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The Role of Informal Collectors of Recyclable Waste and Used Goods in Indonesia

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1. Introduction

Municipal Solid Waste (MSW) is a problem in Indonesia, particularly in big cities, and is one of the most challenging urban issues for city administrators. Population growth and ever-increasing activities in major cities mean the increase of waste generation and all the inherent consequences. It was estimated that of the entire urban wastes generated in 2006, at most only around 60% to 70% could be transported to final disposal by the institutions responsible for handling wastes. The community were expected to handle the rest themselves.

According to the latest census in 2000, Indonesia's population was 205.8 million. An intercensal population survey in 2007 revealed a total population of 224.9 million with a population density of 117.6 people per sq. km. Provinces in Java Island had a higher population density than provinces outside. The province with the highest population density was Jakarta (11,968.8 people per sq. km). Provinces in Papua had the lowest density of 5.9 people per sq. km. Although the absolute number of the population was increasing from census to census, its growth was decreasing, from 2.32% in the period from 1971 to 1980 to 1.49% in the period from 1990 to 2000 (Ministry of Health, 2007).

Until the early twentieth century, the urban population in Indonesia was well distributed. According to the 1920 census, 6.6% of Java's population lived in cities. This pattern changed when the urban population of Java started to grow more quickly than the total population of the other islands. It could be said that the larger the city, the quicker the growth. During the 1960s and 1970s inter-provincial migration also began to increase. The main targets of the movements were the Javanese towns, and in particular Jakarta, to which 40% moved immediately, whereas others reached the capital city only after first settling in smaller towns (BPS-Statistics Indonesia, 2004).

It is evident that none of the Indonesian cities was prepared properly to absorb the newly arrived rural migrants as far as employment and housing, including public utilities, were concerned. Once the natural absorption capacity was exhausted, the newcomers established themselves in slums located along railway tracks, waterways, etc. The primary motive behind the rural-urban migration was the lack of employment in the villages (push factor) and not so much the attraction of city life (pull factor) (Donner, 1987).

Though such migrants are not contributing more than their poverty to the cities, they feel that they can make a living in the towns rather than in their villages, although their quality of life will be worse. The number of formal working places is not growing at the same speed as the number of job seekers. In addition, most of them cannot offer any qualifications whatsoever. It is the informal sector that absorbs the bulk of unemployed migrants without capital or professional qualifications. These informal employments are normally not recorded and therefore never appear in any official statistics.

With the increasing growth of population and economic activities, the volumes of waste to be handled increase accordingly. Rapid population growth in urban areas, socio-cultural classes' heterogeneity and community participation that is generally not well directed and well organized have caused complex MSW problems for municipalities. On the other hand, the funding situation and relatively low priority in waste handling among local governments are general trends, along with the limitations in proper human resources, adding to the low performance of municipalities in handling the sanitation and waste in urban areas. Many factors are involved in inadequate MSW management, some of which are lack of support for municipalities to address waste problems systematically, integrally and comprehensively, lack of standard policies that are comprehensive and consistent in matters of waste handling, and lack of discipline among waste managers in terms of applying proper technical procedures (Damanhuri, 2005).

The problems of waste management in developing countries, such as Indonesia, have a number of aspects associated with them, such as technical, institutional, financial, environmental and social aspects. To overcome this problem effectively and efficiently a holistic approach to developing solutions is required. The impact of these aspects varies markedly depending upon the income levels and socio-economic factors of individual countries or cities. Higher per capita income levels in developed countries provide the financial means to maintain appropriate collection systems, treatment and disposal management. The generally higher education levels of the population in developed countries also provide support for the implementation of the mantra 'reduce, reuse and recycle' (3Rs) for waste programmes, public education and strict environmental regulations. Eventually it has become clear that sustainable improvement can be reached only by the integration of socio-economic and socio-cultural elements into the whole scheme. In Indonesia, proper waste management has been a major challenge, but concerns about gradual waste reduction through recycling have been raised in recent years. During the last few years, because the problems of solid waste disposal are all too obvious, public pressure and growing environmental awareness have also caused a change in the policy concerning waste management.

This report will discuss used goods and waste recycling activities, especially among informal sectors, emphasizing discussions on actors' roles and the linkage of one informal sector stakeholder with another in the performance of their activities as waste and used goods collectors, and how material flows and qualities are applied in economic transactions by informal sectors in Indonesia.

2. Municipal Solid Waste (MSW) issues

Indonesia is a country located in South East Asia, which comprises more than 13,000 large and small islands. Administratively, the country is divided into 33 provinces and more than

465 municipalities which consist of 14 metropolitans (one million population or more), 15 big cities (500,000 up to a million population), 56 medium-sized cities (100,000 up to 500,000 population), and 380 small cities (20,000 up to 100,000 population). Indonesia is located at the equator, and it has two seasons every year (dry and rainy seasons) and because of the monsoon rains each season lasts six months. The rainy season is also the fruit season and fruits produce an enormous amount of waste in the city.

Municipal solid waste (MSW) management in Indonesia is the responsibility of municipalities (local government). There is a city/district cleanliness division within the municipality organization. Some big cities contract out part of the services to third parties. In fact, most of the municipalities still give low priority to solid waste services.

The general method currently observed in waste management is collect-transport-dispose. The authorities in urban municipalities transport the waste from designated collection points to a location for its final dumping. Most of the local authorities practise crude open dumping, creating a desperate situation at the landfill sites. The potentials for reuse and recycling have not been fully realized because of a multitude of problems.

The principal source of MSW in Indonesia is households. They generate about 50 to 60 % (wet weight) of the total quantity of MSW per day. Some cities provide their generation data by conducting surveys and sampling but many other cities usually estimate their waste volume by using the estimated generation rate of 2.5-3.0 L/capita/day based on standard national MSW figures. According to a survey of the Bandung area in 2005, the estimated MSW generated in this area was 0.59 kg/capita-day (Damanhuri et al., 2009). In a questionnaire survey conducted in 2007, it was estimated that MSW generation of all municipalities in Indonesia in 2006 was 38.5 million tonnes, as presented in Table 1.

The amount of MSW is normally dominated by organic matter (more than 55% by weight) that mainly comes from food waste. This amount contributes to about 65% of the water content of MSW. This waste consists mainly of food scraps, yard waste, and wrapping materials. It is a mixture of all kinds of waste, organic and non-organic, recyclable and non-recyclable, even hazardous and non-hazardous materials. The other sources are traditional markets, commercial activities/areas, industries (non-hazardous categories), public gardens and streets. Plastic and paper are the two next commonest items. They mainly comprise packaging/wrapping materials and food, beverages, etc. Wood and textiles are the next two important components. According to a survey in 2007 of Bandung metropolitan areas, the average amount of organic MSW taken at transfer stations was around 60% (by weight), as presented in Table 2. The amount of inorganic waste was around 40% (by weight), and about 6% (by weight) was classified as recyclable inorganic components.

Waste collection is the first subsystem of the technical system of MSW management which is part of the municipalities' services. Some households can afford a waste bin made of concrete, plastic or steel built in front of their houses. Others simply store their waste in plastic bags or in used cartons or boxes in front of their houses. These wastes are then picked up by a community collector cart, a small truck, etc. depending on the arrangement in the neighbourhood community. Some large and medium-sized cities have been contracting out part of the collection and transportation to private firms. In the year 2006, collection of MSW in Indonesia covered about 130 million inhabitants or 56% of the total population (Table 3).

ISLANDS	MSW Generation (thousands tonnes)
Sumatera	8.7
Java	21.2
Bali and Nusa Tenggara Islands	1.3
Kalimantan	2.3
Sulawesi, Maluku and Papua	5.0
TOTAL	38.5

Source: Solid Waste Statistics year 2008

Table 1. MSW generated in Indonesia, 2006.

Item		% wet-weight	
		TS-1	TS-2
Recyclable components	Hard – papers	0.92	0.95
	Archives (white) Papers	0.14	0.34
	Bottle – glass	1.77	0.50
	Drinking bottle-plastic	0.29	0.19
	Drinking glass – plastic	0.17	0.34
	Can	0.22	0.32
	PE – plastic	0.03	0.42
	Divers – plastic	1.63	0.47
	Aluminum	0.06	0.05
	Cartoon/cardboard	0.33	0.31
	Newspapers	0.13	0.16
	Metals		0.03
	Total of Recyclable Components	5.69	4.08
Organic Component	Food waste	33.90	58.04
	Leaves etc.	12.32	2.21
	Tissue-papers	11.02	1.78
	Textile	0.89	0.90
	Wood	1.98	0.70
Total of Organic Components		60.10	63.62
Others: an-organic non-recyclable		34.21	32.30

Source: Municipal Solid Waste Management in Indonesia, 2010

Table 2. Composition of MSW at transfer station (TS) at Bandung (2007).

ISLANDS	Population (million inhabit)	Population served (million inhabit)	% population served
Sumatera	49.3	23.5	48
Java	137.2	80.8	59
Bali and Nusa Tenggara Islands	12.6	6.0	47
Kalimantan	12.9	6.0	46
Sulawesi, Maluku and Papua	20.8	14.2	68
TOTAL	232.7	130.3	56

Source: Solid Waste Statistics year 2008

Table 3. Population served by municipalities in Indonesia in 2006.

Like any other collection system in developing countries, where the municipal waste from household sources is commonly collected through labour-intensive services (Cointreau, 1982; Joseph, 2010), in urban areas in Indonesia waste is collected by handcarts drawn by one or two crew members. Typically, waste generated by households is accumulated in small containers and placed on the ground to be shovelled manually or left in plastic bags, open cartons or baskets to be picked up by hand. These waste crew collection workers have significant direct contact with solid waste, so they are more likely to encounter potentially toxic and hazardous materials. Containers used for household storage of solid wastes are of many shapes and sizes, fabricated from a variety of materials depending on the economic status of the waste generator. The wide variety of types and shapes commonly encountered within a community creates difficulty in establishing and operating an efficient solid waste collection system (Joseph, 2010).

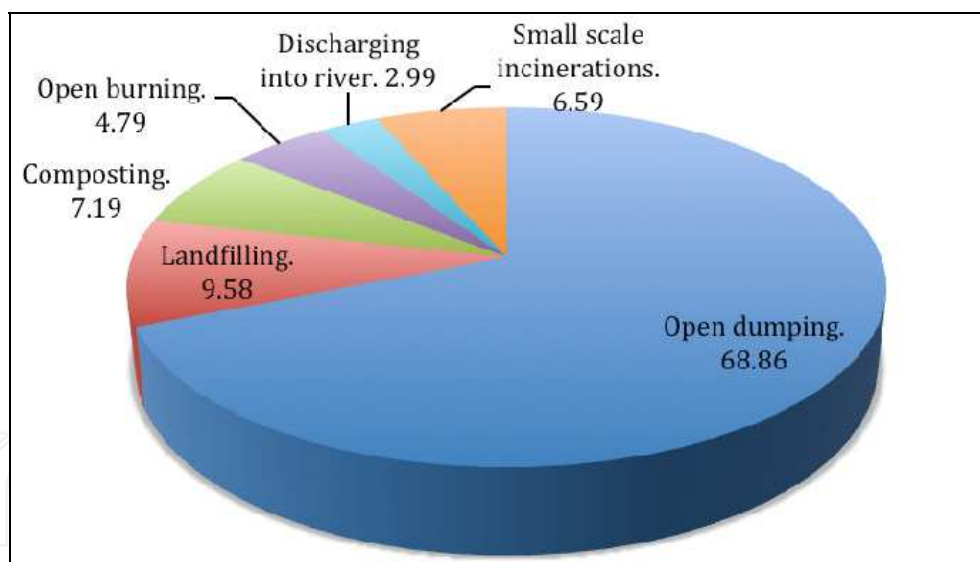
The waste collection from households to transfer stations is normally organized by the respective neighbourhoods. The system is handled and funded by the communities, who can afford the expenses associated with the activities. This community employs a person who usually lives near the settlement. Generally these are people who do not have a permanent job. They are not scavengers and this activity is considered legal, but the waste crew is categorized as an informal sector. Almost all these waste crews perform valuable waste segregation. In many cases, the waste collected is already sorted by the generator and given to these waste crews. All wastes in the transfer depot, along with non-residential wastes, will be subsequently transported by trucks to landfills by city cleansing division crews.

Collection of waste is conducted by several methods, namely:

- Communal collection: where the community bring their own waste to a temporary collection point whence transportation is carried out by trucks. This method is usually applied in the very thickly populated areas. In certain places, the community bring their waste to vehicles which move along their routes while playing a traditional song, rather like an ice-cream cart.
- Individual indirect collection: where collection of waste is conducted by small vehicles or carts from door-to-door, and brought to the transfer depot where the waste is transferred onto trucks and transported to disposal/treatment sites.

- Individual direct collection: where garbage is collected door-to-door by trucks and directly transported to disposal/treatment sites. This type of collection is conducted in the high-income areas or commercial areas where a large amount of waste is generated.
- Temporary disposal sites are provided and managed by municipalities. From these facilities, collected MSW is transported to final disposal sites.
- Street sweeping is carried out to collect waste from public places and main streets by manual sweepers as well as sweeper vehicles.

So far, most of the existing MSW management systems in Indonesian municipalities have relied on the existence of landfills. The excess has been handled by the community in regular ways, such as burning, burying, composting, and other less regular ways such as recycling or disposal at inappropriate sites, including ducts or drainage channels. Another method of treating MSW in some cities is incineration. There are several small-scale incinerators in operation in different cities, each with a capacity of about 100-200 kg/hour and operating eight hours per-day. Therefore, the system is only able to handle a small percentage of the total MSW generated. Composting of organic waste has also been introduced as part of waste treatment. Compostors are located, normally, in final disposal sites. In principle, the composting system comprises a centralized sorting and shredding system, and thereafter composting of the organic matter is done by means of a simple composting method. According to a questionnaire survey conducted in 2007, the mode of handling of MSW in Indonesia in 2006 is as shown in Figure 1.



Source of data: Source: Solid Waste Statistics year 2008

Fig. 1. Percentage of MSW handling in Indonesia in 2006.

There are three groups of waste materials that serve as the main objects of recycling activity (Damanhuri et al., 2009):

- Wet waste, especially organic waste, to be converted into compost.
- Dry wastes, especially those with the potentials to be recycled, such as papers, plastics, aluminium, etc.
- Used goods resold by traders.

In 2008 Indonesia introduced the Law of Solid Waste Management (Law No. 18/2008). Some of the central issues of Law No. 18/2008 are as follows:

- Extended producers' responsibility (EPR); every producer should provide a label on their product packaging and/or their final products about reducing and proper handling of waste; and they should also responsible for the packaging of products that are difficult to decompose by means of natural processes (biodegradable).
- Application of waste reuse and recycling through the entire chain of waste transport, from origin to final disposal.
- Selection of waste processing and dumping technologies that are safe and healthy, and conform to the Indonesian situation. Open dumping and open burning are forbidden and five years after the passing of the law open dumping will be completely banned.
- Prohibition on importing waste into Indonesia territories or mixing waste with other hazardous wastes.

The basic aim of this new law is waste reduction through the 3Rs (reduce, reuse and recycle) as the first priority, and the next priority is waste handling. This concept is considered as a new paradigm to replace the collect-transport-dispose concept which is usually adopted in most Indonesian cities. All of the involved parties agreed that the new concept is the best available measure to reduce wastes, and active involvement on the part of the community and other waste generators to reduce waste volume is the key to the success of any waste management system. One of the important mandates in Law No. 18/2008 is the implementation of waste recycling. Any recyclable waste is collected from its respective sources, such as residential areas, commercial zones, temporary collection facilities and the final processing facilities. Wastes are recycled into useful raw materials for production processes (i.e. reprocessing and remanufacturing activities). Activities related to community involvement consist of separation, composting (at source and communal), and recycling. The municipality is then responsible for the transportation of the residue to disposal sites.

A national policy has been established with an initial target of 'reduction of waste as much as possible starting from its sources'. The government has set a target of waste reduction of up to 20% by the year 2014. Some strategies besides 3R education and campaigns have also been formulated to promote the reduction of waste from its sources, starting with households. The Ministry of Environment and the Ministry of Public Works facilitate recycling activities performed in several regions in the country. The top priority in the implementation of these activities is the recycling of organic wastes into either individual or communal level composting facilities. In order to accelerate the multiplication of such activities, the Ministry of Public Works has launched recycling activities in more than 200 locations in 150 cities since 2006 by adopting cost-sharing mechanisms with the local community, NGOs, and municipalities. Components of the project are a composting hall, a plastic crusher, a rotary screen and other ancillary items. Some difficulties arise especially in the formation of a local institution to run the project, and the limited capability of the local community to pay the collection fee among others.

3. Informal sector and waste recycling

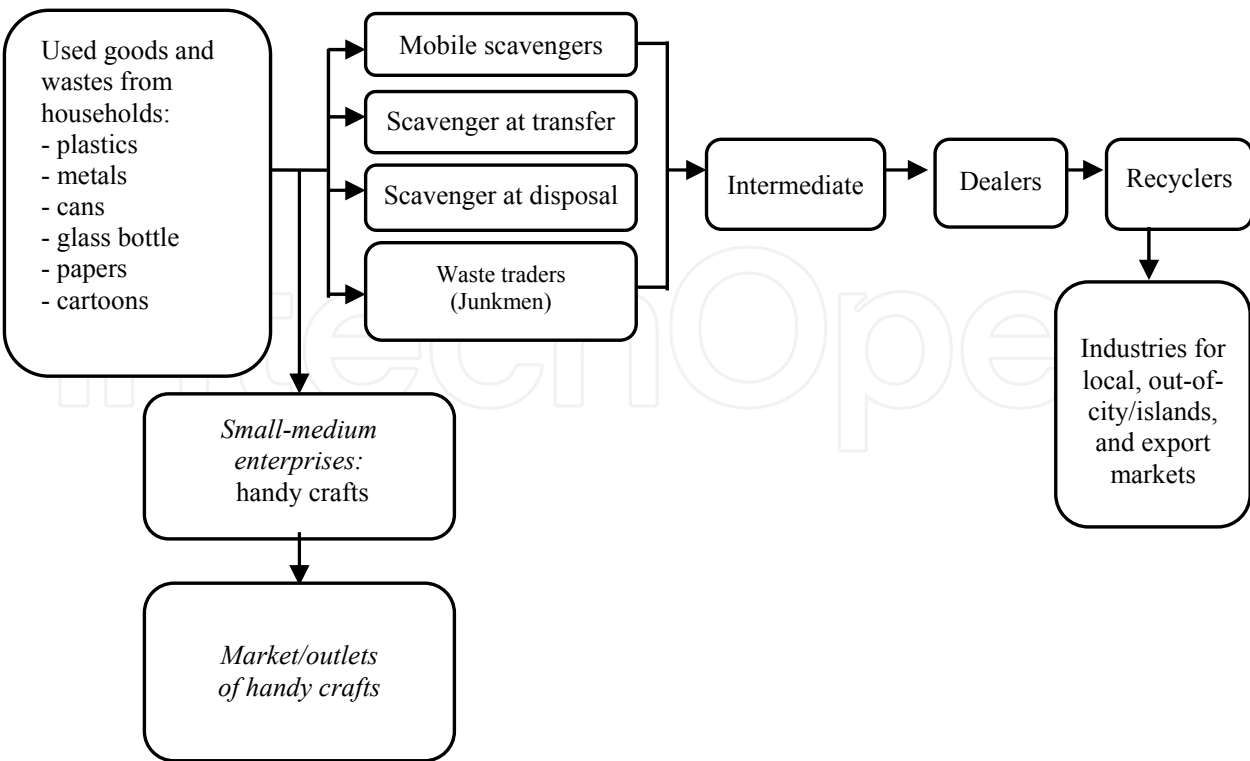
Waste definitions as well as MSW definitions vary in different countries. Among developed countries, for instance, the definition of an MSW will encompass any goods that would be

defined among developing countries as used goods that still have economic value. In developed countries, the elimination of used electronic appliances, furniture and fixture, used newspapers, used magazines, and used clothes, etc. incurs a disposal cost. Thus in developed countries, these goods are defined as waste, tend to generate problems and require further handling. Conversely, in developing countries, these are regarded as valuable goods and could still be used after being repaired or their components recovered in such a way that they could be reusable. Most Indonesian people of all economic levels have different perceptions of the end-of-life of goods, including consumer goods. These materials are perceived as used objects that still have an economic value, to the extent that they are rarely found in municipal waste management chains, for the reason that these items are actually saleable, or could be donated to others of lower income.

A positive impact derived from the current solid waste management systems in developing countries and economies in transition is the high level of recycling of the inorganic components of MSW. Although the methods employed for sorting and separation of MSW in these countries are considered inappropriate for solid waste management systems as defined by developed countries, these existing methods not only provide an income stream to the hundreds of thousands of people involved in this informal sector but also ensure a far greater amount of MSW generated is recycled. In most countries, plastics, glass, paper, and metals are collected by either the informal sector or municipalities, and these materials are recycled. There are two main recycling flows. In the first flow, collectors, including those in the informal sector, collect recyclable materials at sources. In the second flow, these materials are separated and recycled by the municipality after MSW collection. Recycling activities in this context are all activities reusing objects that have previously been called 'waste', either by directly reusing them or by selling them to waste traders.

Like other major cities in developing countries, the informal sector in Indonesia plays an important role in any recovery effort regarding the usable materials of waste. Recycling of dry waste (inorganic waste) is common practice in large cities in Indonesia. It is known that the recyclable material is reduced en route to the transfer points and to the final disposal. Many stakeholders are involved in the reduction process, e.g. sorting at the solid waste sources, scavenging. Many people treat the informal sector engaged in used goods and waste economic transactions or trading in Indonesia as scavengers. Indeed, it is the group that has attracted most attention owing to its association with social issues faced by most urban areas in developing countries. Actually, the latter is just one of the multiple stakeholders in recyclable collections. The recycling sector includes housewives, waste workers (from the cleansing division), vendors of used articles, and waste pickers (scavengers). Middlemen or intermediary traders are found in all corners of Indonesian cities buying used articles directly door-to-door. These waste recovery activities practised in many cities in Indonesia are mostly done by the informal sectors, consisting of handcart crews, mobile scavengers, transfer depot scavengers, final disposal scavengers, waste traders, recycling business people, and composting units at several points over a city, as presented in Figure 2. So far, the informal sectors' waste recovery activities have not been well organized.

Informal waste recycling is a common way to earn income. Studies suggest that, when organized and supported, waste picking can encourage grassroots investment by poor people, create jobs, reduce poverty, save municipalities' money, improve industrial



Source: Current Situation of Waste Recycling in Indonesia, 2009

Fig. 2. Interaction between informal sectors in waste recycling.

competitiveness, conserve natural resources, and protect the environment. Three models have been used to organize waste pickers: microenterprises, cooperatives, and public-private partnerships. These can lead to more efficient recycling and more effective poverty reduction (Medina, 2008).

Informal sector activities are not considered illegal in Indonesia. This group performs many economic activities, especially small businesses. All parties in Indonesia, including the government, appreciate its resilience in the face of the global economic crisis which affected the country and other regions during 1997 and 1998. It is documented that this sector has the ability to absorb many independent labours, 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 sector business after working hours to increase their income.

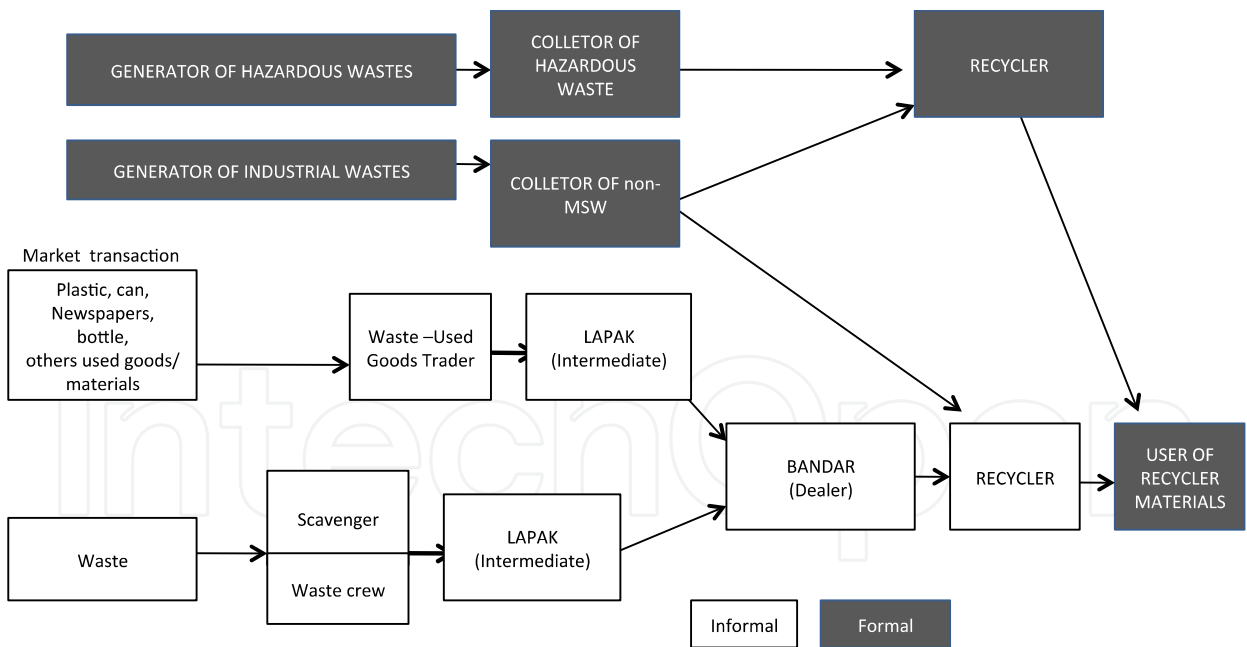
Informal sector activities are done openly and have not been deemed as illegal activities so security or law enforcement officers do not need to become involved. These types of activity can be found throughout the cities, either in people's own homes or on the public streets or unoccupied lands. In most cases, however, raids launched by legal officers are because these activities are disturbing civic order, such as using sidewalks for their business, or occupying forbidden areas, such as city parks. Many of these informal sectors go door-to-door, offering goods or services directly to prospective consumers. Usually, these activities are prevalent in cities, such as foods stores, electronic/electric appliance reparation/services, tailors, and other service sectors. The most marked distinction between the informal and formal sectors is that the objects of the former are not taxation objects from their economic activities. In some cases, these informal sector activities have some linkages with the formal sector

economic chains, and they are mutually dependent (Figure 3). The informal sectors engage primarily in using wastes generated by a household, especially dry wastes such as plastics, papers, metals, and the like, whereas wastes generated by an industry will certainly be addressed by the formal sectors.

The trading of dry wastes, which are non-compostable, has been the profession of choice of those people generally belonging to informal sectors. Cycles of potentially recyclable and financially valuable wastes start from their sources such as residential areas, industries and so on. These informal sector activities are most attractive for businesses, involving main actors such as scavengers and waste traders, who collect wastes or used goods door-to-door, or their customers/partners. In addition to their contribution to reducing waste handling costs, another benefit is that they serve as a generator of job opportunities.

Stakeholders for the recycled used goods and waste in all sectors (formal and informal) who play an important role in collecting recycled wastes and used goods are:

- Scavengers
- Waste collector crews
- Junkmen (waste traders)
- Intermediates (*lapak*)
- Dealers (*bandar*)
- Brokers



Source: Current Situation of Waste Recycling in Indonesia, 2009

Fig. 3. Formal and informal sectors in used goods/waste recycling.

Waste pickers (scavengers)

Used goods and waste recycling actors usually start by searching for and collecting used goods. The lowest group consists of valuable used goods hunters at the waste sites, and

they are known as scavengers (waste pickers). Usually, they are coordinated by the *lapak*, owners or gatherers who accept and buy their used goods. They search for and collecting used goods rigorously. Usually, there are social ties between scavengers and *lapak*, such as similar hometowns. In general, these scavengers are migrants to the cities and not inhabitants. They are assumed to be one of the social urban problems, because they usually have no permanent domicile and live in the unoccupied spaces in the cities. Actually, few want to be permanent scavengers but they migrate to the cities out of economic necessity. Since they are generally unskilled and have no capital, they are forced to be scavengers.

Intermediates (*lapak*) lend money to the scavengers through credit sales for certain used items, similar to future trading, including provision of 'shelters'. Most of them incur heavy debt. Therefore, people who give them loans serve as a significant 'bond' and are very influential; relationships can become those of protectors and protectorates.

The scavengers usually start searching for used goods in waste disposal bins between three and four in the morning and end by four in the afternoon, covering certain areas, usually crowded settlements, transfer waste sites, residential areas, markets, commercial areas, and roadsides. Depending on their locations, scavengers are divided into door-to-door, transfer waste site, and final waste disposal area scavengers.

Door-to-door scavengers are more common than other types of scavengers. The varieties of goods obtained from houses, stores or markets are greater than those obtained by searching the transfer waste sites. The latter scavengers compete with small collectors (waste traders) who stand by the transfer waste sites to obtain used goods or wastes, because these collectors are usually more able to handle waste already separated s thanks to waste transport crews and have established business relationships with *lapak* or dealers.

According to interviews with some of the scavengers in the Bandung area, they sell their goods to the nearest *lapak* or junkmen in dirty condition without any further treatment. Most goods are cup and bottle packaging plastics, newspapers, cardboards, cans and glasses. Scavengers' selling prices are determined by the *lapak*. In general, they prefer collecting plastic packaging wastes and cardboards rather than the other items as they fetch higher prices. Door-to-door scavengers also obtain their items from houses that have separated their wastes into plastic, papers, cans and other non-perishable items. At the end of the day, they deliver their collected items directly to their *lapak* customers under a direct payment scheme. In response to dealers' requests, *lapaks* frequently ask scavengers for one type of item in a certain quantity and provide them with capital. Generally, the scavengers will try to rise to become *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.

Waste collector crews

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

- Community self-help groups; and
- City waste managers.

The lowest-level community unit in Indonesia is single-neighbourhood, i.e. a group consisting of 30 to 40 households and led by a sub-neighbourhood leader regularly elected from among community members' it is a voluntary group. Ten to fifteen neighbourhoods will form one multiple neighbourhood. As in sub-neighbourhoods, the leader of the neighbourhood is elected regularly. Several neighbourhoods elect a village leader. Village leaders are civil servants and are appointed by formal and official assignment or by the decree of their respective district leader or city mayor.

One of the single-neighbourhood or multiple-neighbourhood tasks is associated with daily waste (garbage) collection of their inhabitants. Subject to the established agreements, waste collecting from households can take the form of either single-neighbourhood or multiple-neighbourhood collection. Usually, these communities hire waste transport crews that transport wastes from households to a waste transfer terminal that has been made available by local government. It is at the waste transfer terminal point that the work of local government (cleanliness department) starts: transporting the collected wastes to waste processors or final disposal sites. These waste collector crews usually serve as recyclable waste collectors as well, the product to be sold to intermediates (*lapak*) at current prices.

In most cases, mid-to-top level income groups will usually give their used goods 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 are of higher quality than recyclable wastes obtained by the scavengers. Compared with junkmen, these waste collectors gain advantage from acting as recyclable waste collectors. To obtain handcarts they need no money, because these vehicles are made available by the communities they serve and they do not need to buy used goods from their original owners. The only thing that makes them different from waste scavengers is that they reside in the area adjacent to the they serve and they have clear identities and addresses.

In some Indonesian cities, communities, sponsored by their city government, build simple recycling centres independently to manage their wastes. In addition to financing their waste collectors to collect the community wastes, they process wet wastes to be transformed into compost, by simple waste processing and facilities. Many of these centres are subsidized either by local government or central government-. The major tasks of the respective communities are financing and maintaining the continuity of these centres. It is also in these places that wastes are separated into dry wastes available for sale, wet waste available for processing into compost (biodegradable waste) and rejected wastes for transporting to the landfill. Therefore, these waste crews have three income sources, i.e. from compost sales revenue, dry recyclable waste sales revenue and official wages for 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 on the basis of the 3Rs principle.

Junkmen (waste traders)

Waste traders are generally found as door-to-door junk people, who buy varieties of used items. They usually work for *lapaks* who lend them money or carts. Generally, they buy items from each house at a price 10% lower than the selling price to the *lapaks*. In middle to high-class residential areas, they usually get their items free of charge from the owners, such as broken 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. Interviews with standby junkmen who have been based for five years at a particular location, revealed that this used goods business is quite profitable, especially when they obtain items free of charge that are saleable second-hand such as electric fans, irons, water pumps. These standby junkmen start their business with a certain amount of capital, asking for items door-to-door. After obtaining enough customers, however, they finally decide to stand at a fixed site with the other junkmen (usually at junk markets). Most of them have aspirations to extend their business to include dealers.

Intermediates (*lapak*)

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

After receiving items from scavengers or junkmen, they will place them in the warehouses that have been partitioned with plastic tarps, equipped with large plastic drums to store used cans. The usual pre-treatment of these items before delivery them to the dealers involves cleaning the packaging of labels and removing the covers for cup and bottle packaging plastics, milk cans, and glass bottles. In clean conditions, their selling prices at dealer level are higher. *Lapaks* sell them to the dealers in an incomplete state, but by opening these cans to form sheets to boost their selling prices 50% of their completed states. As regards other items such as papers and cardboard, *lapaks* pack them by sorting according to type and they are subsequently tied in bundles of 1 kg. *Lapaks* deliver their items at three to six-day intervals. The total quantities of these items are not fixed, but depend on the type obtained. The items go to the appropriate dealers, such as plastic dealers, glass bottle dealers, iron dealers and metal or cans dealers, and paper and cardboard dealers.

The relationships between *lapaks* as sellers and dealers as buyers are specified under contracts or agreements between both parties, specifying the details of items, terms of cooperation and item quantities. Frequently, dealers grant *lapaks* loans as capital to search for items, extend their warehouses, buy vehicles or meet other requirements. Dealers usually grant loans to their old customers, such as those who have had business relationships with them for a few years.

Generally, these *lapak* businesses are the extension of a business started by a scavenger or junkman. According to interviews with several *lapaks* in the Bandung area, these used goods businesses started fifteen years ago without any legal status as a formal company. *Lapaks* are usually integral parts of owners' houses or abandoned sites or rented lands for their workers. They are always trying to keep good relationships with workers who help them search for their items and with dealers who accept their items to maintain 'trust' and enhance sustainable cooperation.

Dealers (*bandar*)

The dealers most often to be found in Bandung City are cup packaging plastics and glasses dealers. In addition to iron and metal dealers, and paper and cardboard dealers, there are

many plastic dealers in Bandung City, because many plastic recycling factories are located there. There are some *lapaks* or dealers outside Bandung City who deliver their items to Bandung City. The business areas of these dealers are not necessarily similar. In general, dealers do further processing of 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 terephthalate, 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 processing factories outside Bandung City.

Interviews in 2009 of one dealer at Bekasi who is an ex-packaging plastic dealer and the owner and industrial manager of pellet and product recycling businesses, 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 equipment such as press machinery and/or chopping and pelletizing machinery to meet market needs and to secure the quality of products available for sale. In general, these packaging plastic dealers will follow the minimum volume standards to accept items from their peers (dealers) or from *lapaks* inside or outside their cities. Other items such as glass bottles are not valued, because the prices are the lowest in comparison with other items. The glass bottles collected by this dealer have a certain trademark and are subsequently bought back by their original factories.

A used iron and metal dealer at Bandung City revealed that the processing of irons and metals tends to fluctuate. Special treatment applied to irons before delivery to the related industries includes cutting and sorting. Irons and other metals such as copper wires are obtained from intermediates and gatherers of irons or smaller dealers. These irons and metals are delivered to automotive factories in Jakarta according to the respective agreements and ensure good, long-term cooperation between the dealer owners and industrial workers who have special authorization to procure them. According to the dealer's contact owner, irons are the items that have relatively stable selling prices compared with other products such as plastics.

In some cases, dealers in plastic recycling act as recyclers for plastic material processing, which is widely known as the pelletizing industry. It is acknowledged that the pelletizing industry generally needs materials in the form of plastic scraps that should be homogeneous by their respective types of plastics, PP scraps only or PET scraps only. If the industry has grinding machines, it prefers to accept items in pressed form because is a better guarantee of the quality of the resulting scraps.

Brokers

From the interviews conducted in 2009 with one of the plastic recycling players in Bandung City (Damanhuri et al., 2009) it could be concluded that most of the intermediaries or brokers in the recycling business channels serve as the main hubs between small collectors and large collectors, or between collectors and pellet-making industries. These brokers work independently and individually, using territorial bonds or family relationships or phone listings to obtain buyers or sellers. These brokers have authority to determine the quality of any item that would be sold by the sellers, and to be offered later to the buyers or, alternatively, they find the items requested by the buyers. For example, these brokers would

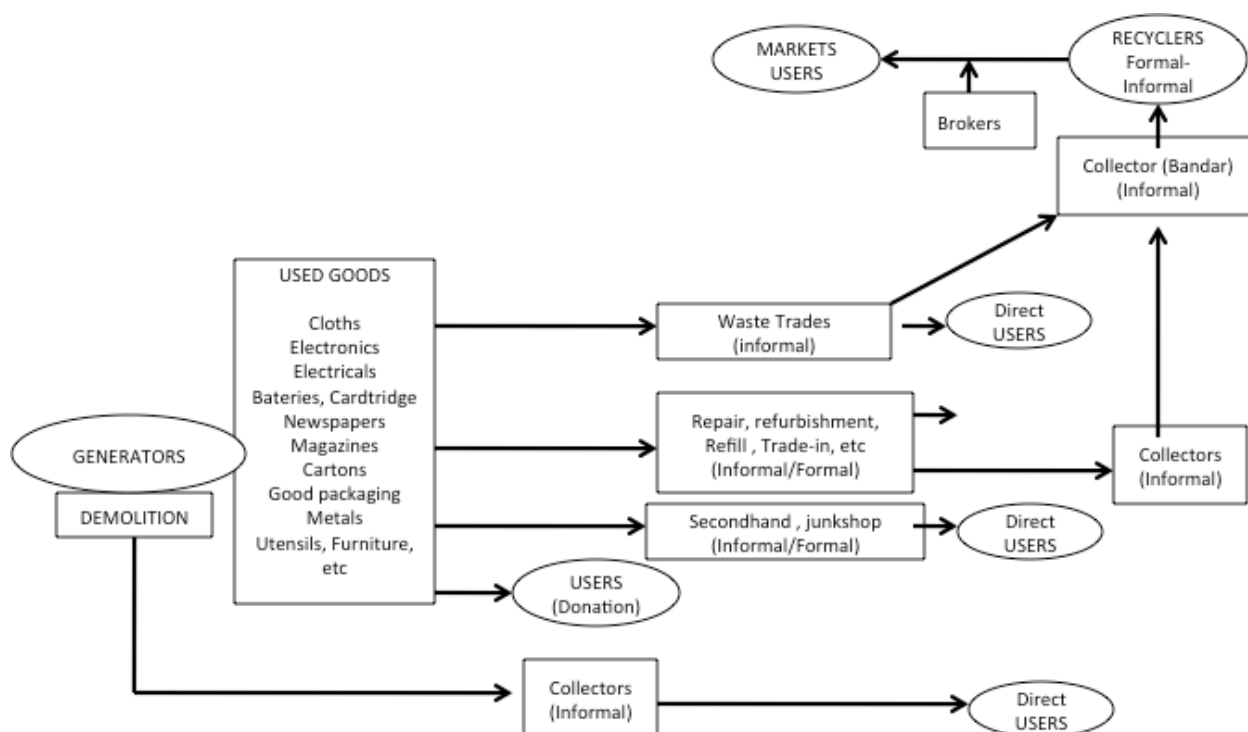
search for items in the form of coloured or transparent PET plastic bottles already pressed and ready for the pellet-making industries. Brokers' income is in the form of a commission, i.e. a percentage of the pre-agreed amount.

4. Waste recycling routes

Used goods' trading in urban areas in Indonesia has long been practised as a junk market. The types of junk traded among junkmen, junk stores and junk markets are as follows (Figure 4):

- Home appliances such as irons, blenders, cake mixers, hairdryers, electric fans, TVs, radios and tape recorders;
- Used fabrics and clothes;
- Shoes and bags;
- Used books;
- Used cassettes; and
- Wood from building demolition and furniture.

These used goods are usually kept at special locations, such as stores, street trading sites, and junk markets. The stores accept varieties of usable objects under a revenue-sharing scheme. Unlike junk markets, these stores are actually count as formal business, because they appear as ordinary business stores.



Source: Current Situation of Waste Recycling in Indonesia, 2009

Fig. 4. General destination of recyclable used goods.

In addition to used goods such as electronic/electric appliances, lead batteries and other objects that are considered as non-waste by Indonesians, waste category goods, or any

goods that have been disposed of by their owner and are commonly found in public waste bins but still have potential for trading, include (Figure 5):

- 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

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. Generally, intermediates and dealers will not deal in one single category of goods. They collect hard plastic packaging, glass containers, zincs, metals, cardboards and papers that can subsequently be sold to the major dealers. They trade not only in plastic packaging, but also convert these goods into pellets, in addition to accepting supplies of used metals such as trellis fences and copper wires, used drinking cans and used spoons.

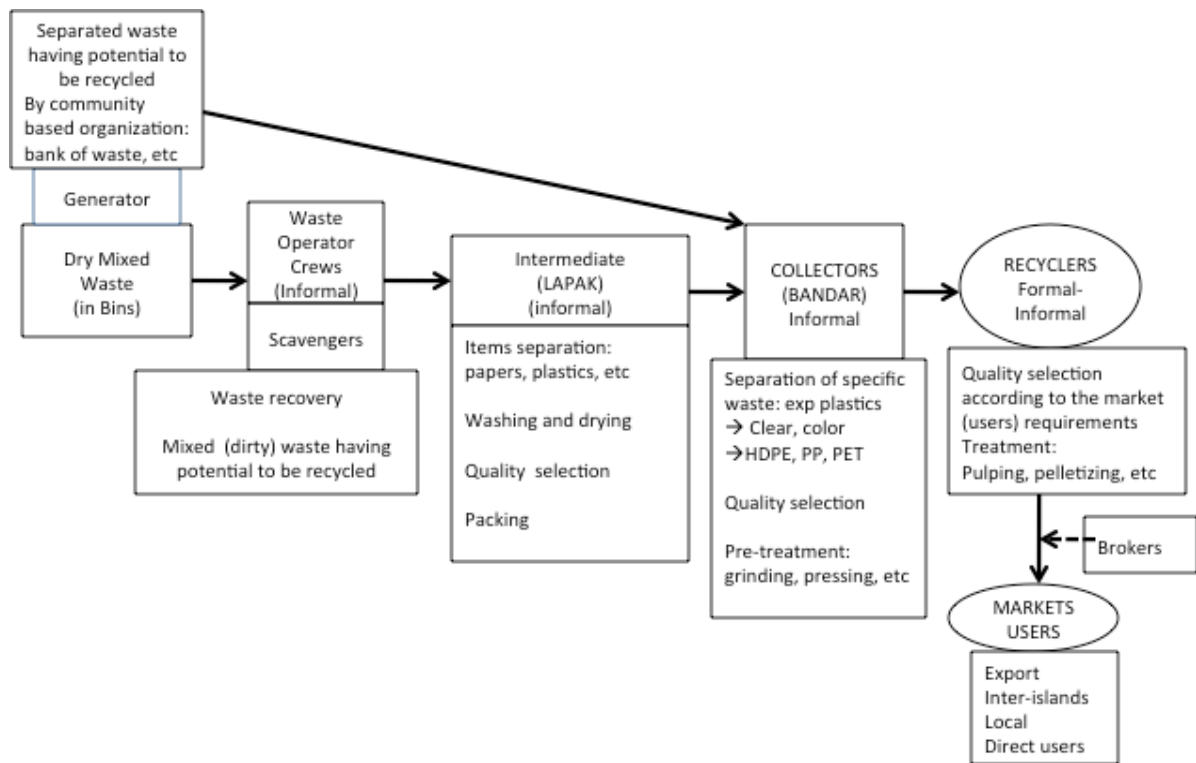
The destinations of potentially recyclable wastes and used goods vary with their respective market circumstances and the availability of a recycler as their end processor. Figures 4 and 5 depict the paths of potentially recyclable wastes, used goods and wastes from their source levels through to the end actors.

Used goods and waste trading start in residential environments. Middle or higher-income residential areas usually donate their used goods free of charge to door-to-door junkmen, waste transport crews in their areas, or scavengers who pass by. In mid- to low-income residential areas, used goods or wastes that still have economic value are additional sources of income as they are sold to door-to-door junkmen or directly to junkmen or trading sites or small craftsmen in the vicinity. The difference between junkmen and scavengers is that the latter get their valuable wastes free of charge while the former have capital to buy these used goods.

Waste pickers often throw out the contents of rubbish bags or bins to take anything of value. In many cases, they take the plastic bag itself, so increasing the difficulty of waste collection by the crew. Waste recovery by waste pickers is often a problem. Unauthorized waste picking can have an adverse impact on neighbourhoods and cities. Municipal authorities do not ban the activity but neither do they support it.

Waste scavengers who sell to the collectors collect some of the recyclable wastes. The collectors separate and classify the wastes into several groups, then sell them to the wholesalers. These wholesalers will then trade these wastes with recycling factories. Some of these wastes are recycled within the cities that produce them, but generally are sold to other cities, or even exported abroad.

The buying prices offered by junkmen or trading sites are affected by the condition of the goods offered by the sellers. Price flux occurs at wholesale level, junkmen locations and trading sites. In general, however, these junkmen or trading sites are situated in the vicinities of the respective residential areas, so interdependent beneficial relationships are



Source: Current Situation of Waste Recycling in Indonesia, 2009

Fig. 5. General pathway of recyclable wastes.

formed. Goods collected at junkmen sites 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 labels and covers, so that their prices will increase. Cleaned materials increase the selling value from 40% to 50% from base or dirty prices. Figure 4 demonstrates the pathway of second-hand goods that attract the most attention among urban areas.

Dealers as collectors of goods on a mass scale usually arrange for the processing of these goods, especially plastics, to be converted into goods available for recycling. Then they deliver these processed goods to the related industry/recycler within or outside their city or even export collected recyclables to foreign countries such as China. At dealer level, goods categories such as iron, metal or glasses are not specially treated. It is common practice for a dealer to have direct brokerage networks or sell goods to any industry that will use them. The factory that initially produced them will reclaim glass bottles with certain trademarks. The brokers collect good-quality used iron and metals and sell them to automotive assembling companies in Jakarta, for instance. Recycling factories, as end actors, not only produce products, but also process goods such as chopped papers, chopped or granulated plastics and iron scraps.

Recycling industries, more widely known as pelletizing industries, in some cases serve dual roles, either as collectors or as end users of recycled products, depending on their business scale and the completeness of their own production means. A study in 2008 and interviews with one of the collectors (Damanhuri et al., 2009) showed that plastic pellet manufacturing industries generally required materials in the form of homogeneous scrapped plastics in terms of packaging uniformities, such as PP-only scraps or PET-only scraps. As long as

these pellet industries have grinding machines, however, they prefer to accept items in their pressed form, because this guarantees the scraps' quality as export products or premium products for local usage. Impurity in the scrap of mixed plastic products from several different sub-collectors is frequently found such as PVC (*polyvinyl chloride*), PS (*polystyrene*), iron rods, broken glass, and aluminium rods.

Figure 4 above demonstrates the trading paths of used goods originating 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 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 a price commensurate with the goods' condition. The prices for broken but repairable goods are normally 20% to 30% below the market prices of brand-new ones. Irreparable goods are bought by junkmen at a much cheaper price, sometimes at only 5% to 10% of their market price, and there are some sellers who give them free of charge to the junkmen. In the case of irreparable used electronic goods, the junkmen usually disassemble them for the valuable components that can be sold to dealers, such as copper wires, screws, and plastic hard covers, etc. These dealers subsequently sell them to related industries.

Research results in 2007 on waste from mineral water packaging in Bandung City (Damanhuri et al., 2009) showed that the most frequently traded used items were mineral water packaging plastics (bottles and cups), plastic sheets (leaves), newspapers, office supplies papers, packaging cardboard boxes, glass bottles, iron, metals (aluminium, copper) and used electronic debris. This profile is similar to the results of a survey conducted in 2008 among recyclers in the five cities of Batam, Bogor, Magelang, Makasar and Pontianak. The used items most often recycled for local and export purposes comprised plastics, papers, irons and metals.

According to interviews with one of the collectors of used plastic packaging, who is also the owner and manager of a pellet-making and recycled product factory, the power of a broker to survive and expand in weak economic conditions lies in his or her wide networks (inter-city, intra-city, even internationally), the availability of supporting means such as press machines and/or cracking and pelletizing machinery to meet market needs, and the reliability of the products to be sold. Generally, these collectors determine minimum standards for any item to be accepted from their suppliers, e.g. scavengers. These minimum standards are as follows:

- Transparent PP (*polypropylene*) from mineral water cups and transparent or coloured PET from any drinking product bottles are usually subject to an under two-tonnes/week minimum quantities requirement.
- Other types of wastes that can be accepted by some plastic waste collectors such as papers, metals and glasses have no definite criteria.

Waste recycling factories in Indonesia as the ultimate players in the waste recycling business not only manufacture finished goods but also intermediate products (raw materials) such as papers, plastic flakes or granules and scrapped irons. Bekasi City (West Java Province) and its surrounding are famous for finished goods, intermediate products and raw material exports, although their top priority is domestic markets.

The PET bottle recycling factories and other factories manufacture plastic pellet products to be processed further into finished goods (plastic appliances). Some of these plastic flakes and

pellets are exported to other countries like Singapore, Taiwan, China, Malaysia and the Philippines, though most products are used for domestic industrial purposes. The capacity of plastic waste-based recycling businesses in Indonesia is evidenced by the existence of plastic recycling associations. They are able to maintain the quality of their products and good business relationships, and thus their PET scrap products can enter international markets.

Generally speaking, other wastes that have specific potential for recycling are papers and metals. The paper- and metal-based waste paths do not significantly differ from those of plastic-based waste. It seems, however, that these paper- and metal-based waste recycling businesses have not yet been accommodated in an association or partnership programme, unlike the plastic-based waste recycling business. It was found that their consumers would discard any waste containing metal elements. Iron- and metal-based scraps from Batam and Pontianak would be delivered to Medan and Jakarta, whereas the same scraps from Makassar and Magelang would be delivered to Surabaya. There are exports of iron- and metal-based recycling products to countries like Taiwan and China, but most of these products are absorbed by domestic steel factories. The areas of Jakarta, Bogor, Bekasi and Surabaya play important roles in the network of the recycling business because the majority of waste recycling activities occurs in these areas.

The same data source from Ministry of Environment (2008) also reported that in paper-based recycling wastes are transported to Jakarta (from Batam, Pontianak, Bogor) and Surabaya (from Batam, Magelang and Makassar). In addition to delivery to Surabaya, paper-based wastes from Magelang are delivered to Magelang's pulp- and paper-based factories. Though here is paper-based waste export, most of these paper-based wastes are absorbed domestically as raw materials of paper recycling.

Another source of used goods, s used clothes, is found mostly in major cities. In Bandung, there are junk markets for used clothes that buy these goods from brokers of imported used clothes from Taiwan, Korea and China at low prices per sack or 100 kg bales of trousers, T-shirts, shirts and jackets. The contents are reopened and mixed with used sweaters and T-shirts, and then sold to junkmen at higher prices. Other types of goods such as automotive electronics and other used electronics are sold individually by their respective owners to junk markets. These junkmen resell them to visiting consumers in a minimally repaired condition.

The other type of waste/used goods recycling category is building demolition by-products in the lumber business. The interviews with several actors in Bandung city revealed that this business has distinct breadth, ranging from sources to end-products. Essential items are wooden frames from old buildings obtained in one of two ways:

- Trading with the owners of old houses/buildings to be demolished in order to obtain lumber from wood frames, roofs, doors, etc.
- Cooperation with construction projects, most of them order wood frames in large quantities.

The buying prices of lumber depend on the buildings to be demolished. Buyers refurbish the collected items by cleaning, repainting and displaying them in front of their stores for being sold.

Other lumber businesses collect wood pellets and used frames from lumber wastes, to be processed into sofa/chair frames and then delivered to sofa production factories and other

subscribers in the Bandung area. One trading business explained that they have been operating their business for 10 years with five workers. Low-quality and non-reusable lumber is cut and sold to tofu factories to be used as firewood.

The waste materials, after sorting, cleaning, and processing, are sold to scrap dealers, who in turn sell to industry. The recovery process of the waste component for waste recycling includes various activities, which comprise sorting, collection, washing, crushing, and pelleting. These activities involve scavengers, collectors, agents, suppliers, and recycling industries, which operate in a recycling business chain. Each level in this business chain has a specific activity pattern, which is different from one level to another. At the lower level, the need for equipment, energy, and space is less pressing than at the higher ones. For example, the required facilities on the scavenger level are limited to simple equipment, such as a collecting stick, mask, and gunny bag, whereas at the higher levels more complex equipment, such as a mechanical crusher, extruder, and pelleting machine, may be needed.

Owing to the different treatment of the waste component in each level, the product quality is improved at the higher level. As a consequence the price of plastic material, for example, increases from the bottom to the top chain levels. These prices, however, vary from place to place and are dependent not only on the quality (i.e. degrees of cleanliness and homogeneity), but also on the highly competitive markets (Trihadiningrum et al., 2006). The quality of wastes as used items that have potential to be recycled determines their market selling prices. The recycling business chain players in this activity are collectors (waste traders, and scavengers), intermediaries and recycling industries. They have unique criteria that must be met by their respective business partners.

According to the interview in February 2009 of a big collector/recycler in Bekasi City (Damanhuri et al., 2009), the grade required to produce the end-product in the form of coconut root sweepers, would be met by green, red and blue pellets, depending on the colour of the sweeper frames to be produced. For the end-products in the form of plastic balls, however, they required used grease bottles HDPE (*high-density polyethylene*) pellets. Thus, the essential thing is the homogeneous quality that they accepted from their trusted business partners. This plays an important role in the success of their product and in maintaining good partnerships.

A producer of plastic zips in the west of Java Province expressed similar views (Damanhuri et al., 2009). His company produces zips that require transparent and coloured PET as raw materials. It has an established criterion for items that it will accept from its partner-collectors, i.e. that these items should already be in their pressed form. The main reason for setting this criterion is the limited area of its raw material warehouses and the fact that the quality of the scrap products is generally better if they are produced in-house. Consequently, this industry will only sort pressed materials according to colour for the cleansing, scrapping, washing and drying processes.

The difference between purchasing and selling prices is also affected by the exact status of the respective recycling players. The linchpin of this relationship is that the final price of any metal-based waste is affected by its own quality. Large scavengers receive most of this waste from small waste scavengers, so the items they receive are usually dirtier than the items sold by the used products sellers. This is because the latter purchases his or her used items from households and institutional sources.

5. Conclusion

In Indonesia, waste recycling is an activity strongly supported by all parties concerned. Their efforts are not incorporated into actual and integrated activities, however. 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 and community's self-help. The main question of municipal waste handling is how ensure waste generated is well-handled so that the overall city environment remains clean and has no negative impact on human health or residential environments. Waste generators and their corresponding local governments would be satisfied if recycling activities helped to decrease their waste problems and at the same time decreased the cost of waste handling that should be provided, owing to the existence of revenues from recyclable waste sales. On the other hand, the main target of waste recycling by people in the recycling business activity is how to manage recovered materials to obtain as high an economic value as possible. Waste problems are not their problems. They will be satisfied if they can get as much waste as possible with a high economic value. They do not care about the remaining non-economic and non-saleable part of these wastes.

There is a different perception in terms of the goals of waste management and recycling activities. The main purpose of city waste management is ensure the city is clean, healthy and environmentally sound. Recycling activity is supported because it is associated with the image of a green city, but very rarely is the waste recovery in MSW management associated with efforts to gain quality recyclable waste in accordance with the needs of the recycling market. Recyclable waste quality is not their concern. The same point of view is found in waste recycling activity. The stakeholders who engage in this activity are only interested in cheap recyclable waste of high quality that meets market demand.

In the case of recyclable and used goods pathways, efforts should be made to enhance the selling process, through selection, separation or reparation and so on. Activities performed in informal sectors in developing countries are pre-treatments such as the melting process, generally performed without consideration for workers' safety and the impact on the residential environment. In the case of large industries, they usually guard their company image and accordingly comply with the appropriate regulations. In the case of small industries, notably home industries, most of them belong to informal sectors; usually they pay less attention to safety aspects, owing to limited capital and knowledge.

The recycling efforts in urban waste management are an integral part of the sustainable waste management concept. The main target is to drive communities to minimize their waste as much as possible, and encourage reusable wastes, safe waste processing and disposal from health and living environment perspectives. On the other hand, recycled goods and waste trading businesses are essentially economic activities, where such factors as prices, product/material qualities, supply continuity based on required quantities, and related profit obey the current market. The two interests, i.e. interest in sound waste handling and recycled product business interests, should be bridged to enhance the continuous growth of recycling efforts along with higher quality of the end-products and an ultimate increase in their economic value.

It is clear that the implementation of waste recycling as alternative materials or energy requires proper regulations and standards to enhance economic value. To process the use of

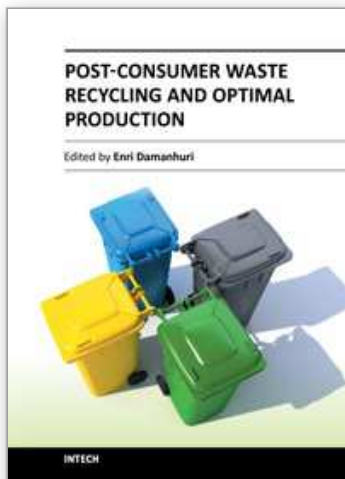
wastes and used goods, which is usually performed by informal sectors, it is important to consider the development of standards, at least the standards and guidance related to market demands, workers' safety and environmental compliance. Cross-sectoral coordination, especially among the parties responsible for regulating the use and trading of materials, is also necessary.

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7. References

- BPS-Statistics Indonesia. (2004). *Official Statistics and their Development in Indonesia*, BPS-Statistics Indonesia, Jakarta.
- Cointreau, S. (1982). *Environmental Management of Urban Solid Waste in Developing Countries*, the World Bank, Urban Development Technical Papers 5, June 1982.
- Damanhuri, E. (2005). Some Principal Issues on Municipal Solid Waste Management in Indonesia, *1st Expert Meeting on Waste Management in Asia-Pacific Islands*, Oct 27-29, Tokyo.
- Damanhuri, E., Handoko, W. & Padmi, T. (2010). Municipal Solid Waste Management in Indonesia, In: *Municipal Solid Waste Management – in Asia and the Pacific Islands*, Agamuthu, P. & M. Tanaka, (Eds.), ISBN 978-979-1344-78-4, pp. 95-112, ITB Press, Bandung, Indonesia.
- Damanhuri, E. & Padmi, T. (2009). Current Situation of Waste Recycling in Indonesia, In: *3R Policies for Southeast and East Asia*, M. Kojima & E. Damanhuri (Eds.), 23-52, ERIA Research Project Report 2008, No. 6-1, March 2009.
- Damanhuri, E., Wahyu, I. M., Ramang, R. & Padmi, T. (2009). Evaluation of Municipal Solid Waste Flow in the Bandung Metropolitan Area, Indonesia. *Journal of Material Cycles and Waste Management*. Vol.11, No. 3, (September 2009), pp. 270-276, ISSN 14384957, 16118227
- Donner, W (1987). *Land Use and Environment in Indonesia*, C. Hurst & Company, London.
- Joseph, K. 2010. Municipal Solid Waste Management in India, In: *Municipal Solid Waste Management - in Asia and the Pacific Islands*, Agamuthu, P. & M. Tanaka, (Eds.), ISBN 978-979-1344-78-4, pp. 75-93, ITB Press, Bandung, Indonesia.
- Medina, M. (2008). *The Informal Recycling Sector in Developing Countries, Organizing Waste Pickers to Enhance their Impact*, Grid Lines, Note No. 44, October 2008.
- Ministry of Environment of Indonesia (2008). *Solid Waste Statistics 2008* (in Indonesian), Jakarta.
- Ministry of Health of Indonesia (2007). *Indonesia Health Profile 2005*, Jakarta.
- Trihadiningrum, Y., Wigjosoebroto, S., Simatupang, N.D., Tirawaty, S. & Damayanti, O. 2006. Reduction Capacity of Plastic Components in Municipal Solid Waste of Surabaya City, *Environmental Technology and Management Conference*, 7-8 September 2006, Bandung, Indonesia.



Post-Consumer Waste Recycling and Optimal Production

Edited by Prof. Enri Damanhuri

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This book deals with several aspects of waste material recycling. It is divided into three sections. The first section explains the roles of stakeholders, both informal and formal sectors, in post-consumer waste activities. It also discusses waste collection programs for recycling. The second section discusses the analysis tools for recycling system. The third section focuses on the recycling process and optimal production. I hope that this book will convey both the need and means for recycling and resource conservation activities to a wide readership, at both academican and professional level, and contribute to the creation of a sound material-cycle society.

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