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Role of informal sector recycling in waste management in developing countries

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Abstract

Many thousands of people in developing country cities depend on recycling materials from waste for their livelihoods. With the focus of the Millennium Development Goals on poverty reduction, and of waste strategies on improving recycling rates, one of the major challenges in solid waste management in developing countries is how best to work with this informal sector to improve their livelihoods, working conditions and efficiency in recycling.

The general characteristics of informal recycling are reviewed, highlighting both positive and negative aspects. Despite the health and social problems associated with informal recycling, it provides significant economic benefits that need to be retained. Experience shows that it can be highly counterproductive to establish new formal waste recycling systems without taking into account informal systems that already exist. The preferred option is to integrate the informal sector into waste management planning, building on their practices and experience, while working to improve efficiency and the living and working conditions of those involved. Issues associated with integrating informal recycling into the formal waste management sector are discussed.

Keywords: Waste policy; Municipal solid waste management; Informal recycling; Informal sector; Scavenging; Waste picking; Sustainable development; Public-private partnerships; Developing countries; Poverty alleviation; Dumps

Introduction

The informal sector is characterised by small-scale, labour-intensive, largely unregulated and unregistered, low-technology manufacturing or provision of services (Wilson, Whiteman, & Tormin, 2001). Informal sector entrepreneurs or enterprises do not pay taxes, have no trading license and are not included in social welfare or government insurance schemes (Haan, Coad, & Lardinois, 1998). In the context of municipal solid waste management (MSWM), the informal recycling sector refers to the waste recycling activities of scavengers and waste pickers. These terms are used to describe those involved in the extraction of recyclable and reusable materials from mixed waste. These activities epitomise the informal sector as this is labour-intensive, low-technology, low-paid, unrecorded and unregulated work, often completed by individuals or family groups.

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More complicated organisations can form, such as micro and small enterprises (MSEs) involving groups of up to 10 (micro), or 20 (small) people, operating with low capital investment. They provide primary collection and processing of collected materials into intermediate or final products, using creativity and innovation to respond cost effectively to market needs (Ahmed & Ali, 2004).

Specific socio-economic conditions prevail in many economically developing countries, including rapid population growth, migration to urban areas, lack of sufficient funds and affordable services and generally a low-skilled labour force. Solid waste management systems are often poorly run and operate to low standards. They can be unreliable, provide inadequate coverage and may conflict with other urban services. Developing country cities often collect only between 50% and 80% of waste generated, with open dumping the only disposal method available (Medina & Dows, 2000). Insufficient collection, uncontrolled street collection points and improper disposal in open dumps allow refuse to be readily available for informal waste recycling through scavenging/waste picking.

The attitude of the formal waste management sector to informal recycling is often very negative, regarding it as backward, unhygienic and generally incompatible with a modern waste management system. On the other hand, one of the aims of modern waste management is to move 'up the waste hierarchy,' i.e. reduce the reliance on disposal and increase recycling: it would seem ironic to move forward by deliberately eliminating what can be a rather efficient, existing recycling system. Also, the Millennium Development Goals (UN, 2005) focus development efforts on poverty reduction, and again it would seem counter-intuitive to try to move forward by removing the means of livelihood from a major section of the urban poor.

This paper reviews the role of informal waste recycling in achieving more sustainable waste management in developing countries. It identifies both the benefits the informal recycling sector provides to the local economy and its characteristics of concern. Public policy changes required to integrate informal recycling with the formal waste management sector are discussed.

Informal waste recycling in developing countries

Informal waste recycling is carried out by poor and marginalised social groups who resort to scavenging/waste picking for income generation and some even for everyday survival. This is widespread throughout urban areas of the developing world and it is reported that up to 2% of the population in Asian and Latin American cities depend on waste picking to earn their livelihood (Medina, 2000). This is an adaptive response to scarcity by disadvantaged populations. Informal recyclers often form discrete social groups or belong to minorities, examples of which include the Zabbaleen in Egypt, Pepenadores, Catroneros and Buscabotes in Mexico, Basuriegos, Cartoneros, Traperos and Chatarreros in Colombia, Chamberos in Ecuador, Buzos in Costa Rica and Cirujas in Argentina (Medina and Dows, 2000; Berthier, 2003).

In cities with a formal, municipal waste collection and disposal system, at least four main categories of informal waste recycling can be identified, depending on where and how material recovery takes place (Fig. 1):

(a) *Itinerant waste buyers*: Waste collectors who often go from door to door, collecting sorted dry recyclable materials from householders or domestic servants, which they buy or barter and then transport to a recycling shop of some kind. Apart from their labour, they invest capital to acquire and run a vehicle. This activity is widespread all over the world. Fig. 1 shows the '3-wheelers', or tricycles used in Bangkok. China, in particular, is highly dependent on this mode of informal recycling (Li, 2002).
(b) *Street waste picking*: Secondary raw materials are recovered from mixed waste thrown on the streets or from communal bins before collection.
(c) *Municipal waste collection crew*: Secondary raw materials are recovered from vehicles transporting MSW to disposal sites. This practice is widespread, e.g. in Mexico, Colombia, Thailand and the Philippines.
(d) *Waste picking from dumps*: Waste pickers/scavengers sort through wastes prior to being covered, as shown in Fig. 2. This is often associated with communities that live in shacks, built from waste construction materials, on or near the dump. Scavenging at dumps occurs in cities throughout the economically developing world including Manila, Mexico City, Cape Town, Bangalore, Guadelajara, Rio de Janeiro, Dar es Salaam, Guatemala City and many others (Bernache, 2003).

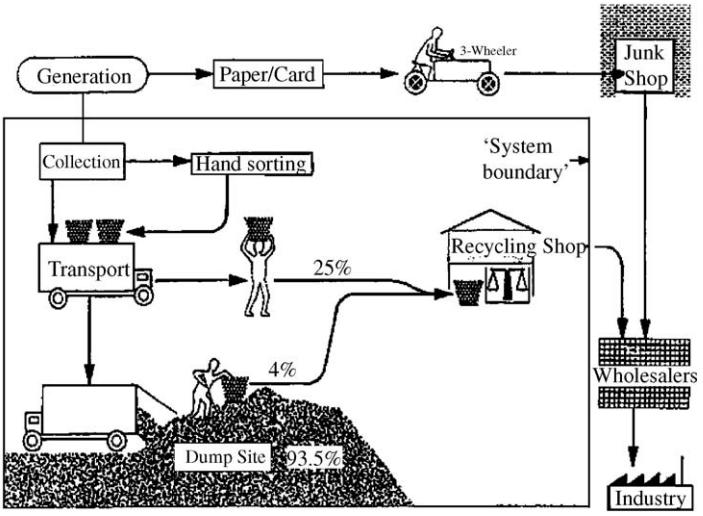

Fig. 1. Example flow chart of an informal recycling system, showing four types of informal recycling (reproduced from Wilson et al., 2001).

Fig. 2. Waste pickers sorting through waste at an open dump (photo credit: David C. Wilson).

Variations on these basic categories also occur. For example, if waste is transported to disposal via a transfer station or another intermediate point, then that provides an additional opportunity for waste picking.

In a number of countries, the informal sector also directly provides a waste collection service in areas where there is no formal municipal system in place (Coad, 2003; Haan et al., 1998; Scheinberg, 2001b). Even here, the prime economic motivation is sometimes not the fee that can be charged for providing the service, but rather the income that can be made from sorting and recycling the collected waste, a notable example being the Zabbaleen in Cairo (Neamatalla, 1998).

Organisation types and the recycling trade hierarchy

The way informal recycling activities are organised has important consequences for income generation, working conditions and social status. As a general rule, the less organised the informal recycling sector is, the less the people involved are capable of adding value to the secondary raw materials they collect, and the more vulnerable they are to exploitation from intermediate dealers.

Secondary materials collected by informal recycling are normally traded locally. Possible end-users are local industries, including craftsmen and artisans. A chain of intermediate dealers often exists between the scavengers and end-users (Fig. 1). This chain may contain primary and secondary dealers, recycling MSEs, junk shops, intermediate processors, brokers and wholesalers, and may include both formal and informal sector activities.

The recycling network takes the form of a hierarchy (Table 1). The higher a secondary raw material is traded, the greater the added value it possesses. Informal recyclers tend to occupy, and are restricted to, the base of the secondary materials trade hierarchy and this significantly reduces their potential income.

Individual scavengers/waste pickers are the most vulnerable as they do not have an organised supportive network. They have limited capacity for processing or storing materials and are easily exploited. Family-organised activities are common in dump scavenging and in situations where waste collection is provided by the informal sector. This often involves vulnerable individuals such as women, children and the elderly and exposes them to increased health risks. It also often prevents children from having any chance of a formal education. However, family-organised activities reduce individual vulnerability by providing a level of social and economic support.

Organising and training informal recyclers into MSEs is a very effective way to upgrade their ability to add value to collected materials (Haan et al., 1998). By circumventing intermediate dealers, their income can be significantly increased and their activities become more legitimised and socially acceptable. Forming scavenger/waste picker cooperatives and associations can also enhance their position. They can then negotiate as a discrete entity with the local authorities and/or the private sector and this legitimises their activities and increases income by circumventing middlemen (Medina, 2000). Ways of organising the informal recycling sector, and integrating their activities with the formal waste management sector, are discussed further in Public policies towards informal waste recycling and Integrating informal recycling into formal MSWM below.

Table 1
Hierarchy of informal sector recycling

Highest value	Manufacturing industries
	Brokers, wholesalers and other processors
	Craftsmen, middlemen
	Recycling MSEs and scavenger co-operatives
	Family type units involved in waste collection or scavenging/picking
Lowest value	Individual waste scavengers/pickers

Economic driving forces for informal recycling

The informal recycling sector is often highly skilled at identifying wastes with potential value. They collect materials when they have been discarded as waste and add value to them by sorting, cleaning, altering the physical shape to facilitate transport or by aggregating materials (Scheinberg, 2001a) into a commercially viable quantity, as shown in Fig. 3. Table 2 describes the ways in which value can be added to recovered waste materials. Potential profit margin is the main selection criteria for targeting materials, although this also depends on accessibility, convenience, ease of transporting and handling. Informal recycling systems can be highly efficient. Recovery rates as high as 80% are achieved by the Zabbaleen in Cairo due to intensive manual sorting and their expertise at extracting waste with value (Iskandar, 2003).

Commonly collected materials are plastics, paper, cardboard, aluminium, steel, other metals, glass and textiles (Haan et al., 1998). Organic wastes can also have monetary, nutrient or energy value, as they are used as livestock fodder, soil improvers and fuel (Dulac, 2001).

The degree to which a particular material is recycled depends on income levels, the existence of local and national markets, need for secondary raw materials, level of financial and regulatory governmental intervention, prices of virgin materials, international trade in secondary raw materials and relevant treaties. In many countries, e.g. India and China, major industries have a strong dependency on the availability of secondary raw materials, either local or imported.

Scavenger/waste picker income is very low, although they are not necessarily the very poorest in society (Medina, 2000). Low income is due to their low position in the trade hierarchy for recycled materials. They are often badly exploited and paid very low prices for the materials collected. This is particularly true in markets where only one buyer exists. Such conditions often prevail for wastes collected from dumps, where the distance to the city makes transport impossible for impoverished waste pickers. In some cases, the pickers have to pay for the right to access the waste, and may also have to sell their materials to the same individual or organisation.

Informal recycling occurs in developing countries because of low levels of economic development. Poor wages and low prices for products and services create viable profit margins from collecting and selling

Fig. 3. A waste recycling shop located near a dump site. This shop collects, sorts, accumulates volume and carries out some pre-processing (see Table 2, photo credit: David C. Wilson).

Table 2
Ways of extracting and adding value to recovered waste materials (Adapted from Scheinberg (2001a) and from Community and Institutional Development (CID), Cairo, private communication)

Extracting and adding value processes	Explanation and comments
Collection	Identification and picking of items or collecting mixed waste allows the sector to acquire the waste and turn it into a resource. Most primary materials recovered from refuse, such as paper, plastics, rags, metal, glass, and food leftovers, constitute a commodity as they all have a market price
Sorting	Main process that increases the value of the waste recovered. The deeper the sorting differentiation, the higher the value of waste. For instance, if plastic is grouped into one major category, its value is lower than when it is further separated into sub-categories of hard and soft, then HDPE, PET, LDPE, etc. Sorting according to colour, size, shape and potential use or re-use of the materials so as to meet the end-users quality specifications
Accumulation of volume	Additional volume adds value: larger volumes command higher per-unit prices. The greater the quantity, the better bargaining power the trader has. For small quantities, transactions costs, such as checking quality, arranging transport and paying the seller, reduce the profit margin. Industrial feedstocks are massive in volume. It follows that storage space is required
Pre-processing	For instance: washing, changing in shape-cutting, granulating, compacting, baling
Small manufacturing craftsmanship	Creation of micro-enterprises that use the special skills of informal recyclers to transform recyclates into articles traded directly to the community and being affordable by the poor
Market intelligence	Proximity to markets where informal recyclers and traders conduct business allows for the flow of information which allows decisions to be made on accurate market prices, competitors, trading partners, etc
Trading	In informal or formal markets. Links to the secondary materials network are crucial. Traders should be financially capable to add and conserve value of recyclates. Difference between buying and selling should also provide buffer against risk

secondary raw materials. If alternative employment opportunities and associated wages were higher, scavenging would be less financially attractive (Porter, 2002).

Economic and social issues

Informal recycling systems can bring significant economic benefits to developing countries. From a macroeconomic perspective, they are well adapted to the prevailing conditions, namely abundant supply of working force, but scarce capital: they minimise capital expenditures and maximise hand (and animal) power (Haan et al., 1998; Scheinberg, 2001a). They are able to provide a steady, reliable supply of secondary raw materials for local manufacturing industry which can replace more expensive imported raw materials. This also stimulates the manufacture of low-cost, affordable products made from recycled materials.

Recycling is always placed above disposal in the waste management 'hierarchy'. Most if not all Western countries allowed their earlier informal recycling systems to disappear, and have struggled over the last 10 years to re-establish more formal systems to rebuild recycling percentages to former levels and meet what are now ever-increasing recycling targets. The informal waste recycling systems that already exist in many developing countries reduce the cost of formal waste management systems as they reduce the quantity of waste for collection, resulting in less money and time spent on collection and transport. Void space at disposal sites is preserved and only used for wastes with no potential value as recycled materials are diverted for reuse. For the most part, these economic benefits are achieved at no direct cost to the tax-payers.

There are also social benefits associated with informal recycling. It provides employment and a livelihood for impoverished, marginalised and vulnerable individuals or social groups (Medina, 2000). Despite the particularly adverse working conditions associated with informal recyclers, it is important to recognise that it does allow those involved to survive and be employed in regions that often have high unemployment. Many

scavengers may not be able to enter formal sector employment because of poor education or physical disability. This inability to enter more conventional occupations and the resulting absence of real choice needs to be recognised by interventions that attempt to change the role and working practices associated with informal recycling. If waste pickers do find alternative employment in the formal sector, other individuals are highly likely to replace them as long as poverty continues and waste remains accessible.

Informal recycling has traditionally been practised by outcasts and marginal groups in developing countries such as gypsies, rural migrants, immigrants and members of religious minorities. In India, the Harijans are a cast of untouchables that deal with waste collection and recycling. In Cairo, the Zabbaleen informal recyclers belong to a Christian minority. Isolation as a part of social exclusion leads societies of scavengers to develop their own habits, customs, beliefs and values (Berthier, 2003). As a result of their marginalisation, they are often a subject of harassment by the authorities and police and female scavengers in particular may be considered easy sexual targets (Eerd, 1996).

Poor living conditions, limited access to facilities and infrastructure, no provision of urban services such as water supply and sewerage and absence of social safety networks are typical of scavenging communities. This is particularly true for communities that live in shanty towns on or around dumps.

Health impacts of informal recycling

Health and safety risks associated with informal recycling include (1) occupational health risks posed to scavenger/waste pickers and (2) community health risks posed to the related community or general public. These risks can originate from the nature of the waste or the process of collecting, processing, recycling and disposing of it. Table 3 summarises the waste-related factors that may pose risk (Cointreau, undated). Informal waste pickers are undoubtedly exposed to increased risks as basic principles of occupational health and safety are disregarded. Scavenging in open dumps is considered to be the most detrimental to health. Relevant literature is surprisingly limited, with comparative data on health and accidents almost non-existent and studies often suffering from methodological flaws. It is widely recognised that further research is needed in this important area (Eerd, 1996).

(1) The *occupational health risks* to waste pickers in developing countries are high because of manual handling and lack of protective clothing/equipment, resulting in direct contact with waste (Cointreau, undated). Risks from manual handling of mixed waste may come, e.g., from direct contact with broken glass, human/animal faecal matter, paper that may have become saturated with toxic materials, containers with residues of chemicals, pesticides or solvents, and needles and bandages from hospitals. Inhalation of bioaerosols, and of smoke and fumes produced by open burning of waste, can cause health problems. Although there are insufficient data on the long-term effect of exposure to air-borne bacteria as well as infectious or toxic materials present in solid waste, studies have shown that respiratory and dermatological problems, eye infections and low life expectancy are common. Vulnerable groups such as children, the elderly and women are in many cases the most exposed, as they often play critical roles in informal recycling activities.

Table 3
Risk causing factors related to solid waste: origin and examples (Cointreau, undated)

Origin of risk factor	Examples of source of possible risk
Composition of waste	Toxic, allergenic and infectious components including gases, dust, leachate, sharps, broken glass
Nature of organic decomposing waste	Gaseous emissions, bioaerosols, dust, leachate, and fine particle sizes; and their change in ability to cause a toxic, allergenic or infectious health response
Handling of waste	Working in traffic, shovelling, lifting, equipment vibrations, accidents
Processing of waste	Odour, noise, vibration, accidents, air and water emissions, residuals, explosions, fires
Disposal of wastes	Odour, noise, vibration, stability of waste piles, air and water emissions, explosions, fires

Table 4
Health effects reported from involvement in informal recycling (Eerd, 1996)

Reported outcomes of case studies
The overall respiratory illness score for children of waste-picking parents was the same as those with non-waste-picking parents
There was no association between below normal pulmonary function performance and waste picking and current/past smoking
There was no significant relationship between HIV infection /HBV infection and waste picking
Waste picking was not associated with abnormal lung function among respondents
More of the waste pickers reported past health problems than the control group
Waste pickers were in a worse state of malnutrition than the control group
In relation to the average for height and age, both groups were normal, indicating that neither suffered from chronic malnutrition. However, the waste pickers showed a slightly worse average
Many of the waste pickers suffered from chronic backache and many complained of general weakness. Coughs were a chronic problem
Many suffered from injuries like cuts and needle stick injuries
Eye infections and other eye problems were highly prevalent
A few night-shift labourers from a dump complained of suffering from severe hallucinations due to the environment they worked in
Many of the waste pickers suffered from intestinal protozoa and helminthes
The dumps and waste bins were infested with stray dogs and rats. Bites from dogs and rats were quite common
Diarrhoea was extremely common among all waste pickers
Many of the waste pickers complained of having one or more attacks of jaundice in the last year
Many waste pickers suffered from skin diseases

Examples of the possible health consequences of informal recycling which have been investigated are given in Table 4. This presents the outcomes of four studies examining the relationship between waste picking in developing countries and health impacts (Eerd, 1996). In many cases, it is difficult to distinguish between health implications of work and living conditions. Personal behaviour and hygiene can also have an important effect on the risk posed.

It has been claimed that in certain cases, waste pickers have better health than unemployed people who live in the same shanty town (Kungskulniti, 1991). It could thus be argued that, under certain conditions, working with waste may be less detrimental to health than not having a financial means to survive.

(2) *Community health risks* of informal recycling can be posed to both related communities and the general public. However, there is no clear evidence for the degree of such risk. The most severe cases of adverse health effects have been reported for communities that live and work in shanty towns on or beside open dumps (Eerd, 1996). Mexico City dumpsite scavengers were reported to have a life expectancy of 39 years, while that of the general population was 67 years (Medina, 2000). Manual sorting of mixed waste within or near the living space can create very unsanitary conditions. This attracts disease-carrying animals and increases the exposure of vulnerable sections of the population, such as children, to risk. Open burning of waste in dumps or in backyards constitutes another community health hazard. Proximity of waste accumulations to living space is often combined with low sanitation, poor personal hygiene and poor or non-existent urban infrastructure and health care services.

Public policies towards informal waste recycling

Public policy in waste management has been traditionally driven by the need to control public health and the environmental consequences of poor waste management and this determines the legal context in which

informal recycling operates. In many countries, public policies towards the informal sector are largely negative. This may be characterised as *repression*, where either embarrassment at the presence of scavengers or 'concern' for their inhuman and unhygienic working and living conditions has led, inter alia, to police harassment (e.g. in Colombia); as *neglect* (e.g. in parts of West Africa); or as *collusion*, where scavengers are tolerated in return for either bribes or support to political parties (e.g. Mexico City) (Medina, 2000).

Over the last 20 years, there has been a growing recognition of the economic, social and environmental benefits of the informal sector in waste management. This has led to considerable activity in many countries in developing more supportive policies, to stimulate and improve the working conditions of the informal sector. Often the lead in this has been taken by local or national non-governmental organisations (NGOs) and community-based organisations (CBOs) sometimes with external support from international donor agencies, rather than by the public authorities.

One of the better-known and longest established examples of an NGO-led supportive programme is that with the Zabbaleen in Cairo. The Zabbaleen are a Coptic Christian minority, who have been active in collecting, sorting and recycling a substantial portion of waste in Cairo since the 1930s (Iskandar, 2003). In the 1970s, the Coptic church helped establish an association representing the interests of the community, the Zabbaleen Gameya. In 1981, a Zabbaleen Environment and Development Program was initiated, with funding from the Ford Foundation, the World Bank, Oxfam and others. Over 15 years, the components included (Neamatalla, 1998) upgrading of the settlement and provision of basic infrastructure including a primary school and health centre; an internal clean-up project; a small industries project, designed to provide the Zabbaleen with new business opportunities related to their trade; a project to provide income generation opportunities and credit to women-headed households, who are among the poorest of the poor; a project to improve animal health (the Zabbaleen raise pigs on the organic fraction of the waste); extension of collection services to unserved low-income communities in the city, with the Zabbaleen's income from recycling being supplemented by a collection fee administered by the Gameya; a mechanisation project, initiated in 1987 when the Governorate of Cairo banned the use of donkey-drawn carts for refuse collection; and the development of a composting plant. The Association for the Protection of the Environment (APE) has been running various community development activities since 1984, including a rug weaving school, a paper recycling project and literacy classes; and a number of healthcare initiatives run by APE and others.

Integrating informal recycling into formal MSWM

To convince municipal authorities and politicians to move from their traditional policies of repression and neglect of, or collusion with, the informal recycling sector to one of positive engagement, support and integration with the formal MSWM system is a major challenge. A necessary first step is for those in authority to recognise the economic, social and environmental benefits that result from informal recycling. There also needs to be recognition of the limited effectiveness of simply copying approaches to MSWM used in more economically developed countries as these are unlikely to be appropriate. Perhaps the greatest challenge is to shift the perception and attitudes, particularly of local officials and also of the general public, towards those involved in informal waste recycling.

One step towards integration is to work with the informal sector, to help them organise themselves and to add value to their recycled materials before selling them on, i.e. to move up the hierarchy shown in Table 1 and to extract higher value from recovered materials as shown in Table 2. Various examples of how this can be done were given above for the case of the Zabbaleen. Another example would be efforts to expand door-to-door collection (itinerant buyers) by helping street collectors or dumpsite scavengers to enter this market. However, all such interventions do need to be planned and integrated if they are to achieve maximum effect.

One area which has received much attention is assisting waste pickers and scavengers to form MSEs. A major international workshop in Cairo in 1996 led to the publication of guidelines for municipal managers on involving MSEs in MSWM (Haan et al., 1998), which recognises working with MSEs as an important form of public–private partnership (PPP). The Dutch funded Urban Waste Expertise Programme (UWEP) also published a toolkit for municipal decision makers on involving MSEs in Integrated Sustainable Waste Management (Scheinberg, 2001b). They classify MSEs involving informal sector recycling as

commodity-based MSEs, distinguishing them from service-based MSEs, such as those whose primary source of income is charging a fee for providing a waste collection service.

The involvement of the private sector in delivering MSWM services is a major theme in current efforts to improve MSWM in developing economies (Cointreau, Gopalan, & Coad, 2000; GTZ, ERM, & GKW, 2004; Wilson et al., 2001). PPP involving MSEs and the existing informal recycling network is one important option which needs to be considered more widely. A fundamental requirement for this to happen is to provide proper and effective incentives for all formal and informal actors, possibly under the capacity building services of an external, independent facilitating agency (Ahmed & Ali, 2004). Policy makers increasingly recognise the positive role of the informal sector, and strategic planning of MSWM needs to place more emphasis on documenting, understanding and building on existing informal collection and recycling systems (Olley, Scheinberg, Wilson, & Read, 2003). This may increase the overall efficiency of the MSWM system.

A successful recent example of PPP incorporating the informal sector waste pickers is the case of Sao Sebastiao in Brazil where the Catadores created a cooperative and succeeded in legitimising their profession (GTZ, 2004).

There are a number of potential points of conflict between formal MSWM services and informal recycling activities that need to be recognised and addressed in attempting integration. When a collection crew also separate wastes, this increases the loading time and reduces their efficiency. Similarly, the presence of scavengers at transfer stations and landfill sites can interfere with vehicle movements, which is both dangerous and increases vehicle turnaround times and reduces efficiency (ISWA, 2002). However, it is not possible to solve the problem simply by ignoring the informal sector. One way forward has been discussed in many of the MSWM investment projects proposed for international donor funding in which one of the authors has been involved. These projects were seeking to invest in improved transfer stations or engineered landfill sites to replace exiting open dumps. The solutions proposed were to provide separate areas of the sites where pickers could operate safely, without interfering with vehicle movements or with waste placement at the landfill face. Such engineering solutions need to be combined with social development programmes, e.g. working with local NGOs to provide schools and health-care facilities, so that it becomes feasible to ban children under a certain age from scavenging activities and require pickers to have regular medical checks.

Integration of informal recycling with formal MSWM systems continues to face many challenges. For example, despite 20 years of work to improve the living and working conditions of Cairo's 60,000 Zabbaleen as cited above, one could argue that official attitudes are still hostile. After many years of discussion on how to improve waste management services in the city, the authorities decided in 2002 to privatise the entire MSWM system, letting four contracts to international companies, which were intended to start in January 2003 (Iskandar, 2003). These contracts effectively ignored the services that the Zabbaleen had been providing for 70 years, and the fact that they were already collecting one-third of the city's waste (a service that has now been included in the foreign contracts) (Copts.com, 2003; AmCham Egypt, 2003). Some of the contractors were planning to hire Zabbaleen or to allow them to scavenge at the new landfill sites, while others appeared to be intent on 'meeting international standards' (Al-Ahram Weekly Online, 2003). It could be argued that it would have been better to adopt a more cooperative approach, involving the Zabbaleen and the NGOs working with them in the planning process prior to privatisation, rather than attempting to reach some accommodation after the contracts were let. At a minimum, ignoring a large, existing informal sector in planning new services is likely to result in delays and controversy; in extreme cases, it can result in the failure of the planned improvements.

Conclusions

Many thousands of people in developing country cities depend on recycling materials from waste for their livelihoods. With the focus of the Millennium Development Goals on poverty reduction and of waste strategies on improving recycling rates, one of the major challenges in SWM in developing countries is how best to work with this informal sector to improve their livelihoods, working conditions and efficiency in recycling.

It has become increasingly evident that incorporating existing informal recycling systems into the operations of formal MSWM can bring significant benefits. Strategic planning of MSWM needs to document, understand

and build on existing informal collection and recycling systems. Western experience shows that it is very expensive to establish new formal recovery systems once existing informal ones have been allowed to decline or disappear. Developing economies face the challenge, but also the opportunity, of building on, rather than replacing, their existing informal recycling systems. Measures need to be taken to protect livelihoods while working to improve both the efficiency and the living and working conditions of those involved.

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