



MinFuture

Aluminium case study demo

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30/11/2017

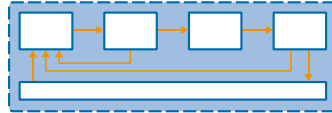


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Aluminium Case Study:

How to cover the four dimensions in real life?



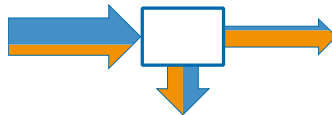
1. Stages

Integrate primary and secondary resources



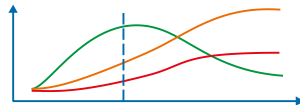
2. Trade

Integrate international trade with production and consumption for analyzing global supply chains



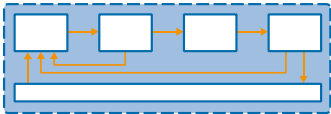
3. Layers (linkages of materials, energy, value)

Capture linkages of metals at all stages

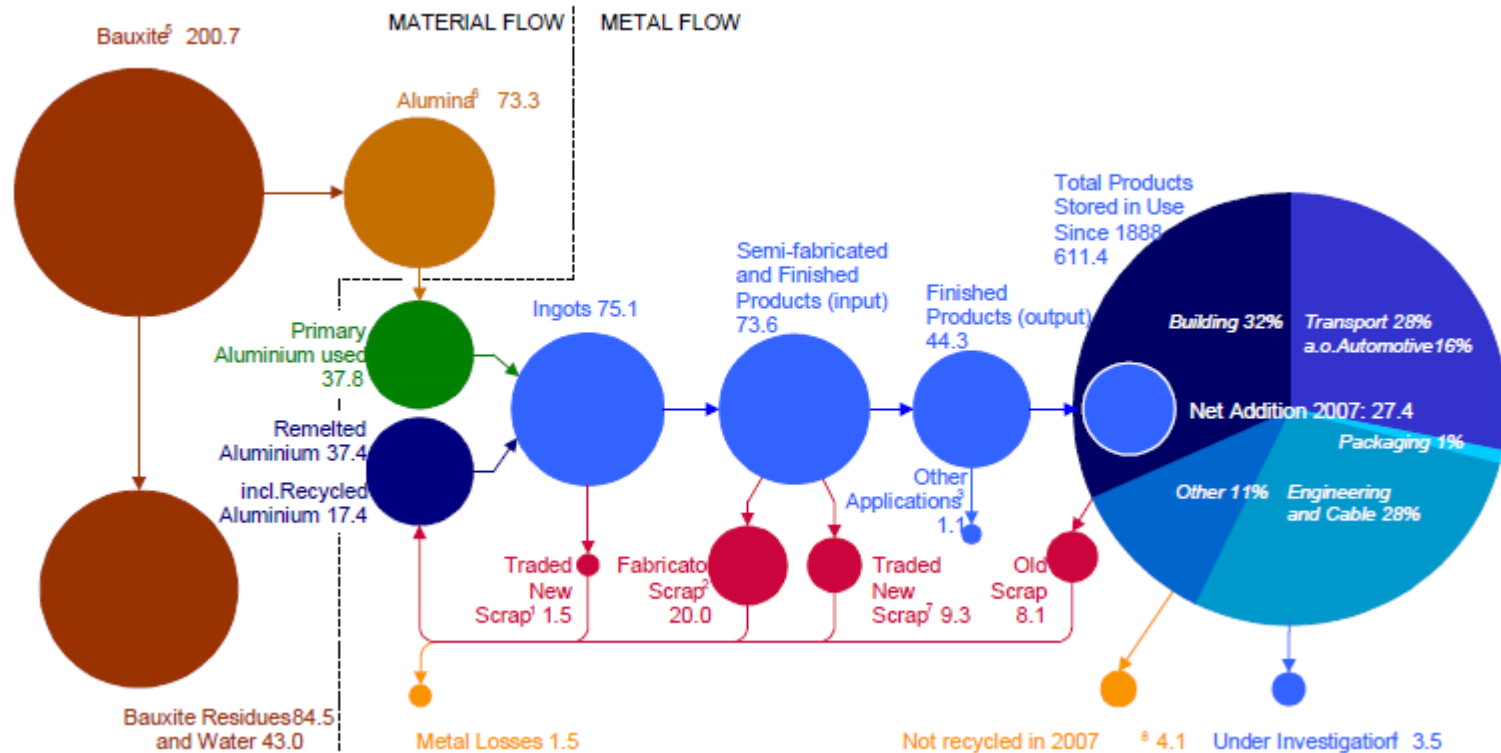


4. Time

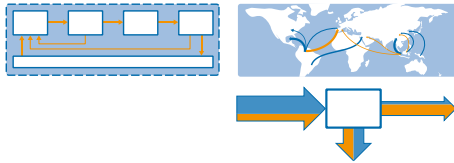
Historical development and future scenarios



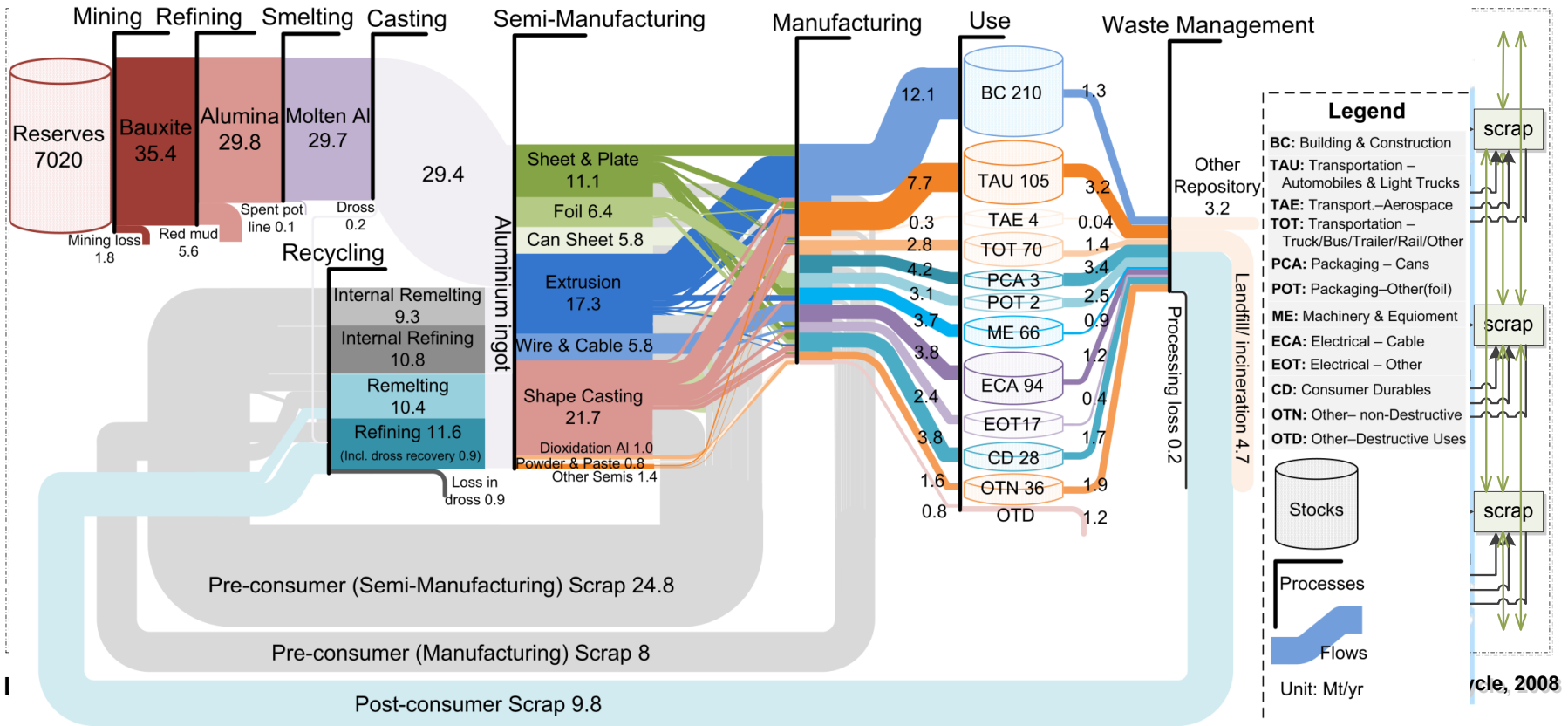
Only stages: GARC model (2009)



A global model of Al mass flows with different stages, but no layers, so only mass flows are considered and not Al content (this is an issue for bauxite for instance)

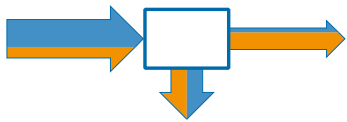


Adding trade and layers: Gang's model (2013)

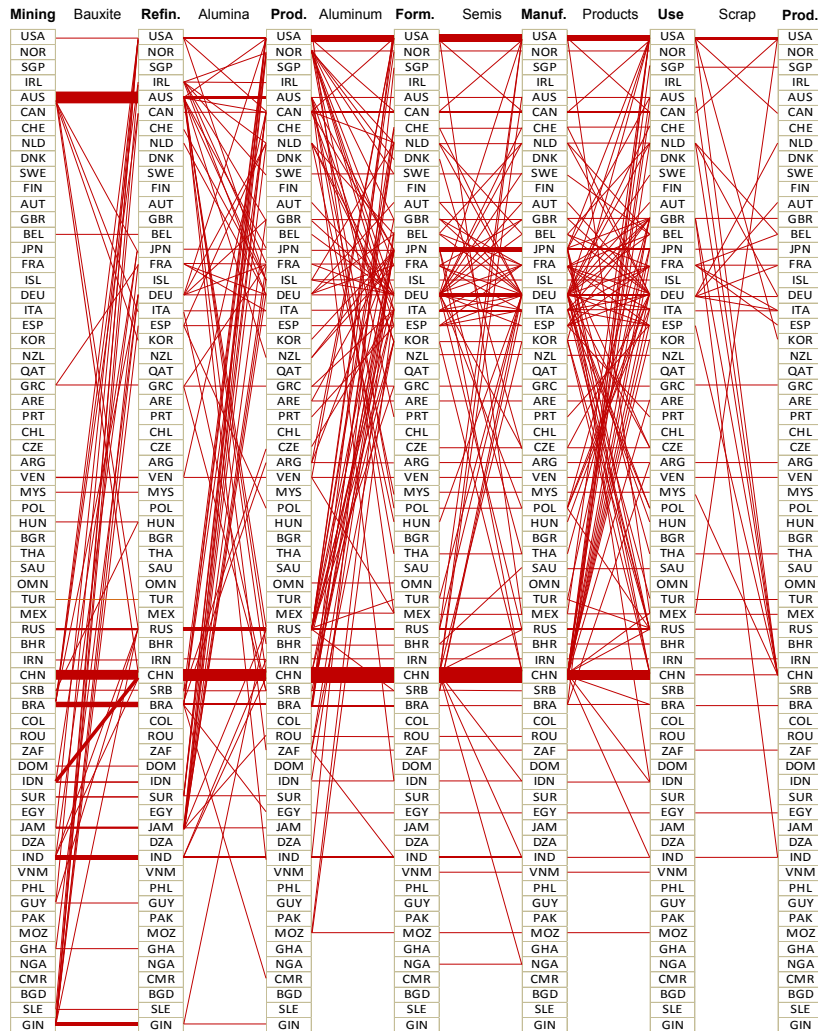


Improvements:

- Trade is added from UN Comtrade database
- Use of layers, so the Aluminium content in goods is explicit

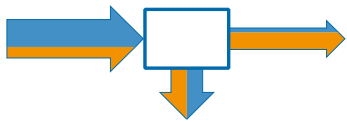


Expanding the trade dimension

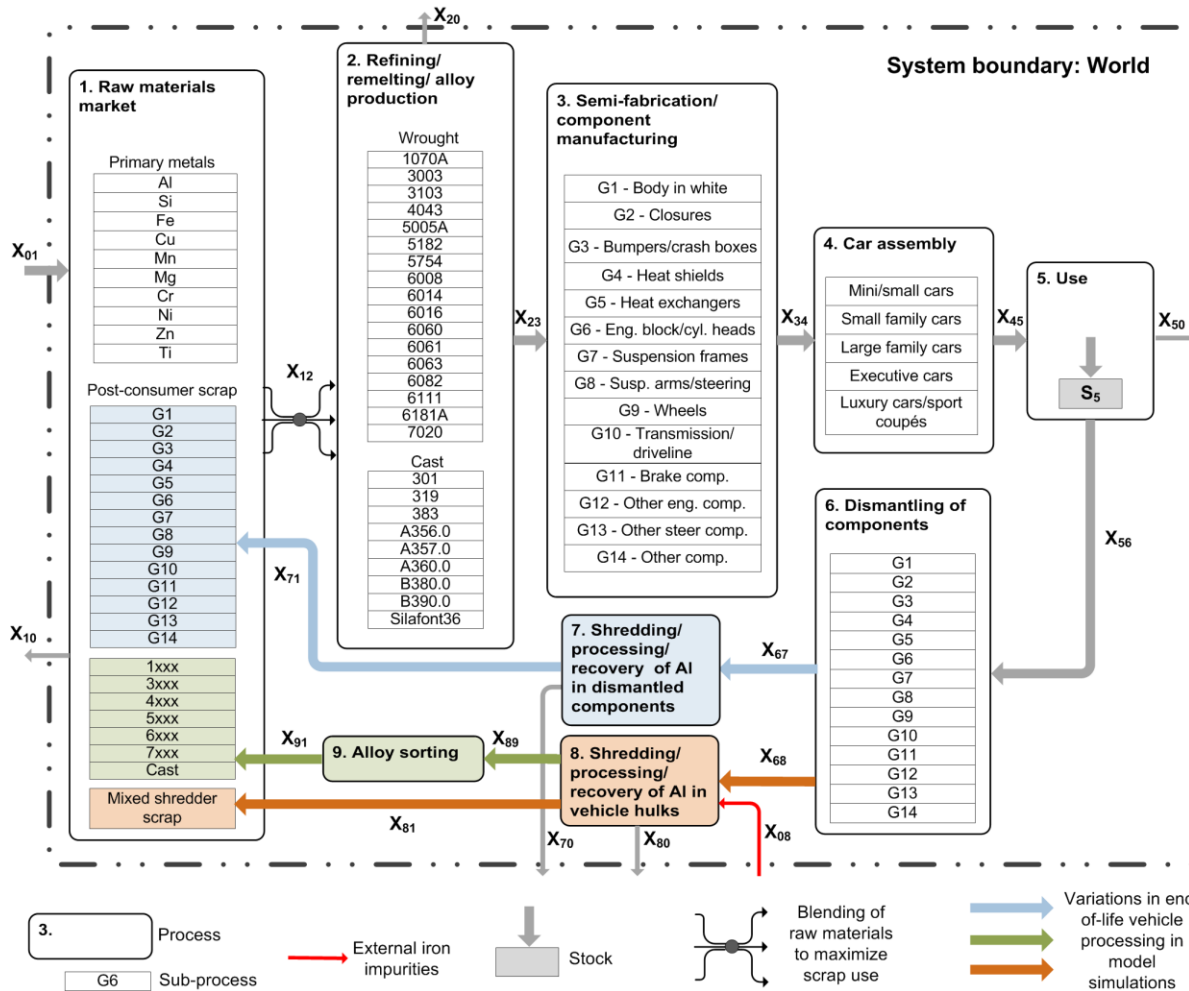


Example of the global aluminium trade:

- Trade is implemented along the different stages
- Specific trade issues to be examined in the next presentation



Expanding the layers dimension



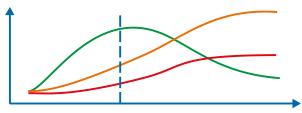
Example of a more detailed Multi layer system (car sector)

Layers:

- Components
- Alloys
- Elements

This approach enables to analyze relationships between different materials

Source: Løvik, Modaresi and Müller (2014)



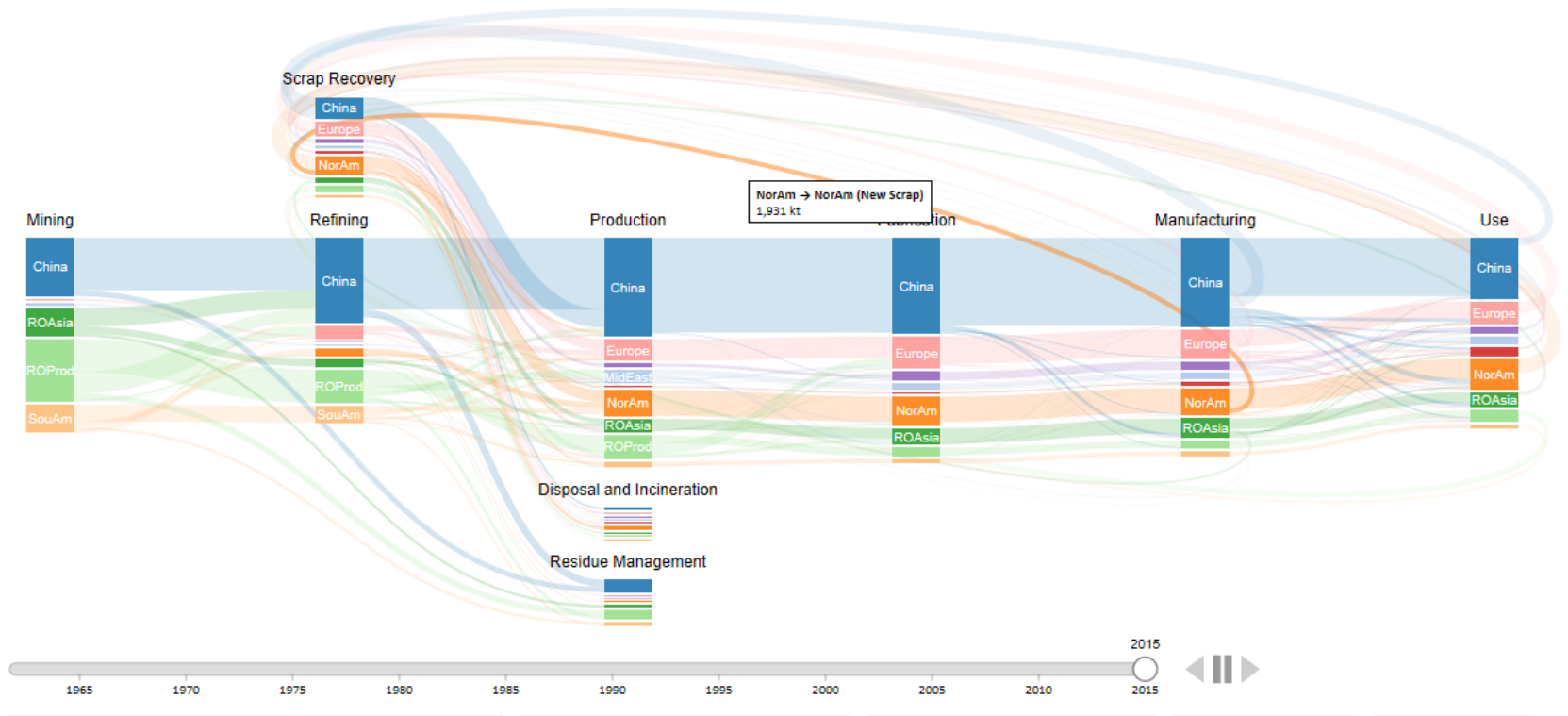
Expanding the time dimension: Gang's model + visualization



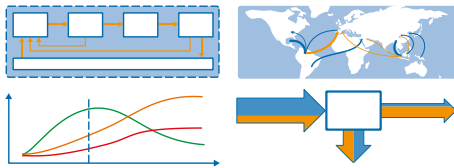
GLOBAL ALUMINUM FLOW 2015

Top 10 [regions/countries](#), sorted by Alphabetical

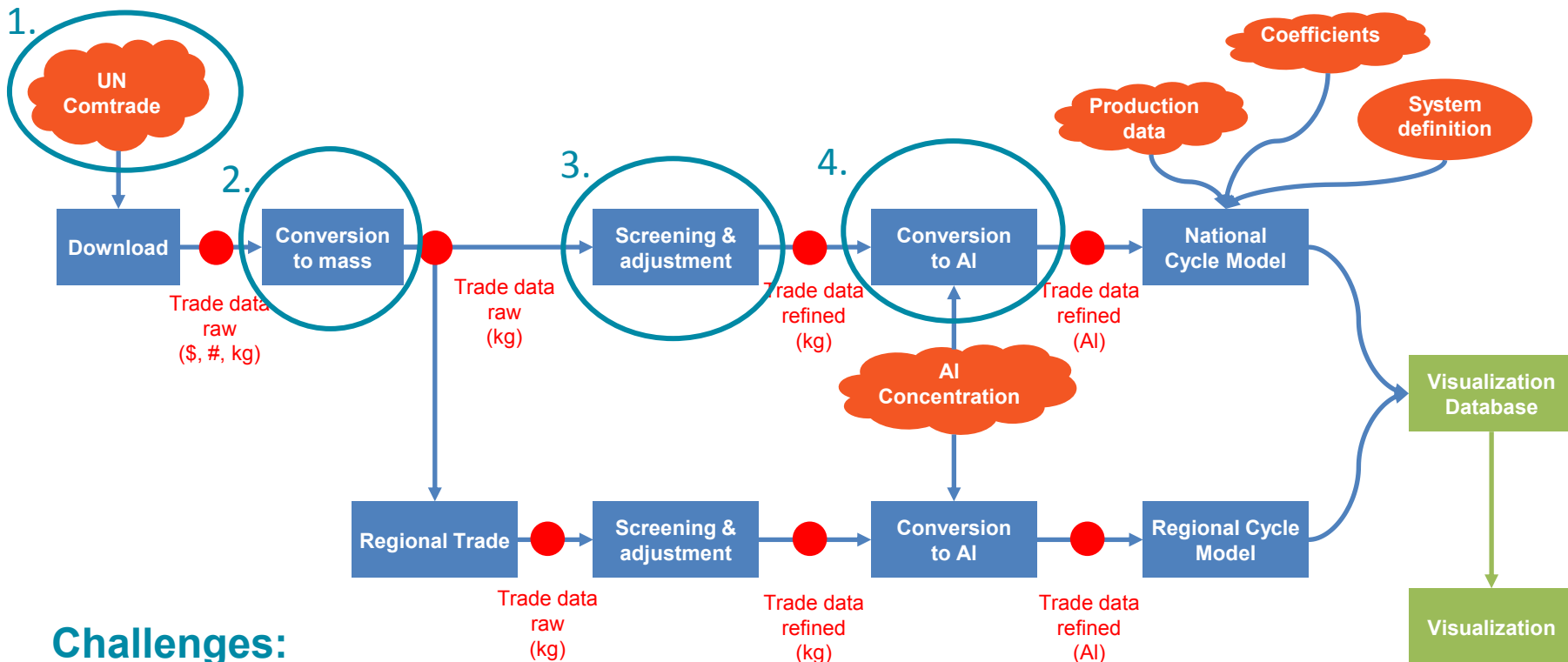
[Methodology](#) - Resources, Conservation and Recycling Volume 125, October 2017, Pages 48–69



<http://www.world-aluminium.org/statistics/massflow/>



Challenges in building more refined models



Challenges:

1. Large amount of data (70 millions data records)
2. Reconciliation between monetary and physical units can be challenging
3. Inconsistencies in trade statistics
4. AI content in goods is hard to estimate

Challenges with data collection remain



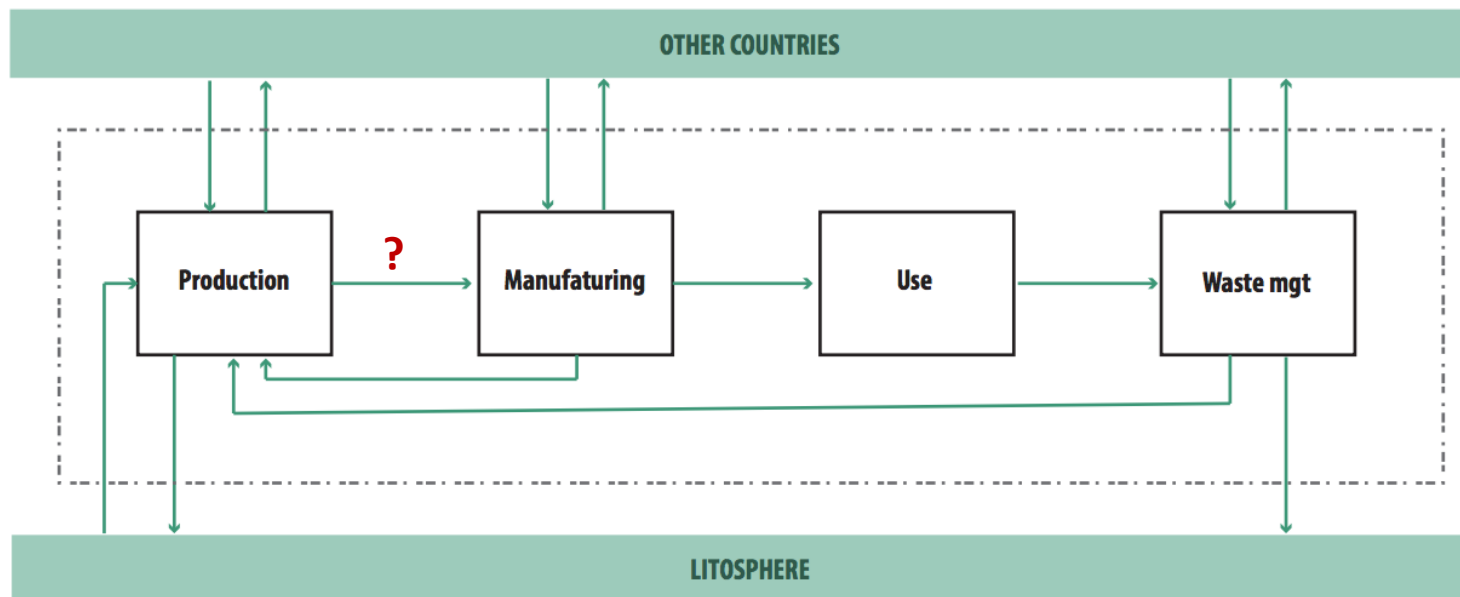
USGS Mineral Yearbook, 2017 Aluminum

<u>Salient Statistics—United States:</u>	<u>2016*</u>
Production:	
Primary	840
Secondary (from old scrap)	4,490
Imports for consumption	
Crude and semimanufactures	5,370
Scrap	610
Exports, total	3,000
Consumption, apparent ²	4,840
Price, ingot, average U.S. market (spot), cents per pound	80.0
Stocks, yearend:	
Aluminum industry, stocks	1,350
London Metal Exchange U.S. warehouses ³	370
Employment, number ⁴	27,000
Net import reliance ⁵ as a percentage of apparent consumption	52

Crude maps with hidden gaps

Aggregate systems can be useful for providing a crude first overview, but relevant information is lost.

Problem: Systems don't reflect reality of data collection



Alternative MFA: placing system around data



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“Refined maps with explicit gaps”

Refined system definitions can be made to reflect the exact location of the measurements.

The resulting explicit gaps make the system more complex, but also more robust.
 → The system definition requires knowledge of the institution collecting the data.

