Avoiding Co-Product Allocation in the Metals Sector

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Co-Production in Metals Life Cycles

- Joint production of different metals from same ore
- Joint or combined production of several alloys, semi-manufactured products from same metal base and machinery
- Recycling (“co-product” of a life cycle)

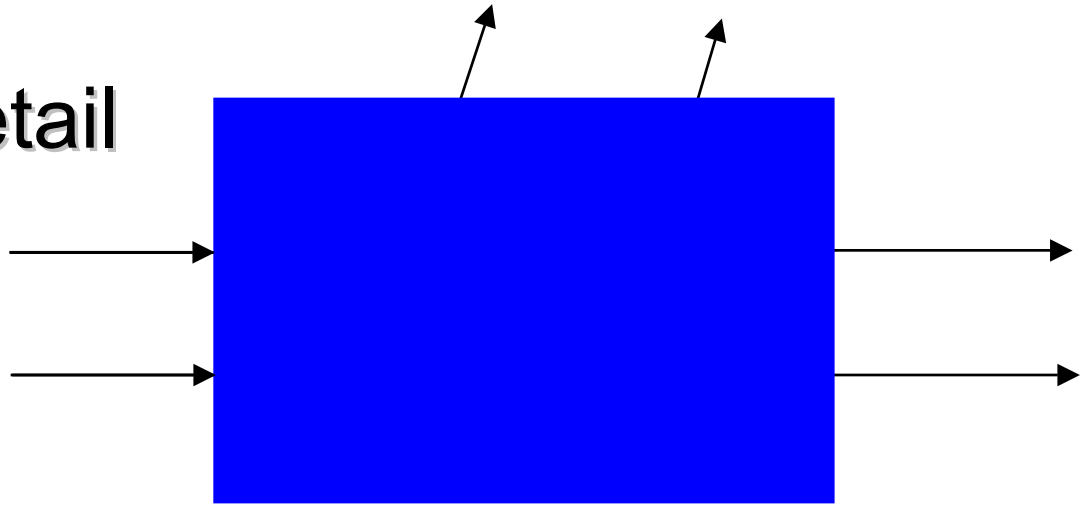
ISO 14041 Allocation Hierarchy

- 1. Avoid allocation
  - 1a. Finer detail
  - 1b. Expand system
- 2. Causally model
- 3. *Allocate*

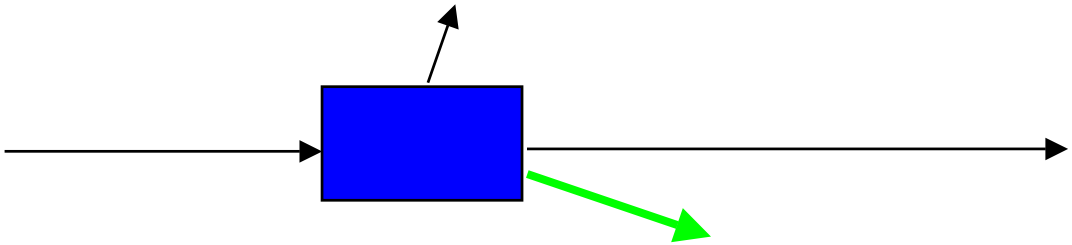
  (Apportion based on a selected key)

Step 1: avoid allocation

- Greater detail



- System expansion – avoided products



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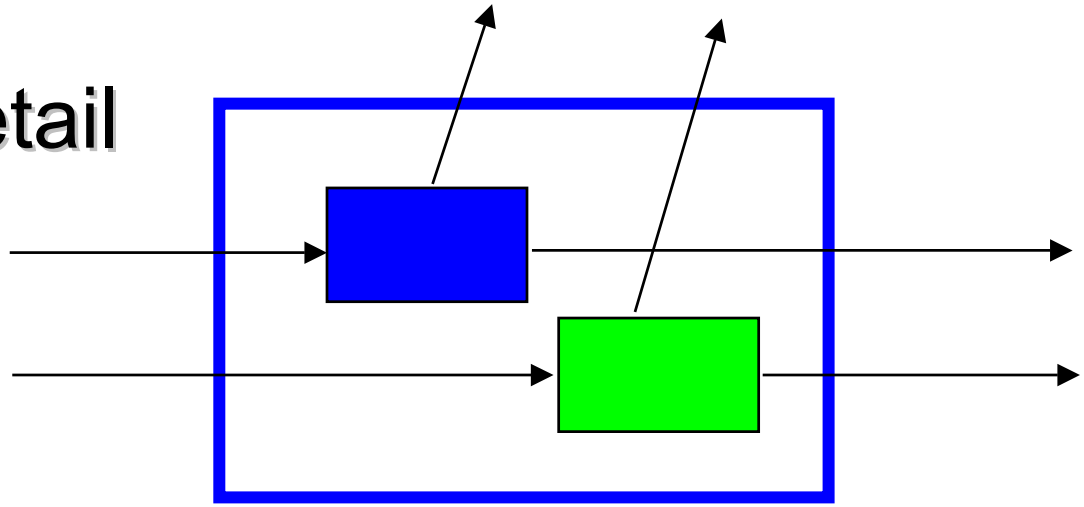

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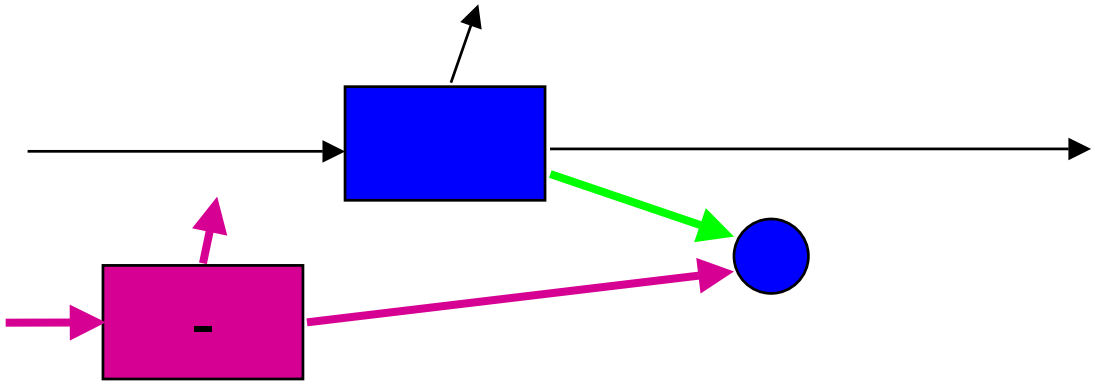
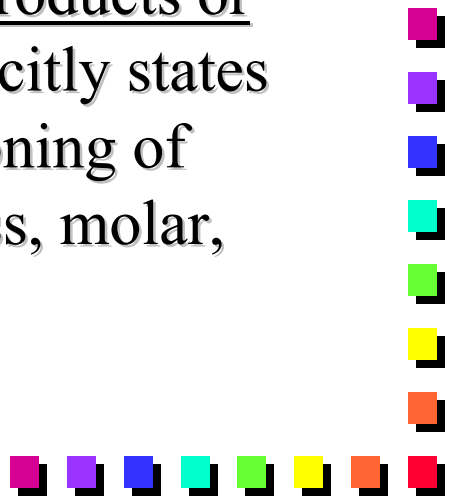


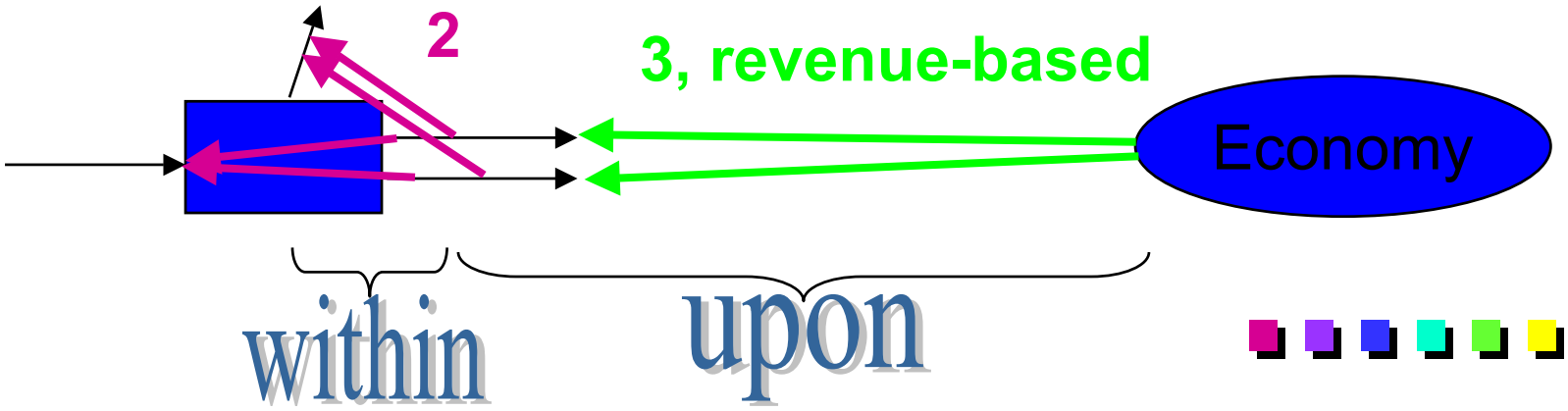
Step 2: Causal Model of Δ exchanges = f(Δ output)

- Study the system to determine how the burdens (that is, the process inputs and releases) causally depend upon the co-product amounts.
- The resulting Step 2 allocation basis *must* ("shall") reflect the "underlying physical relationships" … how exchanges "are changed by quantitative changes in the products or functions delivered by the system." ISO explicitly states that step 2 is *not* the same as *a priori* apportioning of burdens to co-products according to their mass, molar, energy shares or any other such apportioning.



Step 3: Allocate, apportion

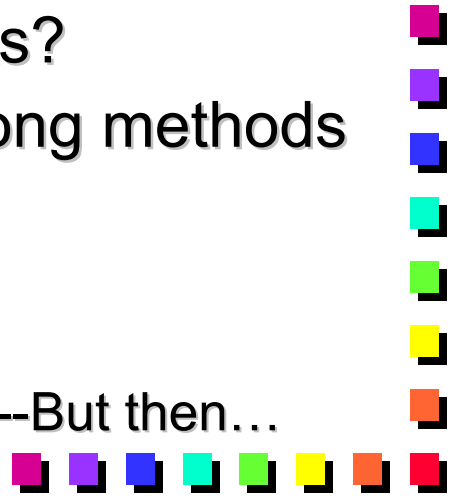
- Find some *basis* on which to allocate or apportion burdens: the allocation "key"
- Economic value attractive since co-product economic values can be seen to reflect shares of causal influence of the economy upon the process outputs: (p, o) = f(econ)



Getting Our Bearings on Allocation (or any LCA modeling issue)

- How do we know a “good” or “bad” allocation method when we see it?
  - Balance of practicality and realism
  - Realism?
    - Actual consequences, response of system
- Why do we use LCAs?
  - To support decisions to benefit the environment
  - To compare products based on accounting rules

- Consequential LCI, LCA
  - How will system respond to a decision, a selection among options?
  - Basis for evaluation and selection among competing models, modeling methods:
    - Realism
    - Practicality
- Attributional LCI, LCA
  - How do different product life cycles compare if I use certain rule(s) for assigning portions of system's total burdens among products?
  - Basis for evaluating and selecting among methods
    - Consistency
    - Practicality / data availability
    - → 1/n? Alphabetical order?
    - No! Those are arbitrary! Or not realistic! --But then…



In practice, we seek *consequentially inspired* models to the extent they are:

- **Practical**
  - Data available
  - Affordable ← manageable complexity
- **Database-able**
  - We are able to develop databases/models whose processes are **re-usable** for many analyses / decisions

Map analogy

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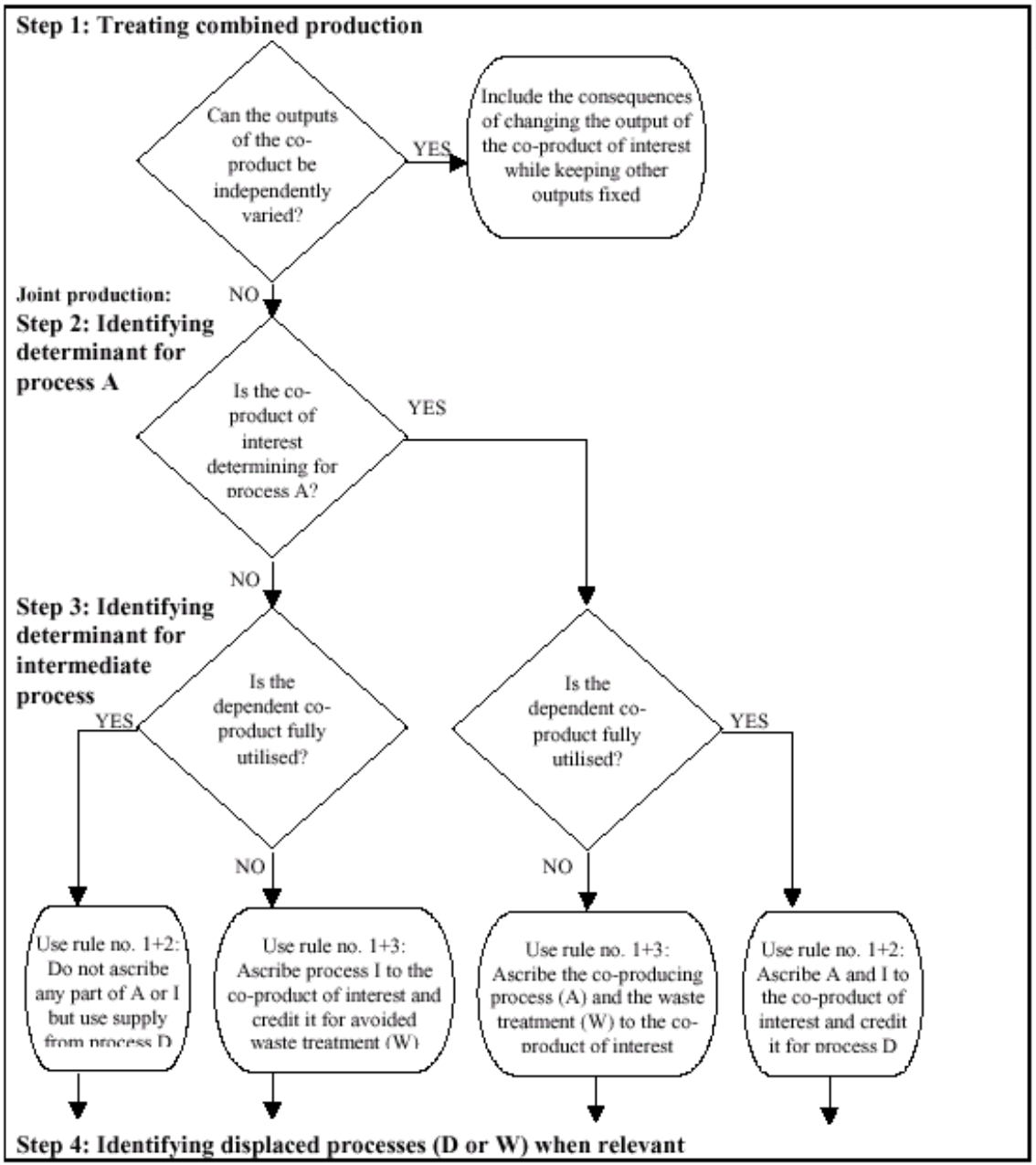
Responses to Δ Demand

- Economic models:
  - Δ demand → Δ price → Δ output
- Simplification
  - Δ demand → Δ output
  - Processes are price-takers

Co-product response: 2 classes

- Combined production
  - Ratios among outputs can be independently varied
  - → ISO Step 2
- Joint production
  - Ratios are fixed
    - Determining product
    - Dependent product(s)
- Reality is often:
  - Joint production at establishment level (e.g., mine)
  - Combined production at industry level

Decision Tree for Co-Product Modeling



Market Data Needed

- Identifying determining product
  - Marginal revenues
  - Market trends
- Utilization of dependent co-products
  - Full or not

System Expansion Concepts