Cradle to Cradle
and
Intelligent Materials Pooling

Responsible Packaging Forum

Steve Bolton

March 8, 2007

MBDC

Cradle to Grave Product Life Cycle

Cradle → **Grave**

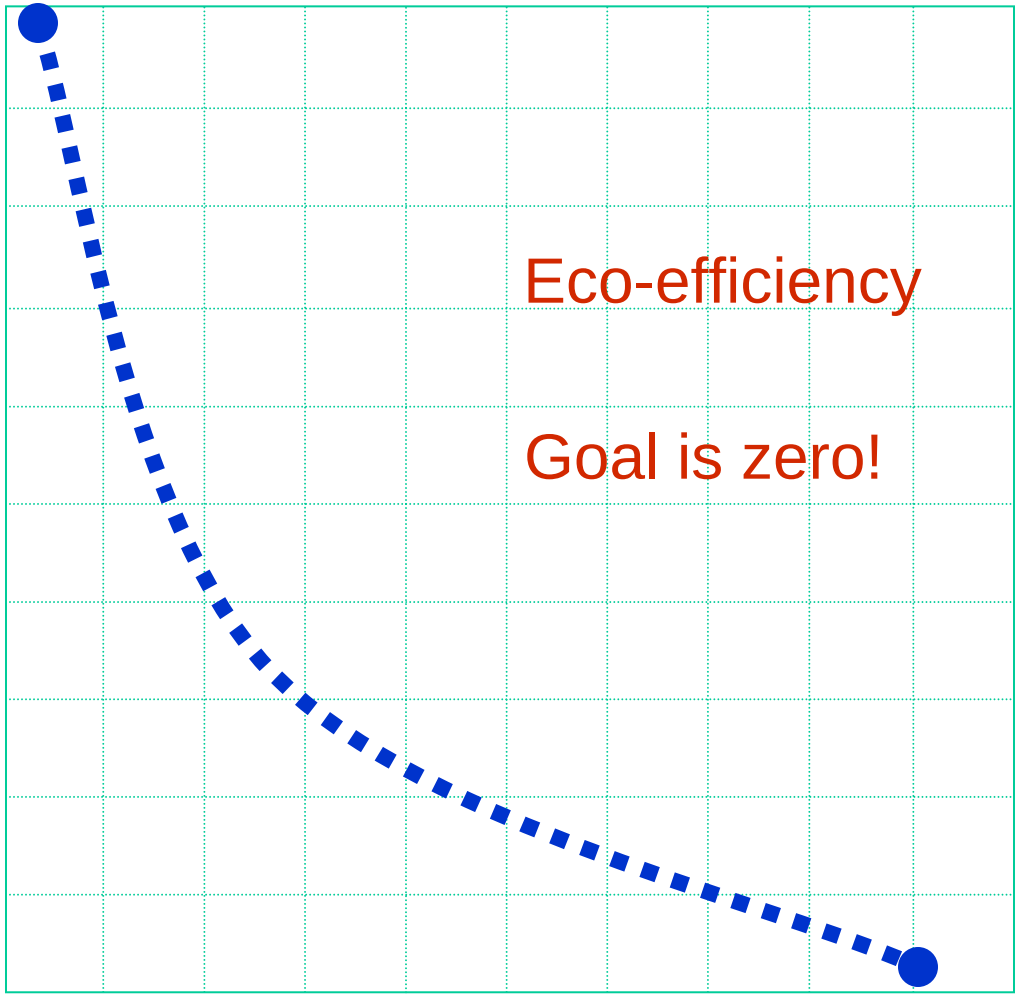
Manufacture

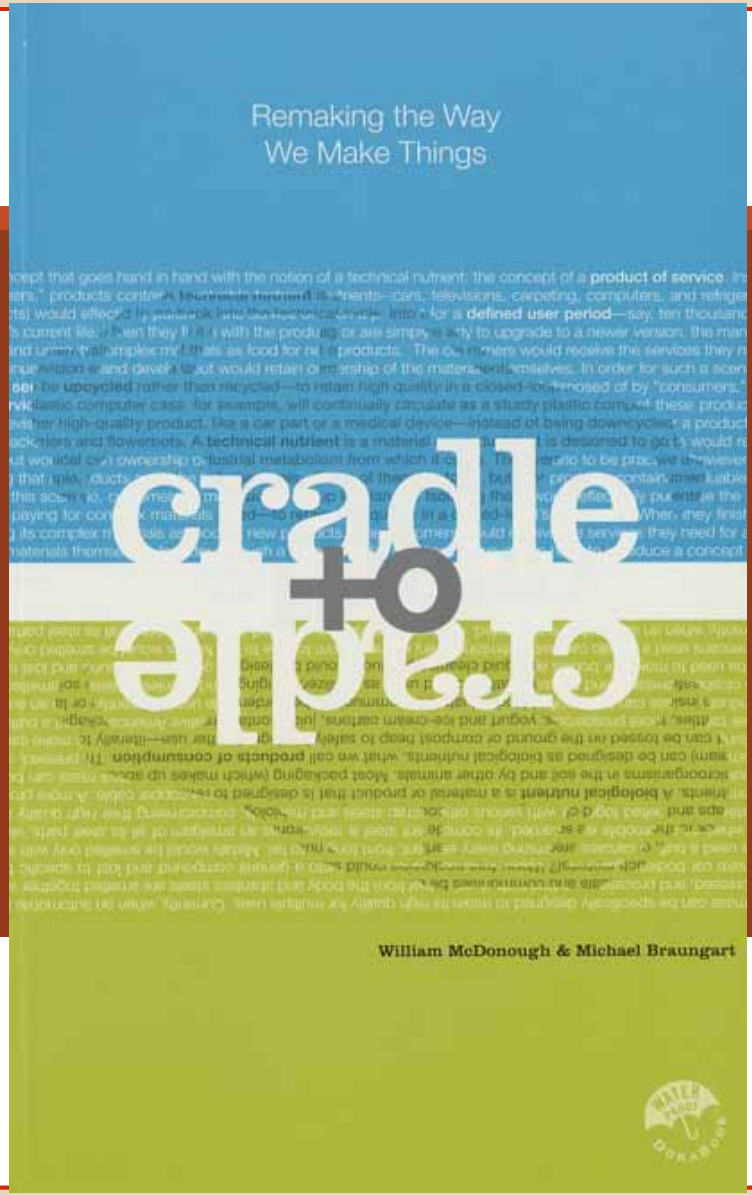
Use

Minimizing Negative Impact

Ecological &
Social Damage

- Pollution
- Workplace hazards
- Climate change
- Social deterioration
- Liability exposure



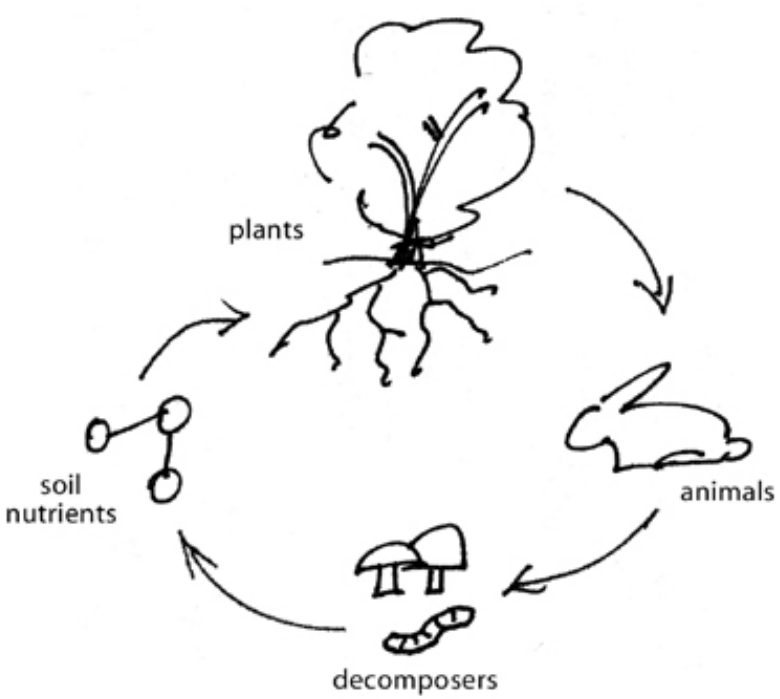

Remaking the Way
We Make Things
cradle to cradle
William McDonough & Michael Braungart

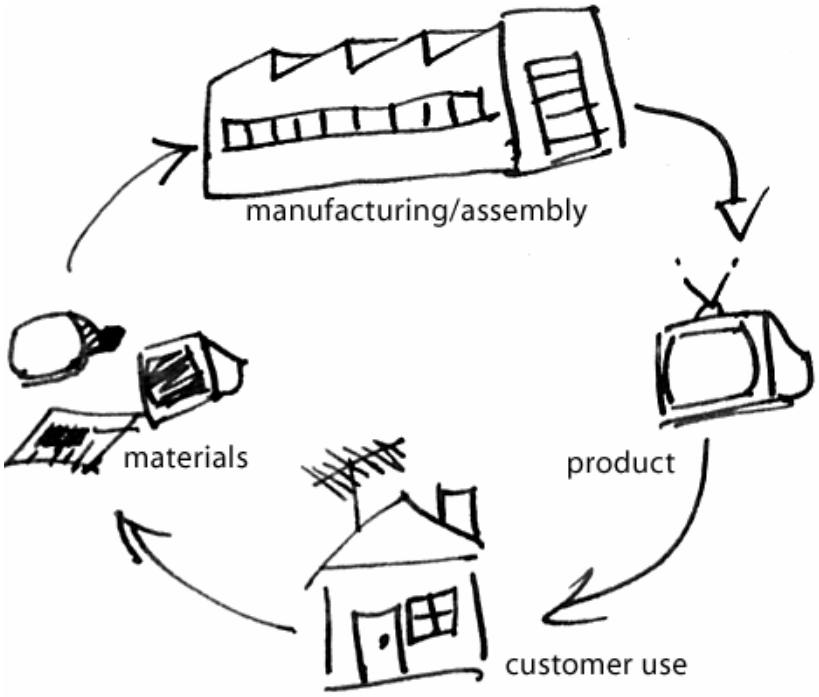
MBDC

Design Modeled on Nature

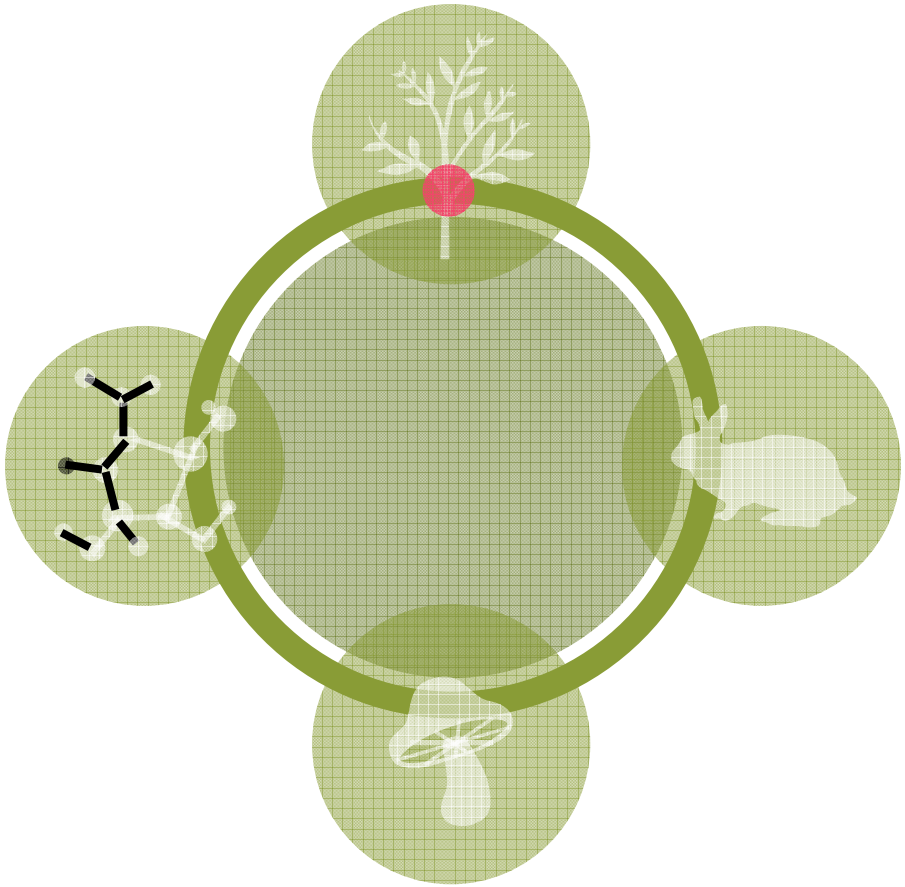
- Nature focuses primarily on *effectiveness* (pursuing the most valuable end)
- Then it may be *efficient*
- Eco-effectiveness embraces nature's design principles

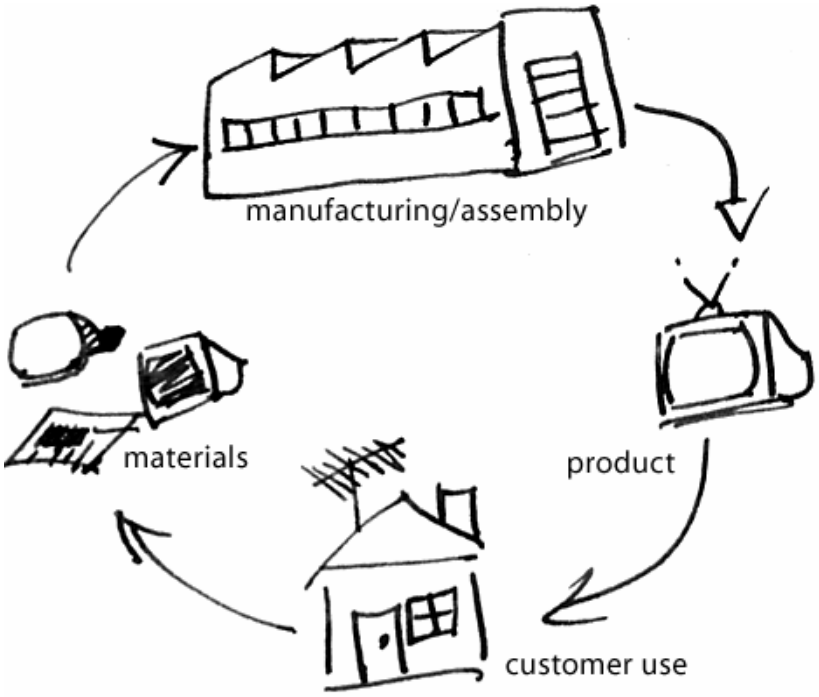
Emulating Natural Cycles





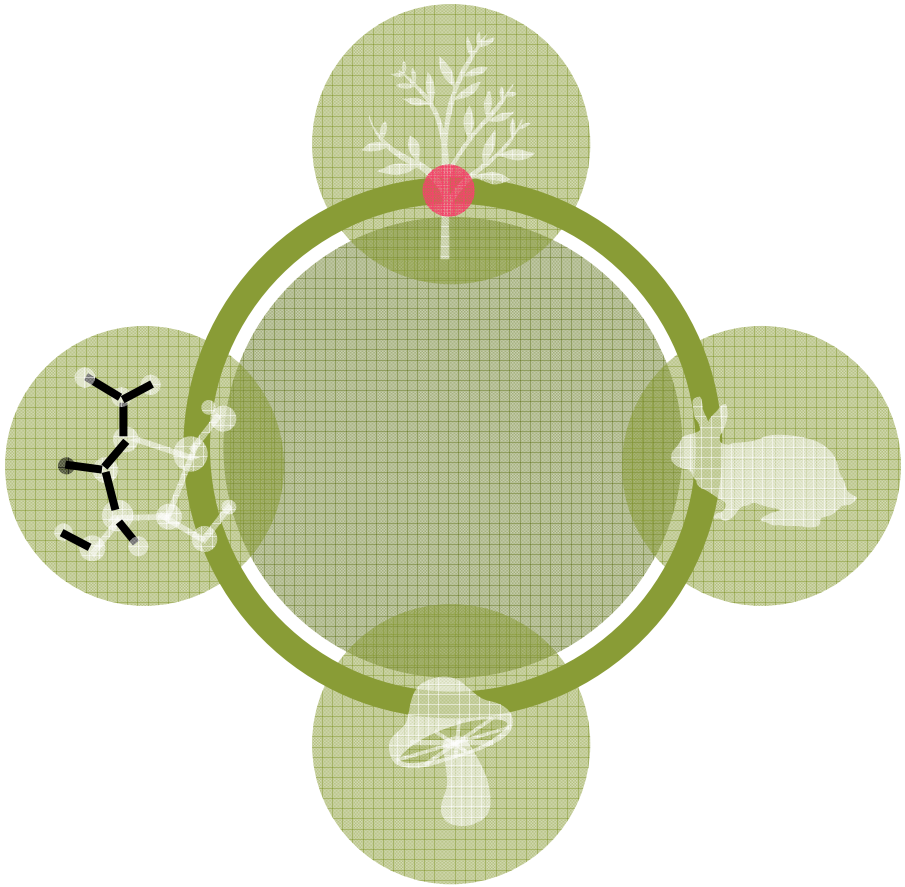
Emulating Natural Cycles



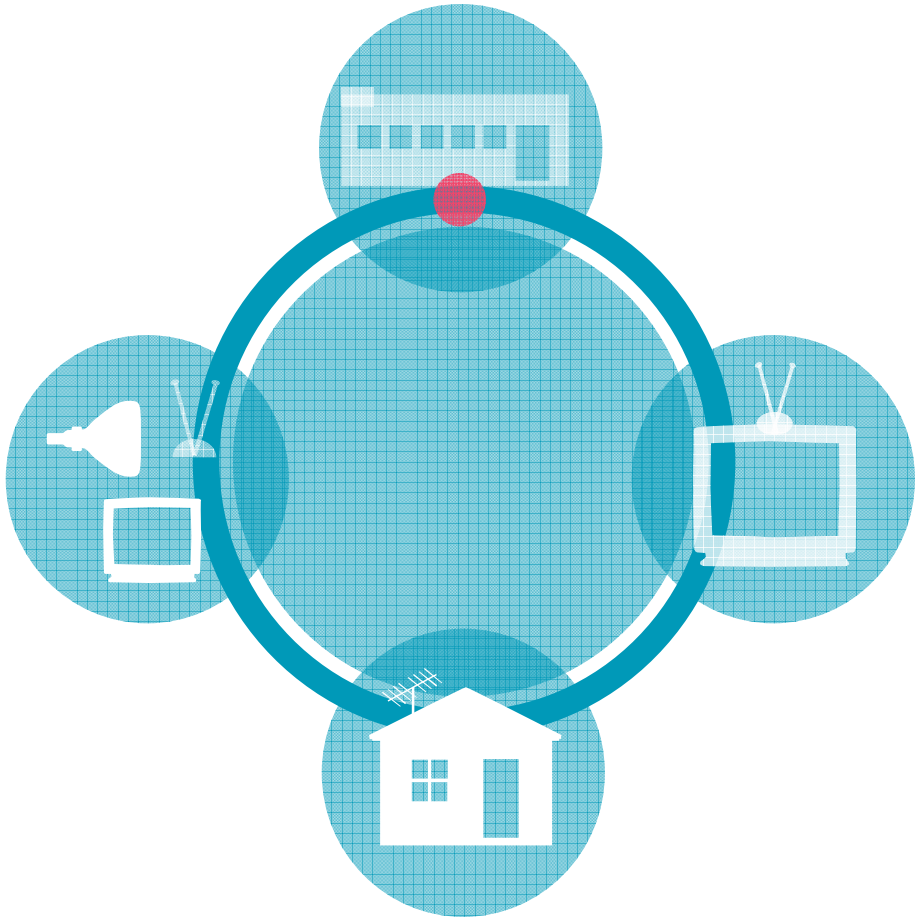


Biological Nutrients

Two Interdependent Metabolisms



Biological Nutrients

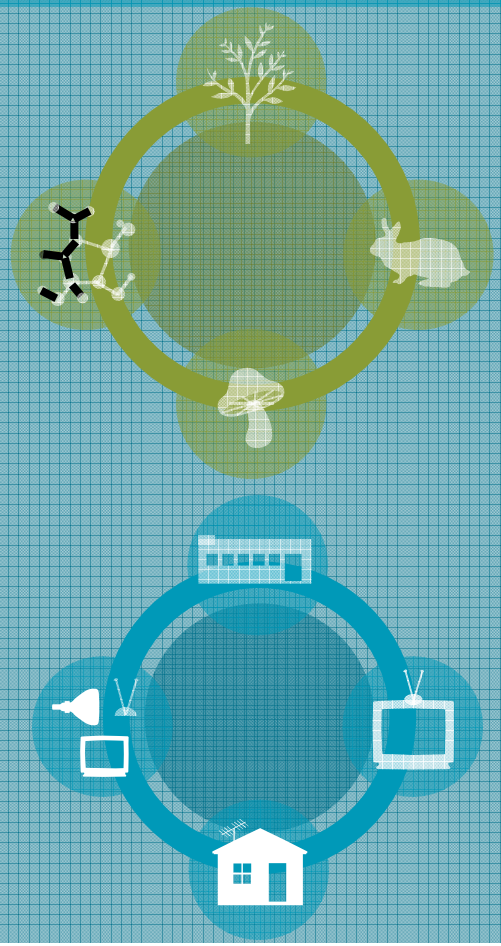


Technical Nutrients

Two Interdependent Metabolisms

Cradle to Cradle Design Principles

Waste equals food

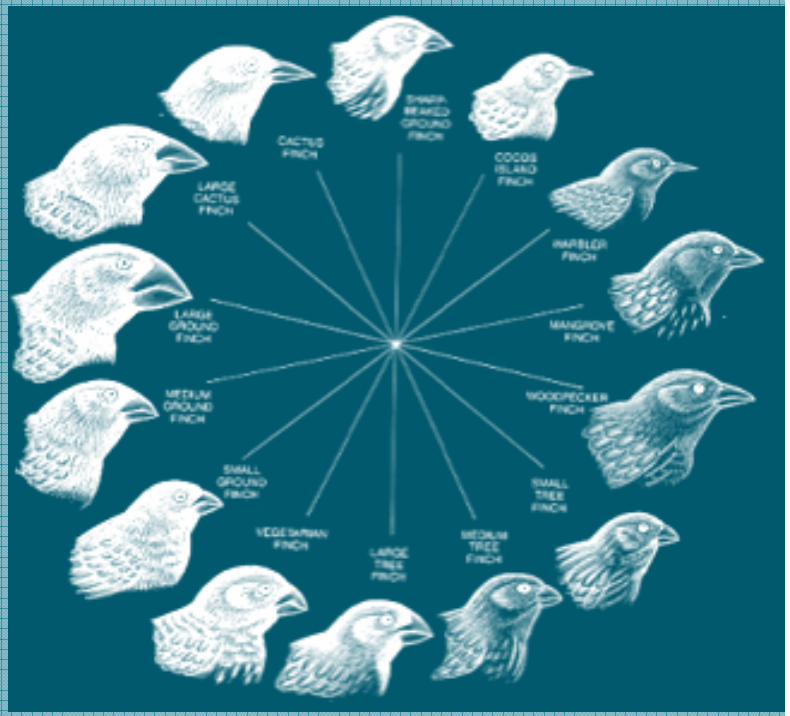


Cradle to Cradle Design Principles

Waste equals food

Use current solar income

Celebrate diversity

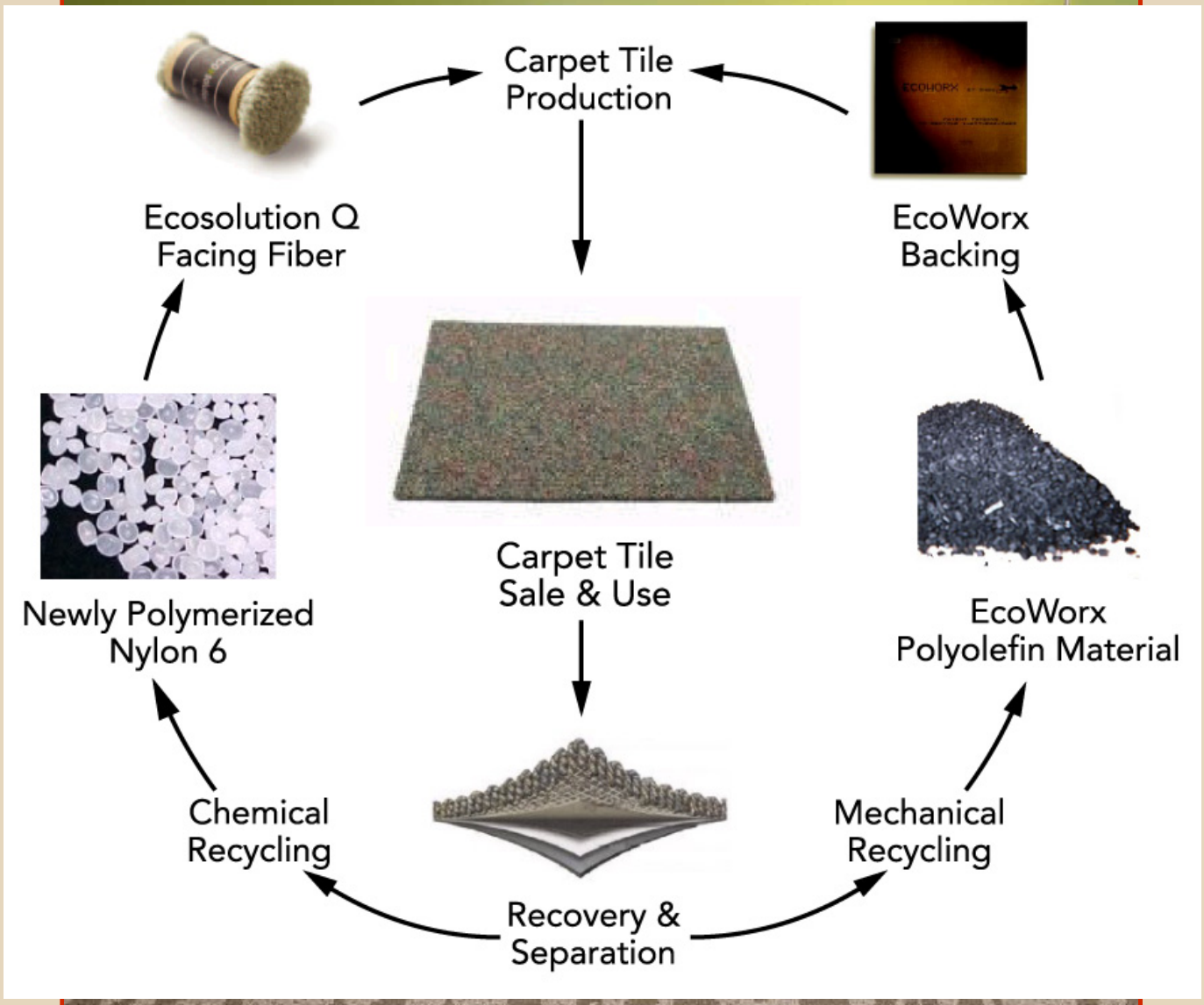



DESIGN
TEX


Fabric Sale & Use
Disposal & Trimmings
Mulch & Compost
Resource Growth
Fiber & Fabric Production
DESIGN TEX

“Blades” from the William McDonough Design Portfolio

Shaw™


Carpet Tile Production
Ecosolution Q Facing Fiber
EcoWorx Backing
Carpet Tile Sale & Use
Newly Polymerized Nylon 6
EcoWorx Polyolefin Material
Chemical Recycling
Mechanical Recycling
Recovery & Separation

Shaw™

Steelcase®

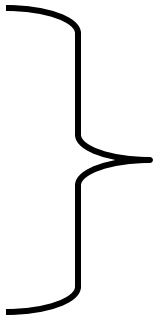
Steelcase®

Materials Pooling

- Materials available in market
- Cooperative purchasing
  - Buying power: joint greater than individuals
  - Optimize B2B networks
  - However, purchasing as extent of “pooling”
- Leverage suppliers
  - Challenge to supply specific material formulation
  - Cost/quality “takers” → Cost/quality “makers”

Measures of Quality

- Cost
- Performance
- Aesthetics



Traditional measures of quality

Measures of Quality

- Cost
- Performance
- Aesthetics
- Ecological intelligence
- Social fairness
- Delight

Traditional measures of quality

Expanded measures of quality

Cradle to Cradle filter

Materials Pooling (Plus)

Materials Pooling

+

Cradle to Cradle Filter
for Material Quality

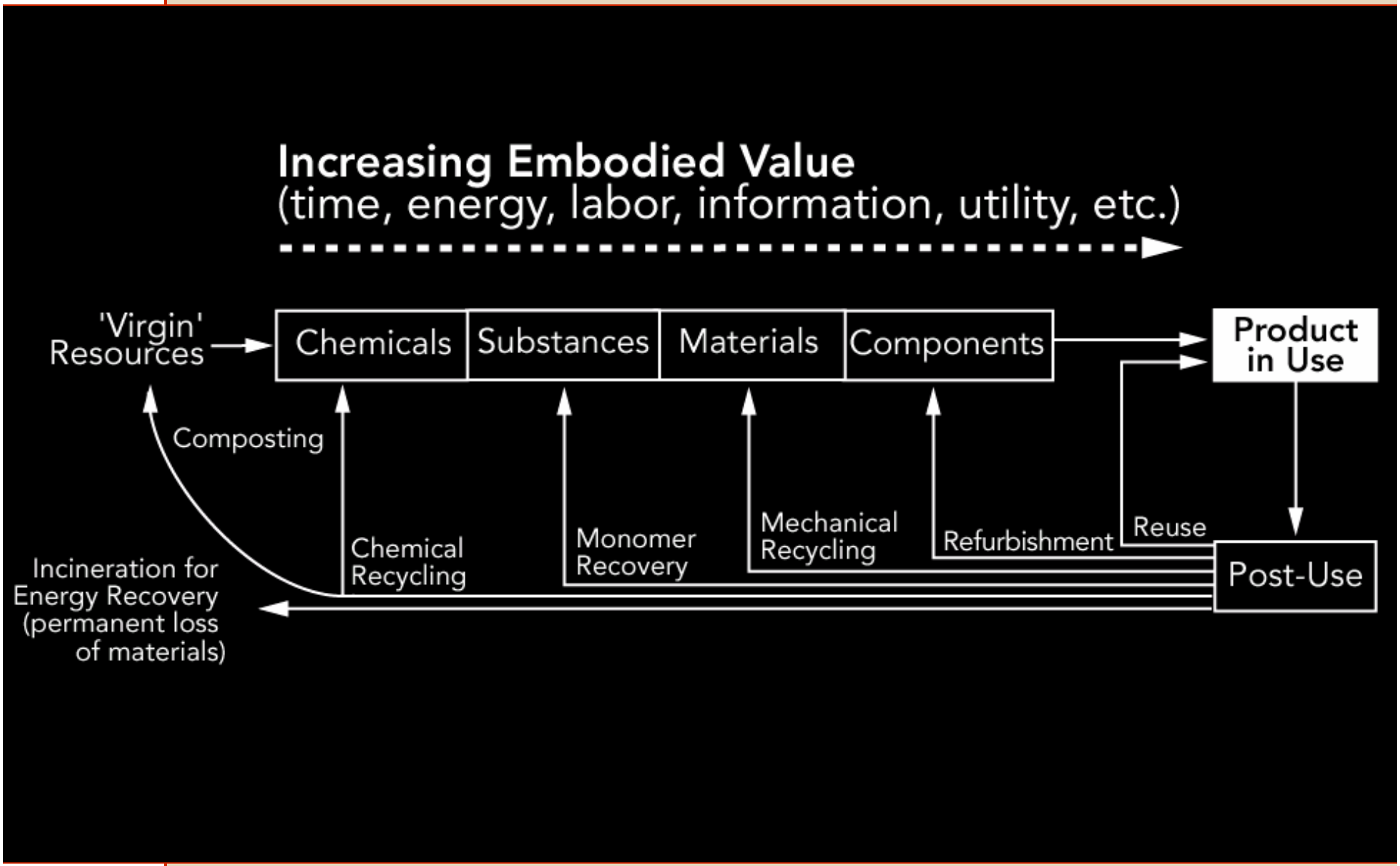
=

“Intelligent Materials Pooling”

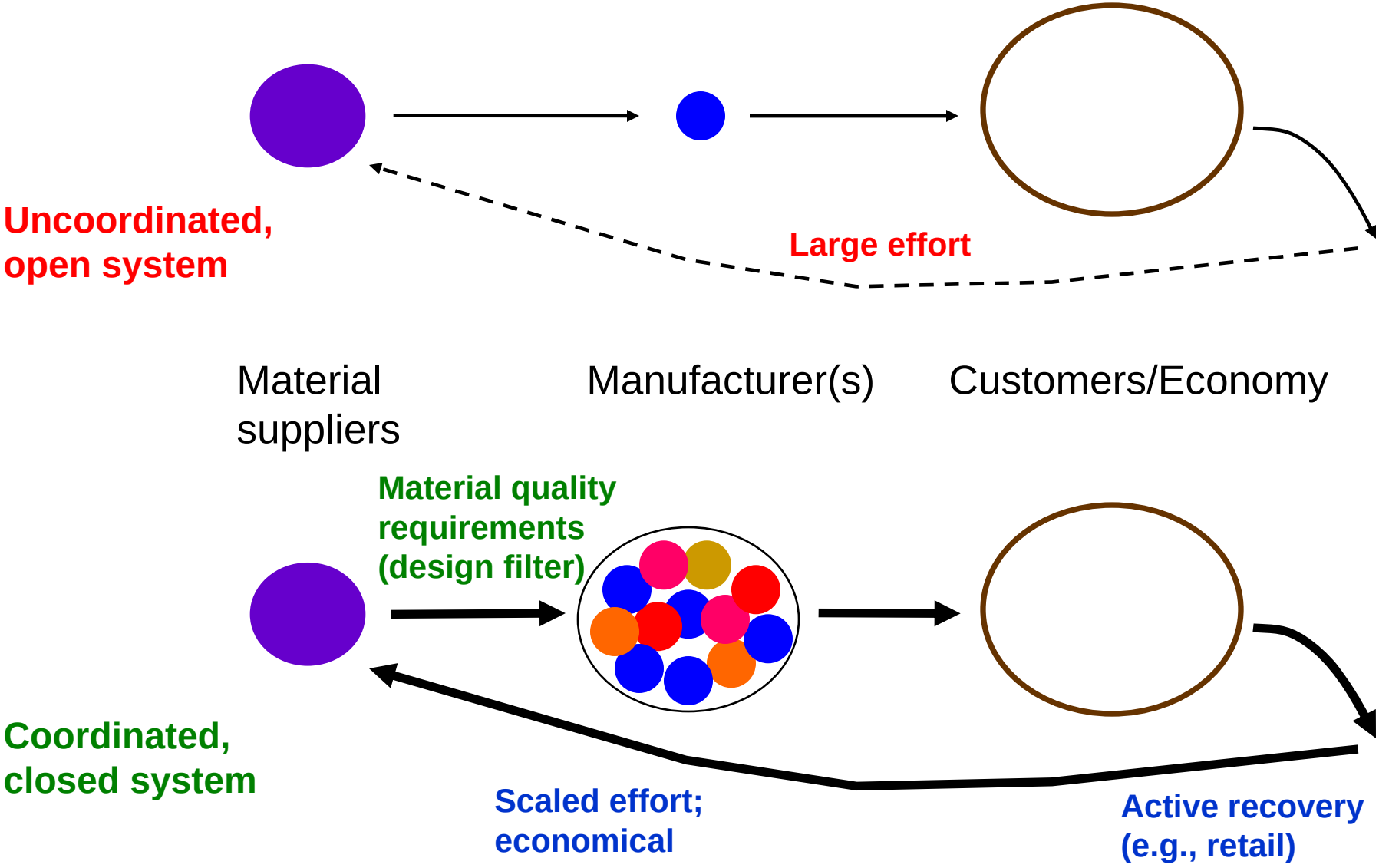
Intelligent Materials Pooling

- "Values-based" community
  - Intentional, coordinated
  - Must be significant alignment on commercial & material quality goals
  - Members mutually define & share information on materials they want to use
- Expand "pooling" beyond purchasing
  - Enhance material quality requirements
    - Human health, ecological health
    - Recycled/renewable content, recyclability/compostability
  - Replenish material through post-use recovery & recycling/composting

Cradle to Cradle Value Recovery Hierarchy



Materials Pooling / Materials Economy



Uncoordinated, Open System

- Initial demand signal to suppliers
  - Emergent market for biopolymers
- Initial R&D and product introductions
  - NatureWorks PLA
- Interest in exploring potential applications
- Performance & cost refinement
- Sustainability concerns, initial consideration
  - GMOs
  - Food vs. non-food sources
  - Sustainable farming
  - Land use implications

Leverage challenge with uncoordinated response

Uncoordinated, Open System

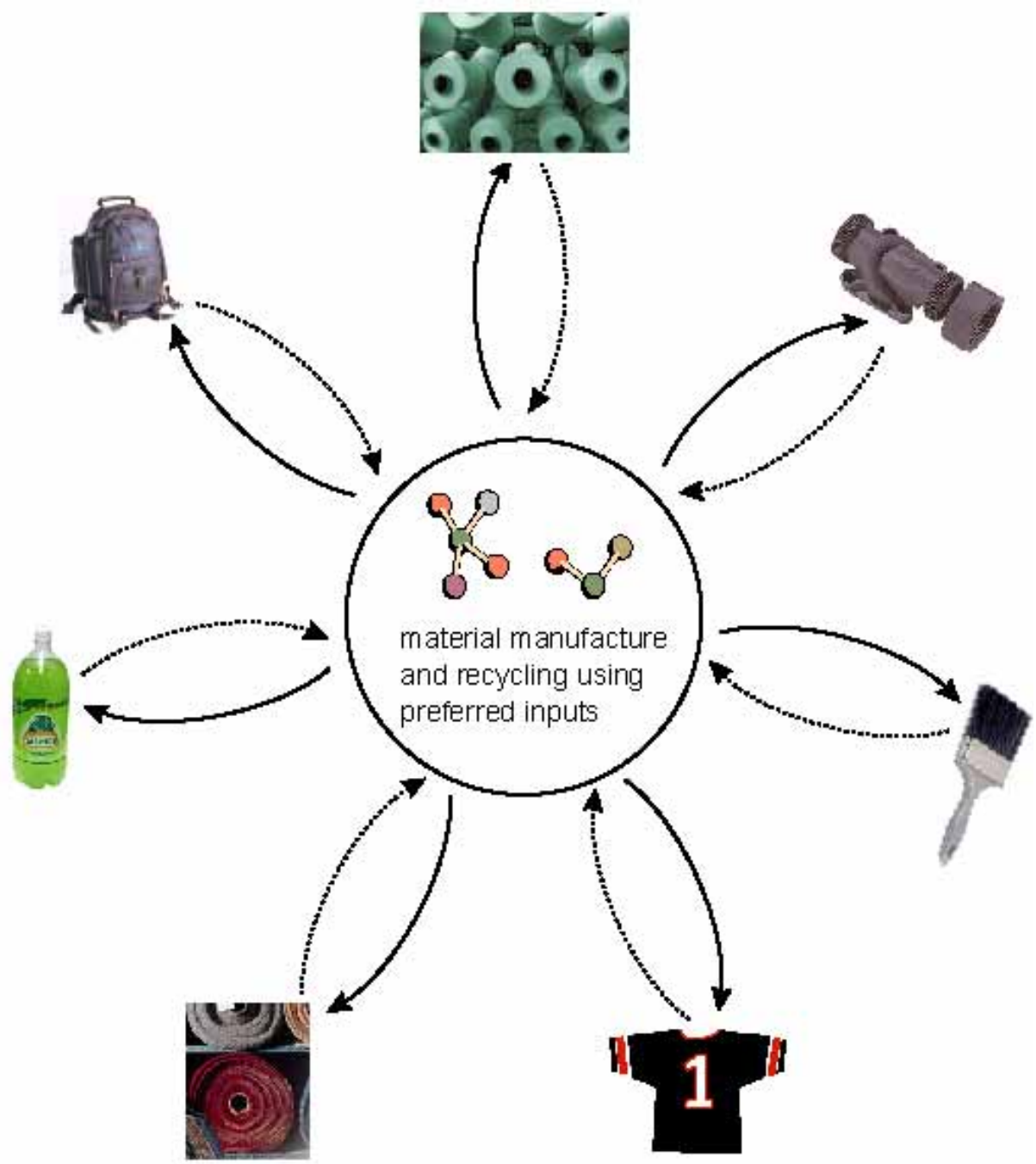
- Antimony-free polyester
  - Residual carcinogenic process catalyst in fiber
  - Victor Innovatex: small company, limited market, but leadership as first mover

  ⇒Future coordination: larger purchasing community
    - Increase demand
    - Increase supply & decrease price
- NatureWorks PLA
  - Allow customers to purchase off-sets to stimulate non-GMO farming

  ⇒Future coordination: companies leverage GMO-free & non-food sources

Coordinated, Closed System

- Greater leverage
  - Enhance material quality requirements
  - Replenish material through post-use recovery & recycling/composting
- Purposeful coordination is key
  - Clear demand signal for advanced attributes
  - Suppliers as contractual partners
  - Recyclers/composters as partners
  - However, potential anti-trust concern


material manufacture
and recycling using
preferred inputs

Coordinated, Closed System

- Biopolymers post-use
  - Optimize ingredients for safe composting
  - Compost to recover nutrient value (biological nutrients)
  - Recycle?
  - Retail opportunities (e.g., Whole Foods, Community Recycling)
  - Will need to engage local, state, federal partners

Future for Biopolymer Pooling

- Opportunities
- Challenges
- Alternative responses
- Value of discussion