

WASTE MANAGEMENT PRACTICES AND POLICY IN INDIA

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Introduction

Women, whether they work within the home or outside, are expected in most societies to do the cooking, which generates the biodegradable wastes that decay most readily and cause the greatest problems if uncollected. Women bear the brunt of caring for family members with waste-related illnesses caused by flies, rats, polluted water and smoking waste-piles. Women have to make up for the missed days of school caused by such illnesses, and manage the home with less of everything when sick wage earners have to stay home. And women, to survive, are most often the ones to forage for scraps and recyclables from waste-dumps.

Sadly, policies in most societies are made by men who do not think about or care about these burdens, because the State usually does not have to bear the real costs of sickness, absence and missed schooling, and economists choose not to account for these costs in their national budgets.

Yet there is hope. Men, women, and children too, if they choose, have the opportunity to manage waste within the home and mitigate many of the problems associated with poor waste management. Some of India's best practices are described below. What the State needs to do is to recognize, support and reward such efforts. This is what many citizens in India are trying to achieve.

Waste is Wealth

In India's villages, and other rural economies, raw food waste is worked into the soil around plants or coconut trees, or added into a backyard pit with the straw bedding from cattle-sheds, to decompose naturally into compost that is fully used in the fields every monsoon. Cooked food is rarely wasted, or is fed to livestock. Until plastics came along to replace leaf or paper packaging, this ancient practice of returning nutrients to the soil was sustainable, profitable and nuisance-free.

The problem of waste began as villages grew larger, and began to dump their waste in compost-heaps away from their homes, on the outskirts of the village, generally beside the footpaths for ease of disposal and of collecting before planting. Archaeologists and anthropologists today excavate such ancient "middens" for clues to what early man grew, ate, and threw away. As villages have grown into towns and cities and urban clusters, these habits have led to our streets being used not just for traffic, but also as a place to dump waste at all hours, and, if and when it is collected, being thrown just outside the city limits, often into the backyard of the town or village next door.

Before the age of plastics and packaging and industrialization, urban waste was still valuable: bullock-carts bringing produce into town would collect and return with city waste for their fields. But modern mixed waste is useless.

Plastics render the land less fertile or even uncultivable, yet cities continue to dump on the outskirts as before. These discarded piles become no-man's land. Here stray dogs, feeding on waste-piles, turn feral and attack rural livestock. Flies and rats abound. The stench of large rotting piles affects everyone. Yet surprisingly, there is little official protest. Village leaders do not defend their territory from such "official" ravaging by the larger "government" of the city next door, or have tried and seen the futility of it. When the problem becomes huge and begins to encroach on private village lands, it leads to conflicts: stone throwing and tire slashing of vehicles that bring out such waste from the city. Then waste lies uncollected within the city, and is thrown into open gutters and storm-water drains which are mostly open sewers because of administrative apathy.

The 1994 "Plague": a wake-up call

This is what caused the "plague" in Surat in September 1994: choked storm-drains and heavy rains during high tide in this West Coast city flooded rat burrows, and the rodents came up and out into the population. Very few died, but migrant workers fled the city, and there were huge economic losses for Surat and for India as the United Kingdom refused landing rights for our airplanes for a while. It was a wake-up call for India. Soon after, a new and dedicated Municipal Commissioner, S. R. Rao, worked to build a team of motivated and efficient city officials and sweepers that transformed India's dirtiest city into its cleanest in eighteen months. His motto was: "A city is only as clean as its dirtiest areas", so that is where he began his work. Meanwhile, across the country, on the East Coast, the filthy city of Calcutta was quietly and steadily cleaned up by Commissioner Asim Barman, whose motto was: "The best way to keep streets clean is not to dirty them in the first place". He used the city's regular cleaning staff and their usual wheelbarrows to collect waste door-to-door and remove the street dustbins that were magnets for filth.

Public Interest Litigation in the Supreme Court

A 100-city Clean India Road Campaign, led by Captain J. S. Velu and myself after the plague, highlighted many good examples like these, but also the enormous problem of cities across India without proper dumpsites. This experience led to my filing of a PIL (Public Interest Litigation) No. WP 888/96 in the Supreme Court, asking all the States and Union Territories to follow hygienic waste-management practices. In 1998 the Court appointed a committee of eight, including four of the country's best city managers, three Central Government officials and myself, under the Ministry of Urban Development. We prepared an interim report that was presented for discussion at four 1-day workshops in the north, south, east and west of India, to which a total of 400 city officials from our 300 cities of over 100,000 population were invited for comments.

Supreme Court Committee Report

The feedback from these workshops was included in the March 1999 Report of the Committee Constituted by the Hon. Supreme Court of India, titled *Solid Waste Management in Class 1 Cities* which has become a widely-accepted "bible" of waste-management practices in the country. The Supreme Court had this Report circulated to the 300 Class 1 cities of every State and it was widely endorsed. This great success was because it was a report written by city managers for city managers, not by consultants or academics or outside "subject experts".

The 100-page report covered, in 13 Chapters, not just the technical aspects of managing various types of special wastes, but also administrative and institutional aspects and capacity building, management information systems, financial, health and legal aspects, public awareness, the constitution of a Technology Mission, and time limited recommendations for cities, State and Central Governments on all these inter-related aspects. This paper will deal only with the basic principles recommended for waste management, and describe some successful strategies.

Waste Management Rules

At the same time, India's Central Pollution Control Board prepared waste-management rules based on this report and discussions with our Committee. At the Court's direction, these were issued by the Government of India's Ministry of Environment as the country's first *Municipal Solid Waste (Management and Handling) Rules 2000*, issued under the Environment Protection Act 1986. This is now a mandatory blueprint for action by all urban local bodies having populations of 20,000 and over. Once citizens realize its potential, this is a powerful weapon in the hands of the public to enforce compliance, hygienic waste management, and responsible behaviour on the part of both elected and appointed city managers. However this also puts a responsibility on the public that generates the waste in the first place.

Waste Management Policy

Broadly, the report and rules recommend, as an ideal scenario to be achieved, the keeping of source separated waste until the time for daily doorstep collection of "wet" food wastes. "Dry" recyclables are to be left to the existing informal sector. Doorstep collection of "wet" food wastes is to be done in 4-6-bucket carts which are emptied directly into trucks, to avoid double handling of waste. This biodegradable waste is to be composted, and only compost rejects and inert (construction) waste is to be land filled.

India's cities are still a long way from achieving this goal everywhere, but there is a great effort in many places to put in place one or more of these systems. For example, many cities are stopping the purchase or replacement of roadside bins, and are in fact removing them in areas where doorstep collection is done.

India's Best Practices for Waste Management

In Calcutta, 80% of house-to-house collection has been achieved in residential areas at no extra cost to citizens, using only existing Municipal sweepers since 1995. They cover two "beats" by moving in pairs with a wheelbarrow. One pushes the cart and blows a whistle at each gate at a fixed time daily, while the other empties waste-bins into it, and they exchange duties on alternate days. Commercial establishments are not cooperating so well: only 60% do. There is no waste-segregation. Waste-pickers forage at the transfer-points or landfill.

Private groups are doing doorstep collection for payment in many communities. They collect Rs 15-50 (US \$0.30 to \$1.00) per month per household for this service. It is a system that has evolved spontaneously in many cities, and NGOs in at least six South Asian countries have found this to be a very successful method. Where other services are offered, like night-patrolling for security, or bill-payment services for power and water and telephone, residents are willing to pay far more, even up to Rs 200 per month (US \$ 4.00).

Doorstep collection is most successful in slums. Cities usually make the mistake of thinking that rich or upper-middle areas will not feel the pinch of such small monthly collections. However, they are always the most unwilling group to pay this, so such attempts often fail and municipalities get discouraged. Slum-dwellers, neglected everywhere, understand and appreciate the monetary value of cleanliness and are most willing to cooperate and pay willingly.

Temporary take-away bins work in extremely crowded slums where handcarts cannot move through the lanes. At Mumbai's Prem Nagar slum, stackable plastic bins are made available from 8.00-10.00 am at every gully corner and inner-lane crossing. From 10.00-11.00 am, these are emptied into waiting Municipal trucks and then stacked in a central place till next morning. Nobody minds a dustbin at their door for just 2 hours a day, and they are used in a very disciplined way. Residents pay Rs 1 per head per month, with a maximum of Rs 5 per household per month (US \$0.10), to support the local cleaning boys, who are paid Rs 1500 per month (US \$30) for 4 hours' work. Cooperation by slum-dwellers was 50% from the first month.

In Ahmedabad, the door-to-door bell carts have a special frame that can hold four to six 25-litre containers which can be directly emptied, when full, into waiting trucks or dumper placers, avoiding manual handling of waste which was formerly lifted off the street and into trucks.

Nashik is a city without dustbins, as trucks move from one street corner to another directly receiving waste from each household at fixed times. Loaders receive waste bins from residents, or fetch them from outside some houses where people are away at work. This is very popular with residents and cost effective for the city, but results in a lot of fuel wastage and pollution if the trucks keep their engines idling for 7-10 minutes while waiting at each road crossing. This system is ideal for smaller towns where tractor-trailers can be used.

Surat has spotless dumper placers and surroundings because of "pin-point beats", in which sweepers must take personal responsibility for the cleanliness of their stretch of road and any dustbins or dumper placers in their stretch. These rest on paved areas, slightly higher than the road, and slope towards a drain opening nearby. This system works only because of the extreme dedication of Commissioner S.R. Rao and the fine work ethic he initiated. In almost every other city, dustbins are surrounded by a huge permanent area of filth.

Waste separation at source is vital but difficult. Bangalore has opted for this as its official city policy. The entire sweeper force has been trained and sufficient 4-bucket handcarts have been donated by the corporate sector to cover 50% of the city which is served by the city's own sweepers. New contracts for the remaining 50% of the city now specify doorstep collection of source-separated wastes as part of the cleaning and transport contracts. Cooperation has been 20% in the first year. One drawback is that city sweepers keep the clean saleable recyclables for themselves, leaving less for traditional rag pickers. Also, residents seeing their source-separated "dry" and "wet" waste go from the handcarts into the same truck wonder if their efforts are worth it and get discouraged.

Weekly doorstep collection of dry wastes is done in Ahmedabad by SEWA's rag-picker cooperative, which has a hotline to ensure punctual collection and solve absenteeism and crises. No money is paid or asked for. The waste-pickers get their earnings from the higher-value clean and unmixed waste.

Doorstep collection of both dry and wet wastes is done for a fee at Pune, by a 5,000 member rag pickers' union. They keep the dry waste for sale and dump the wet waste into municipal bins or into a nearby composting site if available. The rag pickers do not seem interested in learning composting skills and trying out an additional source of income.

Coorg District was cleaned up by having all schoolchildren bring dry recyclable wastes weekly from home to school, where an NGO arranged for its purchase by a waste-buyer visiting regularly every week. Funds collected were used for eco-club activities for the classes.

Public Participation and Cooperation

The Coorg experiment proved that mothers will do for their children what they will not do for rag pickers or the environment: keep dry wastes separate for their kids to take to school. Under the existing program for SUPW (Socially Useful and Productive Work), required in all schools today and for which marks are given, all children at the start of term should be required to prepare and hang at home a pretty bag for collecting dry waste, and bring it to a school exhibition. Local NGOs can help arrange for waste-buyers to regularly visit the schools to collect this waste. Thin plastic bags must be brought to school, for donation to the local jail etc. for weaving but not for sale, so that parents do not go out and buy or demand more plastic bags than required.

Pimpri-Chinchwad Municipal Corporation has an effective low-cost Public Awareness Campaign. Every letter or bill going out of the Municipality has one of several rubber stamped messages on it, like "Do not litter", "Use the bell-cart", "Keep dry wastes separate from food wastes" etc. Children in Municipal schools have to get their parents to sign not just the monthly mark-sheet but a checklist of similar items also, every month. It is an effective reminder.

Calcutta has distributed five lakh bookmarks to all schoolchildren of Standard 6 and upward. On the bookmarks is a year 2000 calendar and a brief civic message on separating dry and wet waste, using bell carts, not littering etc.

Spotless streets are seen in Chandigarh, where residents take pride in personally sweeping and washing their half of the road in front of their homes, every morning. There is personal responsibility by each property owner for the cleanliness of the pavement and road in front of their properties.

It is worth framing by-laws that require each and every ground floor commercial establishment to keep its frontage clean up to and including the curbside drains. This will also curb unauthorized pavement encroachments that keep returning after clearing.

Handling of Special Wastes

Calcutta has a separate charge of Rs 20 per handcart of debris or of garden waste to be collected from households. The handcarts circulate after the regular morning door-to-door round, and the city has separately designated places for disposal of their contents.

Street Food Waste Management

Surat ensures that every small shop has a wastebasket and uses it, and that every mobile food cart has a shelf, basket or canvas slung beneath it to collect the wastes it generates. Cart owners must take their waste out of the area daily to a designated spot.

Tender coconut shells are collected in Bangalore in cycle rickshaws (when not in use for school children), and delivered to Police Quarters to be dried for heating water. Rs 10 per day is collected from the coconut-vendor as well as the police families.

Sugarcane juice waste, bagasse, is purchased on Saturdays by the poorest, for heating Sunday bath water. The stalls can be licensed by the Municipality if owners agree to store their bagasse within their wooden box-stands until collected by a separate waste-collection service for transport to a paper recycler or to slums needing fuel. The license fee should also cover the cost of waste-collection.

Hotel Food Waste

In Bangalore and parts of Mumbai, pig farmers pay nominal or even significant sums to hotels for the right to collect their food wastes. Non-vegetarian food waste is preferred. Tea leaves, coffee grounds and citrus peels should be kept out of waste intended for pigs, to get better prices for the waste.

At Vijayawada, leftover hotel food goes to a charity night shelter. This helps to bring in street children for baths and a little education. Twice daily, three containers containing mixed vegetable leftovers, mixed rice and mixed liquids (dal, rasam, sambhar) are picked up in a pushcart by one of the children and kept in a fridge until the next mealtime. Children pay Rs 1 per meal for good nutrition. In Delhi, 12 five star hotels are participating in a highly organized version of the same idea: waste food for the needy, e.g. in orphanages.

Market Waste

In Calcutta, every truck bringing produce into the market area has to pay a clean up fee. It is collected from the drivers/owners as they wait in a queue to enter the market. Trucks must unload goods in the market and also bring out any straw, baskets, boxes and packaging to be put in waiting tractor-trailers at the exit. Only consumable produce is left behind for sale.

Stall to stall waste collection keeps Pune markets clean. Every stall owner must keep a small basket handy for damaged fruit or vegetables or onion peels etc. Hourly, a sweeper with a handcart moves along the stall lanes, emptying the little waste collection baskets into it and taking it to a large container outside, which can be auctioned to local goat breeders or dairies. Dry packaging waste is not allowed to be put into the same wastebaskets. It is collected separately, once a day.

Commercial Street Waste

This is usually privately managed. For example, the Hardware Merchants' Association at Bangalore pays Karuna, an NGO of women waste-pickers / slum-dwellers, an annual fee (recovered from its members) for keeping their busy Godown Street litter free all day. Streets are swept twice daily, 7 days a week.

Offices should not mix carbon paper with their other paper waste. Separate carbon paper collectors recycle this for fine carbon powder in many cities. Waste pickers now litter large areas of the city, sorting carbon out of the paper waste.

Decentralized Composting

Decentralized composting not only achieves waste minimization, but also saves enormously on transportation costs for cities, which are mostly bankrupt and depend on State Government grants to survive. It is the most cost-effective and nuisance-free method of handling waste.

Neighbourhood composting of segregated wet wastes is done in the middle income Joshi Lane in Mumbai. Dustbins have been removed, the street lined with flower pots, and a couple of handfuls of vegetarian food waste from all of the few apartments along the lane are added to each pot daily. One can return to the first pot in 15-30 days. This has had the unexpected benefit of preventing littering and open defecation in their beautified lane. The dry waste is collected separately and taken away by privately employed women who sweep the apartment stairs and parking lots.

Composting is done on site at 400 housing societies and apartment complexes in Mumbai (Bombay), helped by a special Municipal officer who is highly dedicated to promoting and supporting these private initiatives, which Bombay calls ALM or Advanced Local Management. This has reduced wastes to 10% of former levels. Pune is setting targets for each Zonal Office to set up five new decentralized composting initiatives each month, and the Commissioner monitors progress monthly. However, making compost is usually far easier than finding buyers for it. The city must help by buying the compost from such decentralized efforts and using it in its own parks and gardens.

The problem of finding buyers for compost has been creatively solved by a Pune lady. Her soil free terrace garden using only garbage, has inspired thousands of other families. The joy of growing things, by adding household food wastes into pots that never overflow, and harvesting fresh flowers, fruit and vegetables, has to be seen to be believed. There is a deep spiritual need in city-dwellers for growing plants and working with soil, that can be a powerful motivating force for such waste minimization. Even if no profit is made from sale of compost, it is worth promoting for its cost savings to the city. Composting of Tihar Jail waste in Delhi saved the institution Rs 1.6 million in garbage clearance costs and added Rs 0.8 million to the prisoners' welfare fund through compost sales. Another jail and a zoo in Bombay have carried out a similar initiative.

City waste-minimization regulations should insist that institutional waste must be composted on site at large hospitals, colleges, clubs, hostels, wherever there is room. Elite luxury spaces make urban land scarce and unaffordable for housing the poorest, so they must take on some social responsibility to enjoy this privilege.

Coir pith from coconut fibre is very effective for low capital and low operating cost composting. At Kuilapalyam near Auroville, raw garbage is purchased in cartloads from the Pondicherry garbage dump and piled in 20ft x 20ft x 3 ft high heaps, in a tamarind grove near the village huts. These heaps are covered with a 15 cm layer of coir pith purchased from coconut fibre rope makers. Left undisturbed for months till the next planting season, the coir dust forms an insulating blanket which keeps in heat, moisture and odor, and keeps out flies and animals. This method can be adopted wherever coir pith is available, but well segregated organic waste is a must. This method cannot be used for mixed wastes containing plastic or toxic items like torch cells, button cells, insect spray

cans etc. These will ruin the soil when compost containing such contaminants is used. Inoculating the waste with composting bio-culture before covering it with coir pith will accelerate decomposition to a 50 day cycle requiring a very small area, and chain link fencing is necessary to keep dogs away from bones in fresh garbage.

At Aligarh and Hyderabad, private meatpacking firms are successfully composting slaughterhouse wastes. In Calcutta, chrome free tannery fleshings are made into compost which is in high demand by tea gardens. A new plant on a 3-acre site at the Calcutta disposal yard will be operational in 6 months.

Waste Sanitizing

Vasco da Gama city in Goa had no waste-processing site but effectively sanitized its open dumps and made them entirely nuisance-free. Sanitizing of large collection-points or transfer-points saves on transport costs. During a month-long experiment in Delhi, garbage was sprayed twice daily with compost-promoting bio-cultures and left uncleared. At the end, the stabilized odor-free garbage was carted away in just 6 trucks, compared to the 30 required for daily clearance each month. Residents were happy with results.

Hospital Waste Management

This is a specialized subject too vast to be covered here. India passed Biomedical Waste (Management & Handling) Rules 1998 which have timetables for compliance that are forcing hospitals to address this issue. Basically, the secret of success is not to mix different wastes. Food waste from patient and nurses' canteens can be composted, plastics autoclaved and shredded, and "sharps" like needles and glass collected separately and buried. Only infectious waste and human body parts require incineration, in twin-chamber incinerators to ensure that all outgoing flue gases are exposed to temperatures above 1,100°C.

Composting as Waste-Processing Policy

Large-scale composting has become possible in India by adopting the principle of first composting the mixed waste, as received, by arranging it in aerobic wind-rows and spraying it with composting bio-cultures. The heap of raw garbage loses odor and rapidly builds up heat. Temperatures of 55-70°C are advisable, to kill germs and weed seeds and evaporate the moisture, so that the heaps are eventually reduced to 50-60% of their original volume and are sufficiently free-flowing and earthy to be sieved for removing unwanted items. Care must be taken to water the heaps frequently so that temperatures do not rise to the extent that the heaps catch fire and produce only smoke and ashes. Good yard management is vital and leachate should be absent or minimal. In the rainy season, any leachate can be collected and re-circulated onto the top of the windrows as a rich microbial soup. Its moisture evaporates since the heaps are hot in all seasons, and its solids add to the compost.

After 3-5 repeated turnings of the windrow heaps (with a front-end-loader or excavator) over a period of 45-60 days, the soil-like material is ready for sieving (except in the monsoon, unless covered to keep it free-flowing). The sieved compost can be supplied loose (bagging is expensive and necessary only for brand image) for use in agriculture,

horticulture, forestry, and re-vegetation of mining overburden and reclamation of saline soils.

Compost is not a substitute for chemical fertilizers. The two need to be used together, for Integrated Plant Nutrient Management. The main advantage of “city compost” is not so much the 1-1-1% N-P-K it contains, as the micronutrients and rich microbial content that dissolve the minerals in soil for uptake by plants and make the root systems healthy and pest resistant. Also, when urea alone is used, only 20% is absorbed by plants and 80% runs into the soil to cause nitrate pollution of wells and groundwater. Compost acts as a sponge and makes all of the urea and synthetic fertilizers available for use by crops. Without organic manures, soils lose their fertility and become barren in a generation. In combination, chemical fertilizers and organic manures give 2.5 times the yields of either one alone, without declining yields. The main reason the Supreme Court Committee recommended composting of biodegradable waste as the method of choice for processing city waste was not just to save landfill area, but to return to the soil sustainability that cities take away from it

Large-Scale Compost Plants

Since changing public habits and promoting household waste-management is so time-consuming and difficult, large centralized compost plants are currently the most-preferred option for municipalities trying to comply with the deadlines and conditions of the Waste Management Rules. Over 20 such plants are operating or in the pipeline. Garbage is supplied free to a municipal or state site leased out at nominal rates for 30 years to a private compost operator who builds, owns and operates it as a BOOT plant. The problem with this plan is local resistance by neighbours fearing loss of property values. This is less so when the plant is constructed by the city and given out on operating contract for a fee based on sales value of compost produced. Management by the municipality or government bodies has proved highly unsatisfactory, with the compost plants degenerating to smoking open dumps as before.

With either of these arrangements, the return on investment is slow, ranging from 7-10 years, and operators are finding it difficult to market their compost without encouragement from the State Agriculture Department, which needs to popularize its use through demonstration plots and field trials.

Waste to Energy Options

Biomethanation of waste is acceptable because it is not a “burn” technology that can generate deadly dioxins that pollute soil, water and air. However, because it is so difficult to shred mixed municipal waste and the process requires so much energy, it is more suitable for sewage and possibly for large canteens or convention centers with reasonably uniform food-waste streams.

Incineration of Municipal Wastes has been a disastrous failure in developing country cities and should be resisted at all costs. There are powerful lobbies trying to market this disposal system via aid agencies and consultants, because complying with clean-air laws is

making them prohibitively costly and they are being banned or phased out in many places. In India, for instance, the capital cost for a compost plant of 100 tons a day of waste is Rs 20 million versus Rs 130-160 million for a waste to energy plant. The generated electricity is also not economically feasible as the capital cost investment for a one megawatt plant for thermal or hydro power is Rs 40-60 million, compared to Rs 140-150 million for a municipal waste to energy installation.

Another more important reason for totally refusing this option is that developing country waste (where peas are eaten fresh and not from packages) has a very high moisture content. More energy is spent in removing this water than can be got from burning the waste. Our calorific value is very low. To raise this caloric value, we would have to deprive thousands of poor waste pickers the right to remove combustible recyclables from the waste stream. In Timarpur at Delhi, a Rs 41-crore waste incineration plant ran for just six days before being shut down forever because the dust in the garbage was jamming and wearing out the conveyor screws. Now, more than thirty years later, the city has been unable even to give away the plant free to someone to operate it.

Encourage Waste Recycling

Recycling of “dry” wastes provides employment to about 1-2% of a large city’s population, often the poorest women and children. The street waste pickers and those on the open dumps are usually loyal to a particular waste buyer who provides 10-20 of them with sorting space and protection from police harassment. Their loyalty is bought by loans, at rates which make payback long and arduous. In large cities, there are 2-3 tiers of waste buyers, all very well organized and specializing in specific wastes. Some, in Bombay, have kept a pay phone near their shop so that members of the public can call them up and ask for someone to collect bulky wastes. Waste picking and trading is far less common in smaller cities, which in fact suffer from a lack of recycling facilities in their vicinity.

There is a great need for official support to this unappreciated activity that saves at least 10-15% in transportation costs daily to the city, adding up to millions of rupees a year. Several policies have proved helpful: starting a dialogue to find out the needs of this sector, issuing ID badges to street waste pickers who desire them (through NGOs or police, to prevent harassment), providing them with sorting and storage space in a low area such as below a flyover, and providing a doorstep pickup service for post sorting rejects to be taken away from slum houses or waste-buyer’s yards, so that these do not end up clogging the storm-drains.

At the macro-level, it is worth mapping, within the State or even nationally, the location of major recyclers of specific wastes and encouraging the filling of perceived gaps. Policies are needed to help this waste reducing and partially pollution abating industry to become legitimate, through designated recycling eco-parks, concessional power rates and low or no sales taxes. Village industry agencies should help identify or develop clean, low cost recycling technologies. Banks should be encouraged, or at least permitted, to advance loans against raw-material stocks. They would like to be able to have their materials insured against fire like anyone else. India has many NGOs working to improve their lot at the lowest levels but not at these policy levels.

An Indian is patenting a successful way to introduce shredded waste plastic film into bitumen for road improvement. The improved road qualities of polymer-modified bitumen are well known. Using waste carry bags would increase the price of such waste and make their collection viable for waste pickers. Laboratory results are encouraging, but months have been wasted in trying to get permission to officially lay a test stretch at no extra cost. It will be a couple of years before highway specifications will include the use of shredded film or banks get around to financing this revolutionary idea. Such official apathy discourages innovation in the recycling field, and funding and aid agencies are so tied down by their own dated guidelines for lending that they too are useless as a source of venture capital for taking forward and field-testing such new and progressive ideas.

Conclusion

Unrecycled waste quantities in developing countries are increasing exponentially. Calling a material “recyclable” is meaningless unless recycling is actually done. Thin plastic bags and PET bottles of mineral water and soft drinks clog India’s drains and sewers. It also causes monsoon flooding, littering of the peri-urban landscape, and affects water percolation and seed germination. Tetrapaks are made into hardboard in dozens of countries, but not in India. Styrofoam continues to be used for shipping goods though it is banned elsewhere. No world class recycling technology has yet come to India because it still has no laws enacted to require this. It is a moral tragedy that in most developing countries, many multi-national corporations use cheap and dirty practices that their home countries stopped tolerating over a decade ago. Consumers pay for such corporate profits through city taxes for cleaning up the new one-time use wastes, or in health costs, filth or eco-damage.

Hence, there is urgent need for new legislation and market strategies that promote product stewardship, producer responsibility and waste minimization. This is the next battle to be fought in India. Both Europe and North America have numerous examples of such legislation (see www.raymond.com) that developing countries can study and adopt before it is too late. A simple solution is to restrict entry of new industries to the country only to those who bring in the same recycling and product life-cycle policies and standards that are complied with in the West.