

*Workshop 2011 of the Asian
Network for Prevention of Illegal
Transboundary Movement of
Hazardous Wastes in China
30 Nov 2011, Shenzhen, China*

**Good Practices on ESM
-Comparison of formal and
informal recyclers of E-waste-**

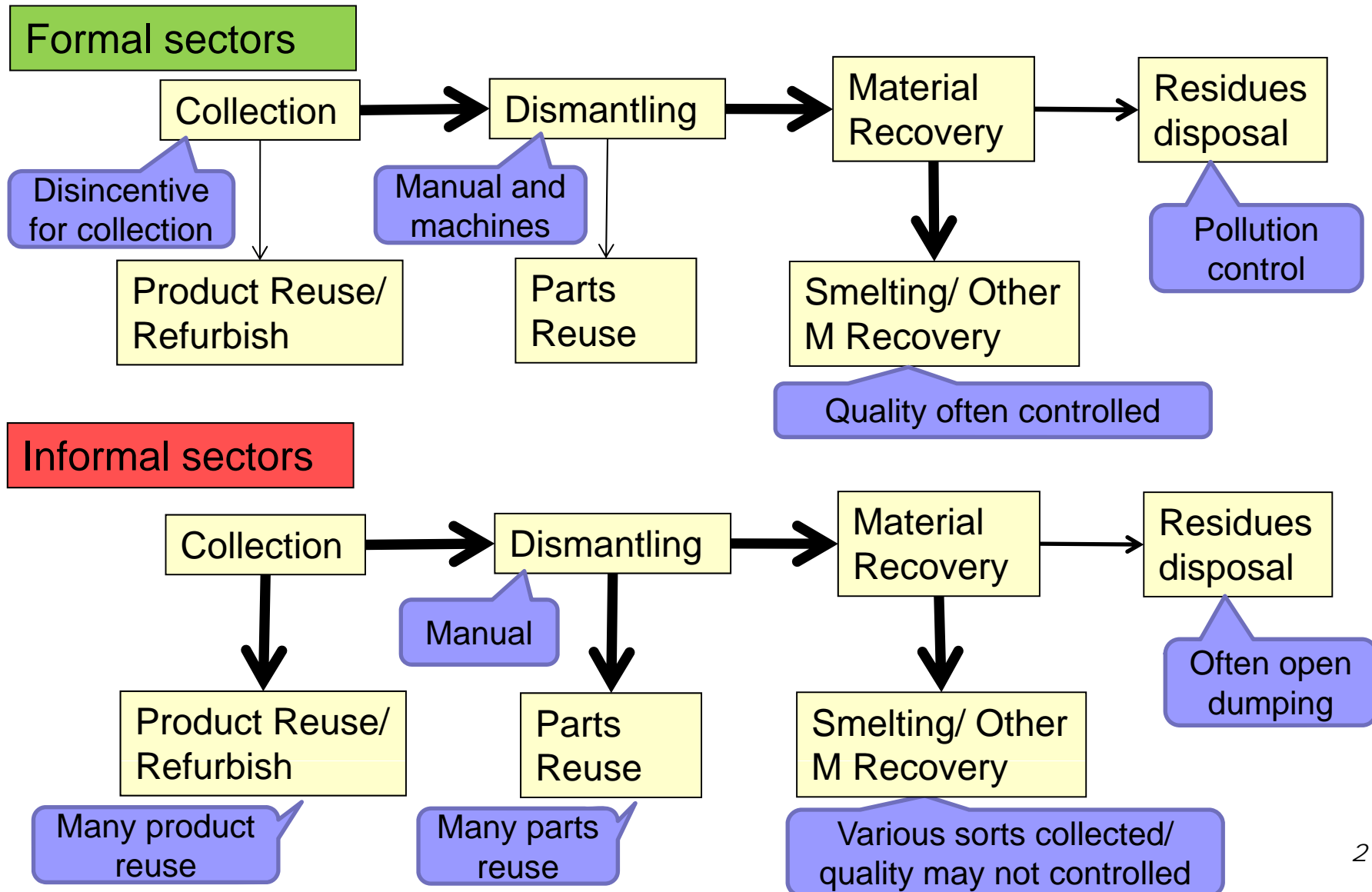
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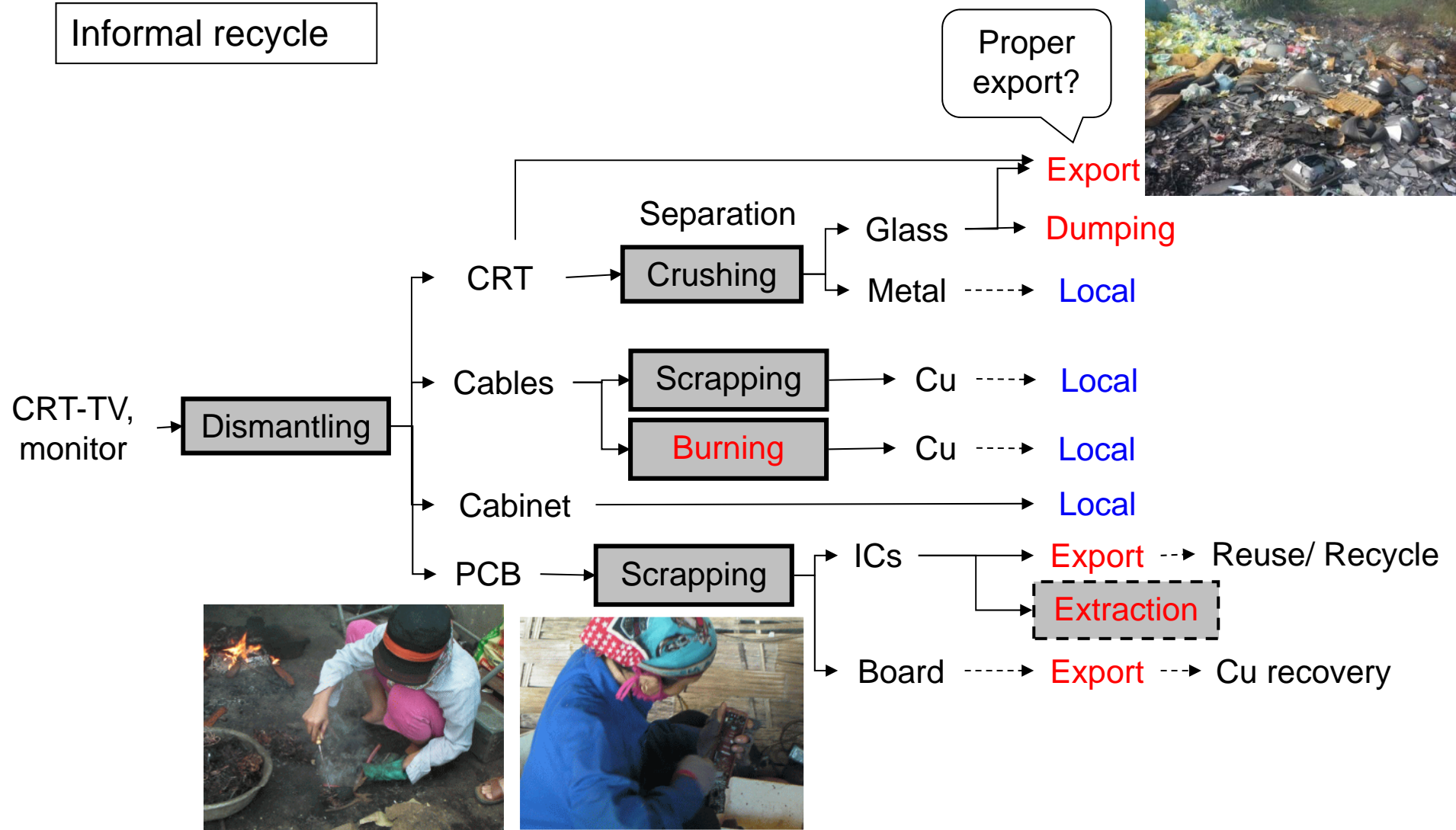
Simplified process comparison



CRT Recycling in Vietnam

Informal recycle

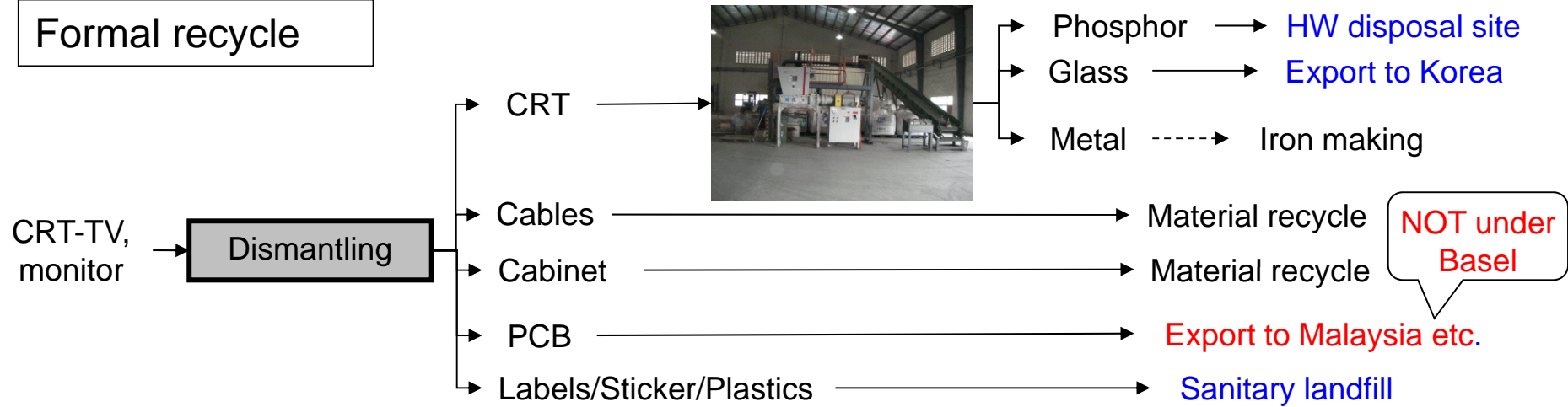
Proper export?



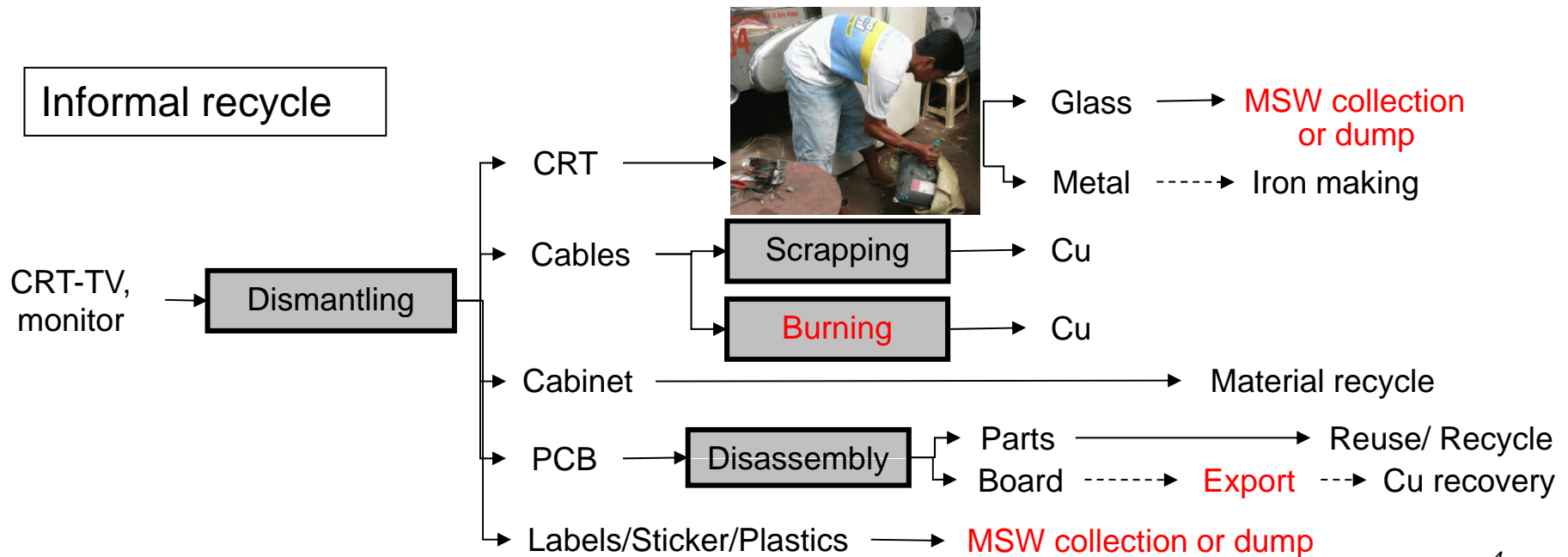
PCB: Printed Circuit Board

CRT Recycling in the Philippines

Formal recycle

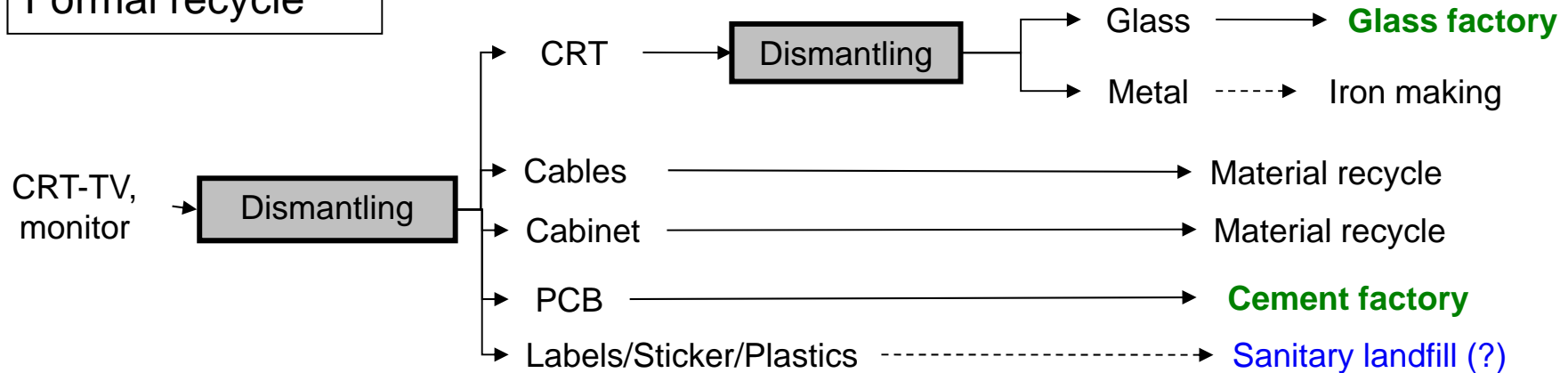


Informal recycle

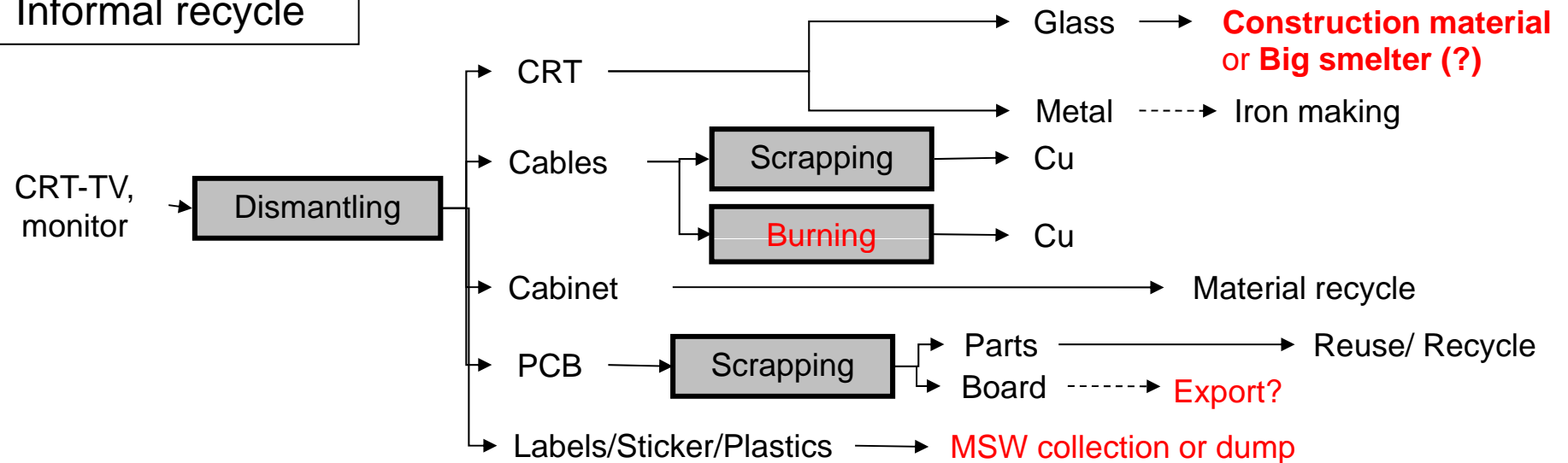


CRT Recycling in Indonesia

Formal recycle

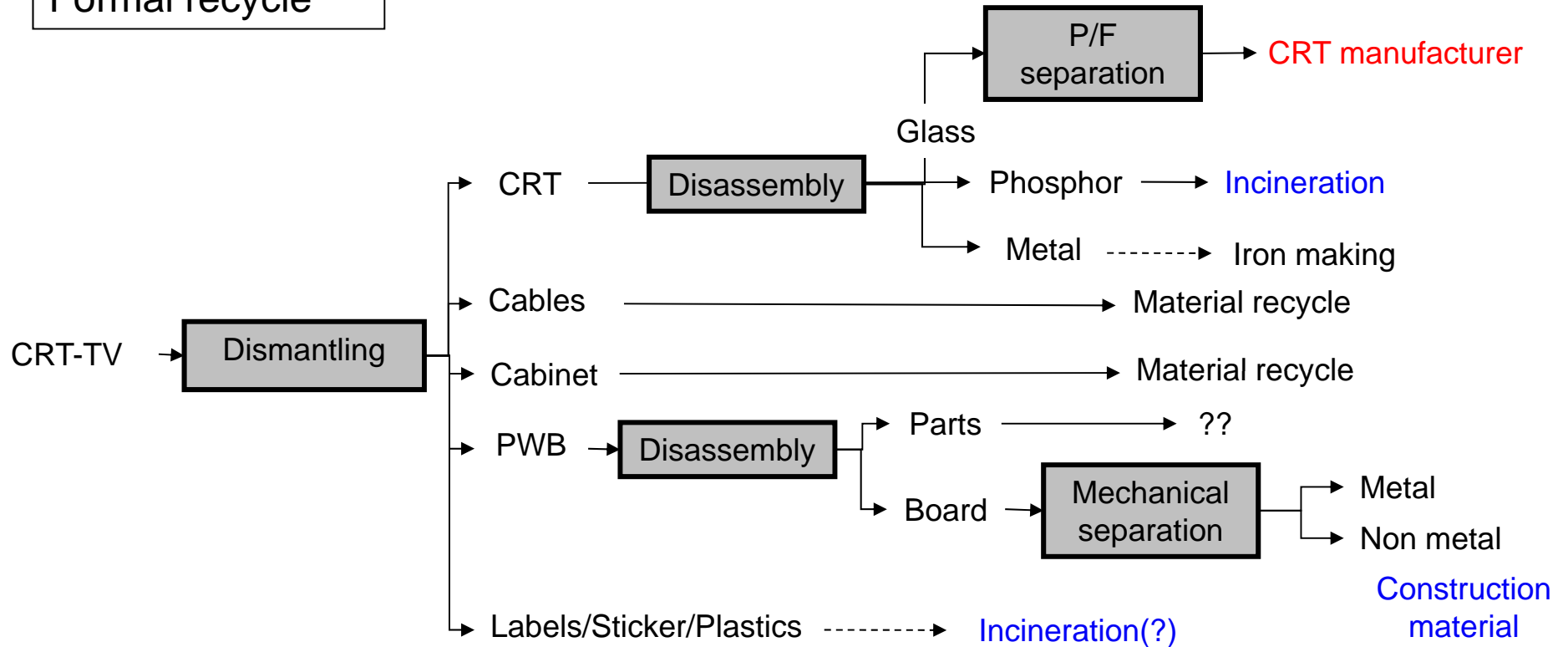


Informal recycle



CRT Recycling in China

Formal recycle



Informal processes

(Summary from our investigation)

	Vietnam	Indonesia	Philippines	China
Manual dismantling	√	√	√	√
CRT Panel/Funnel Separation	--	--	--	??
De-soldering PCBs (parts separation)	√	√	√	√
Leaching of gold from PCBs	√ Nitric acid	√ Nitric acid, Hydrogen peroxide	√ Cyanide	√ Aqua regia
Leaching of silver from PCBs	√ Nitric acid	√ Nitric acid	√ Aqua regia	√ ??
Open burning	√	√	√	√
Open dumping	√	??	√	√
Export of PCBs	√	??	√	??



Formal processes

(Summary from our investigation)

	Vietnam	Indonesia	Philippines	China
Collection from industry	√	√	√	√
Collection from household	--	--	--	√
Manual dismantling	√	√	√	√
CRT: (Semi-) automatic crushing and separation	--	--	√	√
CRT: P/F separation	--	--	--	√
CRT: glass cullet cleaning	--	--	--	√
Pyrometallurgical processing	--	--	√	√
Hydrometallurgical processing	--	Under consideration	√	√
Export of PCBs	--	--	√ Improper export exist	√
Export of CRTs	--	--	√	--
Disposal in general landfills	--	??	√	√
Disposal in incinerators	--	--	--	√

Cu extraction from cables

Open burning



Vietnam (Informal)

Mask

Mechanical separation



Indonesia (Formal)

IC chip extraction from print circuit board

Improper fan

No mask

Chamber and gas treatment

Mask



China (Informal)

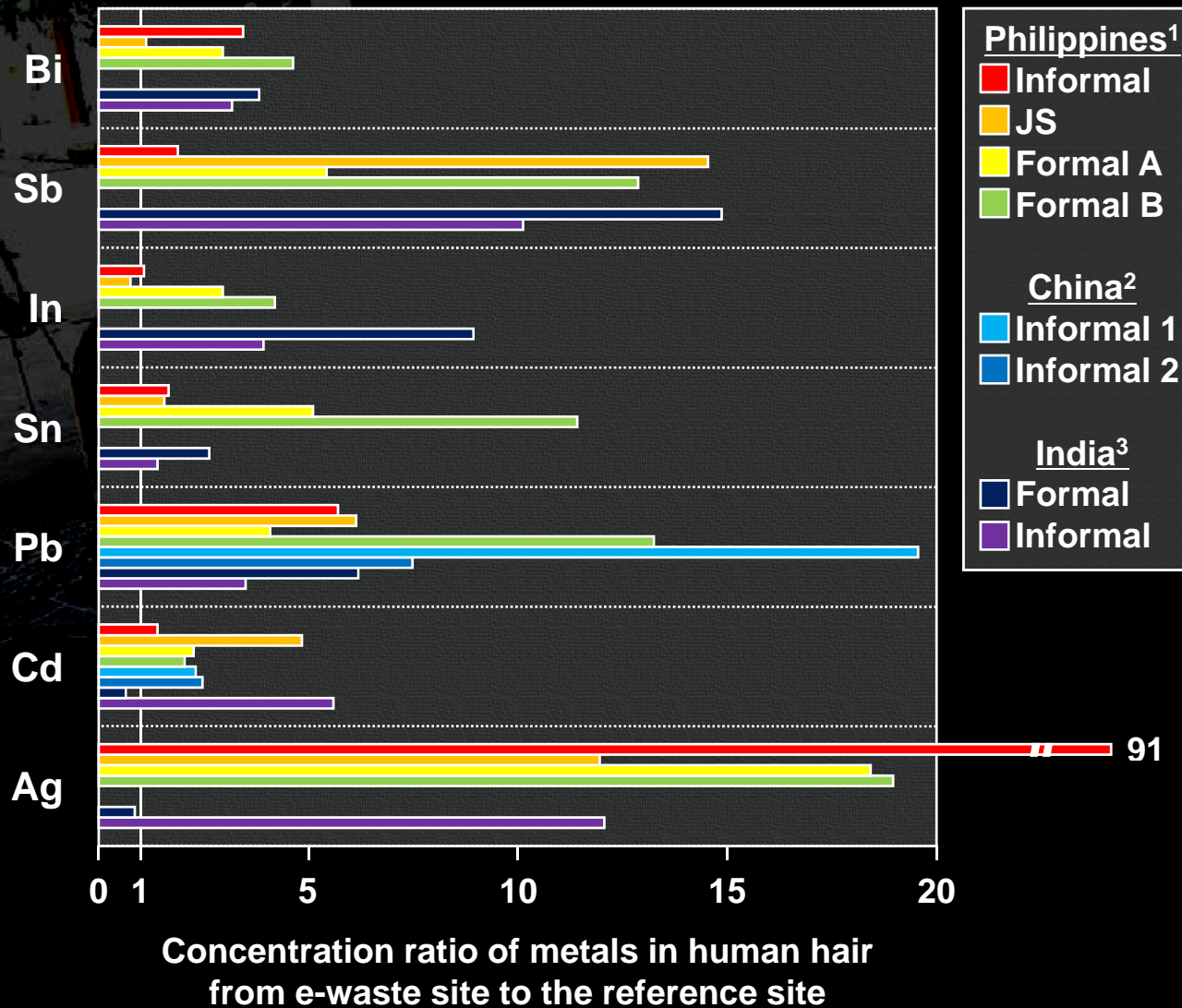


Indonesia (Formal)

Sampling campaign in the Philippines with Ehime Univ. in 2010



Comparison of contamination at e-waste sites in Asia



1; This study
 2; Wong et al, 2009
 3; Ha et al., 2009

Hazardous and high-priced(?) soil at the informal gold recovery site

Soil ($n = 4$) GM concentration (mg/kg)

Ag 110	Cu 7800	Sn 1300
Au 54	Ni 700	Sb 99
Cd 4.7	Pb 5400	Zn 2280



Ref. Au in gold ore 4-5 mg/kg

Interior dust ($n = 1$) Concentration (mg/kg)

Ag 190	Cu 11000	Sn 2200
Au 150	Ni 3900	Sb 1100
Cd 28	Pb 160000	Zn 3000

H. Takigami



Summary

- Formal and informal processes were compared.
- From **physical aspect of ESM**, the followings improvements are needed.
 - **Occupational health** (masks, etc.)
 - **Reduction of environmental burden** (Closed system, etc.)
 - High efficiency of material recovery
- Formal recyclers do not always show better performance (e.g. body burden). However, the **management system** that can find problems (e.g. health care check) is significant.



Thank you for your kind attention!

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