

# Knowledge Partnerships with Developing and Transition Countries in e-Waste Recycling



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**EMPA** - Swiss Federal Laboratories for Materials Testing and Research

**tsl/sustec** - sustainable technology cooperation

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# e-Waste: Truly a Problem Everywhere?



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# Questions to be Answered

- Is e-waste recycling posing major problems / risks now or in the near future?
  - What is e-Waste or WEEE (Waste from Electric and Electronic Equipment)?
  - How much e-Waste has to be handled? globally and locally?
  - How is e-Waste handled / recycled?
- Do the framework conditions for e-waste handling allow for economically feasible improvements?
- Are solutions along the concepts of the SWICO / S.EN.S recycling system, the Swiss model for e-waste handling, feasible?

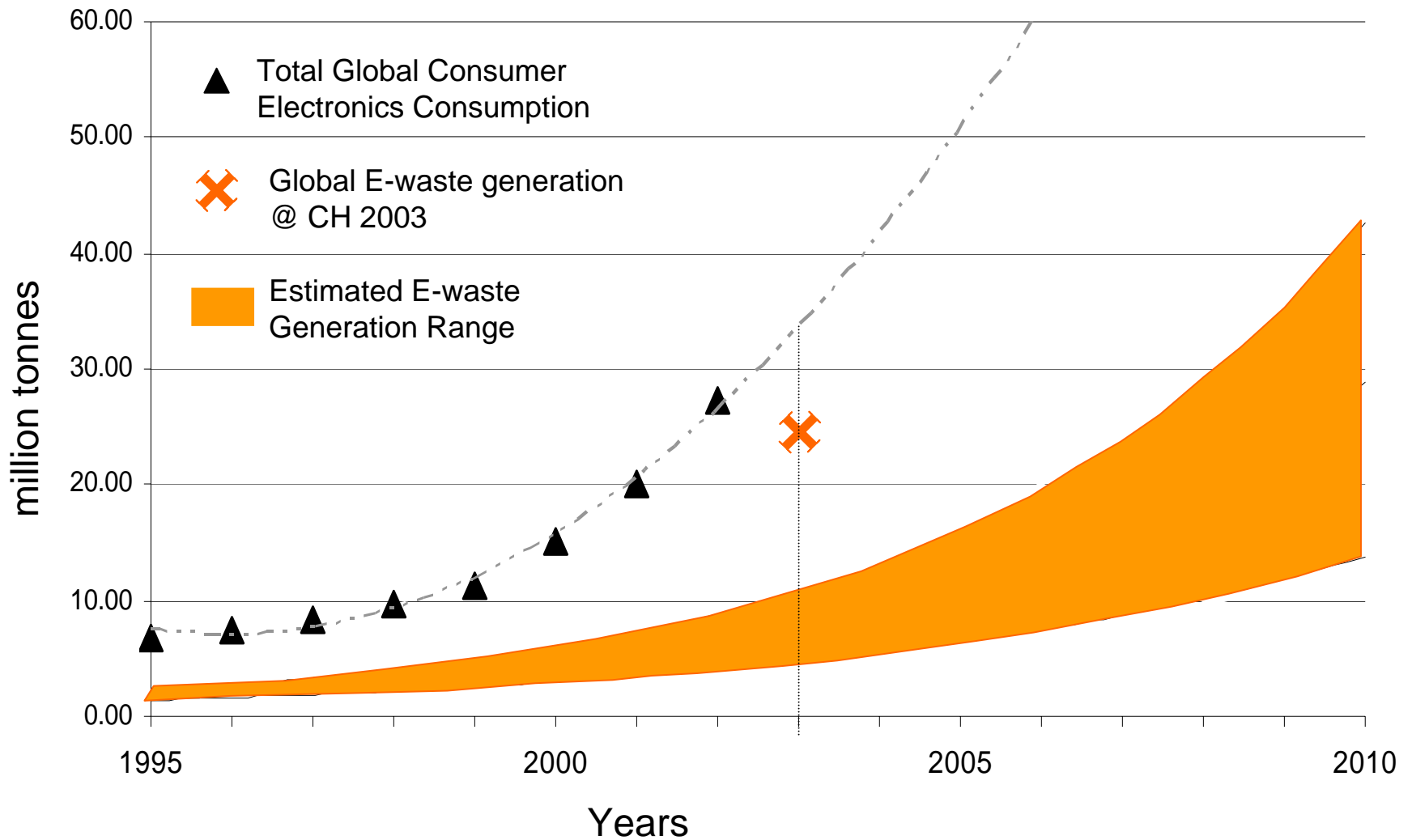
# WEEE Facts and Figures, Switzerland

7.4 Mio.	Residents (2003)
<100'000 t	<b>WEEE</b> per year for recycling (tons, 2003)
~35'000 t	from the above 100'000 t are <b>electric waste</b> (per year, 2003)
~30'000 t	<b>electronic waste</b> (e-waste per year, 2003)
2'791 €	Investment in ICT per person and per year (2002) = ~3'000 US\$
63%	of the Swiss are internet users
80%	of the Swiss are mobile phone users (2002)

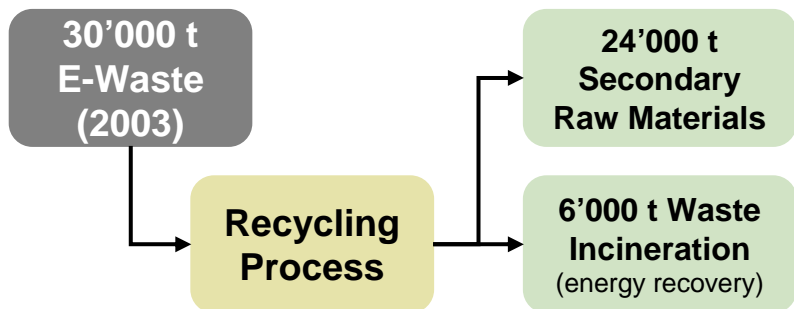
## Electronic Equipment in Switzerland:

8.6 Mio.	TV sets	3.5 Mio.	Modems
8.2 Mio.	Hi-fi sets	1.9 Mio.	Scanners
7.0 Mio.	Mobile phones	1.7 Mio.	Video cameras
5.6 Mio.	Personal computers	1.7 Mio.	CD Players
5.6 Mio.	Video recorders	1.6 Mio.	Game consoles
5.0 Mio.	Printers	1.5 Mio.	Fax machines

# Global E-waste Estimates

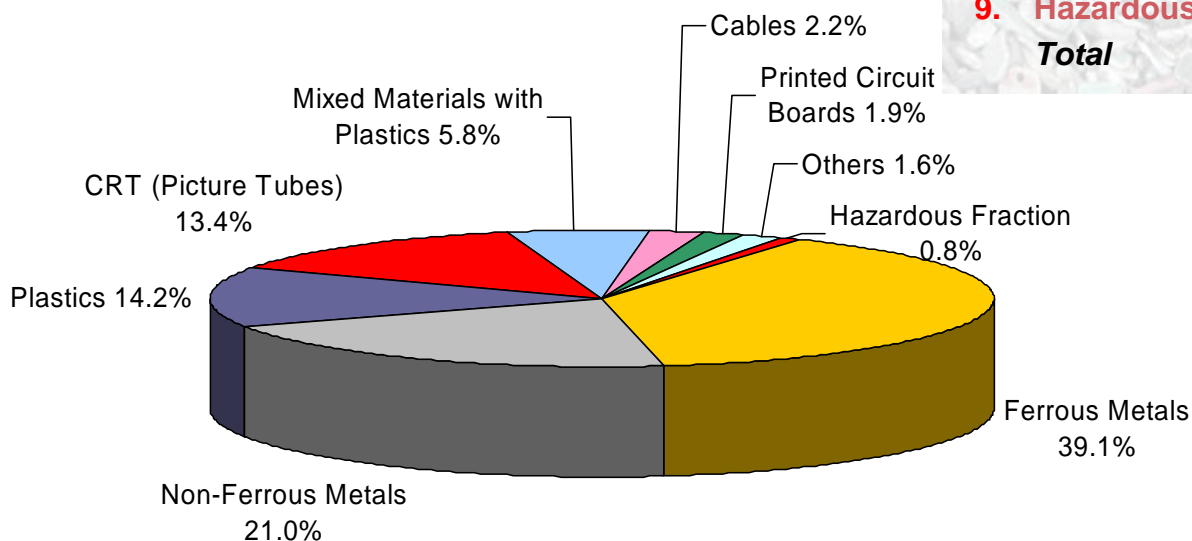


# Materials from the e-Waste Recycling Processes



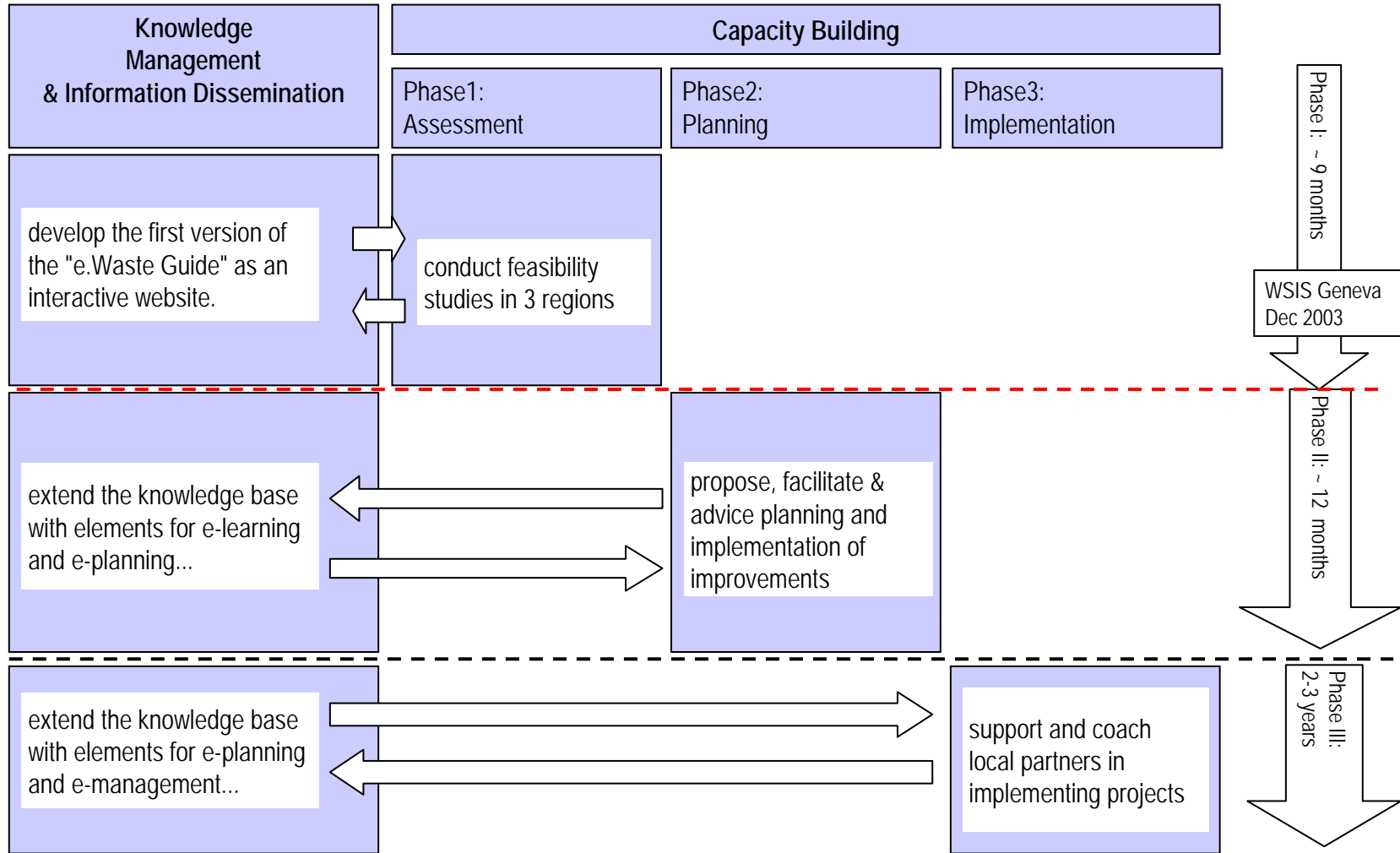
**Materials from all SWICO Recyclers:**

1. Ferrous Metals	39.1 %
2. Non-Fe Metals (Al, Cu, Au, Ag ..)	21.0 %
3. Plastics	14.2 %
4. CRT Glass	13.4 %
5. Mixed Materials with Plastics	5.8 %
6. Cables	2.2 %
7. Printed Circuit Boards	1.9 %
8. Others	1.6 %
9. Hazardous Fractions	0.8 %
<b>Total</b>	<b>100.0 %</b>

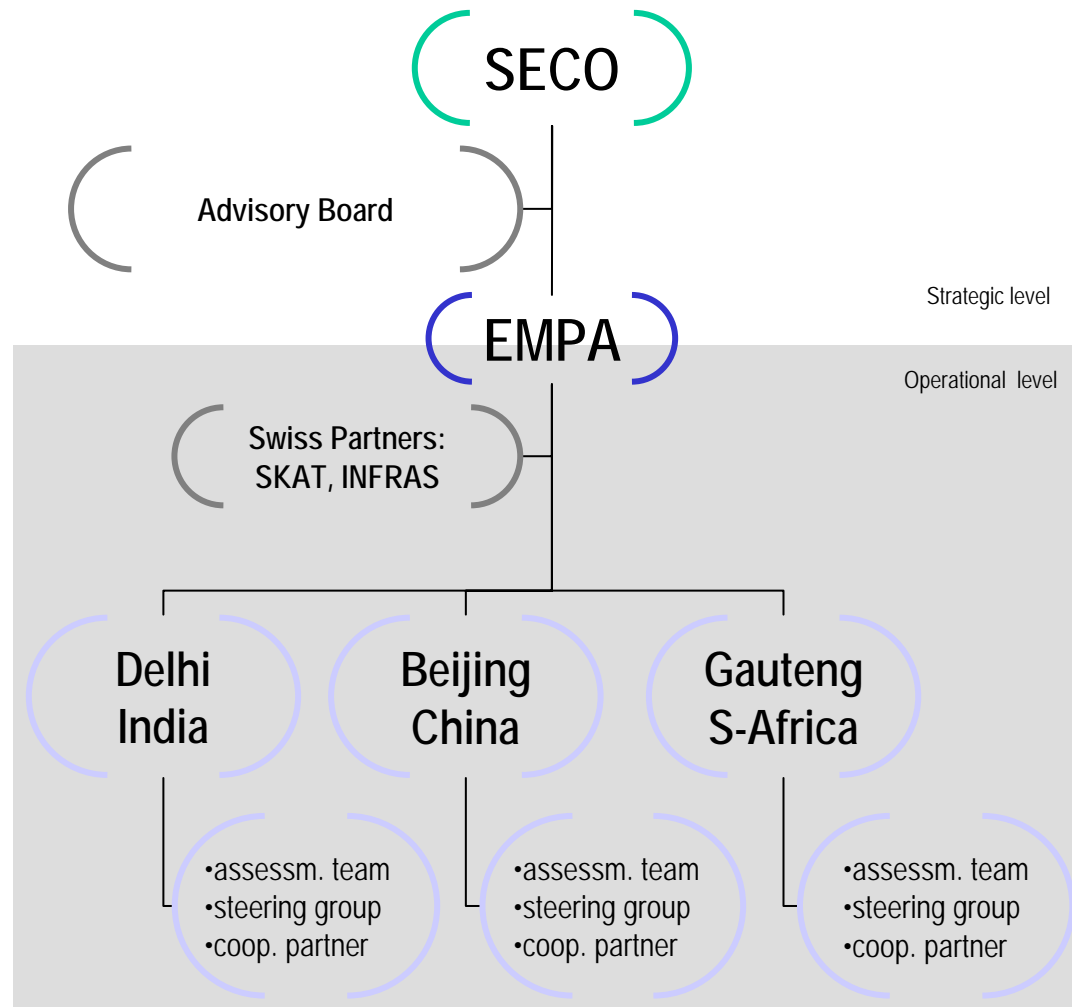


Individual figures from recyclers may differ from the above figures – depending on their specific recycling processes.

# Project Outline



# Project Structure & Organisation



The screenshot shows a Microsoft Internet Explorer browser window displaying the eWaste Guide website. The browser's address bar shows the URL <http://www.ewaste.ch/>. The website's header includes the title "Electronic Waste Guide" and a subtitle: ">> A knowledge base for the sustainable recycling of eWaste <<".

The left sidebar contains a navigation menu with the following items:

- Welcome
- Facts & Figures
- Case Study Switzerland
- Case Study India
- Services

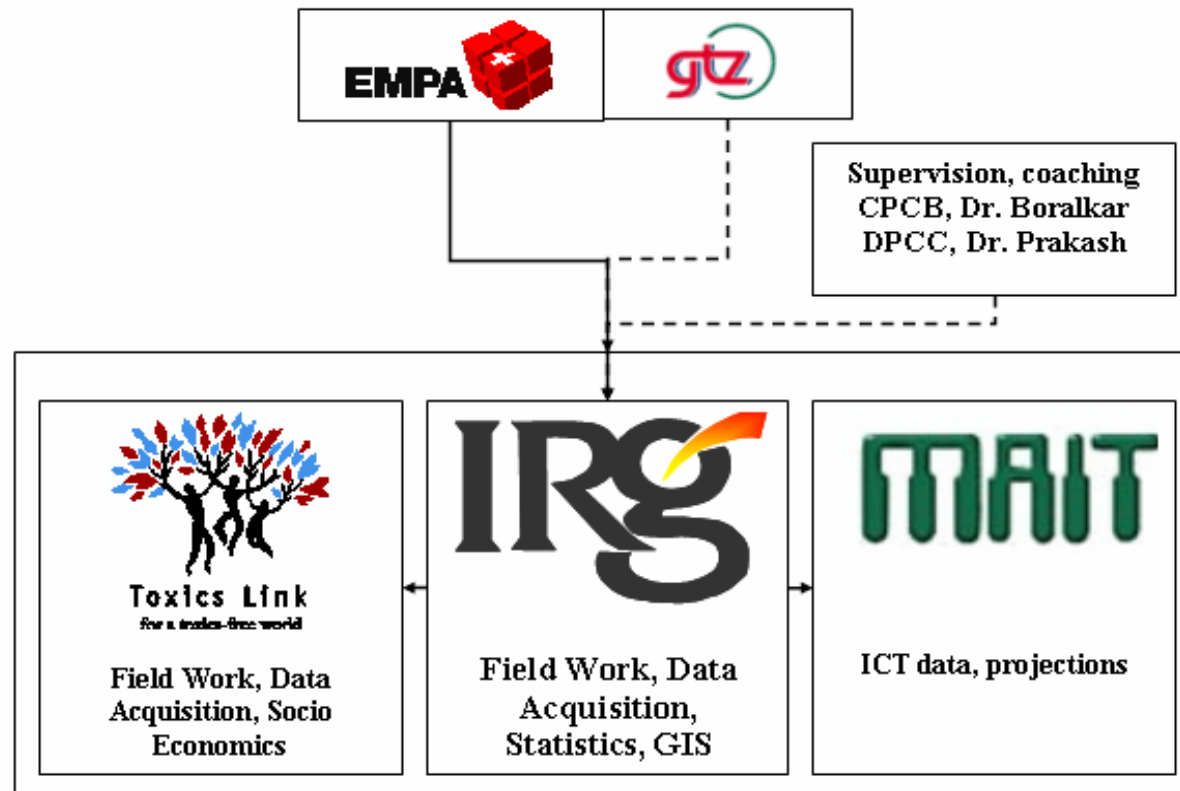
The main content area is divided into two columns:

- Overview:** This section contains three sub-sections:
  - Welcome:** A paragraph explaining that the booming ICT market is producing a rapidly growing pile of electronic waste (e-waste) – a pile that implies both risks and opportunities on a global scale. It mentions that the State Secretariat for Economic Affairs (SECO) has commissioned the Swiss Federal Laboratories for Materials Testing and Research (EMPA) to conduct this project. The ultimate aim is the reduction of harmful factors without ruining the attractiveness of e-waste recycling as a business.
  - Facts & Figures:** A paragraph stating that e-waste includes materials which are both valuable and recyclable; some of them are toxic. Modern technologies and management principles applied in OECD countries allow for nearly hazard-free recycling and disposal of e-waste. In non-OECD countries, manual e-waste processing represents an important business opportunity for local people. However, as many non-OECD countries have not yet established adequate environmental standards, a situation often results in which e-waste processing causes detrimental impacts on health and the environment.
  - Case Studies:** A paragraph stating that feasibility studies respecting the local conditions for the introduction of a sustainable e-waste recycling system are on the way. The examined regions are: **Switzerland**, **New Delhi in India**, Beijing in China and Johannesburg/Pretoria in South Africa.
- Services:** A paragraph stating that additional information can be found in the service area: **discussion forum** on e-waste-recycling, **links**, and more to come.

- News from around the world:** A list of recent news items, each with a date and source:
- Govt moves to stem tide of 'e-waste'** (April 14, 2004, The Nation, Thailand)
- E-waste a health hazard** (April 11, 2004, Delhi Newslines, Indian Express, India)
- Born-again PCs** (April 3, 2004, The Sydney Morning Herald, Australia)
- PC waste leaves toxic taste** (March 22, 2004, The Tribune, India)
- Toxic waste: Junkyards rip PCs to last bargaining chip** (March 21, 2004, Delhi Newslines, Indian Express, India)
- E-waste rules still being flouted** (March 19, 2004, BBC News)
- Warning on e-waste threat** (March 16, 2004, The Hindu)
- Govt steps in as e-waste piles up** (March 16, 2004, Times Of India)
- e-waste management gaining momentum** (March 14, 2004, The Hindu)
- NGO sounds e-waste alert** (March 13, 2004, The Times of India)

The footer of the browser window shows the copyright notice "© 2004 EMPA" and the text "initiated by seco".

# Indo - Swiss Pilot Assessment in Delhi: Management, Handling & Practices of e-Waste Recycling in Delhi (2003 - 04)



# Impressions of e-Waste Handling in Delhi



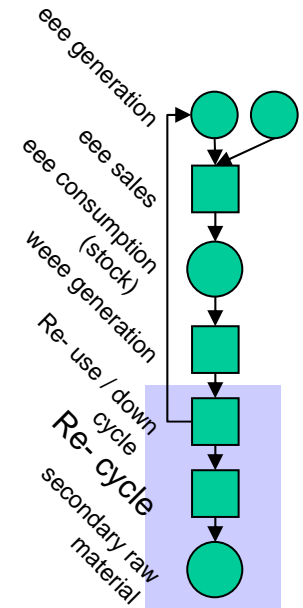
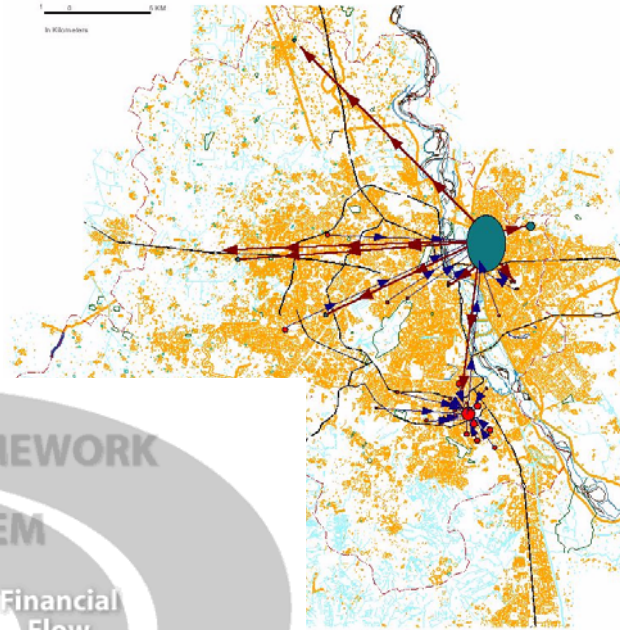
# Impressions of e-Waste Handling in Delhi



# 2-3-4 e-Waste Assessment Methodology

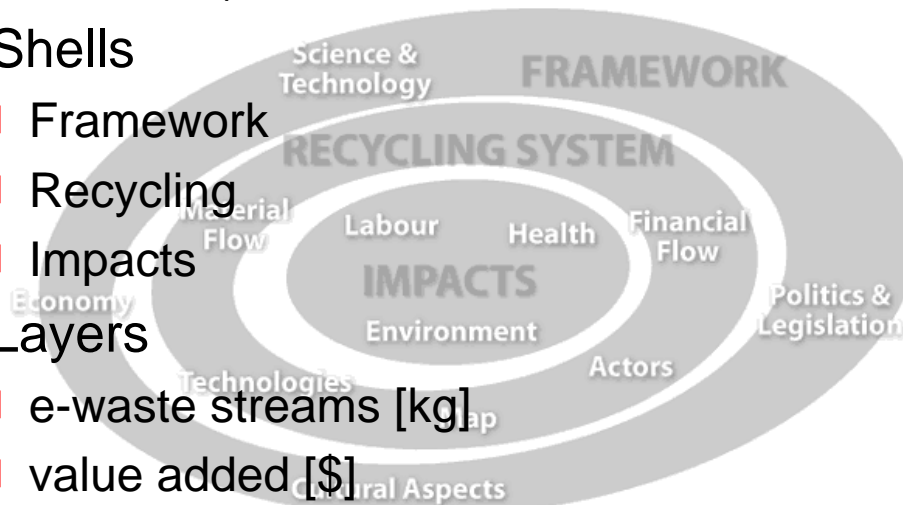
## 2 Views

- process (stream analysis, “umberto”)
- geographical (GIS, “arcview”)



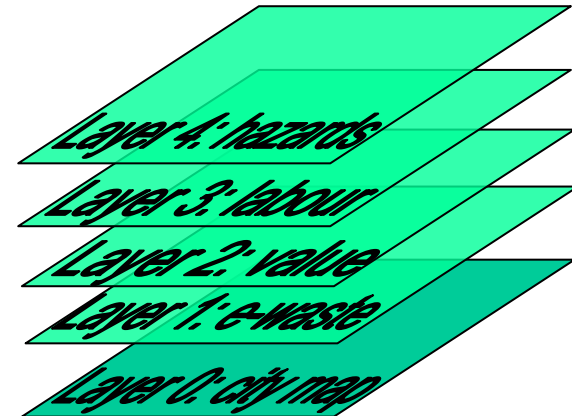
## 3 Shells

- Framework
- Recycling
- Impacts



## 4 Layers

- e-waste streams [kg]
- value added [\$]
- employment [hrs]
- hazards [+=-]



# PWB acid washing / burning



Step 0

Inspecting raw material: PWB (Printed Wiring Boards) with varnish or multilayer

Step 1

remove varnish manually with spate and water. Residues washed away!



Step 2

PWBs submerged in sulphuric acid to remove Cu layer (12hrs)

Step 3

pouring acid to stainless steel tub and boil of the water (firing with PWBs!). Remove Cu-Sulphate crystals for selling.

Step 4

remaining acid solution is poured into plastic drums and iron scrap (for instance Fe wires) is added to fallout Cu.



Step 5

the solution is poured in drums for settling. Cu sludge is recovered. Solution is thrown. Cu is sold.

Step 6

glass fiber residues are stocked (further use unclear). Some cleaning / rinsing processes take place here. water hose runs constantly and dilutes effluents

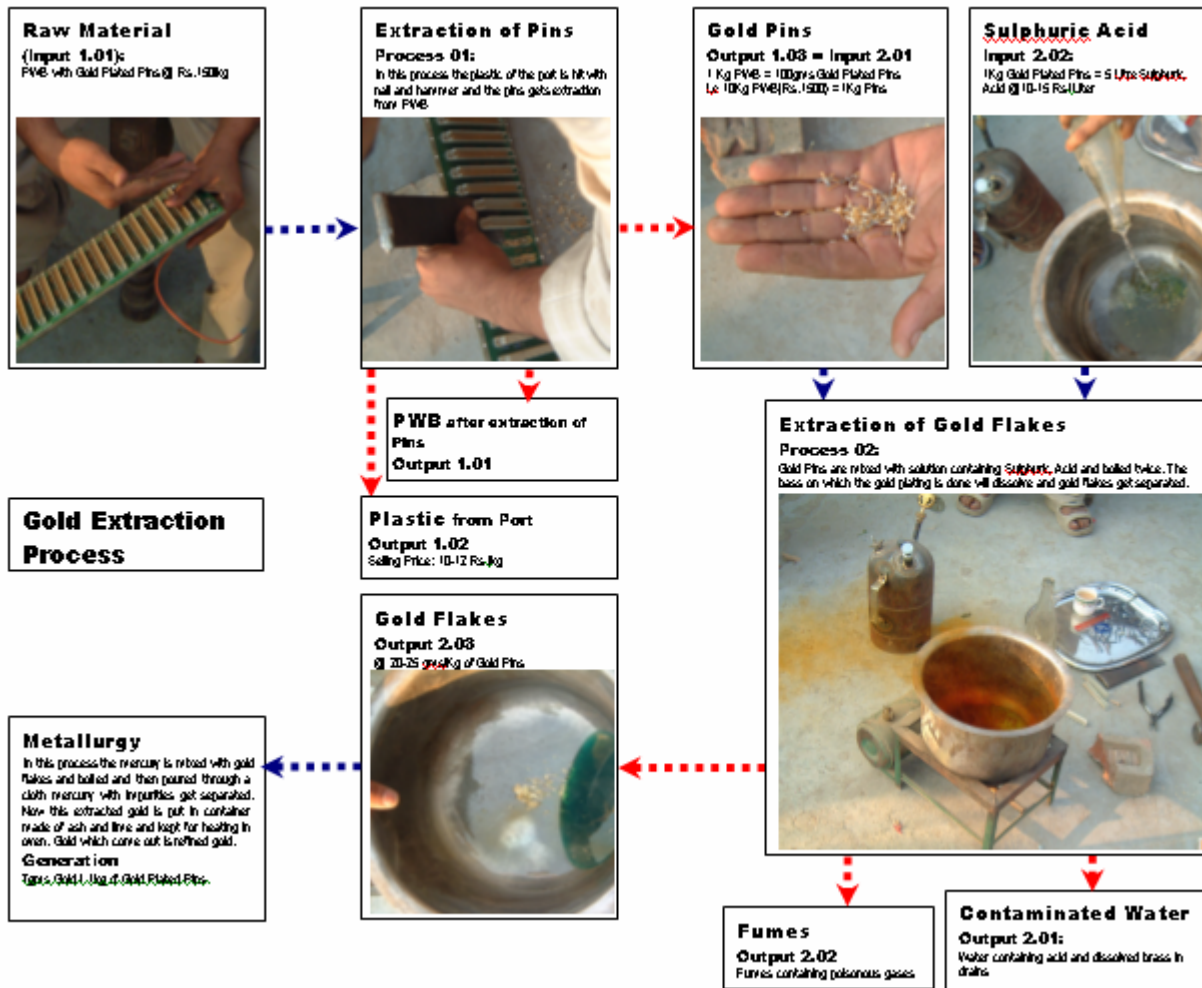


Step 7

behind the factory wall are rice paddies and vegetable gardens. Effluents end up here.



# Quantitative Analysis of Gold Extraction



# Total WEEE Stream for Delhi

		<b>2004</b>	<b>2010</b>
PCs		8'000	23'000
<b>Scenario 1 (conservative)</b>			
WEEE	t	80'000	230'000
Recycling Market Turn Over	mio US\$	51	147
Jobs	person years	4'000	11'500
<b>Scenario 2 (realistic)</b>			
WEEE	t	160'000	460'000
Recycling Market Turn Over	mio US\$	102	294
Jobs	person years	7'900	22'713

# Global Impacts Delhi

Impact	Health (Score)	Environment (Score)	Bussiness (Score)	Total
<b>Process</b>				
IC's Extraction from PWB (Manual Plucking)	0	0	+1	+1
Surface Heating of PWB and Extraction of components	0	-1	+1	0
Regunning CRT's	0	+1	+1	+2
Disassembling of Monitor and extraction of components	-1	-1	-1	-3
Yoke core extraction	+1	0	0	+1
Metallic Transformer	+1	0	0	+1
Rare Earth Core of Transformer	+1	-1	0	0
Rare Earth Static Transformer	+1	-1	-1	-1
Wire PVC and Copper (Manual Stripping)	+1	0	0	+1
Plastic Shredder	0	0	+1	+1
Gold Extractions from pins and Comb	0	-1	+1	0
Acid Bath for PWB	-1	-1	-1	-3

Note: Score of Impacts

(-1) bad; (0) improvable; (+1) ok

[www.ewaste.ch](http://www.ewaste.ch)

Thank you for your Attention