

Cradle to Cradle and Intelligent Materials Pooling

Responsible Packaging Forum

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March 8, 2007

Cradle to Grave Product Life Cycle



Minimizing Negative Impact

Ecological &
Social Damage

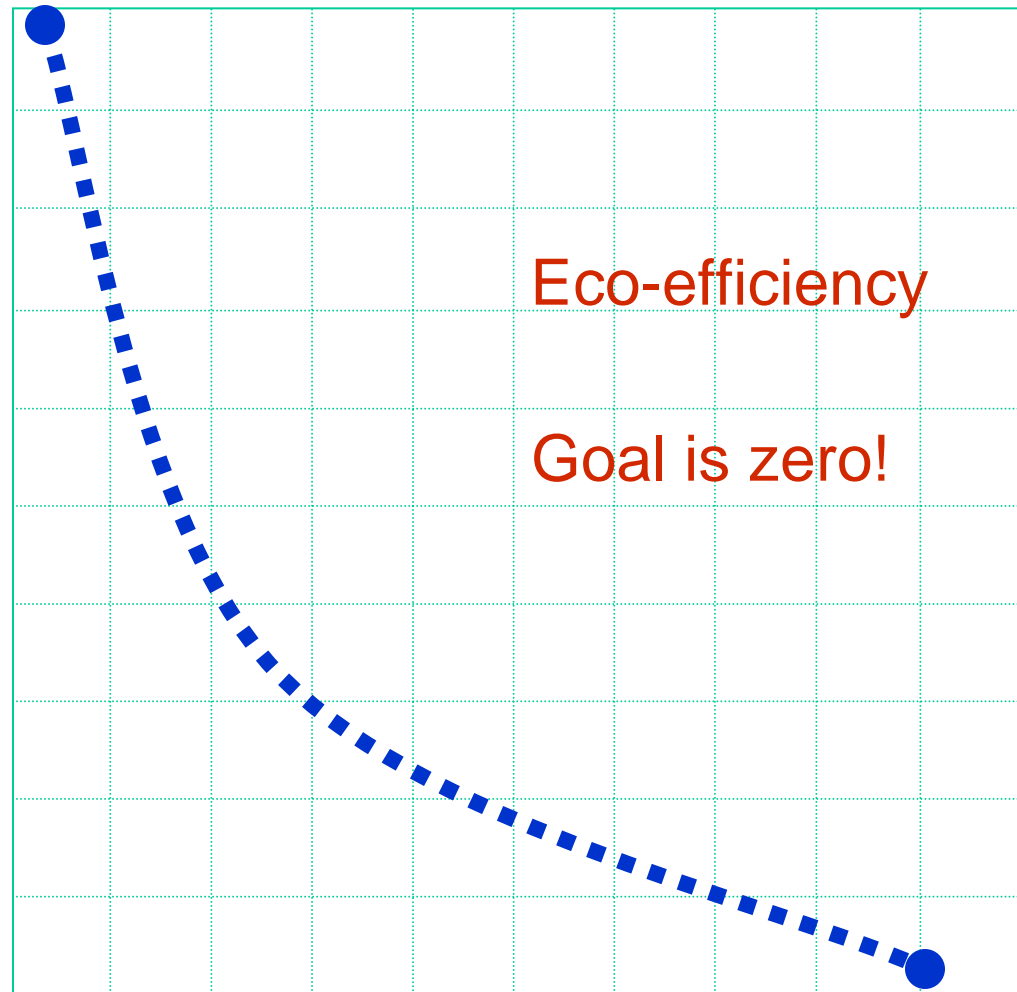
Pollution

Workplace hazards

Climate change

Social deterioration

Liability exposure



Time

Remaking the Way We Make Things



cept that goes hand in hand with the notion of a technical nutrient: the concept of a **product of service**. In
ers' products contain a **technical nutrient**—lights, cars, televisions, carpeting, computers, and refrigerators
ts) would effectively **gradually** and **continuously** **degrade** into a **defined user period**—say, ten thousand
s current life. Then they'll **part** with the product, or else simply **let it** upgrade to a newer version, the man
and **conveniently** **recycle** it as food for new products. The customers would receive the services they n
e vision of and **develop** it out would retain ownership of the materials themselves. In order for such a **con**
ser be **upcycled** rather than **recycled**—to retain high quality in a closed-loop process of by "consumers,"
nyc classic computer case, for example, will continuously **circulate** as a sturdy plastic component; these products
either high-quality products, like a car part or a medical device—instead of being **downcycled**; a product
bookshelves and flowerpots. A **technical nutrient** is a material that is designed to **gradually** **degrade** to be **practically** **re-**
of **worldwide** ownership of **biological** metabolism from which it **gradually** **degrades** to be **practically** **re-**
y that **products** **gradually** **degrade** into a **defined user period**—say, ten thousand hours of use. **When** they **part**
this **period**, **consumers** **can** **part** with the product, or else simply **let it** upgrade to a newer version, the man
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cradle to cradle

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William McDonough & Michael Braungart

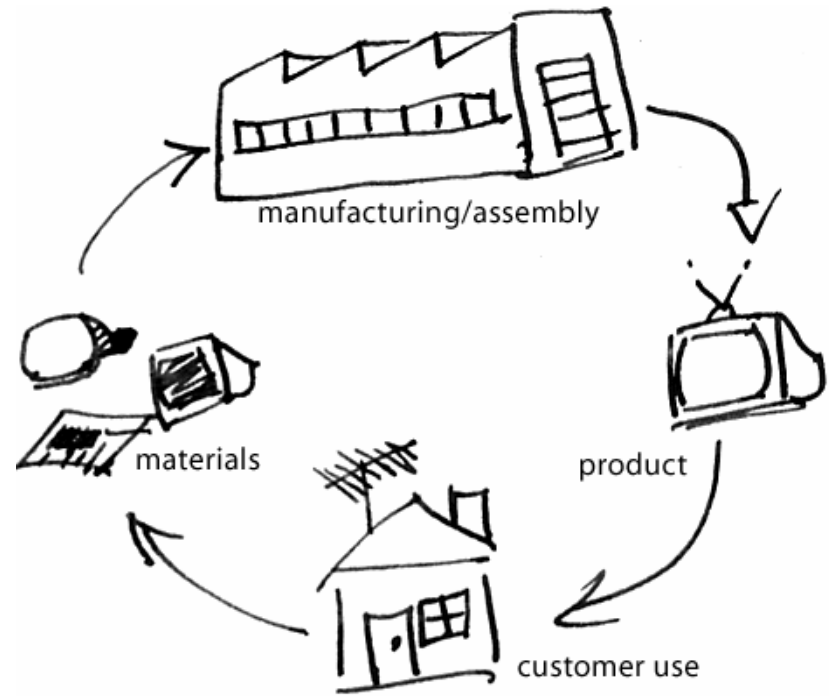
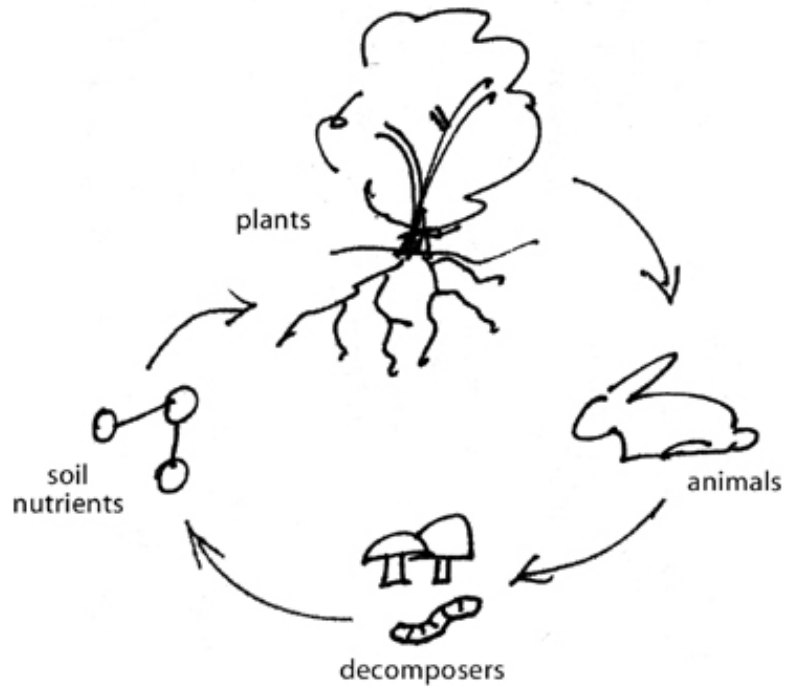


Design Modeled on Nature

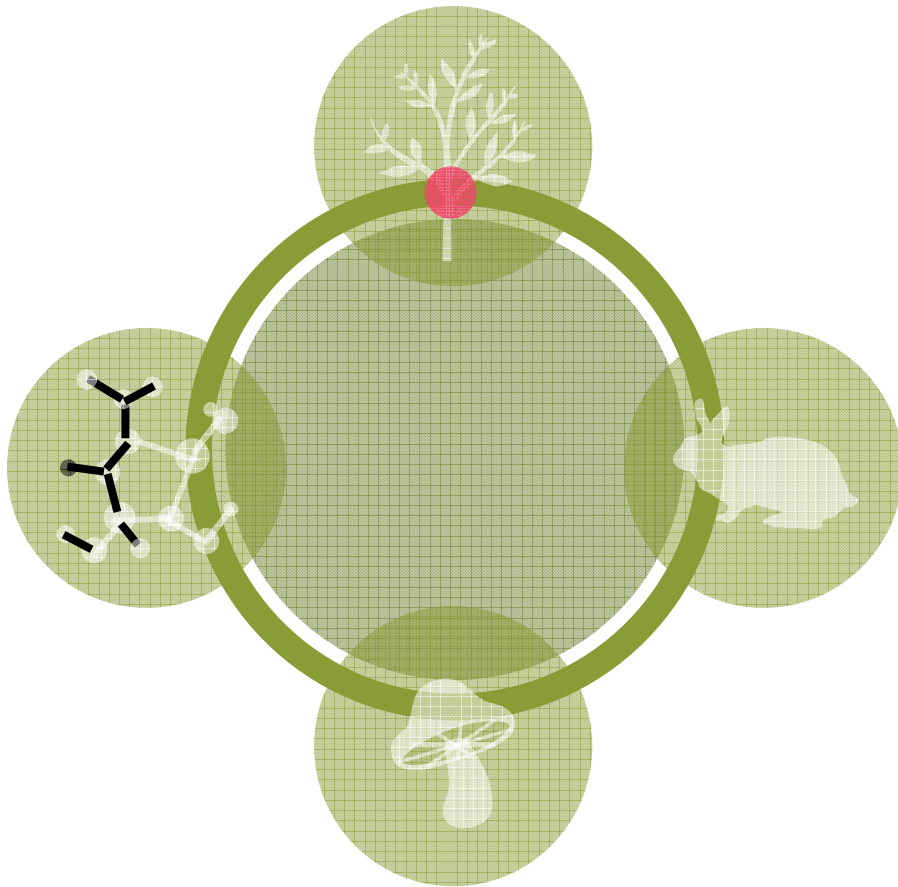
- Nature focuses primarily on *effectiveness* (pursuing the most valuable end)
- Then it may be *efficient*
- Eco-effectiveness embraces nature's design principles



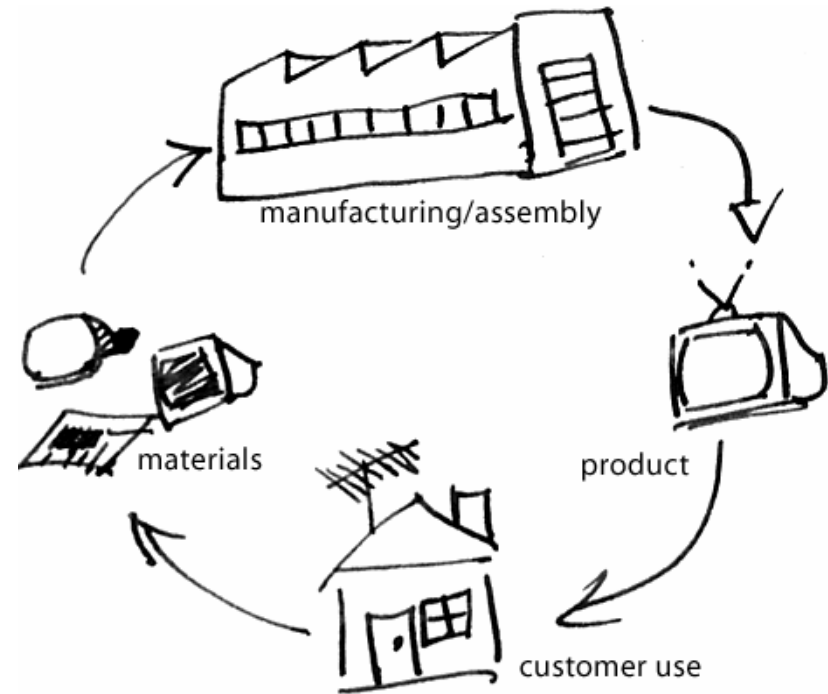
Emulating Natural Cycles



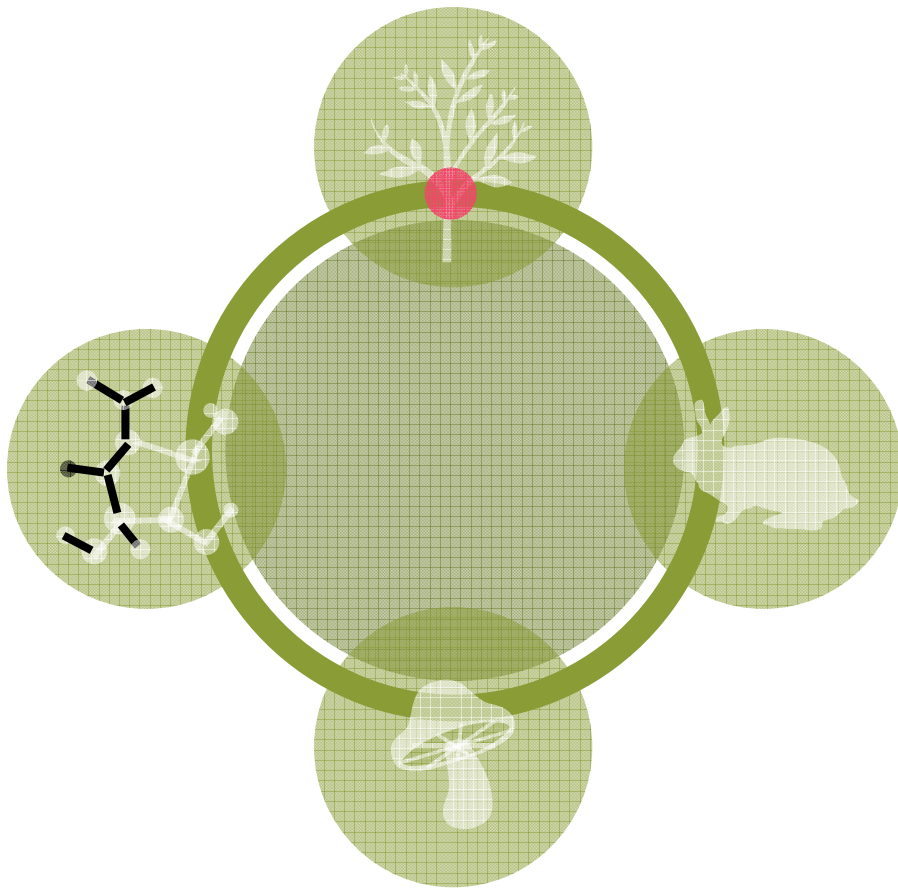
Emulating Natural Cycles



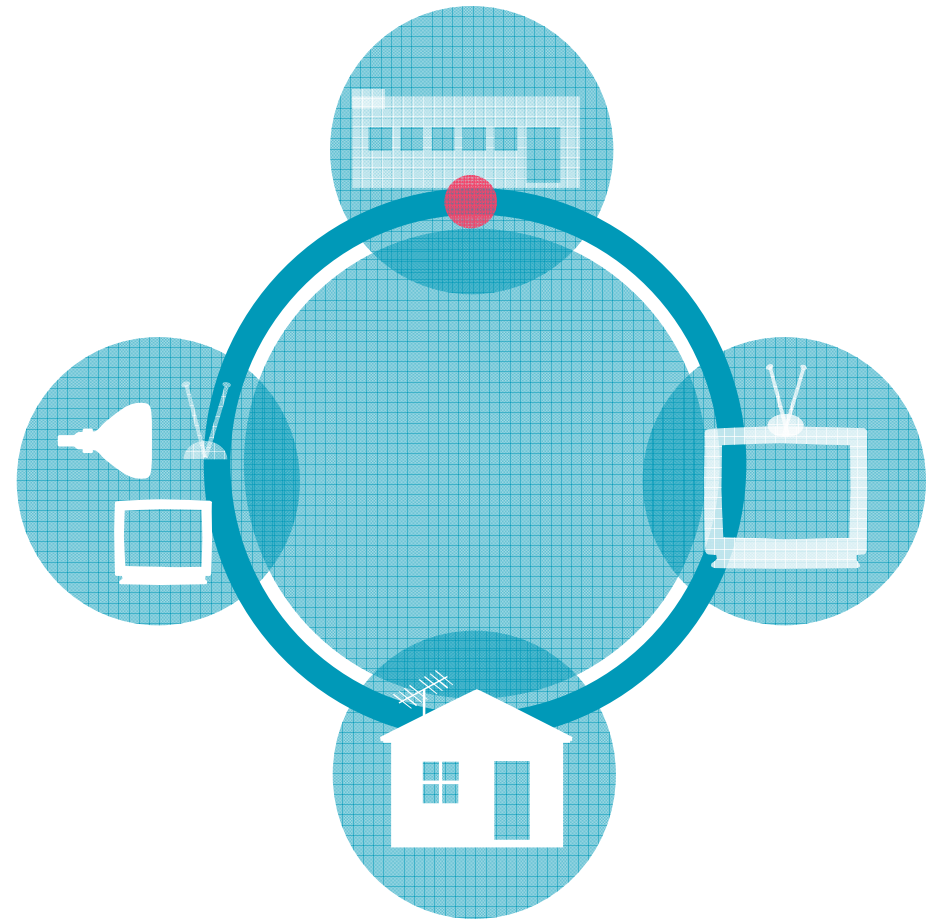
Biological
Nutrients



Two Interdependent Metabolisms



Biological
Nutrients



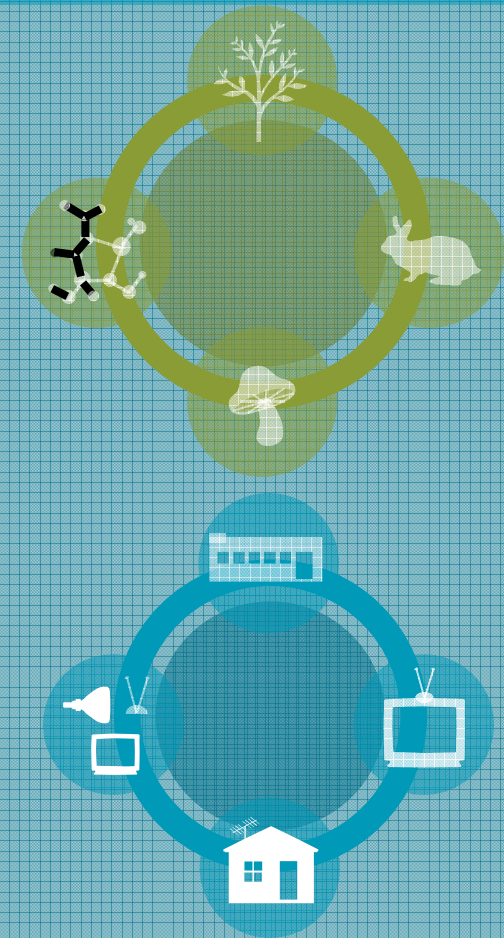
Technical
Nutrients

Two Interdependent Metabolisms



Cradle to Cradle Design Principles

Waste equals food

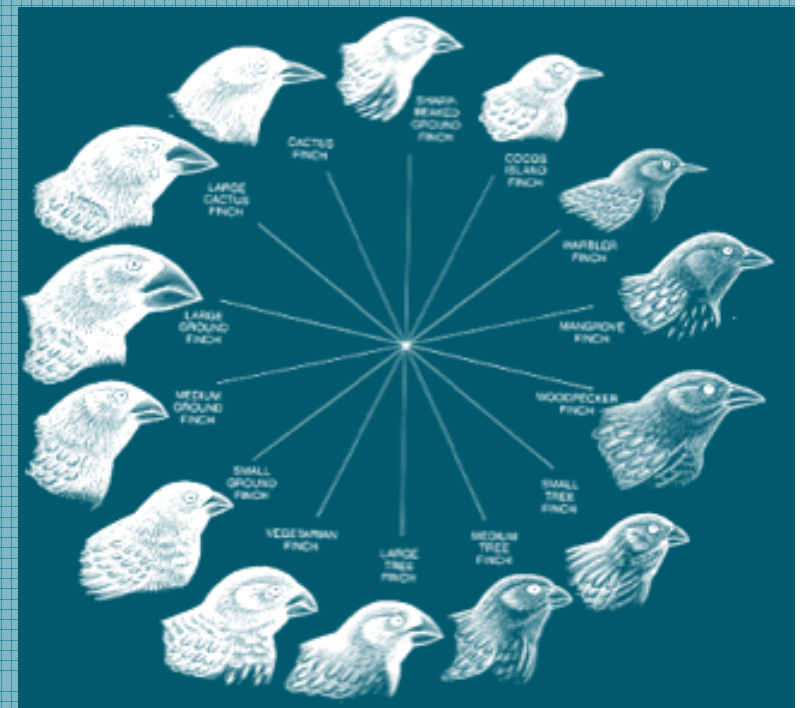


Cradle to Cradle Design Principles

Waste equals food

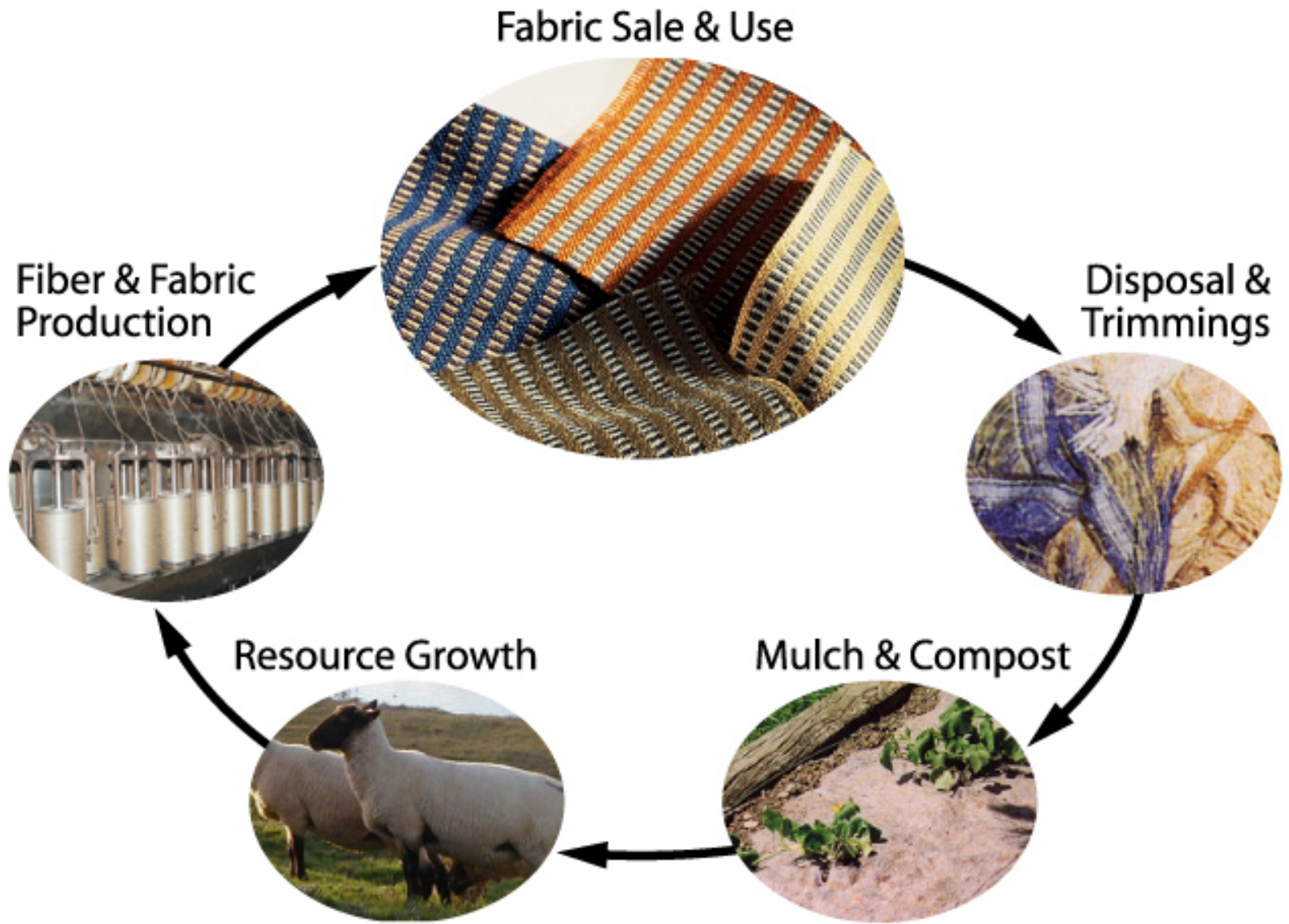
Use current solar
income

Celebrate diversity





DESIGN
Tex

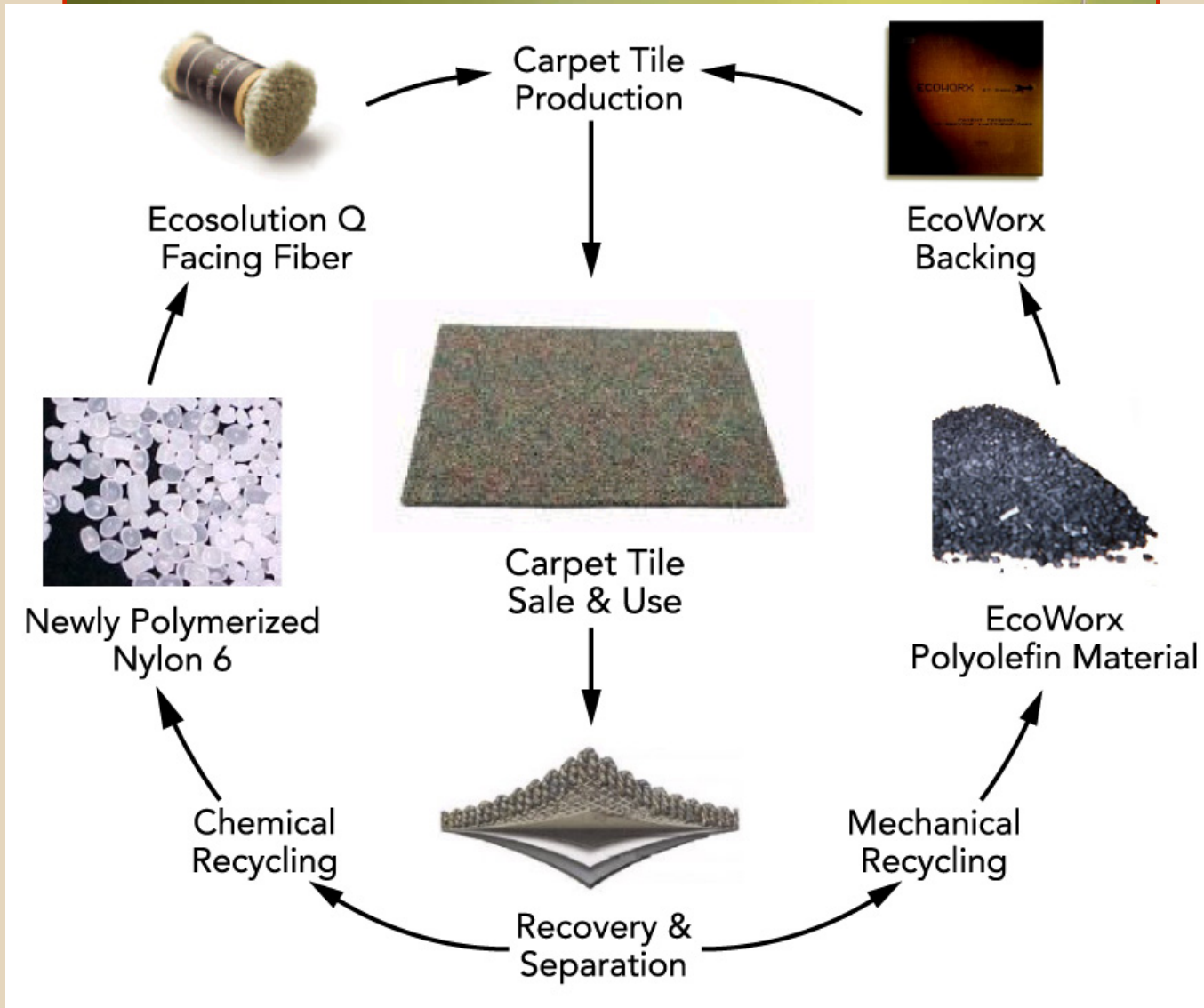


DESIGN
Tex



“Blades” from the William McDonough
Design Portfolio





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

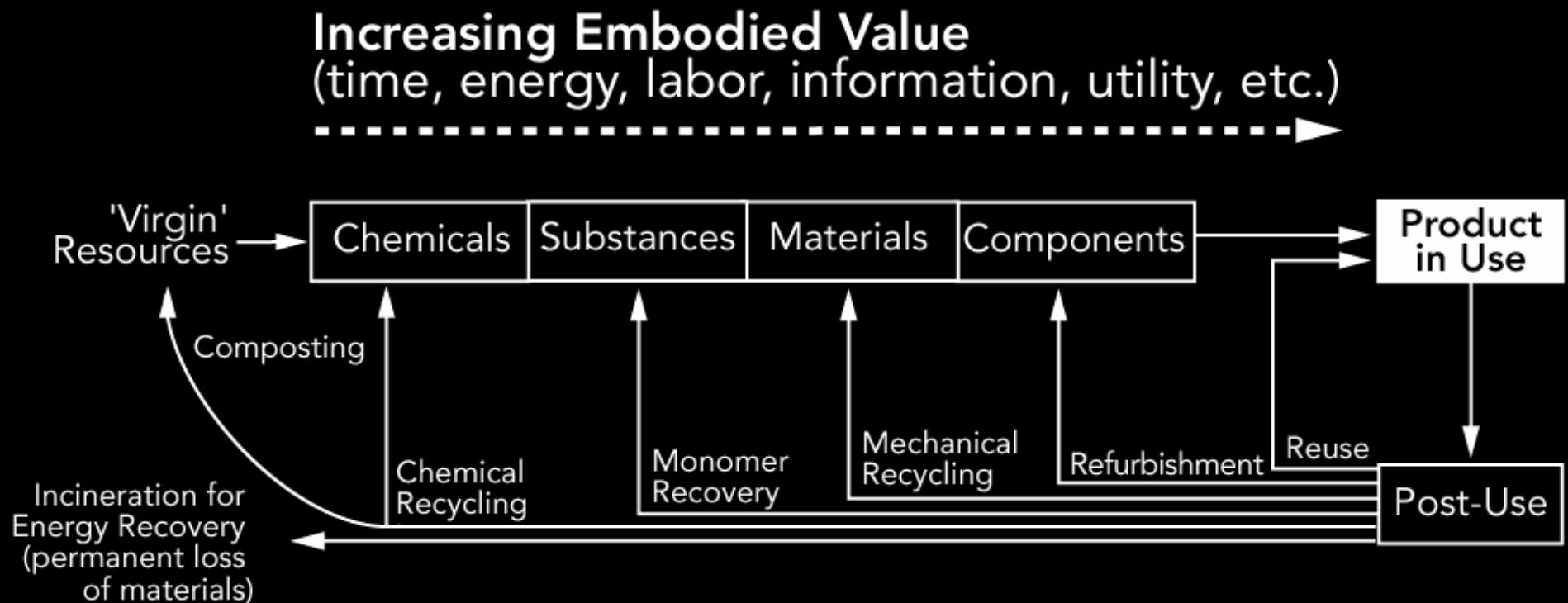
Materials Pooling (Plus)

Materials Pooling
+
Cradle to Cradle Filter
for Material Quality
=
“Intelligent Materials Pooling”

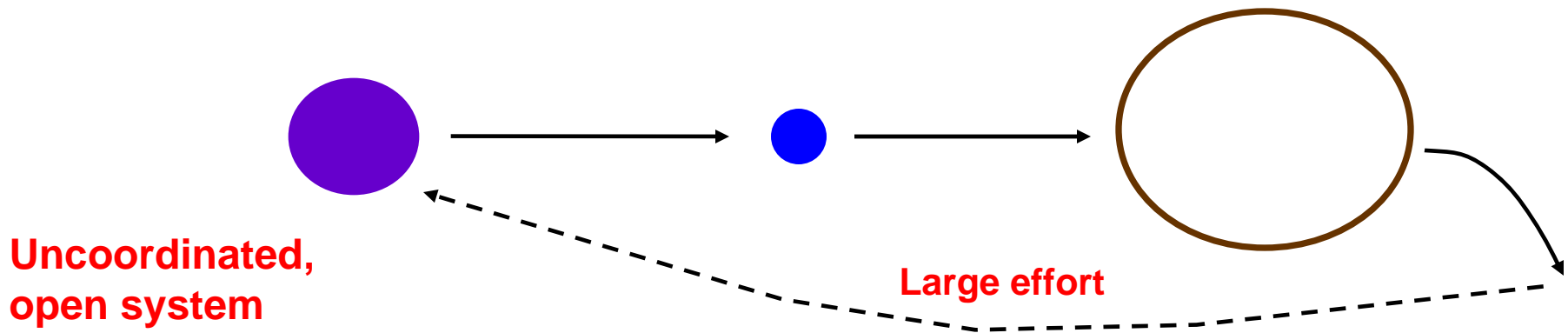
Intelligent Materials Pooling

- “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



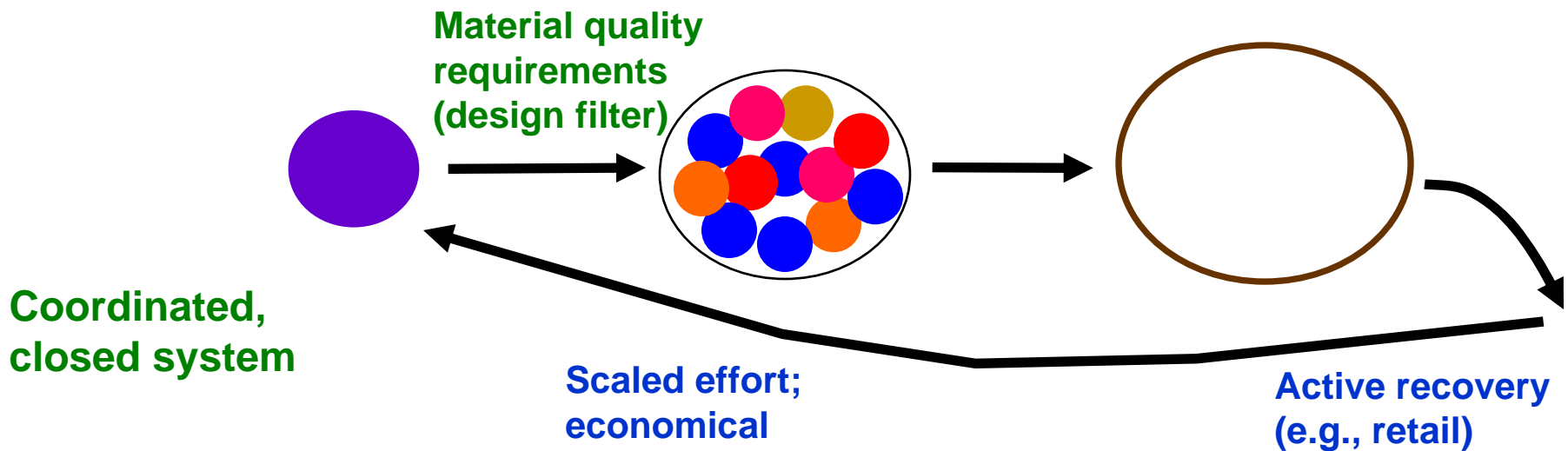
Materials Pooling / Materials Economy



Material suppliers

Manufacturer(s)

Customers/Economy



Uncoordinated, Open System

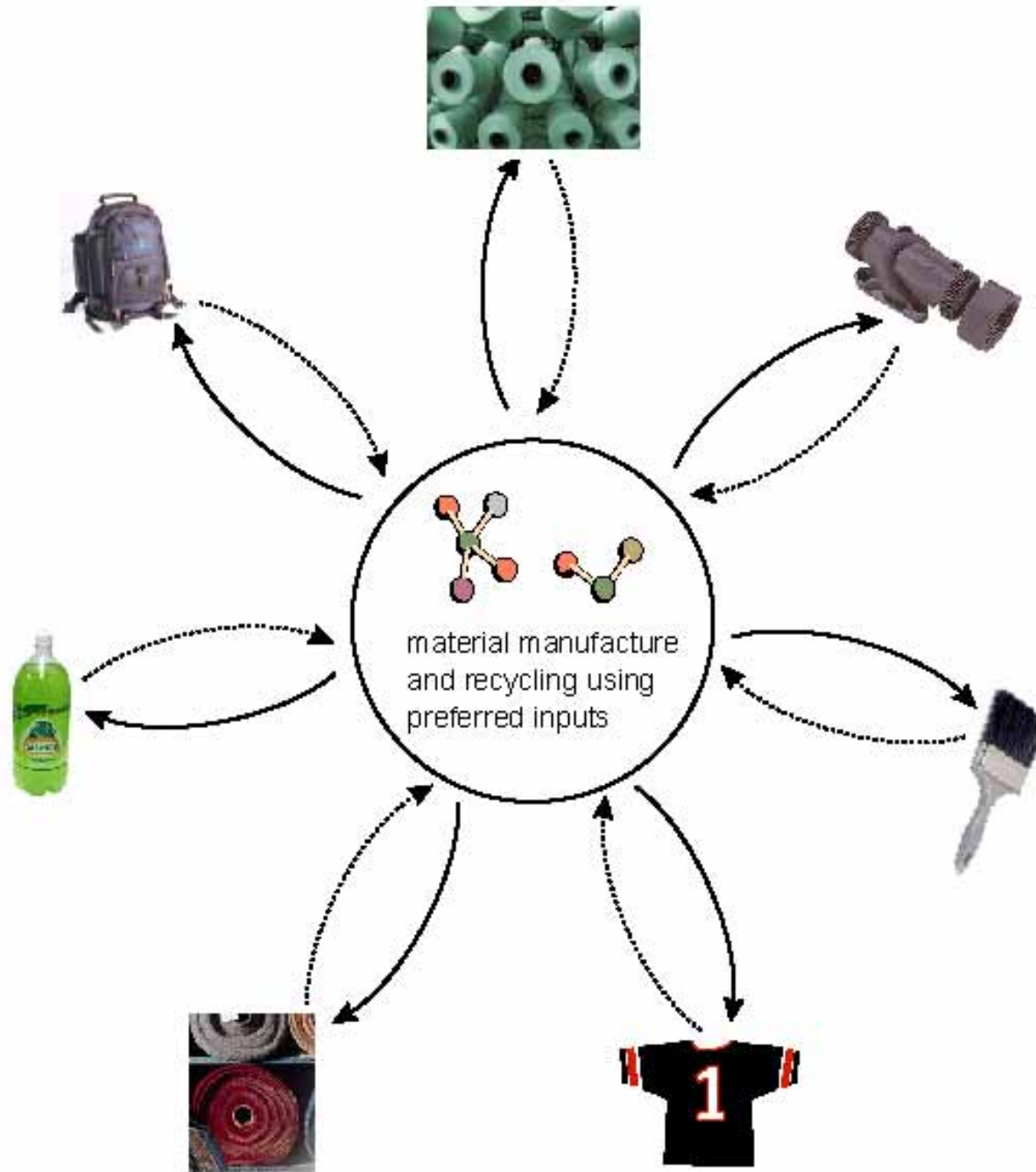
- Initial demand signal to suppliers
 - Emergent market for biopolymers
 - Initial R&D and product introductions
 - NatureWorks PLA
 - Interest in exploring potential applications
 - Performance & cost refinement
 - Sustainability concerns, initial consideration
 - GMOs
 - Food vs. non-food sources
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



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