot projects are successful in improving public awareness on recycling and reduce the wastes to be disposed by 40%. The joint-venture is an effort by the PPSPPA, Solid Waste Management Department,

Putrajaya Corporation, Alam Flora and Konsortium SSI-Schaefer. Another successful recycling strategy due to CBWM was also observed in Penang with 15% recycling to enable the local authorities to recover 40% of their revenue spent on solid waste for other projects. In terms of bulky waste, Community Recycling Centre (CRC) is funded by Danish International Development Assistance (DANIDA) with an allocation of RM400,000 for the project (The Star.com, 2009). The program required the community to play their role by bringing in their bulky waste to the centre for disposal. Another project funded by DANIDA, under the partnership programme of Local Agenda 21 Petaling Jaya is the composting project in Petaling Jaya where 25 tonnes of garbage were reduced via composting (The Star.com, 2010). In addition to recycling and composting of organic waste, 'No-plastic bag day' is also introduced to reduce plastic waste and instill recycling habits in the public in line with the Government's campaign to educate the public on recycling and reducing waste by introduce a day of not using plastic bags (The Star.com, 2009). This managed to reduce plastic bag consumption by more than a million a day (The Star.com, 2010).

In Sri Lanka, study on the improvement of solid waste management in Secondary Cities in Sri Lanka sees the upgrading of landfill facilities increases the awareness among the residents on waste management issues and models sanitary landfill for Sri Lanka (JICA, 2005).

CBWM strategies in the City of Manila improved the livelihood of the waste pickers with the establishment of proper recycling business. The strategies not only improving the formal sector of recycling but also improve the waste management towards a more sustainable approach while reducing health risk among the waste pickers in Manila. In addition, the CBWM enables the target to close all open dump sites by 2000 be achieved with the construction of a new sanitary landfill near San Mateo landfill and an incineration plant (JICA, 2005).

The most significant CBWM strategies were reported in Australia and Japan. In 1996, a zero-waste community was inspired in Canberra, Australian. By 2001 the city had reduced waste sent to landfills by 40% and recycled and reuse more than 80%. The harvesting of methane gas from its landfills managed to power 3,000 homes for 30 years. The success of the strategy is mainly due to the active participation of the citizen.

In 2003, the community in Kamikatsu, Japan aimed to achieve a zero-waste community by 2020. Due to the high participation of the community, Kamikatsu's recycling rate has risen from 55 % a decade ago to about 80% today. After five years of the shutting down of the incineration for the community due to a strict new regulation, 98% of the population uses home composters while non compostable materials are taken to the village's zero waste centre to be separated into 34 categories. The separated wastes are then identified for other alternatives including recycling. The significant reduction in waste generation indicated the success of the CBWM strategies within the community where survey showed that the community is willing to do more to improve their current achievement.

CBWM is also crucial in elevating the challenges in waste management systems in many underdeveloped nations. Among the most successful is in Zimbabwe with the implementation of the called Improving the Urban Environment with Organisations of Poor Women and Men by the Practical Action Southern Africa. It is a partnership with CBOs and local authorities in the three areas namely Chitungwiza, Epworth and Mbare (Harare). The project embarked on community managed waste collection and recycling projects, resulting in income generation and increased environmental awareness among communities. As a result of effective lobbying by the CBOs and with the support of Practical Action Southern Africa, successful negotiations were made with ELB, leading to CBOs being awarded a contract to provide waste collection services to the area allowing the remittance of 50% of refuse collection revenue. This has been a big boost for the participating CBOs and ensures the sustainability of the CBWM strategy in the long run.

The lack of financial capacity within the public sector, the inadequate skill, technology and facilities, and the lack of enforcement by the local governments, deteriorate the quality of urban services, particularly in waste management system in many underdeveloped and developing nations. In Dakar, Senegal for example, the situation is being remedied with the existing CBWM run by international agencies, NGOs, and local associations. Environment and Development Action in the Third World (ENDAD), the NGO initiated small scale systems for horse-drawn cart trash collection and alternative sanitation systems in the areas. As a result, the immense problem of unhygienic and sanitation within the area are slightly elevated. The various strategies within the CBWM concept have been successful in reducing the environmental issues particularly those in urban areas.

### **Conclusions**

The implementation of various strategies is important in order to achieve a sustainable waste management. Appropriate policy and effective waste management system by municipalities and local government are crucial to improve the waste management in a country. Waste management sector should be economically appealing to enable the generation of income from waste conversion. Also, PPP and community based waste management system should be in place in order to allow the participation of all relevant stakeholders in the strategy to implement sustainable waste management.

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