

# Challenges and Opportunities with Green Technology Transfer on the 3R

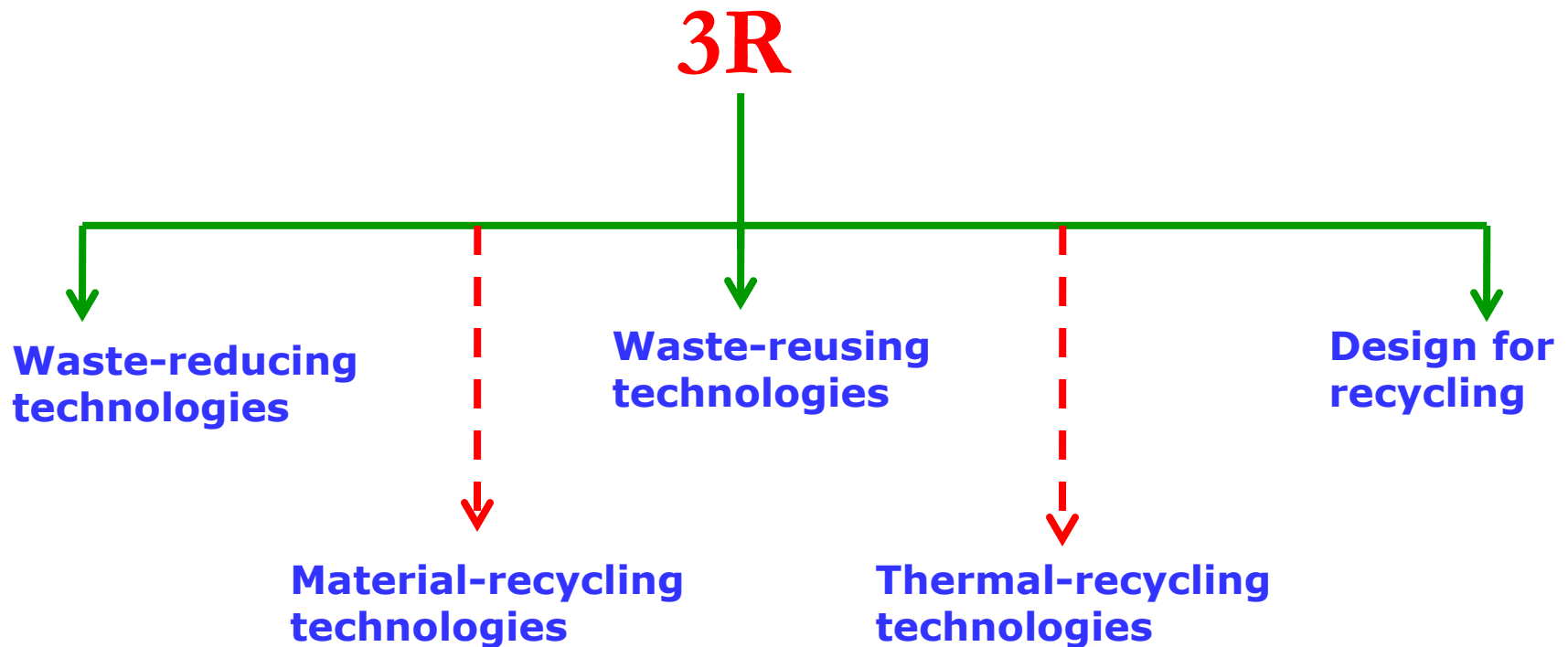


**C. Visvanathan**  
**Environmental Engineering and Management Program**  
**Asian Institute of Technology**  
**Thailand**

**[visu@ait.ac.th](mailto:visu@ait.ac.th)**  
**[www.faculty.ait.ac.th/visu/](http://www.faculty.ait.ac.th/visu/)**

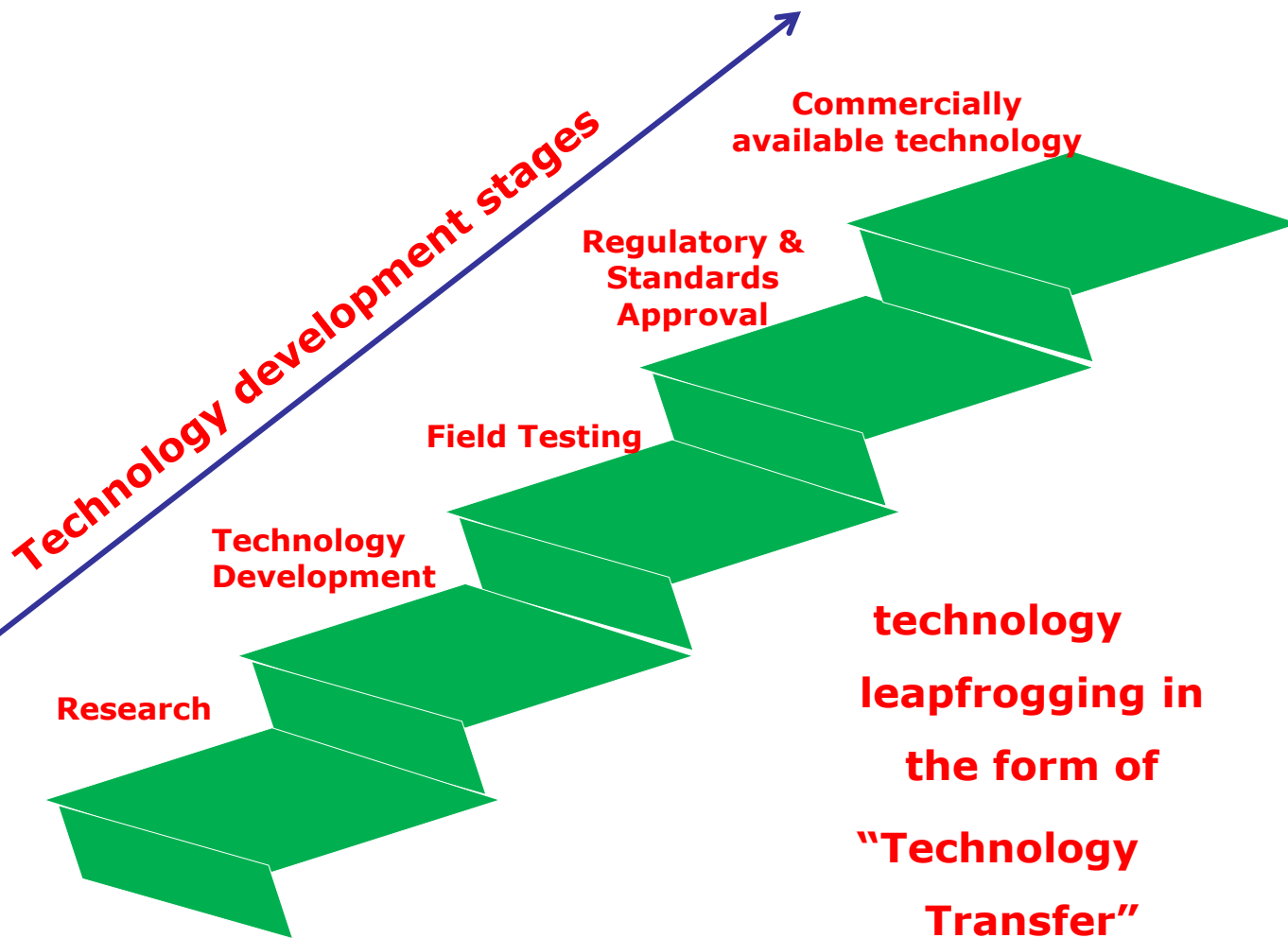
# 3R and Green Technology

**Green Technology: Technology that prevents waste from being generated in the environment and keeps resources moving in the material cycle.**



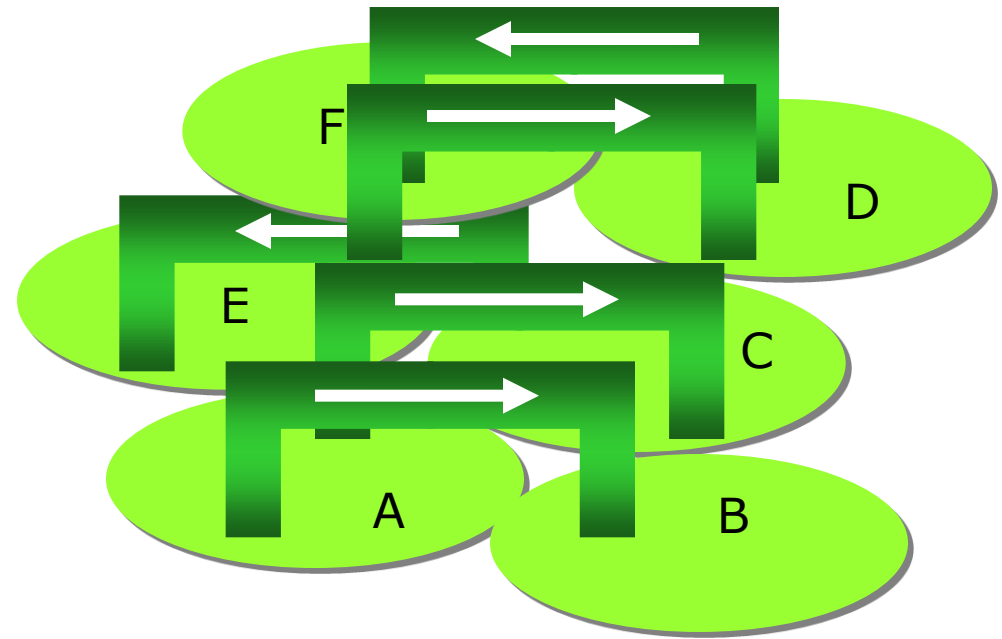
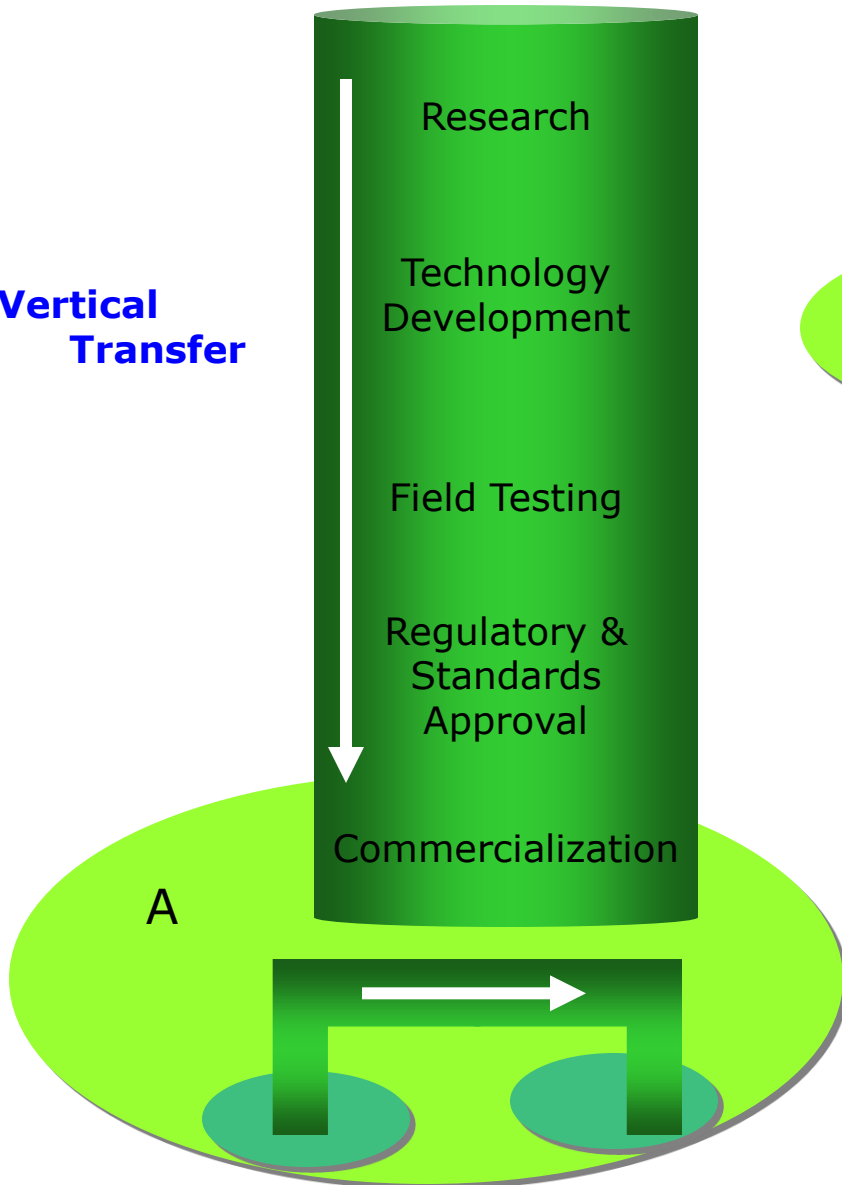
**3R : Green Technology**

# Technology Transfer (TT)



# Technology Transfer Models

## Vertical Transfer



## Horizontal Transfer

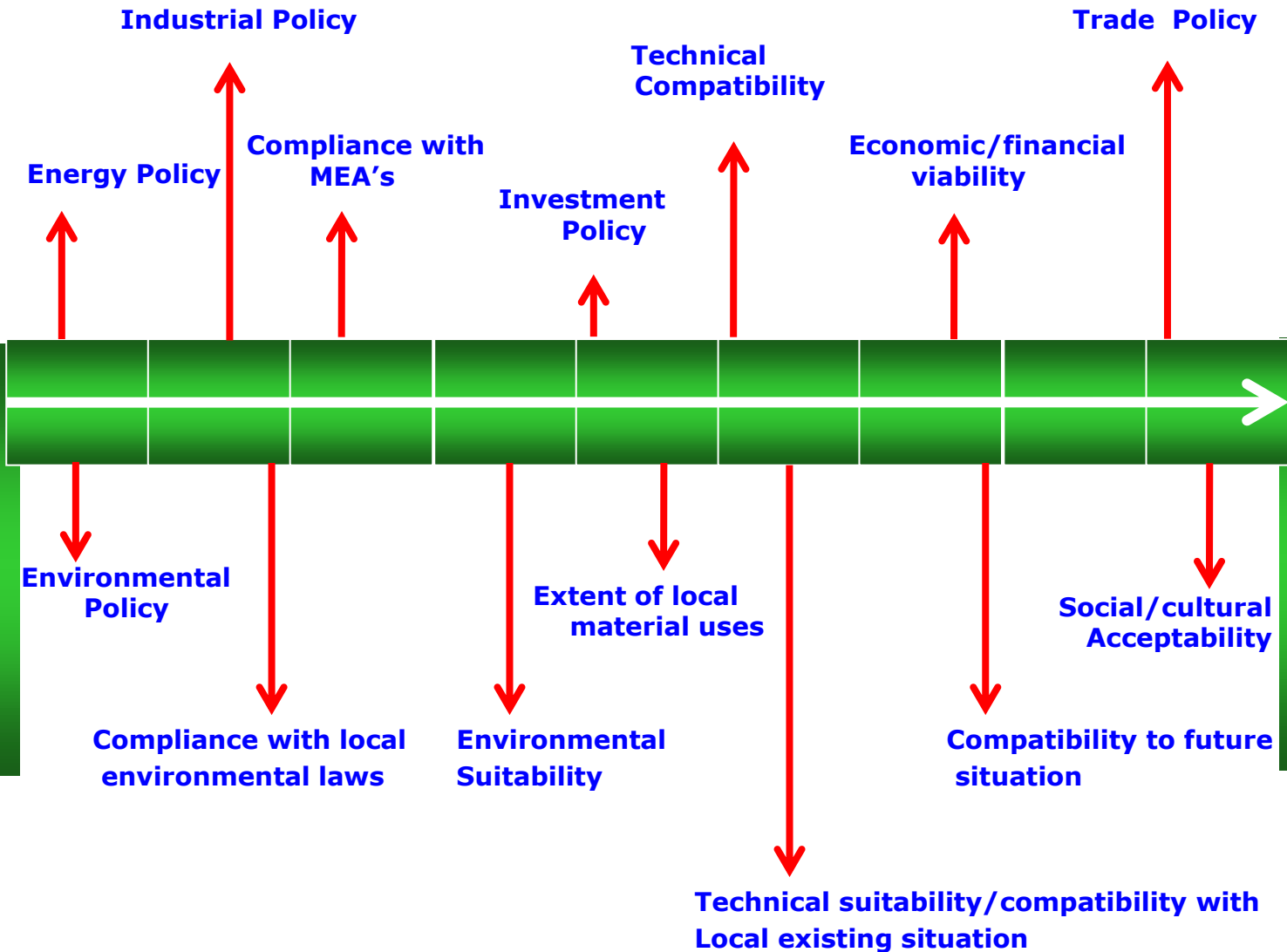
Vertical - within the country

✗

Horizontal - between countries

✓

# Aspects Involved in Horizontal Technology Transfer



# What we are dealing with?

- **Technical**

**Mostly associated with the technology itself i.e. hardware/physical technology**

- **Management**

**Mostly associated with the overall process of transfer of technology from "X" to "Y" and covers "N" number of issues**

# Failed Treatment Facilities....1

- **Municipal Corporation of developing country built an incineration**
- **Capacity of 300 tonnes/day solid waste**
- **Segregated waste as input**
- **To generate 3 MW of power**
- **Cost around US\$3.5 million**
- **Technical assistance from developed country**
- ✓ **Designed for segregated waste as input, which was not practiced by the households or promoted by the municipality**
- ✓ **Waste had a very low heating values**
- ✓ **High percentage of inert materials**

**CLOSED**

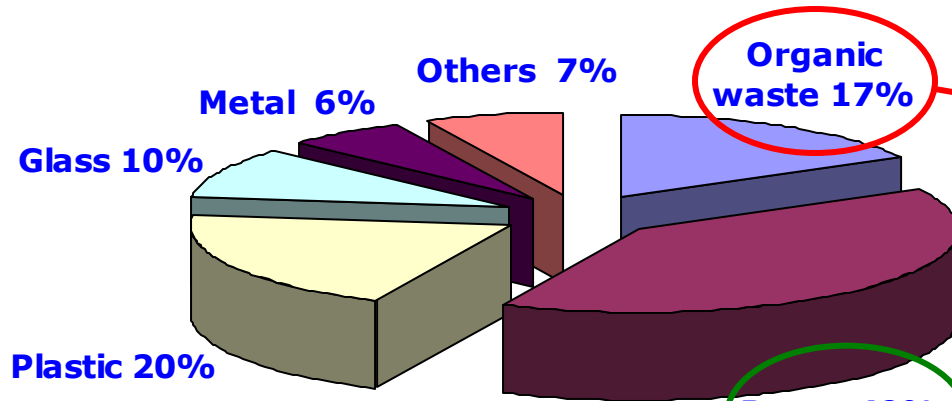
# Failed Treatment Facilities....2

- Municipal Corporation of developing country built an anaerobic digestion plant
  - 500-600 tonnes of MSW per day
  - 5MW waste-to-energy project
  - US\$18 million
  - Private companies from developed country provided the technical inputs
  - Host country firm supplied the human resources and execution on build-own-operate(BOO) basis
- CLOSED**
- ✓ Plant was not able to run on its full capacity due to high level of inert materials in the waste
  - ✓ There was a operational difficulty that lead into permanent failure
  - ✓ Design assumptions were based on the European waste and waste management practices

***This is called hardware transfer,  
not the technology/knowledge  
transfer***

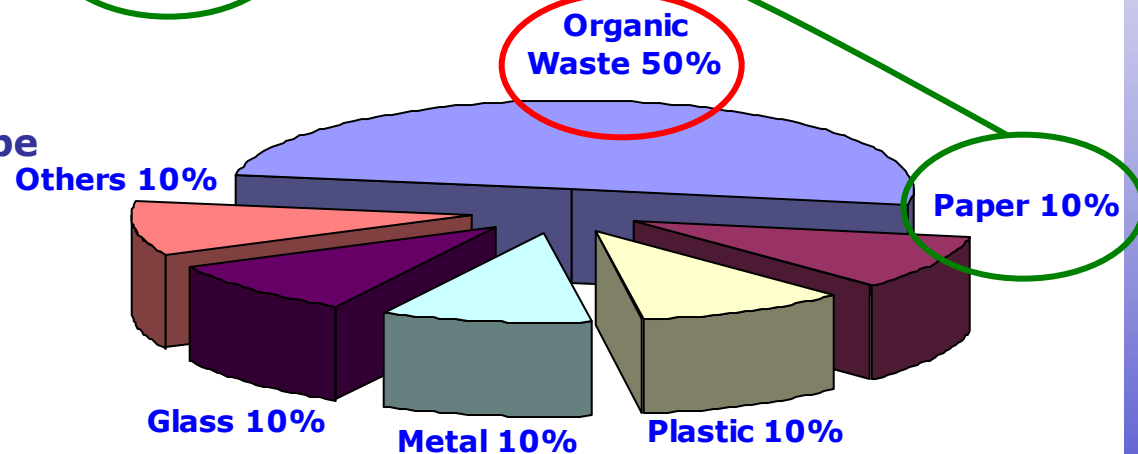


# Waste Composition



**MSW composition in Japan**

Quantity – even with higher population recyclable waste will be less in developing countries resulting in less than minimum volumes required for recycling



**MSW composition in a typical Asian developing country**

Fundamental differences in culture and lifestyle reflect on waste characteristics

Direct adoption of recycling technologies may not be possible

# SW Carrying Vehicle with Compactor On!



- **Not suitable for SW with high moisture content**
- **If compacted juice comes out**
- **Trickle all the way during transportation**



# Does one size fits all?

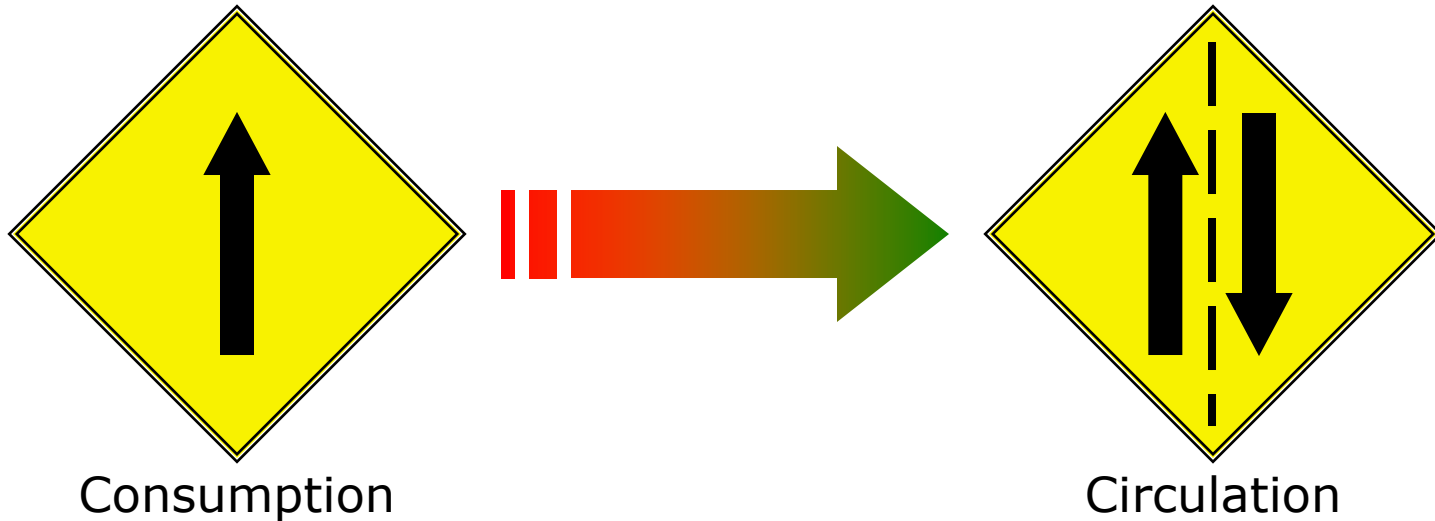


Then..... what is needed...???

- Development needs must be recognized first
- Technology solutions can be tailored accordingly
- Important to recognize diversity between and within countries
- Technology needs to be both appropriate and financially sustainable under local condition

# Consumption to Circulation

**Resource consumption has been increasing across the globe, particularly in Asia**



**Resource Consumption to Resource Circulation... can be achieved only by having the right 3R technology in place**

"Having the right 3R Technology" - often connects to Technology Transfer (TT)



# Current Waste Sector in Developing Countries...

**Collection (Mostly bulk collection by local authority)**

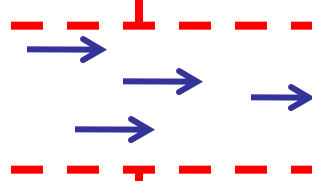
**Transportation (contractual/ Semi-formal)**



**Informal recycling business**

**Manual shredding (minimum safety measures)**

**Segregation/ Sorting (waste pickers, mostly women's & small kids)**



**Landfilling, Open dumping/burning**

# After 3R Technology Transfer

**Collection (Organized formal collection system)**

**Collection (Mostly bulk collection by local authority)**

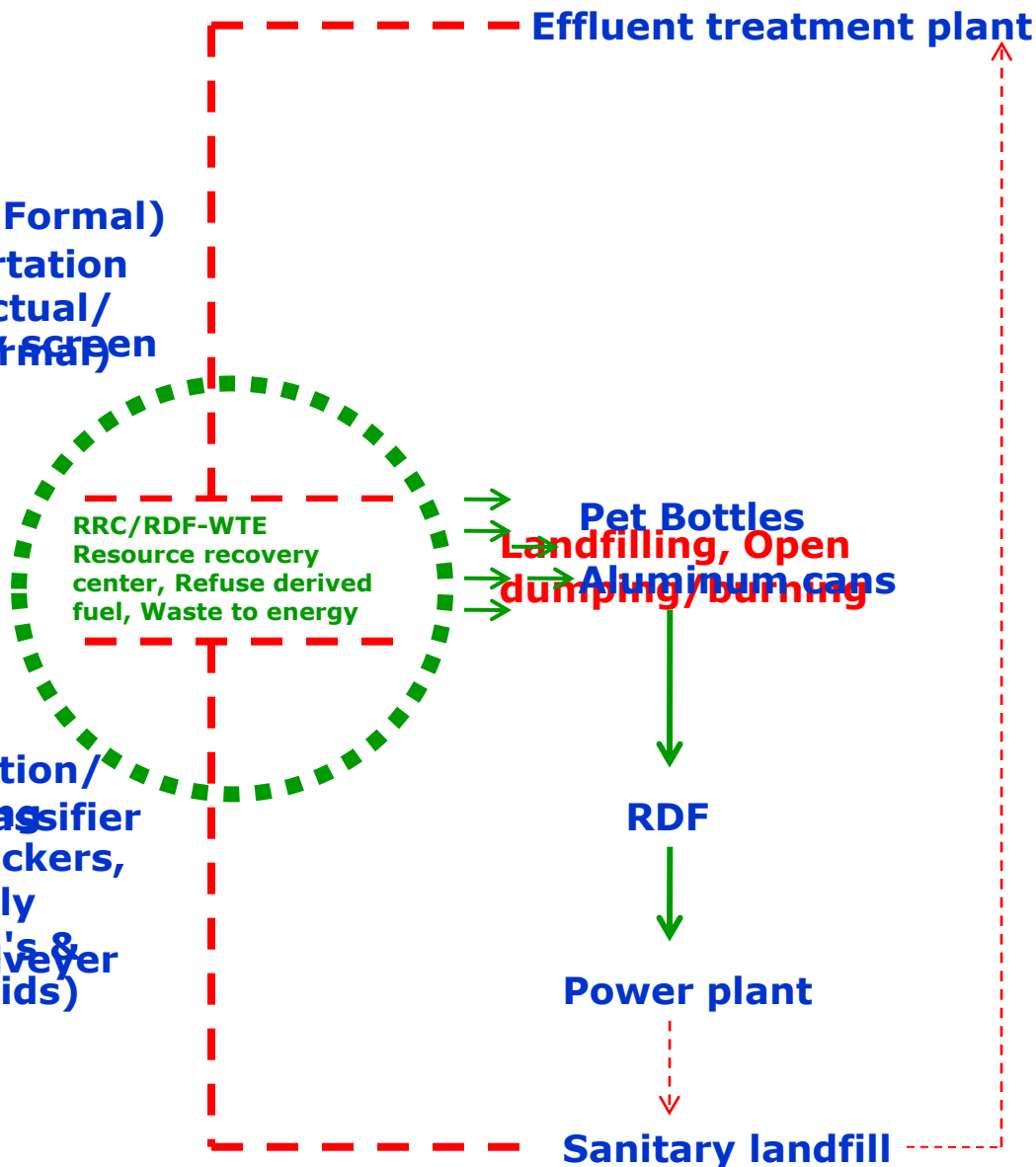
**Transportation (Formal)**  
**(contractual/semi-formal)**



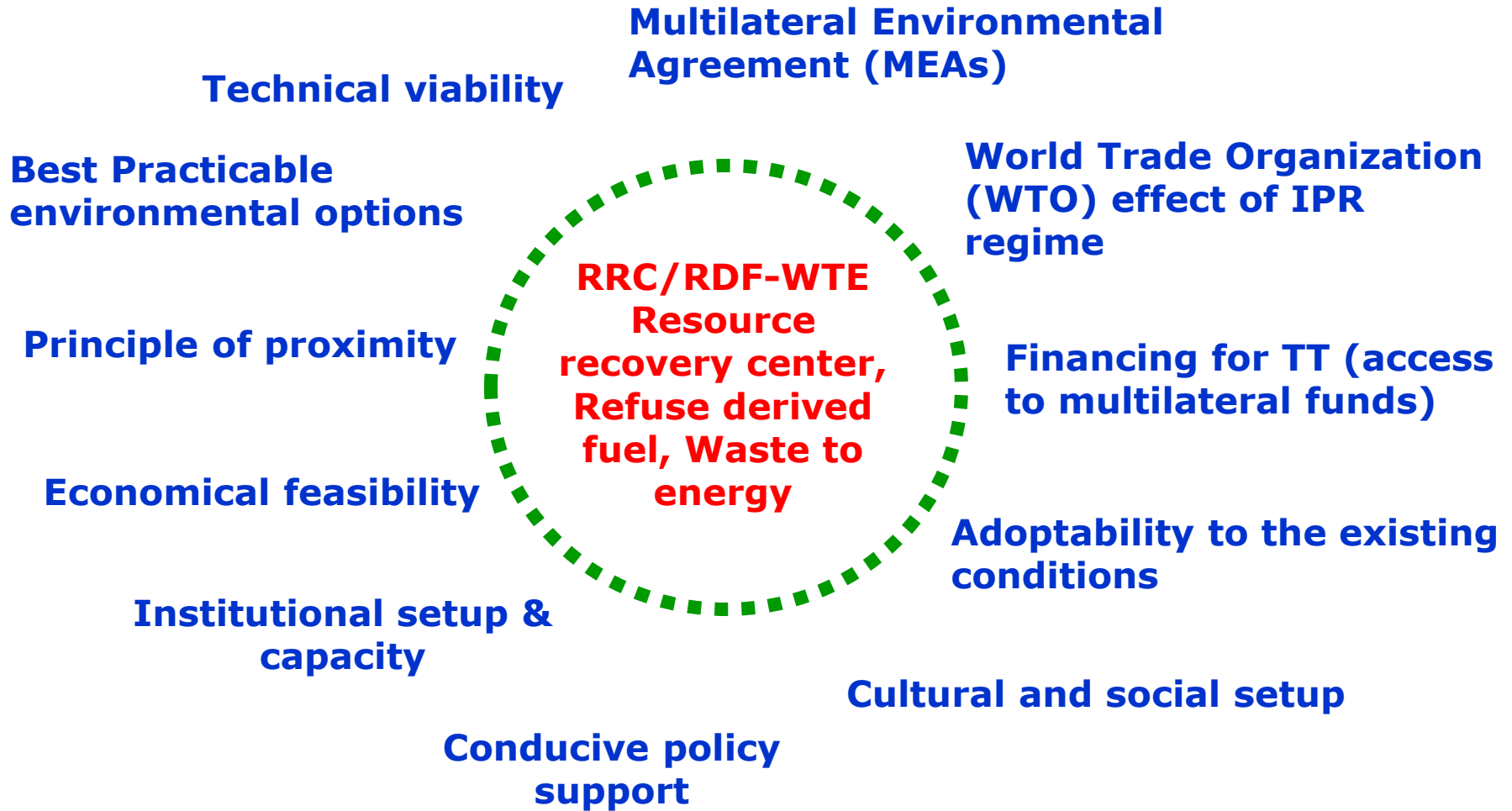
**Informal waste recycling business**

**Waste shredder**  
**Manual shredding (minimum safety measures)**  
**Bag splitter**

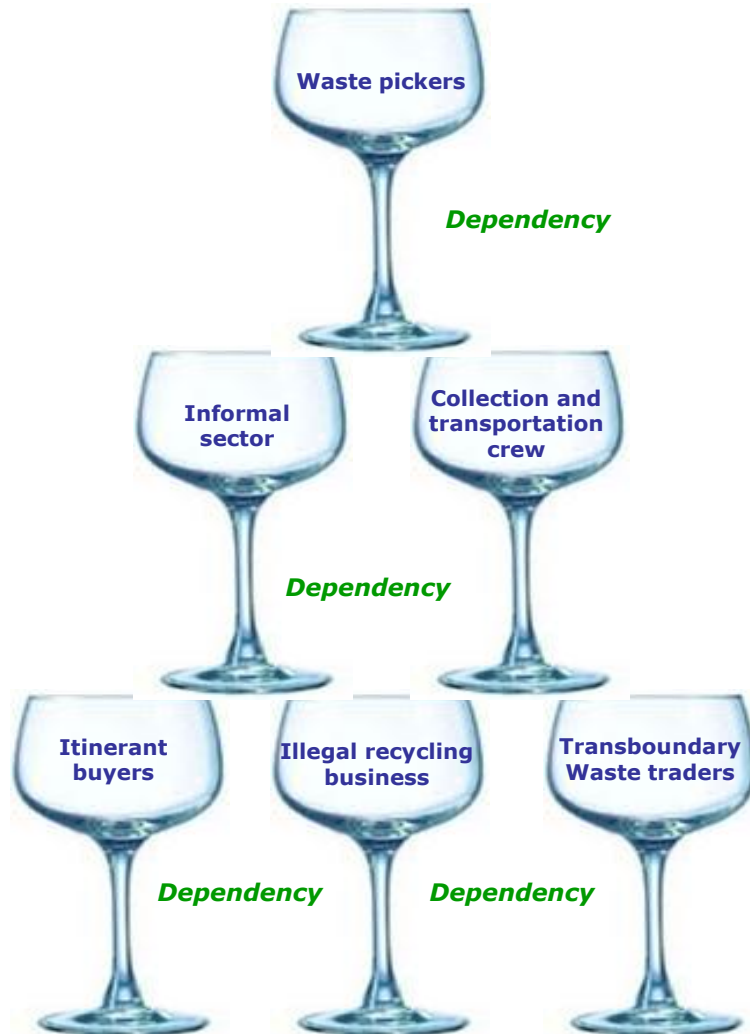
**Segregation/Sorting**  
**Sort classifier (waste pickers, mostly women's & small kids)**  
**Waste conveyor**



# What it brings in light?



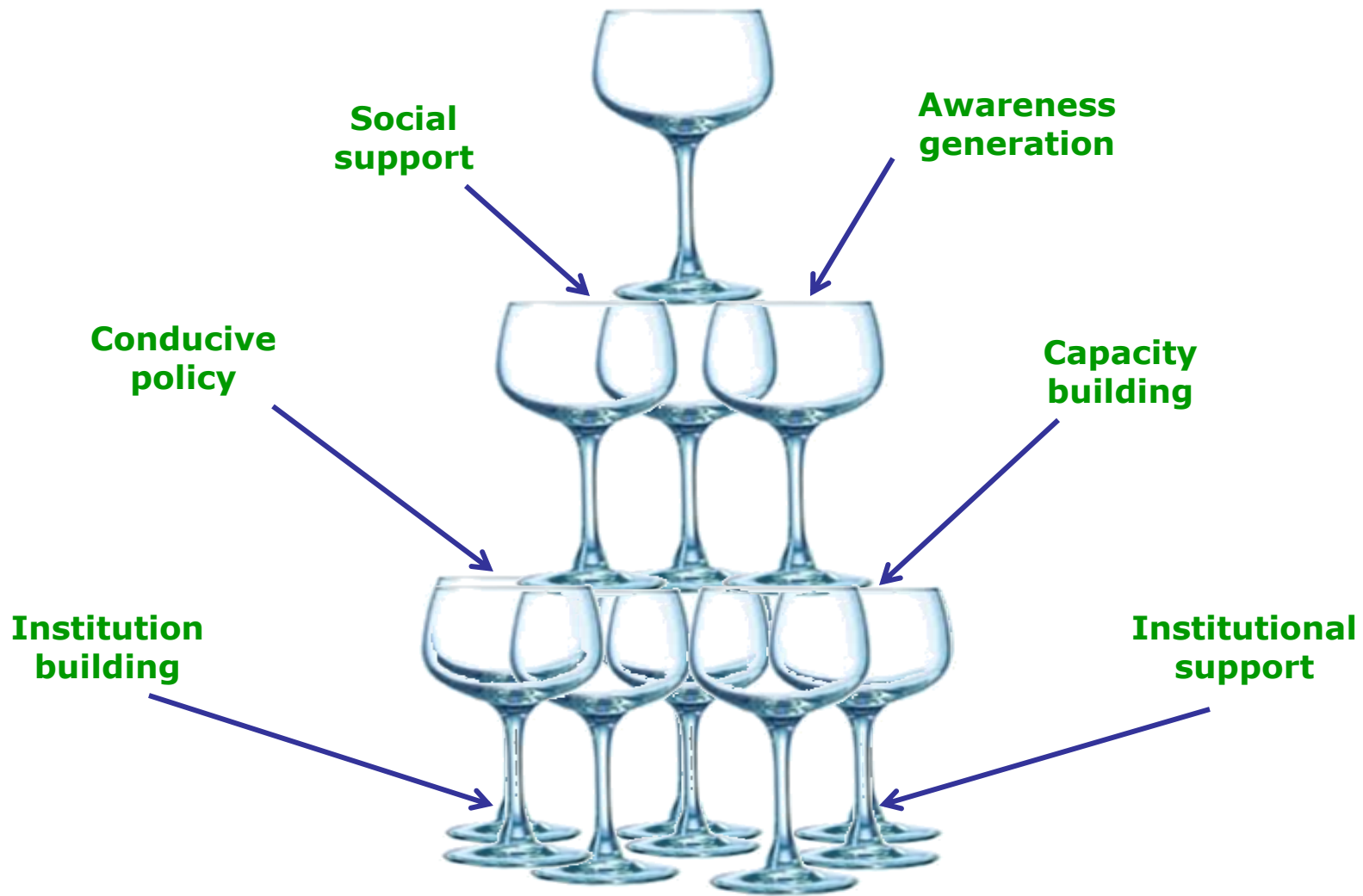
# Handle with Care!



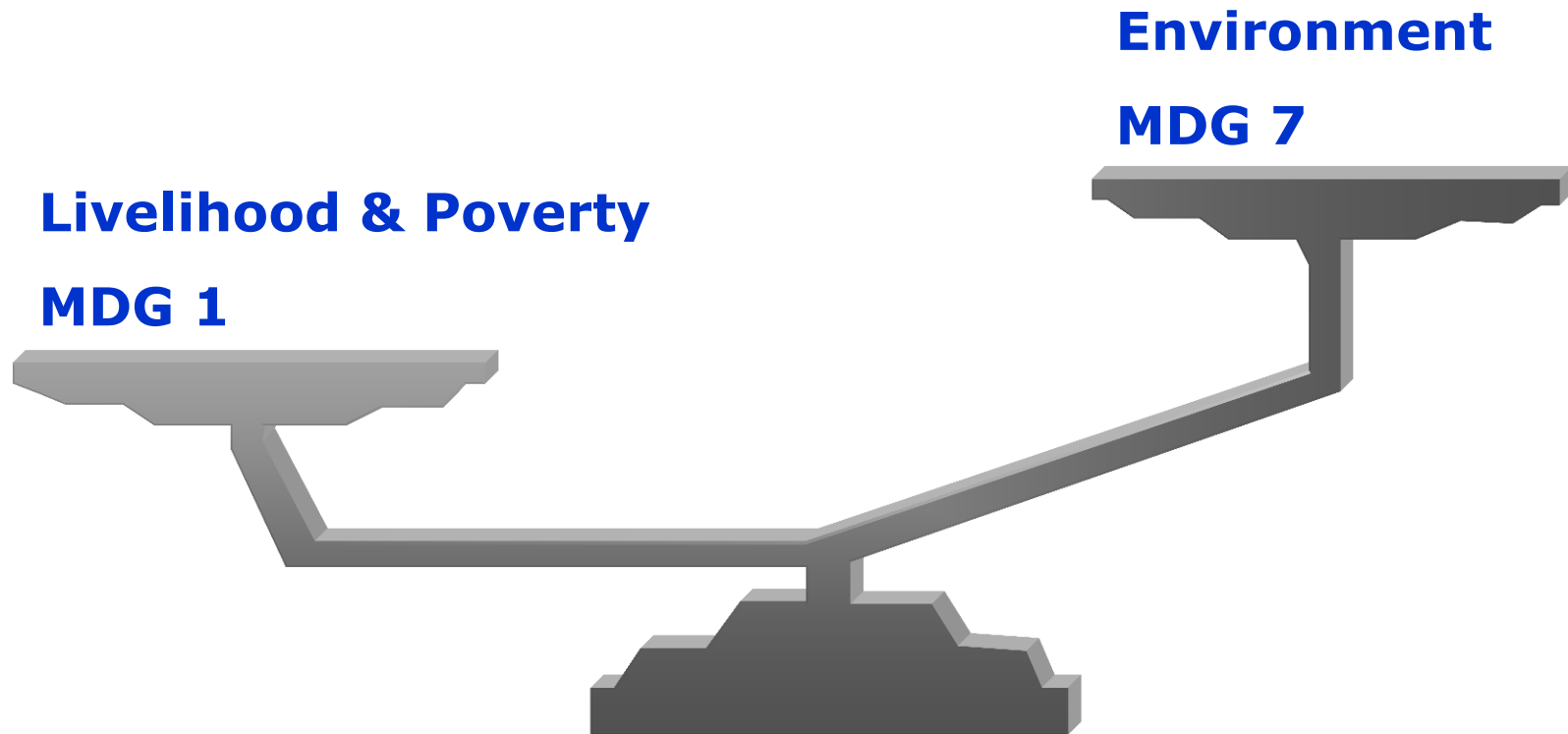
- ✓ Highly unorganized
- ✓ Provide livelihood to number of peoples
- ✓ High share and contribution in the recycling waste business
- ✓ Poorly acknowledge
- ✓ Considered as business of poor and homeless people
- ✓ Human force is the main strength
- ✓ Mostly women's and small kids
- ✓ Good network and communication channel among the waste traders



# How to prevent from splintering?



# How to balance?



# Challenges and Opportunities

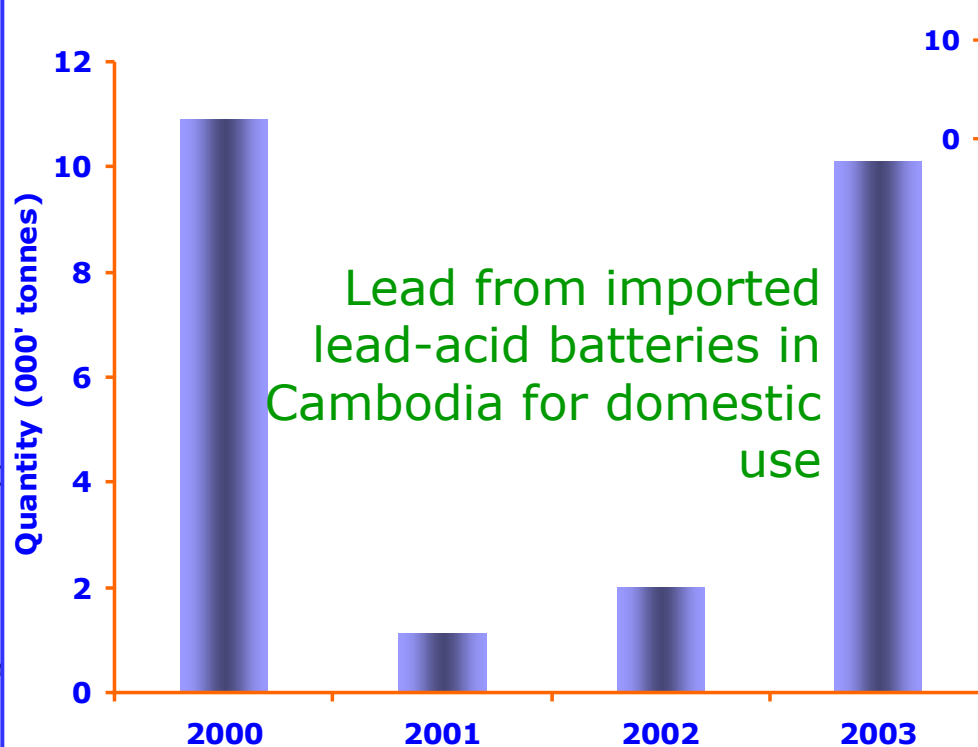
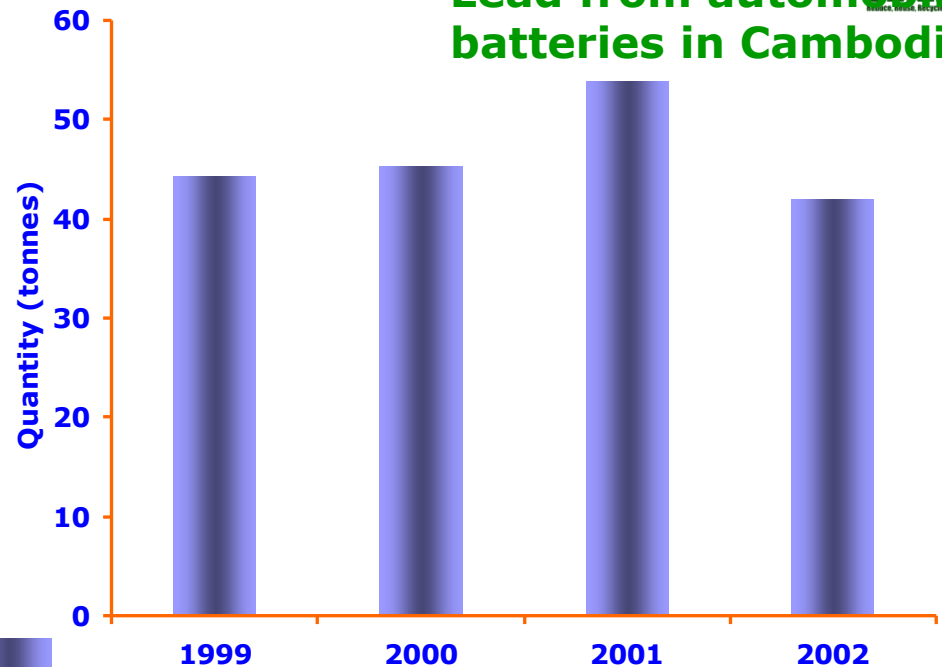
- **Economies of scale**
- **Financing of Recycling Industry**
- **Technology Uptake**
- **Diverse Stakeholders**
- **Institution and Policy**
- **CDM and 3R**
- **EPR and TT**

# Case of Lead Recycling...



Of the 8+ million tons of lead produced worldwide every year, over 85% goes into lead acid batteries

Lead from automobile batteries in Cambodia



In Cambodia, Approx 11,000 tonnes of lead in circulation every year worth.... US\$ 23 million\*



\*@ 2170 US\$/tonne, London Metal Exchange, 10 Aug 2010

# Lead Recycling...Cambodia

**How is this lead kept in the cycle?**

**Battery Sales outlets**

**Recharging and  
reconditioning centres**

**Used batteries collected  
by scavengers**

**Used batteries recycling at  
Battambang Province**

**How environmentally safe and  
efficient is this operation?**

**Level of technology use...!!!**





# Some Thoughts...

**Lead recycling system in Cambodia has a critically linked supply chain with many actors involved at various stages !!!**

**Number of families make their livelihood on the battery supply chain**

**- Has a socio-economic component**

Is it workable to transfer lead recycling technology?

What could be the direct and indirect implications?



# Lead Recycling TT

- **Need to develop a supply chain and formalize it**
- **Quench the social, economic and environmental needs of all stakeholders in the chain**

## Some Issues to consider

- **Minimum feedstock supply, variations in supply**
- **Pollution control and prevention**
- **Occupational health and safety**
- **Technology deployment**
- **Social linkage - informal sector, livelihood opportunity, poverty alleviation**

11,000 tonnes/year...is it economically viable to transfer technology to set up a lead recycling plant ???



# Recycling as a Business

**Bergsoe Metal Corp., operates a lead battery recycling plant in Saraburi, Thailand**

**Imports lead waste from developed countries such as Australia, Japan and the US.**

**Annual capacity for Lead recycling is 80,000 tonnes**

**A classical case of economy of scale compared to the Cambodian case!!!**

Can a similar industry be set up in Cambodia to promote lead recycling? Or

Can all the lead be sent to Thailand for recycling?





# Options to Promote Recycling

- **Setting up Lead Recycling in Cambodia**
  - **Feedstock to keep the industry running round the year - Need to ensure steady supply**
  - **Sourcing lead from other neighboring countries, import from developing countries - basel convention !!!**
  - **Formalizing the informal sector making livelihood on the supply chain – social issues**
  - **Moving recycling to another country**
  - **Transporting lead to another country – transboundary movement of waste**
  - **Basel convention**
  - **Local legislations**
  - **Set of social issues**
- Promoting recycling industries capitalizing on economies of scale will raise new social, environmental and technological issues to confront!!!

Need to find a balance

# Financing of Recycling Industries

- Are recycling industries differentiated from routine industries?
  - Based on feedstock – virgin materials or waste, scrap, refurbished products
- Recycling industries contribute to a country in many ways. How are they encouraged?
- What financing options are available for recycling industries?
- If recycling industries are not differentiated from their counterparts, what could be the driver (other than profit) for entrepreneurs to start a recycling industry?



# Recycling Industries...Thailand

- **Recycling and the reuse of unwanted materials**
  - Separation of unused materials
  - Collection of unused materials
  - Reuse of unwanted materials
  - Recycling of unwanted materials
  - Recovery of valuable substances from unused materials
  - Unwanted materials have to be sourced within Thailand
- **Classified as a priority activity by the Board of Investment**
  - Import duty exemption on machinery
  - Corporate income tax exemption for eight years

Typical recycling  
industry scenario

Favorable conditions, yet the recycling sector in Thailand has  
not picked up satisfactorily...why?





# Recycling Industries...Thailand



- **Unwanted materials have to be sourced within Thailand**
  - **A constraint since threshold waste volumes may not be available within the country**
- **Import duty exemption on machinery and Corporate income tax exemption come only after the plant comes up**
- **Equity investment for recycling industries - not yet attractive for private investors as an independent business**
- **Financial institutions – debt coverage for recycling project – risky business**
- **Venture capitalist – project finance for recycling industrial investment – perceived risks are high**

More untapped opportunities in the core industries sector, not yet saturated. Need financing models to support upfront costs of recycling industries. Tax incentives and rebates help only later.

# Technology Uptake

- **Skill and education level matters – Developing Asian countries Vs developed countries such as Japan**
  - Citizens awareness, waste collection crew knowledge, recycling facility workers skill
- **Introducing new recycling technology/practice warrants training at various levels**
  - Citizens – need to know how the waste will be processed, only then can get along with the system
  - Waste collection crew – what if the crew does not realize the need for segregated waste and mixes it during transportation
  - Recycling facility workers – need to have the skills to operate and control the recycling system



Ability to uptake a technology can be attained only through  
Training and Capacity Building

# Diverse Stakeholders

Municipality in  
the country of  
origin of waste

Judiciary

Municipality in the  
destination  
country

Waste  
Management  
Services

Importing  
company

Exporting  
company

Customs – Exporting  
country

Shipping  
company

Customs –  
Importing country



Broad spectrum of stakeholders with varying  
business and professional interests

Every stakeholder has a different daily agenda;  
recycling is not often on top in everyone's list.

# Institution and Policy

- How clear are we on our stance to promote/regulate Transboundary movement of waste? – Basel convention has its own set of issues
- How deep and wide is the required competency and knowledge on Basel convention? – for example, 2<sup>nd</sup> hand goods, goods for recycling, goods for donation; waste in disguise
- How can we develop strong Intellectual Property Rights (IPR) to attract FDI
- How we deal with MEAs, e.g. waste aluminum recycling releases dioxins, what if host country is already a signatory to Stockholm convention....?????



????

# Some Thoughts...

Moving waste between countries for recycling can raise several practical issues to address.

- **Ensuring the legitimate needs of all stakeholders is vital**
- **Educate and build capacity of stakeholders - to handle situations of illegal waste movements**
- **Formulate legislations to assign/reflect due powers for all stakeholders – to respond at times of crisis in complying with rules, e.g., illegal waste movements.**
- **Build institutional setup/capacity to ensure proper checks and balances – to establish surveillance as a preventive measure**

Setting up a large-scale regional recycling facility requires multidimensional and holistic perspectives from a transboundary movement point of view.





# CDM and 3R

- **AMS III AJ - Recovery and recycling of materials from solid wastes**
- **Activities for recovery and recycling of HDPE and LDPE materials in MSW to process them into intermediate or finished products**
- **Measures are limited to those that result in aggregate emission reductions of less than or equal to 60,000 t CO<sub>2</sub> eq annually.**
- **Approved by CDM Executive Board on 26 Mar 2010 – no projects received at CDM EB yet – 5 months since approval**



Waste management/3R sector has to take advantage of this methodology - an opportunity to capitalise

# EPR & TT

- **Extended Producer Responsibility**
  - Every producers assumes responsibility for the end-of-life handling of their products
  - Typically done by establishing channel partners to collect, treat, recycle...so on...
- **Apple → Li Tong Recycling, Hong Kong → DHL in Asia\***
  - Apple products – free of charge
  - Non-Apple-branded products – at a cost, say USD\$ 30/PC\*\*

\*[www.reverselogistic.com/apple.consumer/](http://www.reverselogistic.com/apple.consumer/); \*\*[www.apple.com/recycling/computer/](http://www.apple.com/recycling/computer/)

# EPR & TT

- At some point of time, when EPR picks up, all producers will have their own recyclers
- Over time, the quantity of unattended “waste” in the society will decline
- Recycling facilities promoted as EPR initiatives
  - Have a fair knowledge base
  - Adopt state-of-the-art technologies
  - Operate as independent business
  - Lack social inclusion – informal sector
- Trade-off between EPR and TT for Green Technologies



Could EPR become a challenge to TT for Green Technologies?

# Overview of TT Challenges and Opportunities

## Challenges

- Economies of Scale
- Financing of Recycling Industries / TT projects
- Training – uptake ability
- Diverse stakeholders
- Enabling policies
- Mechanisms for IPRs
- Social exclusion



## Opportunities

- Create new eco-friendly products and services
- Create social entrepreneurs
- Create green jobs
- Increase cash flow
  - poverty alleviation
- Capacity building of stakeholders
- Conserve resources
- Social inclusion
- Boost in the regional and international cooperation



# Take-home Message...1

- **TT related policy issues on one hand and practical issues on the other – both need to be equally addressed**
- **Practical issues have to be resolved to keep resource circulating with the help of recycling industries**
- **Policy and strategy development – in full swing – thanks to the initiatives of various organizations.**
- **Challenges to Green TT for 3R are omnipresent – equally present are the opportunities**
- **Transforming challenges to opportunities through concerted regional action – Regional 3R Forum an initiative in this direction**
- **3R TT has strong social dimension, potential to affect livelihood of informal sector; thus host country got long stick to balance with**

# Take-home Message...2

- **Time to move ahead and start resolving the issues**
- **Make community aware on benefits of the TT**
- **Streamline informal sector during TT**
- **Look for Environmentally Sound Technology and Knowledge Transfer**
- **Important to understand the function of the technology**



**Thanks for your attention!**