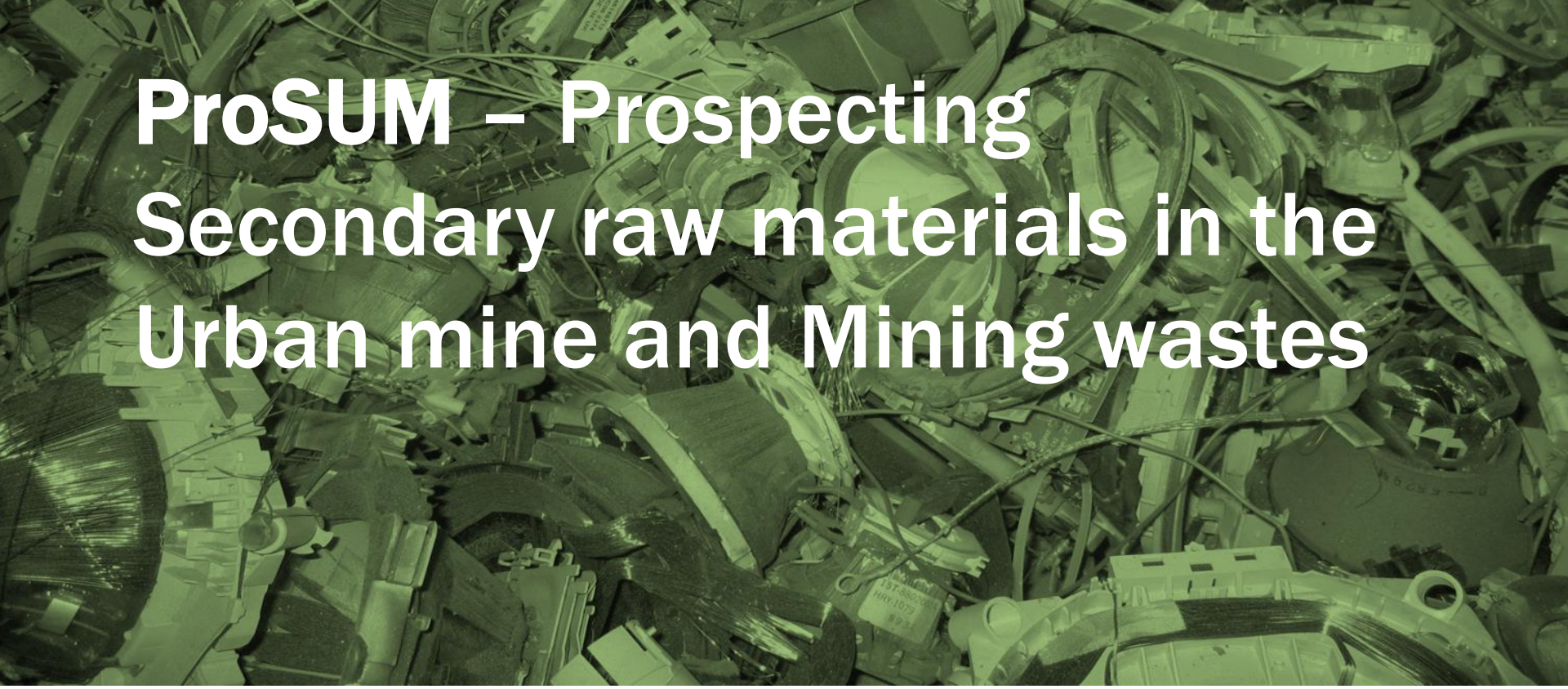

ProSUM – Prospecting Secondary raw materials in the Urban mine and Mining wastes

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MinFuture Workshop, Vienna

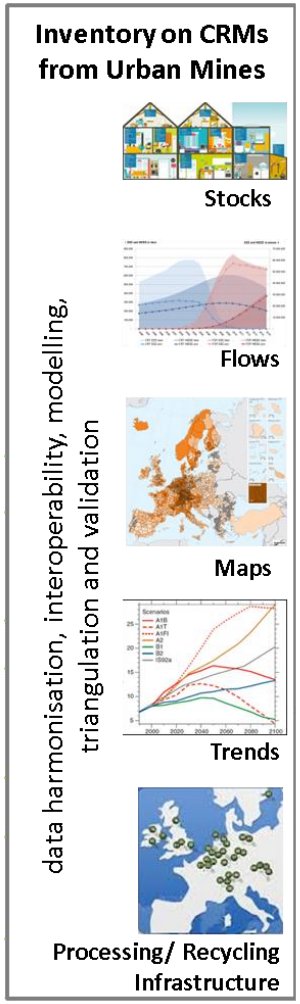
Amund N. Løvik

Empa
Materials Science and Technology

ProSUM
Prospecting Secondary raw materials in the Urban mine and Mining wastes

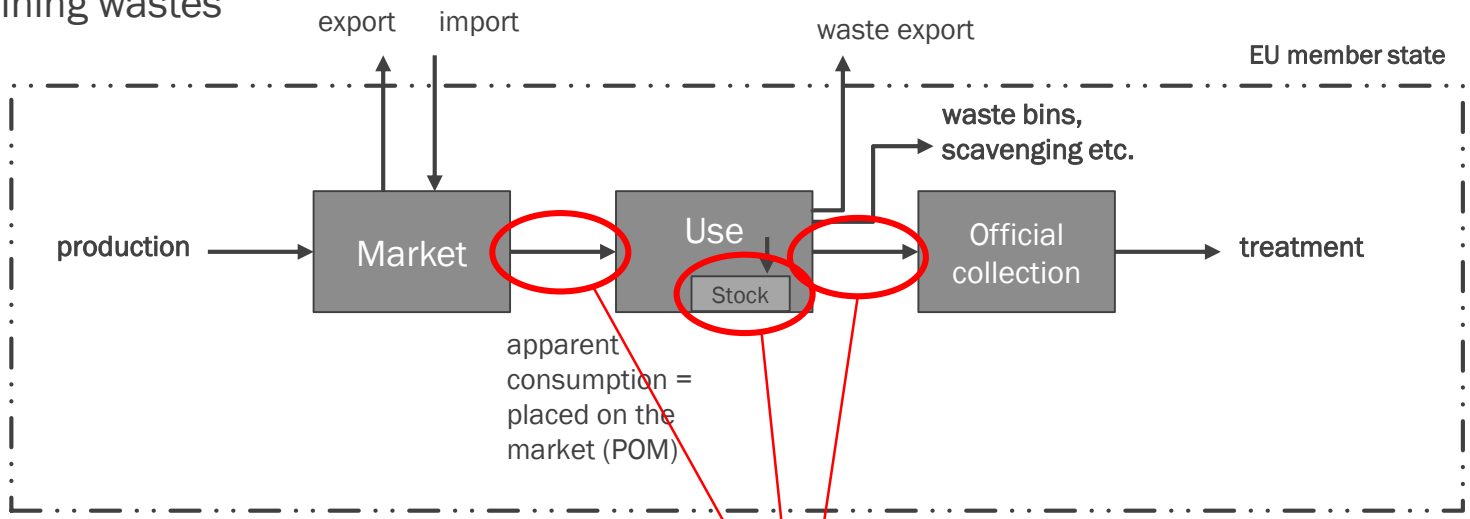
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 641999.

Objectives


Inventory on CRMs from Urban Mines
Stocks
Flows
Maps
Trends
Processing/ Recycling Infrastructure
data harmonisation, interoperability, modelling, triangulation and validation

Scope

- Passenger vehicles (675 types)
- Electrical and electronic equipment (EEE) (54 types)
- Batteries (15 types)
- Mining wastes



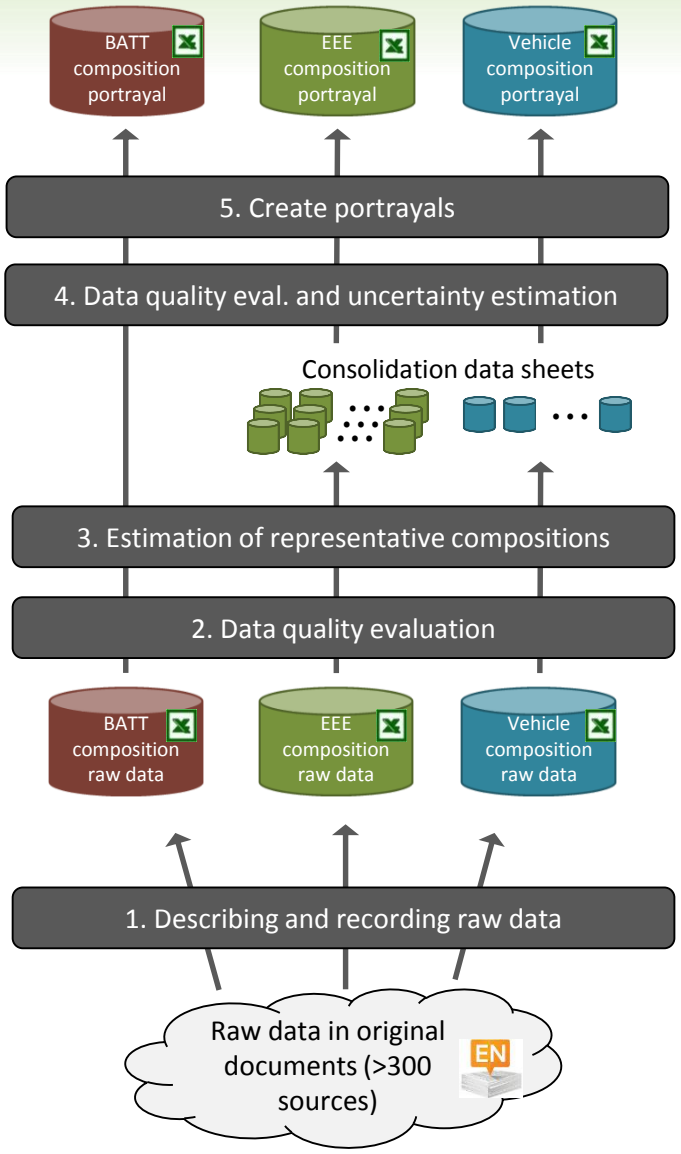
$$X_e = \sum_p X_p w_{e,p}$$

Stock/flow of element *e* (kg or kg/year)

Stock/flow of product *p* (kg or kg/year)

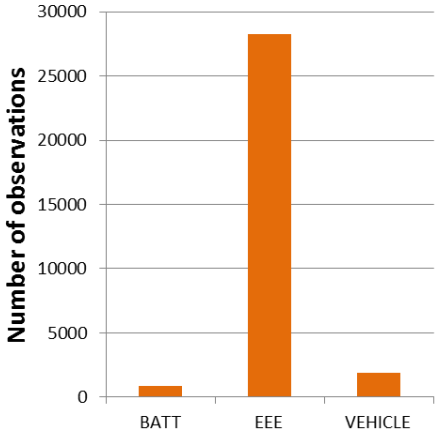
Mass fraction of element *e* in product *p* (kg/kg)

Composition data – consolidation

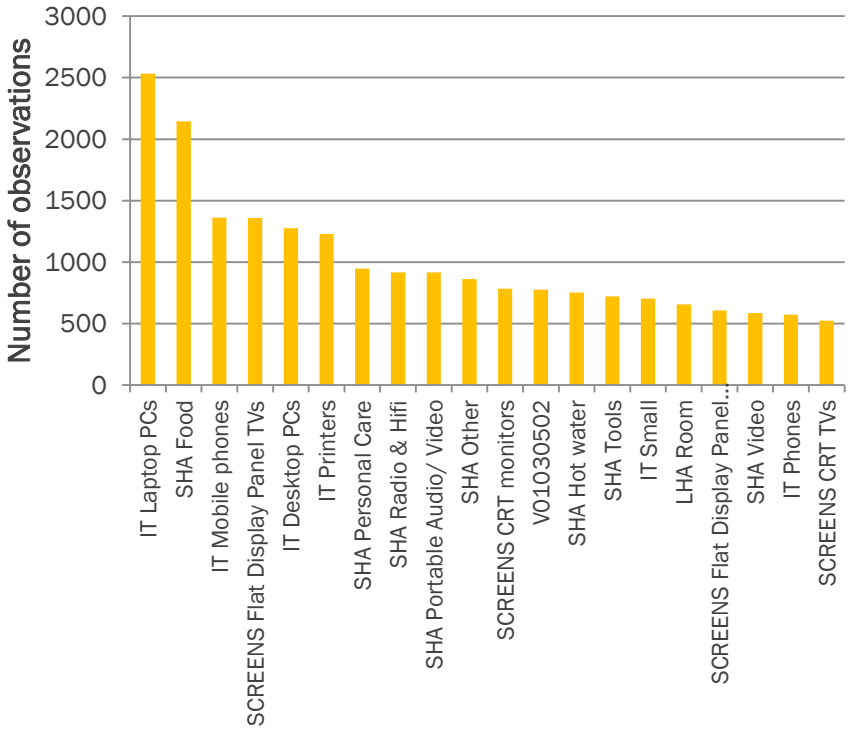


Composition data – results

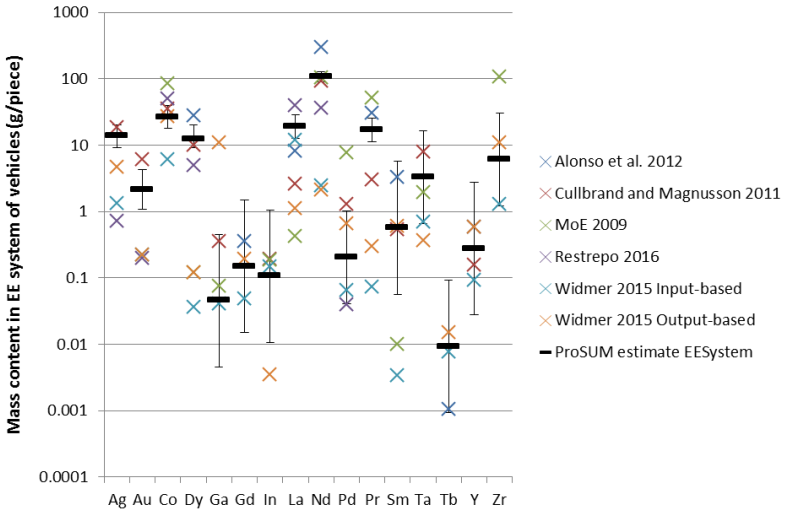
>30’000 data recorded



66 product types covered

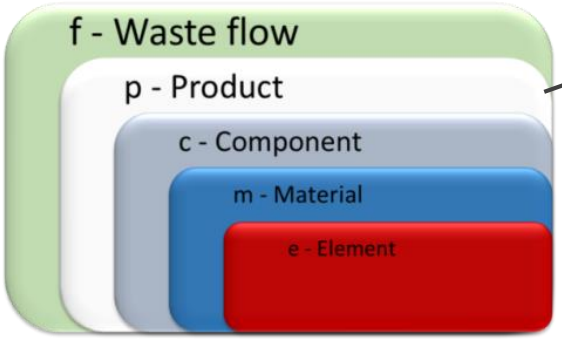


Average composition estimated



Composition data – describing

Levels of composition

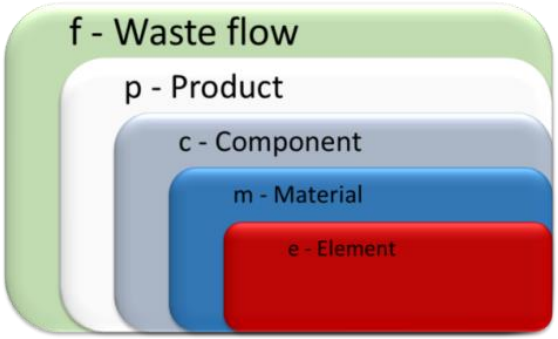


Code lists

Code	*Product description*
0001	PROF Central Heat (HH installed central heating)
0002	PROF PV panels
0101	PROF Heating & Ventilation (excl. cooling eq.)
0102	LHA Dishwashing (dishwashers)
0103	LHA Kitchen (large furnaces, ovens, cooking equipm.)
0104	LHA Washing (washing machines&combined dryers)
0105	LHA Drying (wash dryers, centrifuges)
0106	LHA Room (large HH room heating & ventilation, hoods)
0108	C&F Fridge (fridges for food, wine, ice, etc.)
…	…
…	…

Composition data – describing

Levels of composition



Parameters

- Mass fraction

  $w_{c,p}$ - component *c* in product *p*

  $w_{c,c'}$ - mass fraction of component *c* in component *c'*

  $w_{m,c}$ - mass fraction of material *m* in component *c*

  $w_{e,m}$ - mass fraction of element *e* in material *m*

- Number
- Mass
- ...

Composition data - challenges

Challenges with harmonization of composition data

1. **Data on different levels**

Example: Laptop composition

Source 1	Source 2
Cables: 1%	Fe: 19.5%
Polymers: 14.5%	Cu: 1%
Printed circuit boards: 6.5%	Al: 2.4%
Liquid crystal display: 18.5%	Ag: 0.015%
LED background lighting: 1%	Au: 0.0086%
Metal alloys: 35%	Ta: 0.085%
Others: 4%	etc.

Composition data - challenges

Challenges with harmonization of composition data

1. Data on different levels
2. **Different lists of components and materials**

Example: Laptop composition

Source 1
Cables: 1%
Polymers: 14.5%
Printed circuit boards: 6.5%
Liquid crystal display: 18.5%
LED background lighting: 1%
Metal alloys: 35%
Others: 4%

Source 3
Aluminium alloys: 7.5%
Copper alloys: 0.4%
Steel: 14.4%
Stainless steel: 2.0%
Zinc alloys: 1.0%
etc.

Composition data - challenges

Challenges with harmonization of composition data

1. Data on different levels
2. Different lists of components and materials
3. **Different parameters**

Example: Laptop composition

Source 1
Cables: 1%
Polymers: 14.5%
Printed circuit boards: 6.5%
Liquid crystal display: 18.5%
LED background lighting: 1%
Metal alloys: 35%
Others: 4%

Source 3
Keyboard: 109 g
CD drive: 177 g
RAM: 8 g
Motherboard: 206 g
CPU: 4 g
Display: 800 g
Top casing: 369 g
Bottom casing: 292 g

Composition data - approach

1. Record available raw data according using a system that is as flexible as necessary (levels, code lists, parameters). Retain as much information as possible, including that relevant for data quality and uncertainty.

   → Minimize information loss

2. Consolidate data from different sources
   a) Inspect raw data
   b) Choose level of detail based on data availability and goals
   c) Weight data from different sources by their data quality

   → Information loss unavoidable

Composition data - lessons

1. The system of levels and code lists is flexible enough to record all data without major revisions
2. Components and products could perhaps be merged to one level
3. Components and materials are often treated as the same level due to data limitations
4. Components and materials lists for consolidated data must be based on a “least common denominator” principle for the most important data sources
5. A more automatic data reconciliation procedure might be possible, but was not attempted so far

Thank you!

Amund N. Løvik
amund.loevik@empa.ch

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