

Right2Repair and Policies for More Circular Electronic Products

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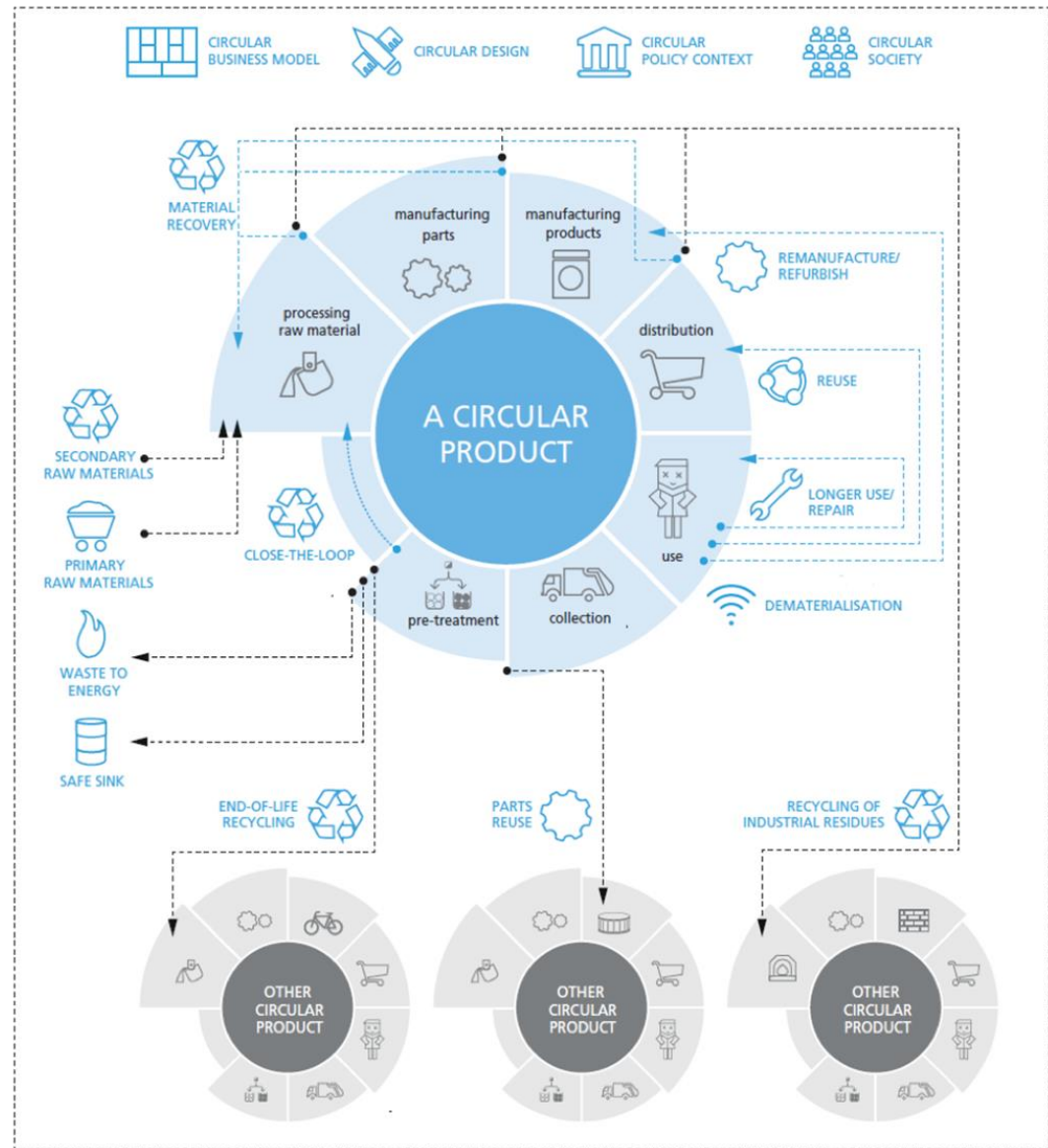
Who am I?



Circular Economy

‘circular economy’ means an economic system whereby the value of products, materials and other resources in the economy is maintained for as long as possible, enhancing their efficient use in production and consumption, thereby reducing the environmental impact of their use, minimising waste and the release of hazardous substances at all stages of their life cycle, including through the application of the waste hierarchy”

Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088



Why do we need more circular electronics?

Electronics products and impact

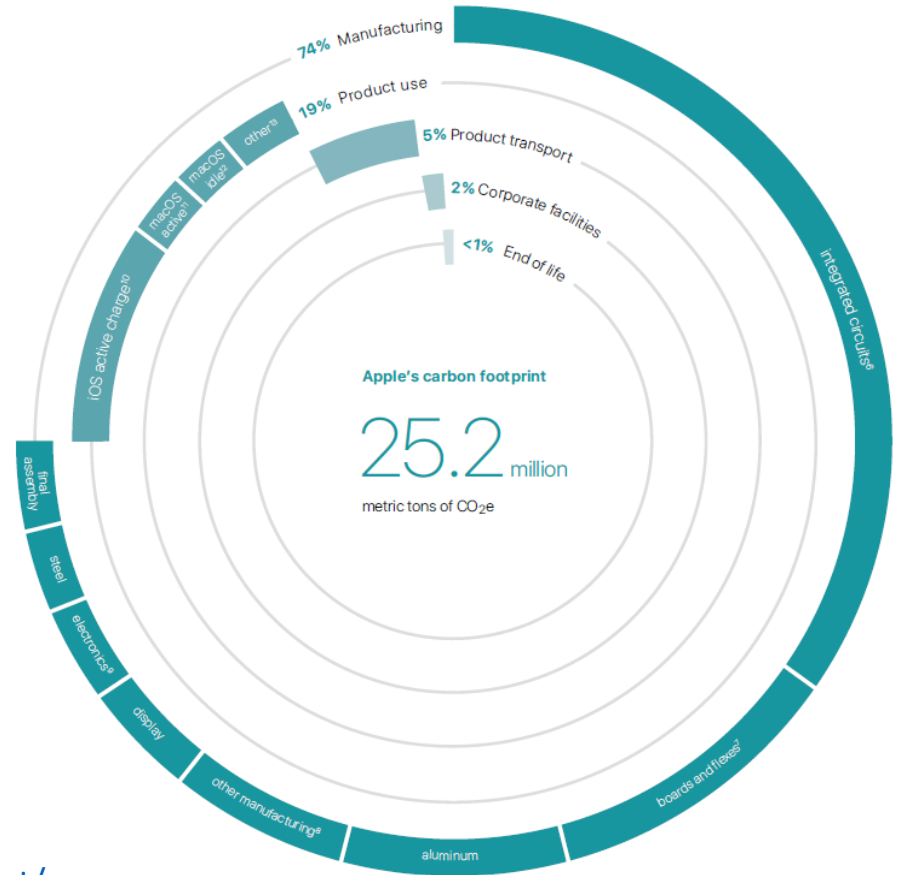
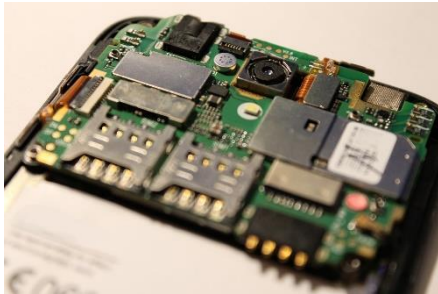
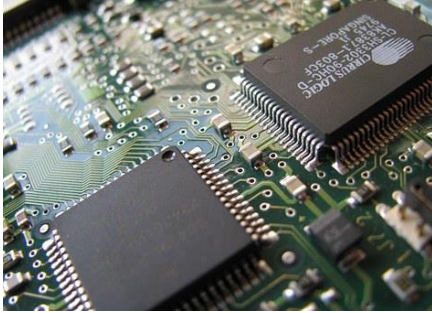
To accurately measure a company's environmental footprint, you must look at the impact that company's products have on the planet. Apple uses comprehensive life cycle analysis to determine exactly where our greenhouse gas emissions — all 10.2 million metric tons of them¹ — come from.



Source: Apple, 2009

<https://www.apple.com/environment/>

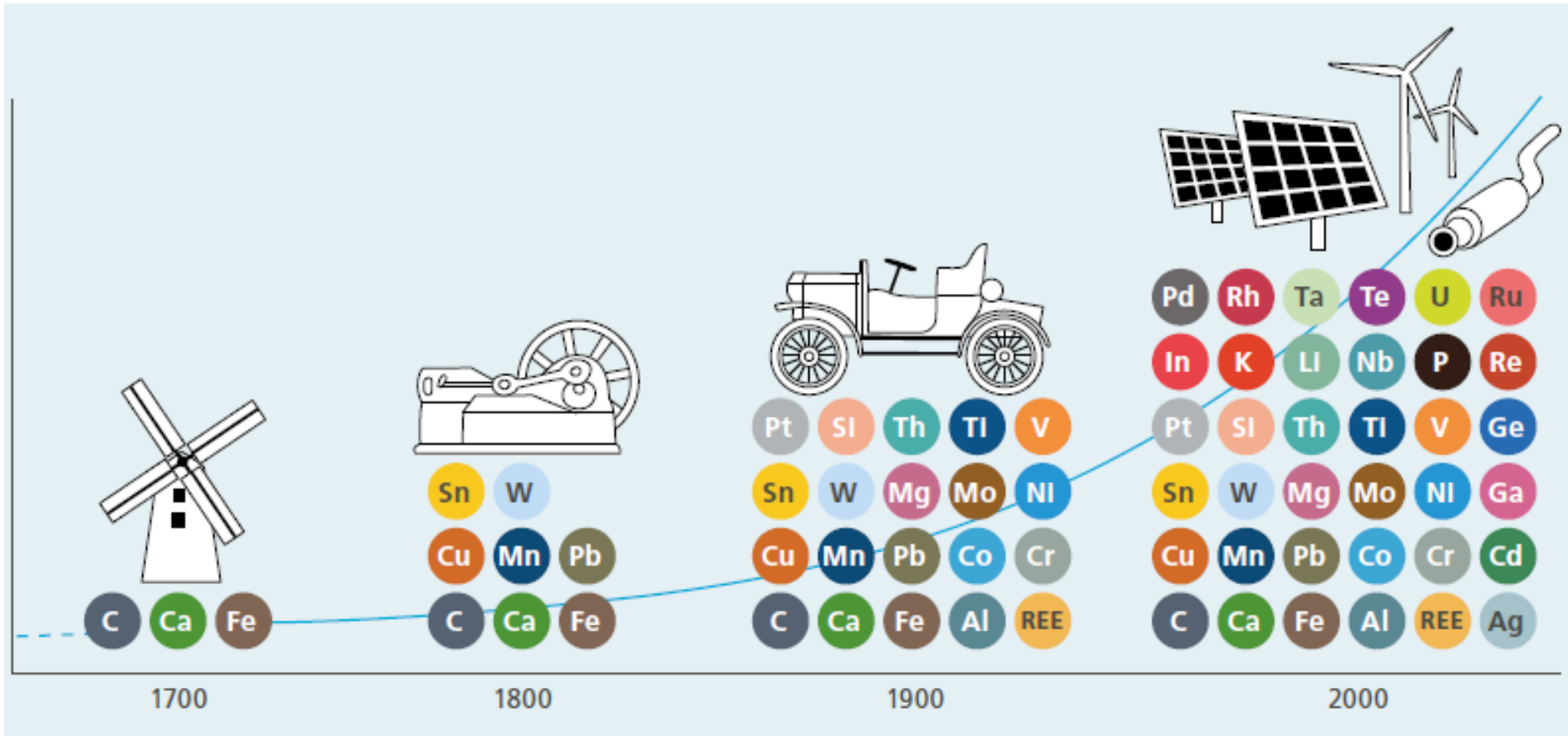
Challenge: impacts shift upstream in lifecycle



Source: Apple, 2019 <https://www.apple.com/environment/>

Images: Pixabay

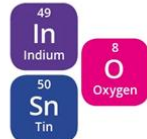
Material use has changed over time



ELEMENTS OF A SMARTPHONE

ELEMENTS COLOUR KEY: ● ALKALI METAL ● ALKALINE EARTH METAL ● TRANSITION METAL ● GROUP 13 ● GROUP 14 ● GROUP 15 ● GROUP 16 ● HALOGEN ● LANTHANIDE

SCREEN



Indium tin oxide is a mixture of indium oxide and tin oxide, used in a transparent film in the screen that conducts electricity. This allows the screen to function as a touch screen.



The glass used on the majority of smartphones is an aluminosilicate glass, composed of a mix of alumina (Al_2O_3) and silica (SiO_2). This glass also contains potassium ions, which help to strengthen it.



A variety of Rare Earth Element compounds are used in small quantities to produce the colours in the smartphone's screen. Some compounds are also used to reduce UV light penetration into the phone.

BATTERY



The majority of phones use lithium ion batteries, which are composed of lithium cobalt oxide as a positive electrode and graphite (carbon) as the negative electrode. Some batteries use other metals, such as manganese, in place of cobalt. The battery's casing is made of aluminium.

ELECTRONICS

Copper is used for wiring in the phone, whilst copper, gold and silver are the major metals from which microelectrical components are fashioned. Tantalum is the major component of micro-capacitors.



Nickel is used in the microphone as well as for other electrical connections. Alloys including the elements praseodymium, gadolinium and neodymium are used in the magnets in the speaker and microphone. Neodymium, terbium and dysprosium are used in the vibration unit.



Pure silicon is used to manufacture the chip in the phone. It is oxidised to produce non-conducting regions, then other elements are added in order to allow the chip to conduct electricity.



Tin & lead are used to solder electronics in the phone. Newer lead-free solders use a mix of tin, copper and silver.



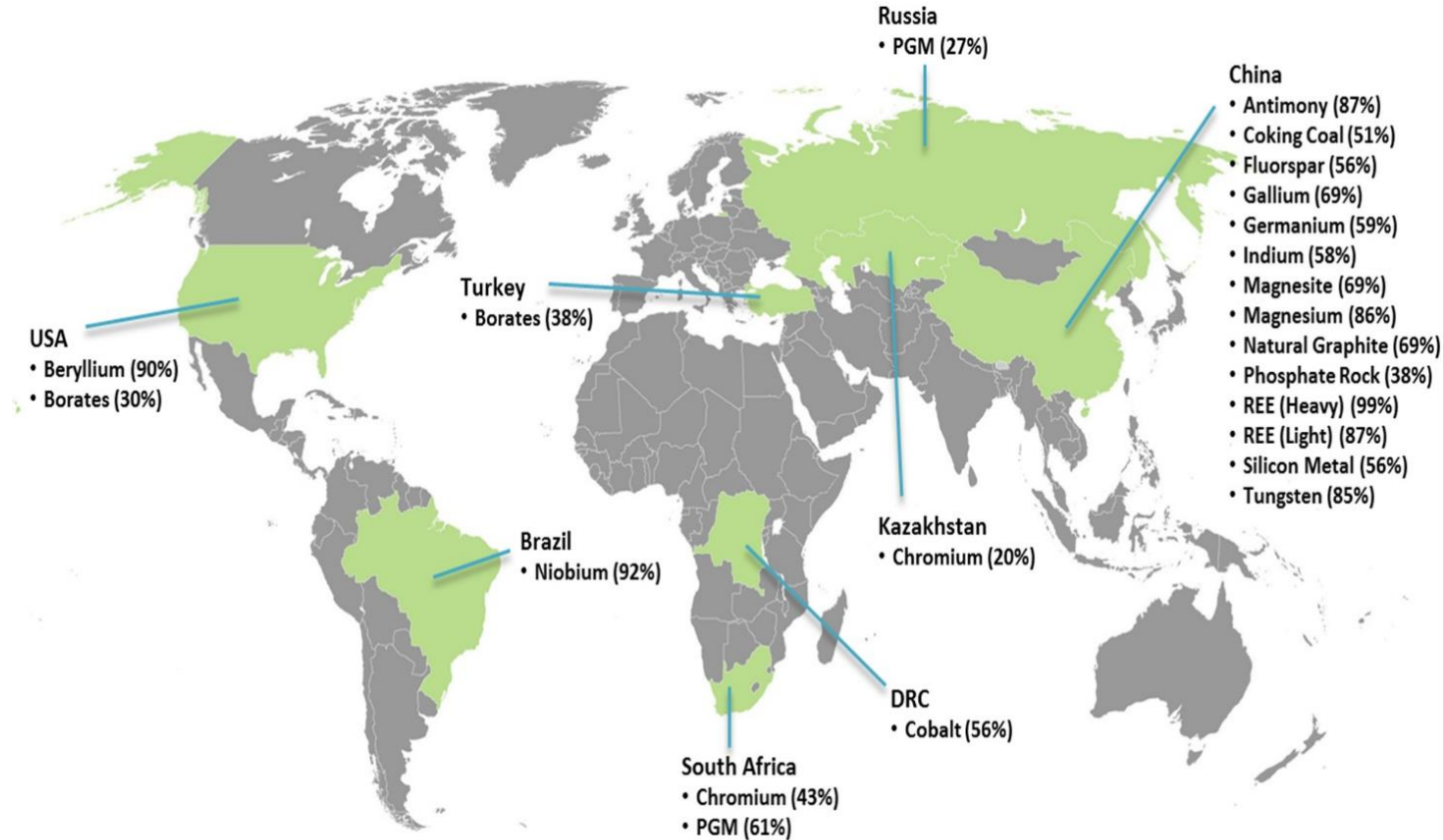
CASING

Magnesium compounds are alloyed to make some phone cases, whilst many are made of plastics. Plastics will also include flame retardant compounds, some of which contain bromine, whilst nickel can be included to reduce electromagnetic interference.



Critical raw materials

Supply risk



Source: [EU Commission, 2014](#)

Mining has environmental impacts



1 mobile phone gives rise
to 86 kg of waste material

— [IVL report, 2015](#)

Mining has social impacts

Conflict

Tantalum

Tin

Tungsten

Gold

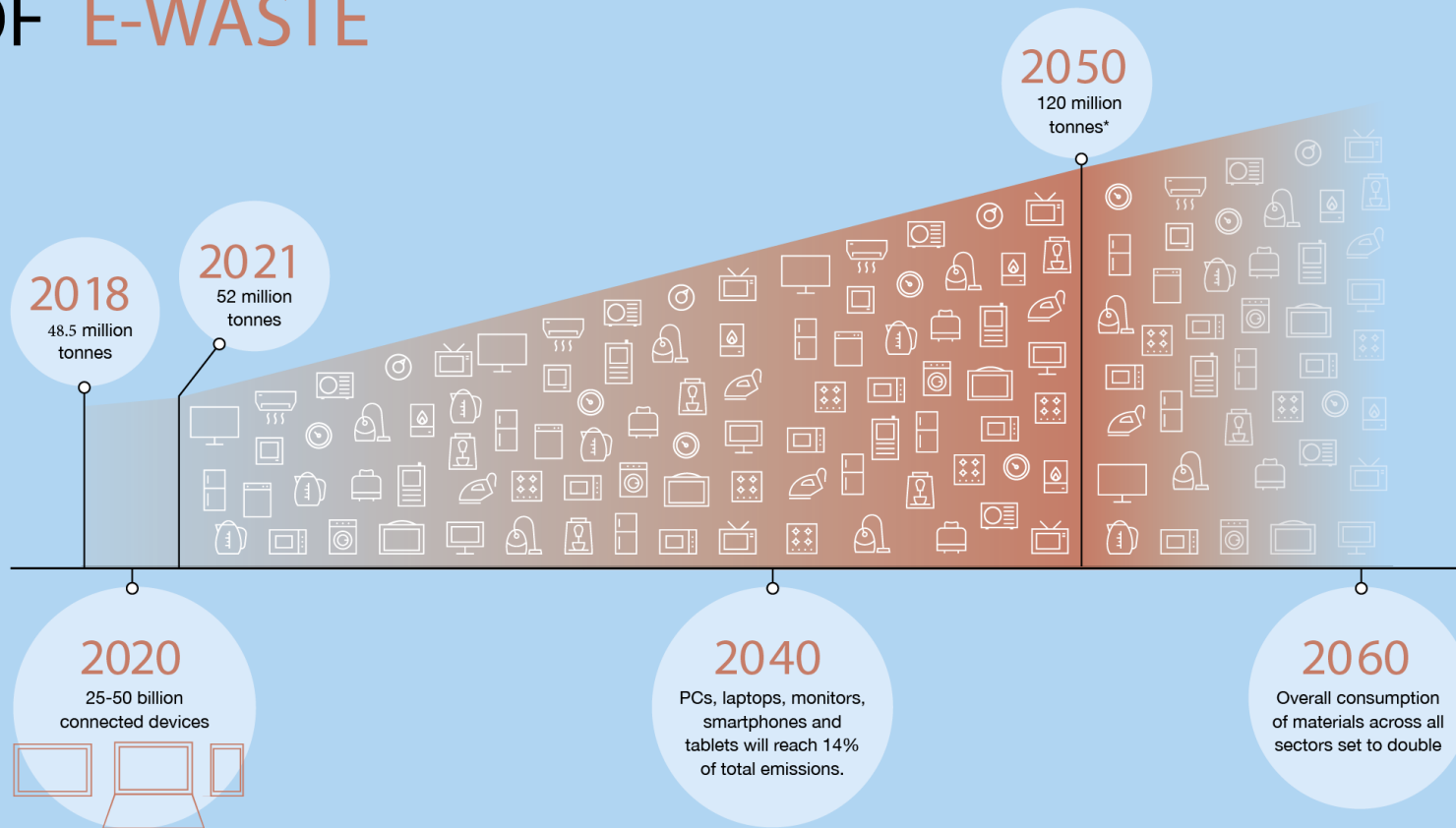
Cobalt

Mica



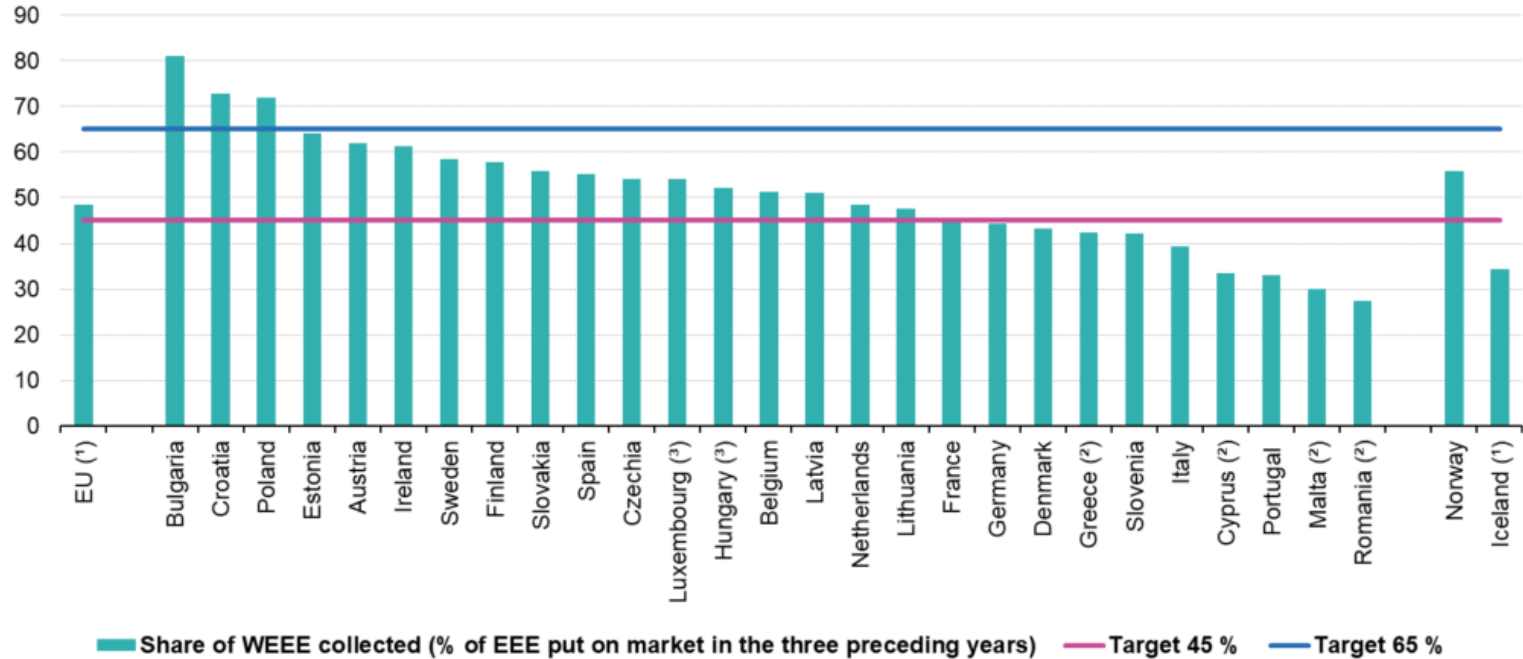
Source: [Ethical Consumer](#)

THE FUTURE OF E-WASTE



Total collection rate for waste electrical and electronic equipment (EEE), 2019

(% of the average weight of EEE put on the market in the three preceding years (2016-2018))



(1) Eurostat estimate.

(2) Data on collection 2018 instead of 2019; % of average weight of EEE put on the market in years 2015-2017.

(3) 65 % target not applicable, since Luxembourg and Hungary have chosen the calculation methodology based on share of WEEE generated. See Figure 2b.

Source: Eurostat (online data code: env_waseleeos and env_waselee)

RECYCLING RATES OF SMARTPHONE METALS

COLOUR KEY: ● < 1% RECYCLE RATE ● 1-10% RECYCLE RATE ● 10-25% RECYCLE RATE ● 25-50% RECYCLE RATE ● > 50% RECYCLE RATE ● NON-METAL (OR RECYCLE RATE UNKNOWN)

SCREEN ○



TOUCH: INDIUM TIN OXIDE
Used in a transparent film over the phone's screen that conducts electricity. This allows the screen to function as a touch screen. This is the major use of indium.



GLASS: ALUMINA & SILICA
On most phones the glass is aluminosilicate glass, a mix of aluminium oxide & silicon dioxide. It also contains potassium ions which help strengthen it.



COLOURS: RARE EARTH METALS
A variety of rare earth metal-containing compounds are used to help to produce the colours in a smartphone's screen. Some of these compounds are also used to help reduce light penetration into the phone. Many of the 'rare earths' occur commonly in the Earth's crust, but often at levels too low to be economically extracted.

BATTERY ○



Most phones use lithium ion batteries, composed of lithium cobalt oxide as a positive electrode and graphite (carbon) as the negative electrode. Sometimes other metals, such as manganese, are used in place of cobalt. The battery casing is often made of aluminium.

ELECTRONICS ○

WIRING & MICROELECTRONICS
Copper is used for wiring, and for micro-electrical components along with gold and silver. Tantalum is the major component in micro-capacitors.



MICROPHONES & VIBRATIONS
Nickel is used in the microphone and for electrical connections. Rare earth element alloys are used in magnets in the speaker and microphone, and the vibration unit.



THE SILICON CHIP
Pure silicon is used to manufacture the chip, which is then oxidised to produce non-conducting regions. Other elements are added to allow the chip to conduct electricity.



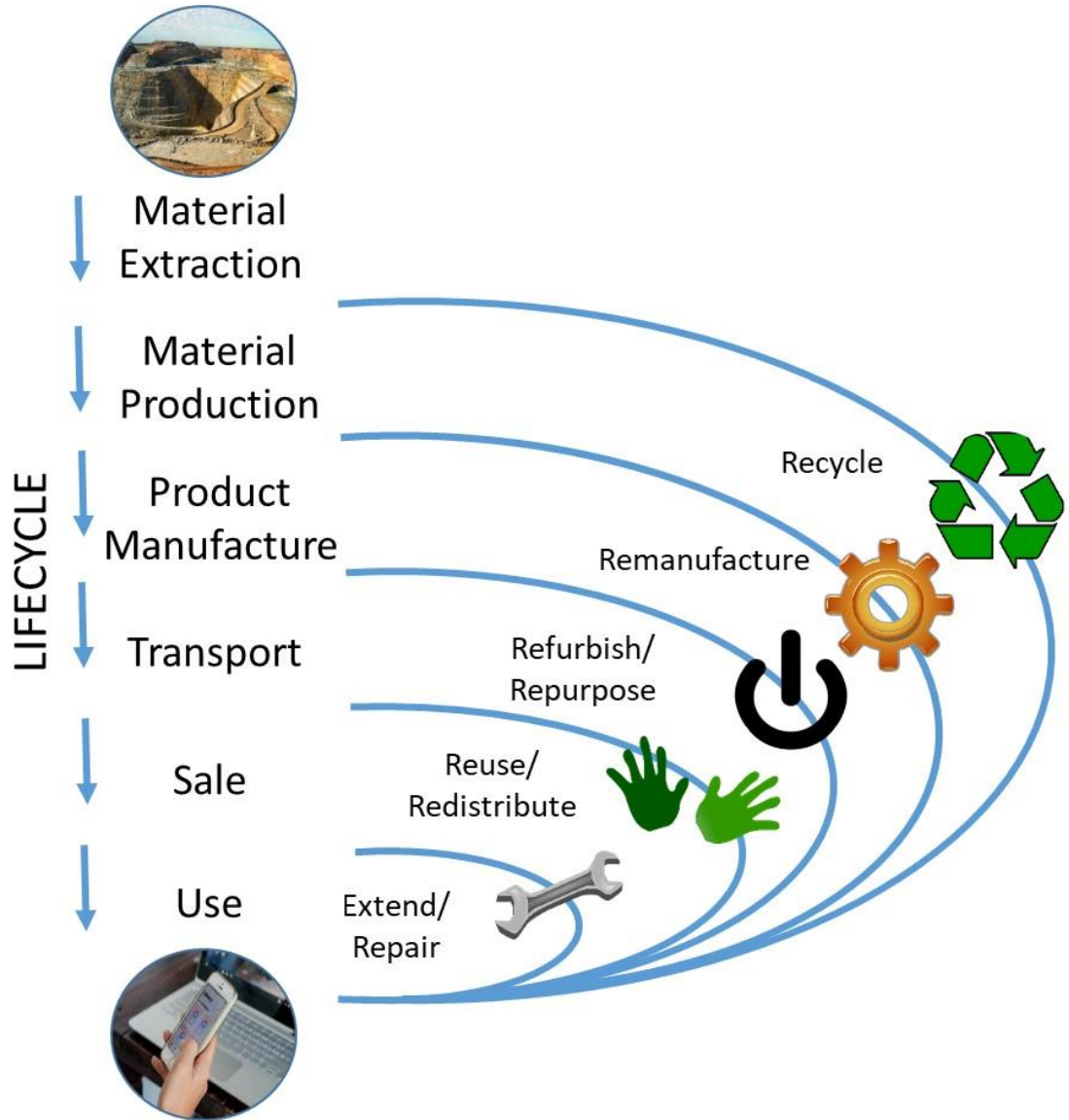
CONNECTING ELECTRONICS
Tin & lead were used in older solders; newer, lead-free solders use a mix of tin, copper & silver.



CASING ○

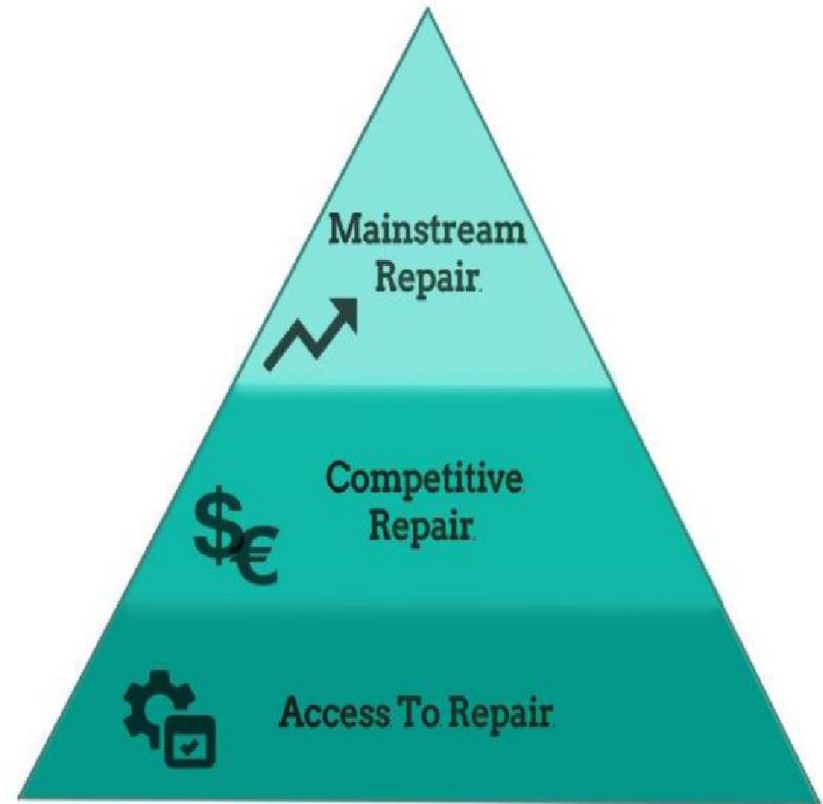
Magnesium alloy is used to make some phone cases, whilst many others are made of plastics, which are carbon-based. Plastics will also include flame retardant compounds, some of which contain bromine, whilst nickel can be included to reduce electromagnetic interference.





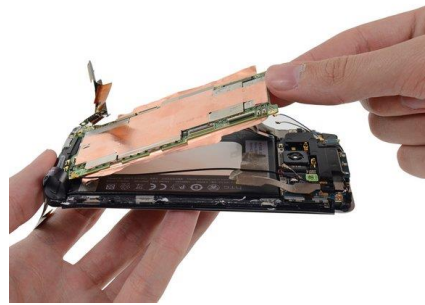
Barriers to repair

- 1) Fundamental legal and non-legal barriers preventing accessible repair;
- 2) the total price of repair and other competitive factors deterring consumers from choosing repair as an economic and convenient option;
- 3) consumer preferences and attitudes not favoring repair.

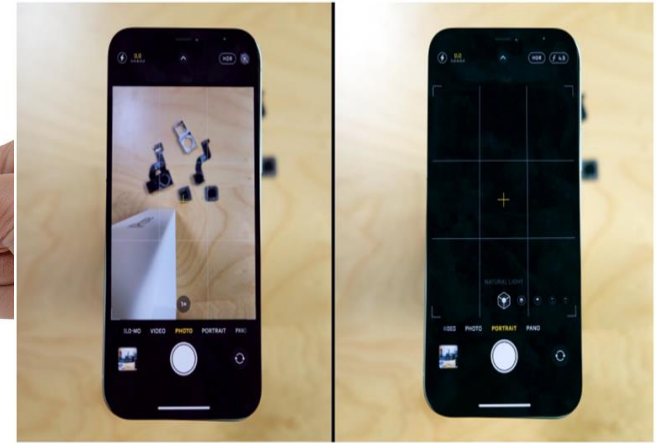


Design Barriers: examples

- Product Design
 - Premature Obsolescence
 - Adhesives, proprietary screws
 - Software doping, serialisation, etc.
- Repair system
 - Limited provision of spare parts information, diagnostics, software



Mobile phones often have designs with adhesives. Photo: iFixit, 2013



Replacing camera modules with non-OEM parts or even swapping might decrease functionality. Photo: iFixit, 2020



Jibo social robot announced in March 2019: "The servers out there that let me do what I do will be turned off soon." (Photo: Jibo)



Diagnostic software restrictions for tractors and military vehicles



Legal Barriers: examples

Intellectual Property law preventing unauthorized repair, disassembly and/or use of non-OEM parts, enforced under:

- Patent law
- Copyright Law (manuals)
- Trademark Law (logos on parts)



Henrik Huseby (til høyre) og advokat Per Harald Gjerstad vant saken mot Apple, hvor Apple hevdet at 63 iPhone-skjermer Huseby hadde importert som reservedeler var piratkopier. Foto: Skjalg Bohmer Vold

Iphone-reparatør Henrik Huseby (37) vant over Apple i retten

Apple wins in 'David v Goliath' right to repair battle

By Samuel Stolton | EURACTIV.com

📅 03-06-2020 (updated: 📅 04-06-2020)



The Apple logo is pictured at the Apple Store in Santa Monica, California, USA. [EPA-EFE/MIKE NELSON]

Languages: Deutsch

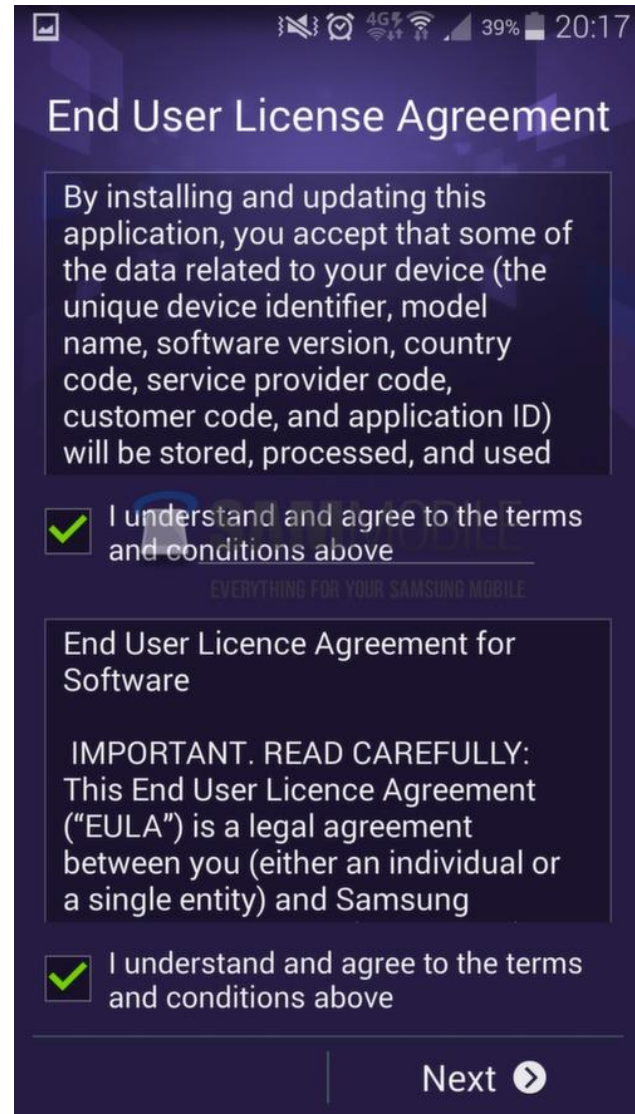


Norway's Supreme Court has upheld a decision by the Court of Appeal, ruling in favour of US tech giant Apple and their claim that an independent smartphone repairer had breached trademark rules by using cheaper repair parts. The decision has sparked an outcry from 'right to repair' activists.

Legal barriers: examples

Contract law

- End-user license agreements with repair restrictions
- Clarity on interpretation lacking



Legal Barriers: examples

Consumer Law

- Repair as a remedy
 - not always followed or accepted
- Lack of awareness
 - Guarantee or warranty?
 - Misleading information, e.g. warranties



Other Barriers: examples

- Waste and recycling laws/systems
 - recycling targets, not reuse/repair targets
 - waste treatment handling

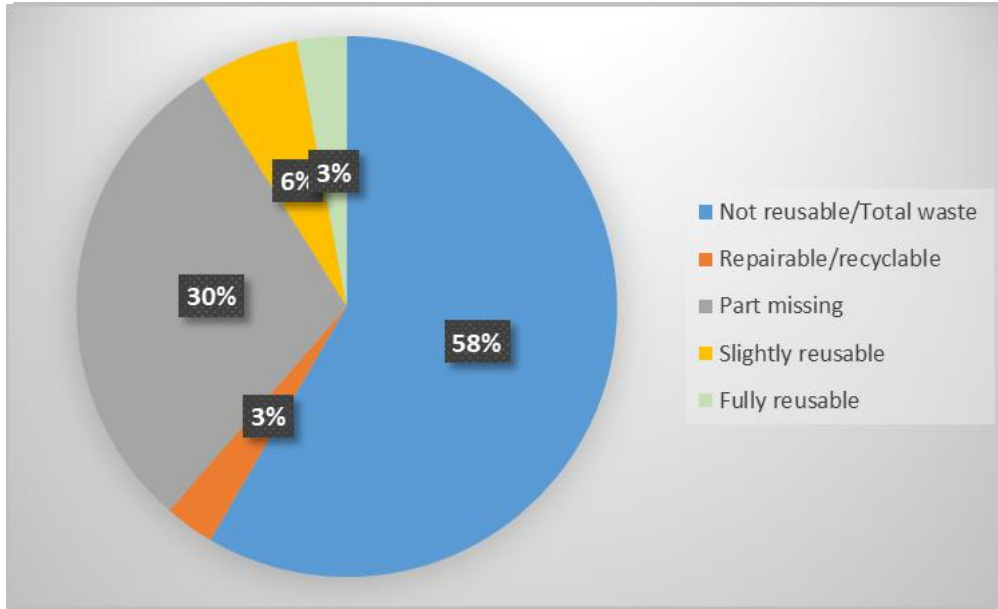


Economic barriers

- Repair costs vs replace costs
 - Individual local production v global economies of scale



Economic barriers



Sample of WEEE from cage collection

“Financially, there is no incentive to look for functioning products in the WEEE collection”

“This study demonstrated that there is no potential for preparing for re-use in the WEEE that is collected.”

“The study shows that the best kind of re-use of a product is re-use which happens before the product is discarded as waste”

Source – [El Kretsen Functionality test 2015](#)

Economic barriers

Apple's own battery blunder may be to blame for its earnings miss

A report claims that Apple CEO Tim Cook told staff the company had carried out 11 million battery replacements under the \$29 program that was rolled out, compared to the 1 to 2 million that would normally be carried out in a year.



Written by **Adrian Kingsley-Hughes**, Contributing Writer

on Jan. 15, 2019



What was behind Apple's first profits warning since 2002? Was it the weakening Chinese market, in combination with pressures from the ratcheting of the US-China trade war and supply chain constraints, or did Apple bring it upon itself with the [\\$29 iPhone battery replacement program](#)

<https://www.zdnet.com/article/apples-own-battery-blunder-may-be-to-blame-for-its-earnings-miss/>

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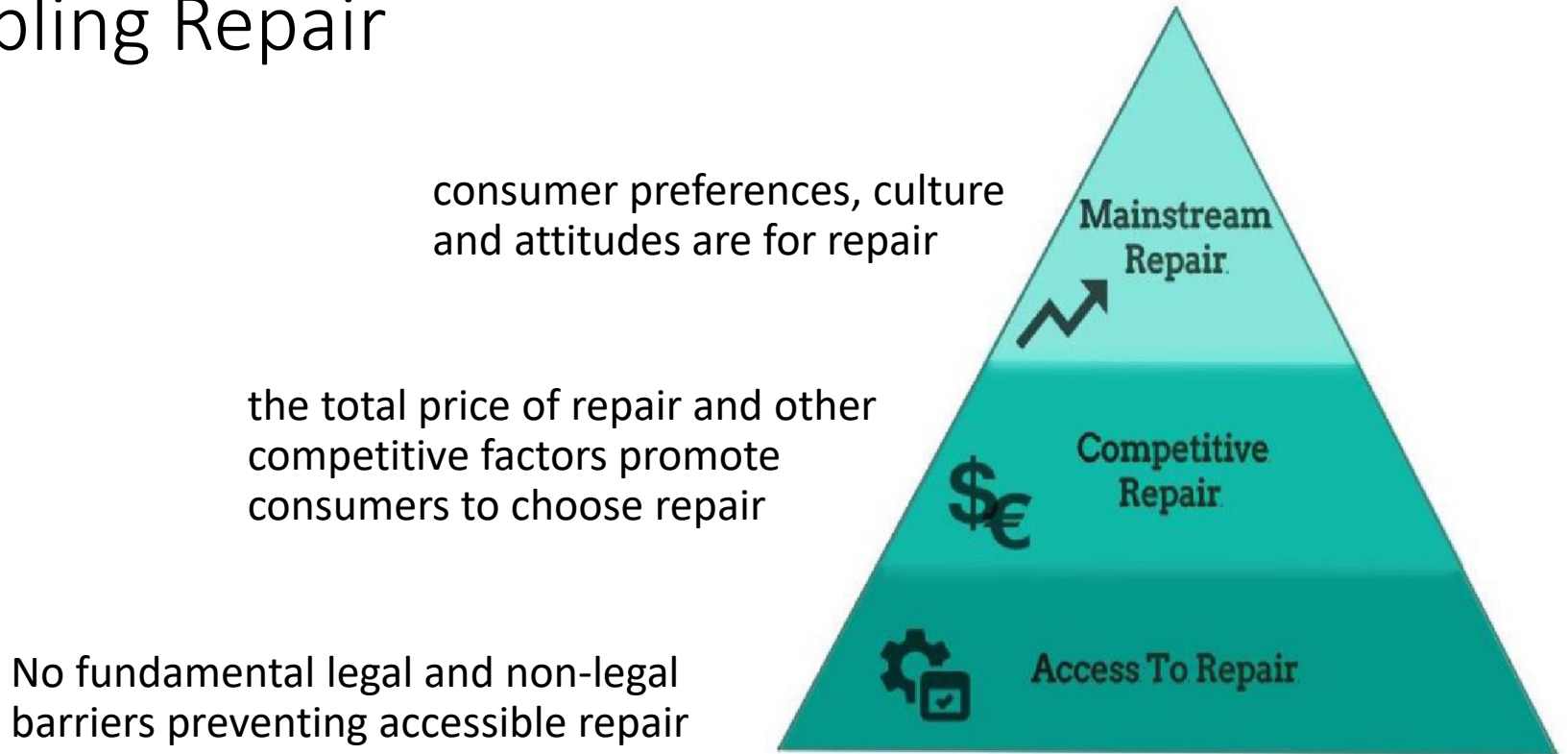
Other Barriers: examples

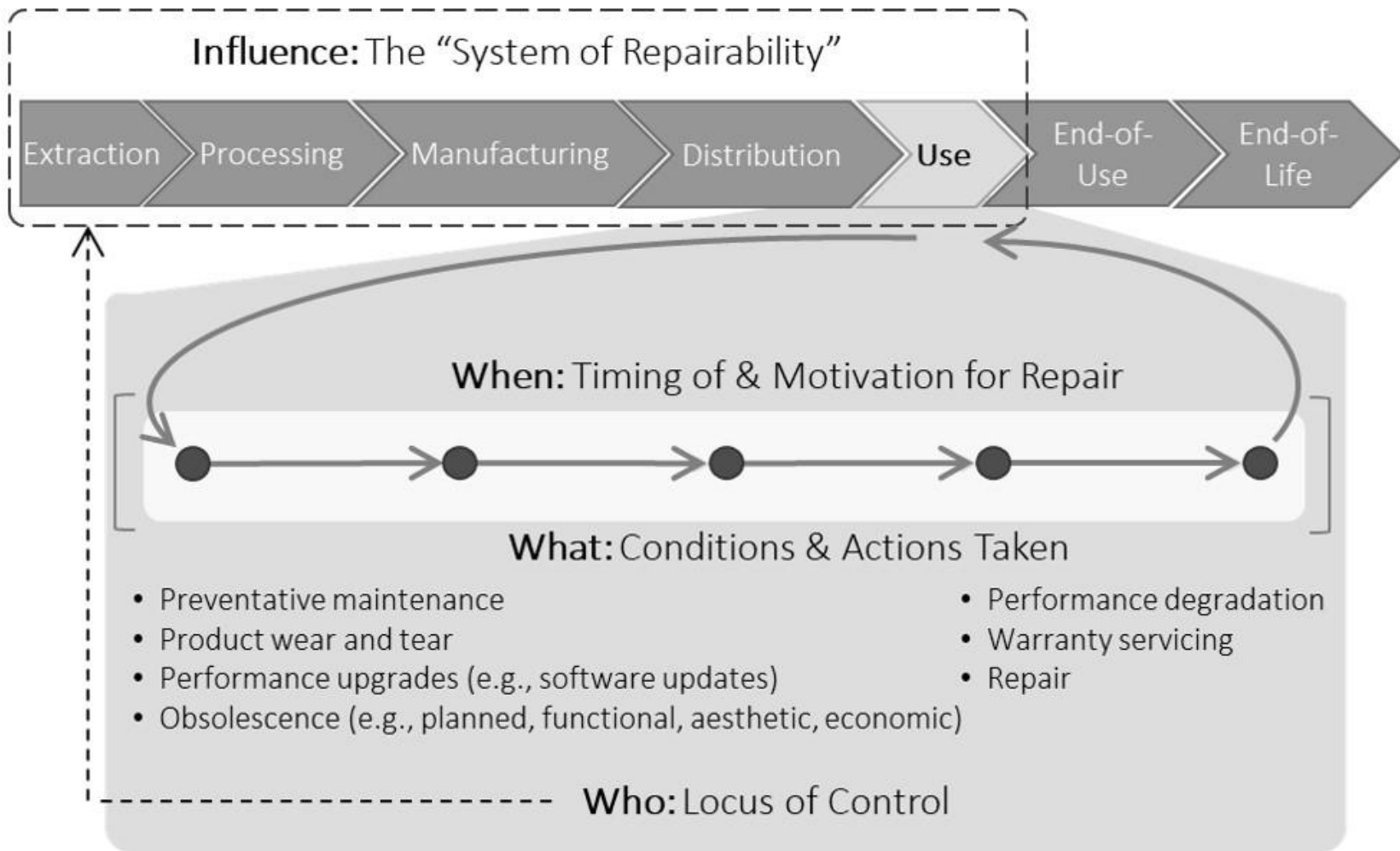
- Consumer culture
 - expectations for fast innovation cycles
 - fashion obsolescence
 - (lack of) relationship to products



Barbara Kruger, 'I Shop Therefore I am' (1990).

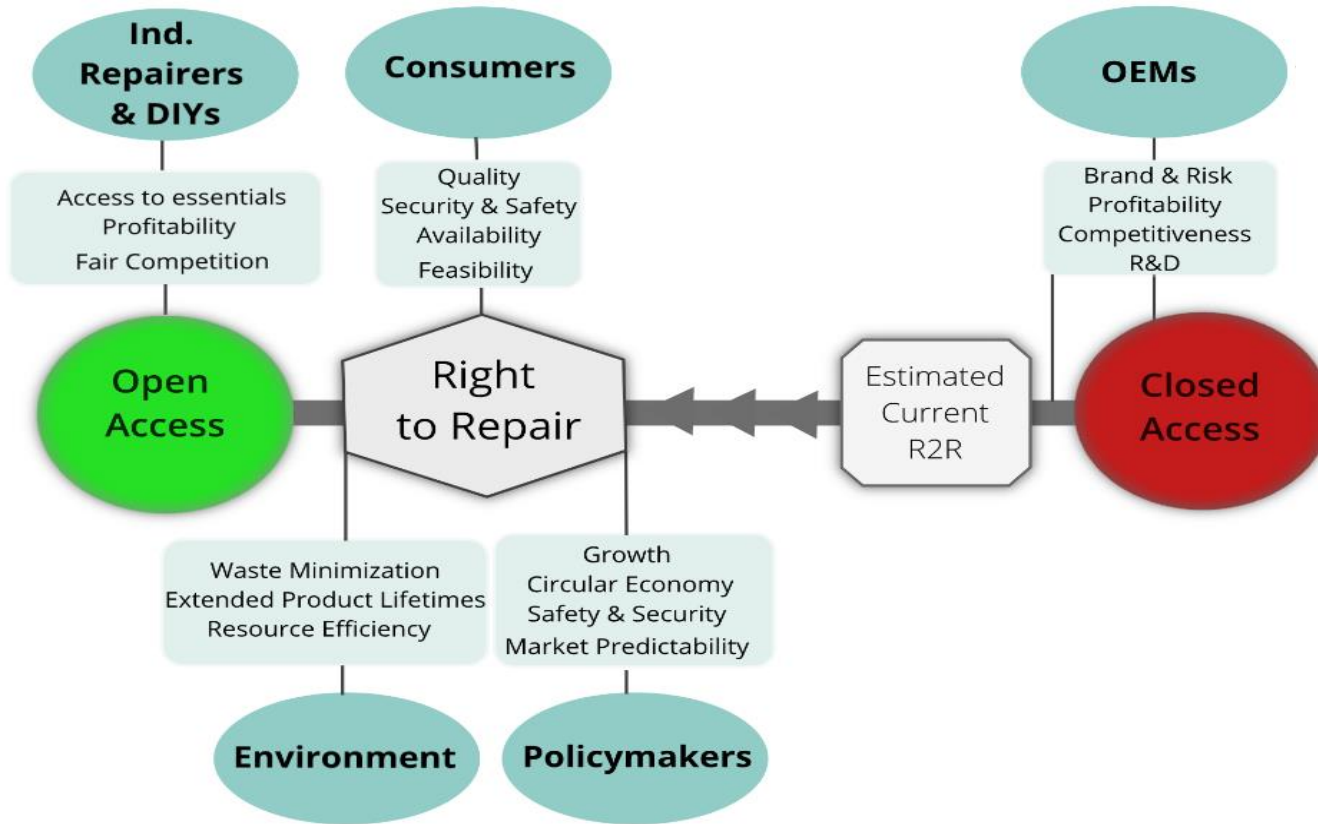
Enabling Repair





Russell, J. D., Svensson-Hoglund, S., Richter, J. L., & Dalhammar, C., Milios, L. (2021). A matter of timing: System requirements for repair and their temporal dimensions. 4th Plate Conference Proceedings. Product Lifetimes and the Environment, Limerick, Ireland. <https://ulir.ul.ie/handle/10344/10237>

Stakeholder interests in upscaling repair



Policies enabling repair

EU:

- Ecodesign regulations
 - Availability of spare parts and manuals
 - Repairable with common tools
 - Minimum lifetimes (some products)
 - Software support
 - Disassembly



Example: spare parts for smartphones must be available for at least 7 years after being put on market

- Software supports must be provided for minimum 5 years
- Battery should be removable (but only non-durable batteries available to end-users)

Example: spare parts for household washing machines must be available for at least 10 years:



Available to professional repairers and end-users (at least)

- doors
- door hinges and seals
- other seals
- door locking assembly
- plastic peripherals

Available to professional repairers (at least)

- motor and motor brushes
- transmission between motor and drum
- pumps
- shock absorbers and springs
- washing drum, drum spider and ball bearings
- heaters and heating elements
- piping and related equipment
- printed circuit boards
- electronic displays
- pressure switches
- thermostats and sensors
- software and firmware including reset software

Policies enabling repair

EU:

- Green procurement reparability criteria
 - Availability of spare parts and manuals
 - Repairable with common tools
 - Longer warranties

Member states:

- Longer Guarantees
 - Length (2 years currently)
 - Burden of proof (6 months)
- VAT reductions
- Repair funds
- Repairability scores



EU Circular Economy Policy Package



A Culture of Repair



Hem & Möbler Kök Kläder/Tyg & Skor Hobby&Fritid Trädgård & Balkong Elektronik Varför Fixa? Om Kampanjen

Smarta tips & hemmahacks

Förläng livet på dina kläder och prylar och gör en insats för klimatet och miljön!



KLÄDER/TYG & SKOR, KÖK



KLÄDER/TYG & SKOR



KLÄDER/TYG & SKOR

Bradley, K., & Persson, O. (2022). Community repair in the circular economy: Fixing more than stuff. *Local Environment: The International Journal of Justice and Sustainability*, 1–17.



Community Repair: Repair Cafes



About News Restart Parties Schools Get Involved **Give**

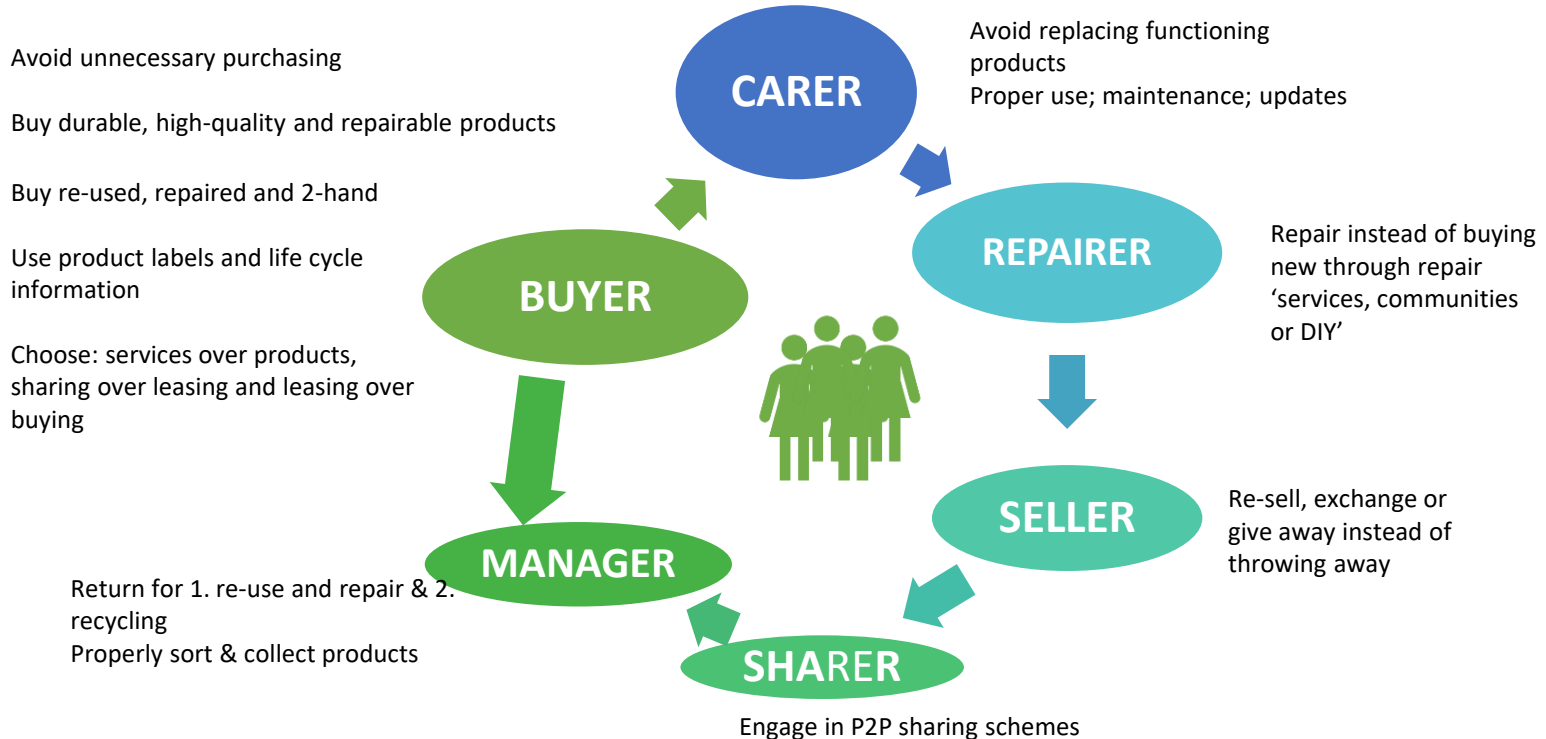


Be an "early adopter" of the new European Right to Repair campaign

Get Involved



Individuals' roles in circular consumption



Source: O. Mont. Based on (Maitre-Ekern and Dalhammar 2019)

GATT, TBT Agreement, bilateral trade agreements etc.

Digital product passports (ESPR & Battery Regulation)

Supporting standards for products, materials, reporting and monitoring etc.
 Legal framework for sustainable finance, e.g. reporting and taxonomy
 Product Environmental Footprint (PEF)

Basel Convention, EU Waste Shipment Regulation, ADR, COTIF etc.

Upstream – supply chains

Design, production, information

Point of sale

Product destruction

Use phase

End-of-use

Examples of EU policies

- Conflict Minerals Regulation
- Carbon border adjustment mechanism
- Timber Regulation
- Directive on Corporate Sustainability Due Diligence
- Regulation on deforestation-free products
- Proposal: Regulation on prohibiting products made with forced labour on the EU market
- Proposal: Critical Raw Materials Act

- Ecodesign Directive
- REACH, RoHS, ELV Directive etc.
- Battery Regulation
- Proposal Ecodesign Regulation (ESPR)

- Mandatory labeling
- EU Eco-label (voluntary)
- Rules on consumer rights, guarantees, marketing
- Proposals for consumer information: Empowering consumer green transition
- Proposal: labeling in proposal for Ecodesign Regulation (ESPR)
- Proposal: Directive on Green Claims

- Rules on reporting/bans on unsold goods in proposal for Ecodesign Regulation (ESPR)

- Legal proposal on right-to-repair in consumer law
- Battery Regulation: easier to replace batteries in products
- Rules on right-to-repair in Ecodesign Directive (and forthcoming ESPR): provision of spare parts, tools, manuals etc.

- Rules on producer responsibility and packaging, labeling
- Standards on e.g. remanufacturing
- New legal definition on e.g. refurbishment & remanufacturing, ESPR

Examples of national, regional and local policies

- Supply Chain Due Diligence Act (Ger)
- Fashion Sustainability and Social Accountability Act (NY State)
- Corporate responsibility for human rights (Can)
- Transparency Act (Nor)

- Mandatory labeling information (Fra)
- Repair fund (Fra)
- Criminalisation of planned obsolescence (Fra)

- Repair index (Fra)
- Proposed durability index (Fra)
- Longer guarantees in consumer law (several EU MS)
- Voluntary eco-labels

- Partial ban, destruction on unsold goods (Fra)
- Duty of Care (Ger)
- No VAT on donated goods (Bel)

- Repair fund (Fra)
- Tax reductions on repairs (Swe)
- Repair vouchers & repair networks (Austria)

- Re-use options at recycling stations
- Public procurement of remanufactured goods
- Local re-use centers and support to second-hand
- National labeling

Adapted and updated based on Dalhammar & Milios

Thanks!



Questions?

jessika.richter@iiiee.lu.se

The logo for CREACE, featuring the word "CREACE" in a large, blue, sans-serif font. The letter "C" has a circular arrow inside it, and the letter "E" has a wrench icon inside it.

<https://repairsociety.blogg.lu.se/>

