Building an Efficient Waste Management System in the Face of Increasing Natural Disaster and Catastrophic Events ~ A Win-Win Solution for People, City Authority, Environment and Economy

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What is a resilient city or community?

Resilience is the capacity and ability of a community to withstand stress, survive, adapt, bounce back from a crisis or disaster and rapidly move on. Resilience needs to be understood as the societal benefit of collective efforts to build collective capacity and the ability to withstand stress **(ICLEI, 2011).**

"Cities need to build resilience, not only to climate impacts but to all kind of potential shocks and crises" ***- Konrad Otto-Zimmermann, ICLEI Secretary General and Congress Chair, Resilient Cities 2012***

Climate change mitigation and adaptation should not be treated as two separate goals. Planning priority should be given to measures that contribute to both, such as improvement of wastewater treatment systems, green spaces, building standards, and public facilities - **3rd Global Forum on Urban Resilience and Adaptation, May'2012**

Local governments should apply local economic instruments such as charges and taxes for emitters and polluters (carbon, waste water, solid waste, property taxes for vulnerable locations) and subsidies and tax incentives for developments contributing to financing resilience. Private investment, fostered through developments that increase resilience, will be crucial to fund all necessary investment in adaptation. Public Private Partnerships (PPP) should be used from the inception stages of a project, to ensure it is feasible and profitable **- 3rd Global Forum on Urban Resilience and Adaptation, May'2012**

Resilience, in turn, increases the attractiveness and competitiveness of cities for investment by businesses through - lower costs for public services (transportation, energy, waste management, clean water supply, etc.), lower risk of disruption to business, lower long-term insurance costs, job creation in a range of low-to-high skilled occupations – Adapted from 3rd Global Forum on Urban Resilience and Adaptation, May'2012

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Does it represent a resilient society? What would be the impact of extreme weather events?

Waste dumps potentially serve as breeding ground for Malaria, thus having implications in achieving MDGs.

People living in a place 20 times above safe level of lead, arsenic, nitrogen….what would happen during extreme weather events such as flooding?

Source: ADB (2004)

Many children waste pickers at the highly polluted dumping site… is it a resilient society?

Health risks of informal waste pickers: hospital waste (HIV), jagged metal (tetanus) , smoke (PCBs), lead (neural damage), violence (knife cuts), adult behaviour (premature drinking), stress, skin, gastric, respiratory problems

Conventional waste management and the consequences .....what would be water security in the face of climatic impacts and natural disasters?

Source: ADB (2004)

Highly contaminated leachate seeps untreated into groundwater, a source of drinking water….

Water availability is an emerging issue in many countries and some are already heading towards water stress, but water quality deterioration because of industrial discharges and municipal sewage, agrochemicals will further accelerate the issue!

Key Considerations for Disaster Debris Management – Prevention / build your city as a smart city

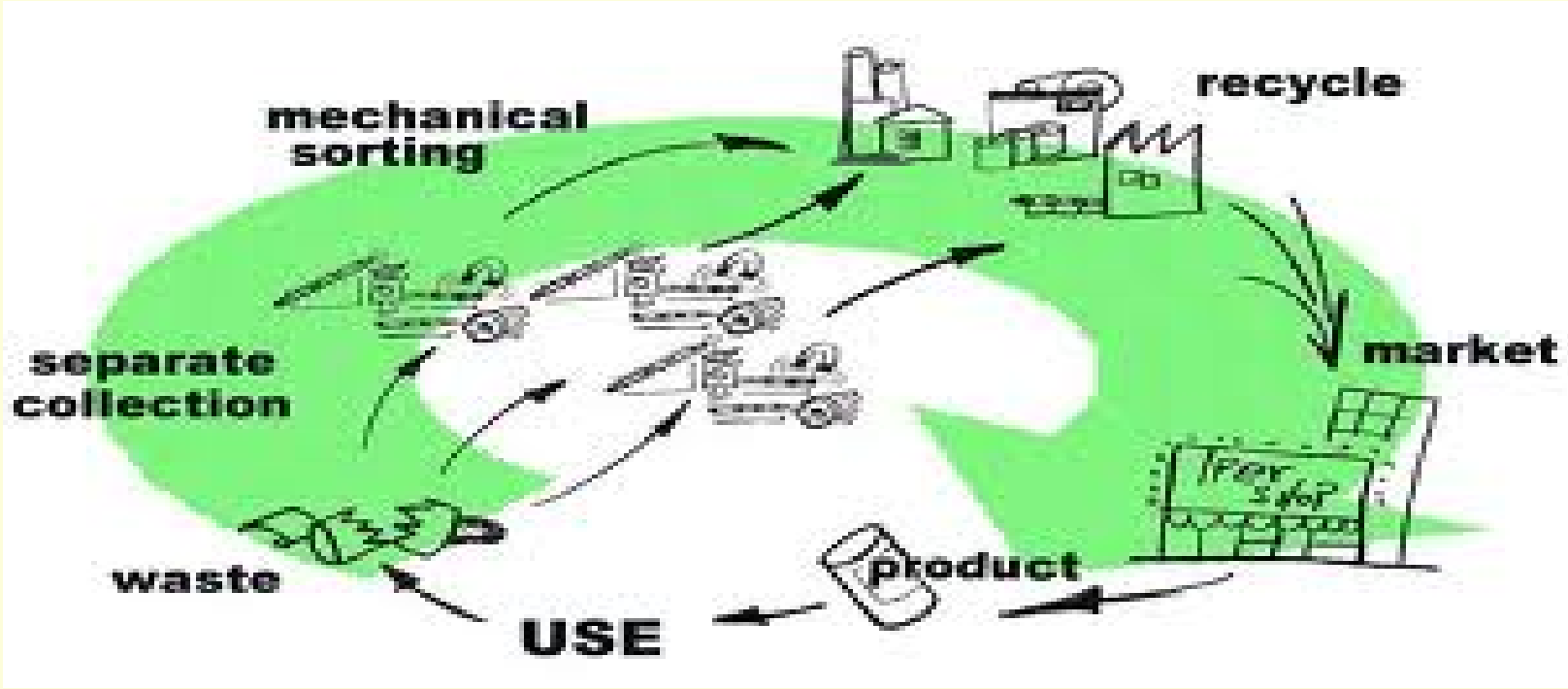
1) Prevention is the best strategy: for example, preventing plastics clogging drains or waterways that reduce their carrying capacity for run off or flooding water, thereby minimizing the impact during flooding events. A robust 3R programme with strong participation of private sector can prevent such a situation to occur during disasters.

Photo Source: thenhindu.com

Photo Source: newindianexpress.com

Key Considerations for Disaster Debris Management – 3R Infrastructure

2) Fast restoring public health and safety is the top priority of the local and national government in the aftermath of any major disaster. The major steps could involve – (a) collection of debris, (b) clear and transparent assessment of the nature and components of the debris, (c) assessment of the toxic and hazardous constituents of the debris and waste; (d) proper sorting and segregation of the debris and waste; (e) storage of segregated waste; (f) recycling of recyclable constituents; and (g) disposal of remaining waste only after all 3R (reduce/reuse/recycle) options are exhausted.



Picture Source: http://glr-vr-eng.beepworld.it/

Immediate availability of adequate temporary storage facilities and infrastructure is indispensable in the aftermath of a disaster.

Picture Source: http://www.wastemanagementrecycling.net

3) Cleaning up of disaster waste and debris presents a serious hazard for employees, contractors and community, hence should be controlled and carefully planned. For instance, a lack of clear understanding on the various affected materials, toxic and hazardous chemicals mixed with general municipal waste streams could lead to serious public health and environmental hazards. What would happen if these mixture of general and toxic wastes are incinerated?

Photo Source: streetnewsservice.org

Photo Source: http://sites.cdnis.edu.hk

Key Considerations for Disaster Debris Management – Technical & Financial Capacity of Service Providers

4. Given the need for state-of-art waste disposal infrastructure for treating such disaster waste, cities and countries need to gradually build regulated treatment and disposal facilities. At the same time, a proper evaluation and careful assessment of the technical and financial capacity of the waste management and disposal contractors should be done.

Photo Source: en.wikipedia.org

Photo Source: www.servwel.com

5. Who is responsible for clean up liability – legal and financial issues? The huge clean up cost poses a significant potential liability for the local and central government. Property owners of previously uncontaminated sites may be facing serious problems in property disposition due to decrease in market value. Countries should develop and introduce appropriate legislative solutions, including insurance policies, to deal with such issues.

Photo Source: www.prwatch.org

Key Considerations for Disaster Debris Management – Institutional Capacity

6. Institutional capacity for rapid assessment of the quantity of disaster waste and debris is important in terms of estimating the associated workload, cost of cleaning up and mobilization of essential resources and services. Estimation of waste volume after a disaster is a significant challenge as all subsequent actions depend on reasonable estimates (UNEP, 2012).

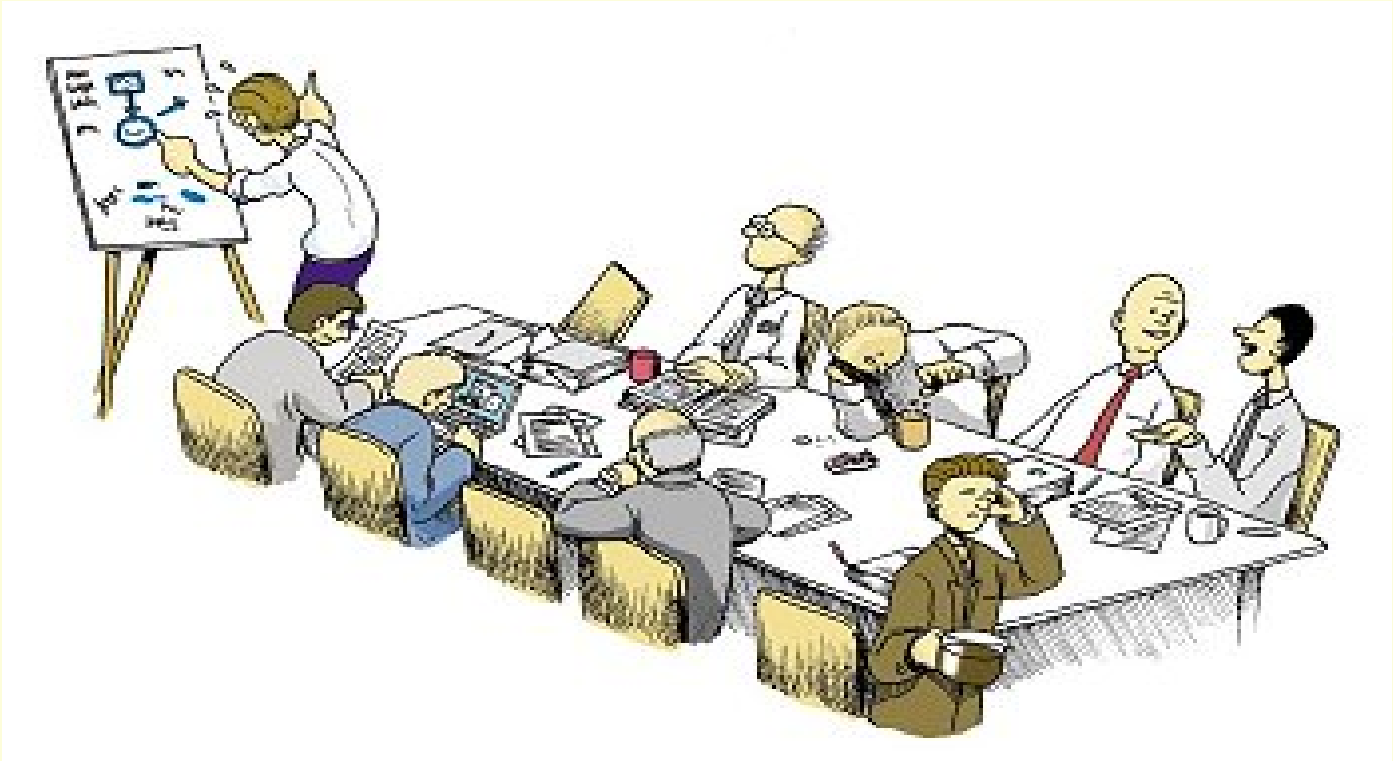


Photo Source: http://www.german-business-etiquette.com

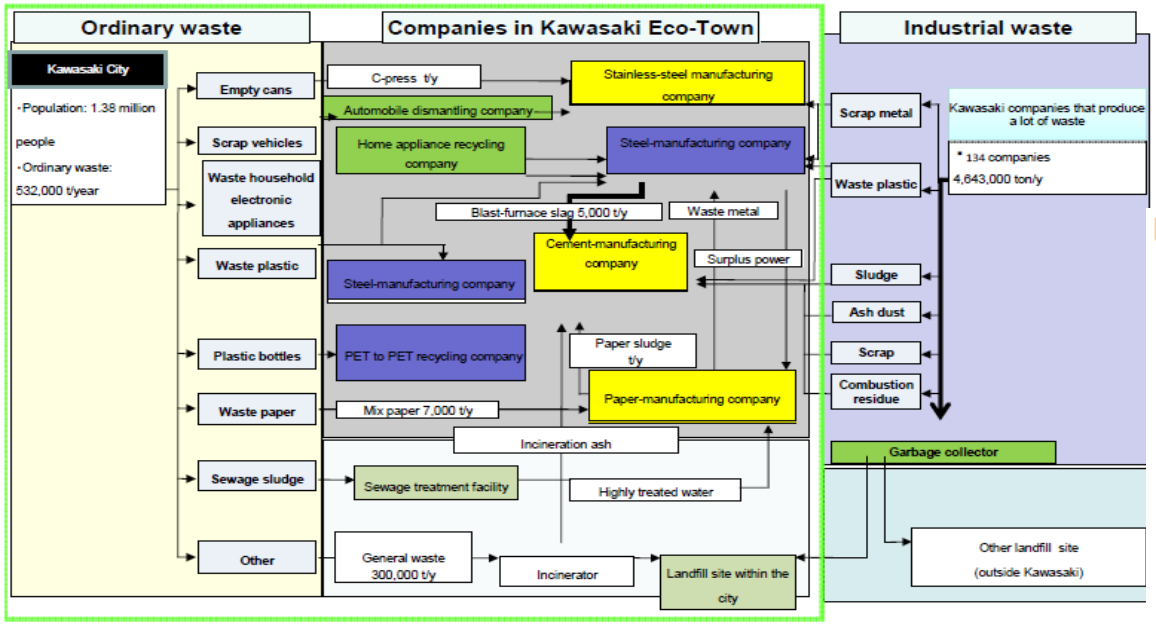
Key Considerations for Disaster Debris Management – Promote 3R policies and programmes and regional network for resource recovery and recycling with economic potential

7. Though land-filling and incineration are some of the easy solutions after major disasters to achieve rapid reduction in waste and debris volume, it is highly beneficial in long run to gradually establish regional network for resource recovery and recycling. For instance, a cement factory in Japan is using some of the disaster debris from 2011 The Great East Japan Earthquake and tsunami as its fuel and feedstock for cement manufacturing (UNEP, 2012).

Key lessons learned from Japanese case: Maximizing waste recovery and recycle while minimizing the need for transportation should be top priority for effective debris waste management.

Photo Source: http://www.theguardian.com

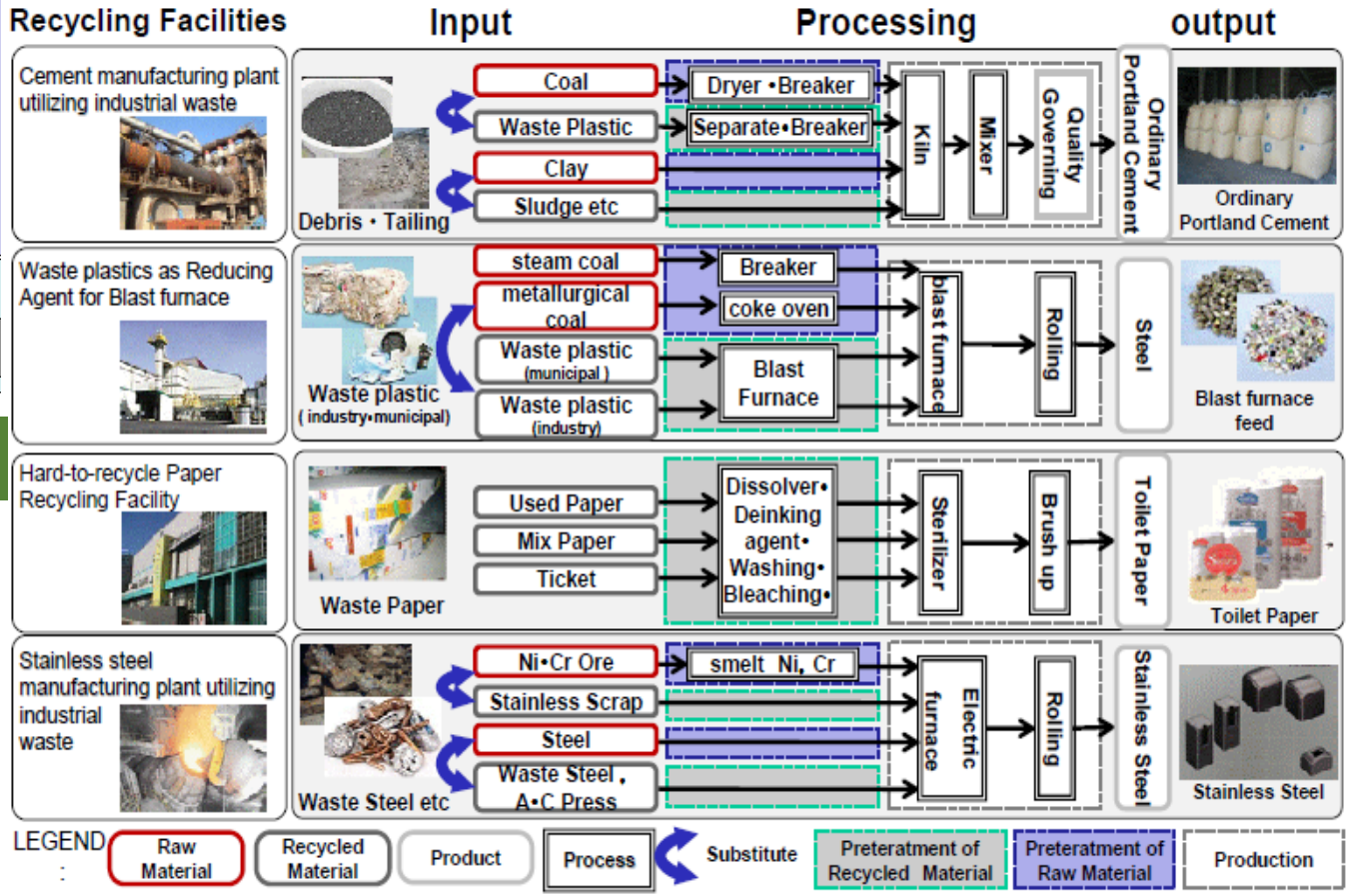
Kawasaki Eco-Town where economy and environment are integrated to create sustainable business opportunities…



Key Features of Kitakyushu Eco-Town

1. revitalization through environmental technologies accumulated in traditional industries
2. Industrial symbiosis through a regional network for resource reuse/recycling
3. local private companies take their own initiative in environmentally sound business operations and contribute to preventing local and global environmental pollution.
4. strong collaboration between R&D industries and private companies on environmental technologies
5. international cooperation in technology transfer

Formation of a Regional Network for Resource Recycling

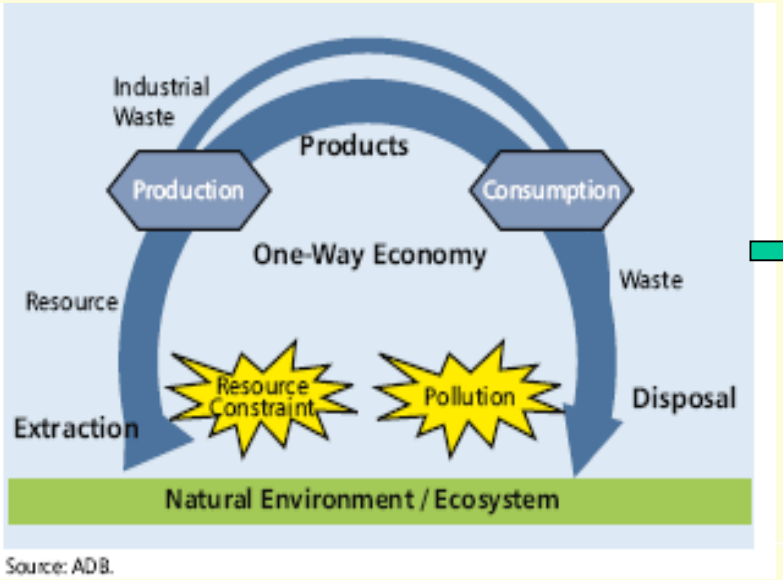


Quantified material accounting for Symbiosis in Kawasaki

Source: SABURO KATO, Special Advisor to the Mayor of Kawasaki for International Environmental Policy, President of Research Institute for Environment and Society
http://nett21.gec.jp/Ecotowns/data/et_b-kawasaki.html R.V. Berkel and T. Fujita et. al. ; Environmental Science & Technology(2009)

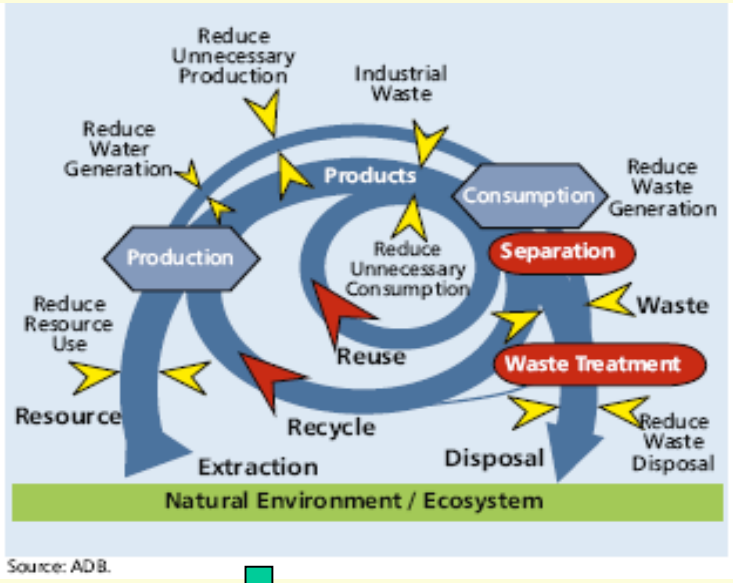
Key Considerations for Disaster Debris Management – Build your city as a resource efficient economy to better tackle the waste management issues in the aftermath of disasters

1. One-way/conventional Economy



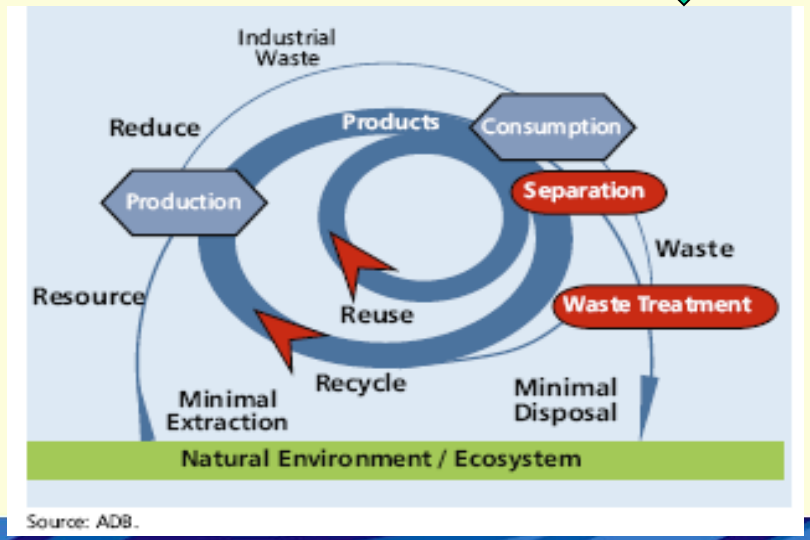
Source: ADB.

2. More resource efficient economy



Source: ADB.

3. Closed Loop Economy



Source: ADB.

1. **one way economy** -> a little effort is made to reduce the amount of materials consumed in production and hence the wastes are produced. Also little effort is made to reuse or recycle those wastes which mainly go for landfill.
2. **greater resource efficiency** -> by reducing consumption and waste of materials, and by reusing and recycling waste/byproducts minimize (per unit of product or services) – quantity of input raw material/energy /water as well as pollution /emission/environmental impact of the residual materials flow that flow to disposal sites.
3. **closed-loop economy** -> nearly all waste/outputs either become inputs to other manufacturing processes or are returned to natural systems as benign emissions rather than as pollutants, e.g, a closed-cycle processing plant takes in freshwater and does not discharge any liquid effluents. Rather, the water is constantly recycled and possibly utilized in the final product itself.

Key Considerations for Disaster Debris Management – Promote Effective Partnerships

- **Partnerships** offer alternatives in which governments and private companies assume co-responsibility and co-ownership for the delivery of solid waste management services. Waste disposal is expensive – financially and in lost resources (substantial inputs of labour, material, energy, land resources for land filling, etc.)

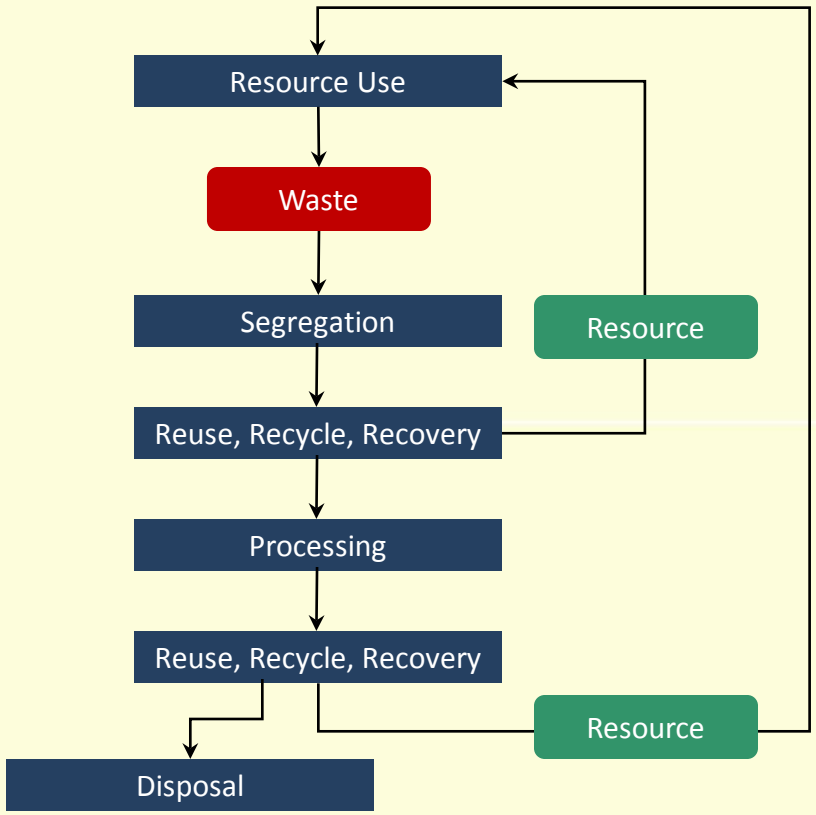
- **Partnerships** combine the advantages of the private sector (dynamism, access to financial resources and latest technologies, managerial efficiency, and entrepreneurial spirit, etc.) with social concerns and responsibility of the public sector (public health and better life, environmental awareness, local knowledge and job creation, etc.).

- **Partnerships** (PPP) are indispensable for creating and financing adaptation measures towards resilient cities which in turn are more attractive for private investments.

- **Partnerships** provide win-win solutions both for the public utilities and private sector—if duly supported by appropriate policy frameworks. Such partnerships could lead to savings in municipal budgets where waste management usually consumes a large portion. The private sector, on the other hand, may use this opportunity to convert waste into environmentally friendly products and energy that could also serve as income generating opportunities.

e.g., Shifting the roles of municipalities from being a 'service provider' to 'facilitator of service', by focusing its activity on planning and management, while a private company takes up the actual day-to-day operation.

Key Considerations for Disaster Debris Management – Take full benefit of informal sector to expand the waste management services and achieve resource efficiency



Low Resource Efficiency

- Manual segregation
- Transfer of materials to formal sector with no value addition
- Low efficiency due to lack of finance and technology knowhow

Low involvement of informal sector

- Infrastructure
- Technology
- Finance
- Institutional Arrangements

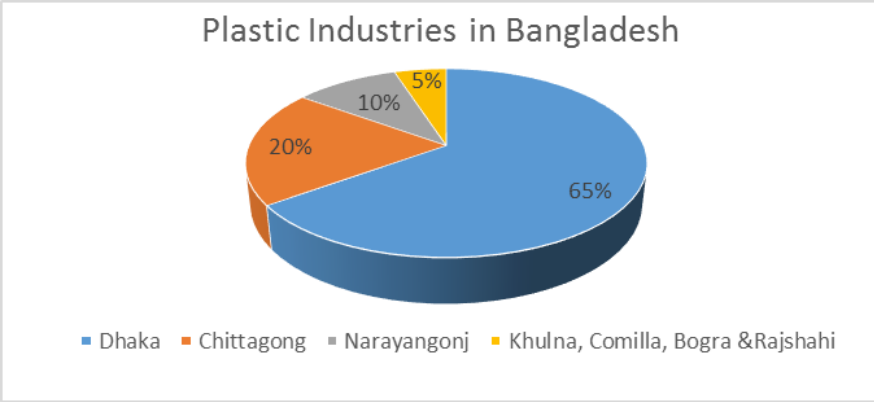
High Resource Efficiency

- Mechanized segregation
- Value addition for better income
- PPP and other institutional arrangements to create green jobs

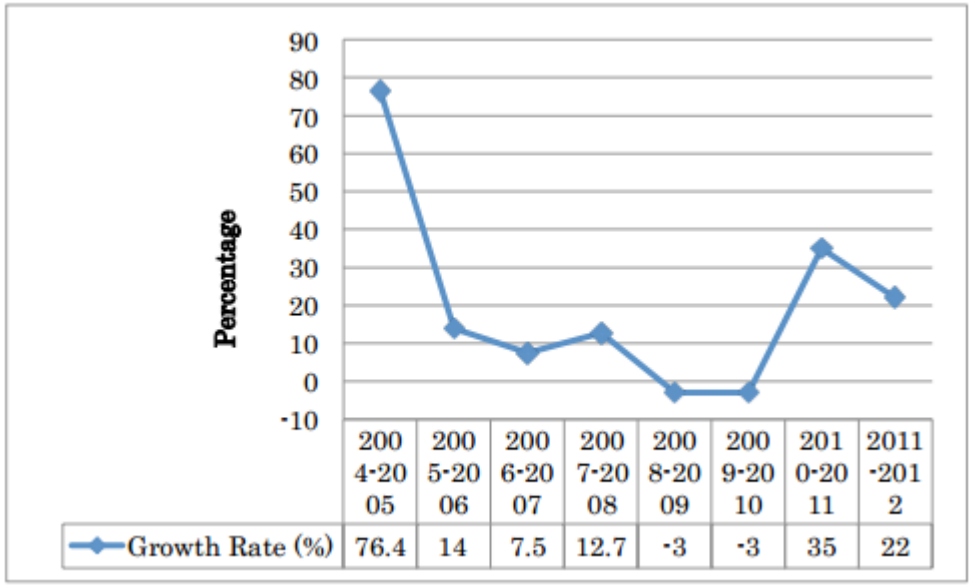
High involvement of informal sector with partnerships

Source: Prasad Modak, Environmental Management Centre, India

Business opportunity: Recycling of plastic waste in Bangladesh



Plastic waste is ranked **12th** in terms of **export oriented sectors** of the country



Growth rate of plastic export

Plastic waste recycling follows direct economic benefit

(a) Less landfilling requirement

(b) Large recycling **industry jobs and economic output**

(c) Direct savings of foreign currency

- Per capita consumption of plastics in Bangladesh is 5 kg per year. The plastic sector constitutes **1.0 of GDP** and provides **employment for half a million people**. Total export earning for both direct and deem exports is about US $ 337 million.

Plastic waste disposed
130 tons/day
47,450 tons/year

→

70% Recycled and used in the country (Except PET)
33,215 tons/year

→

- **Generating** 21,000 jobs
- **Saving expenditure** of Tk3.08 crore by avoiding plastic waste
- **Saving Foreign currency** of US $51 million/ year by avoiding import of virgin plastic.

Source: Waste Concern, Prospects of Green Jobs in Waste Recycling, 2008.

Source: Waste Concern. Plastic waste recycling and its opportunities in Bangladesh, May 2006.

Source: M. Serajul Islam, Prospects and challenges of plastic industries in Bangladesh. Journal of Chemical Engineering, IEB, Vol. ChE. 26, No. 1, December 2011

Business opportunity: Recycling of Lead acid battery in Bangladesh

- Recycling of lead acid batteries are taking place in an **environmental sound manner** to adopt public policy for **economically efficient** and also keeping in view the **health hazards arising from exposure to lead**.
- Lead acid battery has more than **ten parts** such as, plates, separator, hard rubber container, lead, bitumen, battery cap, cork, connectors, electrolyte, electrical accumulator, negative plate or anode positive plate or cathode, sealant and chemical compound: CFCs, carbon tetrachloride, halons, methyl chloroform, lead, Sulphuric acid.
- Approximately, **3,420 tons of lead are recovered per year** from ULABs in Bangladesh. This allows to meet **60%** of the total lead requirement of the country **from secondary lead**.

In recycling process, the price of used battery is increasing by about 100% in each stage of transfer.

Small buyers → Broker → Separator → Re-builder/Smelter

- **Recovered Lead**: 6000 ton/Year
- **Savings**: 4.73 millon US$/year

(avoiding lead import using foreign currency (60% recycling rate at present)

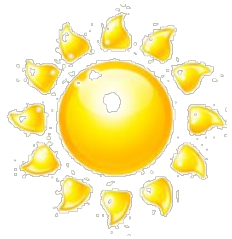
- **Jobs Created**: 6000 new jobs

Source: Kazi Arif-Uz-Zaman, Md. Ahasan Habib, Subrata Talapatra, Mostafa Lutfi, Md. Enamul Kabir. Recent Trends and Issues of Sustainability in Battery Manufacturing Industries of Bangladesh. *International Conference on Mechanical, Industrial and Materials Engineering 2013 (ICMIME2013) 1-3 November, 2013, RUET, Rajshahi, Bangladesh*

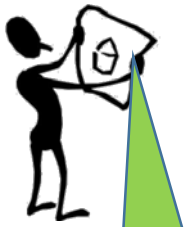
Source: Waste Concern, Lead acid battery recycling in Bangladesh, June 2006.

CONCLUSION: CONNECT PEOPLE-ENVIRONMENT-TECHNOLOGY-BUSINESS FOR A SMART AND RESILIENT SOCIETY

R & D/Engineering



Energy Efficiency



Energy service companies (energy audit, energy efficient system design /equipment manufacturing, specialty engg. services, etc.

Nano tech market : more than US$1 trillion

Green Chemistry & Nano Technology

- cosmetics, baby lotion, computer chips, paints, medical equipments, etc.

Water Efficiency

- Water saving devices
- distribution efficiency
- Zero leakage,
- Waste water treatment,
- Rain water harvesting, etc.

Waste-Water-reuse for urban agriculture practices

- Water purification technologies, waste water treatment (ecological engineering: constructed wetlands for pre-treatment of urban run off water & river water)
- Distributed sewage treatment systems, etc.

Green Buildings

- Engineering, design & construction materials

Bio-economy (high value processing/conversion of biomass)

- Bio-products
- Bio-energy
- Bio-Engineering
- Landscape trimming, etc.

Synthetic fibers/oil, bioplastics, materials from fiber by-products, composts, animal feeds, bio-chemical

Resource Recovery/3R

Sustainable Transportation

- ITS, IFS, BRT, Railways, walkways & bicycle ways
- Fuel efficiency measures
- Vehicle I/M
- Alternative fuels,
- PPP for urban transport. etc.

Sustainable Farming Support Companies

- Efficient water & nutrient management system
- Water & nutrient delivery system
- Biomass energy company
- Energy efficient cultivating, harvesting, hauling equipment
- Compost industry (e.g. Dhaka Community-based Composting System)
- Roof top agriculture (urban greening) for food security

CH4 & fertilizer from animal manure /sewage sludge with anaerobic or aerobic digesters, refused-derived fuel (RDF), etc.

Urban Services and Supplies