



***3Rs and Resource Efficiency  
towards Sustainable Urban Development –  
Recommendations of the Singapore 3R Forum  
in the Context of Rio+20 Outcome***

**UNCRD Seminar on**

**Advancing 3Rs and Resource Efficiency in the Context of Rio+20 Outcome**

**(4 July 2012, 9:30-12:00, Level 4, Peony Jr, Room 4412)**

**CleanEnviro Summit Singapore 2012**

**The Sands Expo & Convention Centre, Marina Bay Sands,**

**1-4 July 2012, Singapore**

**CRC Mohanty,**

**Environment Programme Coordinator, UNCRD**

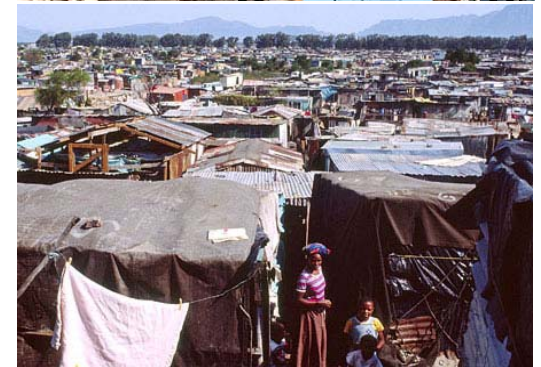
# Urbanization trend and its impacts

## Facts and figures

- ✓ Half of humanity – 3.5 billion people – live in cities today.
- ✓ By 2030, almost 60 per cent of the world's population will live in urban areas.
- ✓ 95 per cent of urban expansion in the next decades will take place in developing world.
- ✓ 828 million people live in slums today and the number keeps rising.
- ✓ The world's cities occupy just 2 per cent of the Earth's land, but account for 60-80 per cent of energy consumption, 75 per cent of carbon emissions, approximately 70% of global GDP, and consume 70% of all resources.
- ✓ Rapid urbanization is exerting pressure on fresh water supplies, sewage, the living environment, and public health.

Source: United Nations 2012

<http://www.un.org/en/sustainablefuture/cities.shtml#overview>



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Direct exposure of children to emission from open burning  
Source: Annepu, 2011, *Sustainable Solid Waste Management in India*.



Source: <http://crunkish.com/top-10-pollution-causes/>



Source: <http://surfingindia.net/>



Source: <http://www.thehindu.com/news/cities/Delhi/article236710.ece>

# People living in a place 20 times above safe level of lead, arsenic, nitrogen.....



Matthew Westfall

# *Conventional waste management and the consequences .....*



*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!*

Source: ADB (2004)

*Many serious issues associated with informal sector – child labour, health impacts...*

**Health risks** for informal sector workers, local communities living near dumpsites, etc.

**Informal waste pickers most often operate without any protective measures -**

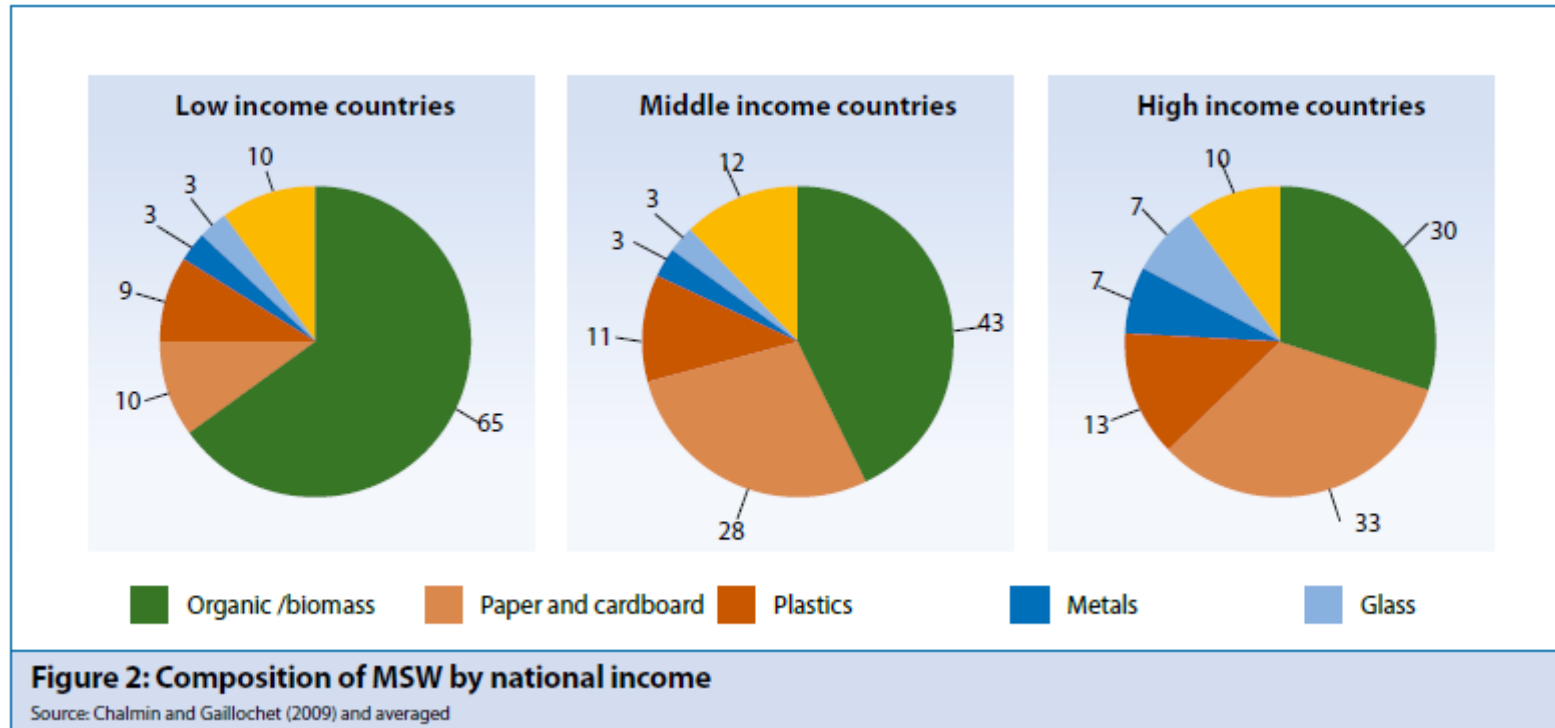
- hospital waste -> HIV
- jagged metal -> tetanus
- smoke (PCBs)
- lead -> neural damage
- violence (knife cuts)
- adult behaviour (premature drinking)
- stress
- skin, gastric, respiratory problems

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



Source: Adapted from ILO (2009), presented at the Inaugural Meeting of the Regional 3R Forum in Asia in November 2009 in Tokyo.

*Composition of waste becomes more complicated as the economically & industrially grow...*



Source: UNEP, 2011, Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication.

- New emerging waste streams such as **e-waste, and industrial wastes (including hazardous waste construction and demolition waste, end-of-life vehicles, healthcare waste, etc.)** further compound the pressure to the local environment

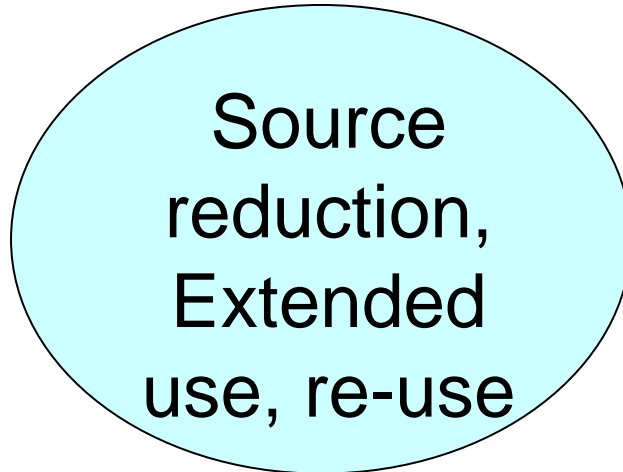
# Waste disposal is expensive – financially and in lost resources

- Requires substantial inputs of labour (for collection/processing)
- Substantial materials input (construction of facilities for wastewater treatment, landfilling, incineration)
- Energy input (collection, treatment, incineration)
- Land resources (land-filling, incineration, treatment facilities)



In advancing 3Rs/Resource Efficiency, what should be the priority for government authorities?

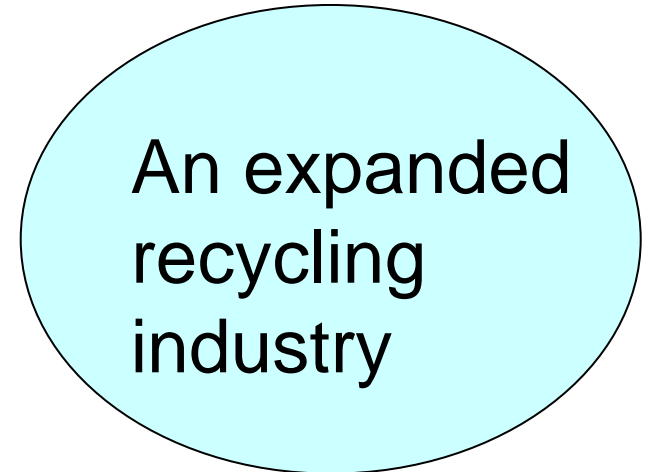
### UPSTREAM MEASURES



(Product policy  
towards resource  
efficiency)

versus

### DOWNSTREAM FOCUS

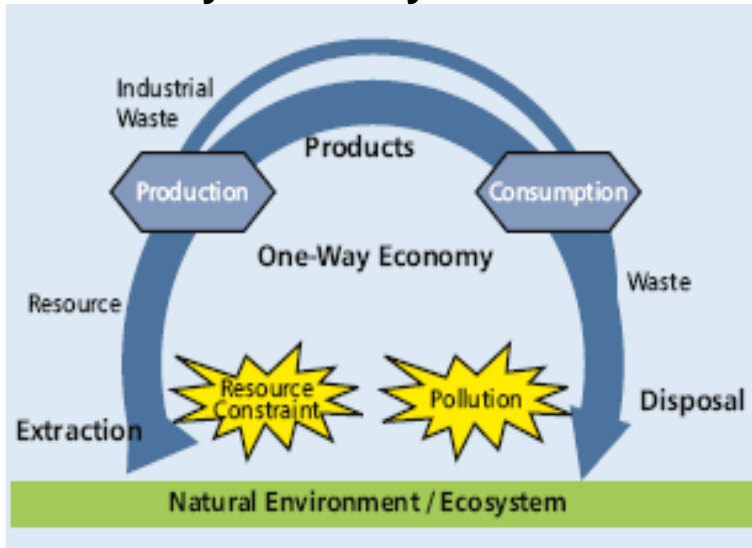


(Resource intensive  
and hazardous  
production of  
expanding markets)

***Many government policies and programs tend to focus on conventional waste management solutions such as sanitary land filling or incineration – mainly downstream disposal, which is expensive, while failing to pursue upstream measures to reduce the actual waste load***

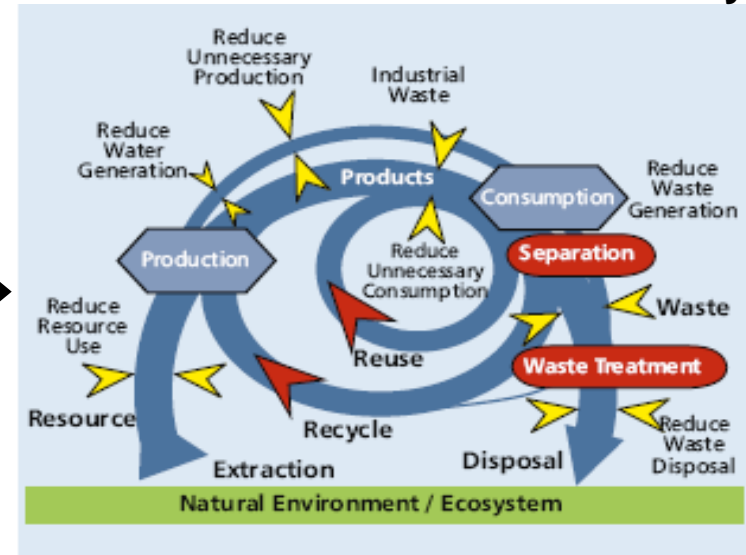
# Where should the governments be heading?

## 1. One-way Economy



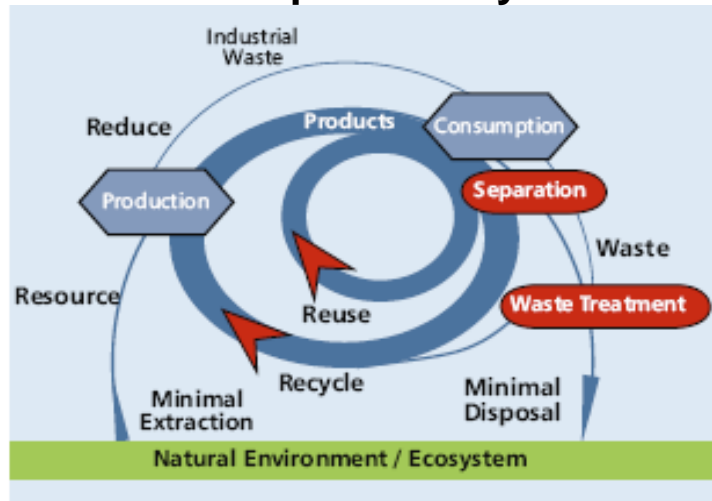
Source: ADB.

## 2. More resource efficient economy



Source: ADB.

## 3. Closed Loop Economy

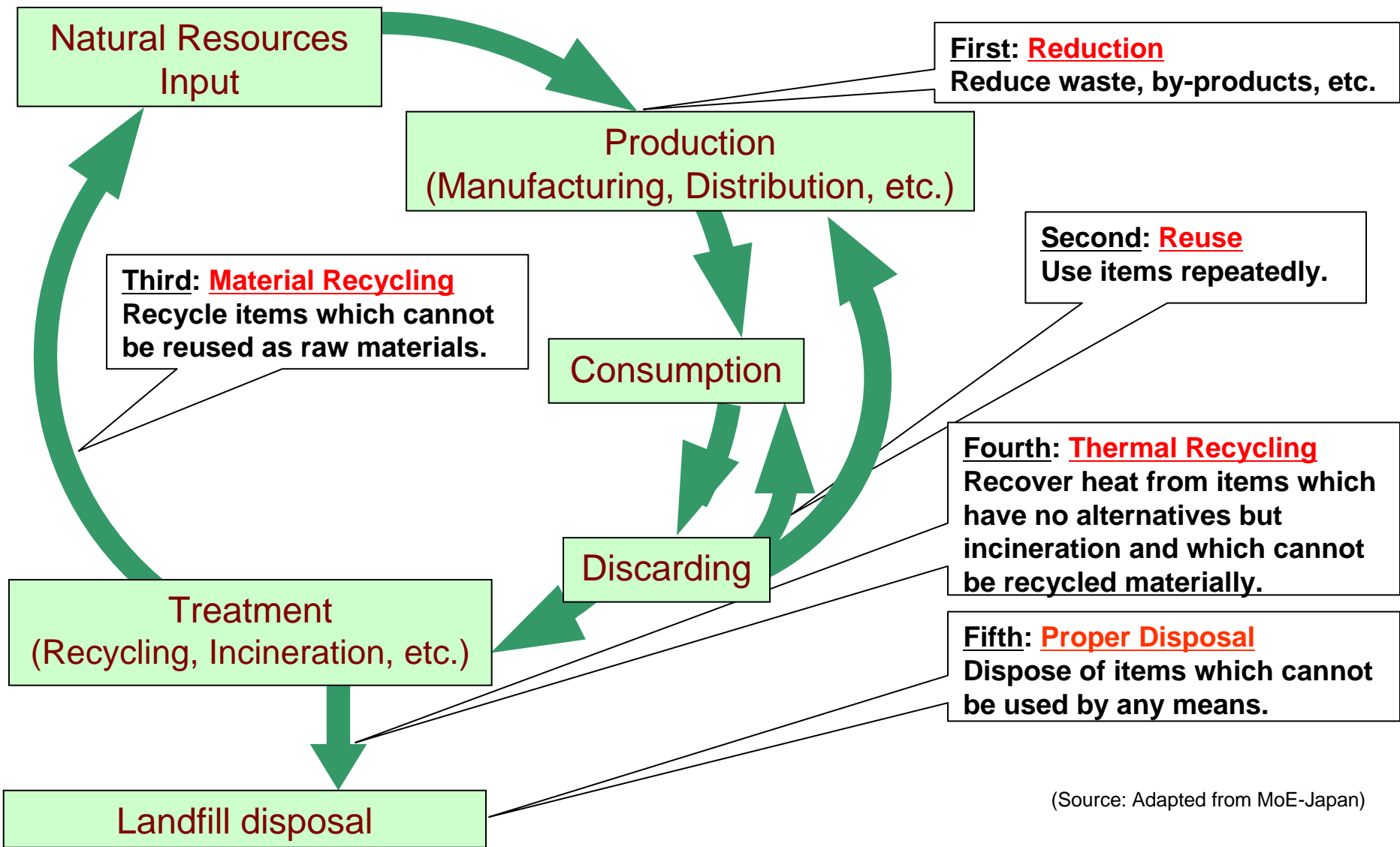


Source: ADB.

Resource efficiency => minimize per unit product or services

- Raw material input ↓
- Water input ↓
- Energy input ↓
- Emission, pollution, waste generation ↓

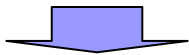
# 3Rs offer an environmentally friendly alternatives for moving towards zero waste society and to deal with impact of growing wastes on human health, economy and natural ecosystem



(Source: Adapted from MoE-Japan)

# Income level is a powerful driver of waste generation

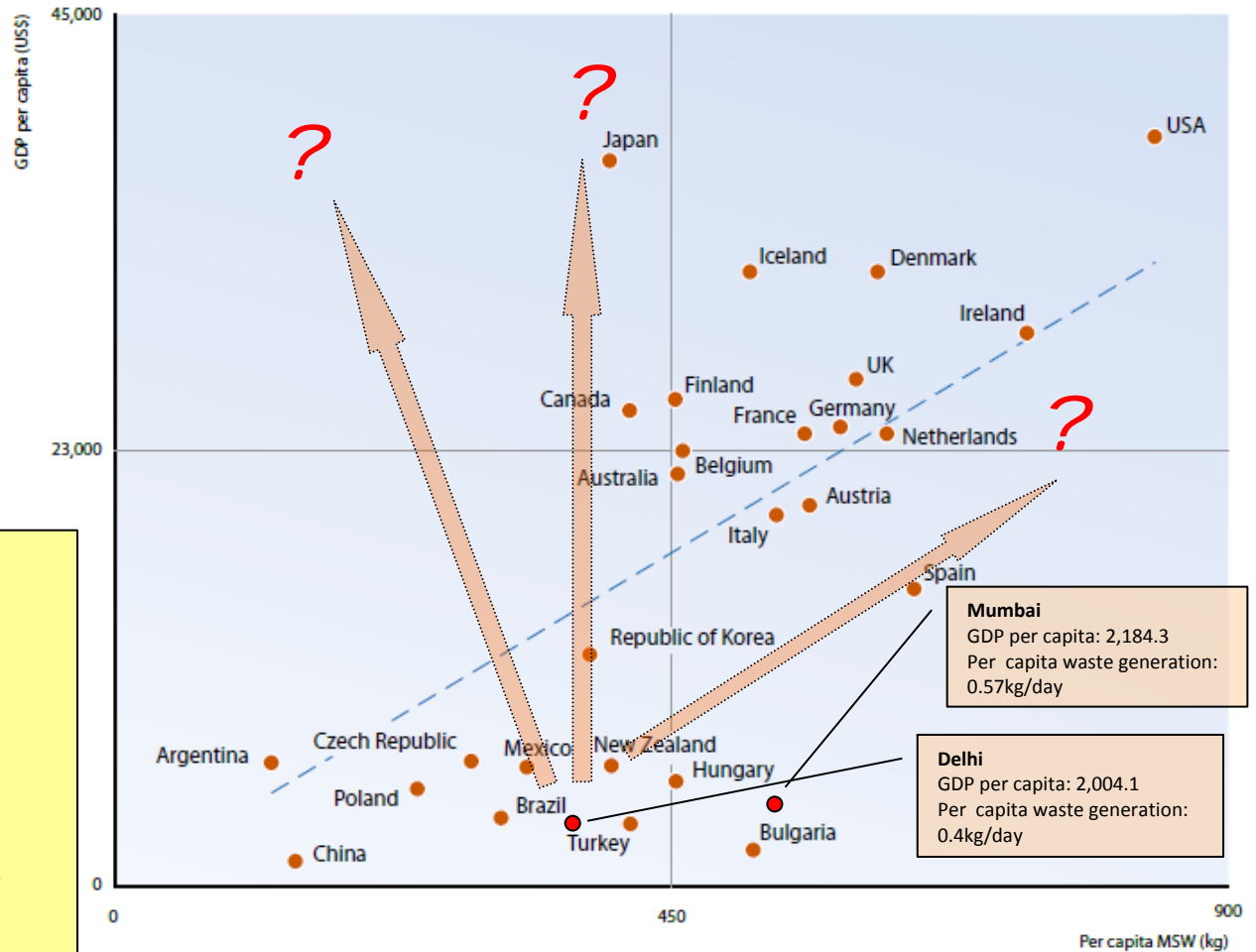
In high-income countries, per capita waste generation can be as high as 0.8kg per capita per day, whereas in the low-income countries the figure can be a quarter of this level, or around 0.2 kg per capita per day.



## Question:

As the countries develop, do they have to follow the same wrong path?  
 – grow now and clean up later?

Can the countries develop while decoupling (or reducing) waste generation ~ towards resource efficient economy?

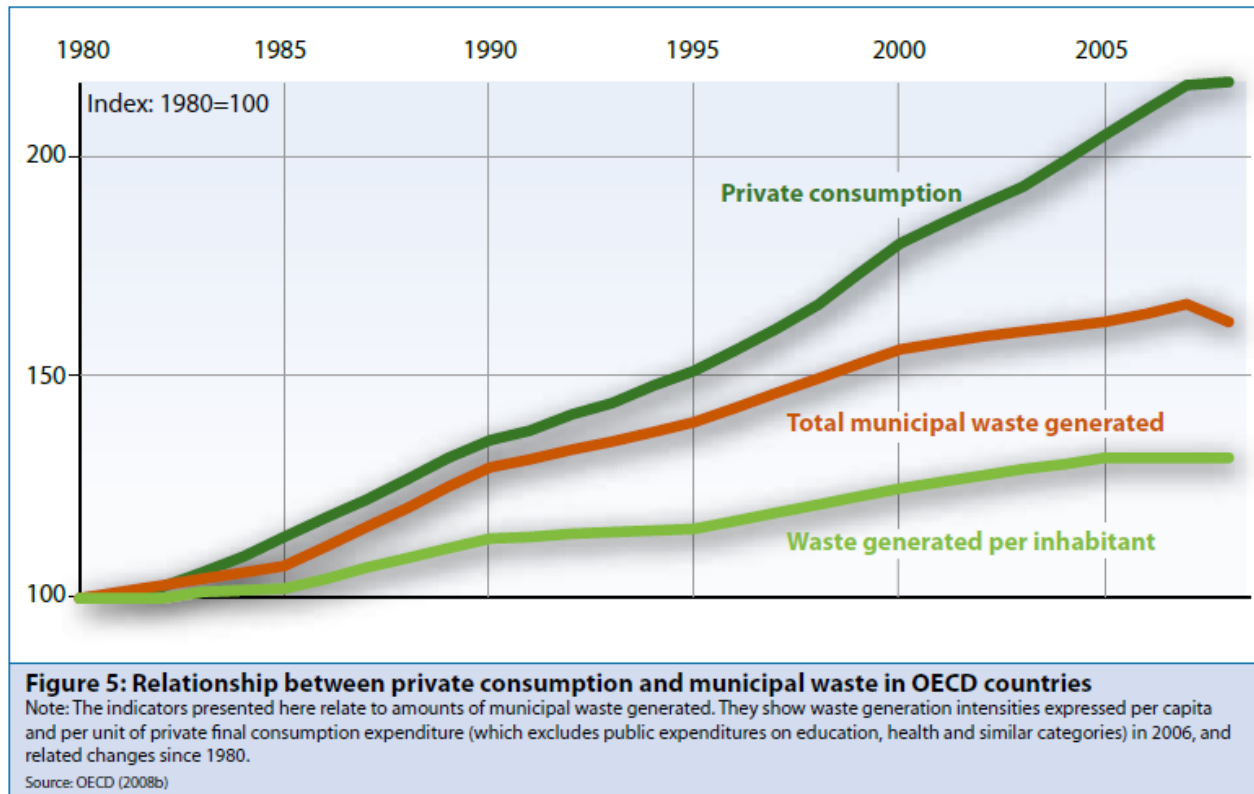


Correlation between MSW generation and GDP

Source: Adapted from UNEP, 2011, Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication.

(Data for Delhi and Mumbai: Siemens AG, 2011. Asian Green City Index-Assessing the environmental performance of Asia's major cities. [http://www.siemens.com/entry/cc/features/greencityindex\\_international/all/de/pdf/report\\_asia.pdf](http://www.siemens.com/entry/cc/features/greencityindex_international/all/de/pdf/report_asia.pdf))

# Relative decoupling has begun in OECD countries



Source: UNEP, 2011, Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication.

What can the developing and emerging economies do to decouple waste generation from economic development?

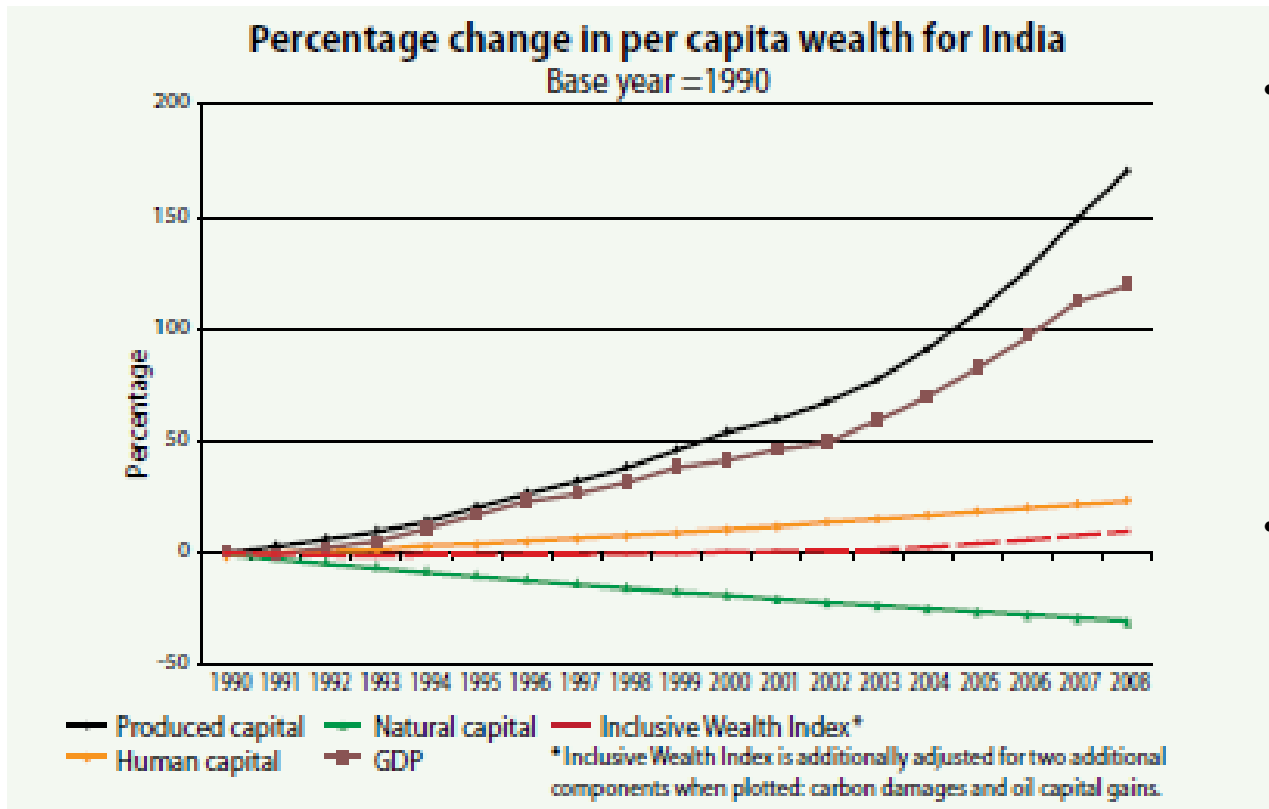


## KEY FACTORS

- Political will/a vision towards zero waste
- Awareness/Change in lifestyles

# *Economic growth in India 1990-2008*

## *... at the sacrifice of natural capital*



- GDP per capita grew by 120% between 1990 and 2008 in India, while the Inclusive Wealth Index increased by mere 9%.
- Natural capital (i.e., ecological assets) declined by 31% during the same period.

Note: Inclusive wealth consists of three main components: human, manufactured, and natural capital.

# Regional 3R Forum in Asia

**Goal:** To achieve *low carbon and sound material cycle societies in Asia* through facilitating bilateral and multilateral cooperation for increasing **resource and energy efficiency** through the 3Rs, and for promoting **environmentally sound management of wastes** in the region; to set in motion a **regional mechanism** to address 3R issues, needs and priorities in Asian countries, including emerging issues of concern in waste management (**Tokyo 3R Statement, 2009**).

## **Objectives:**

- (a) facilitate **high-level policy dialogues** on 3R issues, challenges, & opportunities;
- (b) facilitate **improved dialogue and cooperation with international organizations and donor communities** for materializing and implementation of 3R projects at local and national level identified through national 3R strategies;
- (c) provide a **strategic and knowledge platform** for sharing experiences and disseminating among Asian countries best practices, tools, technologies, policy instruments on various aspects of the 3Rs;
- (d) provide a platform to develop **multilayered networks of stakeholders** such as governments, academia, scientific and research community, private sector, and NGOs;
- (e) generate international consensus and understanding on the beneficial aspects of the 3Rs in the context of achieving **MDGs, resource and energy efficiency, resource efficient economy, and climate change mitigation**; and to
- (f) provide a platform for **proliferation of national 3R strategies** in developing countries.

# Recommendations of the Singapore 3R Forum towards Resource Efficient Society in Asia, 7 Oct 2011

- **A comprehensive set of recommendations**, covering a wide range of sectors and issues relevant to the 3Rs and resource efficiency, based on the fundamental understanding that the **3Rs is not just about municipal waste management, but is intrinsically linked with resource efficiency** in a wide range of sectors with an objective to reduce or eliminate the waste load for final disposal towards transitioning towards to a resource efficient and green economy.
- Government of Singapore officially submitted it as an input to **UNCSD/Rio+20**



**RIO+20**  
United Nations Conference  
on Sustainable Development



# Rio+20 Outcome – The Future We Want

Green economy in the context of sustainable development and poverty eradication (para. 56-74)



**RIO+20**  
United Nations Conference  
on Sustainable Development

Among others, the States ..

- emphasize that *green economy* should contribute to eradicating poverty as well as sustained economic growth, enhancing social inclusion, improving human welfare and creating opportunities for employment and decent work for all, while maintaining the healthy functioning of the Earth's ecosystems.
- acknowledge *increasing resource efficiency and reduction of waste* and achieving green economy in the context of sustainable development and poverty eradication are complementary to each other in enhancing the ability to manage natural resources sustainably and with lower negative environmental impacts
- recognize urgent action on *unsustainable patterns of production and consumption* where they occur remains fundamental in addressing environmental sustainability and promoting conservation and sustainable use of biodiversity and ecosystems, regeneration of natural resources and the promotion of sustained, inclusive and equitable global growth

# Rio+20 Outcome – The Future We Want

Chemicals and waste (para. 213-223)



Among others, the States call for:

- *Sound management of chemicals and waste* which is crucial for the protection of human health and the environment.
- *development and implementation of policies for resource efficiency* and environmentally sound waste management, including commitment to further **3Rs** as well as to increase energy recovery from waste with a view to managing the majority of global waste in an environmentally sound manner
- development and enforcement of comprehensive *national and local waste management policies, strategies, laws and regulations*.
- continued, new and innovative *public-private partnerships* among industry, governments, academia and other non-governmental stakeholders aiming to enhance *capacity and technology* for environmentally sound chemicals and waste management, including for *waste prevention*

# Rio+20 Outcome – The Future We Want

## Sustainable cities and human settlements

(para. 134-137)

*Among others, the States ....*



**RIO+20**  
United Nations Conference  
on Sustainable Development

- recognize that, if they are well planned and developed, including through **integrated planning and management approaches**, cities can promote economically, socially and environmentally sustainable societies.
- commit to promote sustainable development policies that support a **safe and healthy living environment for all, safe and clean drinking water and sanitation**; healthy air quality; generation of decent jobs; and improved urban planning and slum upgrading.
- support sustainable management of waste through the application of the **3Rs**.
- emphasize the importance of increasing the number of metropolitan regions, cities and towns that are implementing **policies for sustainable urban planning and design** in order to respond effectively to the **expected growth of urban populations in the coming decades**.

# Rio+20 Outcome – The Future We Want

Other thematic areas and cross-sectoral issues..



**RIO+20**  
United Nations Conference  
on Sustainable Development

## Ocean and seas/coastal ecosystem:

- commit to protect, and restore, the health, productivity and resilience of oceans and marine ecosystems, and to maintain their biodiversity, enabling their conservation and sustainable use for present and future generations..(para 158)
- commit to take action to reduce the incidence and impacts of various marine pollution such as debris, especially **plastic**, persistent organic pollutants, heavy metals and nitrogen-based compounds, from a number of marine and land-based sources, including shipping and land run-off (para 163).

## Sustainable production and consumption:

- recognize that **fundamental changes in the way societies consume and produce** are indispensable for achieving global sustainable development (para 224).

# Rio+20 Outcome – The Future We Want

## Other thematic areas and cross-sectoral issues..



### Water and sanitation

- underline the critical importance of water and sanitation within three dimensions (social, economic, environmental) of sustainable development (para 119)
- reaffirm commitments under **MDG on access to safe drinking water and basic sanitation** (para 120)
- reaffirm commitment to 2005-2015 International Decade for Action, Water for Life
- protect freshwater ecosystem in maintaining quantity and quality

### Promoting full and productive employment, decent work for all and social protection

- recognize that workers should have access to education, skills, health care, social security, fundamental rights at work, social and legal protections, including **occupational safety and health, and decent work opportunities** (para 152).
- acknowledge the importance of efforts to promote the exchange of information and knowledge on decent work for all and job creation, including **green jobs** initiatives and related skills...(para 154)

# Major Recommendations of the Singapore 3R Forum

## Green Economy ↔ Rio+20 Outcome – The Future We Want / Framework for Action

Environmentally protective/ Low Carbon	Resource (material, water, energy) Efficient (RE)	Socially Inclusive /poverty /green jobs /health	Sustainable cities	Decent work /social protection /health	Ocean and marine /coastal ecosystem	Water and sanitation /fresh water ecosystem
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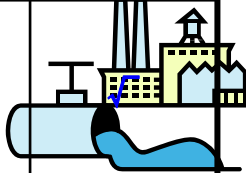
### 1) 3Rs in Municipal Solid Waste (MSW)

<ul style="list-style-type: none"> <li>promote economic instruments that provide incentives to reduce the waste</li> </ul>	✓	✓		✓		✓	✓
<ul style="list-style-type: none"> <li>Utilize organic waste as a valuable resource with an objective to reduce landfill requirements; resource efficiency and energy recovery; and reduction of GHG emissions.</li> </ul>	✓	✓		✓			✓
<ul style="list-style-type: none"> <li>Promote recycling markets</li> </ul>		✓	✓	✓			
<ul style="list-style-type: none"> <li>Set up institutional and financing mechanisms and infrastructure for recycling, with the involvement of citizens, recycling industry, and end-users of the recycled products.</li> </ul>		✓	✓	✓			
<ul style="list-style-type: none"> <li>Develop policies, programmes, and regulatory measures to ensure decent work and livelihood security of workers in the informal sector.</li> </ul>			✓		✓		
<ul style="list-style-type: none"> <li>Occupational and environmental health and safety (EHS) standards for recycling processes and recycled goods.</li> </ul>			✓		✓		



Major Recommendations of the Singapore 3R Forum	Green Economy ←			→ Rio+20 Outcome – The Future We Want / Framework for Action			
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**2) 3Rs in Industrial Sector**

<ul style="list-style-type: none"> <li>Develop policies and provide support and incentives that encourage the private sector to implement RE measures.</li> </ul>	✓	✓		✓			
<ul style="list-style-type: none"> <li>Promote recycling of waste from one industry as a resource for another (industrial symbiosis).</li> </ul>		✓		✓		✓	✓
<ul style="list-style-type: none"> <li>Develop local capacity to implement energy and resource efficient technologies in industry sector.</li> </ul>		✓	✓				
<ul style="list-style-type: none"> <li>Specific curricula should be developed for universities and business schools.</li> </ul>	✓	✓	✓				
<ul style="list-style-type: none"> <li>Encourage market development for eco-products.</li> </ul>	✓	✓	✓				
<ul style="list-style-type: none"> <li>Promoting the greening of the supply chain.</li> </ul>	✓	✓					
<ul style="list-style-type: none"> <li>Encourage the establishment of industry code of practices for a management approach that addresses issues of RE.</li> </ul>		✓		✓			

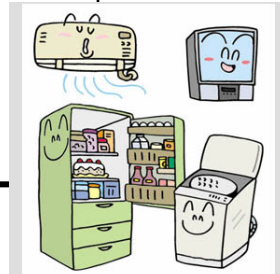
# Major Recommendations of the Singapore 3R Forum

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### 3) New and emerging waste

<ul style="list-style-type: none"> <li>Strengthen regional, national and local efforts to address the issue of plastic waste in marine and coastal environment.</li> </ul>	✓		✓	✓		✓	✓
<ul style="list-style-type: none"> <li>Establish appropriate regulatory procedures to control illegal exports of e-waste and to ensure their environmentally sound management.</li> </ul>	✓			✓			
<ul style="list-style-type: none"> <li>Introduce awareness raising programmes and activities at all levels on issues related to health and safety aspects of e-waste.</li> </ul>	✓		✓	✓			
<ul style="list-style-type: none"> <li>Establish formal standards, certification systems and licensing procedures for recycling and disposal enterprises.</li> </ul>	✓			✓			
<ul style="list-style-type: none"> <li>Implement 'extended producer responsibility' (EPR) mandating producers, importers and retailers with the cost of collecting, recycling and disposal of e-waste.</li> </ul>	✓	✓		✓			





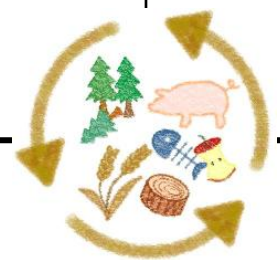
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## 4) 3Rs in Agriculture Sector

<ul style="list-style-type: none"> <li>■ Improve infrastructure to reduce losses in the entire food supply chain.</li> </ul>		✓				
<ul style="list-style-type: none"> <li>■ Promote efficient use of biomass and reuse of agriculture biomass waste involving minimal or no processing.</li> </ul>	✓	✓	✓			
<ul style="list-style-type: none"> <li>■ Promote recycling of agriculture biomass waste and livestock waste. Promote, where appropriate and feasible, the production of high-value products from biomass.</li> </ul>		✓				
<ul style="list-style-type: none"> <li>■ Promote agricultural policies in harmony with the 3R principles.</li> </ul>		✓				
<ul style="list-style-type: none"> <li>■ Develop national waste management strategies, policies and programmes with effective link to sustainable agriculture, food security, and rural employment generation.</li> </ul>	✓	✓	✓			




Major Recommendations of the Singapore 3R Forum	Green Economy				Rio+20 Outcome – The Future We Want / Framework for Action			
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**5) Partnership for Moving Toward Zero Waste**

<ul style="list-style-type: none"> <li>Promote partnerships as the basis for sustainable waste management.</li> </ul>			✓	✓			
<ul style="list-style-type: none"> <li>Develop appropriate policy frameworks and conducive climate for fostering partnership that provide win-win solutions for public utilities and the private sector.</li> </ul>			✓	✓			
<ul style="list-style-type: none"> <li>Use international partnerships such as IPLA to share knowledge, technologies, best practices and models in the area of 3Rs, integrated solid waste management, and RE.</li> </ul>		✓	✓	✓			

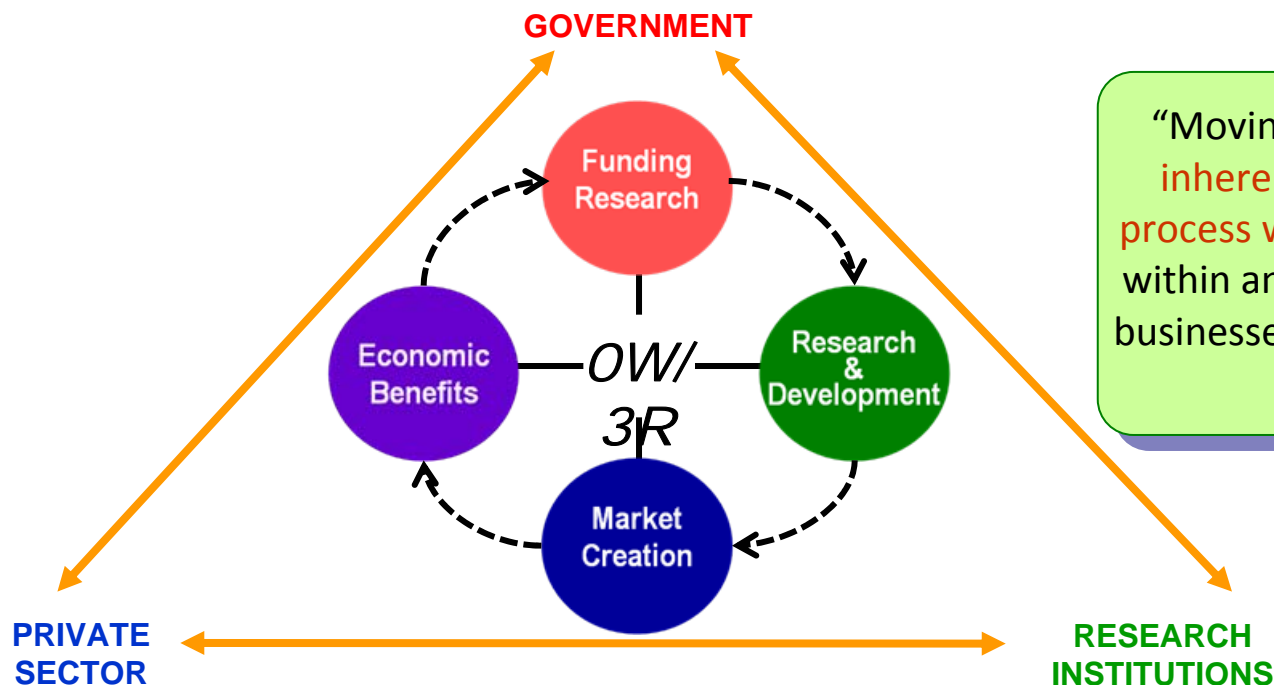
**6) Enhance knowledge base and research network**

<ul style="list-style-type: none"> <li>Facilitate linkage among government, private sector, and scientific community to enhance national and local knowledge base.</li> </ul>	✓	✓	✓	✓	✓	✓	✓
<ul style="list-style-type: none"> <li>Set up mechanisms whereby government can receive constructive feedback from citizens, private sector, and scientific community. Support and strengthen local and national networks.</li> </ul>			✓	✓			

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<b>7) Public Awareness</b>							
■ Improve public awareness on the beneficial aspects of the 3Rs.	✓	✓	✓	✓	✓	✓	✓
■ Introduce the concepts of the 3Rs, sustainable production and consumption, and RE as part of environmental education programmes at all levels.	✓	✓	✓	✓	✓	✓	✓
■ Promote 3R actions to support the behavioural change of the citizens.	✓	✓	✓	✓	✓	✓	✓
<b>8) Institutional Arrangements</b>							
■ Integrate the 3R concept in relevant policies and programmes of key ministries and agencies. Strengthen inter-ministerial coordination.	✓	✓	✓	✓	✓	✓	✓
■ Promote green procurement across all line ministries.		✓	✓	✓			
■ Work towards a gradual phase out of subsidies that favour unsustainable use of resources and energy	✓	✓					
■ Promote indicators of resource efficiency		✓					

## ***Triangular cooperation between Government – Private – scientific/R&D institutions***

- Promote recycling of waste from one industry as a resource for another (industrial symbiosis), through, for example, supporting the establishment of eco-industrial parks, science parks, and research/university networks.
- Encourage joint R&D, knowledge sharing, technology transfer among various actors (e.g., between private sector and universities).



“Moving towards zero waste is inherently a multi-stakeholder process which calls for partnerships within and between communities, businesses, industries, and all levels of government.”

# Example - Zero Emission Kitakyushu Eco-town

## Kitakyushu Eco-Town Project (Largest recycling society model in Japan)

The first “Eco-Town” project in Japan for building a recycling society has contributed to environmental preservation and industrial development.



Experimental study area



Comprehensive Environmental Complex;  
Hibiki Recycling Park

**Outline: Research facilities: 16; Business facilities: 29**

**Project achievement: Environmental preservation and economic development**

**Environment:** Reduction of environmental load, resource saving and energy saving

**Economic:** Invested amount: approx. 66 billion yen (City: Nation, etc.: Private = 1:2:7)

No. of persons employed: approx. 1,300 (including part time workers)

Visitors for inspection: approx. 1 million (1998 – Oct. 2011)

**Key factors:** strong leadership of local government, strong participation of private sector (recycling industries), strong involvement of local community backed up by strong and comprehensive national legislative framework for Sound Material Cycle Society

(Courtesy of: Kitakyushu-City, Presented at the Fourth 3R Conference for Asian Local Governments, 30-31 January 2012, Tokyo, Japan)

# There are many other key stakeholders who can play very important role in promoting resource efficiency/3Rs

<b>National Government</b>	Develop policies, programs, and institutions, innovative financing for resource efficiency / 3R infrastructures (eco-towns, eco-industrial parks, R&D facilities (Environment, 3Rs, Nano-Technology, IT, Biotechnology) etc.), create conducive policy framework to encourage PPPs, capacity building programs/facilities for SMEs, awareness programme for citizens, green procurement, develop and institute EPR system, foster triangular cooperation (government-private/industry-R&D/Universities) for , circular economic approach, green growth, technology transfer, information clearing house, etc.
<b>Local Government</b>	Integrate resource efficiency in urban development policy and strategy (energy, transport, water, industry), innovative financing for resource efficient infrastructure (eco-towns, eco-industrial parks, R&D facilities, etc.), realize PPPs, awareness programs for citizens, green procurement
<b>Private / Industry Sector</b>	Develop strategies to commercialize 3Rs, Environmental performance reporting, R&D (3R technologies, green products, waste recycling, waste exchange, green purchasing, PPP, in-house capacity building programs, CSR,
<b>Banks / Financial institutions</b>	Investment/loan schemes for eco-town projects and green industries
<b>Scientific and Research Institutions / Universities</b>	Provide back up for science based policy making at government level, develop dedicated R&D projects on resource efficiency/3Rs in collaboration with government and business/industry sector, create human resources and experts in the field of resource efficiency/3Rs, look for international collaboration (University-University, University-Multi-national corporation), catalyst for decision makers, technology evaluation.
<b>Citizens / NGOs</b>	Promote green consumerism, community awareness raising on house-hold waste segregation and its contribution to resource efficiency/3Rs, knowledge dissemination

(Source: C.R.C. Mohanty, 2012)

# Conclusion: (1) Pursuing resource efficiency will help countries..

- **Tackling local environmental problems** → in efficient use of resources lead to environmental burdens;
- **Addressing climate change** → resource efficiency is key strategy for low carbon path by reducing GHG emissions from energy generation and use, material extraction, processing, transportation, and waste disposal;
- **Ensuring energy security** → through energy efficiency measures, WtE;
- **Preserving natural capital and avoiding resource conflicts**
- **Improving economic competitiveness of firms and nations** → better respond to volatility of oil prices, metal prices, etc; improvement of production process brings financial benefits to the producer as well as improvement of product quality;
- **Minimizing disposal costs by minimizing wastes** → land fills and incinerators are very expensive methods; end-of-pipe disposal is a sunk cost with no financial return;
- **Developing new business opportunities** → resource recovery, recycling, WtE schemes can create green jobs; biotechnology, nanotechnology, renewable energy;
- **Pursuing social benefits** → environment industry as potential source of employment and long term natural asset protection; reducing environmental impacts from harmful wastes;

## Conclusion: (2) Partnership is key to expand waste management services of local authorities that lack resources, institutional capacity, and technological know-how...

- **Partnerships** offer alternatives in which governments and private companies assume co-responsibility and co-ownership for the delivery of solid waste management services.
- **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** provides 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.