REMANUFACTURING AND THE CIRCULAR ECONOMY

Current work at the OECD

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DES POLITIQUES MEILLEURES POUR UNE VIE MEILLEURE

The OECD

- Helps countries develop **better policies for better lives**
- Analyses, measures and compares experiences and policies to give advice that helps **raise living standards** globally
- Offers evidence-based, **independent** policy advice
- Takes a **multidisciplinary** approach
- **Monitors** countries' progress through **peer reviews**
- Seeks and sets **best practice standards**

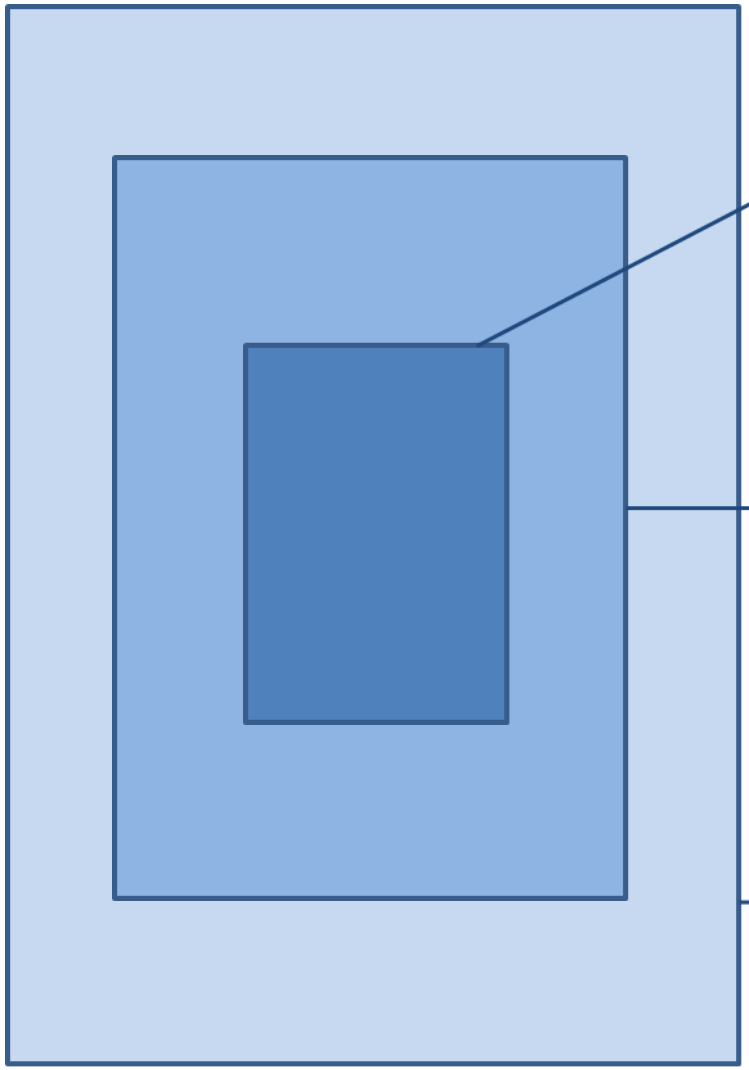
Emerging interest in a transition to a more resource efficient and circular economy

- Growing ambition at the international level:
  - OECD council recommendations on resource productivity
  - Resource efficiency targets are included in the SDGs
  - G7 process and recent introduction into the G20 agenda

- And an evolving policy landscape at the national level:
  - Circular economy roadmaps were introduced in a number of countries in 2015 - 2016

- Why the increased interest?
  - A pathway for decoupling economic activity from the use of resources *and* the generation of polluting by-products
  - Growth and jobs may be generated along the way
  - For resource importing countries, the circular economy can improve resource security

What is the circular economy?



Closing resource loops

- Increased material recycling

Slowing resource loops

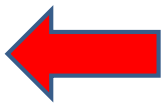
- More durable products by design
- Increased reuse, repair, and remanufacture

Narrower resource flows

- Increased resource productivity
- Improved asset utilisation
- Changes in consumer behaviour

OECD work program for 2017 - 2018

- Science, Technology and Innovation (STI)
  - Bio- and circular value chains
  - Bio-principled cities: designing cities based on bio principles
  - Waste to resource: bio-waste
- Trade and Agriculture (TAD)
  - Examine extent of trade restrictions on recyclable metallic waste and scrap
  - Modelling (TAD Metro model) trade impacts for steel
- Environment (ENV)
  - Macroeconomics of the circular economy transition
  - Plastics in the environment
  - Food waste prevention
  - Business models for the circular economy



BUSINESS MODELS FOR A CIRCULAR ECONOMY

Business models for the circular economy

- CBMs involve modes of production and consumption that change the flow of materials through the economy
- OECD is currently developing a report based on existing literature
- This work addresses three main questions:
  - What is their potential environmental impact of CBMs?
  - What is their current scale and potential scalability?
  - What are the enablers and barriers to scale up, and what policies can help?

Five main business models + sub-types

Circular input models	Waste value models	Life span models	Platform models	Product as service models
ceranex	QCP – Quality Circular Polymers	TOYOTA	SnappCar	PHILIPS Lighting
NESPRESSO	SCHMITZ CARGOBULL The TrailerCompany.	CISCO	SISO Managing your ICT life cycle	DESSO A Tarkett Company
SLM	VEOLIA	ACE Re-use Technology BV	we helpen	Spotify
SAVORY INSTITUTE	patagonia	Repair Café	airbnb	TECHNOGYM
IBERDROLA				

Source: adapted from Accenture (2015)

Messages from the report

- The activities underlying CBMs – 3Rs, sharing, leasing – are not new, but are emerging in a broader range of settings than before

- LCA literature indicates that products associated with CBMs have a small envi. footprint relative to traditional equivalents
  - But beware new risks and burden shifting across the product lifecycle
  - And beware potential rebound effects from changing prices

- CBMs remain niche in most sectors. In many cases, they are also relatively mature – more widespread uptake will require new policy frameworks

- In other cases, CBMs are emerging in response to technological change, the emergence of new risks, and changing consumer preferences. Policy could support this and mitigate against any potentially desirable outcomes

A CLOSER LOOK AT REMANUFACTURING

Environmental impact of remanufacturing
Insights from selected LCA literature

Author	Study type	Product Focus	Δ in resource extraction	Δ in sectoral energy consumption	Δ in waste disposal
Kerr and Ryan (2000)	LCA	Photocopiers	-19% to -25%	-27%	-35%
		Photocopiers (modular)	-39% to -48%	-68%	-47%
Smith and Keolian (2004)	LCA	Engines	-26% to -90%	-68% to -83%	-65% to -88%
Neto and Bloemhof (2009)	LCA	Personal computers	-	-80%	-
Kara (2010)	LCA	Printer cartridges	-	-	-
Gutowski et al (2011)	Meta-review	Furniture	-	-100%	-
		Clothing	-	-64%	-
		Computers	-	-57%	-
		Electric motors	-	3%	-
		Tires	-	9%	-
		Appliances	-	75%	-
		Engines	-	-4%	-
		Toner cartridges	-	-6%	-
Biswas and Rosano (2011)	LCA	Compressors	-	-	-
Liu et al (2014)	LCA	Engines	-25%	-66%	-
Wilson et al (2014)	LCA	Turbine blades	-	-36%	-
Gao et al (2017)	LCA	Turbochargers	-	-82.50%	-

- Remanufactured products have a relatively small emissions footprint
- However, most LCA studies don't take into account use-phase impacts
- Also avoided resource extraction and disposal (but what are envi impacts?)

Current scale of remanufacturing
Insights from market data

Remanufacturing relative to market penetration of other CBMs

	Sector	Market penetration	Explanation
PSS: result-oriented (chemicals)	Automotive	50 - 80%	Of manufacturer uptake
	Aerospace	5 - 15%	
PSS: result oriented (digital content)	Music	50%	Of total industry revenues
	Books	25 - 35%	
PSS: result-oriented (lighting & heating)	Various	4 - 7.5%	Of potential ESCO uptake
PSS: user-oriented (car sharing)	Transport	<1%	Of total global car fleet
Waste as value: recycling	Pulp and paper	38%	Of total global output
	Metals	0 - 30%	
	Plastics	13%	
Product life extension: refurbishment	Smartphones	4 - 8%	Of annual manufactures
	Various	2 - 3%	Of EOL products
Product life extension: remanufacturing	Aerospace	2 - 12%	Of total manufactures
	Machinery	3 - 4%	
	Automotive	1%	
	Consumer and EEE	0 - 1%	
Idle Capacity: co-access	Lodging	1% - 6%	Of total short term bookings

- Limited market penetration: generally less than 4%
- But variation across products: more uptake in B2B industrial settings?
- Low manufacturing market penetration relative to other CBMs
- Considerable potential for scale up?

Barriers and enablers: your opinions?!

- The business case for remanufacturing seems clear: leveraging already existing cores can generate significant cost reductions

- But current market penetration suggests otherwise. Why?
  - Labour costs - remanufacturing difficult to automate
  - Transport and administration costs – ass w. reverse logistics
  - Cannabalisation fears – reduced demand for premium products
  - Competition fears – potential value created by designing products for remanufacturing could be captured by third parties

- What role could emerging technologies play?
  - Product tracking systems
  - Automated disassembly

- And what role could policy play?

Next steps

- What could the European Remanufacturing Council do?
  - The environmental and job creation case for remanufacturing is well established
  - What is hindering scale up? We are not aware of an authoritative report assessing the reman business case across sectors. Role for ERC?
  - Improved data on adoption rates would also be useful

- What could the OECD do?
  - Remanufacturing will be included in upcoming business models report
  - Other ideas or suggestions?