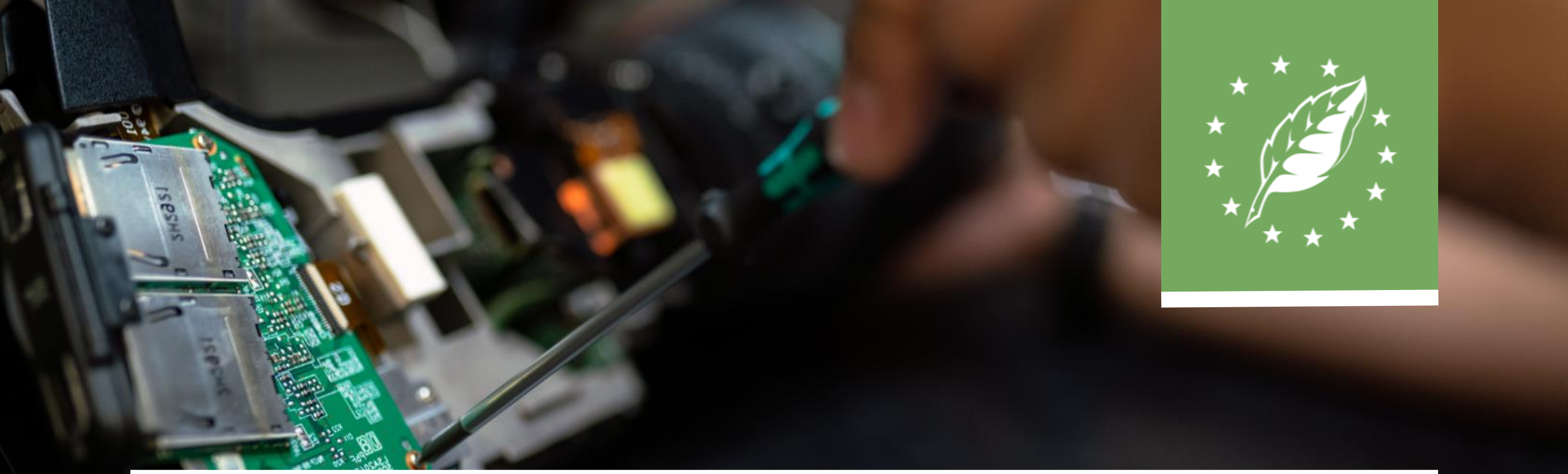


The ‘right to repair’

Addressing social and environmental spillovers in the electrical and electronic equipment sector

This briefing is one of a series assessing social and environmental spillovers associated with the EU’s circular transition. Sections 1 and 2 summarise the material flows associated with the EU consumption of EEE, and their principal environmental and social impacts. Section 3 introduces the objectives of the ‘right to repair’ and sections 4 and 5 map its potential positive and negative environmental and social spillovers, respectively, both inside and outside the EU. Section 6 concludes with some initial policy recommendations for the forthcoming ‘right to repair’ proposal.

Publication date:
July 2022

Author:
Agata Meysner and Jesus Urios

Material consumption in the European Union (EU), particularly in the Electrical and Electronic Equipment (EEE) sector, is high and rising, entailing significant environmental and social impacts along the value chain from raw material extraction to e-waste treatment both inside and outside the EU.

The development of the ‘right to repair’ through a number of EU policy initiatives from the Circular Economy Action Plan has the potential to slow and reduce this material throughput and therefore to mitigate its environmental and social consequences. However, all circular economy policies can have positive as well as negative environmental and social spillovers, both inside and outside the EU, which should be carefully assessed in policy design.

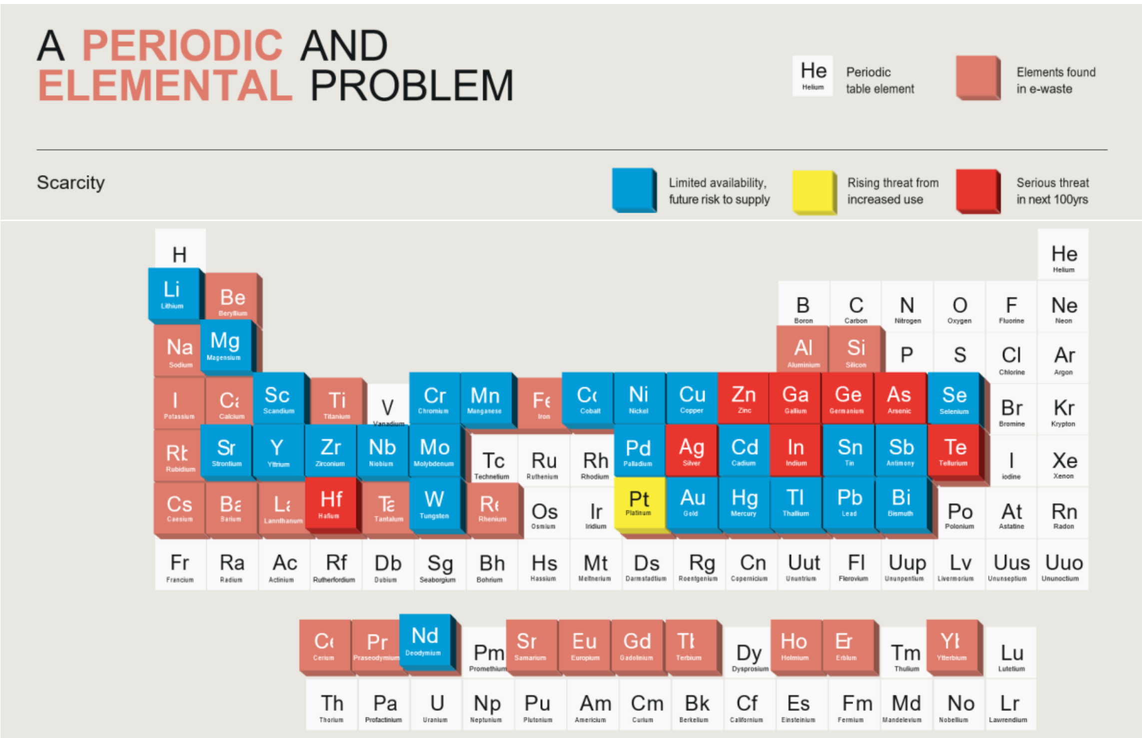
This briefing maps out some of the principal spillovers that may be associated with the introduction of the 'right to repair' in the EEE sector in particular, including implications for job creation, labour standards and the role of social economy actors in the repair economy, as well as possible rebound effects both inside and outside the EU, and sets out some initial policy recommendations to address them.

1. Material flows in the electronics sector

From 2009 to 2019 the total weight of EEE products placed on the EU market increased from 7.5 to 11.2 million tonnes, representing a 49 percent increase over the period (Eurostat, 2022a). EEE consumption is expected to continue to grow both in the EU and globally (Grand View Research, 2014), with the global market for electronic components predicted to grow at a compound annual growth rate (CAGR) of approximately 5 percent from 2020 to 2027 (Fortune Business Insights, 2021).

This expected growth will be accompanied with an increase of natural resources necessary to produce EEE, mainly metals. Some of the elements found in EEE products are highlighted in the periodic table below.

Figure 1: A periodic and elemental problem (World Economic Forum, 2019)



The EU is between 75% and 100% reliant on imports for most metals. The EU is 100% import reliant for platinum, lithium and magnesium, and 86% for cobalt (European Commission, 2020c). Gold mining in Europe accounted for less than 1% of global gold production in 2012 (Euromines, 2012). Only for a few metals is the situation less critical. For instance, EU import reliance is 40% for silver and 63% for silicon metal (European Commission, 2020c).

China has a virtual monopoly of rare earths globally, producing 95% of the 17 rare earths that are key for some technologies, such as neodymium (used to make powerful magnets for hybrid cars), lanthanum (used in camera and telescopic lenses, studio lighting and cinema projection), praseodymium (used to create strong metals for aircraft engines), and gadolinium (used in X-ray and MRI scanning systems, as well as television screens) (Wyoming Mining Association, 2022). Demand for some of these could increase tenfold by 2050 (European Commission, 2020c).

With some variation, most of these materials are imported into the EU – in the form of raw materials, components and finished goods – from Turkey, China, Brazil, and several African countries (Eurostat, 2022c; Schüler, 2017)**.** A more detailed list of the different critical metals being imported into the EU by countries can be found in the Annex 1 of the European Commission (EC)'s Communication on critical raw materials (European Commission, 2020c).

The growing scarcity of some of these metals contrasts with the expected increase in demand of them driven by both the sustainable and digital transitions. For instance, the greening of the energy mix and the deployment of electric mobility will require huge amounts of lithium for batteries (Greim, Solomon, & Breyer, 2020). It is expected that for energy storage and mobility purposes alone, almost 60 times more lithium and 15 times more cobalt will be needed in 2050 in the EU, compared to current total use in the EU (Joint Research Center of the European Commission, 2020). Other examples of likely increased demand in the future include silicon metal for semiconductors and platinum group metals for electrolysers to produce green hydrogen (European Commission, 2020c).

The increasing levels of e-consumption also translate into growing levels of e-waste, one of the fastest growing waste streams in the EU at an annual growth rate of 2% (European Commission, 2020a). Globally, e-waste generation was estimated to amount to 53.6 million tonnes in 2019. Of this total amount, a staggering 44.3 million tonnes had an uncertain destination, ending up either in landfills, burned, illegally traded, or disposed of by informal workers in poor conditions. By 2030 e-waste generation is expected to reach 74 million tonnes (UN University, 2020). Table 1 indicates the breakdown of e-waste in the EU across the major material categories.

Table 1. Simplified material composition of WEEE (Near-Zero European Waste Innovation Network, 2016)

Category	Iron, kt	Copper, kt	Aluminium, kt	Silver, kt	Gold, kt	Palladium, kt	Plastics, kt	Glass, kt
Total, kt	4564	460	469	0.382	0.056	0.020	2154	601
Total, %	46	5	5	0.004	0.001	0.000	22	6

Collection rates for e-waste in the EU remain low. In 2019, only 4.48 million tonnes of e-waste were collected in the EU, out of 11.23 million tonnes of EEE placed on the market that year (Eurostat, 2022a). Huge imbalances also exist in collection between Member States. In 2019, 3.3 kg of e-waste per inhabitant were collected in Romania while the figure reached 15.1 kg per inhabitant in Sweden, reflecting different performance of collection systems, different levels of consumption of EEE across the EU and different degrees of illegal activity (Eurostat, 2022a).

Overall, Eurostat calculates that less than 40% of electronic waste was recycled in 2018, with huge divergences among Member States: from an 83.4% recycling rate in Croatia to a 20.8% in Malta (European Parliament, 2021). The rest of e-waste ends up in landfills, exported legally or illegally and potentially recycled by informal workers. In fact, The EU is an exporter of e-waste, most of it being shipped to west Africa and Asian countries (Basel Action Network, 2019).

Eurostat reports that in 2019, the EU28 exported 119,279 tonnes of e-waste containing hazardous substances and 14,557 tonnes of non-hazardous e-waste (Eurostat, 2022b). However, according to the UN, 1.3 million tonnes of discarded electronics departed the EU in undocumented mixed exports (30% in the form of e-waste and 70% in the form of functioning equipment). The study also estimates that around 4.7 million tonnes are wrongfully mismanaged or illegally traded within Europe.

The value loss was estimated to be between EUR 800 million and EUR 1.7 billion annually (United Nations University, 2015). This represents a serious loss of precious – and increasingly scarce – materials for the EU. In addition, EEE also represented 8% of all goods imported by EU Member States in 2018, 70% of them coming from China (European Environmental Agency, 2020).

2. Environmental and social impacts of material flows in the EU electronics sector

These significant material flows associated with EEE consumption in the EU have major environmental and social consequences both inside the EU and in many other parts of the world, both upstream and downstream in the value chain.

Environmental and social impacts upstream

Half of total greenhouse gas emissions (GHG) and 90% of biodiversity loss and water stress is linked to resource extraction and processing (International Resource Panel, 2019). Moreover, GHG emissions linked with primary mineral and metal extraction were estimated to be 10 percent of total global energy-related greenhouse emissions in 2018 (Azaki, Northey, Ali, & Edraki, 2020). In addition, water and soil pollution, erosion, release of toxic gases and radioactive elements, land movements and deforestation are some of the main environmental problems associated with mining activities (MIT, 2022).

Mining activities, which mostly take place outside of the EU (Eurometaux, 2022), also generate negative impacts on local communities, often in the form of human rights violations. These include forced displacement of people, restricted access to clean land and water, exposure to harassment by mine or even governments (Oxfam, 2022).

Environmental and social impacts downstream

Downstream, the lack of proper collection and recycling of e-waste alongside illegal trading of e-waste in the EU leads to accumulation of e-waste in landfills in inappropriate conditions. Accumulation of e-waste as well as informal disposal of it causes soil and water contamination and GHG emissions if burned to extract valuable metals (Platform for Accelerating the Circular Economy, 2019).

The majority of e-waste recycling takes place in the informal economy and is often carried out by migrants, children and other vulnerable groups. Working conditions are for the most part poor, unsafe and unhealthy. In addition, rights at work are often not respected for informal e-waste workers (International Labour Organisation, 2019). Disposal of e-waste also exposes workers to highly carcinogenic substances such as mercury, lead, and cadmium (Platform for Accelerating the Circular Economy, 2019).

Box 1: The EU legislative landscape

- In the context of the European Green Deal, the EC released a new Circular Economy Action Plan (European Commission, 2020a), with a specific section targeted at the electronics sector.
- This materialized in the announcement of the Circular Electronics Initiative (European Parliament, 2022a), which should deal with several sustainability issues of the sector, such as durability, circular design, recycled content, reparability, obsolescence, e-waste prevention, collection, reuse and recycling.
- The European Commission proposed to revise the Radio Equipment Directive which would include harmonising the charging port for electronic devices (European Commission, 2021)
- It will also publish a proposal 'Sustainable consumption of goods – promoting repair and reuse' which will amend the Sale of Goods Directive and potentially put forward a separate new legislative proposal on the 'right to repair' in Q3 2022 (European Commission, 2022a).
- The EC has also proposed the EU Batteries Regulation (European Commission, 2020b) which concerns making batteries more sustainable.
- The EC put forward a proposal for the Sustainable Products Initiative (European Commission, 2022b) which includes a revision of the Ecodesign Directive, extending its scope to all products in the internal market beyond only energy-related products, and including provisions related to the repairability and durability of new products.

3. Enhancing circularity: The potential of the 'right to repair'

As discussed in Box 1, the EC has recognised the importance of increasing circularity in the electronics sector in particular, in order to mitigate some of the environmental and social consequences of material flows associated with EEE products. In the rest of this briefing, we assess a number of mandatory and voluntary initiatives put forward and forthcoming that facilitate the development of the 'right to repair' at the EU level.

So far, the most direct reference of the 'right to repair' has been put forward in the EC proposal 'Sustainable consumption of goods – promoting repair and reuse'. The main objective of this initiative is to 'encourage consumers to use consumer goods for a longer time, by repairing defective goods and by purchasing more second-hand and refurbished goods.' (European

Commission, 2022a). Based on the information provided so far, if the EC was to implement policies in line with the highest ambitions, the initiative would:

- Prioritise repair over replacement
- Oblige producers or sellers to repair goods beyond the legal guarantee period, in some cases for free
- Extend the legal guarantee period beyond the current minimum period of 2 years
- Enable the seller to replace defective products with refurbished goods and not new ones.
- Consider additional legislative and non-legislative measures to promote sustainable use of goods, including extending the useful life of goods.

However, other initiatives have also put forward measures relevant for the development of the ‘right to repair’. The EC adopted the Sustainable Products Initiative (European Commission, 2022b) which includes a revision of the Ecodesign Directive. It puts forward provisions on repairability and durability of new products. Sustainable Products Initiative provides an opportunity to strengthen the development of the ‘right to repair’ if it, among others, ensures that the product passport includes repair-related information, that repair is promoted to extend the product lifecycle and third-party repairers are fully engaged in the process (European Commission, 2022c).

Moreover, the EU Batteries Regulation is expected to address the removability and replaceability of batteries which will contribute to making them easier to repair. Earlier this year the European Parliament called for batteries to be easily and safely removable by consumers and independent operators (European Parliament, 2022b). Moreover, the revised Radio Equipment Directive puts forward a proposal to harmonise the charging port to USB-C which will apply to EEE such as smartphones, tablets and speakers (European Commission, 2021).

All circular economy strategies may entail both positive and negative spillovers in the EU and beyond (Brink, Lucas, Baldé, & Kuehr, 2021). These need to be carefully considered in the design of circular economy policies to ensure that the circular transition does not substitute one set of adverse social and environmental impacts with another.

This briefing focuses on the implications of the development of the ‘right to repair’ in EU policy initiatives outlined above. Prospective positive and negative spillovers are considered both with regard to the environment and socio-economic impacts, and both within and outside the EU, and some of the factors that will determine the nature and extent of these spillovers are briefly discussed before initial policy recommendations are made.

4. Prospective positive spillovers

Table 2: Prospective positive spillovers of the 'right to repair'

	Inside EU	Outside EU
Social	• Job creation in the repair sector • Supporting the growth of the social economy	• Job creation in the repair sector • Labour standard-setting in the repair sector outside the EU
Environmental	• E-waste reduction	• Environmental standard-setting in the repair sector outside the EU • E-waste reduction • Reduced extraction of virgin raw materials (for the EU market)

Job creation in the repair sector inside and outside the EU

A number of studies have highlighted the potential of circular economy policies to generate additional employment (ReLondon, 2022; International Institute for Sustainable Development & The Finnish Innovation Fund Sitra, 2021; Club of Rome, 2020) with the study commissioned by the EC indicating an additional 700,000 jobs by 2030 due to additional labour demand from i.e. repair services (Cambridge Econometrics, Trinomics, & ICF, 2018).

Repair of personal and household items is predicted to be among the most affected sectors by the transition to circular economy, set to experience one of the highest absolute job demand growths (International Institute for Sustainable Development & The Finnish Innovation Fund Sitra, 2021). The development of the 'right to repair' has the potential to address particularly those regions with higher unemployment rates and to boost demand for workers in skilled trades and administrative roles (Green Alliance, 2021).

However, it is important to note that while the repair, recycling and remanufacturing sectors are expected to grow other sectors are expected to decline, including mining and fossil fuels (Club of Rome, 2020), as addressed below. Moreover, new jobs may be created in the repair sector either within and/or outside the EU, depending on the proposal's provisions. Currently most resources originate from countries in the Global South (European Commission, 2020c). If repair activities are also concentrated in those countries, the introduction of the 'right to repair' could see new employment benefits concentrated primarily outside the EU. Alternatively, if the 'right to repair' has clear provisions requiring, enabling or incentivising repairs to be conducted within the EU, then these benefits should be captured primarily within the EU.

Supporting the growth of the social economy

Through increased availability of longer lasting products that might boost trade of second-hand items, the 'right to repair' has the potential to stimulate the growth of the social economy. The social economy already encompasses many independent repair service providers (such as community repair cafes) which offer a number of social benefits. As many social economy actors operate at the local level, they can strengthen community cohesion and stimulate grassroots innovation. Social economy actors play a critical role in training and reskilling, in particular for people that are furthest from the labour market (Gore, 2022)

However, if the 'right to repair' does not recognise and facilitate the key role of social economy actors in the circular economy transition, then feedstocks may be diverted to other commercialised operators and a number of these potential social benefits would be lost (Gore, 2022). Ensuring affordability and accessibility of spare parts and manuals is therefore critical, and provisions should be considered that incentivise the provision of repairs by social economy repair service providers, such as tax reductions or minimum requirements for public procurement of repair services from social economy repair service providers.

Improving labour and environmental standards inside and outside the EU

The implementation of an ambitious legislative framework on a 'right to repair' that tackles all the implications (consumer protection, environmental damage prevention, social and health impacts as well as its effect beyond the EU borders) can set a precedent and inspire legislation elsewhere.

The EU has already one of the most developed policies on the 'right to repair'. In addition, 'right to repair' initiatives have been put forward in the United Kingdom and some parts of the United States (Godwin, 2021), most notably the state of New York which has just passed the Fair Repair Act (Brandom, 2022).

Historically, the EU has been recognized as a strong standard setter at the international level (Bjerkem & Harbour, 2020) (European Commission, 2022d). The strengthening of the 'right to repair' framework is an opportunity for the EU to develop ambitious legislation in line with the EU's environmental and social objectives that can inspire higher standards elsewhere. An example of positive influence is the EU energy label. Out of 59 non-EU countries that have adopted equipment energy labelling schemes, half 53% have adopted labels that emulate fully or partially the EU energy label. This includes major economies such as Brazil, China, Korea, Russia and South Africa, EU accession states and many others including most South American countries, many North African countries and several countries in the Middle East (Coolproducts, 2022).

More specifically, provisions should be included in the EU legislation that require observance of minimum labour and environmental standards in repair value chains both within and beyond the EU. The 'right to repair' should complement the Ecodesign Directive and other measures to ensure that repairable products are not designed with hazardous materials that have the potential of harming the environment and human health during repairs.

E-waste reduction within and beyond the EU

As noted above, recycling activities simply do not match up with current levels of e-waste generation in the EU. To the extent that the 'right to repair' slows down the use of resources and the flow of materials, it should result in less e-waste as well (European Parliament Research Service, 2022), both inside and outside the EU.

As noted above, e-waste has important environmental and social implications. E-waste accumulation in landfills leads to soil and water contamination and workers, especially informal workers in the sector, are exposed to health hazards. A reduction of e-waste would mitigate some of these effects. However, it is also important to note that the informal recycling sector is an important source of employment and income in many third countries, that could be affected by a reduction of e-waste exports (Brink, Lucas, Baldé, & Kuehr, 2021). This suggests careful consideration is needed in the EC's impact assessment to these external spillovers, which may be addressed in part through incentivising the establishment of repair services in third countries or through other forms of development support.

Reduced extraction of virgin raw materials (for the EU market)

An ambitious implementation of the 'right to repair' has the potential to reduce the relative amount of EEE demanded by the EU market and thus reduce environmental pressures derived from natural resources extraction such as soil degradation, deforestation, CO2 emissions and water pollution, both inside and outside the EU.

However, this potential reduction of environmental pressure will depend on whether exporting countries do not simply substitute exports directed to the EU market with exports from another market with even lower regulatory standards than the EU, which would worsen the net environmental impact (Brink, Lucas, Baldé, & Kuehr, 2021). Again, the EC impact assessment should pay careful attention to these external spillovers, and consider addressing them, for example, through development support to exporting countries for economic diversification.

5. Prospective negative spillovers

Table 3: 'Prospective negative spillovers of the 'right to repair'

	Inside EU	Outside EU
Social	• Potential job losses in certain sectors • Risking consumer safety • Risk of exclusion of social economy actors from the repair economy	• Potential job losses in certain sectors
Environmental	• Potential negative environmental impacts in certain product market conditions	• Potential rebound effects outside the EU

Potential job losses in certain sectors

Higher costs for sellers and manufacturers as well as increased warranty times and access to repair services are expected to reduce EU consumer demand for new devices (European Commission, 2022a). This has the potential to have a negative impact on employment levels along the EEE value chain, including in the manufacturing of EEE inside and outside the EU as well as in the mining sector, primarily outside the EU. As described above, the extent to which these job losses are compensated by job creation in the repair sector will depend in part on whether the 'right to repair' initiative encourages repair services inside or outside the EU, and on whether complementary policies are established to support a just transition for such workers.

The potential loss in EEE manufacturing could also be offset by changes in producer's business models. For instance, manufacturers might need to increase their after sales support in order to cover repairability demands from consumers. Businesses could potentially invest as well in product development in order to make products more suitable for repairability e.g., software development, simplification of spare parts.

Risking consumer safety

Critics of the 'right to repair' argue that its implementation may pose risks to consumer safety, in particular when consumers or third parties are to repair their own EEE. Safety hazards resulting from third-party repairs may generate a need for additional repairs or replacement of the products. Indeed, they argue that due to the complexity of the EEE, the repairs should be limited to manufacturers’ authorized repair networks (Montello, 2020). Such limitations would, however, severely restrict the social benefits associated with expanding the repair sector among independent and social economy actors noted above.

On the other hand, repair of products that are, due to design, difficult to repair may result in further damaging them and increasing safety risks. This has been analysed in the context in batteries for EEE, whereby products without easily removable or replaceable batteries have been linked with increased incidents at waste facilities. Ensuring all batteries are repairable and replaceable could therefore help to avoid these safety risks (International Institute for Industrial Environmental Economics & European Environmental Bureau, 2021).

As discussed above, social economy actors, such as community repair cafes, might be excluded from the repair economy if licenses for repair services for WEEE are restricted to highly professionalized actors, if spare parts and manuals are restricted or if repair services are kept in-house by brands (Gore, 2022).

Potential negative environmental impacts in certain product market conditions

Jin, Yang and Zhu (2020) suggest that the environmental impact of the introduction of a ‘right to repair’ depends in part on the manufacturers’ adjustments of prices and the location of the highest environmental impact in the product’s lifecycle. For example, if the main contribution to environmental impacts is in the product’s use phase, then extending the lifetime of products with lower energy efficiency compared to newer designs may result in higher environmental impacts than replacing the product. On the other hand, the European Environmental Bureau (2019) and Oeko-Institut (2018) demonstrate that repairing a product is always more beneficial for the environment. Jin, Yang and Zhu (2020) also argue that if manufacturers respond to the ‘right to repair’ by reducing prices, then this could incentivise consumer demand and result in higher overall production.

This suggests the importance of careful consideration in the EC impact assessment to ensure unintended environmental impacts are minimised. This may entail allowing a replacement option in certain specific circumstances in case environmental benefit of doing so is clearly established. It also points to the need to ensure that the ‘right to repair’ is accompanied by a range of complementary initiatives, including ultimately absolute material footprint reduction targets to minimise rebound effects in relation to aggregate material consumption, as further explored below.

Potential rebound effects outside the EU

Reduced demand for metals and other materials in the EU market could result in exporters substituting their exports of metals and other resources to the EU for other export markets with lower environmental standards for the treatment of e-waste. This would amount to a form of 'material leakage', failing to reduce overall virgin material extraction and potentially worsening the environmental consequences of e-waste in countries outside the EU.

Similarly, if the 'right to repair' results in a reduction of e-waste exports to third countries, where informal recycling may constitute an important source of income and where consumer demand for recycled or repaired products remains high, those countries may seek to import e-waste from alternative markets. Again, if the environmental standards of EEE products are lower in those alternative markets than in the EU, the result would be a worsening of environmental impacts overall in the importing countries.

This further suggests the need to carefully evaluate the potential spillovers beyond the EU in the design of the 'right to repair'. Ensuring that third countries have continued access to 'high quality' electronics for repair and resale in their domestic markets may be an important consideration in ensuring an overall positive environmental impact of the measure (Brink, Lucas, Baldé, & Kuehr, 2021).

6. Initial policy recommendations for a socially- and environmentally-just circular transition

The development of the 'right to repair' has the potential to drive multiple social and environmental benefits, both inside and outside the EU. Nevertheless, it may also trigger negative social and environmental spillovers, which must be carefully evaluated in the initiatives' design Our initial policy recommendations in this regard are as follows:

- The EC should pursue the **highest level of ambition** of the proposals included in the call for evidence for impact assessment of the initiative 'Sustainable consumption of goods – promoting repair and reuse', contributing to the development of similar legislation on the 'right to repair' worldwide.
- The EU legislation on repair should ensure the **availability and accessibility of spare parts and licenses** – including for independent repair service providers – **and clear user-friendly instructions**.
- The EU legislation on repair should clearly recognise, promote and protect the role of **social economy actors** in the implementation of the 'right to repair', including through tax incentives and minimum service provision guarantees from social economy actors in public procurement of repair services.

- The EU legislation on repair should ensure that products are designed to facilitate durability and repairability and to avoid exposure to **hazardous materials** that are harmful to human health during repairs.

- The EU legislation on repair should consider options to support a **just transition** for workers in sectors expected to experience job losses, notably in EEE manufacturing or retail, and guarantee **minimum labour standards** are respected in repair services conducted both inside and outside the EU.

- The EC impact assessments of the EU legislation on repair should consider the potential positive and negative environmental and social **spillovers outside as well as inside the EU** and propose options to address them.

- In particular, the EC impact assessments of the EU legislation on repair should consider the optimal **location of repair services** with a view to balancing both the potential employment and social cohesion benefits of expanding the repair economy inside the EU, with the need to avoid unintended social and/or environmental rebound effects in third countries that are either exporting virgin raw materials to the EU market or importing e-waste from the EU.

- The EU legislation on repair should be complemented by **absolute material footprint reduction targets** (with specific targets for material categories such as metals used in EEE) to ensure that any unintended consequences, for example from reduced manufacturer prices, do not lead to higher aggregate material consumption in the EU.

References

Azaki, M., Northey, S. A., Ali, S. H., & Edraki, M. (2020). Transparency on greenhouse gas emissions from mining to enable climate change mitigation. *Nature Geoscience*, 13, 100-104.

Basel Action Network. (2019). *Holes in the Circular Economy: WEEE leakege from the EU.* Retrieved from http://wiki.ban.org/images/f/f4/Holes_in_the_Circular_Economy-_WEEE_Leakage_from_Europe.pdf

Bjerkem, J., & Harbour, M. (2020). *Europe as a global standard-setter: the strategic importance of European standarisation.* Retrieved from https://www.epc.eu/content/PDF/2020/EPE_JB_Europe_as_a_global_standard-setter.pdf

Brandom, R. (2022, June 3). New York state passes first-ever ‘right to repair’ law for electronics. *The Verge*. Retrieved from https://www.theverge.com/2022/6/3/23153504/right-to-repair-new-york-state-law-ifixit-repairability-diy?utm_campaign=theverge&utm_content=entry&utm_medium=social&utm_source=linkedin

Brink, H., Lucas, P., Baldé, C. P., & Kuehr, R. (2021). Potential effects of Dutch circular economy strategies on low- and middle income- countries. The case of electrical and electronic equipment. Retrieved from https://www.pbl.nl/sites/default/files/downloads/pbl-2021-potential-effects-of-dutch-circular-economy-strategies-on_low-and-middle-income-countries_4312.pdf

Cambridge Econometrics, Trinomics, & ICF. (2018). *Impacts of circular economy policies on the labour market: final report.* European Commission. Retrieved from https://circulareconomy.europa.eu/platform/sites/default/files/ec_2018_-_impacts_of_circular_economy_policies_on_the_labour_market.pdf

Club of Rome. (2020). The Circular Economy and Benefits for Society: Jobs and Climate Clear Winners in an Economy Based on Renewable Energy and Resource Efficiency. Retrieved from https://clubofrome.org/wp-content/uploads/2020/03/The-Circular-Economy-and-Benefits-for-Society.pdf

Coolproducts. (2022, 07 1). *coolproducts*. Retrieved from The World is changing: https://www.coolproducts.eu/home-the-world-is-changing/

Eurometaux. (2022). *Eurometaux*. Retrieved from Metals mining and production: https://eurometaux.eu/about-our-industry/the-metals-story/production/

Euromines. (2012). *Sustainable gold mining in Europe*. Retrieved from https://www.euromines.org/files/publications/sustainable-gold-mining-europe-english-language-version.pdf

European Commission. (2020a). *A new Circular Economy Action Plan for a cleaner and more competitive Europe*. Retrieved from https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1.0017.02/DOC_1&format=PDF

European Commission. (2020b). *EU Batteries Regulation*. Retrieved from https://environment.ec.europa.eu/topics/waste-and-recycling/batteries-and-accumulators_en

European Commission. (2020c). *Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability*. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0474&from=EN

European Commission. (2021). Pulling the plug on consumer frustration and e-waste: Commission proposes a common charger for electronic devices. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/IP_21_4613

European Commission. (2022a). *Sustainable consumption of goods – promoting repair and reuse*. Retrieved from https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13150-Sustainable-consumption-of-goods-promoting-repair-and-reuse_en

European Commission. (2022b). *Sustainable Products Initiative*. Retrieved from https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative_en

European Commission. (2022c). *Questions and Answers: Sustainable Products Initiative*. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/QANDA_22_2014

European Commission. (2022d). An EU Strategy on Standarisation. Setting global standards in support of a resilient, green and digital EU single market. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/ip_22_661

European Environmental Agency. (2020). *Electronic products and obsolescence in a circular economy.* Retrieved from https://www.eionet.europa.eu/etcs/etc-wmge/products/etc-wmge-reports/electronics-and-obsolescence-in-a-circular-economy

European Environmental Bureau. (2019). *Coolproducts don't cost the earth - full report*. Retrieved from https://eeb.org/wp-content/uploads/2019/09/Coolproducts-report.pdf

European Parliament. (2021). European Parliament resolution of 10 March 2021 with recommendations to the Commission on corporate due diligence and corporate accountability. Retrieved from https://www.europarl.europa.eu/doceo/document/TA-9-2021-0073_EN.html?utm_source=POLITICO.EU&utm_campaign=f902eb3f83-EMAIL_CAMPAIGN_2022_02_10_05_59&utm_medium=email&utm_term=0_10959edeb5-f902eb3f83-190844672

European Parliament. (2022a). *Circular Electronics Initiative.* Retrieved from https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-circular-electronics

European Parliament. (2022b). *MEPs want to strengthen new EU rules for design, production and disposal of batteries*. Retrieved from https://www.europarl.europa.eu/news/en/press-room/20220202IPR22435/meps-want-to-strengthen-new-eu-rules-for-batteries

European Parliament Research Service. (2022). *Right to repair.* Retrieved from https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/698869/EPRS_BRI(2022)698869_EN.pdf

Eurostat. (2022a, February). *Eurostat - Statistics Explained*. Retrieved from Waste statistics - electrical and electronic equipment: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics_-_electrical_and_electronic_equipment#Electronic_equipment_.28EEE.29_put_on_the_market_and_WEEE_processed_in_the_EU

Eurostat. (2022b). *Eurostat*. Retrieved from Waste Shipment statistics: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_shipment_statistics#Waste_of_Electrical_and_Electronic_Equipment_.28WEEE.29

Eurostat. (2022c, March). *Extra-EU trade in raw materials*. Retrieved from Eurostat: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Extra-EU_trade_in_raw_materials#Raw_materials_by_product_group

Fortune Business Insights. (2021). Consumer Electronics Market Size, share & COVID-19 impact analysis, by product, distribution channel and regional forecast 2020-2027. Retrieved from https://www.fortunebusinessinsights.com/consumer-electronics-market-104693

Godwin, C. (2021, July 7). Right to repair movement gains power in US and Europe. San Francisco, California, USA. Retrieved from https://www.bbc.com/news/technology-57744091

Gore, T. (2022). The circular economy and green jobs in the EU and beyond. Chapter 6: Labour rights and inclusion: towards a social and circular economy. Foundation for European Progressive Studies. Retrieved from https://circulareconomy.europa.eu/platform/sites/default/files/220224_circular_economy_final_book.pdf

Grand View Research. (2014). *Consumer electronics market analysis by product and segment forecasts to 2020.* Retrieved from https://www.grandviewresearch.com/industry-analysis/personal-consumer-electronics-market

Green Alliance. (2021). *Levelling up through circular economy jobs.* Retrieved from https://green-alliance.org.uk/wp-content/uploads/2021/11/Levelling_up_through_circular_economy_jobs.pdf

Greim, P., Solomon, A. A., & Breyer, C. (2020). *Assessment of lithium criticality in the global energy transition and addressing policy gaps in transportation.* Nature Communications. Retrieved from https://www.nature.com/articles/s41467-020-18402-y

International Institute for Industrial Environmental Economics, & European Environmental Bureau. (2021). *Removable, replaceable and repairable batteries.* Retrieved from https://eeb.org/library/battery-repair-report/

International Institute for Sustainable Development, & The Finnish Innovation Fund Sitra. (2021). *Effects of the Circular Economy on Jobs.* Retrieved from https://www.iisd.org/system/files/2020-12/circular-economy-jobs.pdf

International Labour Organisation. (2019). *Decent work in the management of electricalm and electronic waste (e-waste).* Retrieved from https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/publication/wcms_673662.pdf

International Resource Panel. (2019). *Global Resources Outlook*. Retrieved from https://www.resourcepanel.org/sites/default/files/documents/document/media/unep_252_global_resource_outlook_2019_web.pdf

Jin, C., Yang, L., & Zhu, C. (2020). Right to Repair: Pricing, Welfare, and Environmental Implications. *Management Science*. doi:http://dx.doi.org/10.2139/ssrn.3516450

Joint Research Center of the European Commission. (2020). *Critical Raw Materials for Strategic Technologies and Sectors in the EU*. Retrieved from https://rmis.jrc.ec.europa.eu/uploads/CRMs_for_Strategic_Technologies_and_Sectors_in_the_EU_2020.pdf

MIT. (2022). *The Future of strategic natural resources*. Retrieved from https://web.mit.edu/12.000/www/m2016/finalwebsite/problems/mining.html

Montello, K. S. (2020). The Right to Repair and the Corporate Stranglehold over the Consumer: Profits over People. *Tulane Journal of Technology and Intellectual Property f*. Retrieved from https://journals.tulane.edu/TIP/article/view/2993

Near-Zero European Waste Innovation Network. (2016). *Report summarising the results of the analysis of Electronics value*. European Commission. Retrieved from https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5ac195926&appId=PPGMS

Oeko-Institut. (2018). *Extending the life span of home appliances*. Retrieved from https://www.oeko.de/fileadmin/oekodoc/FAQ-Extending-life-span-of-home_apps.pdf

Oxfam. (2022). *Oxfam Australia*. Retrieved from Impacts of mining: https://www.oxfam.org.au/what-we-do/economic-inequality/mining/impacts-of-mining/

Platform for Accelerating the Circular Economy. (2019). *A new Circular Vision for Electronics: Time for a global reboot*. Retrieved from https://www3.weforum.org/docs/WEF_A_New_Circular_Vision_for_Electronics.pdf

ReLondon. (2022). *The circular economy at work*. Retrieved from https://relondon.gov.uk/wp-content/uploads/2022/06/The-circular-economy-at-work_jobs-and-skills-for-Londons-low-carbon-future.pdf

Schüler, D. (2017). EU’s ore and metal import flows and engagement towards responsible sourcing in industry supply chains. *GREAT Insights Magazine*, Volume 6, Issue 3.

Retrieved from https://ecdpm.org/great-insights/mining-for-development/eus-ore-metal-import-flows-engagement-towards-responsible-sourcing-industry-supply-chains/

UN University. (2020). *The global e-waste monitor 2020.* Retrieved from https://www.itu.int/en/ITU-D/Environment/Documents/Toolbox/GEM_2020_def.pdf

United Nations University. (2015). *United Nations University*. Retrieved from Discarded Electronics Mismanaged within Europe Equals ~10 Times the Volume of E-waste Exported: https://unu.edu/media-relations/releases/discarded-electronics-mismanaged-in-europe-is-10x-volume-of-e-waste-exports.html

World Economic Forum. (2019). *A New Circular Vision for electronics. Time for a reboot.* Retrieved from https://www3.weforum.org/docs/WEF_A_New_Circular_Vision_for_Electronics.pdf

Wyoming Mining Association. (2022). *Wyoming mining association*. Retrieved from Rare Earths: https://www.wyomingmining.org/minerals/rare-earths/