Reduce, Reuse, and Recycle: The 3Rs in South Asia

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1. Background

1.1 Waste Generation in South Asia

Participants at the opening session of the World Economic Forum on East Asia held in Tokyo, Japan on 15 June 2006 were told that "the new century belongs to Asia, but at the same time, it seriously requires to tackle many challenges facing today." To which, it also includes environmental pollution, out of few major issues. According to Japan External Trade Organization (JETRO) statistics, the total number of middle class in Asia is rapidly escalating. This growing number of Asia's middle class is significant in itself to reveal the emerging consumer society. These massive growths of consumer markets have, in fact, in many forms, compelled the industries and responsible parties to sideline the environmental issues in the name of urbanization. Unfortunately, this growth was also accompanied by a corresponding rise in solid waste generation and degradation of natural resources.

Appropriate and safe Solid Waste Management (SWM) is of utmost importance to allow healthy living conditions for the population. This fact has been acknowledged by most governments, however many municipalities are struggling to provide even the most basic services. Most of the municipal solid waste (MSW) collected in the region is dumped on land in a more or less uncontrolled manner. Such inappropriate waste disposal creates serious environmental problems that affect health of humans and animals and cause serious economic and other welfare losses. There is also a growing concern from various international agencies that Asia may have to reassess its "growth-first" strategy, which assumes that the environment can be cleaned up once development aims are achieved. According to World Bank estimation, the urban authorities in Asia spend 50-70 percent of their revenues on waste management and the effect of neglecting the environment is costing an average of 5 percent of GDP. As for India, it is believed to be losing as much as 5-6 percent of its national income for pollution control (Alan, 2002). At this crossroad of unplanned urbanization and sustainable development, the 3Rs concept, Reduce Reuse and Recycle if implemented, could be the missing piece in solving the Asian waste puzzle.

2. Current Practices of 3Rs in South Asia

It would be unfair to state that Reduce, Reuse and Recycle (3Rs) activities are unknown to South Asian countries and are not practiced on regular basis. Many NGOs and CBOs are actively working round the clock in these countries (in most cases) in a decentralized manner and often fail to fit in the bigger picture due to lack of communication, networking and other factors. As of today, a long-standing practice and a complex networking of informal source separation and recycling of materials exists. In most cases, they were compelled to focus more on reusing and recycling of waste than on source reduction. Prioritizing the 3Rs among themselves may not promise a drastic change within a short period, but will reap a significant reward in the long run.

Recycling not only provides economic benefits but also offers environmental benefits by reducing reliance on virgin materials. Such programs can reduce pollution, save energy, mitigate global climate change, and reduce pressures on biodiversity. Reusing items delays or sometimes avoid that item's entry in the waste collection and disposal system. Source reduction coupled with reuse can help reduce waste handling and disposal costs, by avoiding the cost of recycling, municipal composting, land filling and combustion. Figure 1 shows the factors affecting the waste management hierarchy.

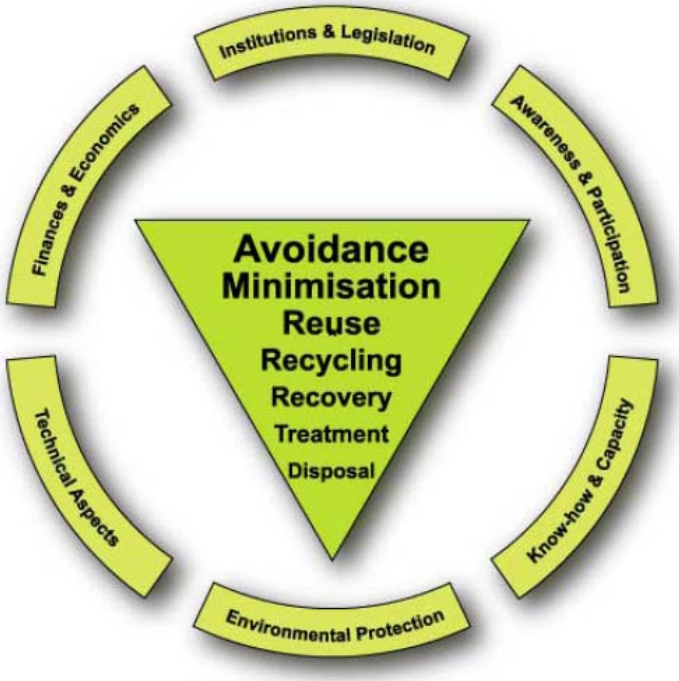

Figure 1: Factors influencing the core concepts of the waste management hierarchy
Source: Zurburgg, 2002

Similarly, recycling of wastes play a vital part in any waste management strategy. This involves the reprocessing of waste into a usable raw material or product thus enabling materials to have an extended life in addition to reducing resource consumption and

avoiding disposal costs. Transportation and collection of recyclable materials incurs costs thus resulting in an increased market price of such materials compared to virgin materials.

A typical waste management system in the South Asian region can be described by the following elements:

1 Waste generation and storage at the household level
2 Reuse and recycling at the household level
3 Primary waste collection and transport to community bin or transfer station
4 Management of the community bin or transfer station
5 Secondary collection and transport to the waste disposal sites/landfills

In South Asia, resource recovery and recycling usually takes place in all components of the system predominantly by the informal sector "waste pickers" or by the solid waste management staff themselves for extra income. Such work is done in a very labor-intensive and unsafe way, and for very low incomes. Recovered and recyclable products then enter a chain of dealers or processing before they are finally sold to manufacturing enterprises. The situation in industrialized countries is very different, since resource recovery is undertaken by the formal sector, driven by law and a general public concern. However, recently the importance of recycling activities in reducing waste volume, recovering resources and its economic benefits is being acknowledged. Table 1 describes the prevailing 3R activities carried out by informal and formal sector in South Asian countries.

Table 1: Current 3R activities in South Asian Countries

Country	**3 R practice**
Afghanistan	Informal
Bangladesh	Informal
Bhutan	Informal
India	Formal + Informal
Maldives	Informal
Nepal	Informal
Pakistan	Formal + Informal
Sri Lanka	Formal + Informal

Most of the recyclable materials such as paper, cardboard, plastics and metal are frequently recycled either by households or more often by rag pickers from the informal recycling sector. Though the rag pickers play a significant role in the entire process of waste management, their services goes unnoticed and issues concerning their livelihood are unaddressed. Government initiatives to the needs of the waste pickers are too compartmentalized and fail to have a holistic view of their problems and requirements. It is imperative that policies be designed to incorporate them in waste management.

2.1 Informal Sectors

The existing informal sector recycling system in developing cities of South Asia essentially comprise of three groups of actors; the waste pickers who collect recyclable wastes; the middle-men that buy the recyclable waste from the waste pickers, sort, clean and small scale enterprises that buy recyclable waste.

Tackling solid waste issues in the developing countries could be one of the most complicated and cumbersome task. Without any formal source segregation and with minimum public participation, almost all the waste ends up in one common container or in an open backyard. Handling of such heterogenic waste becomes trickier, costlier and beyond it remains unattended for longer time. The informal sector, though very selective in their act, they play a major role in recycling papers/ cardboards, plastics, metals scraps etc. They are purely dependent on the discarded refuse irrespective of its nature and toxicity. For them, the buy-back centers and the informal recycling shops are the backbone of their very survival, which in turn are market driven and in most cases receive no government support.

In many Asian countries, collecting, sorting, trading and recycling of disposed materials provides income to hundreds of thousands of people and are usually conducted by these scavengers under labor–intensive and unhygienic way. Many of these people work parallel to the formal solid waste management system; but only in an informal manner.

Informal waste separation or waste picking takes place in three ways:

1. At source - in large urban areas, e.g., commercial areas or residential areas. Here waste pickers sort out the waste before the authorized collection vehicle arrives.
2. During collection – where the collectors segregate recyclable materials during loading and store them separately.
3. At the disposal site – where the waste pickers often live or near the dumps. However, they risk the danger of potential slides and fires.

In the past the role of the informal sector in waste management has hardly been recognized by the responsible authorities. Often the municipal authorities actively hinder such recycling activities. Now the importance of recycling activities in reducing waste volume and recovering resources and its economic benefits is being acknowledged. In most countries, the extent of the formal and informal sources of separation and recycling of non-organic wastes (manufactured materials) is significant. However, since industries would only be interested to use recycled materials when they cost less than virgin materials, the practice of recycling is so market-driven that recycling has become selective. The disposal of those unselected recyclables remains a problem.

It is estimated that about 20 to 30 percent of the waste generated in cities of Asia Pacific region, is recycled by the informal sector. In Delhi, there are about 200,000 self-employed waste pickers comprising of men, women, and children collecting about 2,000 tons of rubbish daily (CSE-publications).

Karachi Metropolitan Corporation, (KMCP) Pakistan alone supports around 21,000 waste pickers or scavengers, who thrive by recycling waste paper and plastics from KMCP neighborhoods. The informal sector recycles about 1,500 tons/day including the material separated at source. In total there are about 90,000 waste pickers or scavengers (often Afghans in the age group of 10-25), mostly involved in waste paper and plastic scavenging-recycling sector. Recyclable items are largely separated at source where they are sold to junk dealers. There are over 400 units of recycling industrial units in the city which belong to the informal sector. According to the studies conducted by an NGO, over 5,500 households draw their livelihoods from the informal recycling industry. Under the present system, municipalities do not carry out any type of recycling activity. Normally, the main recyclable items like plastic, paper, glass and metals are retained by the people themselves, which are later sold to street hawkers/waste dealers for recycling. As a routine scavengers make 2 to 3 trips to garbage dumps everyday and earn Rs 100 to 200/per day (Also see Box 1) (URC, 2005 & Moten and Rehman, 2000).

Box 1: Karachi Waste Pickers and the Recycling Industry

The waste pickers collect paper, plastic, rags, bone and metal. They put these in big plastic bags and carry them to sorting places. If the sorting point is near the Kutchra Kundi, the pickers carry it there physically or on bicycles. If it is far, a donkey cart or a Suzuki pick-up is hired for this purpose. KMC garbage collection crews and drivers do not lift garbage from these garbage dumps regularly so as to help the pickers in their work. In return the contractor pays the KMC drivers and crew between Rs 50 to 150 per day. At the sorting point, the waste are manually sorted and packed in separate containers. The packed waste is then taken to Sher Shah Factories for primary recycling or to dealers who are also located in Sher Shah, for refined sorting. Alternatively, in a few cases, it is taken directly to factories in Korangi, New Karachi, Orangi and in Sher Shah itself for recycling or sent to recycling factories in the Punjab industrial cities. Paper and bone are the two main items that are collected from the dumps. Others such as plastic, glass and metal are removed at home by housewives and sold to the kabaris. Paper is turned into cardboard and bones are boiled to remove grease from them. The grease is used for washing soap factories and also for soap making. The bones are ground and mixed with poultry feed. In addition to picking from dumps, pickers invade all the city markets, even in high income areas, after they close at around 7:30 pm. Here the contractors, and sometimes the pickers as well, pay the market administrators, caretakers and or shopkeepers for the waste they collect

Source: URC, 2005

The informal sector in Bangladesh is responsible for recycling from 4-15 percent of the solid waste generated in different cities and urban centers. It is estimated that the informal sector has been able to save Tk 10,705.5 million (approx. 154 Million USD) annually through such recycling (Iftekhar, E. *et.al*, 2005).

In Kathmandu, about 5percent of the municipal waste, containing iron scraps, aluminum cans/plates, copper scrapes, plastic bags, and paper are recycled. The scrap dealers buy waste through scavengers and scrap collectors and sell it to recycling factories in Nepal and India. Due to lack of clean scrap plastics the recycled products are of low quality.

From a broader perspective, these amounts can be significantly increased if the municipal solid waste management systems (MSWM) were reengineered to incorporate and strengthen the existing informal waste recycling systems.

2.2 Involvement of Government Agencies, Private Sectors and Organizations

As most of the South Asian cities reel under the pressure of unplanned urban growth, waste management has taken a backseat and to go with it, the non-stringent waste policies. For decades, this joyride has taken a big toll in polluting the environment and peoples mind towards environmental ethics. Often, polluters go unpunished and the consequences are borne by the poor and the innocent. In recent times many NGOs and international organizations are footing in their resources to persuade local people and younger generations to participate in waste management campaigns, home composting and recycling of electronic waste. Figure 2 describes (subjectively) the overall involvement of Government, NGOs and International organizations towards promoting 3Rs and MSWM in South Asian Countries.

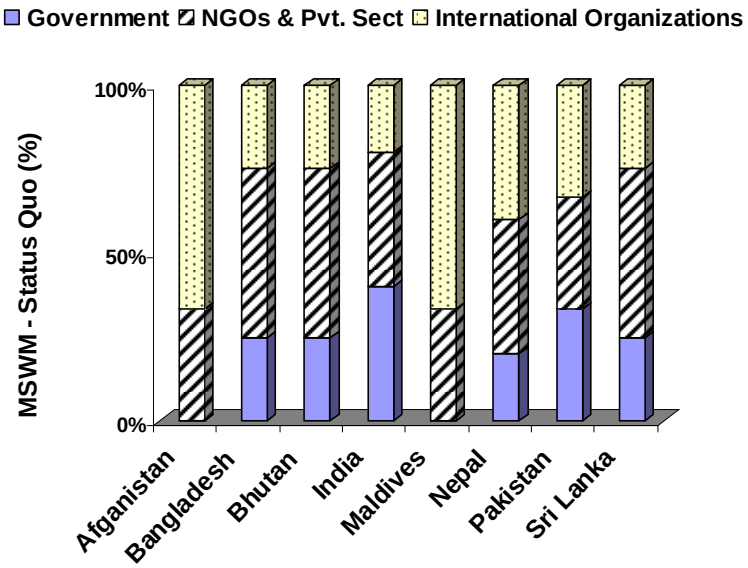

Figure 2: Government and Stakeholder involvement in 3R and MSWM

According to available sources and literature, it appears that, government agencies are less involved in overall SWM, let alone for 3Rs activities, especially in Afghanistan and Maldives. The collective efforts from NGOs, Private Organizations and International organizations are worth applauding.

In both developed and developing countries, many advantages have been realized through the involvement of the private sector in the delivery of waste management services. Involving the private sector in waste management services usually results in an efficient SWM system. The private sector is usually best at providing efficiency and technical expertise, while the public sector, which is directly responsible to the people, is best at monitoring and enforcement. Therefore, a suitable combination of the best attributes of the private and the public sector will provide an efficient waste management system.

The Maharagama Pradeshiya Sabha (Sri Lanka) encouraged by the Ministry of Environment and Forest (MoEF) initiated a source segregation scheme among 2300

households for the separation of paper, cardboard, glass, metals, plastic and polythene. In the short time that it has been in place, it has effectively reduced the total quantity of waste collected for final disposal. The Ministry, in an attempt to replicate this success story in other Local Authorities has distributed a newsletter among them giving guidance and encouragement to initiate such recycling practices (UNEP, 2001).

In 1998, under the West Sector Project, the Kathmandu Municipal Corporation-Nepal (KMC-N), signed a five-year agreement with Silt Environmental Services to implement door-to-door waste collection in selected wards. The contracted service also insists the agent to introduce source separated waste collection system to promote recycling. Similarly, in mid 2002, KMCN contracted two different companies for waste management services (door-to-door collection, street sweeping, and waste transfer) under a Pilot Project. Since then, KMCN has launched Private Sector Participation to achieve efficient transfer, scrap recovery and maximum recycling and composting (Manandhar, 2002).

In Navi Mumbai (India), a private agency has been appointed for door-to-door collection of solid waste. Besides covering large waste generators such as hotels, restaurants and institutions; they also cover residential areas for collecting biodegradable and recyclable waste. Moreover, an NGO - Stree Mukti Sangathana, has organized about 37 women rag pickers to sort out recyclable items from dumpsites thus recovering about 25 tons per day (Gupta, 2006).

Similarly in other parts of the South Asian countries, many NGOs are working close by with government agencies and local people to promote their participation in environmental conservation and recycling. National Forum of People's Organization (NFPO) in Sri Lanka provides technical support, training, disseminating information, and initiating innovative projects in partnership with others. Some of their activities are household source separation of waste, small scale composting and biogas generation, paper recycling, networking and information sharing (See Box 2). Also, Seth Sevana, a local enterprise, has successfully developed small-medium scale recycling of waste plastics into pellets/granules using both locally manufactured and imported machinery from India in processing HDPE, LDPE and PP (AIT, 2004).

Box 2: Waste separation in Sri Lanka

- **National Forum of People's Organizations (NFPO)** has developed a pilot program for source separation targeting 500 low/middle income households at Madapatha, Piliyandala. Each participating household was required to pay Rs. 30 per month (US $ 0.31) to cover the labour costs for the collection of the source-separated waste.
- **Abans Environmental Services Ltd** has been conducting a small-scale source separation of refuse collection scheme for approximately 90 - 100 households along three streets in a high-income area of Havelock Town, Colombo 5, since June 2000.
- **Seth Sevana** is an NGO currently undertaking a pilot project involving 1280 families in the Moratuwa area for source separation of household wastes into different components with funding from the Community Environmental Initiatives Facility (CEIF). It hopes to extend this project in the future to cover 8000 families generating an extra 15 tons/month of plastic waste for processing in its plastic recycling factory.

Source: AIT, 2004

In order to assist the Pakistan government's officials to develop cost-effective strategies for dealing with recycling, the National Cleaner Production Center (UNIDO-NCPC) in collaboration with the Tetra-Pak, has setup a program. The program provides awareness to the industry and community on segregation, classification and recycling in addition to advising the government on policy approaches that are financially self sustaining and socially and environmentally responsible.

The main objectives of the program are to;

1 Improve the efficiency of communities and industries in designing and implementing integrated waste recycling and management systems.
2 Build capacity of workers and community for integrated waste recycling management.
3 Create awareness among the community and planners to develop long-term plans for sustainability of the system

Recycling Campaign 2003 was initiated to recycle post consumer wastes and promote waste management in younger generations. This campaign was joined by UNIDO, Local Government and Rural Development, Waste Busters, Green Earth Recycling, Nestle/CDL and UNIDO-Pakistan. There are many actors and NGO's involved in promoting a better living environment. Box 3 presents information on a few.

Box 3. Private actors and NGO's (Pakistan)

The Safai Kamai Bank: It operates every Tuesday from a bazaar in Karachi and uses the slogan "Garbage is Gold". People can bring their dry garbage for sale on a per kilogram basis – the price paid depends on the item. Items purchased include newspapers, other paper waste, plastic bags, metal, glass and plastic bottles.

Waste Busters: They collect rubbish from households and charge about US$2 a month, which includes the delivery of about 30 rubbish bags. The refuse is taken to the transfer station where it is sorted out and loaded onto trucks for recycling.

Pakistan Environment Welfare and Waste Recycling Program (PEWWARP): It is a local NGO which has established a small production unit manufacturing three organic products from waste purchased from itinerant buyers at Karachi's huge vegetable market. This NGO collects organic waste for producing waste pellets.

Gul Bahao: This NGO has initiated a program in which common citizens are encouraged to sell their organic waste in addition to certain other waste items not collected by waste pickers.

Source: Ahmed & Zurbrugg (2002) & URC

In countries with limited involvement of private sectors and government resources, international organizations are actively assisting in managing the waste crisis. In Afghanistan, the International Centre for Science and High Technology has proposed a project to convert debris into usable building materials. The project consists of a crushing and sieving machine to transform debris for use as sub-grade in the construction of roads or as a low-cost alternative building material (ICS-UNIDO).

In Maldives, UNDP has funded a project over a five year period focusing on a range of activities to develop and implement the National Solid Waste Management Policy and

remove all existing barriers. Presently, the separation and storage of different, non-combustible waste streams is practiced within the facility. However, little consideration has been given to the concept of processing or recycling these items (UNDP, 2004).

In recent years, many stakeholders in South Asian countries are undertaking waste management programs, making guidelines, identifying barriers through research projects and organizing training programs to enhance the overall solid waste management strategy of the community. It is also equally important that these guidelines and existing barriers should be known in full detail to the policy makers in drafting appropriate and effective legislations and policies.

2.3 E-waste Recycling, 'One step forward, two steps backward'

According to Financial Express (2005), about 80 percent of the Electronic waste or E-waste generated in the US is exported to India, China and Pakistan. This recent ban on importing E-waste to China has diverted much of it to Bangladesh and other neighboring countries due to cheap labor and recycling businesses. As for India alone, the waste generated by obsolete or broken-down electronic and electrical equipment has been estimated to be 146,180 tons per year based on selected EEE (Electronic and Electrical Equipment) tracer items, not including the imported WEEE (Waste from Electronic and Electrical Equipment) shipments (IRG-SSA). Neighboring countries like Sri Lanka, Nepal and Bangladesh are also not spared by this overflowing E-waste. It is a crisis not only of quantity but also of toxic ingredients such as lead, beryllium, mercury, cadmium, and brominated flame retardants that pose both occupational and environmental health threats. But, to date, industry, government and consumers have only taken small steps to deal with this looming problem. Especially in developing countries, electronic waste is the highly sought-after item for scavengers and local recyclers. Table 2 describes the informal recycling of E-waste in Chennai, India.

Table 2: E-waste components in Chennai, India

Computer component	Recovered component	Mechanism employed
Monitor	Cathode ray tube, circuit board, copper, plastics	Dismantling using screw drivers (the broken CRTs are dumped)
Hard disk	China steel, aluminum, actuator (magnet), platter, circuit board	Broken using hammer
Circuit board	Capacitor, condenser, copper, gold, chipped board	Gold recovery - acid treatment, Copper recovery - heating, Crushing of boards by custom-made crushers
Printer	Motor, plastics	Dismantling using screw drivers
Cables and wires	Copper, aluminum	Burning or stripping

Source: Toxics link

In Delhi alone, there are about 25,000 workers employed at scrap-yards, where 10,000 to 20,000 tons of E-wastes are handled every year, with computers accounting for 25 percent (Indian Express, 2005). Figure 3 shows current scenarios about the E-waste recycling and the same practice is prevalent in most developing countries.

Figure 3: E-waste recycling shops in India and Pakistan -'Man-in-Action'!
Source: Toxics Link

The informal sectors in the urban areas of developing countries are now targeting more on these WEEE issue not knowing the level of toxicity involved in their act. To recover copper and other metals, they burn the electrical components (including electrical wires) releasing deadly cocktails of toxins (Figure 4). The other accrued electronic and electric waste are dismantled and sorted manually to fractions of printed wiring boards (PWB), cathode ray tubes (CRT), cables, plastics, metals, condensers and other materials like batteries, LCDs or wood.

Figure 4: Burning of WEEE to recover precious metals.
Source: Toxics Link

In Pakistan, Sher Shah in Karachi is one of the principle markets for second hand and scrap materials where all sorts of electronic and electrical spare parts, computers and smuggled goods arrive by sea and land for sale or further distribution to other cities in Pakistan. Sher Shah serves as an open informal market, without state controls of any kind (Toxics link).

2.4 Legislations and Policies

It is a very common practice in developing countries for people to dispose their waste openly or in an abandoned site, whereas they know very well they cannot enjoy this practice in many developed countries where stringent laws and policies exist. It is also not wrong to state that the "NIMBY" (Not In My Back Yard) syndrome might appear more when discussing solid waste issues in developing countries than in developed countries. The global coordination of solid waste management should focus on clearer definitions of monitoring and evaluation, particularly the use of indicators that can promote recycling and reuse of organic wastes. Suitable indicators should be incorporated in national legislation to harmonize the overall waste management activities. Environmental Legislations and Policies do exist in the developing countries to protect their natural resources and environment, but most of them are not revised or updated according to the need and prevailing situation. In most cases they are not clearly defined, creating complications for the implementing body, resulting in duplication of task and negligence in other activities. In cases, where they do exist, its implementation fails. The possible reasons for poor implementation could be a combination of social, technical, institutional and financial issues. Public awareness, political will and public participation are essential for the successful implementation of the legal provisions.

Many South Asian countries have recently made progress on the legislative front and also share common interest in tackling solid waste issues (See Box 4). Perhaps, most noteworthy is India's recent review and finalization process of NEP (National Environmental Policy) which stresses on adoption of cleaner technology, strengthening the informal sector of collection and recycling of various materials, developing and implementing strategies for recycle, reuse and finally environmental friendly disposal of plastic waste.

Box 4: Dhaka Declaration 2004 on Waste Management

In 2004, delegates from the SAARC (South Asian Association for Regional Cooperation) countries – India, Pakistan, Nepal, Bhutan and Bangladesh; confirmed to put forward the recommendations from the three day intensive workshop on Solid Waste Management in Dhaka (Bangladesh). Besides other technical aspects of solid waste management, it also states that the –'SAARC countries agree to encourage NGOs and private companies to establish community based segregation at source, separate collection and resource recovery from wastes with particular focus on composting'.

Source: Waste Concern

Recycled Plastics Manufacture and Usage Rules, 1999 was amended in 2003 and the Rules are applicable in all the States/Union Territories. It lays much stress on the manufacturing of plastics using virgin materials and recycled plastics. The Rule also details the standard size and thickness of the plastics to-be-manufactured. It also emphasizes on the registration of the existing plastics manufacturing and recycling units with the State Pollution Control Board/Pollution Control Committee by fulfilling consent conditions (CPCB, India), also see Box 5.

Box 5: Major developments on 3Rs in India

Non-biodegradable Garbage (Control) Ordinance, 2006, Maharashtra, India

Non-biodegradable Garbage (Control) Ordinance, 2006 has come into force with immediate effect, following the Governor's approval on February 27. The ordinance, controls ways in which non-biodegradable materials are to be disposed. It also bans the manufacture, transport and use of polythene bags. Maharashtra is the third state to pass such an act. The state has set 50 microns as the least permissible thickness for polythene bags (Goa and Himachal Pradesh have specified a thickness limit of 40 microns and 70 microns, respectively). However, polythene bags used for food items, medicines, milk and oil packets are omitted from the ambit of this ban, with a specification that such bags are to be manufactured using virgin plastic raw material in its original. The ordinance makes it mandatory for polythene bags to mention the details of the manufacturers, including the registration numbers issued by the Maharashtra Pollution Control Board (MPCB). It also enjoins manufacturers to provide information on the size and quality (virgin or recycled) of polythene. Moreover, no unit is allowed to manufacture polythene bags in the state without the consent of the Directorate of Industries and Commerce and MPCB.

Source: MPCB –India

Recycling Schemes

Under the MoEF the Government of India has launched a 'Registration Scheme' to channelize indigenously generated and imported recyclable waste to only those units with necessary facilities/technology to reprocess such waste in an environmentally sound manner. The ministry reported a total of 476 registered Plastic Reprocessing, and other 252 registered units for Used Oil Reprocessing, Lead waste Reprocessing and Non-Ferrous Reprocessing.

Charter on Corporate Responsibility for Environmental Protection (CREP)

After a series of industry specific interaction meetings, the Charter on Corporate Responsibility for Environmental Protection (CREP) was adopted in March, 2003 for 17 categories of polluting industries and is a road map for progressive improvement in environmental management. For effective implementation of the Charter, eight task forces comprising of experts and members from institutions and industry associations have been constituted. These task forces are meeting regularly to monitor and to provide guidance to the industries for adopting necessary pollution abatement measures

Source: (SOM, 2006)

The Indian government has also taken several initiatives in promoting recycling and cleaner technologies both at state and national levels. In addition to specific legislation with the following provisions, strict enforcement is being ensured through the state authorities (SOM, 2006):

1 A manifest system to track the waste from the point of generation to disposal.
2 A need for seeking authorization for handling of waste.
3 Registration of recyclers
4 Involvement and participation of the public in schemes such as the Battery dispose scheme etc.

A new waste management system, mandated by the Non-biodegradable Garbage (Control) Ordinance - 2006, emphasizes the Municipal Corporation of Greater Mumbai (MCGM) to ensure that all housing societies, commercial complexes and hotels maintain separate bins for biodegradable and non-biodegradable waste and ward-level centers are

set up to facilitate segregation. Violators will be fined anything between Rs 5,000 to Rs 25,000 (approx. USD 100 – 500). But MCGM has no system in place for this mandatory waste segregation. If the ordinance has to work, a system has to be put in place (CSE-publications).

In Nepal the roles and responsibilities of Solid Waste Management and Resource Mobilization Center (SWMRMC) are partially transferred to Kathmandu Municipality (Pokharel, 2003), and the center is now functioning under the Ministry of Local Development. The Local Self Governance Act 1999 makes local authorities responsible for the management of waste generated in their respective boundaries with special focus on public and private sector participation. This Act empowers the local authorities with the following legal powers;

- Impose a fine up to NRs 100 (approx. 1.4 USD) and recur the expense to dispose the waste or order individual or institutions to remove the waste to a safe place.
- Responsible for the maintenance of sanitary condition of the place, and launch awareness programs relating to the sanitation.
- Responsible for the management of sanitation programs including solid waste management.

In Bhutan, the current Environmental Codes of Practice for Solid Waste Management in Urban Areas was written (in the year 2000) after numerous meetings with relevant organizations. It covers topics from waste generation to post closure of the landfill. It also mentions clearly that the Environmental Codes of Practice will be subject to review periodically and suggested improvements will be carefully considered by the National Environment Commission (NEC) and the relevant ministries, with a view to ensure that the document remains relevant and practical. It also highlights the importance of recycling and discourages informal sector involvement in handling hazardous waste in addition to tax reduction schemes for industries re-using significant amounts of waste with a minimal production of new waste. However, these codes fail to mention that violators would be punishable by law (NEC, Bhutan).

Pakistan has responded to its environmental problems by developing laws, establishing Government agencies and accepting technical assistance from donors, including the World Bank. Environmental legislation is still not well developed in Pakistan, especially in comparison to the developed world. For example, there are no national quality standards for MSW (WWF-Pakistan).

According to an UNIDO-Pakistan report, the Environmental Protection Act 1997 has not been implemented in its truest spirit. Therefore, industries are spreading pollution, even in urban areas, prohibited under the Pakistan Environmental Protection Act. Increasing population and migration into cities have created serious environmental problems including inadequate solid and liquid waste management, lack of safe water and minimal pollution control.

Under the preamble of National Environmental Policy 2005, the government of Pakistan admits the lack of proper waste management. In NEP 2005, Under Section 3.3 (Waste management) it states that, pollution caused by liquid and solid waste in the country

would be prevented and reduced. It is also states that following the approval of the policy, the Ministry of Environment would create a National Environment Policy Implementation Committee to oversee the effective implementation. The Committee would report the status of implementation to the Pakistan Environmental Protection Council. Furthermore, Provincial, District and Tehsil Governments would also constitute Policy Implementation Committees to ensure coordinated implementation through effective participation of all stakeholders, including corporate and civil society organizations (NEP, 2005).

At the national level, in Sri Lanka, the Ministry of Forestry and Environment (MoFE) and the Central Environmental Authority (CEA) are responsible for policies regarding solid waste. Important laws and regulations with regard to solid waste are cited under the National Environmental Act (NEA), the Pradeshiya Sabha Act, and the Urban Council and Municipal Council Ordinances. The NEA restricts the emission of waste materials into the environment. The local Government Acts and Ordinances state that the local authorities are responsible for proper removal of non-industrial solid waste, and for providing suitable dumpsites. The Ministry of Forestry and Environment is working on a National Strategy for Solid Waste Management (NSSWM), aimed at municipal solid waste. A three-year implementation plan has already been made under which the national strategy for Waste avoidance/reduction, reuse and recycling have been covered. It also encourages private sector participation in the development of infrastructure facilities for collection and transport of MSW, establishment of recycling plants at provincial/regional level and disposal with attractive financial and technical support, including adequate protections. It is also recommends that Local Authorities should consider privatizing the collection and disposal of wastes so as to make these activities efficient, particularly in more urbanized areas (Levien and Siriwardena, 2000 and AIT, 2004). Table 3 describes the prevailing legislations and policies governing 3Rs issues in South Asia.

Table 3: Legislations and policies governing 3Rs issues in South Asian countries

Country	**Laws, Policies & Acts**
Afghanistan	No separate law for MSW
Bangladesh	Urban Solid Management Handling Rules of Bangladesh' (under preparation)
Bhutan	Environmental Codes of Practice for Solid Waste Management
India	National Environmental Policy
Maldives	No separate law for MSW & Weak legislation
Nepal	Local Self Governance Act, 1999
Pakistan	No national quality standard for MSW - NEP-National Environmental Policy, 2005
Sri Lanka	NSSWM -National Strategy for Solid Waste Management

3. Emerging Trends and Concepts in SA

3.1 Waste - not wasted

India: Managing Plastic waste (CPCB)

It is estimated that post-consumer plastic waste constitutes approximately 4-5 percent by weight of Municipal Solid Waste (MSW) generated in India, compared to 6-9 percent in developed countries. Thermoplastics constitute about 80percent and thermoset approximately 20 percent. A newly developed machine has been in operation for recycling of plastics in an environmentally sound manner. The aim of green recycling of waste plastic was to design a system which would have zero significant adverse environmental impact. This has been achieved by assigning right motor of minimum capacity, selecting optimum L/D ratio, heat sealing and right temperature for the processes and trapping all the emission in pollution control equipment and treating the pollutants to produce byproducts. The Extrusion and Pelletization processes have been redesigned to make the pollution from the process to a minimum level and as a result to enhance the efficiency of the process.

Another novel approach implemented was reusing plastic waste in road construction. The plastic waste (bags, cups, thermocole) made out of Polyethylene (PE), Polypropylene (PP), & Polystyrene (PS) are separated, cleaned if needed and shredded to small pieces (passing through 4.35mm sieve) The aggregate (granite) is heated to 170°C in the Mini hot Mix Plant and the shredded plastic waste is added, it gets softened and coated over the aggregate. Immediately the hot Bitumen (160°C) is added and mixed well. As the polymer and the bitumen are in the molten state (liquid state) they get mixed and the blend is formed at surface of the aggregate. The mixture is used for laying roads. This technique is extended to Central Mixing Plant too.

As per the Indian Council for Plastics in the Environment (ICPE) the 1.2 million tones of plastics are recycled. In respect of recyclables like paper, glass, tin etc. which are sorted at homes, 13 to 20percent of recyclables are again sorted from MSW collected by the concerned authorities.

Managing Colombo Garbage: An Innovative Solution for Solid Waste in Sri Lanka (US-AEP)

A state-of-the-art garbage system is now turning Colombo's mountains of garbage into compost, easing the capital's disposal problem and offering hope for other cities in the country. The Burns Environmental and Technologies Ltd. (BETL) plant is the single largest MSW processing unit in the country that engages in managing sites as per international standards, for about 800-900 tons of refuse per day. Sri Lanka's largest SWM company, BETL invested 600 million rupees (Over 5.7 million USD) in a facility to treat biodegradable waste and contaminants in a sustainable manner and maximize resource recovery by producing agricultural-grade compost. The public-private

partnership between BETL and Colombo's Municipal Council has eased the city's garbage disposal problems and is contributing to the regeneration of Sri Lanka's coconut and tea plantations by providing high quality, low priced compost to renew agricultural land. This partnership is on its way to solving the city's MSW problems - composting 200 metric tons of municipal solid waste per day and reducing the daily amount of MSW going to the Bloemendhal site by 60 percent.

In Bangladesh, the recycling of MSW by composting is picking up its pace, especially after inception of many projects related to Decentralized Community Based Composting and Barrel Type Composting (See Box 6). Efforts for recycling plastics and Lead Acid Batteries are also picking up by employing appropriate technologies. Aside from other recent developments under solid waste management, UNICEF has initiated a project to establish Recycling Centers in 24 city corporations/municipalities as well as preparation of solid waste management plan (SAARC, 2004).

Box 6: Organic Waste Recovery and Recycling in Bangladesh

Decentralized Community Based Composting in Dhaka by Through Public-Private-Community Partnerships

In an attempt to recover the value from organic portion of waste, a research based organization, Waste Concern, initiated a community based decentralized composting project in Dhaka city in 1995. The prime goal of this project was to explore technical and commercial feasibility of labor intensive aerobic decentralized composting technique and to promote the principle of 4Rs (Reduce, Re-use, Recycle, and Recovery of waste) in urban areas of Bangladesh. Activities under the project included house-to-house waste collection, composting of the collected waste in a decentralized manner, and marketing of compost and recyclables.

Barrel Type Composting Project for the Urban Poor

The Barrel Type Composting model invented by the SEVANATHA, Sri Lanka inspired Waste Concern to implement the concept in the slums of Dhaka. With some modification and changes Waste Concern with the support from Local Initiatives Facility for Environment (LIFE) of UNDP launched the barrel types composting units in two slums of Dhaka. Later after successful results, this concept is being replicated in a number of slums of Dhaka as well as other cities of Bangladesh. The idea is simple; a specially designed 200 liter bottomless perforated green barrel with a lid was supplied to the slum. One green barrel is provided to a group of six households and placed on a raised base with concrete ring. The cost of each specially designed barrel along with the civil work was around TK. 1800 (USD 30).

Source: SAARC, 2004 and Waste concern

3.2 Cleaner Technologies and Waste Minimization Circles

In India, a scheme on adoption of clean technology and promotion and establishment of waste minimization circles in small and medium scale industries is being implemented. The Indian Centre for Promotion of Cleaner Technology has also been established for waste reduction treatment and disposal and to identify and exchange potential recyclable waste. Table 4 describes the recycling/reuse options adopted by the industrial sector in India (SOM, 2006).

In Pakistan, the Cleaner Production Program (CPP) has targeted the implementation of cleaner production technologies in major industrial sectors. The program aims to create well-informed constituencies of industrialists, NGOs, and technology vendors for environmental technology solutions (in terms of cleaner production options and end-of-pipe treatment systems), environmental legislation and mandates of partner institutions for CP solutions, implementation and monitoring all over the country (See Box 7).

Table 4. Recycling/reuse options adopted by the industrial sector in India (SOM, 2006).

Industrial solid waste	Physical state	Source	Non-environmental friendly option	Recycling/Reuse options
Fly ash	Powder/slurry	Coal based thermal power station	(i) Pumped to low lying areas in form of slurry in wet system of disposal (ii) In dry method fly ash is conveyed to dumps	-Road construction -Land reclamation -Dam/earthen waste -Portland pozzolina cement -Lime fly ash bricks block sand aggregates -Cellular concrete and construction industries
Steel & Blast Furnace slag	Solid lumps (granulated/ ungranulated)	Iron & steel industries	Open dumping	-Blast furnace slag cement -As binding material -Road aggregate
Lime sludge	Slurry/paste	Fertilizer sugar and paper industries	Settling pond	-Raw material for cement manufacture -Lime-pozzolina mixture
Phospho Gypsum waste	Slurry/paste	Phosphatic fertilizer industries	Settling pond	-Manufacture of cement in place of mineral gypsum -Gypsum block board, partition panels ceiling tiles, fibre boards
Red Mud	Slurry/paste	Aluminium industries	Open dumping	- Raw mix for cement industry -corrugated sheet, ties, building bricks manufacture -Light weight structural blocks
Press mud	Filler cake	Sugar industries	Open dumping	-organic manure -biogas production, effluent slurry after biogas is useful as nutrient rich bio-fertilizer
Bagasse	Solid waste	Sugar industries	Fuel	-cellulose for pulp and paper -cattle feed -Used in boilers as coal substitute

Box 7: Cleaner Production Program (CPP)- Pakistan

CPP is a Dutch funded project, which has targeted the implementation of cleaner production technologies in major industrial sectors of Pakistan. The program aims to consolidate and replicate the successes of cleaner technologies implementation experience in Pakistan. Further to this, the program plans to disseminate the local experience to a larger audience in general and specially to the target industry sectors. The program aims to prepare major industrial sector specific environmental policies. The knowledge premises of CPP is the implementation of environmental solution packages executed directly under CPP, successful execution of environmental technology programs in different sectors of Pakistan under other projects, individual industrial unit level successful implementation of environmental solutions, and local & international researches on the subject. Cleaner Production Program provides the window of opportunity for systematic adoption of environmental solutions in a cost effective framework along with some pay back benefits. Savings from cleaner production options are of reasonable size and provide good justification for the implementation of full environmental solution package under long-term pay back periods. The expected results, as output of CPP, would support industries to comply with National Environmental Quality Standards (NEQS) and help to achieve ISO 14000 certification.

Source: CPP-Pakistan

3.3 Eco-Industrial Networking –NIA Case study

An Eco-Industrial Networking Exercise in Naroda Industrial Estate, Ahmedabad, India (UNEP.DTIE)

NIA (Naroda Industrial Estate), was the first to be created by the Gujarat Industrial Development Corporation as early in 1964. Today there are nearly 900 industries employing roughly 30,000 people. A further 40,000 people can be considered to depend indirectly on the industrial estate for their livelihood. Approximately 26 percent of the industries in the Estate fall into the chemicals category; predominantly dyestuff and dye-intermediates. Other types of chemical production are plastics (5 percent), pharmaceuticals (3 percent), and pesticides (1 percent). Engineering (24 percent), textiles (5 percent) and trading companies (9 percent) complete the picture of significant industrial sectors within the estate. The need to enhance environmental performance beyond mere compliance has led some firms in the estate to investigate more proactive approaches, such as Cleaner Production.

A combination of environmental and economic pressures has led firms in Naroda to make process improvements so as to improve their resource efficiency and hence their profitability. They have achieved this mainly through a Cleaner Production approach that has helped them to enhance individual environmental performance too. This now sets the scene for them to enlarge the scope of their activities and co-operate with different companies to look for recycle, reuse and resource recovery opportunities. A study revealed that a wide variety of wastes are being generated in the chemical industries, particularly in the manufacture of dyestuff and dye-intermediates (See Box 8).

The most important wastes generated by this industrial sector are iron sludge from the Bechamp reduction process; waste acids, in particular sulphuric and hydrochloric acids;

chemical gypsum with varying content of calcium sulphate and chlorides; sludge containing sodium chloride and sodium glycolate, and boiler ash.

Using the information on the types of waste available, opportunities for Eco-Industrial Networking within the industrial estate were explored. The study revealed that some Eco-Industrial Networking activities, or local partnerships, were already taking place in Naroda Industrial Estate. Based on these existing cases of resource recovery and the potential reuse of materials, wastes were classified into those with commercial value (C/V) and those without commercial value (NC/V). Further options to seek ways of revalorizing NC/V wastes, and look for higher (environmental and economic) value recovery options for C/V by-products or waste were analyzed.

Box 8: Overview of Wastes Generated by Naroda Industrial Estate,

- Mild Steel Scrap C/V Hulled Sesame Seeds NC/V
- Cast Iron Scrap C/V Natural Rubber NC/V
- Aluminium Scrap C/V Synthetic Rubber NC/V
- Cast Iron Powder & Dust C/V Raw Rubber NC/V
- Stainless Steel Scrap C/V Treated Wastewater NC/V
- Carbide Waste NC/V HCl C/V
- Rice Husk C/V Cotton Yarn Waste NC/V
- Food Industries Waste NC/V Mixed Pottery Waste NC/V
- Jute Waste NC/V Broken Marble Tiles NC/V
- Chemical Gypsum NC/V Marble Powder NC/V
- Iron Sludge NC/V Grey Cloth Yarn NC/V
- Spent H2SO4 NC/V Polyester Waste NC/V
- Spent Earth NC/V Waste Paper NC/V
- Soap Stock C/V Mixed Cotton Waste NC/V
- Boiler Ash NC/V

C/V - Commercial Value; NC/V - No Commercial Value

The 20 possible partnerships identified through the study revealed a high potential for reusing, recycling or recovery of the following five materials:

1. Chemical gypsum
2. Biologically-degradable wastes
3. Mild steel scrap
4. Spent sulphuric acid
5. Iron sludge

An analysis of the process for recovering the gypsum as a raw material confirmed that it is economically viable. Gypsum generated by 19 chemical industries in the estate through neutralization of their acidic wastewater with lime had a potential use in the cement industry, subject to complying with certain specifications.

Biodegradable waste is produced by 9 companies in the estate. The total amount of waste is approximately 10,000 kg of solid material and nearly 90,000 liters of liquid waste per year. Digestion of this biodegradable waste had a potential to generate biogas as an

energy source for either the industrial estate or a housing development located nearby. An economic analysis has shown this energy recovery process to be extremely favorable.
While sulphuric acid is produced as a waste by 17 chemical industries, 16 engineering firms generate mild steel scrap. Both waste materials are possible raw materials to make ferrous sulphate, a chemical used in primary wastewater treatment at the CETP (Central Effluent Treatment Plant).

Other possible partnerships that have been identified in the industrial estate, includes using spent sulphuric acid in the manufacture of phosphate for fertilizer, use of iron sludge to prepare synthetic red iron oxide, an alternative application for chemical gypsum in the production of plasterboard, energy conservation, and a reduction in raw material consumption, in the ceramic industries.

Reuse, recycle and resource recovery activities have been a very useful tool to initiate an Eco-Industrial Network within the estate. The particular value of this step-wise approach has gradually encouraged the industries in the estate to focus not only on their individual environmental performance but also on the synergistic effects resulting from the large number of companies concentrated within the estate.

4. Future Prospects of 3R Activities and Implementations

Rapid urbanization in the Asian countries (Korea, Japan, Singapore. etc.) has equally affected the South Asian counterparts. In this race towards urbanizations, many developing countries have witnessed the overflowing of waste and depletion of natural resources at an alarming rate. Governments are becoming more aware of polluting sectors, and many NGOs and private organizations are raising their voices against violations. One recent example could be the failed recycling project of French Battle ship ‘Clemenceau’ at Alang ship yards in Gujarat, India.

It is also high time to learn from developed countries, about exploiting the existing resources in a sustainable way or with minimum environmental impacts. With huge investment demands from Asia’s expanding cities for infrastructure investments, it will require special attention to promote various positive practices and implement new activities. Emphasis should also be laid on developing policy and mechanisms to promote 3 R activities at community and institution level and integrating locally-tailored solid waste management systems based on upstream waste minimization and sound downstream disposal, emphasizing strong community participation throughout.

4.1 Promoting Green Procurement

New government regulations in Japan and the Republic of Korea require the adoption of green procurement practices, which will serve as models for other countries in Asia and

the Pacific. Japan has implemented a law concerning the Promotion of Procurement of Eco-friendly Goods and Services by the State and Other Entities. Each ministry and agency is required to track annual purchases and report them to the Ministry of Environment. The law also requires manufacturers or service providers to provide information on the environmental impacts of items they offer for sale. Also, a Basic Policy on Green Purchasing was released in March 2004. About 45 types of eco-friendly goods and services are specified in the Basic Policy with procurement target guidelines for each

The Republic of Korea introduced similar mandatory green procurement for 20,000 public institutions in 2005. The Green Purchasing Law adopted in Dec 2004 and enforced in 2005 obligated public agencies to purchase environmentally friendly products or Eco-Products. Criteria for the eco-products are set by the Ministry of Environment in addition to Purchasing Guidelines for Eco-Products. It also details public agencies to announce, practice, and report annual performances in purchasing Eco-Products. It also awards preferential grants of environment-related subsidies to local governments. In order to enhance and promote this novel approach, KOECO (Korea Eco-Products Institute) was established for information dissemination, capacity building and developing criteria. The Korean Green Purchasing Network, established in 1999 based on Green Consumer Network also draws up purchasing guidelines, publish eco-products catalogue, give awards, conduct survey, etc.

The Thai Green Purchasing Network founded in 2004 under the Greening the Supply Chain (GSC) Model of the Thailand Environment Institute defines concepts and definitions of Green Purchasing and Procurement and Green Product in Thailand. It also gathers information and materials related to green-products and disseminates to public. Besides organizing information exchange forums among members and other organizations, it also provides guidelines about Green Purchasing procedure best practices (Kataoka, 2006).

4.2 Promoting Efficient and Clean Energy

There is a rapidly growing demand for the expanded use of renewable sources, increasing energy efficiency, wider application of technologies for energy production and use that can reduce both local and global environmental impacts consistent with 3R principles. Many cities are already experiencing severe shortage of sites technically and geographically suitable for landfills, and this creates greater pressure for waste reduction and application of new management and technical approaches. These include waste-to-energy, and methane capture systems that may also be eligible for financing from expanding global carbon markets.

4.3 Awareness Activities - Knowledge Management

Although production and consumption is rising, awareness of citizens, corporations and governments is still low toward waste issues. There are many stakeholders involved in

working toward a recycling-based society, and all are needed to participate to overcome the sheer inertia of resistance to change. Therefore, it is important to enhance public awareness of 3R issues by coordinated action through environmental education and dissemination of information on successful inter-stakeholder partnerships.

4.4 Promoting a Circular Economy (CE)

The concept of CE should be promoted in the South Asian countries not only to resolve the waste issue but also to conserve its natural resources. Neighboring countries like Japan, China and Korea are moving forward successfully in this concept. There are a number of ways to define the term Circular Economy (CE). The accepted working definition may be interlinked to manufacturing and service businesses seeking the enhancement of economy and environmental performance through collaboration in managing environmental and resource issues. The theme of the CE concept is the exchange of materials where one facility's waste, including energy, water, materials - as well as information - is another facility's input. The new term that is also used widely is the 'Eco-Industrial Cluster' or Industrial Symbiosis. These activities, if exercised correctly, could prove a stepping stone towards sustainable Asian cities and possibly the best gift for our future citizens.

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6. Abbreviations

AIT	Asian Institute of Technology
BETL	The Burns Environmental and Technologies Ltd.
CE	Circular Economy
CEA	Central Environmental Authority
CPCB	Central Pollution Control Board
CPP	Cleaner Production Program
CRT	Cathode Ray Tubes
GSC	Greening the Supply Chain
JETRO	Japan External Trade Organization
KMC	Kathmandu Metropolitan City
MCGM	Municipal Corporation of Greater Mumbai
MoFE	Ministry of Forestry and Environment
MSW	Municipal Solid Waste
NCPC	National Cleaner Production Center
NEA	National Environmental Act
NEERI	National Environmental Engineering Research Institute
NEP	National Environmental Policy
NFPO	National Forum of People's Organization
NIMBY	Not In My Backyard
NSSWM	National Strategy for Solid Waste Management
PWB	Printed Wiring Boards
SAARC	South Asian Association for Regional Cooperation
SOM	Senior Official Meeting
SWM	Solid Waste Management
SWMRMC	Solid Waste Management and Resource Mobilization Center
UNDP	United Nations Development Program
UNEP	United Nations Environment Programme
UNEP- RRC.AP	United Nations Environment Programme, Regional Resource Centre for Asia and the Pacific
UNEP-DTIE	United Nations Environment Programme, Division of Technology, Industry and Economics
UNIDO	United Nations Industrial Development Organization
URC	Urban Resource Centre
WEEE	Waste Electronic and Electrical Equipment
WWF-P	World Wildlife Fund –Pakistan

'Reduce, Reuse, Recycle: The 3Rs in South Asia'

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3 R South Asia Expert Workshop 30 August - 1 September, 2006
Kathmandu, Nepal

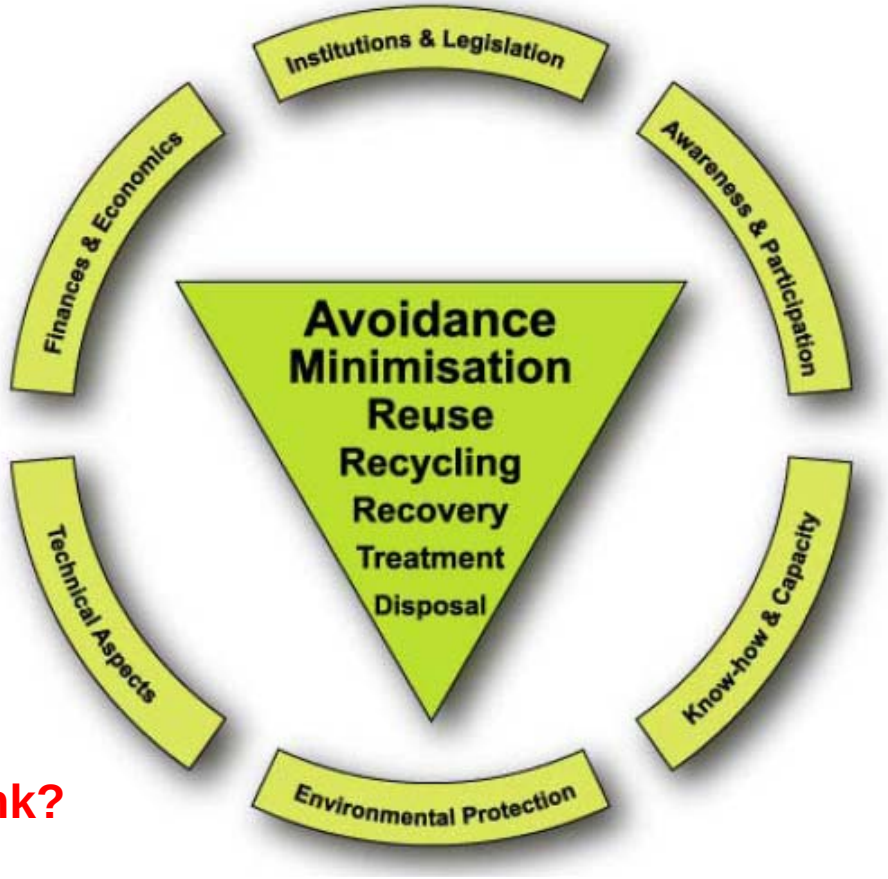
3Rs in South Asia

Waste Management

No SILVER BULLET available to solve the waste problem

Major Barriers;

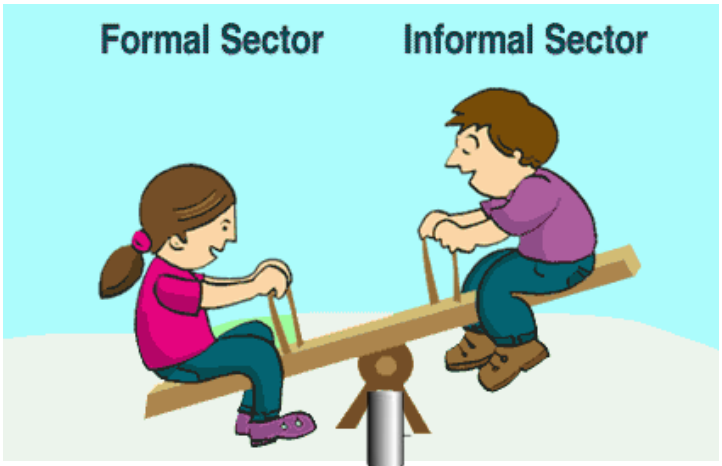
- Technical feasibility
- Social acceptability
- Economic realities and
- Political acceptability
- Public acceptability
- Geographical condition



Is it 3R or 4R --- recovery and rethink?

3Rs in South Asia

Status Quo



Main actors/ contributors to 3R & SWM

Informal sector

2R – Reuse & Recycling

Scavengers, middle-man, waste dealers, cottage or small-scale recyclers

Formal sectors

1R - Reduce, Legislations, Capacity building, Municipalities, NGOs, CBOs, Intl. Orgs & Private Agencies

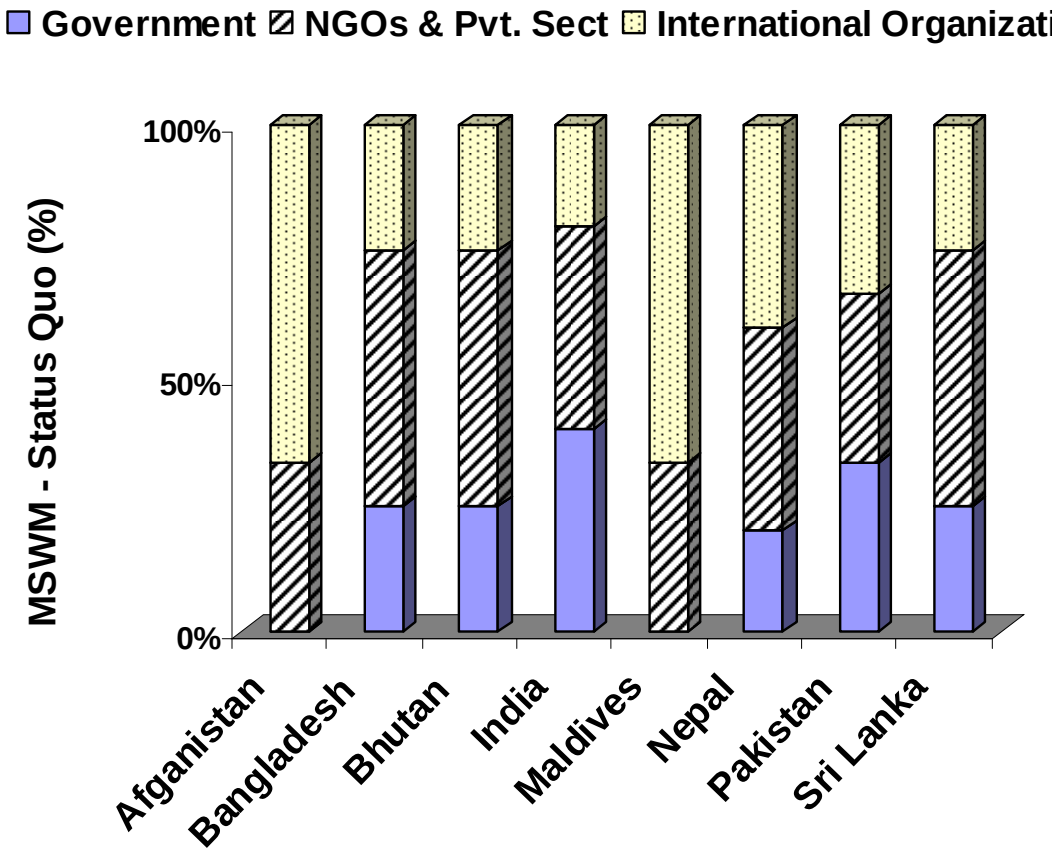
Waste Management

20 – 30 % of generated waste is recycled by Informal Sector

3Rs in South Asia

Status Quo:

Government and Stakeholder involvement in 3R and MSWM



3Rs in South Asia

Typical Waste management system in South Asia as viewed by Policy Makers and Technocrats

- Household waste generation and storage
- Reuse and recycling on household level
- Primary waste collection and transport to transfer station or community bin
- Management of the transfer station or community bin
- Secondary collection and transport to the waste disposal site waste disposal in landfills/ open dumps

What about scavengers!

Are they not included in the waste management hierarchy?

3Rs in South Asia

Pollution Management in South Asian countries

At Industry level: Controlled by either;

- Polluter Pay Principal or
- Pre-cautionary Principal

- So 3R are more active...in this sector.

At Municipal level:

It is not easy to implement..

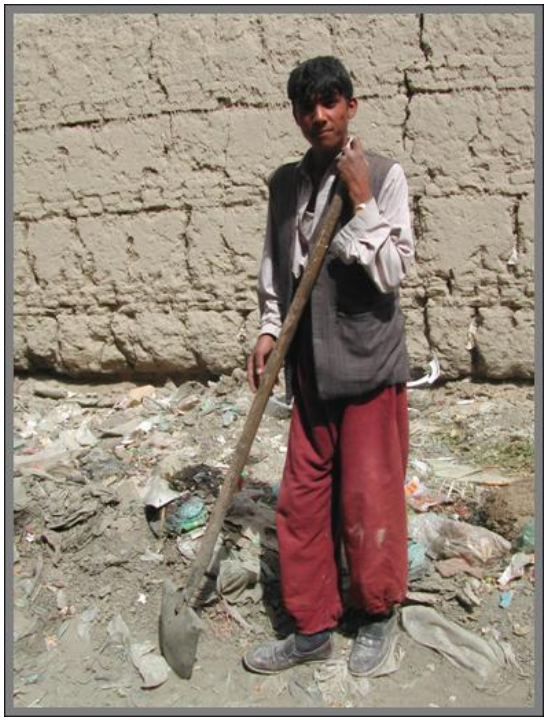
Could privatization be an option?

3Rs in South Asia

Afghanistan:

- Uncontrolled Waste Disposal
- Construction and demolition waste
- Huge potentials for 3Rs, if implemented

Abandoned Soviet Military equipment



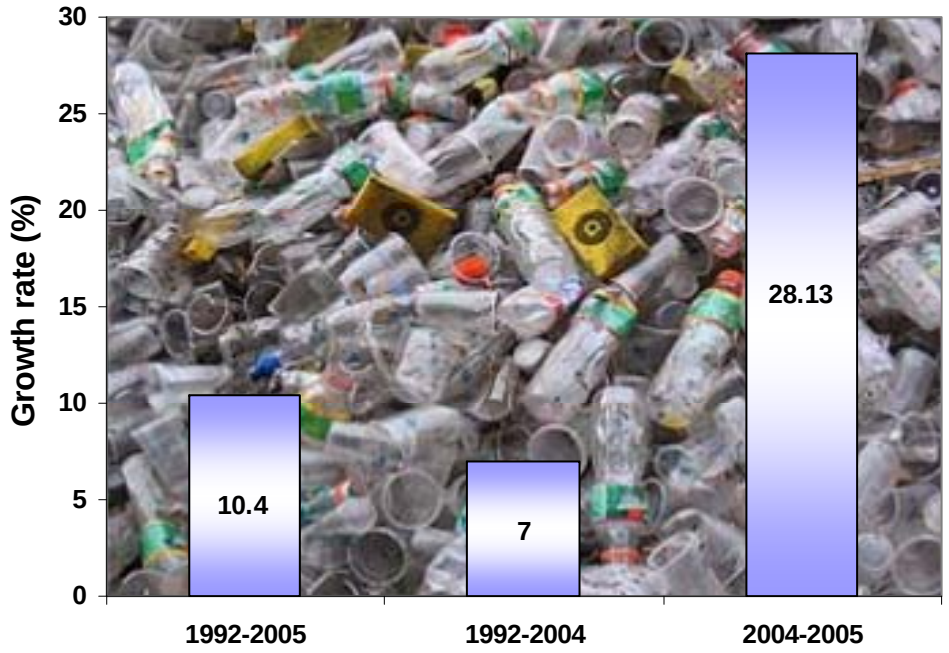
Team in Action:

- Facility Engineer Team (FET)- US Army
- ICS-UNIDO Proposes to Help Afghanistan Recycle Building Debris

3Rs in South Asia

Bangladesh

- Variation in waste generation; Wet season (more) and Dry season (less) (almost 30-40 %)
- Municipal waste dominated by organic fractions - composting
- Increase in Plastic waste (Dhaka) - recycling



Plastic waste growth rate over ten years (Dhaka)

Waste Concern (Data)

50,214 tons of plastic waste (annually) is disposed in the city at the rate of 137.57 tons/day.

At present 51% is recycled

3Rs in South Asia

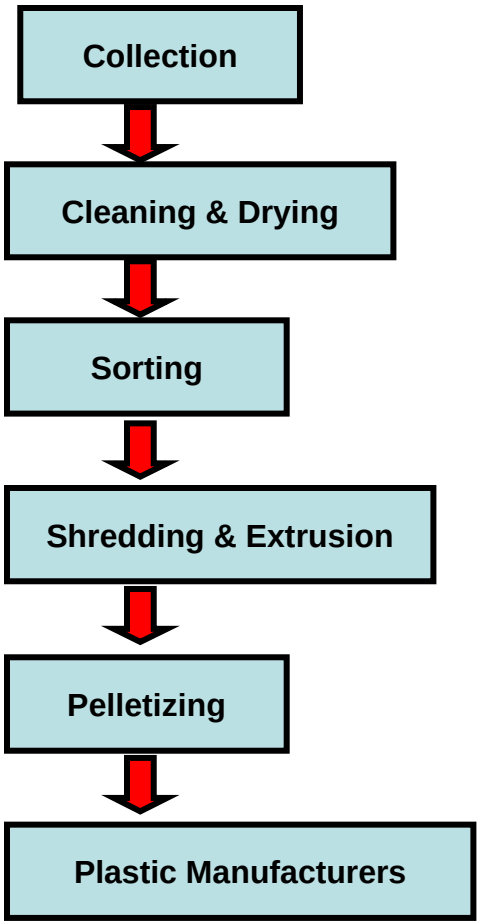
Bangladesh: Recycling by Informal Sector

- Recycling of 4- 15 percent of the total generated waste
- E-waste recycling picking its pace!

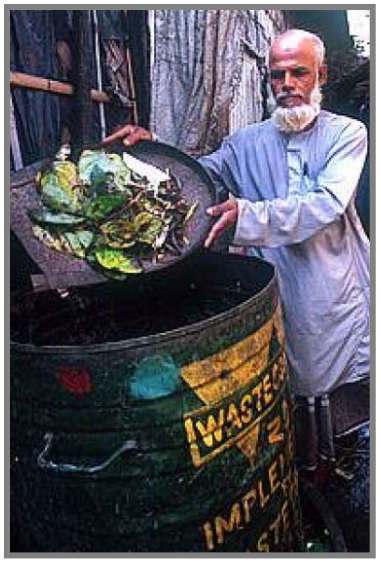
3Rs in South Asia

Bangladesh: Independent Actors/ NGOs

- NGO/ Private sector participation-(Waste Concern)
- Plastic recycling & Composting of organic waste



Community based composting & Barrel composting



3Rs in South Asia

Bhutan:

- Waste/ E-waste disposal emerging problem in Thimphu (UNEP)
- Existence of informal recycling system
- 70 – 80 % solid waste is domestic
- Per-capita waste generation about 0.3 kg/day (increasing)

Mobile Anaerobic digesters as Recycle Agents..

3Rs in South Asia

Bhutan: Private Sector participation

- Environmental Education & public campaign
- Promoting recycling and source separation
- Ban on use of plastic reinforced (2005)
- Maximum effort paid for recycling either locally or to be transported to India for recycling

School Children participating in waste segregation campaign

Team In Action

- NGO, Royal Society for Protection of Nature
- Japan International Cooperation Agency – JICA
- United Nations Children's Fund - UNICEF
- United Nations Environment Programme (UNEP)

3Rs in South Asia

India: Recycling by Informal Sector

- In Delhi, about 2000 tons of garbage per day is sorted by scavengers.
- Cottage and household recyclers (no registration)
- E-waste recycling picking its pace!

About 80,000 Scavengers in Delhi alone

Dismantling E-waste (Delhi)

3Rs in South Asia

India: Informal Sector

- Open dumping & scavenging (waste recycling)

Dumpsites in Chennai

3Rs in South Asia

Kodungaiyur dumping ground (KDG) Chennai

Open burning to recover metals and other scraps

3Rs in South Asia

India: Brighter side

- Private sector participation-(Metro cities)
- Plastic recycling & Composting of organic waste
- Chennai – Exnora (Private Waste Company)
  - Promoting household composting
  - Waste segregation
  - Zero waste approach

3Rs in South Asia

India: Brighter side

- ✓ Non-biodegradable Garbage (Control) Ordinance, 2006, Maharashtra, India
- ✓ Recycling Schemes:
- ✓ Charter on Corporate Responsibility for Environmental Protection (CREP)
- ✓ Recycled Plastics Manufacture and Usage Rules - amended in 2003
- ✓ Review and Finalization of NEP- (National Environmental Policy)
  - Adoption of cleaner technology, strengthening of the informal sector system of collection and
  - Recycling of various materials and develop and implement strategies for recycle,
  - Reuse and final environmental friendly disposal of plastic waste.

3Rs in South Asia

Maldives:

Major barriers to delivering efficient waste management services in the Maldives (UNDP)

- Lack of government investment in waste management infrastructure and equipment,
- Absence of potential cost recovery mechanisms,
- Inadequate institutional capacity to fully execute mandated responsibilities,
- Inadequate level of education and awareness,
- Weak legislative framework and
- Limited involvement of the private sector in service delivery were identified as.

3Rs in South Asia

Maldives: International Organizations

- Domestic waste handling plus Tsunami waste recovery
- About 290,000 cubic metres of waste and debris (Tsunami)

Team in Action:

- ✓ Canadian International Development Agency (CIDA)
- ✓ Canadian and Australian Red cross
- ✓ United Nations Development Program (UNDP)
- ✓ United Nations Educational, Scientific and Cultural Organization (UNESCO)

3Rs in South Asia

Nepal: Prevailing Situation

- Slow decision making and weak implementation are worsening the solid waste management crisis in Kathmandu
- Lack of a management system is fast giving the problem disastrous proportions.
- At present, waste is dumped along and in the Bagmati River, in addition to some dumping in open spaces.

3Rs in South Asia

Nepal: Municipalities & Private organizations

- Promote organic composting
- Door-to-door collection

Team In Action

- Kathmandu Municipal Cooperation - KMC
- Rotary Club
- Japan International Cooperation Agency - JICA
- Zero Waste Nepal

3Rs in South Asia

Nepal: Recycling by Informal Sector

- 300 tons of waste per day (70% organic)
- 5% waste recycled in Kathmandu
- PET bottle waste increasing – tourism and economic growth

3Rs in South Asia

Pakistan: (Karachi)

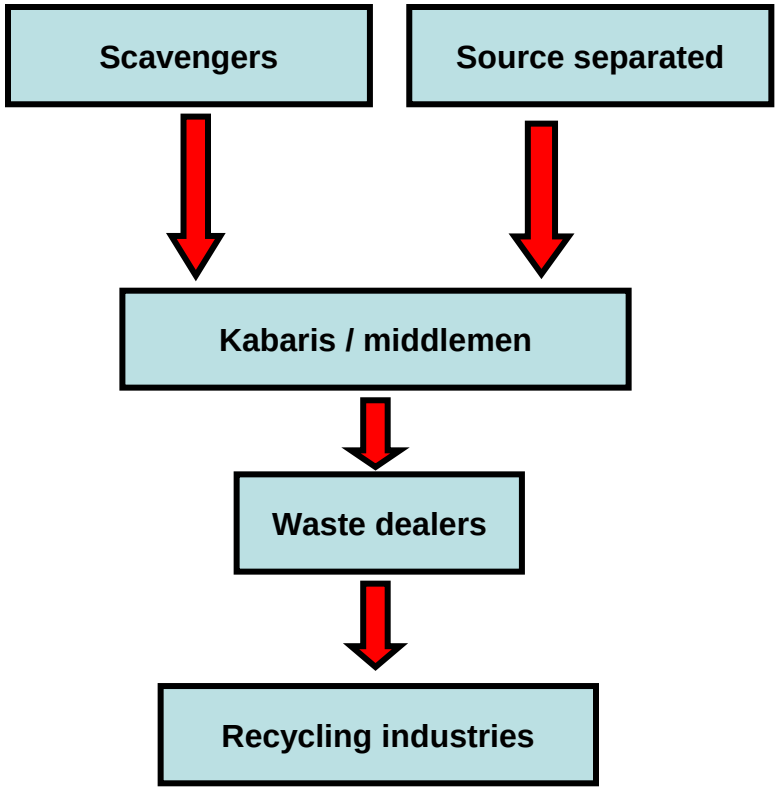
- Poor management of the solid waste system.
- Generates About 7000 tons mixed garbage daily
- Generation rate increasing by 2.4% per year
- About 40 % waste not collected
- Efforts on E-waste recycling (Informal)

Open burning of waste

3Rs in South Asia

Pakistan: Recycling by Informal Sector

- Separated at source by housewives 800 tons per day
- Recycled by Informal Sector 1,500 tons/day
- 21,000 waste pickers (young Afghan boys)-Karachi neighborhood



A typical recycling shop in Karachi

3Rs in South Asia

Pakistan: Formal Actors and Organizations

Activities undertaken

- Development of awareness program for industry and community
- Recycling campaigns – post consumer waste
- Purchasing of Dry Garbage & organic waste – household level

Main Actors:

- UNIDO-NCPC (National Cleaner Production Center) with Tetra-Pak
- Waste Busters, Green Earth Recycling, Nestle/CDL
- Safai Kamai Bank, Gul Bahao
- Pakistan Environment Welfare and Waste Recycling Program (PEWWARP)
- District Municipal Committee (DMC)
- Karachi Municipal Corporation (KMC)

3Rs in South Asia

Sri Lanka: Prevailing Situation

- Colombo daily waste generation → about 6400 tons
- Dominated by Household market and commercial establishments
- Mixed waste stream dominated by Food waste
- Informal sectors are the main recyclers

Haven for Scavengers of all kind

3Rs in South Asia

Sri Lanka: Formal Actors, Pvt. Waste companies and Organizations

Activities undertaken:

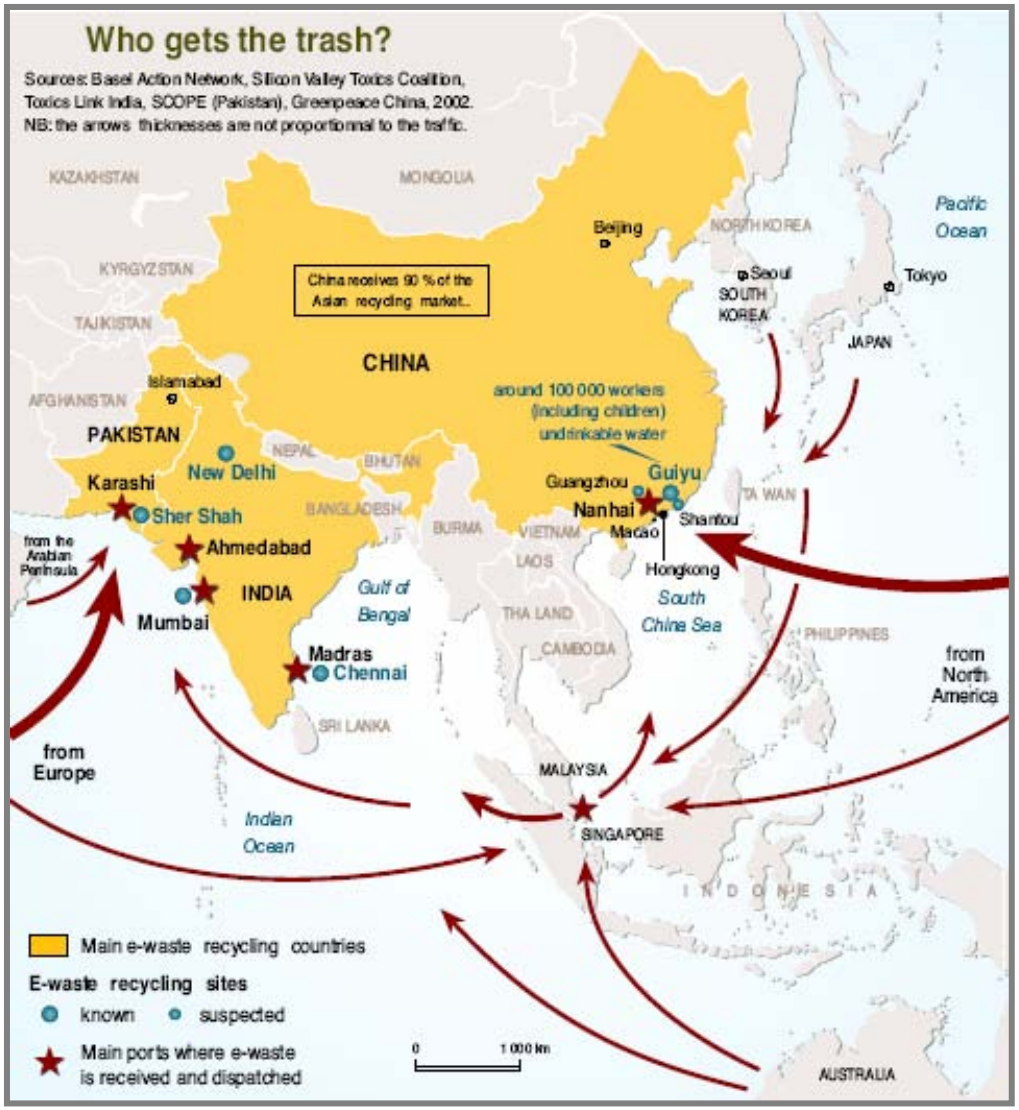
- Household composting of organic waste
- Source separation and storage of household waste
- Refuse collection scheme
- Plastic waste separation, processing and recycling
- Organic waste composting

Main Actors:

- Local Authorities and Pradeshiya Sabha(s)- MoEF
- NGOs, CBOs, e.g National Forum of People's Organizations (NFPO), Seth Sevana
- Abans Environmental Services Ltd
- The Burns Environmental and Technologies Ltd. (BETL)

3Rs in South Asia

E-waste recycling circus



Who gets the trash?

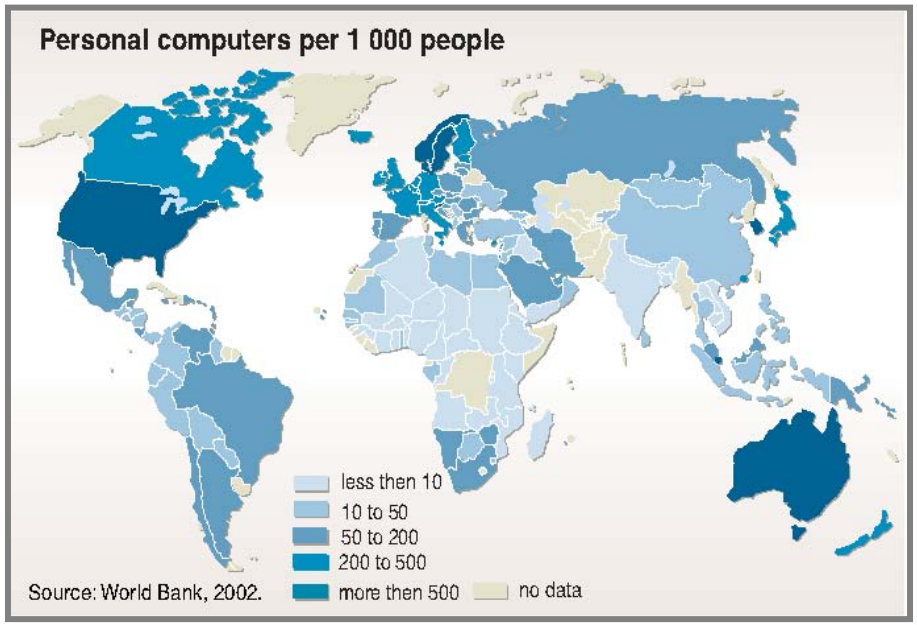
3Rs in South Asia

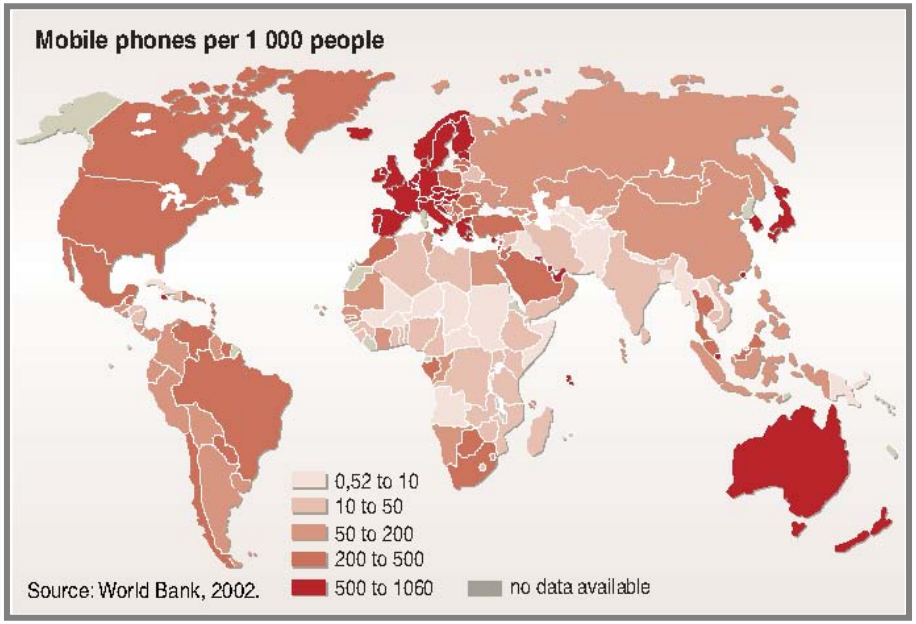
E-waste / Toxic waste recycling: How informal it could get?

Most of these (future E-waste) waste will finds its way (sooner or later) in Asian Countries; India, Pakistan, Bangladesh, China, Sri Lanka.

80% of E-waste from US shipped to India, Pakistan & China (2005)

- **Cheap labor & poverty**
- **No stringent law on imports**
- **Lack of Healthcare awareness and easy income**



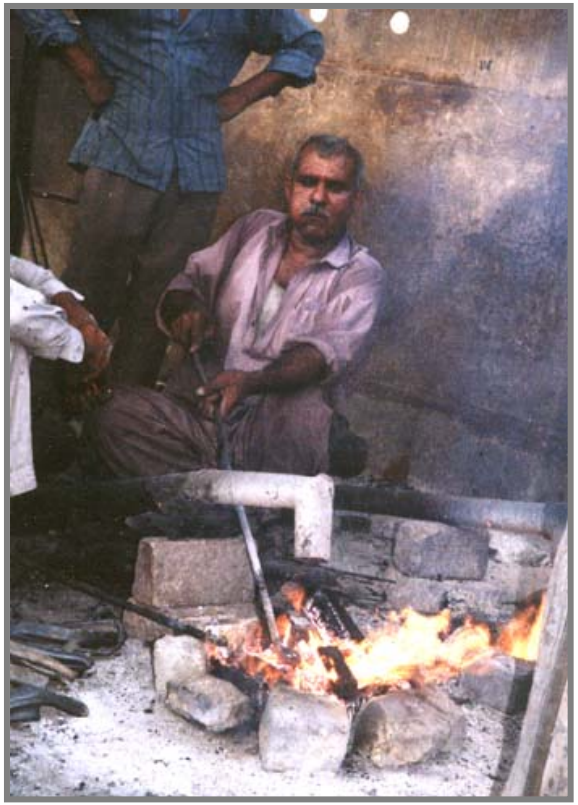


China: Banned the imports of such goods (legally), but still it is getting through…!

3Rs in South Asia

All that glitters is not Gold!

Delhi:
25,000 workers in scraps yards,
10,000 – 20,000 tons of E-waste handled every year



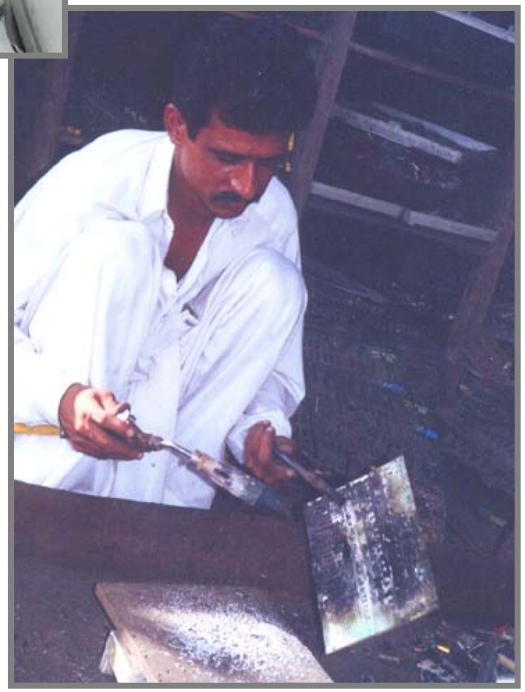
Circuit board:

Gold recovery - acid treatment,
Copper recovery - heating,
Crushing of boards by custom-made crushers

3Rs in South Asia

Just another fine business day!! Techno-trash

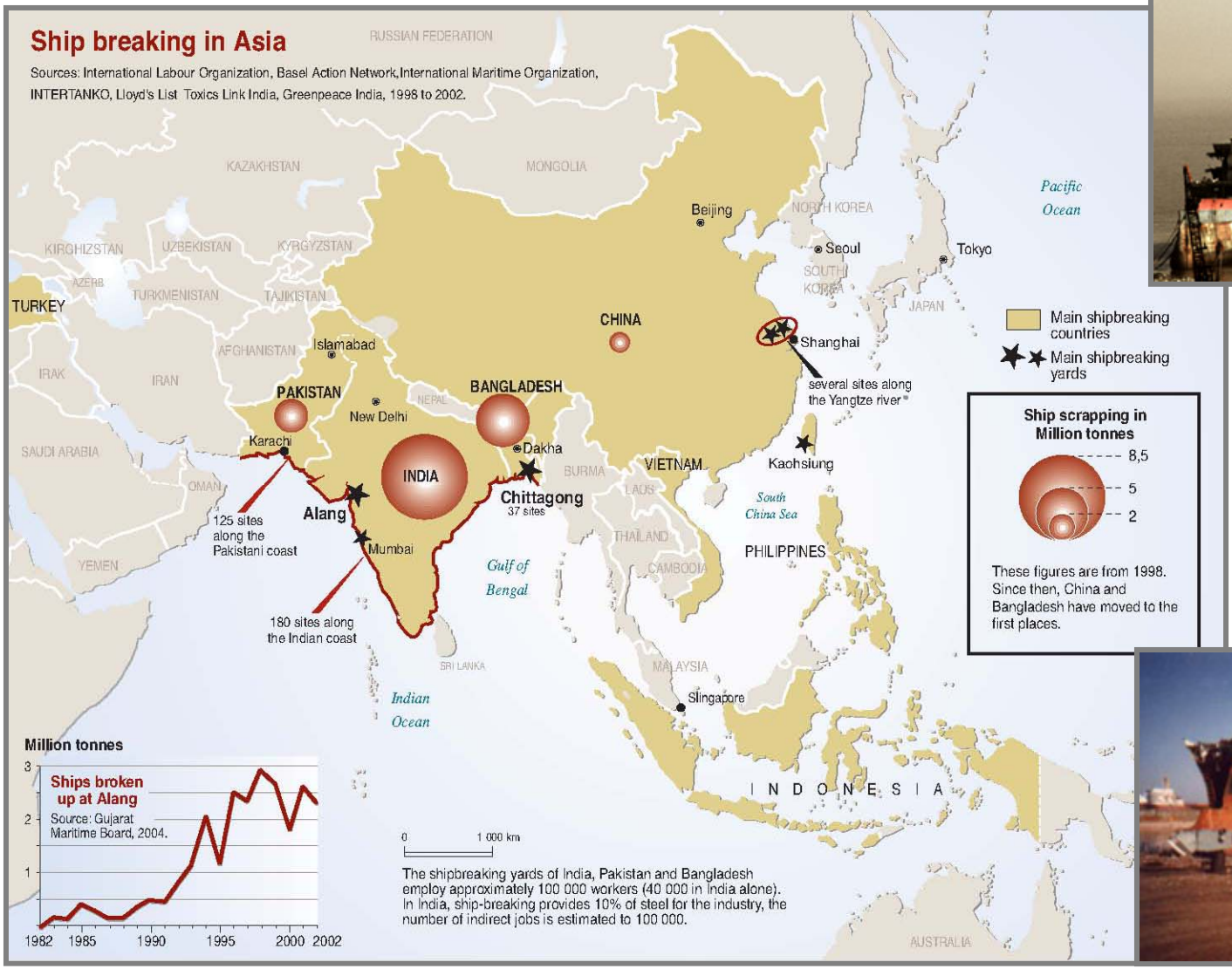
Monitor: Dismantling using screw drivers
(the broken CRTs are dumped)



Cables and wires : Burning or stripping

3Rs in South Asia

Ship Breaking/ recycling! *(Battle over Clemenceau)*



3Rs in South Asia

Failed recycling project *(Clemenceau – French Battle Ship)*

- *Clemenceau; Decommissioned in 1997*
- *Intended Recycling Port: Alang (Gujrat-India),*
- *Main Concern: Asbestos, PCBs and spent Oils*
- *Supreme court banned it from entering Indian water*
- *French president recalls Clemenceau*
- *Credit goes to Greenpeace & other actors*

Clemenceau

Alang Ship Recycling Yard (India)

3Rs in South Asia

Future prospects of 3R activities

- Eco-Industrial Networking
- Promoting Green Procurement
- Promoting Efficient and Clean Energy
- Awareness activities - Knowledge Management
- Promoting Circular Economy (CE)

3Rs in South Asia

Plastic recycling in Thailand – Primary stage