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ONE WORLD OF WASTE: SHOULD COUNTRIES LIKE INDIA DEAL WITH SOLID WASTE PROBLEMS THROUGH SOURCE SEPARATION?

Christine Furedy
York University

INTRODUCTION

In cities of developing countries, solid waste management (SWM) is a bastion of inappropriate technology. Solid waste departments purchase, or request as international aid, machines and equipment that are expensive to operate and inappropriate to serve the needs of various segments of the cities. For instance, compactor trucks are inefficient for highly compact wastes; large vehicles cannot access crowded slum areas. In planning, greater priority may be given to daily house-to-house collection in elite areas while poor areas are left without service indefinitely. Factors that perpetuate poor technological and management decisions include pressures from Northern firms and aid departments, local corruption, ignorance of alternative ways to deal with wastes, and lack of systematic thinking or imagination among decision-makers. An inoperable Danish-aided waste-to-energy incinerator plant in New Delhi is an Indian example of a colossal white elephant: it could not even be started up, as the design was totally inappropriate for treating Delhi's relatively non-combustible garbage.

The Western world, however, is now enthusiastic about new approaches to SWM designed to deal with the root causes of mounting wastes. The solutions are commonly designated "the 5Rs": reduction, reuse, recovery, recycling and residue management. For post-consumer waste, "source separation" (i.e. keeping different types of materials separate at the source so that their recycling is easier and cheaper) is important for putting these principles into practice.

While heavy technology still holds sway in development assistance, there is the beginning of a thrust to export the "soft" approaches that emphasize waste reduction and source separation (hereafter: "separation"). This is the time to scrutinize the assumptions of this new development thrust, and to examine the extent to which it is appropriate for less developed countries (LDCs).

The main critique of technology transfer in the past has come from development project planners who have emphasized working from the

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grassroots up, assessing what is valuable and viable in local practices. We have seen more of this "appropriate technology" or "sustainable development" in agriculture and forestry than in urban development, but it is an approach equally pertinent for cities.

It appears indisputable that, world-wide, waste reduction should be the founding principle of waste management, and that separation is the most effective first step in recovering post-consumer wastes for recycling. In this sense, we have now "one world of waste management." Nevertheless application of such principles to cities in LDCs has to be done with good knowledge of local conditions. Before western advisors rush in with ready-made schemes modelled on our latest thinking, we need to understand common practices in waste reduction and waste recovery, to estimate what amounts of wastes are already being recycled, and to investigate what motivates people to engage in environmental improvement. For instance, one common technique to encourage separation in Northern cities is designated bins in public places for different materials such as bottles, cans, and newspapers. This concept is now being taken up by municipal authorities in countries like Indonesia, and being recommended in India. Is this an appropriate way to promote resource recovery in such countries?

In this presentation, I refer to India, using a case study of Bangalore to discuss separation as a means to recover post-consumer materials. The implications of waste behaviours for both social goals and practices like composting are examined and recommendations made for protecting and enhancing waste reduction in cities of less developed countries.

HOW WASTE BEHAVIOURS DIFFER IN INDIAN CITIES FROM DEVELOPED COUNTRIES

Waste separation is not a practice that the Western world can introduce to Indian cities: all Indian cities have more thorough-going practices of keeping wastes separate or sorting them out later for recycling than most Northern cities have achieved (although one should bear in mind that until the 1950's separation for recycling was common in our cities). But there are some significant differences between the motivations, organization and social aspects of separation as it is now practised in developed countries and in Indian cities.

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Separation in developed countries is mainly driven by the need to reduce the amounts of wastes going to dumps, although general environmental motivations related to resource conservation may also be present. The longest continuing traditions of collecting and trading recyclables from household and shop wastes in the western world are associated with charities wishing to make second hand goods available for poor families, either at home or abroad. The new movement for separation is organized by municipalities, often kick-started by funding from local or provincial governments.

This form of separation, associated in Canada with "blue boxes," curbside collection, and now large bins in workplaces and eating places, is heavily subsidized. It depends upon special equipment, routings, and storage. Besides the subsidies for basic operations, large sums of money have been given for public education to reduce "contamination" in separation. Much municipal waste separation is not market-driven and so is often "out of sync" with the markets for recyclables, which results in stockpiles of materials that may not be saleable in the country that produced them.

In Western cities, there is a strong "not in my backyard" (NIMBY) reaction by residents to the siting of waste dumps, transfer stations and storage facilities. This reaction comes from interference with lifestyles, lowering of property values and fears of health risks; there is minimal concern about negative images of wastes, and little prejudice against handling wastes for recycling. For instance, repulsion is rarely given as a reason for not co-operating with separation schemes. When surveyed, a majority of people typically state they are willing to co-operate with separation and affirm altruistic motivations (e.g. environmental improvement) (Hopper & Nielsen 1991), but the practice falls behind these affirmations. There are very few attempts to link separation and recycling with social and economic advancement of disadvantaged groups, although organizations such as the Mennonite Central Committee have done this in Canada and USA, and employment equity plans are now encouraging the hiring of handicapped people in separation plants.

In contrast, waste separation in LDCs is driven by multiple factors which relate in part to the economic value and marketability of recycled materials: industries' need to substitute secondary materials for scarce virgin resources; households' and enterprises' needs for savings; and unskilled workers' search for employment. Environmental altruism is

rarely stated (although such values are now emerging among the better educated), yet the majority of households and enterprises undertake some kind of separation and do not discard all their unwanted materials as garbage. There is a strong element of "tradition": because people have habitually kept aside reusable and recyclable materials for sale, barter or gifts (e.g. to servants, orphanages), families may continue the practice without further thought even if there is no significant benefit for the household budget.

Waste pickers, itinerant waste buyers (IWBs), small waste-trading shops, larger dealers, wholesalers and recycling enterprises are features of all Indian cities, where most recyclables are recovered and traded through "informal" trading systems (Furedy, 1990, pp. 18-19). Although there are seasonal variations in demand for some materials, especially paper, and inevitable price fluctuations, which may be linked to international commodity flows (cf. van Beukering 1993) and the importing of waste materials, ultimately huge quantities of synthetic materials are reused or recycled. Unskilled, little-educated, adults and children provide the labour cushion that allows waste trading and recycling enterprises to weather the ups and downs of the market: when there is less demand for various materials waste pickers, buyers and recyclers have reduced incomes and the front line workers in waste recovery (mostly the pickers and itinerant buyers) may turn to other work. There is extensive recycling of organics in many urban and peri-urban regions: through organized and natural composting, feeding of food wastes to animals, and use of organics for fuel (Lardinois and van de Klundert 1993).

These activities are labour intensive and account for an estimated 1%-2% at least of the workforce in large cities. Many roles and networks are thus involved in systems of recovering and trading wastes; at the smaller trading and manufacturing levels, these are "informal." This activity in separation and waste trading, then, is not promoted by municipal authorities (indeed, it is often hampered by them), and is not assisted by planning or specialized training and equipment. Typically, the wastes of low value and relatively light weight from houses, shops and offices are collected and transported on foot, cart or bicycle in India. Although both pickers and itinerant buyers may trade with regular dealers, and even sometimes be "tied" to these by clientist relations, the main suppliers are self-employed.

In terms of social attitudes there are either long-standing status systems that discriminate against people who handle wastes (such as the Hindu caste system), or simple prejudices that stem from the highly visible practices of waste picking. Ironically, these attitudes do not inhibit waste recovery, since the stigmatised groups traditionally do this work and hence have, as it were, "social rights" to the wastes (Furedy, 1990, p.9). The association of marginalized, underprivileged people, and especially of street children, with waste recovery, has generated an interest in SWM on the part of charitable or community organizations set up to help waste pickers or small traders. Such organizations are now undertaking pilot projects in separation and environmental education for waste management. Example are Waste Wise in Bangalore or Metro Manila Women Balikatan in Manila (Furedy, 1992b; Rosario, 1993).

As a consequence of extensive recovery of wastes for recycling, large Asian cities typically have wastes for disposal at dump sites that consist of 45-75% organics, 20-40% ash and dirt, 2-8% plastics, 3-5% glass, 4-8% paper, 1% metals, and similarly small quantities of rags, leather, rubber, crockery, wood and construction debris rubble (based on Bangalore figures, Rao 1985). It should be emphasized, however, that some of the waste recovery is not achieved in a desirable manner: of the garbage set out for collection and dumping, waste pickers remove 10%-15% under conditions that are hazardous and degrading. This widespread practice of recovering some materials from mixed garbage is one of the main concerns of grassroots organizations now promoting separation in India.

SOURCE SEPARATION, WASTE TRADING AND URBAN DEVELOPMENT

If we ask whether separation is alive and well in Indian cities, there are, I think, two main answers:

Waste separation traditions still thrive, unaided by government promotion, but there is potential to make separation more thorough.

There are forces of modernization in the Indian city which are undermining informal practices.

To discuss the second point first: In general, as cities modernize and develop land more intensively, and land values rise, operations such as small waste trading shops are displaced or even eliminated. There are "NIMBY" objections to the waste depots, or the sites become too

expensive for small dealers. As waste-dealing depots are located further out, transport costs and time rise, and this affects the profitability of dealing in low quality materials. If a city authority decides that informal waste collectors are bad for its modern image (as did Manila in the 1970s), or a nuisance to traffic flow, there are numerous municipal regulations which can be invoked against pickers and itinerant waste buyers, their handcarts or vehicles.

Without the convenience provided by these door-to-door collectors and neighbourhood waste dealers, households with small quantities of materials are inclined to discard them as garbage.² As standards of living rise, financial incentives for selling materials decline. (In India this does not mean the materials are lost to recycling, as waste pickers will retrieve most of them, but mixing the recyclables with household garbage spoils a proportion of them). Both high rise buildings and distant suburbs present inconveniences for sellers and buyers. There are other important effects of modernization such as the introduction of large containers and compaction vehicles, which damage the residual recyclables retrieved by dump pickers and waste collection crews (Furedy 1990).

It is the potential to make separation more thorough, moving to segregation of "wet" and "dry" wastes, that interests the voluntary organizations which are spearheading changes in the philosophy of SWM (Furedy 1992b). As will be noted below in the Bangalore instance, there are both altruistic and environmental motivations: to improve the working conditions and social status of people who recover and trade wastes, and to improve the quality of the residual organic/inert wastes so that low-cost, community-based composting or vermicomposting (production of worm castings for fertilizer) can contribute to further waste reduction.

BANGALORE: EXAMPLE OF INTENSIVE RECOVERY/RECYCLING

This section discusses Bangalore in order to illustrate some of the issues mentioned above.

Bangalore is India's sixth largest city. The Greater Bangalore urban area has about 5 million people, the municipality about 4.1 million. A city with diverse large and small industries, governmental and educational institutions, surrounded by intensive farming, Bangalore is able to finally recover and recycle the majority of the solid wastes that it generates. I estimate this to be, for Bangalore, about 80% at least of

these wastes.³ Most of the waste recovery takes place informally. An idea of the actors and quantities involved is emerging from several studies being conducted on waste recycling in the city, although precise figures are yet to be verified.⁴

The Bangalore recovery and trading network consists of perhaps 25,000 waste pickers (predominantly women and children), 3,000-4,000 IWBs of newspapers, plastics, glass, metals, clothes and other materials, approximately 800 small dealers, 50 medium dealers and 50 wholesalers. There are two glass and four paper recycling plants, eight aluminium recyclers, 350-500 plastic factories using waste materials, and an uncounted number of small miscellaneous recycling enterprises (Huysman 1994a, van Beukering 1993). Additional actors in the network are householders, household servants, municipal street sweeping and garbage collection workers [(these two last numbering about 7600) (Huysman 1994a)], shop cleaners and office caretakers, piggery and poultry workers who collect food wastes from hotels and institutions, and farmers who remove compost from the garbage dumps or persuade garbage truck drivers to deliver waste directly to their farms.

Street pickers work freely in Bangalore. There are relatively few dump pickers [in fact, currently, there are no operational dumps (Huysman 1994a)]. Pickers are estimated to retrieve about 15% of wastes put out on streets and in over 12,000 street bins, amounting to perhaps 300 tonnes of materials per day within the city (Rosario & Mani 1992). An idea of how much material is recovered, at this point in the recovery process, is given by a study that analyzed the contents of street waste bins before and after picking by street pickers (Rao 1985; Rajabaparah 1988) (see *Table 1*). Municipal collectors and sweepers are estimated to take out 37 tonnes per day, in addition to the wastes removed by pickers.

My survey of 103 IWBs, with pilot surveys of 25 householders, seven dealers, three wholesalers and ten recycling enterprises, examined the nature of informal separation of post-consumer wastes before these materials reach the street bins. The study included the attitudes and problems experienced by those involved, as well as daily earnings and the waste quantities handled.

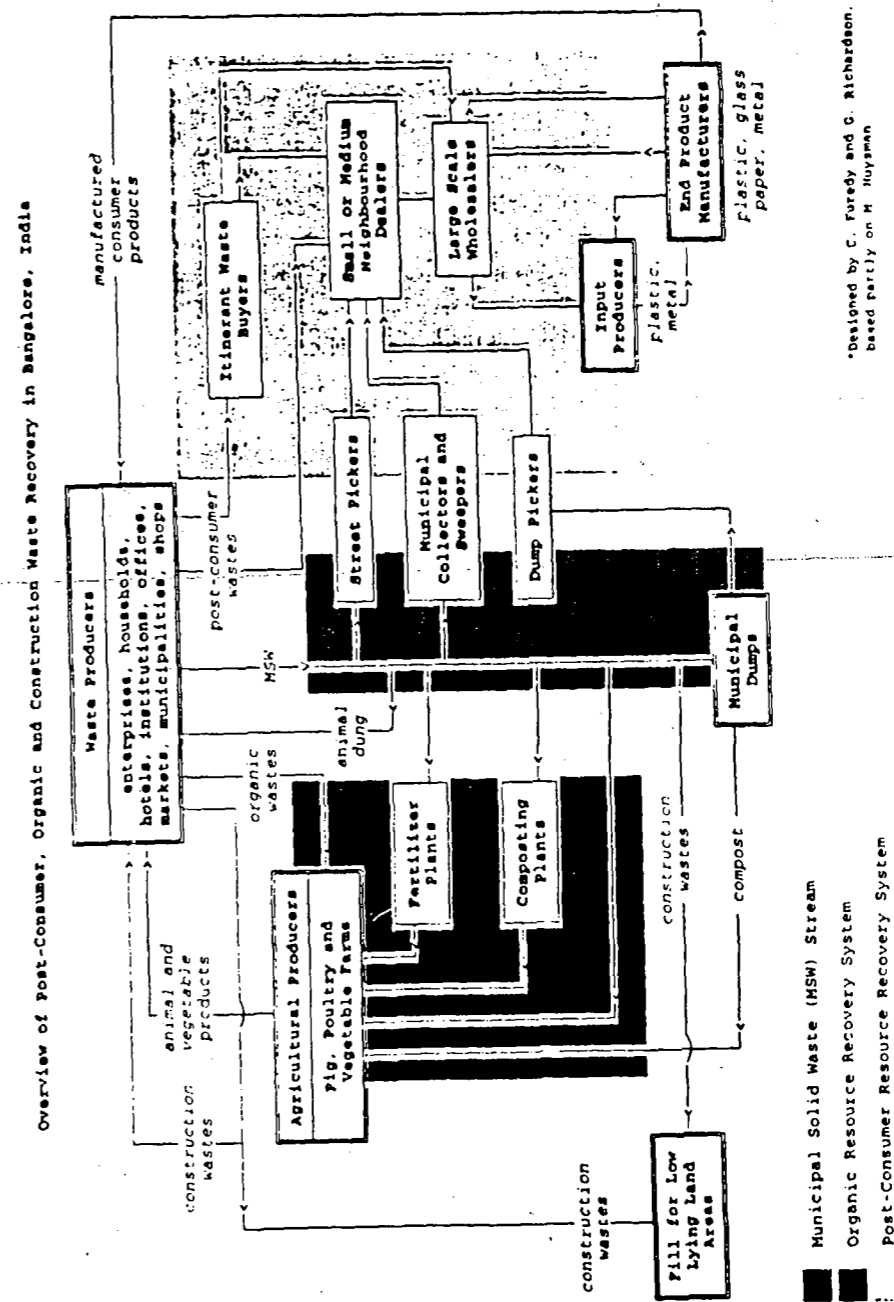


Table 1. Composition of Waste in Sampled Street Bins by Volume (Bangalore 1988)

Material	% before picking	% left after picking
<i>Removed Wastes</i>		
paper	8	4
plastics	6	2
glass	6	1
metals	3	0
<i>Remaining Wastes</i>		
organic matter	65	78
misc.	12	15

(after Rajabaparah 1988)

Itinerant buyers are individuals who have seized an opportunity for self-employment which often offers higher rewards than working in a shop or factory, but which is subject to seasonal downturns and increasing competition. Each recovers about 40 kgs per day, amounting to a total of between 1200-1600 tonnes per day for the city of Bangalore. (This amounts to between 400,000-500,000 tonnes of materials per year, as they usually work every day of the week). In return, these buyers earn from Rs. 50-60 per day (Can \$2-2.50), compared with about Rs. 40 a day that an unskilled worker in a small factory will earn. To get started in the work, IWBs typically invest an average of about Rs. 280 (Can \$ 11.60). They are not highly indebted, nor are they usually "tied" to particular dealers. IWBs sell almost exclusively to small or medium waste dealers although a few surveyed actually sold directly to wholesalers (and make better profits). The more ambitious IWBs hope to start their own shop, either in waste dealing or retail trade, but they would need access to finance to achieve this.

When IWBs and small traders are questioned about their work and the changes they have observed over time, they understandably do not refer to the general urban changes noted above, but rather to the typical ways in which their work is made more difficult.

Many IWBs believe that the trade has become more competitive recently, in spite of the increase in waste materials. In addition, IWBs operate under the typical handicaps of informal work and enterprises (cf. Aziz 1984; Samal 1990). Among these are:

- police harassment and extortion (the most common complaint);
- financial insecurity;
- low status and feelings that their work is undervalued;
- residents' suspicions (re theft and cheating);
- lack of opportunity for upward mobility;
- inability to get loans for vehicles, equipment or premises;
- lack of regular and reliable information about market prices for their materials;
- lack of leadership for a trade organization.

Middle and lower-middle income households are the main residential customers of the IWBs, who also buy from offices and shops. High income families with vehicles often store materials such as newspapers and plastics for some time and then take them directly to a dealer or even a wholesaler. However, these households still deal with the buyers of old clothes, and repairers of leather and metal goods, who come to the house. Trading by householders and shopkeepers who bypass IWBs is estimated to transfer 5 tonnes of materials per day to small and medium dealers.

These dealers have additional problems (including long delays in payments from wholesalers), but the issues of extortion of bribes by city officials, problems in getting finance at reasonable rates of interest, and lack of accurate information about market prices are cited by both dealers and IWBs.

The public (householders) are supportive of traditions of resource conservation and waste trading — all but one who were questioned approved of the informal system. They also supported new ideas for the separation of "wet" and "dry" wastes to allow for composting, although some questioned the practicality on a large scale in Bangalore. When asked their reasons for separating and selling wastes, most replied that it was a tradition or habit; only four out of 25 respondents (16%) gave financial need as their main motive. Seventy-six percent, however, said waste trading was important to their household, since the money they

derived from selling the materials was useful. Frugal habits, rather than altruism or economic necessity, seem to sustain separation in Bangalore.

It is the large amount of "voluntary" separation of synthetics at source (by residents, shopkeepers, etc.) or close to source (by pickers) that allows truckloads organic of wastes to be taken directly to farms and natural composting to take place on the old garbage dumps. At one dump, in 1990, about 15 truck loads (each of about five tonnes of fresh wastes) are delivered per day and about 12 farmers' truck loads of compost are removed. (Chowdappa 1990; Furedy field notes 1990). There is besides, a semi-mechanical compost plant that processes 50-100 tonnes of market wastes per day, producing about 20 tonnes of compost (Karnataka Agro Ind. 1991). About 210 tonnes of cow dung per day are collected from the roads for use as fuel by poor people (Joshi 1987). A considerable amount of kitchen wastes, leaves, grass and tree trimmings are eaten by stray dogs, cows, and pigs from street bins, amounting to perhaps 5% by weight of garbage put in bins. Overall, the diverted post-consumer and organic wastes which we can reasonably estimate are summarized in *Table 2*.

Table 2. Estimated Amounts of Post Consumer and Organic Wastes Diverted per Day (tonnes) in Bangalore

<i>Post-Consumer Wastes</i>	
gathered by street & dump pickers	500
gathered by municipal workers	37
purchased by IWBs	1400
sold directly to waste dealers by householders	5
 <i>Organic Wastes</i>	
caten by animals	200
sent to compost plant	50
diverted directly to farms	225
removed from dumps	100
cow dung taken from streets for fuel	210

	2727

(Based on Joshi 1987, Govt of Karnataka 1989, & author's estimates)

No study has been done of industrial wastes (metals, wiring, batteries, plastics, rubber, leather scraps, etc.) diverted by waste exchange or trading, nor of bones sent to fertilizer factories and food wastes used by pig and poultry farms. We know, from the analysis of dump waste, that none of the major industrial recyclables reach the dumps, and it is also known that food wastes generated by restaurants and hotels are traded. Another unestimated category is construction wastes used for filling low-lying land. Virtually all of these unstudied wastes can be regarded as recycled (although some of the residual industrial and hospital wastes are illegally dumped near to the premises).

Due largely to these varied activities of recovery and reuse, only about 335 tonnes of solid waste per day is handled by the Corporation (Rajabaparah 1988). As a result, Bangalore is not ringed by growing hills of garbage as are so many large cities. (Bangalore's garbage crisis is not so much one of quantity to be disposed as inefficiency in collection and failure to deposit wastes at designated dumping sites, together with lack of facilities for hospital and toxic waste treatment).

Although not all Indian cities have the capacity to recover and recycle as thoroughly as Bangalore, this study demonstrates that where convenient markets exist, traditions of separation and informal waste trading thrive. It suggests that frugal habits are well established across the spectrum of household classes and that financial incentives reinforce these habits in lower income groups, shop and factories. Such waste-reducing practices are found in other developing countries, although the proportions of materials taken by IWBs and waste pickers and patterns of control in the trade may vary (see Ali et al. 1993).

The policy implications of these patterns of waste recovery and recycling are examined in the following sections, where it is argued that enhancement of separation can not only serve economic and social goals but also allows more effective use of the residual organic and inert wastes to achieve maximum recycling.

PROTECTION AND ENHANCEMENT OF SOURCE SEPARATION SYSTEMS

Given the existence of well-established informal and private sector systems of waste trading, it might seem that a city like Bangalore is in no need of any intervention to support waste reduction. It should be remembered, however, that Bangalore, like so many of the "million cities" of the developing world, is under great pressures of

modernization and change (Ravinda 1993). It is a city that is officially unaware of its traditions of waste recycling. On the other hand, it is a city painfully aware of thousands of waste pickers at work each day on its streets, and piles of garbage casually offloaded along its access roads. Even though the municipality has a relatively small amount of waste to deal with daily, it is not able to handle even that quantity efficiently. Most other cities have full-blown waste management crises. They can all benefit from further waste reduction. Facilitating existing practices offers a more sustainable route to post-consumer waste reduction in cities of developing countries than a form of "blue boxing" (i.e. "kerbside" collection of recyclables or designated public bins) organized and financed by a municipal department.

There are three principal means of facilitation:

- supporting and enabling the traditional informal systems of waste trading;
- exploring ways of increasing separation to reduce hand-picking (by street and dump pickers) and to enable good use of organic wastes;
- increasing public awareness of the benefits of separation.

The informal systems can be supported both by directly addressing the handicaps of the IWBs and waste pickers (reduce police harassment and extortion, make small loans easier, establish sorting/storage spaces)(cf. Huysman 1994b re pickers), by enabling them to organize to their advantage, by ensuring that municipal regulations do not unnecessarily impede waste trading, by introducing the awareness of the need for waste trading infrastructure into urban planning, and by public education (which can be achieved by community groups, given financial assistance and training).

Although easily listed, some of these ideas are controversial. The city authorities wish to keep street workers to a minimum, for instance. IWBs think licensing will reduce extortion, but this has not necessarily been the case with other trades in Asian cities, and licensed waste dealers in Bangalore complain of extortion by city and state officials other than the police (Furedy 1992a). It is unlikely that co-operatives could be formed and sustained for itinerant workers, although the Self-Employed Women's Association has some experience with women waste pickers in Ahmedabad (Bentley 1988). The IWBs of Bangalore, however, do not support the concept of a co-operative.

Another concern now being voiced is that better separation will make recyclables attractive to organized entrepreneurs who could displace both IWBs and transforming-picker organizations (Silas 1994; Furedy 1994b).

"Partnerships" linking NGOs, community groups, the actors in waste recovery, corporate donors and municipal corporations may emerge as the most effective means of educating the public, aiding waste workers to achieve upward mobility, and organizing good use of pure organics. In Bangalore, the Waste Wise project and the Centre for Environmental Education are demonstrating in pilot projects how such partnerships in waste management work (Rosario 1992, Furedy 1992b, Krishan 1994).

SEPARATION AND ORGANIC WASTE REUSE/RECYCLING

It is important to couple thorough separation with the promotion of the use of organic waste in, for instance, low-cost composting or vermiculture. There are two main reasons:

- composting is the most effective way of treating residual wastes in countries like India, and has environmental benefits;
- low-cost composting may help to motivate solid waste authorities to support waste reduction and separation in particular.

At present, solid waste authorities have no direct incentives to take an interest in protecting and enhancing separation and waste trading systems. The benefits of waste trading are not obvious to them since the recyclables that are already being kept out or taken out of waste streams have never been handled by the municipality (except for those picked out by municipal crews and dump pickers). Leaving aside the estimates that I have made here, no-one has ever calculated for any city the total volume of wastes that the solid waste department would have to collect and dispose of if people did *not* recover and trade such quantities of recyclables. Thus the arguments that are made in Northern countries for collection of recyclables (mainly, reduction of the cost and of the political controversy of landfilling) do not have the same force for LDCs' cities. The reduction of waste volumes by 10% if separation is extended may not be significant to authorities who are already unable to effectively deal with several hundred tonnes of wastes daily.

If, however, wastes to be collected could be cut by 20%-40% or more by reducing the amounts of residual organic and inert wastes through compost production, vermiculture, or conversion to fuel, and if the reduction was done locally so that waste hauling costs decreased, then the solid waste departments would see the benefits of integrated waste management.

Indeed, it has long been argued that Indian cities should pursue composting as the primary waste reduction strategy (Flintoff 1976). But until recently, it was centralized composting that was recommended. The municipal councils of a number of large Indian cities had their fingers burnt in the 1970s when they operated foreign-designed, mechanical compost plants; almost every one ultimately failed due to mechanical breakdown and lack of markets for the expensive final product. Although it is possible to operate centralized, low technology compost plants successfully (Bangalore's plant is an example), these plants often do not absorb large quantities of raw wastes. [For instance, the Bangalore plant processes only about 50 tonnes per day. (Rao, 1994)].

Decentralized composting, based on thorough separation of organics, community co-operation, and the absorption of compost in city parks, community gardens, institutional landscaping, golf courses and the like, is an alternative that could bring significant savings in transport, dump land costs, dump management and overall environmental pollution.

The potential to extend separation, so that householders keep their residual wastes separated as "wet" and "dry," to undertake decentralized composting or vermiculture, and to recruit street pickers as collectors of the sorted residual wastes was recognized by a community organization which took the name Waste Wise in 1990 (Rosario 1993). The Waste Wise project is doing vermicomposting in a park in Jayanagar neighbourhood, Bangalore, guided by a professor from the Agricultural University. The park space has been donated by the municipal council. The collectors of the separated wastes are former street pickers trained and equipped by Waste Wise, an organization which evolved from one devoted to assisting pickers to achieve social mobility (Ragpickers Education and Development Scheme). This small project has its difficulties, as after high initial enthusiasm, many of the participating households are now lapsing in their commitment to thorough separation. Nevertheless, the most encouraging fact is that the

basic concept of separation is understood and practised: what is needed is to sustain the motivation to separate residual wastes. In a small way, the Waste Wise project is a model of a co-operative community effort to improve local waste management while pursuing social equity goals. The Centre for Environmental Education in Bangalore is supporting both small-scale composting and vermicomposting with more emphasis on education for separation (Krishnan 1994; Furedy 1994a).

ENVIRONMENTAL AND SOCIAL GOALS

To achieve decentralized use of organic wastes on a significant scale, cities will need the co-operation of municipal departments, NGOs, community groups, and private corporations because composting, for instance, requires land and subsidized absorption and/or viable markets. (The potential for "backyard" composting is limited in crowded cities). The co-operation of parks and planning departments will be crucial in finding and managing sites for composting. Careful site selection, training (Harvard Institute 1993), and attention to problems such as rodents are other considerations.

Well-organized and sustained educational campaigns are necessary if people are to understand the principles of waste separation and to keep it up, for this supplementary separation will not offer significant financial gains to householders. So, further environmental and social goals, such as the desire for waste reduction, employment generation, better working conditions for waste workers, social advancement of waste pickers, and the promotion of community co-operation, must support these practices. Some of the support for these motivations will be mainly indigenous, while world-wide principles of environmental management can reinforce local understanding and action.

It may be easier to initiate decentralized composting with market wastes. The wastes provide large amounts of organics; if stall holders co-operate, the effort is highly visible (so there is social reinforcement), and the suppliers and vendors are more reachable for education. Furthermore, there are possibilities of co-composting of human wastes from market latrines with the market wastes. The Sulabh International Institute of Technical Research and Training in New Delhi is currently designing such a project. (Mazumdar 1994).

CONCLUSION

There is "one world of waste" in the sense that we know in principle how to reduce waste problems world-wide, but it will remain true that principles can be translated into practice under conditions of financial and human resource constraint only if they are adapted to existing social and economic conditions. Even with their extensive waste recovery and recycling, cities in developing countries can improve their waste management with further waste separation. It is consonant with concepts of "sustainable development" to enhance waste separation by supporting and improving the current practices of buying and selling of recyclables, while at the same time creating ways of collecting and using pure organic and inert wastes. Non-governmental organizations with social as well as environmental goals, rather than solid waste departments, are already spearheading separation drives in India, the Philippines and some Latin American countries. Decentralized composting or vermicomposting deserves to be tried with more technical support and training. The most effective first step in decentralized composting may be through composting or co-composting of market wastes.

NOTES

1. I am grateful for the grant support of the Social Sciences and Humanities Research Council of Canada. I received valuable assistance in Bangalore from G. D. Badrinath and Anselm Rosario and, in Toronto, from Glen Richardson.

2. No estimate has been made in Bangalore of the total amounts of wastes generated by households, shops, offices and institutions. Statements about per capita generation rates published by the municipality are based on dividing the total amount of waste that the city estimates should be picked up for dumping by the population served. These estimates do not take into account the recyclables that are traded and never discarded in the garbage. The most helpful study of waste volumes for Bangalore is Joshi's (Joshi 1987) because he attempted to estimate amounts taken out of the municipal garbage stream for recycling, and amounts of cow dung and food wastes taken for fuel and pig feed. Nevertheless, his figures do not assess the total of wastes generated in the city.

3. The information comes from the data of Waste Wise, my ongoing study of waste recovery ("Urban wastes and urban management in Asia") funded by the Social Sciences and Humanities Research Council of Canada, van Beukering's work on the recycling system, and the Department of Social Geography of University of Amsterdam's current research project on "Approaches to Urban Solid Waste Management: Linkages between Formal and Informal Systems of Source Separation and Recycling" (I. Baud & M. Huysman). In addition there are some official studies on SWM for Bangalore.

4. The effect of closure of neighbourhood waste-buying shops has been most apparent in Chinese cities. Prior to recent changes in the urban economy, cities like Beijing and Shanghai had some four or five hundred "redemption centres" where people could bring a wide range of household wastes. The numbers have been reduced by about half since about 1985, and municipal officials have noted the increase of bottles and jars, rags, clothes and footwear, and similar items at the garbage dumps. (See Furedy, 1990, pp. 20-21).

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