

Materialen in de circulaire economie

Uitdagingen en kansen voor oppervlaktetechnologie

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Philips Innovation Services

4 oktober 2016

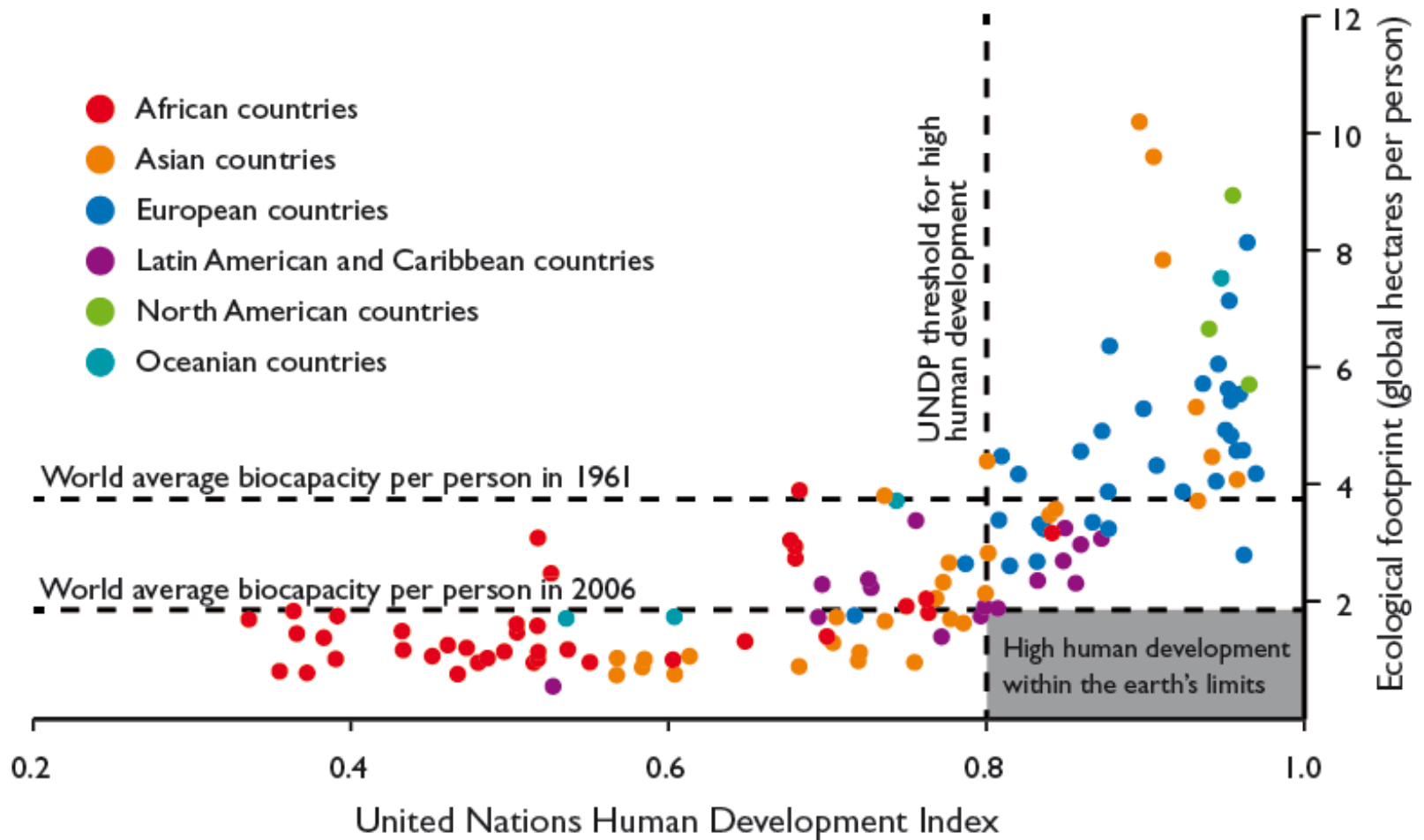
Surface 2016

Inhoud

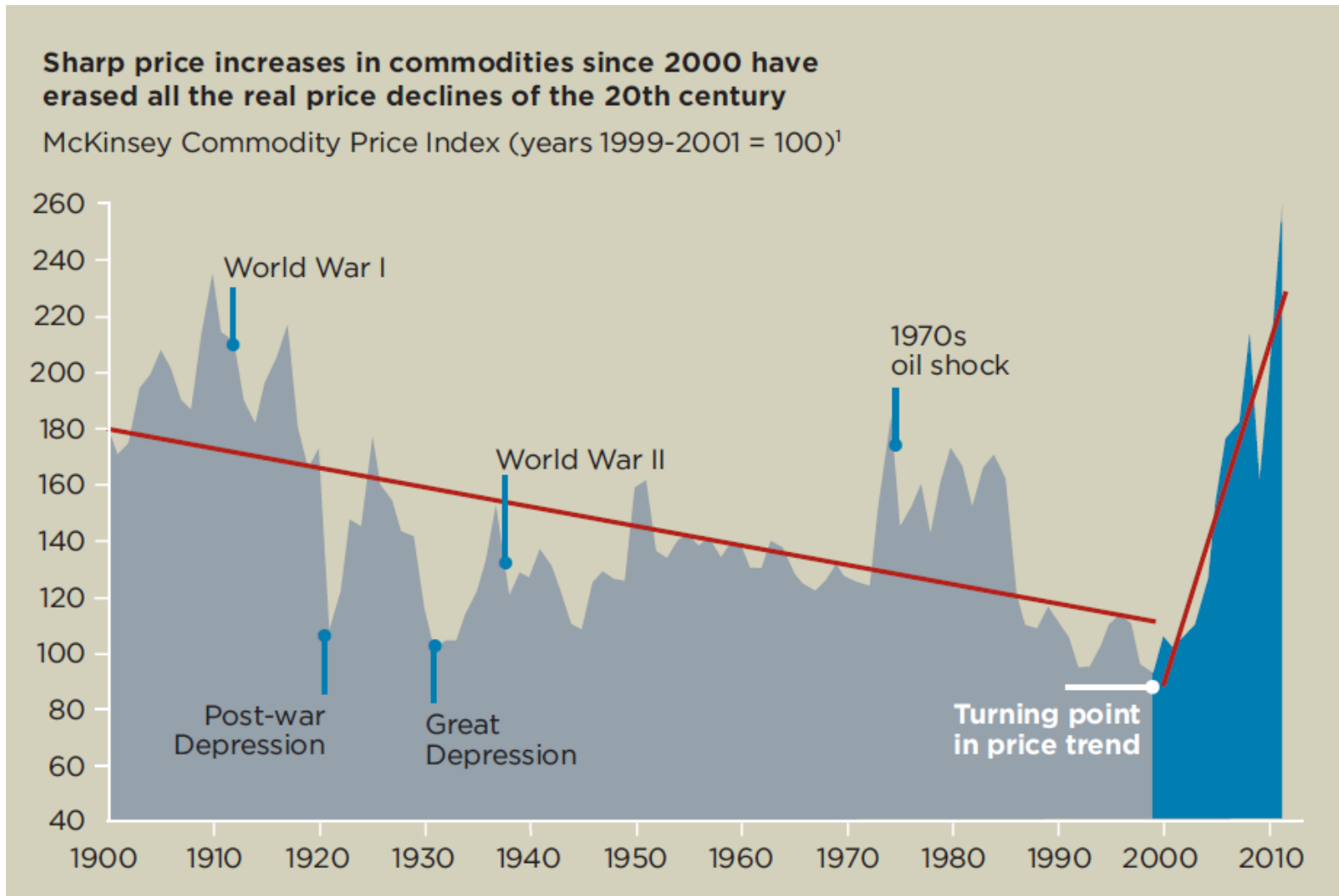
- Circulaire economie
- Ontwerpstrategie
- Materialen
- Uitdagingen & kansen



Met 9 miljard in 2030!



Grundstoffen?



Kringlopen sluiten



- From highest to lowest value retention:**
1. Service & Upgrade
 2. Refurbishment
 3. Parts harvesting
 4. Recycling

bij Philips



Refurbished medical systems

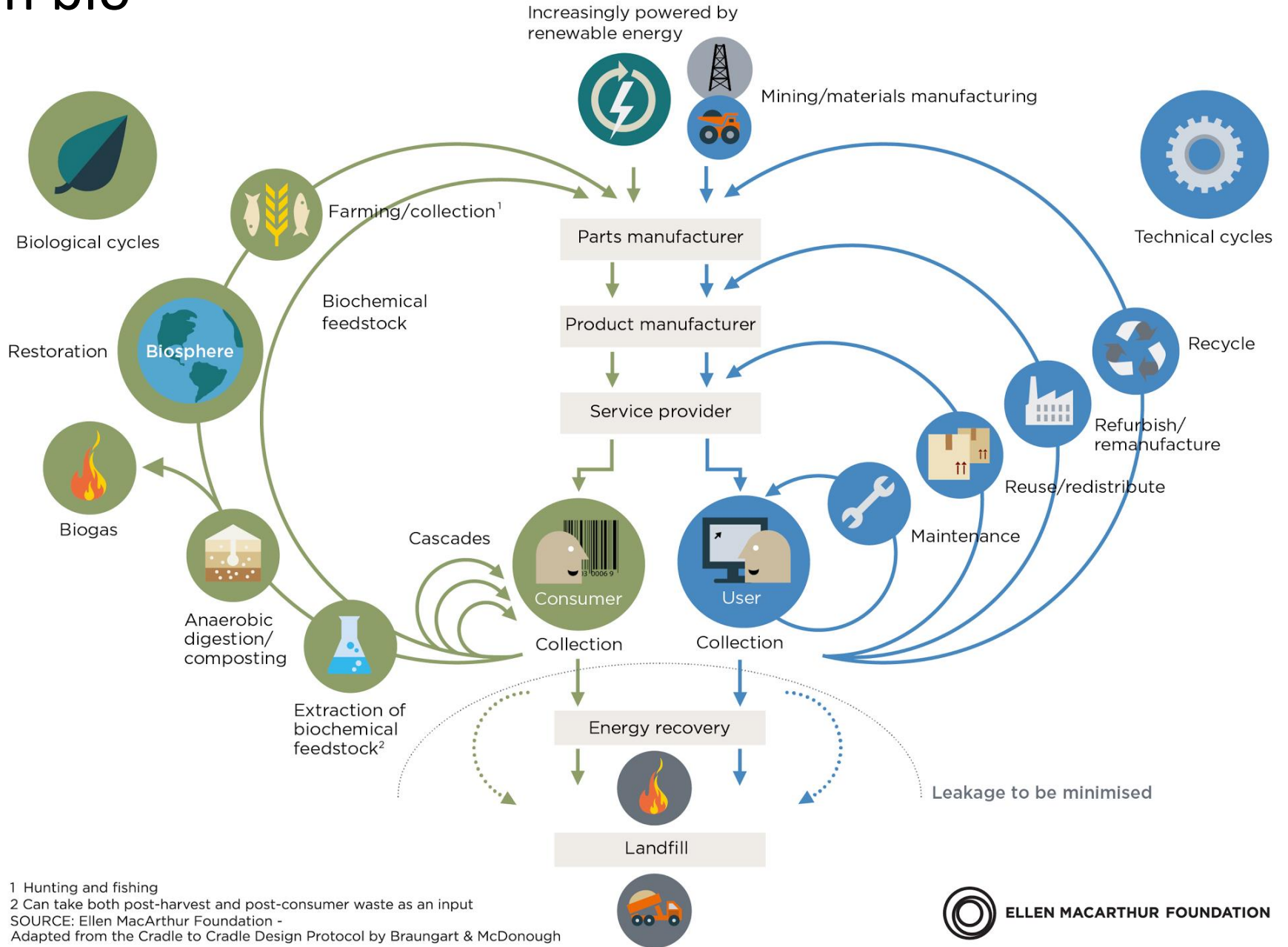


Pay-per-Lux



Gerecycled kunststof & energieverbruik

En bio



1 Hunting and fishing

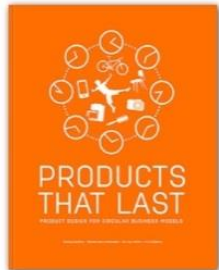
2 Can take both post-harvest and post-consumer waste as an input

SOURCE: Ellen MacArthur Foundation -

Adapted from the Cradle to Cradle Design Protocol by Braungart & McDonough

Ontwerpen voor...

- Product Attachment and Trust
- Product Durability
- Standardization & Compatibility
- Ease of Maintenance and Repair
- Upgradability & Adaptability
- Dis- en Reassembly






























- Longevity
- Leasing / Service
- Re-use in manufacture
- Material recovery



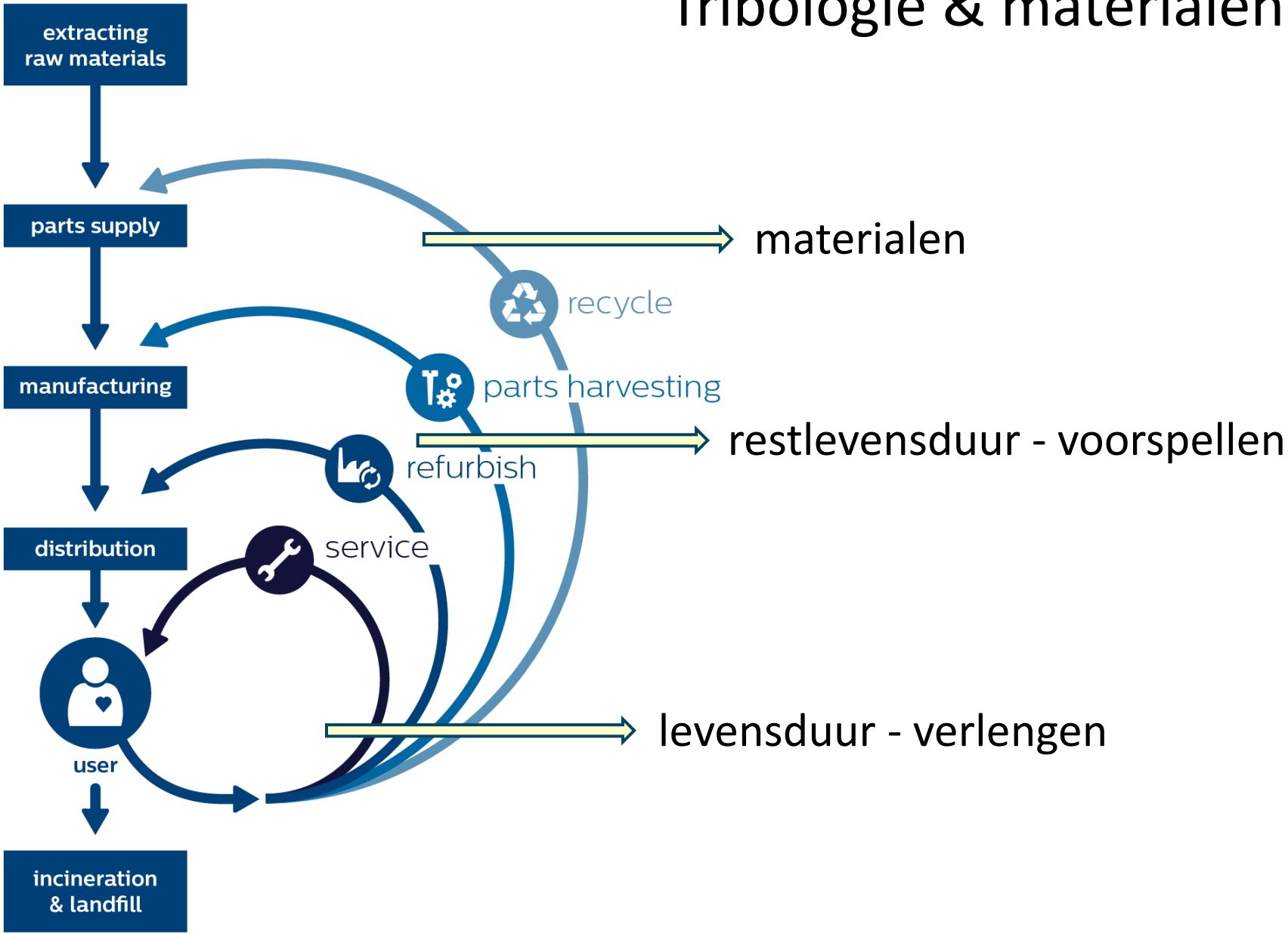
- Futureproof
- Disassembly
- Maintenance
- Remake
- Recycle

- Repair
- Reuse
- Refurbish
- Recycle

Technologieën

		Circular Supplies	Resource Recovery	Product Life Extension	Sharing Platforms	Product as a Service
 Digital	Mobile					
	M2M					
	Cloud					
	Social					
	Big Data Analytics					
 Hybrid	Trace and return systems					
	3D Printing					
 Engineering	Modular design technology					
	Advanced recycling tech					
	Life and Material sciences					

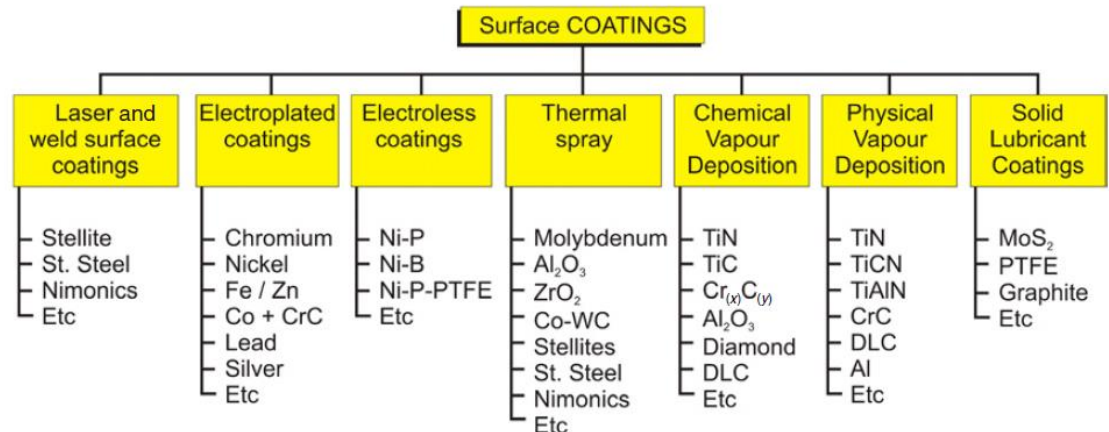
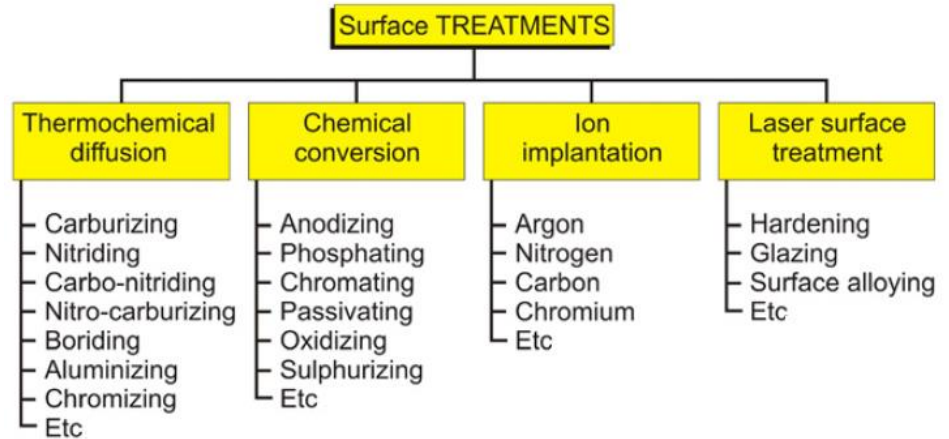
Tribologie & materialen



en oppervlaktebehandelingen & coatings

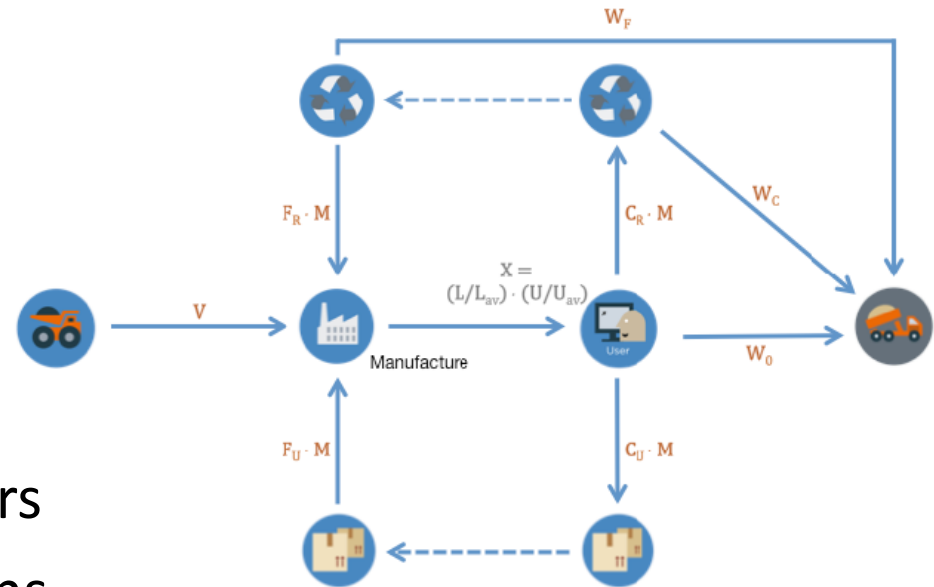
Verminderen van

- Degradatie
- Oxidatie en corrosie
- Slijtage
- Vermoeiing
- ...



Material Circularity Indicator

- Bron: Ellen MacArthur Foundation
- Complementary Indicators
 - Material Price Variation Risk
 - Material Supply Chain Risks
 - Material Scarcity
 - Toxicity
- Complementary Impact Indicators
 - Energy Usage and CO₂ Emissions
 - Water



[\[Circularity Indicators - An Approach to Measuring Circularity, Ellen MacArthur Foundation, 2015\]](#)

Recycling

- Open loop / downcycling
- Closed loop / functioneel
- Upcycling

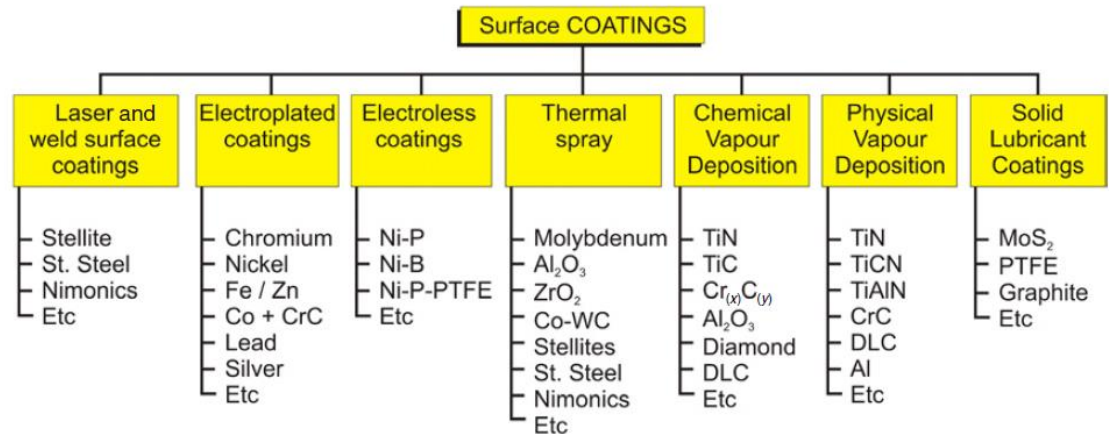
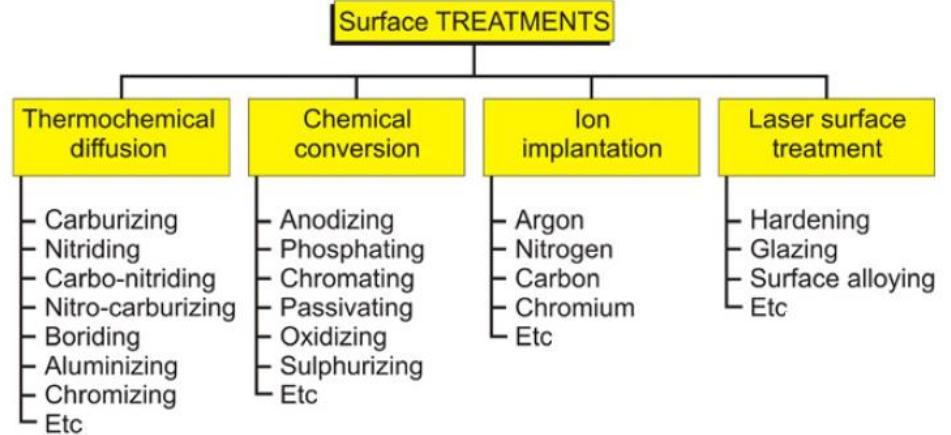
Ontwerprichtlijnen:

- Gebruik recyclebare materialen
- Vermijd coatings
- Weinig verschillende materialen
- Pure materialen



Uitdagingen...

- Recyclebare materialen?
- Pure materialen?



... en kansen

- Hernieuwbare / bio-based materialen
- ‘Nieuwe’ materialen
- Zelfreparerende eigenschappen
- Sensoriek
- Levensduurvoorspelling / ‘physics-of-failure’

**Optically Transparent Wood from a Nanoporous Cell
Combining Functional and Structural Performance**
Yuanyuan Li,^{*,*} Qiliang Fu,^{*,*} Shun Yu,^{*} Min Yan,[§] and Lars Berglund^{*,*}
^{*}Wallenberg Wood Science Center, Department of Fiber and Polymer Technology, and [§]School of In

**Metastable high-entropy dual-phase alloys
overcome the strength-ductility trade-off**
Zi... Konda Gokuldoss Pradeep¹, Yun Deng¹, Dierk Raabe¹ & Cemal Cem Tasan^{1,2}

**Mimosa Origami: A nanostructure-enabled
directional self-organization regime of materials**
William S. Y. Wong,¹ Minfei Li,² David R. Nisbet,³ Vincent S. J. Craig,⁴ Zuankai Wang,^{2*} Antonio Tricoli^{1*}
One of the innate fundamentals of living systems is their ability to respond toward distinct stimuli by various...
organization behaviors. Despite extensive progress, the engineering of spontaneous moti...

MATERIALS SCIENCE

**Materials that couple sensing,
actuation, computation,
and communication**

M. A. McEvoy and N. Correll*

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10.1126/sciadv.1600417

Samenvatting

- Kringlopen sluiten
 - Ontwerpen voor lange levensduur
 - Eisen aan het gebruik van materialen
 - Uitdagingen/kansen voor oppervlaktetechnologie
-
- www.ellenmacarthurfoundation.org
 - www.circulairondernemen.nl
 - TU Delft / edX online cursus





Bedankt voor uw aandacht!

PHILIPS

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