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EMERGING WASTE MARKETS AT NATIONAL AND INTERNATIONAL
LEVEL – HOW LOCAL AUTHORITIES AND PUBLIC WASTE UTILITIES
COULD POTENTIALLY BENEFIT FROM IT BY UTILIZING WIN-WIN
OPPORTUNITIES

(Background Paper for Plenary Session 1(a) of the Provisional Programme)

Final Draft

This background paper was prepared with inputs from Mr. Alban Casimir, Bionersis, for the CSD Intersessional Conference on Building Partnerships for Moving towards Zero Waste ahead of the nineteenth session of the Commission on Sustainable Development. The views expressed herein are those of the author only and do not necessarily reflect the views of the United Nations.

Emerging Waste Markets at National and International Level – How local authorities and public waste utilities could potentially benefit from it by utilizing win-win opportunities

Table of content

I. Introduction

II. Type and scale of waste markets, trend in market price and traded volumes of selected secondary materials

III. What are the benefits and opportunities available for local governments and PWUs through waste markets

1. Economic benefits (Increase revenues and job creation)

2. Other benefits

IV. Constraints/challenges/needs of local governments and PWUs to participate in waste market

V. Potential roles of central government, private sector and other partners in emerging waste market

VI. Recommendations

VII. Conclusion

I. Introduction

The current economic theory, inherited from Adam Smith, states that the Homo economicus must tend towards the best productivity for three factors: labour, capital and natural resources. However, a brief analysis of the current common practices shows that the latest one is largely neglected.

Presently, we are consuming the natural resources of the planet as if they were infinite and perpetually renewable. However, it is now obvious that the current ratios of resources erosion and waste generation exhaust our planet faster than its capacity of regeneration. What would you think about people squandering their capital without ensuring their secure retirement or trying to protect their descendants? It is exactly what we have been doing with our natural capital since the 19th century and the Industrial Revolution.

At the beginning of the 21st century however, the world experienced a series of shocks affecting as much the natural resources markets as the climatic and environmental equilibrium of our planet. The explosion of prices in world markets in 2008 impacted economies reaching their limits as much in demographic as in physical and biological terms. Rarity had suddenly returned to centre stage of our concerns.

But Mankind is capable of remarkable adaptation and similarly to the switch of economic paradigm between agriculture and industry in the 19th century, we should now generalize collecting, sorting, recovering and recycling of waste. In a word, we should get back to the ancient ideal of closing the material cycle loop by transforming waste into material resources in order to reach a "Moving towards Zero waste" economy.

Waste management is one of the major issues of urban engineering for the decades to come but tended to be perceived in a caricatural manner in its environmental pollution reduction task. Today, it is becoming the increasingly world-wide problem of managing resource supplies exploited for the energy, goods...they provide. And we must realize that part of our future depends on the ten billion tons produced each year of which scarcely one-quarter is recovered or recycled at the present time. Waste to energy, compost, scrap, cellulose fibers... are as many "secondary" materials which we can substitute for the raw materials likely to run short before the end of this century.

In this respect, a new but logical phenomenon has appeared over the last few years: the emergence of genuinely worldwide markets for a number of secondary materials (scrap and paper) for which 2007 and 2008 performances copied and then anticipated those for raw materials (steel and paper pulp). From a marginal situation, world secondary material flows have become essential, to the point of becoming a veritable indicator for part of the world waste economy, and also the industry in general.

From these ten billion tons of waste generated a year, Municipal Solid Waste (MSW) represents approximately 1.7 to 1.9 billion tons (while only 65% is being collected) or about 20% of the total waste generated worldwide¹. MSW collection, transfer, transportation and treatment are activities, especially in the Developing countries, mostly under the control of local authorities and Public Waste Utilities (PWUs). Waste recycling would appear to represent a world market of approximately 70 billion € while the municipal waste market as a whole is estimated at 300 billion €. Therefore, recycling activities would appear to represent above 20% of the total waste market².

At the moment, Developed countries recycle, compost, incinerate and landfill, in average and approximately, 25%, 12%, 20% and 43% of the collected MSW respectively while Developing countries recycle 15 to 20% (see the table at the end of this introduction). Therefore, compared to the percentage of recyclable materials in the waste stream, from 40 to 70%³ depending on the country, the potential for increasing waste recovery and recycling is substantial, especially in Developing countries. But what potential benefits local authorities and PWUs could gain by participating more actively in the recycling market, which could provide a strong incentive for cities and citizens to engage in at-source waste separation and contribute towards reduction of waste that ends up in final disposal sites / landfill sites.

In Developed countries where the “Polluter pays” principle is extensively implemented, optimizing the employ of taxes paid by the citizens for the MSW management is a must. The Public, NGOs, Newspapers are very present to remind the local authorities their obligations to protect the environment and tend to the maximum efficiency while improving the public welfare. In Developing countries, local authorities and PWUs are mostly driven by the environmental reduction task. Creating value from waste reuse/recycle projects would surely represent financial benefits for local authorities and PWUs but is not, in the experience of several private companies, the main decision driver to develop or strengthen it. In this respect, we have identified several incentives/constraints that will surely count in the decision making process of City Mayors and Directors of Sanitation/Environment/Public Cleansing department but most of these drivers are not part of a big picture, neither National nor International for MSW recycling. The key explanation is that MSW management is widely decentralized to local governments and PWUs with only local concerns and objectives. Besides, there is a lack of translation of national policies into actions at the local level. This is further compounded by weak enforcement of regulations at every level. Moreover, local representatives are rarely accountable to the Central Government for their success or failure regarding the MSW management and related public welfare effects but they do answer to their electors.

Despite the difficulties, waste recycling is a reality with the emergence of trading markets for secondary materials while Citizens as a whole in Developing countries (classified as the informal sector) already benefit from it. According to some experts, between 1 to 2% of the urban

¹ 2009 Veolia Report : « From waste to resource ».

² 2010 EU and UN statistics, World Bank « country » environmental monitors

³ 2009 Veolia Report : « From waste to resource ».

population in developing countries is involved in informal material recycling (15 million people) representing an economic impact of 700 million €⁴.

What is necessary now is to strengthen this emerging economy by spreading the information to the stakeholders (private companies, formal and informal workers, PWUs...) about its obvious and significant benefits. Moreover, we need to identify what are the constraints/challenges/needs of local authorities and PWUs to participate in waste recycling market. Finally, we must find and optimize the roles of all its stakeholders (local authorities and PWUs, private companies, NGOs, International Organizations and other partners).

Typology of Municipal Solid Waste by country revenue			
	Low revenue countries (India, Africa...)	Average revenue countries (Asia, South America...)	High revenue countries (North America, EU 15...)
GDP in \$ / capita / year	< 5,000	5,000 - 15,000	> 15,000
MSW in kg / capita / year	150 - 250	250 - 550	350 - 750
Formal collection rate	< 70%	70 - 95%	> 95%
MSW composition (%)			
Organic/Fermentable	50 - 80	20 - 65	20 - 40
Paper and Cardboard	4 - 15	15 - 40	15 - 50
Plastics	5 - 12	7 - 15	10 - 15
Metals	1 - 5	1 - 5	5 - 8
Glass	1 - 5	1 - 5	5 - 8
Calorific power in kcal/kg	800 - 1,100	1,100 - 1,300	1,500 - 2,700
Waste treatment	Open dumps > 60% Informal recycling > 20%	Open dumps ≈ 20% Controlled dumps ≈ 40% Sanitary landfill ≈ 20% Formal recycling ≈ 10% Informal recycling ≈ 10%	Recycle, Compost, Incinerate ≈ 57% Landfill ≈ 43%

Source: 2008 EU and UN statistics, World Bank « country » environmental monitors

⁴ 2009 Veolia Report : « From waste to resource ».

II. Type and scale of waste markets, trend in market price and traded volumes of selected secondary materials

Of all the large commodity markets of the 21st century, the market for secondary raw materials obtained from waste is an evolution which will be the most fascinating to monitor, in anticipation of this challenge which mankind will have to meet, that of rediscovering the meaning of scarcity. But we must face the fact that we have very little data and equally limited analysis concerning one of the most difficult sectors to apprehend. One of the key factors is the extent to which the formal and informal sectors are intermingled. This United Nations' Paper, despite its many omissions, tries to fill up an unquestionable gap in our economic knowledge in the waste recycling market worldwide.

Over the last 20 years raw material prices have increased enormously. The main driver of the price increase has been the enormous boost in global demand. Over the last five years, the increase in raw material prices has been especially strong, even partial shortages occurred. The reason for the price increases and partial shortages lies in the significant changes in the commodity markets over the last years. The commodity markets exhibit high long-term demand, longer-term scarcity of supply, a changed supply structure and increasingly trade-distorting policies.

On the **demand** side, the economic boom in China explains a third of the worldwide increase in the demand for raw materials because of the substitutability of primary raw materials through secondary raw materials, prices of secondary raw materials have developed similarly. For example that China's metal commodities imports have multiplied by a factor of 4 to 10 over the past decade. Crude oil is also affected, influencing not only energy prices, but also resulting in increased prices for chemicals and plastics.

Considering the stable, high growth rates in demand described above, **supply** over the last years could not keep pace, in particular in the area of metals, but also oil. This is compounded by the fact that during the past years, capacities were not increased as required. Since 2003, new raw materials deposits have been developed. However the development of new deposits is time intensive and it will take some time until market supply will increase noticeably.

Similarly to raw materials, secondary raw materials also have increasingly become the object of **trade distortions** over the last years: China imposes a 10 percent tax on the export of steel scrap, in the Ukraine and Russia there are taxes on the export of steel scrap (30 € per ton, 15 percent,

respectively) as well as on the export of nonferrous metal scrap. These are just a few examples of existing trade distortions⁵.

Concerning recycled materials, WTO and waste shipment rules provide the legal framework for cross-border trade in such materials. These rules open a global market for recycled materials. The global market at the end guarantees the sustainable production of recycled materials as it creates the demand for recycled materials necessary to ensure a stable market.

The **“Conventional” waste market** such as plastic, glass, metal scrap and paper would represent volumes of the order of one billion tons, or slightly over one quarter of world production or a third of the volume collected. Recycling appears to represent 700 million tons, with precise estimates for scrap (400 million tons)⁶ and recovered cellulose fibres (250 million tons), and substantially less accurate figures for plastics. Some reliable figures exist for plastic, paper and glass recycling in Europe, with of 6 million tons recycled. About 200 million tons would be treated through energy recovery incineration, while biological applications such as composting accounts for another 100 million tons⁷.

As mentioned previously, the price of secondary materials varies strongly in line with the price of raw materials and hence with the economic growth overall. From the charts below, we can witness the effect of the economic crisis in 2008 on the prices of these second materials in 2009 – 2010 in Europe. Europe is the only region where statistics are available and easily accessible. Besides, there is another significant lesson that emerges; both the supply and the demand for secondary materials are relatively own-price inelastic.

Besides, we can witness that the waste market trend is definitely upwards from 2000 to 2009:

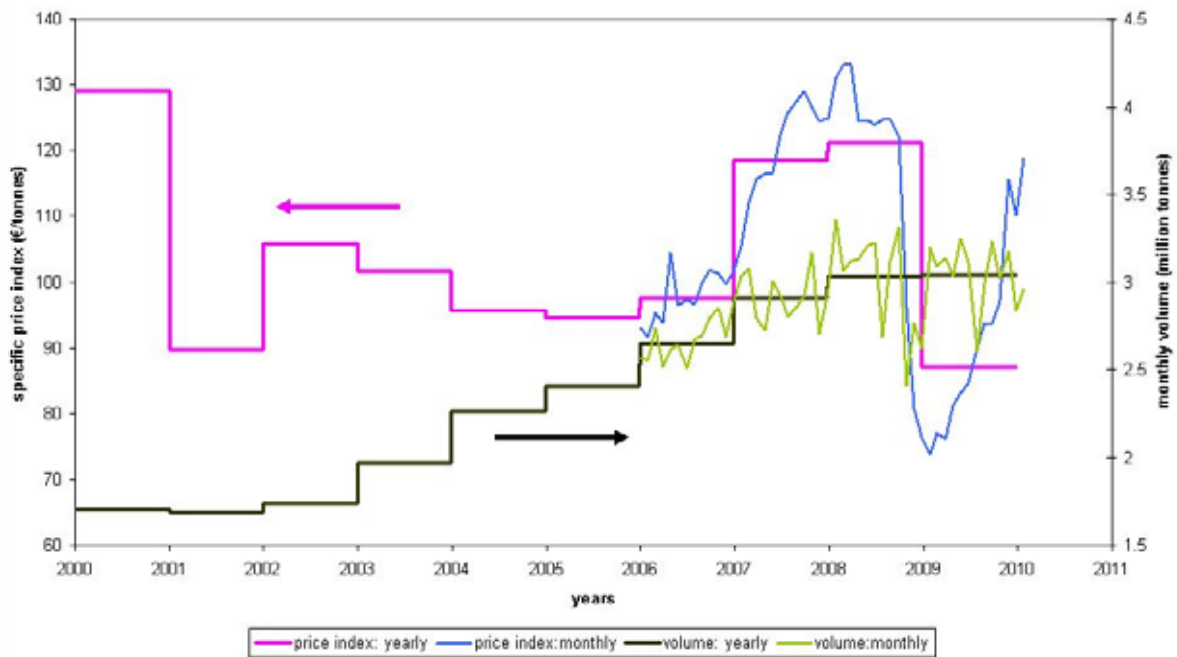
- Glass:
 - Price: 2.8%
 - Volume: 5.4%
- Paper:
 - Price: stable
 - Volume: 5.8%
- Plastic:
 - Price: 1.7%
 - Volume: 12.9%

⁵ Figures given in the previous paragraphs come from the 2007 EU Ad hoc group “Natural resources, secondary raw materials and waste”

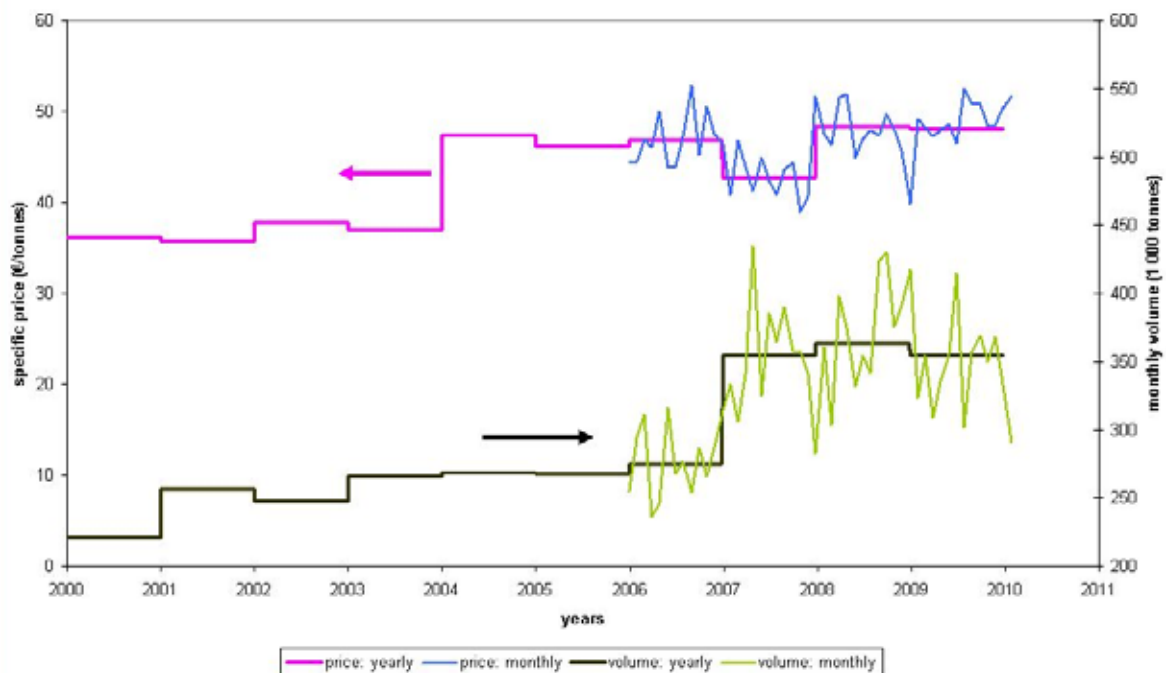
⁶ It is interesting to notice that internet platforms have been created to put together buyers and sellers such as the US Government Metal Scrap for instance. The system is simple, the best bidder takes the lot.

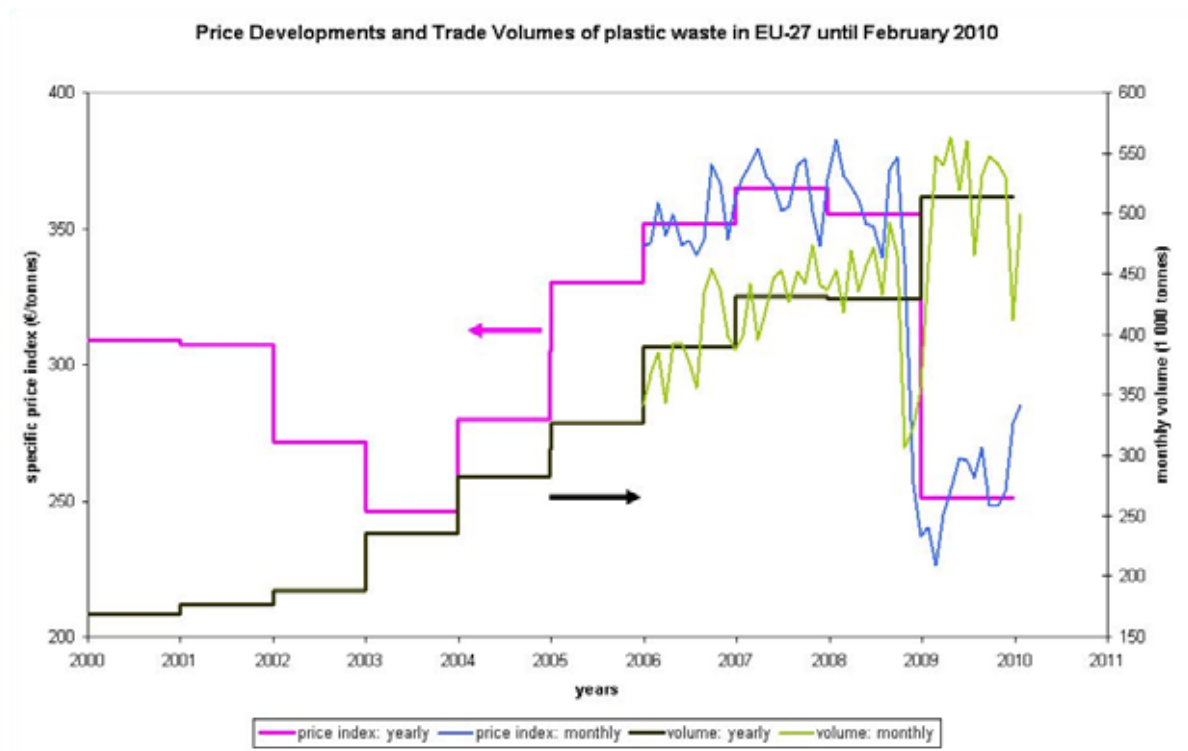
⁷ 2009 Veolia report – « From waste to resource ».

Price Developments and Trade Volume of Paper Waste in EU-27 until February 2010



Price Developments and Trade Volume of Glass Waste in EU-27 until February 2010





Beyond the “conventional” recyclable market, we have experienced recently, the development of an **e-waste market**. Around 40 million metric tons of e-waste are generated each year⁸. Such waste is mainly generated by obsolete computers, printers, and electrical equipment. Other contributors to e-waste include plastics, screens, printed circuit boards, pollutants, metal plastic mixtures, and cables. In the IT industry, personal computers are the major contributor to e-waste. According to TechNavio researchers, “The global e-waste market is forecast to reach 53 million tons by 2012 from 42 million tonnes in 2008. E-waste contains lead, mercury, chromium, cadmium, barium, beryllium, PVCs, brominated flame retardants and other toxic materials as well as plastic, glass, copper, silver and gold, are of growing concern with respect to disposal.

In the United States, electronic waste is estimated to amount to about 2.5 million tons per year, of which only about 10 per cent is recycled. It is estimated that about 70 per cent of the heavy metals in landfills come from electronic waste. A large quantity of discarded computers and other electronic products from the United States, Japan and the Republic of Korea is exported to China and other developing countries in Asia for recycling, often under unsafe conditions.

To reduce electronic waste going to landfills and incinerators, the European Union in 2003 adopted the Waste Electrical and Electronic Equipment (WEEE) Directive requiring producers, starting in 2005, to take responsibility for recovering and recycling electronic waste without charge to consumers. This is intended not only to promote recycling and reduce landfill disposal and incineration, but also as an incentive to producers to design products so as to reduce waste and facilitate recycling.

⁸ 2009 Report buyer - “Global E-Waste Market 2008-2012”

The EU also adopted in 2003 a Directive on Restriction of Hazardous Substances (ROHS) in Electrical and Electronic Equipment (ROHS), banning, from 2006, the use of lead, mercury, cadmium, hexavalent chromium and two brominated flame retardants used in plastics. China has also adopted regulations banning the same six substances, beginning in 2006, thus ensuring that Chinese products meet EU requirements.

Some experts predict the worldwide market for recycling used electronics to reach more than 11 billion € by 2015, up from 4.4 billion € in 2009. Electronic recyclers recovering valuable materials from discarded computers and electronics account for most of the growth⁹.

Box 1: The case of Mobile phones

Consumers bought almost 900 million mobile phones in 2006 and over a billion in 2007, UNEP estimates. A big percentage of those devices are just thrown in the trash, or given to local collectors who extract precious metals from them in environmentally hazardous ways. The study predicts that by 2020, the amount of e-waste from dumped mobiles in China will be about seven times larger than it was in 2007, and in India 18 times higher. At present, India alone produces about 1,700 tons of e-waste from mobiles, Columbia about 1,200 tons, and Kenya another 150 tons.

Mobile phone and PC making gobble up three percent of all the world's gold and silver available each year, not to mention 13 percent of all palladium, 15 percent of cobalt, and plenty of copper, steel, nickel, and aluminum as well. These spew tons of carbon dioxide into the atmosphere.

In developing countries, much of this e-waste is mined yet again by "backyard recyclers" who take apart the discarded devices for their tiny quantities of gold and other precious metals, a practice that releases "steady plumes of far-reaching toxic pollution," but recovers very little value compared to more efficient and modern industrial recycling plants.

Source: 2008 UNEP report on E-Waste.

⁹ TechNavio researchers 2008

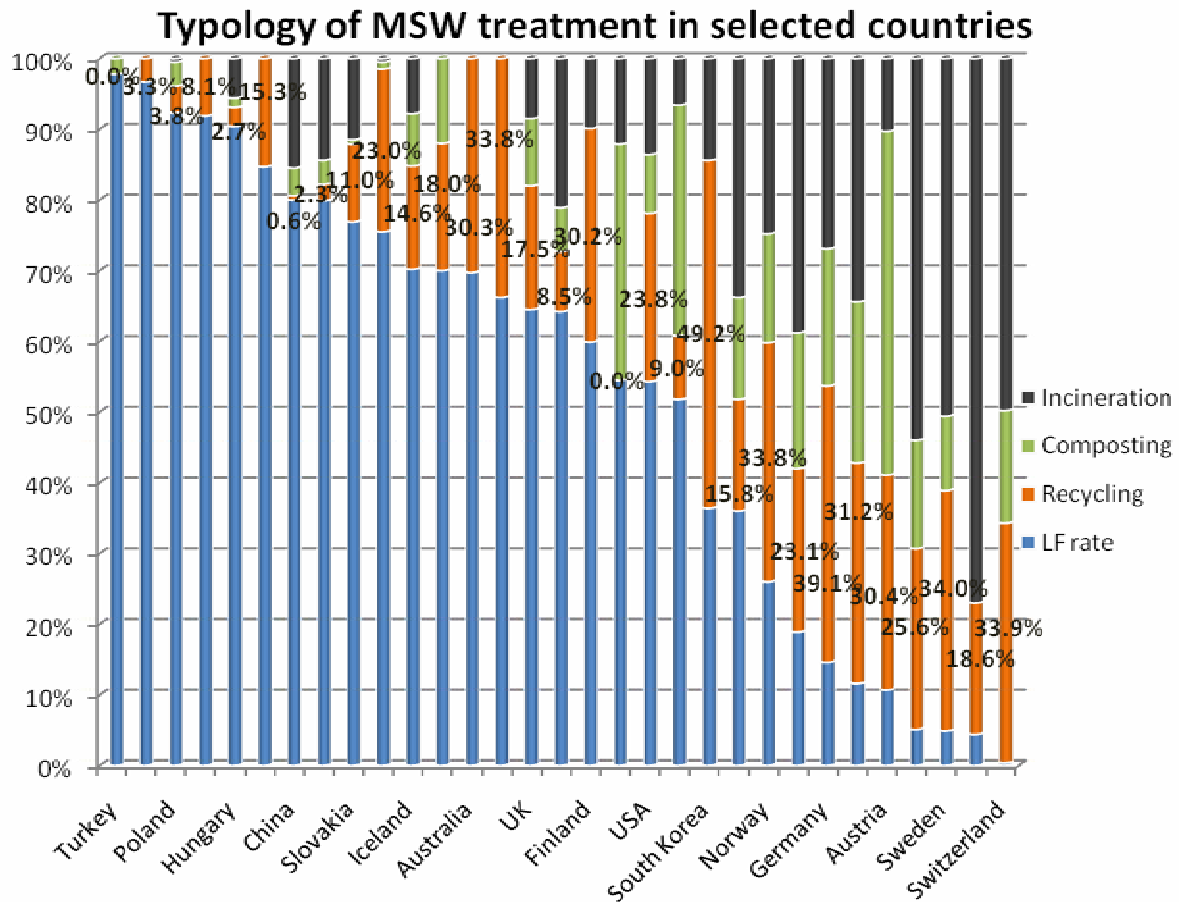
III. What are the benefits and opportunities available for local governments and PWUs through waste markets

The analysis starts from the consideration that the recycled material is a valuable resource and asks the question "Why isn't that value being fully realized by local governments and PWUs (among others)?" Often, that is for reasons that are due to failures in the economic functioning of the market – issues which may be independent of the environmental problem being tackled. Assessing these market failures using economics identifies the stakeholders' behavior in terms of the incentives they face, the constraints to which they are subjected (including the technological ones) and the information that is available when they make decisions.

Maybe a few words should be added on the specific issue of data availability that implies a distortion in the right functioning of any market towards the equilibrium. Therefore, better thought should be given on what data needs to be collected in order to support policy towards higher waste recycling rates.

1. Economic benefits (Increase revenues and job creation)

Beyond the microeconomic analysis of the economic benefits for local governments and PWUs, we think important to give an insight of the typology of waste treatment in several countries and the recycling waste market as a whole: a macroeconomic overview of the waste market.

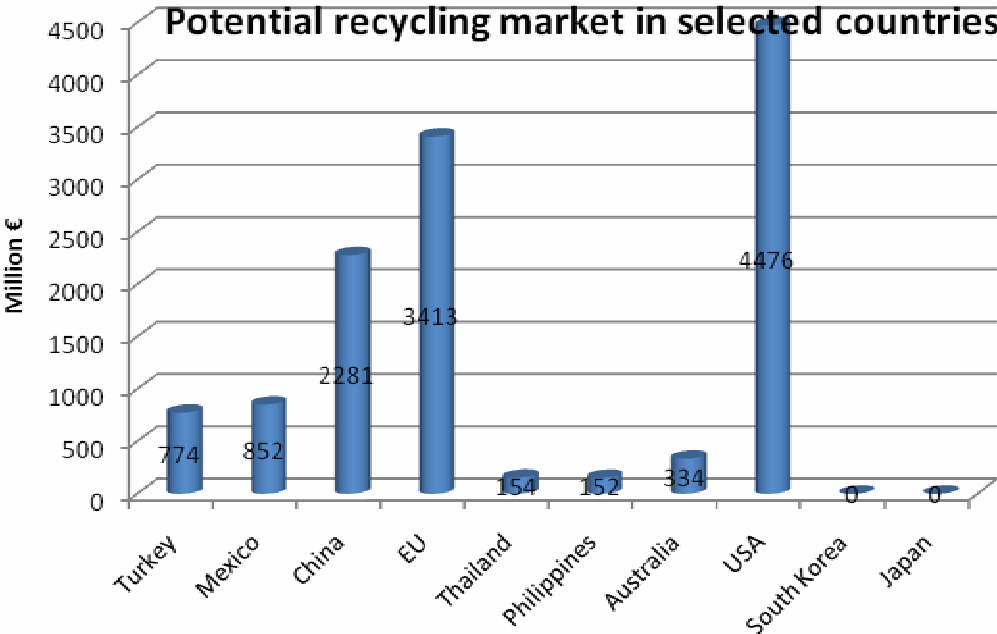


Source: OECD Environmental data (2009) and World Bank Environment reports (2004)

In total, we observe a number of waste treatment schools of thought, apart from differing levels of economic development:

- Countries still marked by landfilling and underground disposal (over 50% of total waste): Oceania, United Kingdom, Ireland, Eastern Europe, China and the USA on the one hand, and Greece, Spain and Italy on the other. On the one side, the Anglo-Saxon countries, and on the other the Mediterranean countries, which we could perhaps not have imagined adopting the same practices in regard to waste.
- Incineration culture generally less marked, but which we find in Northern Europe, Switzerland and, in particular, in Japan, where it represents three-quarters of all waste treatment.
- Growth in material recovery (composting and recycling), very strong (over 50%) in Northern Europe, but also in South Korea and Singapore.
- Finally, a few countries such as France, with more or less balanced profiles. The case of France is relatively unique with an almost even balance between landfilling (36%), incineration (34%) and recovery (30%).

Therefore, it appears obvious that countries with a strong waste recycling or incineration culture, such as South Korea and Japan, there is little potential for recycling waste market development but for the others, there is a lot of potential. In the chart below is estimated the untapped recycling market value:



Source: OECD Environmental data and World Bank Environment reports

Huge gap between China and USA (or to a lesser extent, Europe) is due to the MSW collection efficiency much lower in China (49% against 95% for USA and 99% for EU) and to a lesser extent to the typology of waste (Chinese waste being much more organic and hence less second material value).

At the microeconomic level, let’s take the example of a municipality in an “Average revenue countries” as described in the introduction, collecting 300T/day of fresh municipal solid waste. Typical waste composition would be as follows: 50% organic, 15% paper, 15% plastic, 5% metal, 5% glass and 10% inert. Price of recycled glass, paper, plastic and steel waste are 45€/T, 85€/T, 250€/T and 240€/T respectively¹⁰.

The yearly potential revenues are $365 \cdot 300 \cdot (15\% \cdot 85\text{€} + 15\% \cdot 250\text{€} + 5\% \cdot 240\text{€} + 5\% \cdot 45\text{€}) = 7.06$ million €.

¹⁰ Result of 2011’s crosscheck between prices from EU and Alban Casimir’s research

This theoretical figure postulates a technology for waste sorting 100% efficient and above all available, no waste contamination and no intermediary between the Seller (local governments and PWUs) and the Buyer. This figure might not be achievable in practice, especially without the “at source waste sorting”, and considering that the informal sector is already extensively tapping plastics and paper in particular, but it gives an indication and a strong economic argument to convince the local governments and PWUs taking actions to better organize the current practices for waste recycling and implement strategies to tap this market further.

Moreover, recycling diverts waste from the landfill which has also positive economic impacts on both CAPEX and OPEX.

In developing countries, between 1 to 2% of the urban population would already be involved in informal material recycling (15 million people) representing an economic impact of 700 million €¹¹. Indeed, although involving Local governments and PWUs is important, acknowledging, structuring and developing the work of informal sector is crucial in developing countries in order to increase the waste recycling rate. It is not only the waste pickers in the landfill (often called scavengers) but also ordinary citizens that collect recyclable materials from households in order to sell them to recycling centers (see “Economic instrument in Brazil” and “Thailand Case study”).

Box 2: Economic Instrument in Brazil

Latin America has wide variations in the practice of recycling across countries, owing largely to the systems of rewards and punishments that are in place. According to the Brazilian Aluminium Association, about 80 per cent of the 9.5 billion aluminium cans sold in 2000 are recycled. This would put Brazil right among the ranks of world’s recycling leaders such as Japan. Whereas Japan’s system is based upon responsible citizenship, Brazil uses economic incentives. In the major metropolitan areas, there are many recycling centres that buy back recyclable materials for cash or discount foods.

Source: Review of the Implementation of Agenda 21 and the Johannesburg Plan of Implementation: Waste Management, 2010; Report of the Secretary General – CSD 18th session.

¹¹ 2009 Veolia Report : « From waste to resource ».

Box 3: Waste recycling: Thailand Case Study

In 2010, Thailand manages to recycle approximately 23% of the 15.14 million tons of MSW generated a year which is remarkable considering that more than 70% is collected by the informal sector. The most prominent are the Sa leng, waste collectors who are easily recognized as they commonly use tricycles to collect waste. Additionally, municipal garbage collectors also sort and collect recyclables for sale on an informal basis to supplement their income. Finally, there are several thousand waste pickers or scavengers who collect waste from the landfill and sell it as a livelihood.

Then, the informal sector sells the collected recyclable to Garbage banks, Municipal Collectors or Junk Shops (please see below the prices for one of these shops).

1 Euro = 40 Baht <i>Jun-08</i>	Shops prices closeby Nonthaburi landfill	
	Thai baht/kilo	€/Ton
Glass bottles	1.80	45*
Large black plastic bags	10.00	250*
Plastic bags (coloured)	15.50	388
See-through plastic	18.00	450
Paper and cardboard	5.00	125*
Beer, soda cans	45.00	1,125
Coffee cans	6.50	163

*: remarkably comparable with the European market prices in 2008

Source: 2008 Opportunity for recognition or threat of exclusion for landfill waste pickers? By Sonia Cautain

Private sector is hence deeply involved such as Wongpanit along with their motto: "Waste is Gold". Wongpanit Co. Ltd's success story started in 1974, when its founder, Dr Somthai Wongcharoen, started a recycling business, with a capital of 1,000 Baht (25 €) and an old pick-up truck in the Province of Phitsanulok. Since then, the company has been growing exponentially and is now one of the leading Thai recyclable waste trading companies, with more than 400 franchise branches both in Thailand and abroad.

Moreover Wongpanit is also famous all over the country for being a social enterprise committed to supporting local projects, temples and communities, and awareness raising campaigns. Among other activities, Wongpanit supports the creation of community waste banks, provides training and assistance in waste separation schemes to small businesses and owners of recycling shops, and has recently developed a 'Waste Separation Training for Quality of Life Improvement: Special Program for Homeless and Beggars'. <http://www.wongpanit.com/>

Source: 2011 Alban Casimir's research

In developed countries, the role of local governments and PWUs is crucial since an informal sector cannot exist: the regulation framework is much more developed and the economic scenario as described in the Brazil and Thailand case is not a sufficient incentive in developed economies where minimum wage is way beyond what an informal recycling activity can offer. Therefore, other motivations must be found such as taxation, regulation or public awareness (see “Incentives for waste reduction in Korea”).

Box 4: Incentives for Waste Reduction

Volume Based Collection Fees System: Korea

Prior to 1995, all municipalities in Korea levied waste fees on households through property tax or monthly lump-sum fee. Under this fixed-fee system, cost per residence remained constant regardless of the amount of waste generated, hence there were no incentives for households to reduce the waste they produce. Introduced in 1995, the *Volume Based Waste Fee System* of Korea is a pay-per-sack scheme under which households are required to place residual waste in pre-paid sacks, whilst recyclables are collected free of charge. Different municipalities levy different charges for their bags under the VBWF scheme. For example in Yongsan-gu, the price of a bag ranges from 100 Won for a 5 litre bag up to 1,780 Won for a 100 litre bag for general waste.

In Korea, quantity of municipal solid waste has been reduced by 15.95% from 1994 to 2006. Meanwhile, the recycling rate has increased from 15.4% to 57.2% over the same period.

Source: Performance of Waste Management Policy in Korea - Volume-based Waste Fee System and Packaging Waste EPR (2008).

Beyond the obvious benefits from MSW sorting and recycling, there are also the benefits related to the use of the organic matters which represent about 50% of the overall MSW stream in developing countries. This can be done for large scale projects (several hundred tons a day), an activity mostly driven by private companies, but also for small scale projects dedicated to households cooking or lighting driven by NGOs or local authorities (see “Biogas digester: China case study”).

Box 5: Biogas Digester: China Case Study

In Shipai Village in Jianshi County of Hubei Province, China, more than 90% of a total of 227 households have installed a 10 m³ biogas unit. The gas produced per household on a daily basis amounts to 1.0 – 1.2 m³, which is used for both lighting and cooking. This has saved electricity and coal (RMB 136 per year). Use of digested slurry has saved on chemical fertilizer. The annual labour savings are substantial. In addition, social benefits have been realized, such as employment for technicians, improvement of health, and increased participation in social work by women.

Source: Report from Netherlands Development Organization (SMV), 2006

2. Other benefits

As previously pointed out, the potential economic benefits for local governments and PWUs could be substantial, why is this potential not fully realized yet while the recycling rate is lower than economically expected? Indeed, there are other benefits for local governments and PWUs which may also drive their decisions to expand the waste recycling. As mentioned in the preamble of this paragraph, assessing the market failures identifies the stakeholders' behavior in terms of the incentives they face, the constraints to which they are subjected and the information that is available when they make decisions.

In this respect, we have listed several incentives and constraints that may trigger their decision to increase the MSW recycling in the area under their jurisdiction:

- Public complaints regarding existing open dumps and siting of new landfills are getting increasingly louder. Any workable alternative to landfilling will reduce the headache for local authorities & PWUs and increase the public's satisfaction (so will the appreciation of the City Mayors' decisions) for the environmental improvements created,
- Public awareness is also rising hence local governments (and PWUs indirectly) will be addressing a desire of the electors to reduce the potential environment impacts of the waste treatment,
- Implementing social marketing and education efforts, which are some of the keystone policies for waste reduction/recycling success, also drive the public to believe that local authorities and PWUs are taking actions to address one of the main subjects of our time. Especially if such efforts are successful,
- Local governments and PWUs would mostly use the private sector for developing the recycling (and MSW management as a whole) activities meaning that more and more responsibilities over the MSW will be taken over by the private sector hence reducing the Local governments and PWUs' workload and liabilities to third parties,
- Besides, involving private companies will also drive the decision makers to better understand what are the technologies available and workable on the market, and
- Additional revenues may be used for reducing the level of taxation (there is no specific taxation in developing countries for MSW management) over the citizens and/or for implementing projects creating positive externalities such as park or sports complex which are always helpful achievements when election time comes.

IV. Constraints/challenges/needs of local governments and PWUs to participate in waste market

Economic theory tells us that, in a market without government intervention, recycling will take place up to the point where the price of the recycled product equals the cost of producing an additional recycled product – in economic jargon, up to the point where price equals marginal cost.

This implies that recycling will increase whenever:

- The price, customers are willing to pay for a recycled product increases – this is, whenever demand increases,
- The cost of producing additional units of recycled products decreases – this is, whenever supply increases.

This simple framework provides a useful starting point to understand why actual recycling rates are not always as high as they could, or should, be and to understand why they vary over time and space. Whenever actual market outcomes differ from the market outcomes that would lead to the highest benefits for society as a whole, it is said that market failures occur.

In the case of waste recycling, market failures occur both at the demand and the supply side.

At the demand side, market failures in recycling occur for the following reasons:

- Collected waste is often contaminated by other waste streams. Whenever it is difficult for a buyer to verify the quality of the recycled product, demand will be lower than for a primary product,
- If the users of recycled products have some market power, they use that power to push down prices (which restricts volumes recycled).

At the supply side, the following market failures in recycling occur:

- The producers of primary products do not design products with their eventual “recyclability” in mind. Therefore, it is often expensive to prepare waste for recycling. If this is the case, a “technological externality” is said to occur,
- If collection or recycling firms have some market power, they push up prices for the recycled products (which restricts volumes recycled).

Moreover, trade in waste is governed by strict rules. These rules are justified as much as trade imposes risks and costs on other parties than those who have agreed voluntarily to trade the waste. In reality, it has been suggested by some stakeholders that some national authorities use the rules on imports and exports in order to protect their own recycling industry. Potential gains to trade are therefore lost, even when there are no clear environmental benefits.

Finally, due to transaction and search costs, demand and supply will not always be “matched” in their most valuable application. This is particularly true in developing countries. However, one of the most

obvious market failures in the field of waste management is related to the environmental impacts of the alternatives to recycling (illegal dumping, landfilling and incineration).

As these costs are in general not internalized, the costs of the alternative treatment or disposal methods are too low compared to the cost of recycling. Or, in other words, the costs of recycling are too high compared to the cost of the alternatives. This implies that any measure that better internalizes the environmental effects of the alternatives to recycling will lead to higher recycling rates.

Outside the waste market, we have identified, especially in developing countries, the following as the major barriers for expanding waste management services at the local level (local governments and PWUs):

- Lack of financial resources and the ability to access funding sources that are available,
- Lack of information and access to technology precluded by an absence of reliable data,
- Lack of capacity for developing and implementing integrated solid waste management systems,
- Inability to deal with emerging and complex waste streams,
- Limited public awareness and stakeholders involvement in decision-making processes, and
- Divergence in and lack of coordination among agencies at the local level.

These issues can be categorized into Social, Policy & Institutional capacity issues, Financial barriers and Technological gaps.

Social issues:

- Persisting belief that any sustainable waste treatment must be more expensive than landfilling, and
- Limited public participation.

Policy issues:

- Lack of comprehensive policies, laws, and regulations to promote sustainable waste management or weak implementation and enforcement of the existing ones,
- Existence of numerous illegal dumpsites and other waste treatment facilities without any environmental standards,
- The link between waste management and resource consumption not fully understood, leading to waste recycling being addressed at the downstream level (waste treatment) and not upstream (raw material processing),

- Limited engagement or interest of different stakeholders in the decision-making process in dealing with waste recycling,
- Sustaining policies despite changes in leadership,
- Limited risk appetite of the private sector for countries where the legal framework is not stable or not enforced or changing with new leadership. This is particularly true for foreign companies,
- Waste economics is too often not integrated into policy-making processes, and
- Inadequate consideration of resource-saving measures and their economic return in overall policy and planning.

Institutional capacity issues:

- Weak data collection, documentation, and analysis. Low reliability of data and weak infrastructure for data sharing,
- Weak institutional framework with few or no national/local associations or ‘champions’;
- Force of habit leading the decision makers to prioritize the business as usual for waste management (landfilling),
- Lack of knowledge and capacity for training waste management professionals at local and municipal level, which make international financing or investment unproductive,
- Limited institutional capacity for raising awareness and engaging the public,
- Limited capacity and/or willingness to address and improve the working conditions of the informal sector, and
- Limited capacity to improve the fairness of the revenues sharing among the stakeholders and particularly for the informal sector.

Financial barriers:

- Lack of funds both for investment and operation of waste recycling facilities,
- Lack of information about and access to alternative financing mechanisms,
- Limited interest in funding from the private sector due to unclear business models especially regarding the revenue streams since the polluter pays principle is rarely implemented and the fee per ton of waste treated is usually very low, and
- Limited understanding of business potential in waste recycling.

Technological gaps:

- Lack of capacity for technology assessment and selection,
- Lack of access to, and information on, technologies, particularly new and cutting-edge recycling technologies,

- Apprehension concerning the suitability and performance of technologies in developing country situations, and
- Insufficient information sharing on technology failures.

V. Potential roles of central government, private sector and other partners in emerging waste market

First of all, it is important to define the typology of the Private sector:

- Privately owned and formally registered enterprises
- Commercialized utilities (also known as government-owned corporations, arm's length companies or service councils)
- Joint ventures which are partly owned by private individuals or companies and partly owned by government
- Informal sector enterprises
- Non-governmental Organizations (NGOs)
- Community-based Organizations (CBOs)

We were generating solid waste when we were living in caves, though it appears that then we were relatively successful at recycling, using skins for clothing and bones to make tools. In recent years, we have created for ourselves major environmental problems because of our preference for living in concentrated urban areas, buying more than we need and advertising extensively by means of paper and packaging. Many city administrations have not been able to cope with the rapid escalation of the solid waste problem, and consequently have left densely settled areas with no service, polluted precious air by the open burning of wastes, and damaged land and water resources by careless dumping of the residues of our proud civilization.

Faced with these failures, municipal administrations have looked for experts and new ways of raising funds to pay the ever-increasing costs of solid waste management. First, they recruited and trained their own experts, but the results were not always successful, and failures were blamed on insufficient funds, bureaucratic restrictions, and inadequate decision-making procedures. Often small-scale entrepreneurs and groups of residents took action to fill in the gaps, organizing or providing services on a local scale that at least moved their wastes out of their immediate neighborhoods, and often earning much-needed income from the reuse of materials separated from the mixed waste. The most recent approach has been to invite private enterprise to take over the task, to increase coverage, improve efficiency and reduce the pollution of natural resources.

In this respect, the main roles of the central government could be to:

- Create optimal conditions and frameworks for facilitating the private sector involvement and development such as making regular payments to a contractor,
- Build clear guidelines for the organization of tenders by the local governments and PWUs. Ensure the transparency of such tenders and with doable Terms of Reference in order to benefit at maximum from the competition,
- Ensure that the concession contract is negotiated correctly otherwise there may be serious weaknesses in the arrangements, resulting in inferior service standards or higher costs,

- Monitor closely the efficiency of the contractor and especially their marginal costs in order to adapt their remuneration so as to ensure the best utilization of the public money,
- Avoid monopoly situation: If a powerful private company succeeds in winning many long-term contracts, it may work itself into a monopoly position so that there are no alternative service providers. In such a situation it becomes difficult for local government to control costs and service standards or to offer an alternative service,
- Organize proper trainings of the Municipality staff dedicated to waste management in order to work efficiently in such framework,
- Implement, especially in developing countries, a taxation system closer to “the Polluter pays principle” or at least make it become a “Credible threat” that it will be implemented if households, commercial centers, universities... do not act towards more waste recycling,
- Exercise their best efforts to ensure that the regulatory framework and more especially the environmental standards for landfilling are strictly enforced in order to encourage waste recycling and thus minimizing the landfilling costs,
- Educate the senior local government officials since they may oppose efforts to involve the private sector for political, emotional and personal reasons, because control is being passed to private sector managers and actions are restricted by contracts. This opposition may express itself in the creation of obstructions to the processes of tendering and awarding contracts, in the delaying and reduction of payments, or in personal hostility towards private sector managers, and
- Inform the citizens about the benefits of the private sector involvement so as to prevent the lack of acceptance by the public.

The main roles of International organizations could be:

- WTO and international shipment rules should provide a safe and encouraging legal framework for cross-border trade in such materials in order to open a global market for recycled materials. The global market at the end guarantees the sustainable production of recycled materials as it creates the demand for recycled materials necessary to ensure a stable market,
- Similarly to the Kyoto Protocol to reduce the greenhouse gases, international organizations could push for the discussion of a way to globally and together reduce the waste generated with clear targets and strategies to achieve them,
- Develop a public database with regional price fluctuations and trade volume per type of waste (similarly to what EU has achieved) with the objective to guide the local governments and PWUs,
- Develop studies dedicated to costs and performance comparative analysis of the available recycling technologies,
- Develop studies to rate the technology providers, and
- Grant loans to local governments and PWUs in order to develop their recycling activities. Such loans should be conditioned by clear operational and financial objectives.

VI. Recommendations

Economic/Financial Recommendations:

- In order to avoid waste contamination and high sorting costs, an overhaul for the organization of collection and sorting out at the source could make a great difference – dedicated collection for dedicated waste. However, selective collection can be expensive. Moreover, if collection is subject to economies of density, selective collection is almost surely incompatible with competition in the market. This does not imply that selective collection needs to be put in public hands and lose the incentive of competition. There exist several way to “simulate” competition, such as competitive tendering and yardstick competition. However, organizing and supervising this requires strong and competent authorities. Exchanges of good practice can play an important role in improving the quality of supervision. This should of course not lead to uniformity in practices. Even in household waste collection, the logistics can be highly idiosyncratic (think of city centres with narrow streets versus residential areas with broad avenues),
- National and International financial bodies (World Bank, Asian Development Bank, ...) could strengthen access to and create specific financial schemes to implement waste recycling activities. Besides, they should ensure that the recycling or waste management facilities as a whole they contribute to create can be operated otherwise it will be spent for nothing,

Box 6: Financing of leachate ponds in “X” landfill, Indonesia

“X” landfill mainly receives the MSW from “Y” Municipality. Leachate coming from the landfill was historically polluting the nearby river in particular. In this respect, an international financial organization decided to invest in leachate ponds so as to address this severe environmental issue. As of today, the leachate ponds are still there but nobody in the Municipality is able to operate or maintain them. Therefore, the leachate is still polluting the nearby environment of the landfill.

What would have been more successful was to consider:

- the full costs of the project, Initial investment but also the operation and maintenance,
- the proper training of the municipality staff, and
- and above all, the indefectible support of the municipality to make this project a success.

Source: 2011 Alban Casimir's research

- Exercise best efforts to implement the Polluter-Payer principle by, for example, linking and co-collecting charges for waste management services with charges for other services such as water, sanitation, and electricity. The idea is to keep the waste management fees painless for the people,

- Secure and Promote the Clean Development Mechanism which is an effective financial tool with a double environmental benefit: less waste landfilled and less GHG emitted,
- Rethink rules on imports and exports from the assumption that free trade should be the rule and to leave the burden of proof to those who want to restrict it,
- Avoid recycled materials discrimination compared to raw materials even though the specificity of recycled materials is recognized,
- Develop viable business models to attract private sector investment, risk-sharing mechanisms having a strong social component addressing the needs of vulnerable sections of society such as public-private partnerships (PPPs), and micro-financing schemes particularly to support informal groups/NGOs,

Box 7: Impact of private involvement on waste service cost in selected countries

Engaging the private sector has reduced the waste service cost by at least 25 per cent in countries such as UK, USA and Canada, at least 20 per cent in Malaysia and even 50 per cent in Latin America as a whole.

Source: 2010 – UN Economic and Social Council.

- Make sure that landfill and incineration taxes correctly represent the related external costs, and
- Ensure that pricing of services for waste holders reflects marginal costs. If disposal costs reflect externalities, and if producer responsibility schemes are in place, then passing on these (dis)incentives for waste holders to make proper use of selective collection schemes can play an important role in maximizing the capture of material for recycling. However, this tool is much easier to implement in developed countries than in developing countries.

Policy recommendations:

- With the potential creation of large recycling organizations that may be profitable, either by law or economies of scale, the informal sector is more likely to be driven out of the recycling and the remanufacturing market. Therefore, regulation on the organizations should be enforced to transform the informal workers into formal and hence compensate for their loss of income,
- Development of specific strategies and programmes to manage emerging and specific waste streams such as e-waste, healthcare waste, construction and demolition waste, etc.,

Box 8: Health care waste - Bir Hospital, Kathmandu, Nepal

Nepal has no medical waste management infrastructure, so many hospitals simply dispose of infectious waste with municipal waste which piles up on the city streets. Bir Hospital, Kathmandu, with about 400 beds, is Nepal's oldest hospital and the National Academy of Medical Sciences. It has recently installed two 175 litre autoclaves in a dedicated waste treatment facility to combat this public health threat and practices are being expanded from model wards. Health Care Foundation Nepal, Health Care Without Harm and the World Health Organization are supporting the effort.

A Waste Management Committee has been established and hospital staff has helped develop segregation procedures and adapt trolleys to segregate waste at the bedside. Syringes are destroyed immediately after use by needle cutters and destroyers. Mercury thermometers and sphygmomanometers are being replaced. Infectious waste is transported to the treatment centre separately and dealt with in different parts of the building. Non-infectious plastic, paper, glass and metal are sold to recyclers. Infectious waste is disinfected in autoclaves that have been validated using chemical and biological indicators and will be regularly tested to check if they continue to work effectively.

Source: 2008 WHO

- Implement policies, laws, and regulations on waste management that are enforceable,
- Carry out information campaigns about the benefits of waste recycling,
- Encourage source segregation at all levels (domestic, commercial, industrial, etc.) to facilitate recycling and recovery of valuable resources, and thus enhance economic opportunities from waste management,
- Disposal bans and recycling requirements can play an important role in guiding people to properly divert materials from landfill and incinerator. Bans are only truly effective when a convenient alternative that is widely known, understood and accepted is available to all residents. This requires extensive advertising/promotion and social marketing to educate people on the disposal bans and the alternatives available,

Box 9: Leachate management in "One Asia Country"

In "One Asia Country", the regulation regarding the leachate management is very advanced and comparable to the US and EU standards. However, there is very little number of landfills in "One Asia Country" that meet such standards. Indeed, the tipping fee offered to the landfill operators should be at least ten times higher in order to invest for leachate treatment facilities able to bring the leachate to the acceptable standards of release in the environment. Therefore, landfill operators are building numerous retention ponds that overflow during the rainy season, impacting the local environment.

There is a clear unsuitability of the law with the local conditions which lead to its poor enforcement.

Source: 2004 National Ministry of "One Asia Country"

- Illegal dumpsites must be phased out. It will obviously benefit the environment because of the inherent pollution but it will also improve waste recycling since the local governments and PWUs will be able, for the same waste management bill, to go for landfilling with higher environmental standards,
- Exploit widely the Land Use planning which is a major policy tool that local governments can use to support the creation of zero waste businesses and the infrastructure required to achieve significant reductions in waste generation. In general, local governments have only begun exploring how their powers in regards to zoning and land use can be used to achieve zero waste objectives. A major opportunity, therefore, exists to begin incorporating zero waste considerations into municipal and regional departments that have traditionally not been involved in waste management decisions. Recycling depots, free stores, reuse centers and repair stores can all be clustered together in neighborhoods where similar products are sold. Local governments can consider reducing business taxes or fast-tracking the permits for these types of businesses to further foster their creation. In many communities, zoning issues are not the only barriers to the siting of recycling depots and other zero waste infrastructures. There is a significant social stigma surrounding bottle depots, for example, that has led to citizen resistance against locating new facilities in their neighborhoods. Local governments can help to overcome these barriers by providing operational support to problem facilities in the form of by-law enforcement and a greater police presence where needed, and
- Mobile collection units, whether for EPR programs or local government collection programs, can also be used to overcome some of the challenges in siting permanent depots. As it is important to instill zero waste habits in citizens, these opportunities should be routinely scheduled and widely advertised to ensure greater public participation. Local governments can facilitate these mobile collection units by revising the bylaws surrounding such practices and encouraging the use of public land for this purpose.

Institutional recommendations:

- Planning for zero waste by setting ambitious goals in actual net-waste reduction. A numerical goal to be reached within 10 to 15 years, with interim targets every few years, will provide clear direction for the plan and a yardstick by which to measure success over time. Since a zero waste approach is chiefly concerned with the quantity of waste disposed and the extent to which this number is decreasing, zero waste goals should centre on net-waste reduction,
- Planning comprehensive organic diversion programs should be the top priority of every local government that is serious about moving towards zero waste,
- Utilize a greater variety of policy instruments and cross-policy integration, such as eco-housing policies to require on-site management of organic waste through composting/biomethanation,
- Procure and operate “Green”. Local governments and PWUs have a responsibility to walk the talk of zero waste if they are ever to inspire their citizens to take the issue seriously. By taking

a leadership role in waste diversion and avoidance, local governments can drive positive change in their communities,

- The informal sector:
 - o Share good practices on how to engage constructively and effectively with the informal sector,
 - o Empowering (and not replacing) the informal waste recycling sector in terms of technology and finance will be useful. Reaching and maintaining quality and environmental, health, and labour and safety standards will be key. This would lead to safe employment and a “green economy” as well as trigger innovations,
 - o Improve the skills and knowledge of local workers, both formal and informal,
 - o Develop action plans to improve the working conditions of people engaged in informal waste management practices, especially waste pickers, to enhance their practices and improve their livelihood by bringing them into the formal sector with appropriate strategies to overcome the intrinsic issues,

Box 10: Addressing issues of informal waste pickers in Brazil

In Brazil organized waste pickers are seen as legitimate stakeholders and exercise formal contracts with businesses. The cash transfer program called Bolsa Familia compensates families to shift their children from waste picking to school attendance. This has helped at least 40,000 children to have access to education and good health. Brazil houses at least 500 waste picker cooperatives, with about 60,000 members. Some of them earn their members US\$300 a month, twice the minimum wage.

Source: Medina 2008

Box 11: Addressing issues of informal waste pickers in Egypt

The minority community in Cairo, called the Zabbaleen, has been engaged in informal waste picking since the 1930s. After establishment of associations in 1970s, and the beginning of a Zabbaleen Environment and Development Program in 1981 with support from the Ford Foundation, the World Bank, Oxfam and others, the working conditions and basic infrastructure for waste collection and sorting has been improved considerably. A primary school as well as a paper recycling project, weaving school, health centre and small industries project have been established to support the waste pickers.

Source: Wilson and others 2006.

- Build and strengthen institutional capacity at the local level to share knowledge and to develop trained manpower,
- Ensure greater transparency and accountability of public offices through, for example, simplification and streamlining of procedures for establishing waste management projects,
- Foster interagency coordination among different local authorities for improved waste management,

- Facilitate the formation of sub-national regional collaboration and resource sharing among cities such as associations or leagues of municipalities as well as international inter-city networks,
- Develop and disseminate appropriate decision support tools that can support waste management planning and technology choices,
- Establish effective coordination mechanisms for the work of international organizations in developing projects, in order to enhance the outcome and benefits generated,
- Encourage the participation of the various stakeholders in the decision-making,
- Encourage the private sector to participate in MSW through PPPs. Hereafter are some of the facts that could attract the private sector:
 - o One public interlocutor only. Too often, MSW responsibilities are split between too many agencies with eventually different vision and objectives

Box 12: An example of PPP in Bali, Indonesia – One interlocutor

In 2002 the Bali Province through Public Works (PO) proposed a public-private partnership to open and operate a new landfill site in the Regency Tabanan. However, due to pressure from the public this project was shelved. Open dumping of MSW still continues within the district administrated by SARBAGITA. The obvious choice was then to better utilize the location of the existing landfill site at Suwung. SARBAGITA issued an invitation for development of this site under a PPP which led to PT NOEI's engagement. It is interesting to note that NOEI had previously presented their gasification, landfill gas and anaerobic digestion (GALFAD) MSW management concept to Jakarta, Bandung and Surabaya governments. The main reason for the first project start-up being in Bali is that the southern part of Bali already had a dedicated agency (SARBAGITA) managing MSW and this was seen as making the situation much more efficient in Bali than in the other cities visited by NOEI.

Source: 2009 Australia Indonesia Kemitraan Project for Local Government Energy Efficiency.

- o Attractive financial conditions (such as tipping fee for instance) and length (20 to 25 years) of the PPP

Box 12: An example of PPP in Surabaya, Indonesia – Unattractive financial conditions

Surabaya Municipality has been trying since 2004 to tender the MSW management in the area under its jurisdiction. Thinking that CDM and waste "value" through its various valorization possibilities (organic compost or biomethanation and recyclables in particular) would be sufficient to attract the private sector, the financial conditions offered to the private sector were very low (no tipping fee, no financial support in landfill rehabilitation...). In this respect, Surabaya, although the project was tendered several times, has failed, until now, to attract the private sector to take over the MSW management.

Source: 2011 Alban Casimir's research.

- Commitment and knowledge of the local governments' officials
- Supportive national development framework
- Strengthen the capacity of local governments to enter beneficial agreements with the private sector, monitor the performance of activities carried out under such contracts, and ensure that the contracted services are properly delivered, and
- Support the process to form a global partnership on waste management and help shape this facility towards the multiple and various needs of developing countries.

Technological recommendations:

- Investigate the possibility to introduce producer responsibility in other waste streams, especially if this could help promote design for the environment,
- Identify and promote the replication of success stories and recognition of “champions” at the local level,
- The composting/biomethanation technology in local communities is probably the easiest to implement without significant investment and with the support of the local governments and PWUs (limited skepticism about the technology performance and suitability). Indeed, high percentage of organic material has often led to the suggestion that composting can be an appropriate and viable disposal MSW technique and successful cases have already been developed, and

Box 11: Biogas from Small-scale Household Digesters

The small-scale urban household biogas digesters are well established and politically strongly supported in the south western rural areas of China and the number of household biogas digesters is growing for some million units every year. In 2003 8m units (typical size 8 to 10 m³) were in use.

By 2005 in China, about 10% of the rural population was already producing 5.5bn nm³/a biogas from 15m units. 56m digesters will be operated till 2020 and 20bn nm³/a of biogas will be produced for decentralized energy supply (cooking, lightning), and will make these areas widely independent from central energy supply systems.

Furthermore water and soil pollution problems from liquid and solid organic waste disposal are widely solved. This is an additional motivation to develop further this sector based on the 'National Biogas Construction Plan of the MOA 2003.

Source: Biogas from Municipal and Agricultural Bioorganic Waste: Renewable Energy for China, Bernhard Raninger, ZHAO Youcai, Ji Rong, Li Aimin, Werner Bidlingmaier, Li Rundong, Li Ronggang; International Symposium MBT 2007

- The waste sorting and recycling “by hands” is widely spread in developing countries and is probably the easiest way to start recycling provided the implementation of environmental, health, and labour and safety standards. Indeed, it deals with the informal sector issue by integrating them in the system while labor cost is still cheap.

VII. Conclusion

Last few years have been particularly turbulent for the major natural resource markets. Between the end of the 20th century and the early summer of 2008, world prices were multiplied by a factor of seven in current value. In spring 2008, market tensions were such that the vulnerability of our planet in terms of natural resource availability came to the frontline. With climate change and global warming accelerating, time appeared to be running out before the end of fossil fuel energy, the rarefaction of numerous mineral substances and even penury of agricultural and forestry goods. Soon – in the space of the next two generations – the Earth will be saturated by its human population.

Our grandchildren will then number ten billion, living for the vast majority in huge megapolises, the measure of which we are only just beginning to perceive. They will have to feed themselves, travel and keep warm, and consume resources which will be rarer and more difficult to extract and produce. But, being richer, and more “developed”, they will also produce more waste, perhaps twice as much as we can measure at the present time. We must be prepared for this and start “Moving towards Zero waste” economy now.

As pointed out in this paper, local governments and PWUs must show and lead the way. We have widely mentioned what they will benefit from waste recycling and how it can be done.

Now, beyond the role of the local governments and PWUs in strengthening waste recycling, it could be worth for each individual to ask himself or herself - “What am I doing as an individual for recycling?”

This question is difficult because it reminds all of us that One person can make a difference and that eventually we, too often, end up doing nothing if not constrained by cost or regulation! As for this Native American saying that “We do not inherit the Earth from our Ancestors, we borrow it from our Children”, we are citizen of this world and as such we should do anything in our power to conserve our planet. Without the support and efforts of the citizens, any actions of the local governments and PWUs are almost bound to fail! Education is the main driver for the success of the “Moving towards Zero waste” economy.