The Economics of the Informal Sector in Solid Waste Management

Based on information from: Scheinberg, A., M. Simpson, Y. Gupt et al. (2010): Economic Aspects of the Informal Sector in Solid Waste Management. GTZ and CWG, Eschborn, Germany

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The Economics of the Informal Sector in Solid Waste Management

– a brief review of an investigation into waste picking and commercial activities in solid waste management that are carried out in parallel with the official waste management system.

based on a study commissioned by

GIZ – the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, on behalf of the **Federal Ministry for Economic Cooperation and Development (BMZ)**

and

CWG – **the Collaborative Working Group** on Solid Waste Management in Low- and Middle-income Countries

and undertaken by

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and

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Available on *www.giz.de/recycling-partnerships*

Introducing this booklet

This booklet is about people who earn a livelihood and support their families by extracting value from solid waste. These people are sometimes called rag pickers, waste pickers or scavengers. There are millions of them in cities all around the world, and their work is about finding value in the waste that other people throw away, cleaning the waste, and selling it to industry. The attitudes of municipal authorities towards them differ from place to place. In some places there is hostility, in some places indifference, and in some places they are regarded as a useful part of the waste management system.

This booklet has arisen out of a study that was undertaken in six cities in four continents to look at the economic aspects of informal recycling and to determine whether these recycling workers create a net economic benefit to their cities or an economic cost. The booklet presents the findings of the study as a basis for a discussion of the economic impacts of informal sector activities in solid waste management. These impacts may be experienced on a local, regional or global scale.

A CD is included with this booklet. This CD includes the full report of the study and annexes which contain a large amount of relevant information.

Acknowledgements

This summary is based on research that was conceived and guided by Anne Scheinberg of WASTE and Michael Simpson of Antioch University in collaboration with Skat, and conducted in six cities by the following organisations:

- in Cluj Napoca, Romania – Green Partners
- in Lima, Peru – IPES (Promoción del Desarrollo Sostenible)
- in Lusaka, Zambia – Riverine Associates
- in Pune, India – KKPKP (Kagad Kach Patra Kashtakari Panchayat)
- in Quezon City, the Philippines – SWAPP (Solid Waste Management Association of the Philippines), and
- in Cairo, Egypt – CID (Community and Institutional Development Consulting), and Dr. Rami El-Sherbiny.

The city reports as well as the Excel workbooks prepared by these partners can be found on the attached CD.

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Abbreviations

BMZ	Federal Ministry for Economic Cooperation and Development
CID	Community and Institutional Development Consulting (NGO)
CWG	Collaborative Working Group on Solid Waste Management in Low and Middle Income Countries
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IS	Informal Sector
IPES	Promoción del Desarrollo Sostenible (NGO)
ISP	Informal service providers
IWB	Itinerant waste buyers
KKPKP	Kagad Kach Patra Kashtakari Panchayat (waste picker union)
MSME	Micro-, small and medium-sized enterprises
NGO	Non-governmental Organisation
SWAPP	Solid Waste Management Association of the Philippines
SWM	Solid waste management

1. About the study

This document presents the results of the study entitled "Economic Aspects of the Informal Sector in Solid Waste Management". The "informal sector in solid waste management" refers to individuals, families, and private sector (micro-) enterprises working in waste management services and valorisation, whose activities are neither organised, sponsored, financed, contracted, recognised, managed, taxed, nor reported upon by the formal solid waste authorities. Businesses which work informally in the waste sector are treated as informal even when they are formally registered in some other sector, such as transport, construction or livestock production.

The study focuses on analysing informal economic activities in two closely related sub-sectors, the informal service sector, and the informal valorisation sector. Services include waste removal, transport, and disposal, as well as various urban cleansing activities such as street sweeping and drain cleaning. Valorisation, also referred to as recovery, refers to the extraction, processing, transport, and sale of reusable and recyclable materials in the recycling value chain, together with commercialisation of organic waste as animal feed, compost, or soil supplement in the agricultural value chain. Together, these two sub-sectors comprise the solid waste informal sector.

The main purpose of the study is to inform policymaking related to upgrading and modernising solid waste systems in low- and middle-income countries. Modernisation is an integrated process of upgrading solid waste management to include more than a dumpsite. A key element in modernisation is conforming to widely accepted approaches or ideas of how solid waste management should function in a "modern" city. It can consist of purchasing new infrastructure, introduction of service fees or privatisation of certain services, and usually also requires institutional reform.

The process of modernisation often creates competition between formal authorities and informal enterprises for materials. This competition can have both beneficial and problematic effects: on the one hand, the profile and political interest in valorisation increases, and that can bring about improvements in services and make the city cleaner. On the other, without taking the informal sector into account, cities risk lowering their cost efficiency, and everyone's profitability drops when the formal and the informal systems don't take each other into accoun

The report has a focus on understanding the nature of formal and informal waste management and recycling operations, and the costs and benefits to society of

Photograph 1: Waste pickers on the dumpsite, Peru. Photograph: Thomas J. Mueller

the work of the solid waste informal sector. For this purpose it is also necessary to understand how the informal sector interacts with formal governmental and private sector solid waste management activities. A special focus is on understanding the risks and problems created by the modernisation process, especially as they lead to formulation of policies to restrict the access or rights of the informal sector to valorise materials, or sometimes even to eliminate this sector.

The aim of the study was to widen the debate about the informal sector by providing transparent and verifiable economic information about the impacts of informal sector recycling. Much that has been written about the informal sector appears to have been written by its supporters, but such writings may be disregarded by readers who are less sympathetic to the informal activities. This investigation provides objective data on quantities and costs. A methodological guide (provided on the CD-Rom) can be used to analyse other cities' situation, so that the body of reliable information for policymakers and investors will grow.

2. Methodological Approach

The study uses a systems analysis approach. The system is defined as the current (2006-2007) waste management system in each of the six cities, including both formal and informal waste services and valorisation. The analysis is designed to map, measure, model, and monetise costs and benefits of informal activities, including costs and benefits of operations and indirect ones related to carbon footprint, and socio-economic impacts of these activities in the cities. This current situation analysis is referred to as the baseline.

The potential impacts of future decision- and policy-making are explored through modelling two scenarios. The scenario modelling answers the question: what would be the economic impact on society, and the operational and economic impact on the formal solid waste system, if the activities of the informal solid waste sector would cease or be drastically restricted? And what impact would there be if these activities would be recognised and integrated into the formal solid waste system? These are referred to respectively as the subtraction scenario and the addition scenario.

The study is based on field work, analysis, and modelling done in six cities in 2006-2007:

1. **Cairo, Egypt**
2. **Cluj-Napoca, Romania**
3. **Lima, Peru**
4. **Lusaka, Zambia**
5. **Pune, India**
6. **Quezon City, the Philippines**

In each of the six cities, the informal sector was studied and analysed as part of the overall solid waste system, using an approach based on process flows and materials balances. The action research in the cities, combined with the synergies of working with local experts in six cities on four continents, provided a number of insights in relation to both economic and non-economic aspects of the informal sector in solid waste. In 2010, some corrections were made to methodology and modelling of the Cairo data, and limited supplemental analysis was done to prepare this report for publication. All numbers from the cities are based on the 2006-2007 information.

Photograph 2: Dump pickers looking for materials they can recycle

Photograph: Ulrike Killguss

The main conclusions are presented in terms of performance and economic characteristics of the sector, socio-economic characteristics, and carbon footprint. The recommendations concern policy making for and implementation of an integrated solid waste management system.

3. The informal recycling situation

The results of the study cover economic, technical, environmental, and socio-economic aspects of the informal valorisation and service sector.

3.1 Introducing informal sector activities

All six cities have a large and active informal valorisation sector, and a smaller informal service sector. The six cities together have a population of almost 23 million, with approximately 73,000 informal sector workers who valorise more than 3 million tonnes per year.

The informal waste and recycling sector in the cities is comprised of two distinct sub-sectors,

→ **an informal service sector,** consisting of individuals and micro enterprise informal service providers (ISPs) earning fees for removal of waste, excreta, litter, and, more broadly considered, 'dirt'.

→ **an informal valorisation sector,** consisting of individuals, co-operatives, and family and micro-enterprises - which functions as an extractive resource industry. The main activity of this sector is identifying and removing valuable materials from the waste stream and the places where waste accumulates, and valorising (extracting value added from) it.

There are several main forms of valorisation in the informal private recycling sector, which were found in different combinations in the cities:

→ Personal or commercial reuse: Using materials for household maintenance, including as food for persons or animals, or as household, agricultural, or business inputs. Second-hand shops and flea markets are examples of this.

→ Reuse with repair: Repairing items and materials and marketing them. This activity was identified but not examined in detail during the research.

→ Recycling: collecting separately and/or identifying, sorting, processing, storing and trading materials into the global industrial value chain.

→ Organics valorisation: collecting separately or sorting and processing kitchen, garden, commercial, agricultural and animal wastes and paper, and marketing it as animal feed or compost.

The *table below* gives an idea about the main types of occupations of the informal sector in the different cities:

Table 1: Distribution of informal sector occupations in the six cities

City	Cairo	Cluj	Lima	Lusaka	Pune	Quezon
Largest group of informal workers	Informal waste collection – Zabbaleen	Street pickers	Street pickers	Dump pickers	Authorised waste pickers	Street pickers
% of IS persons in largest group	71%	73%	30%	42%	28%	37%
Second largest group of informal workers	Small-scale manufacturing	Dump pickers	Street pickers with tricycles	Street pickers	Junkshop workers & recyclers	Dump pickers
% of IS persons in second largest group	25%	27%	27%	40%	24%	26%
Other informal workers active in city	IWBs, dump pickers, street pickers	None	Street pickers, organic waste collectors, dump pickers, etc	Unregistered collectors	IWBs, informal collectors, junkshop workers	IWBs, informal collectors, truck pickers, junkshop workers
% of IS persons in other groups	4%	0%	43%	18%	48%	37%

Source: Table 23, full report.

Both the informal service sector and the informal valorisation sectors are part of the private sector. They are constituted of individuals, micro, small, or medium-sized enterprises (MSMEs), and families or extended families working as enterprises.

In all of the cities, there is some degree of private sector participation in the formal solid waste sector, either in collection or disposal. There is variation in the institutional and financial arrangements that finance public-private partnerships in the handling, transport, recovery and disposal of materials. All cities except Pune show some contractual or franchise arrangement between the city authorities and formal solid waste collection and transport companies to collect waste, clean streets, or perform other services for households and businesses. Informal arrangements exist where informal sector workers provide some portion of the required services, supplement formal contracts, and fill small niches. The degree of recognition of the informal sector and its integration into public cleansing activities varies quite a lot between the six cities. In Quezon City, Pune and Lima, a relatively high degree of integration already exists. For example, in the three cities, one sees a concerted effort by the public sector to organise and integrate informal sector workers and recycling businesses to maximise recovery of material, with national legislation or policy as a driving force. Pune is the only of the six cities that has authorized waste pickers and has started providing identity cards and health insurance for these workers on a city-wide basis, although this model originated in Metro Manila in the 1980s with the NGO Linis Ganda (see section 3.4 below). At the time of writing of this booklet, this is also happening in Lima.

In Cairo, the inclusion process is contested, with city authorities reluctant to engage with such a large informal sector. NGOs and civil society organisations fill this gap, and work to promote the informal sector and maintain open channels of communication between the Zabbaleen and formal stakeholders.

The situation is different in Cluj and Lusaka, where the least attention has been paid to the relatively small informal waste sector: no organisations are reported and city authorities do not know what the informal sector does or what it means for their city.

Materials recycled by the informal valorisation sector are sold directly into the industrial value chain, together with those recycled by formal institutions. Many more tonnes of recovered materials come into the value chain via informal channels in the cities, than via formal channels. But materials coming from informal and formal sources end up in the same value chain, and at a certain point become indistinguishable.

Table 2: Comparison of material recovery by formal and informal sector, baseline scenario (in tonnes and as a percentage of total waste generated)

Cairo		Cluj	
			
13 % 433,200 Tonnes	30% 979,400 Tonnes	5% 8,900 Tonnes	8% 14,600 Tonnes
Lima		**Lusaka**	
			
0.3% 9,400 Tonnes	19% 529,400 Tonnes	4% 12,000 Tonnes	2% 5,400 Tonnes
Pune		**Quezon**	
			
0 % - Tonnes	22% 117,900 Tonnes	2% 15,600 Tonnes	23% 141,800 Tonnes
Formal sector	**Informal sector**	**Formal sector**	**Informal sector**

Informal organics recovery tends to supply animal feeding operations, while formal organics recovery tends to supply composting. Both are in the agricultural value chain, but serve different 'markets'. So these tonnes end up in different places.

The study shows that the boundary between formal and informal sector recycling is not always clear. Recyclable materials that are recovered by informal sector pickers often eventually reach formal sector factories or exporters. Municipal employees who load waste into municipal trucks often separate recyclables as they load, and sell what they find unofficially to informal sector dealers. Co-operatives formed by informal sector workers may undertake some (formal) work under contract to a municipal authority while also being involved in informal recycling.

Table 3: Differences in costs per tonne, net costs per tonne (with revenues for materials sales included), for formal and informal sectors

City	Formal sector			Informal sector		
	Total cost /tonne €	Total net cost (benefit) tonne €	Difference (Revenues from materials)	Total cost /tonne €	Total net cost (benefit) tonne €	Difference (Revenues from materials)
Cairo	13	5	-8	55	-90	-145
Cluj	25	7	-18	288	-108	-396
Lima	42	41	-0.5	110	-8	-118
Lusaka	35	15	-20	7	2	-4
Pune	23	21	-2	251	-46	-297
Quezon	31	28	-3.5	48	-51	-93

Source: Project baseline workbooks. Note: negative values indicate net revenue

Photograph 3: This recovered plastic has been sorted by type and colour, cut into small pieces and washed, and it is now drying in the sun, in preparation for further processing

Photograph: Adrian Coad

3.2 Cost and effectiveness of informal SWM activities

A comparison of the formal and informal sectors shows that in the six cities, the formal sector primarily works in service provision (collection and disposal) and does not achieve high recycling rates. This results in high operational costs, because the quantities recovered are small, and so even modest costs to collect these materials are not offset by revenues from selling them to the value chain. The informal sector, on the contrary, primarily works in recovery and recycling of valuable materials. Although operational costs are often higher than in the formal sector, the high revenues from materials result in a much lower cost per tonne, in most cases a net benefit. Even in Lusaka, where the informal sector is primarily working in service provision and not in valorisation, the net cost is only 2 Euro/ tonne and is 13 Euro/ tonne less than in the formal sector. In all other cities, the difference is much more pronounced *(table 2 on page 15)*.

Informal valorisation businesses only extract, process, and sell those materials which have a high intrinsic value and on which they can make a profit. All infor-

mal valorisation activities along the entire value chain are profitable. The informal sector in the six cities together makes a net profit of about 130 million Euro. The large profit is able to sustain or add valuable income to sustaining about 73,000 informal sector workers.

Service revenues are not part of the net cost calculation, because the aim of the study was to identify the economic net cost of the waste management system that would have to be covered by fees, taxes or government subsidies. The actual cost recovery mechanisms depend on political or socio-economic considerations, and fees may be recovered from varying parties.

The informal sector saves the formal authorities a great deal of money, in total €39 million in the six cities. If material is recovered through door-to-door collection by the informal sector, this material no longer needs to be collected, so all expenses – collection, transport and disposal – are reduced, according to the amount that is recovered. The savings on transport depend on the point at which the material is removed from the waste stream for recycling. If material is recovered at the disposal site, transport costs are not reduced, but disposal costs are reduced.

This impact on transport costs suggests that recyclers should have access to the waste at the earliest possible stage in the chain that stretches from storage in the home to final disposal. There is also another advantage of separating recyclable materials at the earliest possible stage – the recyclables themselves are less contaminated by other materials in the waste, and so need less cleaning and have a higher value. If the wastes are less contaminated, the work involved in sorting them is less hazardous and unpleasant.

Most of the avoided costs in the study cities is avoided collection costs, €14 million per year in Lima, €12 million in Cairo, and € 3,4 million in Quezon city. The average avoided costs per worker are €571, which in many cities is more than that same worker earns in a year.

By engaging in the valorisation activities, the informal sector creates environmental benefits for the municipal authorities, helping them to reach recycling targets and save valuable and expensive landfill space. In all cities except Lusaka, where the informal sector is very small, the informal sector is responsible for diverting more materials from disposal than the formal sector.

Formal separate collection programmes handle materials to reduce the quantities of waste that must be disposed of, or because there is a policy for 'recycling'. Formal selective collection usually comes at a net cost per tonne, ranging from a

cost of €85 per tonne in Lusaka to a cost per tonne of €8 in Cairo and Lima even after including revenues from marketing materials. We can conclude that recycling may not usually be profitable for formal selective collection programmes, either because:

a. They are rather oriented to avoid negative environmental effects from disposal than to produce revenue from valorisation

b. The volumes recovered are too small for efficient logistics related to selling the recovered materials to an industrial buyer, or

c. The formal sector knows too little about how to market to the recycling industry, and so makes a loss in the trading activity.

The viability of informal businesses depends on their ability to identify unoccupied niches in the waste and materials chain in the city. For example, informal service providers identify and identify opportunities for collection in areas which are not served. They find and extract materials from disposal facilities and waste generators that are not already part of a materials cycle, and complete that cycle.

Photograph 4: Recovery and recycling of paper (here in the Philippines) and other materials contribute to reduce emissions Photograph: Martina Kolb

3.3 Environmental aspects of informal sector activities

There are many environmental impacts related to recycling. Many are positive, but some are negative. Environmental impacts from recycling can be local – at the neighbourhood or city level – or global. While it is relatively easy to discuss these impacts in qualitative terms, it is more difficult to measure them, and it is very challenging to find ways to put an economic value on the various environmental impacts, positive and negative, so that they can be compared for the purpose of making decisions.

Because of the difficulties in assigning economic values to local and regional environmental impacts, the study focuses on the global environmental impacts (carbon impacts) of the formal and informal waste sectors. The official prices of carbon credits are used to determine the economic value of emissions reduced by the formal and the informal sectors.

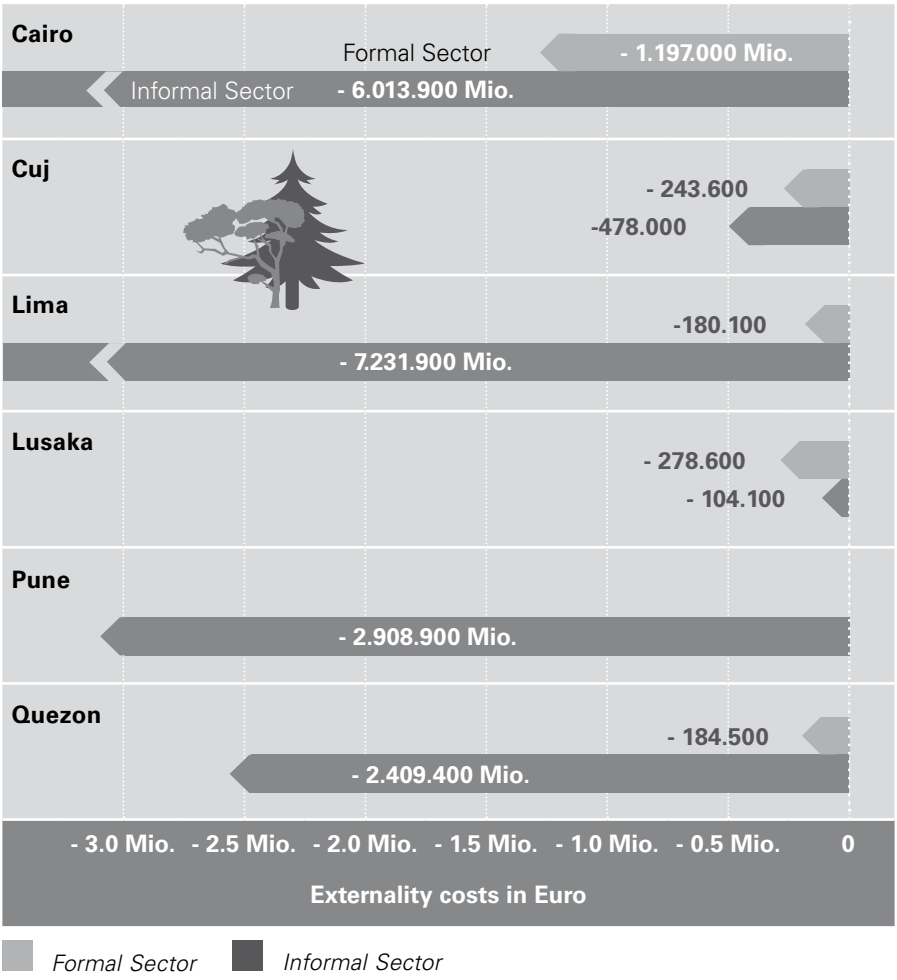
Both formal and informal recovery results in improving the carbon footprint of waste management, by reducing decomposition and methane formation in landfills. But in low- and middle-income cities, most recovery operations are completely or partially informal, so that informal valorisation makes a larger contribution to reducing carbon emissions.

The carbon benefit of recovery activities comes from avoiding disposal, reducing extraction of raw materials and returning secondary raw materials to the production cycle, thereby using less energy in recycling processes than in production processes with primary raw materials. These benefits are significant, but they depend strongly on the equipment used for recovery and on the material that is recovered, as various materials have differing potentials for reducing greenhouse gas (GHG) emissions.

Informal recovery scores considerably better than formal recovery in terms of reduced fossil energy use. This is because many informal activities rely on human or animal muscle traction, rather than on motorised transport. While this is significant, there are some questions as to whether it is sustainable over the longer term.

The carbon benefits in terms of avoided externality costs are shown in *Figure 1 opposite*.

Figure 1: Environmental benefits associated with material recovery in six cities, shown as reducing the negative externality costs in Euros



3.4 Social aspects of informal sector activities

Informal valorisers and service providers have unpleasant and dangerous working conditions, but these are contrasted by earnings which usually exceed legal minimum wage levels. The autonomy and relative freedom of the activity is sometimes also reported by waste pickers to be a benefit that they recognise and appreciate.

In five cities, the informal waste sector provides more livelihoods than the formal waste sector: in Cairo four times as many, and in Cluj 10 times as many, although not all of these are full-time. Lusaka is the only city where there are more people employed or having livelihoods in the formal sector than in the informal.

Average earnings in the informal valorisation sector in Pune, Lima and Cluj, and in the informal service sector in Lusaka, are 110% to 240% above the legal minimum wage. Egypt does not have any legal minimum wage; in Quezon City they

Table 4: Informal and formal livelihoods in the cities

City / Indicator	Cairo	Cluj	Lima	Lusaka	Pune	Quezon
Total no. of livelihoods in informal waste sector (persons)	33,000	3,226	17,643	480	8,850	10,105
Total employment in the formal waste sector (persons)	8,834	330	13,777	800	4,545	5,591
Ratio of persons working in the informal sector to those in the formal sector	3.7	9.8	1.3	0.6	1.9	1.8
Average informal workers' earnings (€ / year)	2.721	345 (1) / 2.070	1.767	586	1.199	1.667

(1) Represents actual earnings from about 50 days of labour per year of €345, multiplied by 6 for purposes of comparison with other cities.

are slightly below (but the legal minimum wage is reported to often not be respected by private companies).

There are a number of distinct informal occupations and earning profiles, with more occupations in the valorisation and recovery sector than in services. Moreover, there are key and recognisable differences between the informal service sector and the valorisation occupations.

a. **Service occupations** tend to be paid as waged or performance-based labour.
b. **Valorisation occupations** are usually treated like other resource extraction industries and are paid by the kilo or by the item. These businesses focus on extracting materials based on what is profitable, not what is good for the environment.

The earning potential for individuals and/or families involved in full-time informal valorisation generally exceeds the minimum wage, and almost always exceeds other individual or family livelihood options.

The role of informal recovery in family income and maintenance varies. Certain occupations are full-time family or individual enterprises; others are part-time, often seasonal alternatives to economic activities in agriculture or industry. On average, 71% of all informal sector households where someone works in the informal sector depend fully on the income of that person.

Photograph 5: A member of the Swach association in Pune Photograph: KKPKP

More women earn livelihoods in the informal waste and valorisation sectors than in similar formal occupations. In all cities, more women are involved in informal valorisation than in the formal valorisation sector. No women are involved in formal collection, and few or no women are involved in informal service provision in any cities, except in street sweeping, a traditionally female occupation. Women in the valorisation sector tend to be involved as pickers, sorters and traders of materials, at the level of family-owned junk shops or as initiators of community-based enterprises. Because women tend to be concentrated in lower-earning activities such as waste picking, their average income is lower. Even when they do the same kind of work, for example, itinerant waste buying, they tend to earn less and also are paid lower rates for materials by junk shops.

Owners and workers in recycling businesses are subject to work-related illnesses and injuries. They seldom protect themselves, and usually do not have access to health care or hygiene – such as washing facilities, protective equipment, or medical services. There is room for improvement of conditions and access to health and safety conditions, but it may affect the profitability of the enterprises.

Informal enterprises by definition are unregistered, which makes them vulnerable to competition and to exploitation. For this reason many of them report that they would prefer to be recognised as formal businesses, including paying taxes, but they often do not know how to make this happen.

In the study cities, the informal valorisation sector is best organised in Pune and Quezon City with 60% and 37% respectively of workers being reported to belong to a sector organisation. Quezon City junkshops and itinerant waste buyers are organised in the NGO Linis Ganda, which has been working for more than 20 years on strengthening the informal waste sector. In Cluj, there are no associations reported, but the residents of a community have formed a group that provides some social benefits. 7% of Lima's informal workers are organised, while only 2,5% of the informal sector in Cairo and 0% in Lusaka are organised.

Associations and cooperatives in the waste field are a relatively new phenomenon in Peru, only 7% of the informal sector workers in Lima are members of an association, cooperative or other representative structure. In Cairo, the level of organisation is surprisingly low (2,5%), given the long history of the Zabbaleen in waste management and ongoing threats to their access to materials and clients. Two NGOs are active in social development and business expansion.

4. Assessing scenarios for efficient Solid Waste Management

The City Partners in each of the study cities not only investigated the current situation, but also proposed alternative scenarios, based on existing policies and laws and in consultation with municipal officials and the project technical support team. Then they investigated the likely consequences of these changes on the economic aspects of recycling. One scenario (the "subtraction scenario") in each city considered the case that the scope of informal sector recycling is restricted or reduced in some way. The other (the "addition scenario") considered the effects of recognising or working together with the informal sector, often as a result of a more favourable official attitude. The costs and benefits of these scenarios were compared with each other and with the current situation. These scenarios appear to be a very useful aid to decision-making.

The subtraction scenario represents one possible and plausible interpretation of a newly enacted law, a newly endorsed plan, or other planned modernisation process in which the activities of the informal sector are severely reduced, via regulations that forbid or criminalise especially valorisation, or claim a monopoly for the local authorities or their agents that denies access to materials. In this scenario, informal valorisation activity declines, and the city bears the positive and negative consequences of having to handle all the materials that previously went through informal channels. Some of the subtraction scenarios (Cluj and Pune) expect that large, formal sector recycling plants will be able to achieve high rates of recycling. Experience suggests however that the performance of large plants of this kind is often disappointing and that it takes time to establish a new system so that it is working well.

The addition scenario is an alternative, but equally possible and plausible interpretation of a newly enacted law or plan in which the policy environment expands its focus on recognising, including, and working with the informal sector, especially the informal valorisation sector. Various mechanisms were suggested by the City Partners as they developed their addition scenarios, and these mechanisms can be ranked from small interventions towards recognition to the major step of formalising the informal sector altogether.

The addition and subtraction scenarios have been formulated according to the reality in each of the cities. Therefore, some of the cities where the informal sector already enjoys a certain degree of integration, such as in Lima or Quezon, the addition scenario did not translate into a greater role of informal sector activities in the addition scenario.

4.1 Economic and operational impacts

The addition scenario modelling results in an increase in tonnes recovered in all cities *(Table 5 below)* except Quezon and Lima, where the numbers stay the same. In Pune, more materials would be recovered in the subtraction scenario than in the addition scenario, but both scenarios involve the introduction of new technology that raises recovery rates.

The policy modelling exercise clearly indicates that a stronger integration of the informal sector in the cities' solid waste system has the potential not only to increase the informal sector revenues, but also to reduce the formal sector costs and the total solid waste system costs in a city. In the addition scenario, the net costs go down for Lima, and the net benefits rise significantly for Cairo, Cluj, and Quezon. In Pune and in Lusaka, the introduction of new higher-cost recovery technologies in both scenarios induces higher costs. While in Lusaka, the addition scenario shows slightly higher costs than the subtraction scenario, in Pune, the subtraction scenario results in significantly higher costs than the addition scenario.

This shows that the overall system costs do not only depend on the question whether informal stakeholders are included or not, but on the logistical and treatment options applied. The cost impacts in these cities are therefore quite

Table 5: Recovered proportions of the total tonnages handled (%) in scenarios

Scenario	Baseline	Subtraction	Addition
Cairo	43%	35%	58%
Cluj	13%	27%	30%
Lima	20%	14%	20%
Lusaka	6%	4%	20%
Pune	22%	79%	71%
Quezon	25%	20%	25%

Source: Table 47 in the full report

Table 6: Total SWM costs and total costs per capita for the three scenarios

City	Baseline		Subtraction		Addition	
	Total net* cost € / year	Cost per capita€	Total net cost € / year	Cost per capita	Total net cost € / year	Cost per capita
Cairo	- 103.963.000	- 13	- 110.001.000	- 14	- 213.301.000	- 27
Cluj	494.000	1	- 849.000	- 2	- 13.714.000	- 36
Lima	68.786.000	9	75.270.000	10	67.815.000	9
Lusaka	1.168.000	1	12.761.000	10	12.904.000	10
Pune	2.081.000	1	4.611.000	2	3.023.000	1
Quezon	7.292.000	3	5.161.000	2	- 3.113.000	- 1

* Net costs include revenues from sales of recovered materials. Negative net costs represent a net benefit.

dependent on how much the recovery itself costs. The cost comparison in *Table 4* does not yet include the monetised carbon benefits, which would lead to an even greater net benefit or lower net cost in most cases.

4.2 Carbon impacts

An integration of the informal sector would contribute significantly to reducing GHG emissions, as it results in increases of the quantity of recovered material in five of the six cities. The informal sector recovery activities are mainly done using human or animal traction, except in Lusaka and Cairo, which represent less energy use and therefore lower carbon impacts than those of the formal sector. The integration of the informal sector in solid waste management activities, therefore, leads to more material recovery at lower environmental cost.

In the subtraction scenario the quantity of waste going for final disposal increases with respect to the baseline in most cities, but not in Pune or Cluj, where it de-

Photograph 6: Women sorting plastic materials, the Philippines Photograph: Johannes Paul

creases due to significant capital investments in diverting waste from dumpsites. In the case of informal sector integration, in all six cities the fraction of waste going to final disposal is less than – or in the case of Pune equal to – the fraction disposed in the current situation or in the subtraction scenario.

4.3 Socio economic impacts

Regarding socio economic impacts in the modelling scenarios the main questions are: **(1)** what would happen if the informal sector would lose its access to the waste stream and related livelihood activities, and **(2)** what would be the change in socio-economic impacts to society if there were an integration of informal sector activities into formal solid waste operations and the solid waste management system? The baseline shows that this activity provides more livelihood than the formal sector and a change in terms of exclusion would represent loss of livelihoods through reduction of the informal sector. Contrary, in an addition scenario, the informal sector would grow but the difference with the baseline is in many cases not very significant.

Reducing informal sector activities would represent a bigger impact for women due to the fact that the informal sector has a higher proportion of women than the formal sector. Even in an addition scenario where the conditions for the informal sector could be improved, women are more vulnerable due to increases in work load, or high risk to lose their jobs because with higher incomes men would want to take their places.

The informal waste sector in Lusaka partly sells to the domestic recycling industry, but also exports 400 tonnes per month, mainly to South Africa and Zimbabwe. In other cities the informal sector is also connected to the global recycling industry through supply and sales chains. So the impacts of a restriction as modelled in the subtraction scenario create negative trans-boundary economic consequences.

In all cities under study, integrating and legitimising the informal sector can be expected to boost sales to the formal recycling industry, with the largest increase being 14-fold in Lusaka. This is because Lusaka has the smallest and least mature recycling sector, when both informal and formal sector are considered.

5. Conclusions

Analysing the current situations - the baselines - in the cities has been a key factor in understanding the relationships between different parts of the system: formal and informal, private and public, valorisation and service. But above all they have shown that **all parts are related to one system,** and that interventions designed for one specific part usually affect all other parts as well. In many cases, formal and informal waste management activities are complementary, but they might also be competitive.

The study shows that the **informal solid waste management sector is more active and more effective in recovering and valorising resources** than the formal one in low- and middle-income countries. It can implement recycling activities at a much lower cost than the formal sector. Because of their long dependence on the industrial value chain, informal entrepreneurs are experienced with valorisation, and can relatively easily learn to divert and process whatever material is not already claimed and valorised. It is clear that those working in informal recycling, in particular, have a high degree of specific knowledge about identifying materials and marketing them and making use of them in a flexible manner.

Furthermore, informal recovery scores considerably better than formal recovery in terms of low or no fossil energy use. This is because many informal activities rely on human or animal muscle power, rather than on motorised transport. This gives the informal sector **a considerably smaller carbon footprint.**

By engaging in valorisation activities, the informal sector creates **social benefits and indirect economic benefits for the municipality.** Had there not been this potential source of income for this mostly unskilled, marginalized group of people that are informal sector workers, authorities might need to provide social assistance to them.

In general, the study shows that the informal sector often has a broader experience in identifying profitable ways for valorising waste. **Regularising and integrating** informal recovery into the overall solid waste system, as modelled in the addition scenarios of the cities, has its **main benefits in terms of recovery rates and overall solid waste system costs.** In general, policies that facilitate stronger integration of the informal sector would result in an increase in the rate of material recovery. Such an increase would be modest in some cities, and dramatic in others, but in all events, disposal rates can be predicted to drop, allowing for savings in investments for transport to landfills, landfill space and landfill operation.

Working with the informal sector is one possible form of private sector participation or public-private partnership strategies for cities. But informal workers have much less general business knowledge, and are often socially disadvantaged groups. For this reason, proposed interventions or policy changes need to consider the specific circumstances of the informal sector, in order to avoid unexpected impacts.

6. Recommendations for policy and practice

The information from the six cities offers us many ideas about how to improve performance and equitability of waste management policies, to optimise both the performance of the system and the returns to the informal sector entrepreneurs.

Investigate and track the performance and impact of the existing informal valorisation and service sectors: Understanding the sector and developing a plausible and feasible integration scenario is only possible if there is information. It is important to include the economic and technical performance of these sectors – together with their socio-economic profile – as the baseline for planning. Once the amount of valorisation that is happening is recorded, it is easier to track whether the modernisation process actually results in increased levels of valorisation, or merely a shift from the informal to the formal and at what cost. Understanding and measuring informal valorisation activities is important because it provides a basis on which to build recycling activities and meet national or international recovery goals. Thorough market and value chain research is also advisable to avoid collecting recyclables for which there is no market.

If it ain't broke, don't fix it: This American proverb highlights that it is better to build on what is working, than abandon or destroy it in favour of something unknown that might or might not work. Where there are robust levels of recovery already occurring, the supply chain is working. The resource recovery goals set by government may already be met, and just need to be documented. In this situation, municipal (or NGO) activities to 'set up' recycling are likely to disturb existing supply relationships. Either the supply relationships will 'win' and the municipal programme will be ineffective, or the municipal programme will 'win' and many poor people will lose their livelihoods.

Where a careful investigation finds little or no informal valorisation activity, the supply chain is weak or missing, or there are geographic or demographic reasons for no valorisation. In this situation, contacts and consultation with informal entrepreneurs can result in legitimising and building on existing efforts or supporting informals to diversify their business models.

DO fix what doesn't work: Not every aspect of the informal sector is positive, and problems need to be recognised, and confronted. The highest on the list are: the health and safety conditions; negative environmental effects from recovery and recycling processes, the transaction costs in terms of harassment, bribery, and the effects of criminalisation; the involvement of children; monopoly structures in the informal value chains etc. Many informal entrepreneurs need support

in order to organise market relationships or longer-distance logistics, or to improve the efficiency and scale of collection and processing systems. These problems must be fixed, but informal workers themselves need to be treated as key actors in this process. Often, it requires facilitation, leadership, advocacy, inter-agency co-operation and an inter-disciplinary team to find solutions. The municipality – often in combination with NGOs - can organise sourcing, horizontal linkages, and social and political protection measures that the informal sector actors cannot usually manage on their own. There are successful models of informal workers' co-operatives in countries as Brazil, Colombia, or India that have become partners of municipalities.

Light Regulation and Integration: Create a portfolio of low-threshold formalisation measures, which combines regulation with facilitation of improvements. Light regulation can provide the city with key data and points of influence, without requiring things that informals may not have, like a street address, an identity card or a bank account. It involves creating instruments, policies, or institutional contact points that are able to work with informals to organise and improve their activities. In Brazil recycling has been accepted as a legitimate profession. Such recognition may lead to the provision of land for sorting and storing recyclables and other benefits.

Some Examples of light regulation:

- The "Swach model" involves creating micro collection and recycling zones for pairs of informal workers. In Pune, the city provides health insurance, and the union has designed a wet-dry source separation protocol. The system is based on a minimal form contract, and a standard for calculating service tariffs. Service fees are paid directly by the households to a service provider whom they know personally, and who has the right to valorise both the dry recyclables and the organic waste.
- The "Lima model" also combines service and valorisation by providing tricycles or push-carts for larger informal groups in middle-class areas. In Lima, uniforms, gloves, and transport equipment are provided, and the informals have the rights to the access of the materials.
- The "Quezon model" is a model of organised acceptance of informal activities. First, truck pickers are formal workers who are authorised to pick and valorise materials. In return for this right, they accept a sub-minimum wage salary which lowers city and Barangay (village) budgets for solid waste. In a similar way, informal junk shops can receive an authorisation to function as materials recovery facilities (MRFs). This semi-formal status channels formal recovery activities to the private recycling business, and both the city and the junk shop benefit.

Build structures that link the formal and the informal: It is essential for local authorities to create structural relationships between the solid waste system and the formal and informal valorisation sector. In OECD countries that went through modernisation 20 years ago, the practical way of doing this was to appoint a "recycling coordinator" whose job was to be the liaison with the informal and formal private recycling sector on the one hand, and to improve the municipality's understanding of the value chains, and critical technical and logistic issues. The existing organisations and structures of the informal sector in some of the cities can provide models of good practice for new relationships between the formal and informal sectors. This communication would also require the appointment by waste pickers of representatives to speak on their behalf or the organisation of waste pickers in associations or co-operatives.

Affordable technologies are the most practical and sustainable: The study shows that expensive technologies create reverse institutional and systemic linkages that drive out the informal sector in order to pay for themselves. It is therefore essential to moderate technical ambitions for new disposal and processing technology, so as to keep them affordable in the short- and middle- term.

Use the comparative carbon advantage of the informal sector and develop Carbon Financing projects: This study makes it clear that the informal sector is more active and more effective in valorisation than the formal one in low- and middle-income countries. While their low-energy and low-fuel collection and treatment technologies create significant carbon benefits, there are some questions as to whether non-motorised approaches are considered to be acceptable to cities over the longer term. Interventions and research supporting the design and procurement of low-energy and small-scale collection, transfer, processing and disposal systems can help is a helpful input. Carbon financing is already a reality for co-financing measures to limit fossil energy use and avoid methane formation. But only one recycling methodology exists until now: for plastics recycling, but no credits have yet been issued. Carbon financing could thus become an instrument supporting integration of the informal valorisation sector, but only if municipal and national authorities, and multi-lateral institutions, invest in developing it further.

The accompanying CD-ROM includes

Full report on the six study cities including

Annex 1 – Glossary of Terms

Annex 2 – Annotated Bibliography and References

Annex 3 – Process Flow Diagrams

Annex 4 – Methodology Guidance Document

Annex 5 – Excel workbooks on economic, environmental and socio-economic aspects in the study cities

Annex 6 – City Reports

The economics of the informal sector in solid waste management

Are informal sector waste recyclers – otherwise known as rag pickers, waste pickers and scavengers – a nuisance or an asset? Do they help municipal administrations by reducing costs and protecting the environment or do they make the management of municipal solid wastes more difficult?

There are various opinions on this subject, and some strong convictions. This booklet is based on an investigation that was carried out in six cities on four continents to collect facts about informal sector recycling and to determine in an objective way what are the economic benefits and drawbacks.

The investigation also considered the effects of possible changes in policies towards the informal sector, both to restrict its opportunities and to increase co-operation.

Inside this booklet is a CD on which can be found the Full Report of the investigation as well as a wealth of background information.

This booklet is primarily intended for municipal officials and for solid waste management practitioners in general.

This booklet is the fifth in a series published by the CWG (the Collaborative Working Group on Solid Waste Management in Low- and Middle-income Countries). The CWG is concerned to spread information that will help to improve standards of solid waste management, using publications, workshops and other means. The CWG is a thematic group of the Water Supply and Sanitation Collaborative Council (WSSCC).

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