



Green Industry

# Sustainable business model involving SMEs

UNIDO's approach to e-waste management

GMS training workshop on e-waste

Hanoi, 10-13 July 2012



UNITED NATIONS  
INDUSTRIAL DEVELOPMENT ORGANIZATION

[www.unido.org](http://www.unido.org)



# Overview

- E-waste in numbers
- E-waste flows
- Sustainable business opportunities
- UNIDO projects
  
- Terminology:
  - CRT: Cathode Ray Tube
  - WEEE: Waste Electronic and Electrical Equipment (EU terminology)
  - LCD: Liquid Crystal Display
  - EPR: Extended Producer Responsibility



## E-products in numbers (\*)

- In EU in 2005, the total weight of electronic appliances put on the market represented almost 10 million tons:
  - more than 44 million large household appliances;
  - 48 million desktops and laptops;
  - Approximately 32 million TVs; and,
  - 776 million light bulbs/lamps.
- In USA in 2006:
  - more than 34 million TVs and displays;
  - more than 24 million PCs; and,
  - roughly 139 million portable communication devices (cell phones, pagers or smart-phones).



Products of concern: PC (printed circuit boards), CRT, flat screen, battery, fridges (CFC)



## E-products in numbers (cont.)

- In China in 2005:
  - roughly 14 million PCs;
  - more than 48 million TVs;
  - nearly 20 million refrigerators; and,
  - 7.5 million air conditioners (in 2001).
- GSM Association estimates that 896 million mobile phones were sold in 2006 worldwide.
- The average lifespan of computers in developed countries has dropped from six years in 1997 to just two years in 2005.
- Mobile phones have a lifecycle of less than two years in developed countries.



## E-waste in numbers (\*)

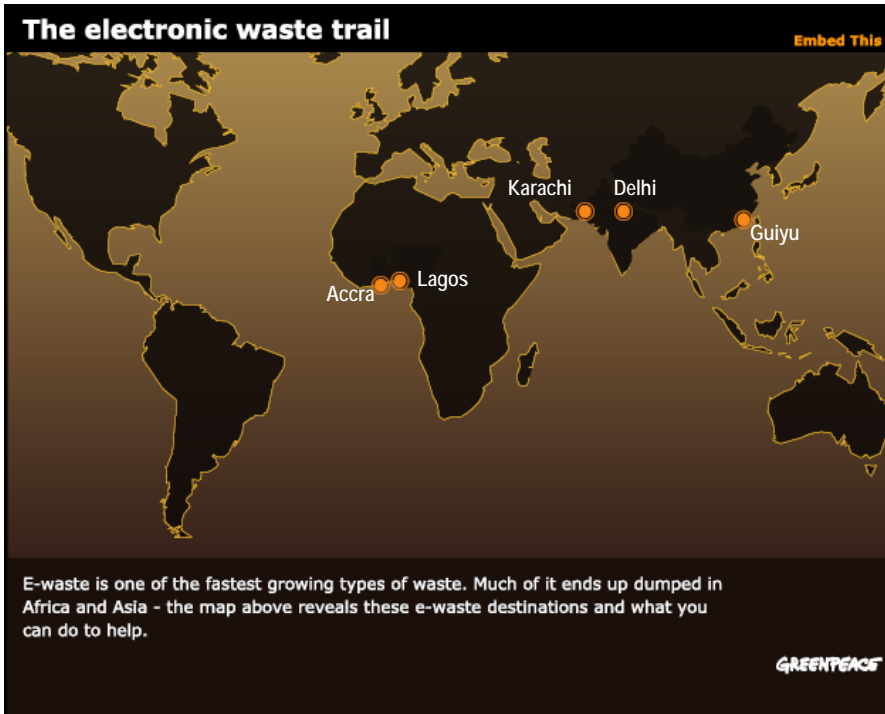
- The amount of electronic products discarded globally has skyrocketed recently, with 20-50 million tons generated every year.
- If this amount of e-waste was stored into containers on a train, the train would go once around the world!
- Not only developed countries generate e-waste; Asia discards an estimated 12 million tons each year.



# Challenges for e-waste solutions

1. The current WEEE Directive (EU) loopholes allow WEEE to be exported from developed countries to developing countries:
  - Only 30% of WEEE given to collection points flows through the official WEEE Directive channels – the other 70% ending up in unreported and largely unknown destinations.
2. The cost of reverse logistics (= cost of reuse of material)
3. “Recycling” practices in developing countries

# E-waste flows to developing countries



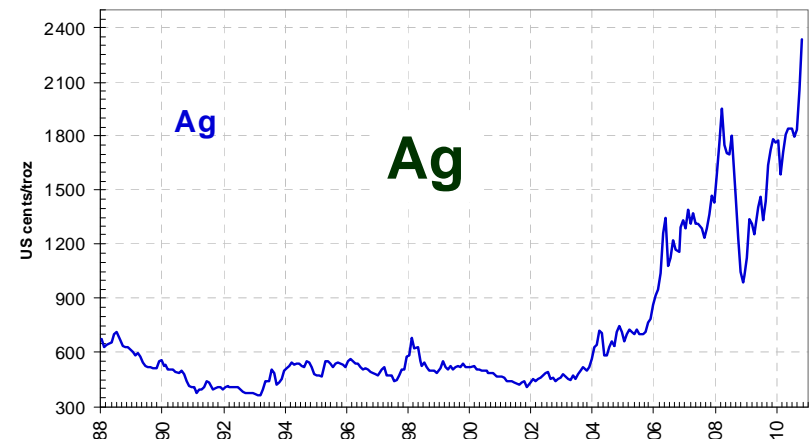
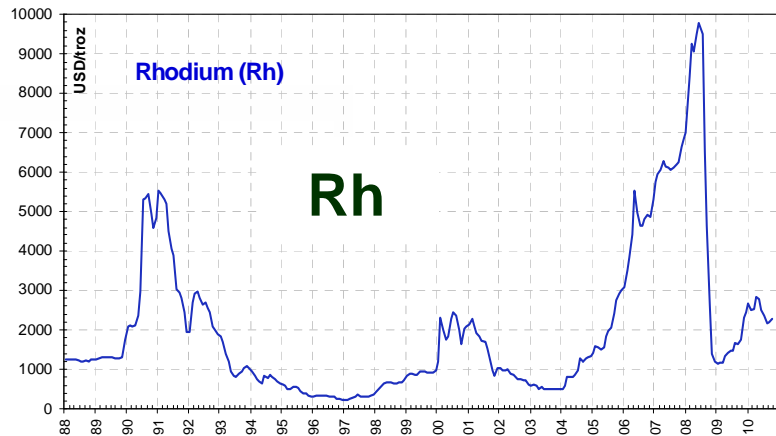
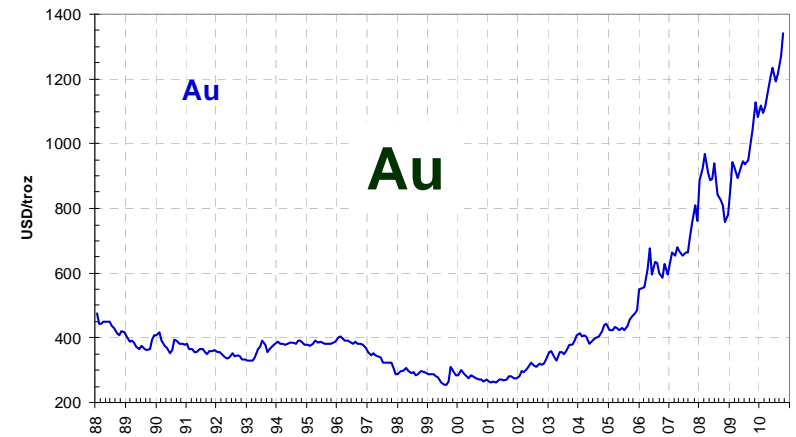
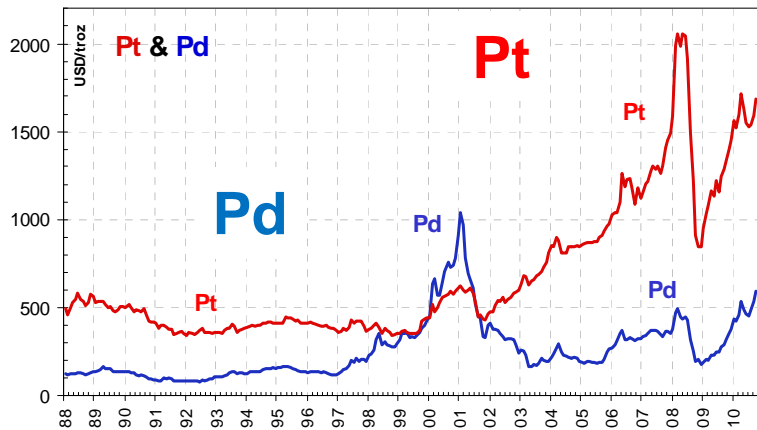
Source:

<http://www.greenpeace.org/international/en/campaigns/toxics/electronics/the-e-waste-problem/where-does-e-waste-end-up/>





# Rising metal prices – a trigger for improvement?





# The challenge: how to recover the valuables without spilling the hazards ?



- E-scrap = a complex mix
  - Precious metals (Ag, Au, Pd...)
  - Base- & special metals (Cu, Al, Ni, Sn, Zn, Fe, Bi, Sb, In...)
  - Heavy metals (Hg, Pb, Cd, As, ...) => substances of concern
  - Halogens (Br, F, Cl...)
  - Plastics & other organics
  - Glass, ceramics
- Environmental risk in case of landfilling & inappropriate recycling
- Valuable metal resource

Composition of mobile phones

■ mobile phone substance (source Nokia)

1	IA																	18	VIIIA	
1	H																	2	He	
2	Li	Be																	10	Ne
3	Na	Mg																	18	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr		
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe		
6	Cs	Ba	La-Lu	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn		
7	Fr	Ra	Ac-Lr	Rf	Db	Sg	Bh	Hs	Mt	Uun	Uuu	Uub	Uuq							



# Harmful substance emissions on 3 levels with dramatic environment & health impacts

1. From the **product itself** (if landfilled):  
=> Pb in circuit boards or CRT Glass, Hg in LCD backlights, ...
2. Due to **substandard processes**:  
Dioxin formation during burning of halogenated plastics or use of smelting processes without suitable off gas treatment
3. Due to **reagents** used in the recycling process:  
Cyanide and other strong leaching acids, NO<sub>x</sub> gas from leaching processes and Hg from amalgamation



 ***Even the perfect 'green' product causes hazardous emissions if not treated in an environmentally sound manner***



# E-waste sustainable business

## 1. Economic sustainability

- Volume of E-waste generated on a yearly basis is considerable
- Price of metal is high



## 2. Environmental sustainability

- Contamination of groundwater => drinking water supply
- Soil contamination
- Air emissions during processing



## 3. Social aspects

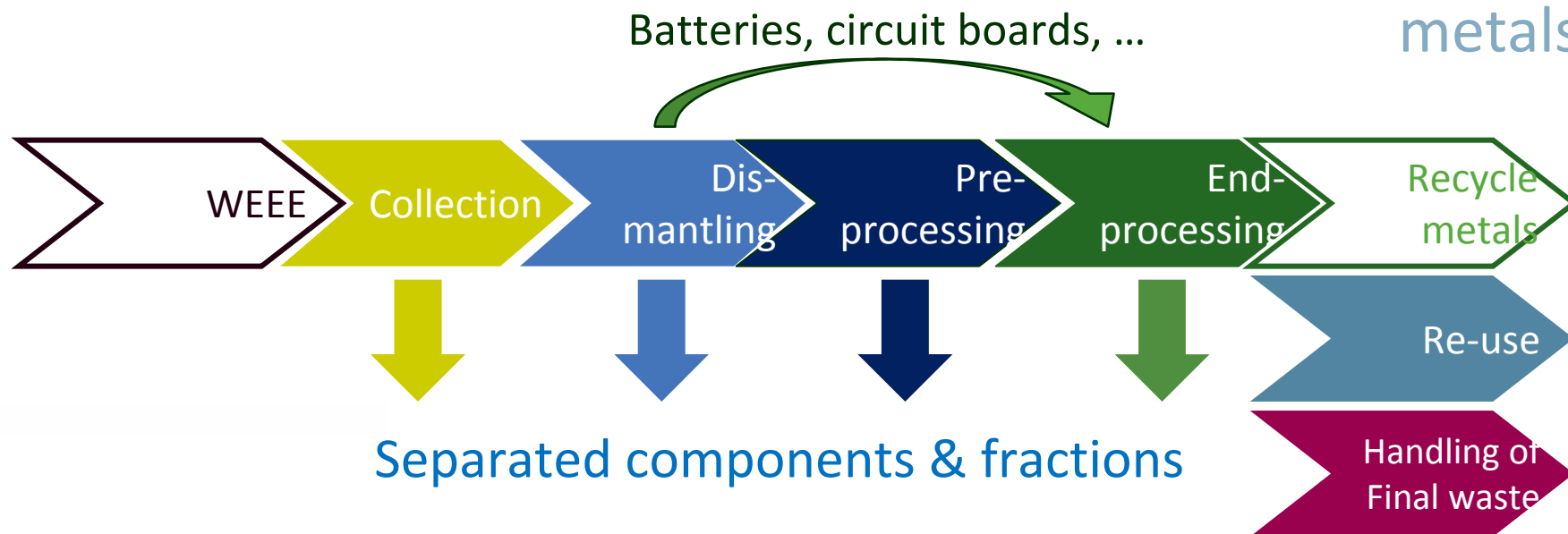
- Child labour
- Unsafe and unhealthy practices





## Recycling chain: system approach is key for optimum value recovery

Example:  $50\% \times 90\% \times 80\% \times 95\% = 34\%$  recycled metals



**➔ Total efficiency determined by the weakest step in the chain!**

## Certainly wrong approach for efficient gold recovery



Acid dissolution

photo  
EMPA

=> 75% of gold is lost, even more of silver and palladium

=> Dramatic environmental & health impact

But shredding PCs without removing the boards does not provide better yields!



=> 75% of gold is lost, even more of silver and palladium



Developing  
country



80 %



x 50 %



x 50 % = 20 %\*

Gold recycling  
efficiency\*:



Developed  
country



50 %



x 25 %



x 95 % = 12 %\*

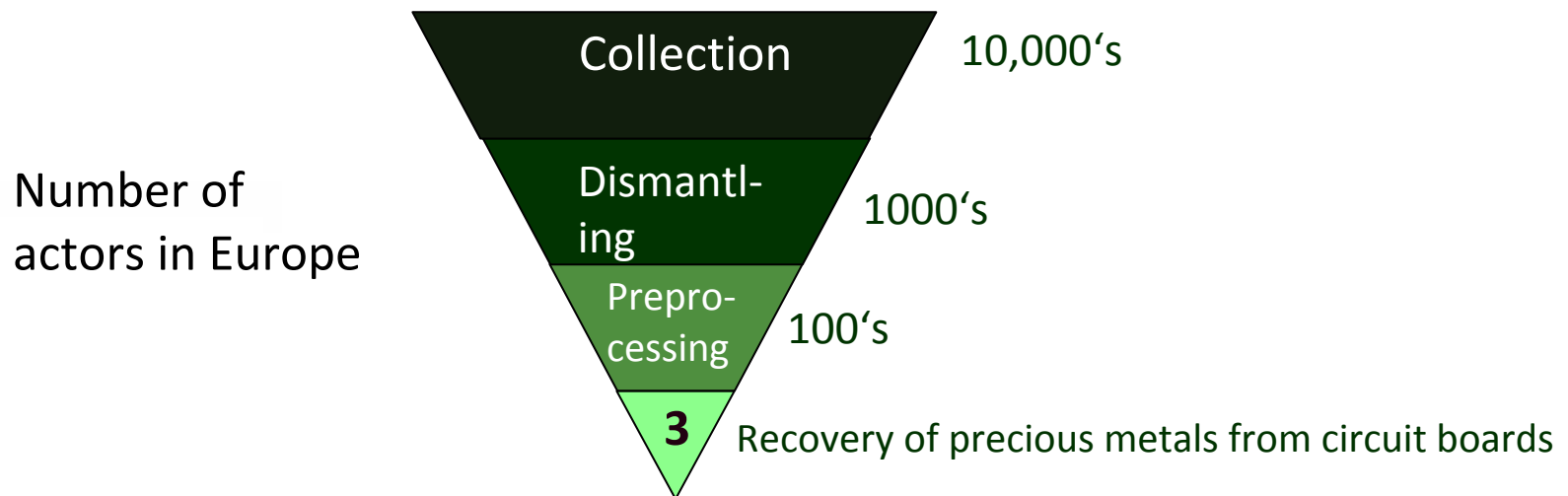
***In the bottom line, a developed country is often not doing better!***

\*Illustrative figures with gold as example



# Recycling chain: system approach is key for optimum value recovery

1. Significant downstream increase of investments & technology requirements
2. Sufficient capacity for recovery of precious metals available
3. Make sure that critical fractions reach these plants!





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# StEP Initiative

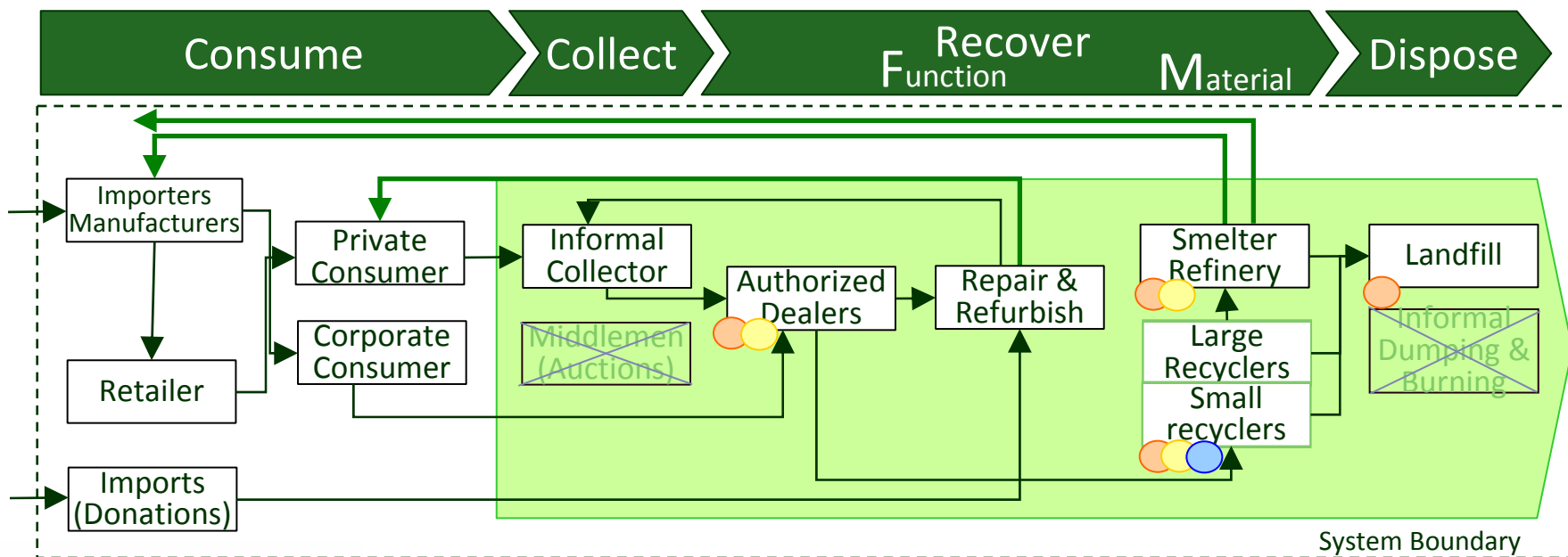
([www.step-initiative.org](http://www.step-initiative.org))

- Initiated by various UN organizations, StEP initiative works with representatives from industry, governments, international organizations, NGOs and the academia to initiate and facilitate approaches that **promote the sustainable handling of e-waste.**
- UNIDO member since 2008
- Involvement in the “re-use” and “recycle” Taskforces





# How to implement a holistic approach?



## Intervention Mechanisms:

- |  |  |  |   |
|--|--|--|---|
| <b>Policy &amp; Legislation</b> <ul style="list-style-type: none"> <li>• Licensing</li> <li>• Legislation</li> </ul> | <b>Business &amp; Finance</b> <ul style="list-style-type: none"> <li>• Take back scheme</li> <li>• Technical control and fixed contracts</li> <li>• New business models</li> </ul> | <b>Technology &amp; Skills</b> <ul style="list-style-type: none"> <li>• Knowledge and technology transfer</li> <li>• Formalizing the informal sector</li> <li>• Trainings</li> </ul> | <b>Monitoring and Control</b> <ul style="list-style-type: none"> <li>• Standards</li> <li>• Audits</li> <li>• Monitoring Massflows</li> </ul> |
|  |  |  | <b>Marketing &amp; Awareness</b> <ul style="list-style-type: none"> <li>• Information Campaigns on all levels</li> </ul>                      |

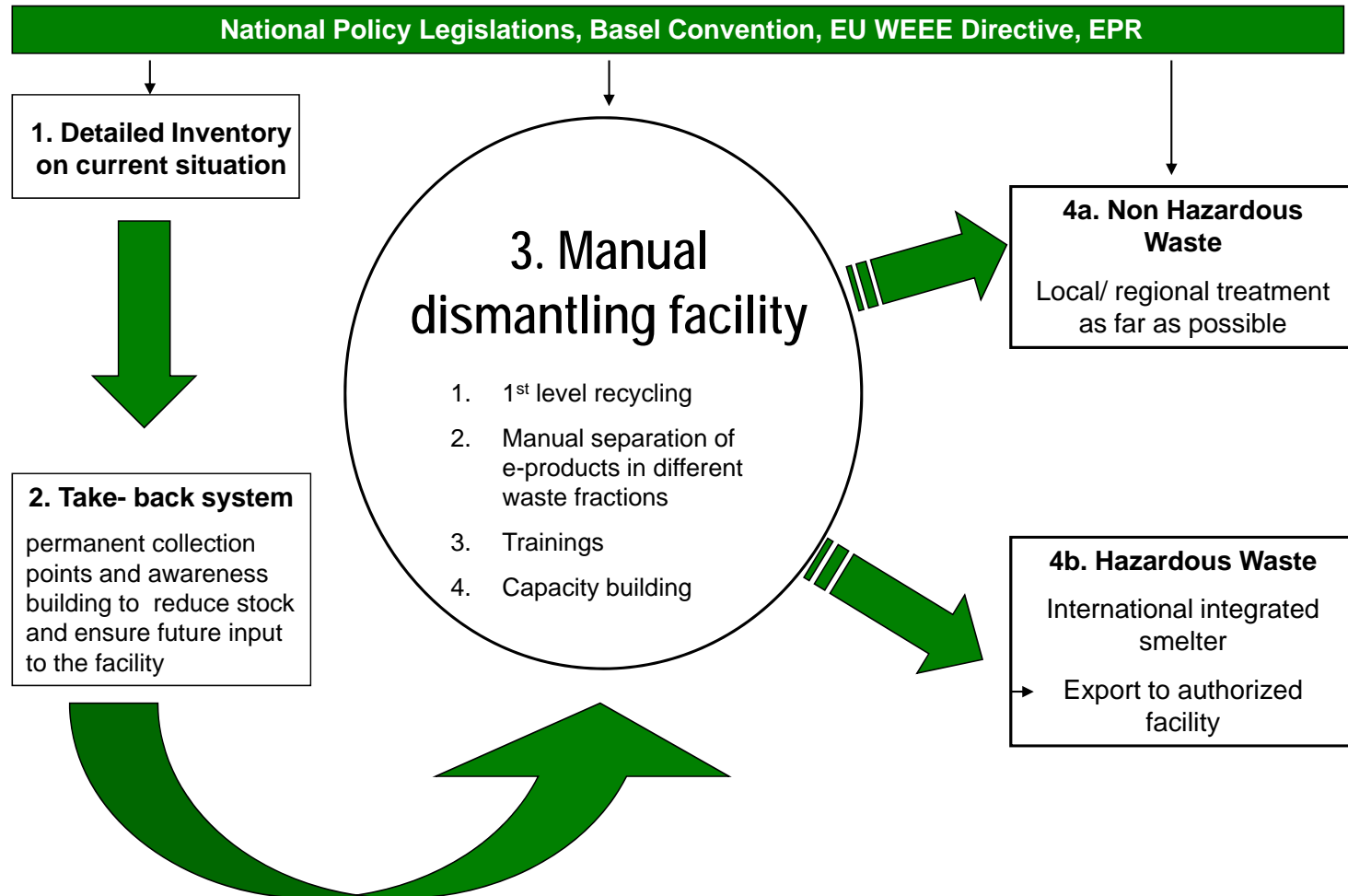


## Business opportunities within the whole recycling chain e-waste



- Formal Take-Back and collection scheme
- Repair/ Reuse
- Manual dismantling facility for 1<sup>st</sup> level treatment with options to sell output fractions to local, regional and international recyclers
- Local treatment of non-hazardous fractions
- Export of hazardous outputs to international smelters to recover precious metals

# UNIDO approach in e-waste management





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## UNIDO's current projects on e-waste management

- Establishment of a manual dismantling facility for WEEE in Uganda
- Investment promotion project on environmentally sound management of electrical and electronic waste in Ethiopia with a regional perspective
- Component on E-waste management in the One UN Programme for Tanzania
- Regional approach for countries with low volumes of e-waste

## Regional approach for East Africa

- Projects in Ethiopia, Uganda and Tanzania
- For countries with low e-waste generation
- One regional facility for pre-processing
- Small collection and dismantling facilities in each country to ensure that e-waste will reach the waste stream
- Recycle as much as possible in the region





## Pipeline projects for Asia

- Project in Cambodia in collaboration with Samsung and financial support from KOICA
- Regional project on POPs in WEEE in six countries (to be funded by GEF) :
  - Cambodia
  - China
  - Indonesia
  - Lao PDR
  - Philippines
  - Thailand



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**Thank you  
for your attention!**

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