How Can a Mandatory Right-to-Repair Address the Global E-Waste Problem?

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There are now more mobile phones than people in the world, and e-waste is one of the largest growing waste streams. Focusing on the tail end of the material life cycle of e-products, this Note raises issues regarding e-waste pollution including how the global trade of this hazardous waste creates informal economies that can be harmful to human health and the environment. The international community has addressed the global e-waste trade since the 1990s, with an international agreement called the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Although signed by the United States, the Convention has not been ratified by Congress and is therefore not binding law. This Note proposes a domestic policy measure that could reduce the amount of e-waste created: the right-to-repair with a repairability index. This policy gives potential consumers for electronic devices a score based on how repairable an item is on a scale from one to ten, thus encouraging consumers to repair their electronic goods before recycling them. Inspired by a French policy, this proposal is one solution to the global e-waste problem.

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INTRODUCTION

Electronic waste (e-waste) is one of the fastest-growing waste streams on Earth today.[1] The United States generated 15,873 million pounds of e-waste in 2022, making it the second largest e-waste-generating nation, behind only China.[2] This is not surprising given that manufacturers unsustainably produce electrical and electronic equipment ("EEE" or "e-products") by practicing planned obsolescence[3] and encouraging consumers to buy the latest model of their EEE regardless of necessity.[4] This is the case with many devices including smartphones, laptops, and audio equipment.[5] Mobile phones[6] are of particular interest because of their small size and numerosity.[7] In fact, there are now more mobile phones than people in the world.[8]

What happens to these phones when the battery runs out or if they will not turn on? Or when a new model is released? How many readers of this Note have a box languishing in their homes labeled "electronics"–filled with devices like mobile phones, laptops, iPods–due to concerns of whether they will be disposed of diligently? Some recycle their devices in appropriate facilities, while others discard them in the trash.[9] When such e-products become waste, they can pose a

1. *Overview: Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*, U.N. ENV'T PROGRAMME [UNEP], https://basel.int/Implementation/Ewaste/Overview/tabid/4063/Default.aspx (last visited Apr. 9, 2024).

2. CORNELIS P. BALDÉ ET AL., GLOBAL E-WASTE MONITOR 2024 120-135 (2024), https://api.globalewaste.org/publications/file/297/Global-E-waste-Monitor-2024.pdf.

3. *See* Will Kenton, *What Is Planned Obsolescence? How Strategy Works and Example*, INVESTOPEDIA (Dec. 27, 2022), https://www.investopedia.com/terms/p/planned_obsolescence.asp (defining planned obsolescence as "a strategy of deliberately ensuring that the current version of a given product will become out of date or useless within a known time period. This proactive move guarantees that consumers will seek replacements in the future, thus bolstering demand.").

4. *See* Rebecca Picciotto, *Black Friday shoppers spent a record $9.8 billion in U.S. online sales, up 7.5% from last year*, CNBC (Nov. 25, 2023), https://www.cnbc.com/2023/11/25/black-friday-shoppers-spent-a-record-9point8-billion-in-us-online-sales-up-7point5percent-from-last-year.html (reporting that individuals are buying more electrical and electronic goods than ever before; *e.g.*, $9.8 billion USD were spent in the United States during Black Friday sales, with electronics, TVs, and smartwatches among the best-selling categories of products); *see also* Seth Doane, *The tragic cost of e-waste and new efforts to recycle*, CBS NEWS (Nov. 26, 2023), https://www.cbsnews.com/news/the-tragic-cost-of-e-waste-and-new-efforts-to-recycle (reporting that Americans upgrade their mobile phones every two-and-a-half years on average).

5. *Id.*

6. While there is a difference between mobile phones and smartphones, these terms are used interchangeably throughout this Note.

7. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 32 (explaining that these devices have valuable components, and their collection is therefore prioritized by compliant e-waste managers). However, collection and recycling rates for these items are lower than for other equipment (larger items such as monitors or refrigerators). *Id.*

8. Felix Richter, *Charted: There Are More Mobile Phones Than People in the World*, WORLD ECON. FORUM (Apr. 11, 2023), https://www.weforum.org/agenda/2023/04/charted-there-are-more-phones-than-people-in-the-world, (stating that in 2022, there were more than 8.58 billion mobile subscriptions in use compared to a 7.95 billion global population).

9. Their small size makes it easier for a consumer to throw smartphones and laptops in the trash. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 32; Alana Semuels, *The World Has an E-Waste Problem*, TIME (May 23, 2019), https://time.com/5594380/world-electronic-waste-problem.

significant risk to the environment and human health–whether the heavy metals or plastic components are burnt, releasing hazardous gases into the air, or leeched into the soil and water when disposed of in landfills. For example, severe air, water, and soil pollution occurred in the infamous "recycling sites," or rather e-waste dump sites, in Agbogbloshie, Ghana,[10] which were subsequently demolished in 2021.[11] In such places, communities rely on informal labor markets for disassembling devices to resell valuable metals and other materials.[12] The management of e-waste is a global problem because most communities and countries do not want to have landfills[13] or simply lack the resources and technology to dispose of their e-waste in an "environmentally and sound manner"–four crucial words in international legislation.[14] The trade of e-waste is also a lucrative business in the informal economies around developed countries' dumpsites and beyond.[15] However, due to the cost of recycling and treatment in developed countries, developing countries continue to receive illegal e-waste and house dumpsites, creating environmental injustices for nearby communities.[16]

In Part I, this Note provides a description of e-waste. It proceeds by highlighting some of the major environmental and social negative externalities of e-waste. Part II then explores what international agreements exist to deal with such problems and highlights some limits. Part III looks at innovative existing policies that address e-waste issues by presenting the right-to-repair movement and two policy proposals that exemplify it. First is the French national policy of a repairability index, particularly for small IT and telecommunication equipment, mobile phones, and laptop computers. The second is a proposed federal act establishing a U.S. right-to-repair, including a repairability index and a mandatory federal Anti-E-Waste Act.

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10. Chris Carroll, *High-Tech Trash*, NAT'L GEO. (Jan. 2008), https://www.crserecycling.com/pdf/High-Tech-Trash.pdf; *see also* Peter Yeung, *The Toxic Effects of Electronic Waste in Accra, Ghana*, BLOOMBERG (May 29, 2019) https://www.bloomberg.com/news/articles/2019-05-29/the-rich-world-s-electronic-waste-dumped-in-ghana.

11. Grace Alkese et al., *Ghana: Agbogbloshie – a Year After the Violent Demolition*, ALLAFRICA, (July 21, 2022), https://allafrica.com/stories/202207220004.html; *see also* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 64 (noting that funding from the German Development Bank is contributing to the establishment of a sustainable e-waste recycling system); *but see* Oladele A. Ogunseitan, *The Environmental Justice Agenda for E- Waste Management*, 65 ENV'TL SCI. & POL'Y FOR SUSTAINABLE DEV. 15, 21 (2023) (stating that such demolition has destabilized migrant workers and affected the efforts of local environmental justice advocates to prevent environmental pollution).

12. *See infra* I. C. 1. B; *see generally*, CORNELIS P. BALDÉ ET AL., *supra* note 2, at 63-67.

13. This mentality is lovingly called "NIMBY," or "Not in My Back Yard." *See generally* Peter D. Kindler, *NIMBY*, BRITANNICA, https://www.britannica.com/topic/NIMBY (last visited Nov. 21, 2024).

14. *See infra*. II. A.

15. CORNELIS P. BALDÉ ET AL., *supra* note 2, at 55 ("informal e-waste businesses have proliferated in many nations to address the growing e-waste issue" and suggesting that e-waste is a valuable secondary source of metals).

16. *See infra* I. C.

I. E-WASTE: VALUABLE RESOURCES WITH NEGATIVE EXTERNALITIES

A. The Meaning of E-Waste

Rapid technological evolution, paired with rising demand among consumers for high-tech products, has generated increasing consumption of electronic equipment.[17] E-waste, or EEE, refers to "[a]ny household or business item with circuitry or electrical components and a power or battery supply."[18] It is sometimes called waste electrical and electronic equipment (WEEE) if the original owner has disposed of it as refuse with no intention of further utilization.[19] Each jurisdiction has its own definition of e-waste with varying categories, such as those with versus without an electrical part.[20] In the United States, the Environmental Protection Agency (EPA) considers e-waste to be "a subset of used electronics," and EPA "recognizes the inherent value of these materials that can be reused, refurbished or recycled to minimize the actual waste that might end up in a landfill or improperly disposed in an unprotected dump site either in the US or abroad."[21]

Unlike the European Union (EU),[22] the United States does not have a uniform federal mandatory e-waste law.[23] Furthermore, part of the difficulty of regulating and controlling e-waste is precisely due to the lack of a common definition of what materials should be considered e-waste.[24] E-waste may be called electronic scrap (e-scrap),[25] since it can include other metals of interest

17. Md Tasbirul Islam et al., *A global review of consumer behavior towards e-waste and implications for the circular economy*, 316 J. CLEANER PROD. 1, 1 (2021).

18. SOLVING THE E-WASTE PROBLEM (STEP), SOLVING THE E-WASTE PROBLEM WHITE PAPER: ONE GLOBAL DEFINITION OF E-WASTE 4 (U.N. Univ. pub., June 3, 2014), https://www.step-initiative.org/files/_documents/whitepapers/StEP_WP_One%20Global%20Definition%20of%20E-waste_20140603_amended.pdf [hereinafter STEP]; *see also* CORNELIS P. BALDÉ ET AL. *supra* note 2, at 20 ("[b]atteries and other electricity storage are not EEE, and most legislation globally recognizes them as separate waste streams, mainly because they require different end-of-life treatment.").

19. CORNELIS P. BALDÉ ET AL., *supra* note 2, at 19.

20. The EU defines e-waste as electrical and electronic equipment "including all components, sub-assemblies and consumables which are part of the product at the time of discarding." The Directive covers the following six categories of electrical and electronic equipment: (i) temperature exchange equipment; (ii) screens and monitors; (iii) lamps; (iv) large equipment (any external dimension more than 50 cm), such as household appliances, information technology and telecommunications equipment, and electrical and electronic tools; (v) small equipment (no external dimension more than 50 cm), such as household appliances, luminaires, musical equipment and toys; and (vi) small information technology and telecommunications equipment (no external dimension more than 50 cm). *See* Council Directive 2012/19, art. 2, O.J. (L. 197) 38, 42-43 (discussing waste electrical and electronic equipment, or "weee").

21. *Cleaning Up Electronic Waste (E-Waste)*, EPA, https://www.epa.gov/international-cooperation/cleaning-electronic-waste-e-waste (last updated Nov. 13, 2024).

22. *See generally* O.J. (L. 197) 38, *supra* note 20; *see also* Council Directive 2011/65, O.J. (L. 174) 88 (discussing the restriction of the use of certain hazardous substances in electrical and electronic equipment).

23. *See* STEP, *supra* note 18, at 4; *see also* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 69.

24. *See, e.g.*, Qinrun Zhang, *China's Policy and Finding Ways to Prevent Collapse in WEEE Processing in the Context of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal*, 21 INT'L ENVT'L AGREEMENTS 698, 694–710 (2021).

25. INT'L LAB. OFF., DECENT WORK IN THE MANAGEMENT OF ELECTRICAL AND ELECTRONIC WASTE (E-WASTE) 1 (Apr. 2019) (ILO) 1 (2019) [hereinafter ILO E-WASTE ISSUE PAPER].

(copper, gold, indium, palladium, rare earth elements, etc.).[26] Plastic makes up a large amount of mobile phones and computer monitors—even the keyboard that is being used to type this Note. Plastic pollution intertwines with e-waste pollution and adds complexity due to the mixture of hazardous heavy metals, plastics, and the additives they contain (e.g., flame retardants and plasticizers).[27]

E-waste can be hazardous waste[28] due to intermediate inputs during manufacturing.[29] E-waste may be contaminated with mercury, lead, cadmium, or polychlorinated biphenyl (PCB), or may contain components such as accumulators and other batteries, PCB capacitors, mercury switches, glass from cathode-ray tubes (CRTs), and other activated glass.[30] For this Note, the author will use EPA's definition of e-waste.

B. The Economic Value of E-Waste

Consumers highly value mobile phones and laptops as digital tools for economic production and social connection. However, most consumers may not realize the ecological monetary value of their physical devices. As mentioned, e-scrap[31] contains materials of strategic value including precious metals[32] that can be recovered and recycled.[33] They can reduce pressure on scarce natural resources, minimize overall environmental footprint, and be a beneficial source of secondary raw material.[34] According to the Global E-waste Monitor 2024, the economic value of the metallic components within global e-waste reached approximately ninety-one billion USD in 2022, whereas e-waste management generated twenty-eight billion USD worth of secondary raw materials from this total.[35] The e-waste management market is likely to grow due to financial

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26. Kerry Lotzof, *What is e-waste and what can we do about it?*, NATURAL HIST. MUSEUM, nhm.ac.uk/discover/what-is-ewaste-and-what-can-we-do-about-it.html (last visited Nov. 22, 2024).

27. *See generally* Asanda Mtibe et al., *Sustainable valorization and conversion of e-waste plastics into value-added products*, 40 CURRENT OP. GREEN & SUSTAINABLE CHEM. 1 (2023) https://doi.org/10.1016/j.cogsc.2023.100762.

28. *See* Marisa D. Pescatore, *The Environmental Impact of Technological Innovation: How U.S. Legislation Fails to Handle Electronic Waste's Rapid Growth*, 32 VILL. ENV'T L.J. 115, 126-27, 140 (2021) (defining hazardous waste in the United States).

29. E-waste can also contain a variety of chemicals from the manufacturing of chips and semiconductors, including volatile organic compounds. *See* KESHAV PARAJULY ET AL., FUTURE E-WASTE SCENARIOS 13 (2019), https://ewastemonitor.info/wp-content/uploads/2020/11/FUTURE-E-WASTE-SCENARIOS_UNU_2019.pdf.

30. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, Mar. 22, 1989, 1673 U.N.T.S. 125, Art. I [hereinafter Basel Convention].

31. *See* ILO E-WASTE ISSUE PAPER, *supra* note 25, at 1.

32. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 14.

33. WHERE ARE WEEE IN AFRICA? FINDINGS FROM THE BASEL CONVENTION E-WASTE AFRICA PROGRAMME (ADVANCE VERSION, SECRETARIAT OF THE BASEL CONVENTION 9 (2011) [hereafter WHERE ARE WEEE IN AFRICA?].

34. *Id*.

35. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 14 (explaining that precious reclaimed resources include copper (valued at nineteen billion USD), gold (fifteen billion USD), and iron (sixteen billion USD). These metals can be effectively extracted with high recycling rates utilizing existing e-waste processing techniques. This suggests that enhancing collection efficiency could significantly boost current

incentives and environmental concerns.[36] The market was valued at $49.88 billion in 2020 and is projected to almost triple to $143.87 billion by 2028.[37] Consequently, when an e-product stays in a drawer at home, valuable natural resources are wasted. Electronic refuse recovery and reuse policies therefore may drive economic value. There already exists a labor market for recyclers around the world.[38]

Economic assessments opine that e-waste management today has economic benefits[39] but also costs.[40] Estimates say that the overall annual economic monetary cost of e-waste management is thirty-seven billion USD worldwide.[41] The main costs are negative environmental externalities passed on to people and the planet from lead and mercury emissions, plastic leakages, and contributions to global warming.[42]

C. Negative Externalities of E-Waste: Harm to Human Health and the Environment

1. E-Waste Creates Informal Toxic Economies

a. Injustice in Developing Countries

E-waste is known to be one of the fastest growing hazardous waste streams.[43] Therefore, proper infrastructure for recovering and recycling these e-products is essential.[44] Additionally, globalization has made hazardous wastes more mobile.[45] Industrialized countries, which trade the most, have more stringent waste management regulations.[46] Nevertheless, studies show that gaps in trade and regulations between industrialized and less industrialized countries have narrowed drastically over the last twenty years.[47] Least developed countries

value reclamation rates. Most losses of value occur as a result of landfilling, incineration, or substandard treatment).

36. Arabella Ruiz, *Latest Global E-Waste Statistics And What They Tell Us*, THE ROUND UP, https://theroundup.org/global-e-waste-statistics (last updated Apr. 15, 2024).

37. *Id.*

38. *See infra C 1 b.*

39. *E.g.*, the recovery of metals.

40. *E.g.*, e-waste treatment and hidden externalized costs for society.

41. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 14 (explaining that seventy-eight billion USD are externalized costs to the population and to the environment plus ten billion USD associated to the cost for treatment of e-waste minus the benefits of twenty-three billion USD of monetized value of avoided greenhouse gas emissions and twenty-eight billion USD worth of recovered metals brought back to the circular economy).

42. *Id*.

43. TACKLING INFORMALITY IN E-WASTE MANAGEMENT: THE POTENTIAL OF COOPERATIVE ENTERPRISES, INTERNAT'L LABOR OFF. 5 (2014).

44. *See also* Doane, *supra* note 4 (reporting that imprecise methods of recycling produce more toxic waste that leach into the earth and pollute the river, the ocean, and the fish in Accra).

45. Shiming Yang, *Trade for the Environment: Transboundary Hazardous Waste Movements After the Basel Convention*, 37 REV. POL'Y RSCH, 733, 713-38 (2020).

46. *Id*.

47. *Id*.

are the least engaged with hazardous trade yet are more vulnerable to waste trafficking.[48] They have struggled to enforce international agreements such as the Basel,[49] Bamako,[50] and Waigani[51] Conventions.[52] African countries in particular experience limited institutional capacity, causing them to suffer from the illegal dumping of hazardous wastes, like in the aforementioned e-waste site in Agbogbloshie, Ghana.[53] The inspection of waste shipments, enforcement of trade restrictions, and handling of hazardous waste already in the country is harder due to limited infrastructure.[54] Many less developed countries do not have a national hazardous waste definition nor domestic regulations to control them.[55] These nations may deliberately refrain from disclosing hazardous waste imports to conceal violations of trade prohibitions.[56] Insufficient technological, economic, and institutional capabilities have constrained these nations, resulting in a persistent inability to effectively enforce regulations in this area.[57] While a large amount of e-waste does land in industrialized countries, the remainder flows into or through developing countries, damaging public health and causing environmental pollution.[58]

While the drafters of international agreements assumed that developed countries dump e-waste in developing countries, recent studies suggest that developing countries have also generated significant e-waste domestically.[59] Today, e-waste is transported amongst developing countries or emerging economies,[60] and increasingly so since China banned its e-waste imports under the National Sword Program.[61] Yet, many developing nations maintain the necessary infrastructure and competencies for appliance reuse and

48. *Id*. at 730.

49. *See generally* Basel Convention, *supra* note 30.

50. Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movements of Hazardous Waste within Africa, *opened for signature* Jan. 30, 1991, 30 I.L.M. 773 [hereinafter Bamako Convention]. The Bamako Convention entered into force on April 21, 1998, by thirty-one countries on the African continent as a response to Article 11 of the Basel Convention, encouraging parties to enter multilateral agreements on hazardous waste. *See* Bamako Convention: Parties, https://www.informea.org/en/treaties/bamako-convention/treaty-parties, (last visited Apr. 5, 2024); *see also id.* art. 11 ¶ 5.

51. The Convention to Ban the importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement of Hazardous wastes within the South Pacific Region (the "Wagani Convention") entered into force the October 21, 2001. *See Waigani Convention*, SECRETARIAT OF THE PAC. REGIONAL ENVT'L PROG., https://www.sprep.org/convention-secretariat/waigani-convention (last visited Apr. 6, 2024).

52. *See* Shiming, *supra* note 45, at 733.

53. *Id*.; *see also* Carroll, *supra* note 10; Yeung, *supra* note 10.

54. *Id*. at 731; *see also* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 64 (explaining that in January 2023, an organized crime group was caught smuggling over eleven million lbs. (331 containers) of e-waste from the Canary Islands to Ghana, Mauritania, Nigeria, and Senegal).

55. *See* Yang, *supra* note 45, at 731.

56. *Id*.

57. *Id*.

58. *Id.*

59. *See* ILO E-WASTE ISSUE PAPER, *supra* note 25, at 7.

60. *Id*.

61. *See* Zhang, *supra* note 24, at 694.

refurbishment.[62] Nevertheless, the global problem of e-waste remains inequitable, mainly affecting developing or emerging economies.

b. Informal Labor Market Working Conditions

Globally, only 22.3 percent of the e-waste generated (equivalent to an average of seventeen pounds per capita per year) was documented as collected and recycled in an environmentally sound manner.[63] Estimates from the International Labor Organization (ILO) state that solid waste management and recycling has provided work for nineteen to twenty-four million people worldwide.[64] Oftentimes this work is not monitored by governments nor reflected in labor statistics.[65] The lack of proper waste management in developing countries has created a large-scale labor market with recyclers working in dire conditions around the world.[66]

The ILO mapped how informal e-waste value chains differ between Argentina, India, and Nigeria and found similarities in how the work is structured and organized. First, distributors buy new and used e-products domestically or from overseas and sell them to consumers directly (individual, public, or corporate consumers).[67] Other collectors buy or collect e-products or scavenge dumps for e-waste.[68] These scavengers, many belonging to disadvantaged groups or minorities, operate in unsafe conditions due to the rudimentary management of e-waste resulting in high exposure to toxic substances.[69] The repairs and refurbishments extend the lifetime of the new and used e-products that they sell for reuse.[70] They also generate e-waste from the equipment that cannot be repaired.[71] According to the ILO, they are among the best-organized actors in this value chain since they specialize in refurbishing specific types of equipment.[72] They manually segregate the equipment that cannot be repaired into marketable components and materials.[73] Then, the recyclers employ techniques such as incineration, chemical extraction, and smelting to transform discarded e-waste into reusable raw resources, which are then supplied to manufacturers as secondary inputs.[74] Finally, downstream vendors purchase the usable e-waste components for resale.[75]

62. *See* ILO E-WASTE ISSUE PAPER, *supra* note 25, at 8; *see also* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 64-67.
63. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 10.
64. *See* ILO E-WASTE ISSUE PAPER, *supra* note 25, at 10.
65. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 31.
66. *Id.* at 35.
67. *See* ILO E-WASTE ISSUE PAPER, *supra* note 25, at 8-10.
68. *Id.* at 9.
69. *Id.* at 9, 16.
70. *Id.*
71. *Id.* at 9-10.
72. *See id.* at 10.
73. *Id.*
74. *Id.* at 9.
75. *See id.* at 9.

Not only does this informal market lead to localized environmental health and environmental pollution, but such material recovery lacks efficiency. The informal e-waste market, although profitable for some, creates many negative externalities for laborers and affected communities. However, it is important to note that policies to reduce e-waste commodities could put informal laborers out of work and lead to further poverty and injustices.[76] E-waste reduction policies should consider parallel job creation programs which seek to reduce negative health and environmental safety effects while minimizing the economic harms to informal laborers.

2. The Harms of Mismanaged E-Waste

a. Impacts on Human Health

When discarded in landfills, e-waste can leach into the soil and water. When burnt, e-waste emits toxic emissions, often heavy metals, which cause significant problems for the environment and human health. Some e-waste contains brominated flame retardants (most of which are found in screens and monitors),[77] which are endocrine-disrupting substances.[78] Endocrine-disrupting chemicals interfere with the body's hormones.[79] Per- and polyfluoroalkyl substances (PFAS)[80] and dioxins[81] are two examples of chemicals that may disrupt the endocrine system.[82] In developing countries, it is common for informal recyclers to handle and process e-waste.[83] Without infrastructure for environmentally sound e-waste management,[84] e-waste may instead be processed through manual removal and open burning sites.[85] This practice

76. Ogunseitan, *supra* note 11, at 19-21.

77. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 50 ("The recycling of plastic containing brominated flame retardants represents a major challenge because of the cost of separating the plastic containing the retardants from other plastics.").

78. WHERE ARE WEEE IN AFRICA?, *supra* note 33, at 3.

79. *Endocrine Disruptors*, NAT'L INST. ENVT'L HEALTH SCIS., https://www.niehs.nih.gov/health/topics/agents/endocrine (last visited Nov. 22, 2024).

80. *Id.* ("Per- and polyfluoroalkyl substances (PFAS) are a large group of chemicals used widely in industrial applications, such as firefighting foam, nonstick pans, paper, and textile coatings.").

81. *Id.* ("Dioxins are a byproduct of certain manufacturing processes, such as herbicide production and paper bleaching. They can be released into the air from waste burning and wildfires.").

82. *Id*.

83. *See, e.g.*, Yeung, *supra* note 10 (reporting on the toxic effects of e-waste in Agbogbloshie, Ghana); *see also* Doane, *supra* note 4 (stating that tens of thousands of people sift through mountains of e-waste in Ghana).

84. WHERE ARE WEEE IN AFRICA?, *supra* note 33, at 3.

85. *See* Doane, *supra* note 4.

releases toxins (such as mercury[86] and lead[87]) into the environment which then bioaccumulate in human tissue.[88] Informal workers and surrounding populations of such sites have been found to have polycyclic aromatic hydrocarbons (chemicals that occur naturally in coal, crude oil, and gasoline) in their bodies, resulting in "carcinogenic, non-carcinogenic, mutagenic, genotoxic, neurotoxicity and endocrine disruption and neonatal issues."[89] They may also have respiratory tract problems, other diseases such as malaria, or physical injuries resulting from the dangerous work conditions.[90]

The World Health Organization (WHO) states that children are the most vulnerable to physical health harms as well as to experiencing negative learning and behavior outcomes.[91] Children are often involved in waste picking and may serve as cheap labor because their dexterity enables them to take apart small items.[92] For such manual dismantling, plastic chipping, and melting, workers must use acid and other chemicals and techniques that release polluting fumes into the atmosphere.[93] This work is generally carried out without adequate personal protective equipment.[94] While air pollution most directly impacts informal e-waste recycling workers, the air can also be polluted for thousands of miles, including in the food markets[95] of neighboring cities.[96]

b. Impacts on the Natural Environment

Hazardous practices, such as open burning or using mercury to extract gold, contaminate air, soil, and water, and endanger biodiversity.[97] Pollutants derived from e-waste, particularly heavy metals, resist natural decomposition and can

86. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 50 ("New provisions on how to treat [mercury] are set out in the Minamata Convention on Mercury, which was adopted in 2013 and entered into force in 2017. A milestone for chemical safety, the Convention has since been amended to include (when alternatives are available) the phasing out of certain uses of mercury by 2025, including for compact fluorescent lamps and satellite propellant."); *see generally Minamata Convention on Mercury - Text and Annexes*, UN ENVT'L PROGRAMME, https://minamataconvention.org/en/resources/minamata-convention-mercury-text-and-annexes (last visited, Apr. 5, 2024).

87. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 14.

88. Thomas Maes & Fiona Preston-Whyte, *E-waste it wisely: lessons from Africa*, 4 SN APPLIED SCI. 1, 5 (2022).

89. *Id*.

90. *Id.*

91. *Electronic waste (e-waste)*, WORLD HEALTH ORG., https://www.who.int/news-room/fact-sheets/detail/electronic-waste-%28e-waste%29 (last updated Oct. 1, 2024).

92. *Id*.

93. Sarker M. Parvez et al., *Health Consequences of Exposure to E-waste: An Updated Systematic Review*, 5 LANCET PLANET HEALTH e905, e920 (2021); *E-Waste & its Negative Effects on the Environment*, ELYTUS, https://elytus.com/blog/e-waste-and-its-negative-effects-on-the-environment.html (last visited Jan. 20, 2025).

94. *Id.*

95. Yeung, *supra* note 10 (reporting on the health risks that enter the food chain, which is problematic when the Agbogbloshie area in Ghana has one of the largest food markets in the city of Accra).

96. *Id.*; *see* Doane, *supra* note 4.

97. Parvez et al., *supra* note 93.

persist indefinitely in ecosystems.[98] Soil can be contaminated when e-waste is improperly disposed of in regular landfills or illegally dumped.[99] The leaching of heavy metals (lead, arsenic, cadmium, etc.) may then contaminate groundwater and crops.[100] Chemicals released into ponds, rivers, and streams can acidify the water, harming marine and freshwater organisms miles away and impacting drinking water.[101] The health impacts can extend catastrophically across wildlife and humans.[102] And this is without accounting for the polluting impacts of both large-scale and artisanal mineral mining needed for e-product production.[103]

c. Recycling and Fire Hazards

While the circular economy[104] incentivizes recycling, not all recycling is positive.[105] Recycling facilities in the United States and Canada use large machines to crush waste.[106] While recyclers try to get rid of lithium batteries before products enter the crusher, some small e-products such as smartphones, air-pods, and smartwatches still end up in the machine.[107] This occurs even as EPA publicly advises individuals not to put items with lithium-ion into household garbage or recycling bins.[108] The dissembling process is made more difficult as many manufacturers now glue smartphones together.[109] Lithium-ion batteries that enter the crusher can self-ignite as they release energy under pressure, potentially setting fire to surrounding materials.[110] According to a 2018

98. *Id.*

99. *See* ELYTUS, *supra* note 93.

100. *Id.*

101. *Id*.

102. *Id*.

103. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 50. The authors encourage "[u]rban mining (i.e. the extraction of resources from waste instead of the Earth's crust)" because through e-waste recycling, 1,984 billion pounds of ore were not excavated during primary mining and 114 billion pounds of CO2 equivalent emissions were avoided." *Id.*

104. Defined by the European Parliament as being a "model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible." *See Circular Economy: Definition, Importance and Benefits*, EUROPEAN PARLIAMENT (May 24, 2023), https://www.europarl.europa.eu/topics/en/article/20151201STO05603/circular-economy-definition-importance-and-benefits.

105. Dropping a device at a recycling station does not guarantee safe disposal. Many recycling companies sell it to brokers who ship the device to the developing world, where enforcement of environmental laws is weak. *See* Carroll, *supra* note 10.

106. Basel Action Network, *Our Right to Repair: An Update from the Front Lines*, YOUTUBE (Sept. 12, 2021), https://www.youtube.com/watch?v=ghUEU8a8N6s [hereinafter Basel Action Network, *Right to Repair*].

107. Ciara Nugent, *Why Recycling Plants Keep Catching on Fire*, TIME (Apr. 13, 2023), https://time.com/6271576/recycling-plant-fire-indiana.

108. *Frequent Questions on Lithium-Ion Batteries*, EPA, https://www.epa.gov/recycle/frequent-questions-lithium-ion-batteries (last visited Apr. 5, 2024); *see generally* AN ANALYSIS OF LITHIUM-ION BATTERY FIRES IN WASTE MANAGEMENT AND RECYCLING, EPA (July 2021), https://www.epa.gov/system/files/documents/2021-08/lithium-ion-battery-report-update-7.01_508.pdf.

109. *See* Basel Action Network, *Right to Repair*, *supra* note 106.

110. *See* Nugent, *supra* note 107.

California Product Stewardship Council survey, 40 percent of fires at the state's waste management facilities were triggered by lithium-ion batteries.[111] These fires put recyclers at risk, are costly, contribute to air pollution, and can also result in biodiversity loss.[112] Nonetheless, recycling e-waste is a complex and expensive process, with many ripple effects addressed in this Note.

E-waste creates informal toxic economies that are harmful to health and the environment. While this Note only begins to address the negative externalities of EEE, the fabrication, use, and disposal of such consumer products each creates high environmental impacts. Mining critical resources for production requires land, water, and energy. It also brings negative socioeconomic impacts, such as public health hazards and human rights abuses,[113] including child labor.[114] Additional waste and pollution are generated when raw materials for e-products are extracted, manufactured, transported, distributed, and sold.[115] A mobile phone generates 80 percent of its total greenhouse gas emissions from extraction and production of raw materials, while only 14 percent from use and 1 percent from end-of-life treatment.[116] The lifecycle of a mobile phone therefore has a high environmental impact that goes beyond the scope of the problems related to e-waste.[117] Yet tackling the end-of-life treatment of such a device is an important step in limiting overall negative impact.

II. HOW INTERNATIONAL LAW HAS ADDRESSED E-WASTE POLLUTION

The issues highlighted above are not new to e-waste and recycling specialists. In fact, the international community signed an infamous international treaty over thirty years ago covering and criminalizing the trade of hazardous waste: the Basel Convention. The United States holds status as a signatory and observer state to this agreement, as a member party of the Organization for Economic Co-operation and Development (OECD).

A. The Basel Convention

The United Nations Environmental Program's (UNEP) Basel Convention was adopted on March 22, 1989 in Basel, Switzerland, and entered into force on May 5, 1992.[118] There are 191 parties to the Basel Convention, including the United States, which signed on March 22, 1990, but to this day has not ratified

111. FIRE INCIDENT RESULTS 4/9/18, CAL. PROD. STEWARDSHIP COUNCIL (2018), https://www.calpsc.org/_files/ugd/ad724e_312a645a03374a038119f5e7790dc79a.pdf.

112. *Id.*

113. *See, e.g., Powering Change of Business as Usual*, AMNESTY INT'L (Sept. 12, 2023) https://www.amnesty.org/en/latest/news/2023/09/drc-cobalt-and-copper-mining-for-batteries-leading-to-human-rights-abuses.

114. *See* Feza Tabassum Azmi, *The Little Hands of Labour Behind your Smartphone*, THE WIRE (June 16, 2021), https://thewire.in/rights/child-labour-unicef-mines-amnesty-international-ilo.

115. *See* ILO E-WASTE ISSUE PAPER, *supra* note 25, at 7.

116. *Id.*

117. *Id*.

118. *See* UNEP, *supra* note 1.

the treaty.[119] The Convention's overarching goal is to protect human health and the environment from the dangers posed by transboundary movements of hazardous waste.[120] It was originally created to prevent developed countries from disposing hazardous waste in developing countries, where regulation and enforcement mechanisms were lacking.[121]

The Basel Convention contains soft and hard law provisions.[122] The soft law provisions are non-binding obligations on the countries and are considered one of the most important contributions of the Basel Convention.[123] The soft law provisions call for: (1) national self-sufficiency in waste management,[124] (2) minimizing all forms of transboundary movement of hazardous waste and other waste,[125] (3) minimizing the generation of hazardous and other waste,[126] and (4) ensuring environmentally sound management of produced waste.[127] In contrast, the hard law provisions define and control certain wastes,[128] such as hazardous waste according to (1) Annexes I, III, and VIII of the Basel Convention; and (2) the national law of the country involved in the trade scenario; Annex II controls other wastes, including plastics.[129]

Controls on hazardous and other waste trade occur according to a prior informed consent (PIC) procedure.[130] The PIC procedure forms the heart of the Basel Convention control system.[131] It essentially allows the importing country

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119. *Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*, BASEL CONVENTION, https://www.basel.int/Countries/StatusofRatifications/PartiesSignatories/tabid/4499/Default.aspx#enote1 (last visited Mar. 10, 2024).

120. Basel Convention, *supra* note 30, art. 2 ¶ 8.

121. Basel Convention, *Overview*, (last visited Mar. 10, 2024), https://www.basel.int/TheConvention/Overview/tabid/1271/Default.aspx.

122. Basel Action Network, *Responding to the New Basel Convention Rules on Plastic Waste Exports/a forum for Recyclers*, YOUTUBE (Jan. 12, 2021), https://www.youtube.com/watch?v=0lPOP9hNWT8 [hereinafter Basel Action Network, *Plastics*].

123. *Milestones*, BASEL CONVENTION, https://www.basel.int/TheConvention/Overview/Milestones/tabid/2270/Default.aspx (last visited Mar. 10, 2024).

124. Basel Convention, *supra* note 30, art. 4 ¶ 2(b).

125. *Id.* art. 4 ¶ 2(d).

126. *Id.* art. 4 ¶ 2(a).

127. *Id.* art. 4 ¶ 8.

128. *Id.* art. 1.

129. *See* Basel Action Network, *Plastics*, *supra* note 122.

130. Basel Convention, *supra* note 30, art. 6. It is based on four key stages: (1) notification; (2) consent and issuance of movement document; (3) transboundary movement; and (4) confirmation of disposal. *See Controlling transboundary movements*, BASEL CONVENTION, https://www.basel.int/Implementation/Controllingtransboundarymovements/Overview/tabid/4325/Default.aspx (last visited Oct. 28, 2023).

131. However, the recycling industry criticizes the PIC due to high costs and delays for importers and exporters. *See* Hannah Carvalho, *What Recyclers Can Learn from the 2022 Basel Convention Conference*, RECYCLED MAT. ASSOC. NEWS (July 22, 2022), https://www.isrinews.org/what-recyclers-can-learn-from-the-2022-basel-convention-conference; *see also* Basel Action Network, *Update from the COP15 on Basel Meeting in Geneva*, YOUTUBE (June 22, 2022) https://www.youtube.com/watch?v=_PnjW4AoV6o [hereinafter Basel Action Network, *COP15*] (stating that it can take months or even years to process PIC and that nothing is digitized); *see also* Marissa Heffernan, *BAN Director gives his take on recent Basel amendment*, E-SCRAP NEWS (June 30, 2022), https://resource-recycling.com/e-scrap/2022/06/30/ban-director-gives-his-take-on-recent-basel-amendment; *see also* UNEP/CHW.15/9 (July 26-30, 2021), https://www.brsmeas.org/20212022COPs/MeetingDocuments/tabid/8810. But a new

to make informed choices about receiving any waste.[132] There are also controls through individual jurisdictions that can decide to prohibit imports.[133] And, parties may enter into separate agreements with non-parties, like the United States, on the condition that these arrangements maintain or exceed the environmentally sound management of hazardous waste and other waste as required by the Basel Convention.[134] The United States has a bilateral agreement with Canada[135] and can trade with the other non-parties of the Basel Convention.[136] The United States acts as an observer in the conference of the parties (COP) and participates in technical working groups.[137]

The United States is therefore not compelled to have federal legislation on hazardous waste and to this day, still does not have any mandatory federal law on e-waste.[138] Indeed, it only has the Resource Conservation and Recovery Act (RCRA),[139] which regulates e-waste disposal by only placing restrictions on the disposal of CRT.[140] RCRA is otherwise largely ineffective for safely processing e-waste due to exemptions and exclusions built into the regulation. Neither RCRA nor any other federal hazardous waste law[141] cover products such as laptops or cell phones.[142] Businesses can avoid liability for pollution by sending

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"e-PIC" process is being currently discussed led by the private sector. Indeed, at COP-15 in 2022, a formal decision was passed to create the digital prior informed consent procedure and assemble a working group. Additionally, a new review of this Article gathers practical experiences of e-waste exports from low and middle-income industries, which the Basel Action Network believes is useful to consider during these updates. *See, e.g.*, *Practical Experiences with the Basel Convention: Challenges, Good Practice and Ways to Improve Transboundary Movements of E-Waste in Low and Middle Income Countries* 9 (2022), https://www.step-initiative.org/files/_documents/publications/PREVENT-StEP_Practical_Experiences_Basel%20Convention_discussion-paper%202022.pdf.

132. Any trade without this procedure is a criminal act under international law. *See* Basel Convention, *supra* note 30, art. 9. However, there are no consequences for authorities who fail to process the paperwork, which creates room for ambiguity. *See* Heffernan, *supra* note 131.

133. Basel Convention, *supra* note 30, art. 4 ¶ 1. As another example, consider China's 2018 ban on e-scrap imports. *See* Zhang, *supra* note 24, at 694.

134. *Id.* art. 11 ¶ 1.

135. Agreement Between Canada and the United States Concerning the Transboundary Movement of Hazardous Waste, Can.-U.S., Oct. 28, 1986, 32 I.L.M. 289, 297-98.

136. E.g., South Sudan, Haiti, etc.

137. Basel Convention, *supra* note 30, art. 15 ¶ 6.

138. *See* Kammy Lai, *E-Waste Regulation Under the RCRA*, GEO. WASH. J. ENERGY & ENV'T L. (Nov. 26, 2011), https://gwjeel.com/2011/11/26/e-waste-regulation-under-the-rcra.

139. 42 U.S.C. § 6901 *et seq.* (1976).

140. CRTs exported for reuse are exempt from notification and consent protocols, while those destined for recycling must comply with these requirements. However, at the export stage, it is impossible to distinguish between CRTs intended for reuse versus recycling. Consequently, enforcement authorities must depend on the exporter's declaration regarding the purpose of the shipment. DAVID HUNTER ET AL., INT'L L.& POL'Y 965 (6 ed. 2006); *see also* JEFFREY GABA, *Exporting Waste: Regulation of the Export of Hazardous Wastes from the United States*, 36 WM & MARY ENV'T L. & POL'Y REV. 403, 434-35 (2012).

141. For example, the Toxic Substance Control Act (TSCA) of 1976 provides EPA with authority to require reporting, recordkeeping, and testing, and to enforce restrictions relating to six chemical substances (PCBs, asbestos, radon, lead, formaldehyde, mercury) that may be contained in e-products. *Toxic Substances Control Act (TSCA) and Federal Facilities*, EPA, https://www.epa.gov/enforcement/toxic-substances-control-act-tsca-and-federal-facilities (last updated July 26, 2024).

142. HUNTER ET AL., *supra* note 140, at 965.

used e-products for reuse and recycling.[143] Such products are considered a commodity (as opposed to hazardous waste) since they are sold before the disassembling process, creating a major loophole in U.S. regulation.[144]

B. Two Limits to the Basel Convention

1. The Repairable Claim Loophole in the Technical Guidelines on E-Waste

Tons of hazardous wastes are sent to low income countries, most of it getting past customs under the pretense of being fixable.[145] Indeed, as much as the circular economy encourages repair, reuse, and recycling, a major loophole in the Basel Convention is found in Article 32(b) of the technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment ("the Technical Guidelines").[146] It suggests any "broken untested or working equipment that is claimed to be destined for failure analysis, repair or refurbishment can fall outside of the scope of the Basel [C]onvention, without requiring any Basel controls as long as the export arrangement meets five minimal requirements."[147] This creates a loophole because these requirements are not enough to ensure that e-waste is properly and safely disposed of, regardless of whether some components are reused or recycled.

The Technical Guidelines, particularly regarding the distinction between waste and non-waste under the Basel Convention, were adopted by the Parties to the Basel Convention at COP-12 on June 23, 2015 "on an interim" basis.[148] According to the Basel Action Network (BAN), an NGO specializing in this matter, these incomplete and unfinished Technical Guidelines were not decided as a result of an agreement.[149] Several parties voiced their strong disagreement with the document due to issues regarding the transboundary movement of used electronics, specifically those destined for repair and refurbishment.[150] However,

143. Lai, *supra* note 138.

144. *See generally* Jeremy Knee, *Guidance for the Awkward: Outgrowing the Adolescence of State Electronic Waste Laws*, 33 ENVIRONS ENV'T L. & POL'Y J. 157, 162 (2009) (discussing the shortcomings of RCRA); *see also* Pescatore, *supra* note 28, at 126-27.

145. *See also* Doane, *supra* note 4.

146. *Previously Adopted Technical Guidelines*, BASEL CONVENTION, https://www.basel.int/Implementation/Publications/TechnicalGuidelines/tabid/2362/Default.aspx (last visited Apr. 7, 2024).

147. The five requirements can be summarized as follows: "(1) the trader must claim that the nonfunctional electronic equipment is being exported for failure analysis or repair, (2) the exporter needs to sign a contract with importing country partner asserting environmentally sound management, proper management of residuals, and make a final report, (3) the exporter must make a declaration that none of the equipment within the consignment is defined as or considered to be waste in any of the countries involved in the transport, (4) ensure that each piece of equipment is individually protected against damage, (5) document is [needed] to accompany the shipment as to the origin and nature of the equipment the existence of contract and declaration." Basel Action Network, *COP15*, *supra* note 131.

148. UNEP/CHW.12/5/Add.1/Rev.1, 23 June 2015.

149. BASEL ACTION NETWORK, THE RESPONSIBLE GUIDELINE ON TRANSBOUNDARY MOVEMENTS OF USED ELECTRONIC EQUIPMENT TO PROMOTE AN ETHICAL CIRCULAR ECONOMY UNDER THE BASEL CONVENTION 1 (Apr. 25, 2019).

150. *Id.* at 1-3.

there were strong lobbies from industry, hardware manufacturers representatives, and the EU.[151] The repairable claim loophole thus came into effect.

As a result, the main prior informed consent procedure is not applied to such used e-products destined for repair and refurbishment.[152] There are no legal frameworks or controls to ensure that exporters abide by the requirements.[153] Moreover, the shipments are rarely controlled at the borders, putting the burden on receiving countries to ensure compliance.[154] The repair activities happen as contracts between individuals or companies and are governed by civil and contractual law without involving the Basel Convention's binding regulation.[155] This violates the intent of the Basel Ban Amendment,[156] which came into force on December 5, 2019, to prohibit the export of hazardous wastes from member states of the OECD, and Liechtenstein to all other countries.[157]

The good news is that at COP-15 in 2022, twenty-two developing Parties demanded a reform of paragraph 32(b) of the Technical Guidelines. The EU and others also suggested adding an entry into Annex IV (used to define "waste") for preparation for reuse, such as repair and refurbishment. According to the Basel Action Network, this is a good policy to ensure that environmentally sound management takes place.[158] It would also prevent bad actors from avoiding the Basel Convention's framework and ensure legitimate trades using the prior informed consent procedures.[159] Hopefully, in the near future, e-products will no longer need to be traded for reuse or repair,[160] in particular if states adopt right-to-repair legislation.[161]

2. Illegal Trade of E-Waste Despite Basel Convention Article 9

While there is little data on illegal e-waste trade, estimates from the EU-funded Countering WEEE Illegal Trade[162] found that approximately a third of all WEEE was legitimately reported to authorities as gathered and treated across Europe in 2012.[163] As discussed, WEEE can be valuable on the black market,[164]

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151. *Id.*

152. *See* Basel Action Network, *COP15*, *supra* note 131.

153. *Id.*

154. *Id.*

155. *Id.*

156. *See The Basel Convention Ban Amendment*, BASEL CONVENTION, https://www.basel.int/Implementation/LegalMatters/BanAmendment/Overview/tabid/1484/Default.aspx (last visited Apr. 7, 2024).

157. *Id.*; *see also* Basel Convention, *supra* note 30, art. 4A.

158. *Id.*

159. *Id.*

160. The noteworthy caveat being that each party to the Basel Convention regulates e-waste domestically prior to any trade—if at all.

161. *See infra*.

162. *Periodic Report Summary 2 - CWIT (CWIT - Countering WEEE Illegal Trade)*, EU COMM'N, https://cordis.europa.eu/project/id/312605/reporting (last updated June 8, 2016).

163. *Id.*

164. *See* Yeung, *supra* note 10 (noting that illicit e-waste dumping is lucrative and far cheaper than proper recycling).

attracting opportunistic individuals and criminal business networks.[165] Countering WEEE Illegal Trade reported that the EU exported 1.3 million tons of undocumented e-waste, and even more was mismanaged and illegally traded.[166]

The Basel Action Network and the Massachusetts Institute of Technology conducted a two-year investigation by placing 200 geolocating tracking devices inside televisions, computers, and other e-waste that they dropped all over the United States at recyclers, electronic take-back programs, and donation centers.[167] The results of the investigation found that a third of the tracked devices went overseas, traveling to Canada, Mexico, Thailand, China, Hong Kong, etc.[168] The investigation tracked six of seventeen CRT monitors being smuggled from California to China.[169] The same organization drafted subsequent reports that discovered more illegal exports of e-waste from Australia, Canada, and the EU,[170] despite Art. 9 ¶ 1 of the Basel Convention criminalizing traffic of hazardous waste.[171] Furthermore, e-waste shipments continue to circumvent the Basel and Bamako Conventions in Africa's most active ports of Durban, South Africa, Bizerte, Tunisia and Lagos, Nigeria. For over a decade, the Basel Convention Conference of the parties have called for more financial support and collaboration to combat the illegal e-waste trade, in vain.[172]

C. Organization for Economic Co-operation and Development

While the United States has not ratified the Basel Convention[173] and is therefore not bound by its provisions, it is a member of the Organization for Economic Co-operation and Development (OECD)[174] along with thirty-seven

165. EU COMM'N, *supra* note 162.

166. *Id*.; *see also* ILO E-WASTE ISSUE PAPER, *supra* note 25, at 8.

167. DISCONNECT: GOODWILL AND DELL, EXPORTING THE PUBLIC'S E-WASTE TO DEVELOPING COUNTRIES, THE E-TRASH TRANSPARENCY PROJECT, BASEL ACTION NETWORK 7 (2016).

168. *Id.*

169. *Id*.

170. *e-Trash Transparency Project*, BASEL ACTION NETWORK, https://www.ban.org/trash-transparency (last visited Apr. 7, 2024).

171. Basel Action Network, *Right to Repair*, *supra* note 106 ("Illegal traffic is defined as a transboundary movement of hazardous wastes: (a) without notification pursuant to the provisions of the Convention to all States concerned; (b) without the consent of a State concerned; (c) through consent obtained by falsification, misrepresentation or fraud; (d) that does not conform in a material way with the documents; or (e) that results in deliberate disposal (e.g. dumping) of hazardous wastes in contravention of the Convention and of general principles of international law, shall be deemed to be illegal traffic.").

172. HUNTER ET AL., *supra* note 140, at 965.

173. Implementing legislation is required before the President can ratify the treaty. The United States signed the Basel Convention in 1990, and the Senate gave its advice and consent to ratify in 1992. *See Frequent Questions on International Agreements on International Agreements on Transboundary Shipments of Waste*, EPA, https://www.epa.gov/hwgenerators/frequent-questions-international-agreements-transboundary-shipments-waste#basel (last visited Apr. 7, 2024) [hereinafter EPA, *International Agreement FAQs*].

174. *Id*. (explaining that OECD is an international organization with a goal to achieve "sustainable economic growth, employment, and an increased standard of living, while simultaneously ensuring the protection of human health and the environment").

other member countries.[175] As a member, the United States is bound by the OECD's decisions. On March 30, 1992, the OECD passed a decision that applies to transboundary movements of waste destined for recovery operations between OECD member countries.[176] This agreement[177] aims to provide a framework for such countries to control the transboundary movement of recoverable waste in an environmentally sound manner.[178] The agreement is intended to facilitate the trade of such waste and minimize the possibility that such waste will be abandoned or handled illegally.[179] It provides a tiered level of control with green and amber[180] as the two categories of waste.[181]

Therefore, unlike the Basel Convention, which covers all transboundary movements of hazardous waste for recovery or disposal, the OECD agreement covers only a subset of such waste "sent for recovery" between the OECD member countries participating in the OECD convention.[182] Yet, since the United States is part of the OECD, it can legally trade recoverable waste with other member parties. Nevertheless, trading e-products for recovery seems like an international compromise that could be the source of the issues raised in this Note and the continued illegal trade of e-waste.

D. Takeaways from the International Agreements and Implications on the United States

Because the United States is an OECD member, and other OECD member states are part of the Basel Convention, many provisions of the treaty, notably the PIC procedure on transporting hazardous waste, affect the United States. Additionally, there are repair/reuse/recovery loopholes in both the Basel Convention and the OECD policy, making it difficult to trace what kind of e-waste actually is traded. There are several different notions of hazardous and non-hazardous waste on the international level, and with so few controls, it is almost expected that illegal trade occurs. Nevertheless, international cooperation is necessary to address the environmental and public health threats from e-waste pollution and to set rules for exporting and importing e-waste.[183] International law can ensure minimum standards are in place to protect the public health of

175. *Countries*, ORG. ECON. CO-OPERATION & DEV., https://www.oecd.org/en/countries.html (last visited Apr. 7, 2024).

176. *Decision of the Council C(92)39/Final Concerning the Control of Transfrontier Movements of Waste Destined for Recovery*, ORG. ECON. CO-OPERATION & DEV., https://www.oecd.org/env/waste/guidance-manual-control-transboundary-movements-recoverable-wastes.pdf, (last visited Apr. 7, 2024).

177. This has been amended several times since 1992 and generally considers any changes that the Basel Convention has incorporated after a conference of the parties. *See* EPA, *International Agreement FAQs*, *supra* note 173.

178. *Id*.

179. *Id*.

180. *Resource efficiency and circular economy*, ORG. ECON. CO-OPERATION & DEV., https://www.oecd.org/env/waste/guidance-manual-control-transboundary-movements-recoverable-wastes.pdf (last visited Mar. 27, 2024).

181. *See* EPA, *International Agreement FAQs*, *supra* note 173.

182. *Id*.

183. HUNTER ET AL., *supra* note 140, at 900-01.

importing countries.[184] Furthermore, the Basel Convention led many countries to create, revise, and/or enact regulation governing the import and export of hazardous waste,[185] after which the quality and enforcement of national legislation is crucial for their success.[186]

Now, this Note will analyze existing policies that could be strengthened or introduced on the federal or state level. Amongst the many policies to combat the e-waste problem (extended producer responsibility,[187] e-waste recycling or collection rate targets[188], advance recycling fee,[189] take-back policies,[190] and electronic bonus cards[191]), this Note focuses on one idea growing in popularity in the United States and internationally: the right-to-repair.

III. WILL THE RIGHT-TO-REPAIR POLICY TACKLE THE E-WASTE PROBLEM?

A. The Right-to-Repair Is a Key Circular Economy Policy

Implementing a circular economy approach to e-waste enables viewing disregarded devices as valuable assets that, when handled appropriately, can sustain incomes, create job opportunities, facilitate technological access, promote technical advancements, transfer expertise, and supply capital to produce second-hand commodities with recovered materials.[192]

The right-to-repair is a key element of the circular economy now being discussed worldwide.[193] The "circular economy" replaces the traditional linear

184. *Id*.

185. It also enabled parties to create a multistakeholder public-private partnerships like the Partnership For Action on Computing Equipment (PACE) and the Mobile Phone Partnership Initiative (MPPI) that produced guidelines on sound management of used and end-of-life computing equipment, respectively mobile phones. *See PACE Guidelines, Manual and Reports*, BASEL CONVENTION, https://www.basel.int/Implementation/TechnicalAssistance/Partnerships/PACE/PACEGuidelines,ManualandReports/tabid/3247/Default.aspx, (last visited Mar. 26, 2024); *Mobile Phone Partnership Initiative (MPPI)*, BASEL CONVENTION, https://www.basel.int/Implementation/TechnicalAssistance/Partnerships/MPPI/Overview/tabid/3268/Default.aspx (last visited Mar. 26, 2024).

186. CORNELIS P. BALDÉ ET AL., *supra* note 2, at 42.

187. *Id.* at 69.

188. *Id.* at 31.

189. California uses this model for covered electronic devices—a video display device, containing a screen greater than four inches, measured diagonally—where consumers, when purchasing the product, pay retailers a fee, which goes into a fund supporting state-wide e-waste management. *See e.g.*, CAL. PUB. RES. CODE §§ 42460 *et seq.* (West); *see also Covered Electronic Waste (CEW) Recycling Program*, CALRECYCLE, https://calrecycle.ca.gov/Electronics/CEW (last visited Mar. 26, 2024).

190. *See generally* Feifei Shan et al., *Comparison of three E-Waste take-back policies*, 242 INT'L J. PROD. ECON. 1 (2021).

191. *See generally* Tetiana Shevchenko et al., *Understanding Consumer E-Waste Recycling Behavior: Introducing a New Economic Incentive to Increase the Collection Rates*, 11 SUSTAINABILITY 1 (2019).

192. ILO E-WASTE ISSUE PAPER, *supra* note 25, at 3.

193. The right-to-repair is seen as a key step for the EU to achieve a circular economy by 2050. *See Right to repair: the EU's actions to make repairs more attractive*, EU PARLIAMENT, https://www.europarl.europa.eu/topics/en/article/20220331STO26410/why-is-the-eu-s-right-to-repair-legislation-important (last updated Apr. 24, 2024); *see also Circular Economy: Definition, Importance and Benefits*, EU PARLIAMENT, https://www.europarl.europa.eu/topics/en/article/20151201STO05603/circular-economy-definition-importance-and-benefits (last updated May 24, 2023).

model of "extract, make, use and dispose" and includes recycling, repair, rental, and remanufacture.[194] Embracing the circular economy reduces material extraction, energy consumption, and waste generation.[195] Repairing a smartphone, for instance, keeps as much of the "embodied energy" as possible in each product.[196] In other words, it retains the total energy consumed throughout the device's lifecycle, from raw material extraction to manufacturing, transportation, and assembly.[197]

The circular economy can also be a source of job creation that could result in net job gains. The International Labor Organization estimated that embracing a circular economy would create six million new employment opportunities worldwide.[198] Building a reuse and repair economy can also create local jobs.[199] Cities across the United States (Austin, Portland, Cleveland), the United Kingdom, Kenya, and the EU have implemented programs that make repair and reuse an easy, affordable, and attractive alternative to buying new products.[200] For example, initiatives in West African countries train workers in mobile phone repair, in turn providing a marketable technological employment opportunity.[201] Initiatives like these drive economic growth and community self-reliance.

European cross-country public opinion surveys find that approximately two-thirds of surveyed citizens in the EU would prefer to repair their products than buy new ones.[202] Additionally, the European Environmental Bureau found that prolonging the operational lifespan of all washing machines, portable computers, vacuum cleaners, and smartphones in the EU by an additional twelve months would save four million tons of carbon dioxide annually by 2030.[203] With such findings, the right-to-repair seems like a win-win solution to limit the generation of e-waste production and safeguard the environment and human health.

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194. INT'L LABOR OFF., WORLD EMPLOYMENT AND SOCIAL OUTLOOK 2018: GREENING WITH JOBS 37 (2018), https://www.ilo.org/wcmsp5/groups/public/—-dgreports/—-dcomm/—-publ/documents/publication/wcms_628654.pdf.

195. *Recycling isn't the Answer; It's the Last Resort*, IFIXIT, https://www.ifixit.com/Right-to-Repair/Recycling, (last visited Apr. 7, 2024).

196. *Id*.

197. *Id*.

198. *See* INT'L LABOR OFF., *supra* note 194.

199. C40 Cities Climate Leadership Group & C40 Knowledge Hub, *How to Grow Your City's Reuse and Repair Economy,* C40 KNOWLEDGE HUB (Oct. 2022), https://www.c40knowledgehub.org/s/article/How-to-grow-your-city-s-reuse-and-repair-economy?language=en_US.

200. *Id*.

201. *See* CORNELIS P. BALDÉ ET AL. 2024, *supra* note 2, at 64.

202. EUROPEAN COMM'N, BEHAVIOURAL STUDY ON CONSUMERS' ENGAGEMENT IN THE CIRCULAR ECONOMY 50 (2018), https://trinomics.eu/wp-content/uploads/2018/10/CHAFEA2018-Behavioural-study-on-consumer-engagement-in-the-circular-economy.pdf.

203. *France Seeks to Reduce E-waste and Boost Culture of Repair*, WASTE360 (Feb. 9, 2021), https://www.waste360.com/e-waste/france-seeks-to-reduce-e-waste-and-boost-culture-of-repair.

1. A Movement Led by Consumers for Consumers

The right-to-repair movement is led by consumer activists who wish for the resources to repair products they have bought. One of the goals of the movement is to make the necessary tools and product design information accessible to individuals and repair shops. The right-to-repair movement also seeks to allow consumers to customize their products with software and to encourage repair-friendly designs.[204] Repair advocates contend that consumers keep their products longer when repairs are easier.[205] The movement has also entered the space of e-waste and smartphones.[206] This movement has urged tech companies to provide resources to revive and repair electronic devices.[207] Encompassed here is the idea that consumers should have the right to repair a product they purchased from the manufacturer by selecting a repair service of their choice.[208]

Advocates for the right-to-repair maintain that manufacturers are increasingly locking up independent repairers through specialized patented hardware, restricting information to service manuals, and not giving access to replacement parts.[209] They call for information to be shared with the tools and knowledge so that a consumer can independently decide how to repair a broken object.[210] Some even consider the right-to-repair a "fundamental human right."[211] While categorizing it as a human right may be far-fetched for certain industries, restricting this privilege results in an increasingly monopolized repair industry and higher consumer expenses. Proponents also contend that such limitations contradict sustainable practices.[212]

Regarding electronic products, advocates also suggest that repair service providers should be housed by recycling centers, because recyclers have the appropriate knowledge to disassemble and often refurbish products. Workers can also resell the refurbished products.[213] Despite these benefits, companies, manufacturers, and politicians have opposed right to repair measures because of certain concerns, discussed below.[214]

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204. Simo Elalj, *What Is the Right to Repair Movement and Why It Matters*, REFURBME (Oct. 17, 2023), https://www.refurb.me/blog/the-right-to-repair-movement-all-you-need-to-know (last visited Apr. 7, 2024).

205. Luyi Yang et al., *Research: The Unintended Consequences of Right-to-Repair Laws*, HARV. BUS. REV. (Jan. 19, 2023), https://hbr.org/2023/01/research-the-unintended-consequences-of-right-to-repair-laws; *see generally* Chen Jin et al., *Right to Repair: Pricing, Welfare, and Environmental Implications*, 69 MGMT. SCI. 1017, 1036 (2022).

206. Yang et al., *supra* note 205.

207. Irene Calboli, *The Right to Repair: Recent Developments in the USA*, WIPO MAG. (Aug. 2023), https://www.wipo.int/wipo_magazine_digital/en/2023/article_0023.html.

208. *Id.*

209. *We Must Secure Our Right to Repair Everything We Own*, IFIXIT, https://www.ifixit.com/Right-to-Repair (last visited Feb. 23, 2024).

210. *Id.*

211. Cody Godwin, *Right to Repair Movement Gains Power in US and Europe*, BBC NEWS (July 7, 2021), https://www.bbc.com/news/technology-57744091.

212. Calboli, *supra* note 207.

213. *See* Basel Action Network, *Plastics*, *supra* note 122.

214. *See infra* III. A.4.

2. The Right-to-Repair in the United States

The Biden White House defines right-to-repair as "the right to fix something you own when it breaks—either by yourself or by taking it to an independent repair shop."[215] Doing so helps extend the use of products.[216] In 2023 EPA affirmed that a right-to-repair goes hand in hand with environmental laws when affirming its support to the National Farmers Union, who strongly support federal legislation that would ensure farmers and independent mechanics have equitable and affordable access to repair farm equipment.[217]

Considered a key pillar of "Bidenomics," the right-to-repair lowers costs, gives consumers more choice on where and how to get devices fixed, and increases economic competition.[218] It also increases opportunities for small businesses.[219] President Biden endorsed this policy in his Executive Order on Promoting Competition on July 9, 2021.[220] In April 2023, the Federal Trade Commission (FTC) promoted "efforts to expand consumer choices and competition when it comes to repairing products."[221] The FTC declared that it "[stands] ready to work with legislators, either at the state or federal level, to ensure that consumers and independent repair shops have appropriate access to replacement parts, instructions, and diagnostic software."[222]

This federal endorsement is part of a larger gain in momentum for the movement nationwide.

3. The Right-to-Repair Is Gaining Momentum in State Legislatures

At least forty states have introduced some form of right-to-repair legislation.[223] In the past year, four states enacted a right-to-repair law: New

215. *Readout of the White House Convening on Right to Repair*, THE WHITE HOUSE (Oct. 25, 2023), https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/25/readout-of-the-white-house-convening-on-right-to-repair [hereinafter THE WHITE HOUSE, *Convening*] (last visited Mar. 21, 2024).

216. *Id*.

217. *EPA Affirms Farmers' Right to Repair*, NAT'L FARMERS UNION (Aug. 8, 2023), https://nfu.org/2023/08/08/epa-affirms-farmers-right-to-repair.

218. THE WHITE HOUSE, *Convening*, *supra* note 215.

219. *Id*.

220. *Fact Sheet: Executive Order on Promoting Competition in the American Economy*, THE WHITE HOUSE (July 9, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/07/09/fact-sheet-executive-order-on-promoting-competition-in-the-american-economy (last visited Mar. 21, 2024).

221. *FTC to Ramp Up Law Enforcement Against Illegal Repair Restrictions*, FTC (July 21, 2021), https://www.ftc.gov/news-events/news/press-releases/2021/07/ftc-ramp-law-enforcement-against-illegal-repair-restrictions; *FTC Testifies Before California State Senate on Right to Repair*, FTC (Apr. 11, 2023), https://www.ftc.gov/news-events/news/press-releases/2023/04/ftc-testifies-california-state-senate-right-repair [hereinafter FTC, *California Testimony*].

222. FTC, *California Testimony*, *supra* note 221.

223. *Right to Repair Legislation*, REPAIR.ORG, https://www.repair.org/legislation (last visited Mar. 10, 2024).

York,[224] Colorado,[225] Minnesota,[226] and California.[227] Other states, such as Massachusetts, have passed right-to-repair laws specifically regarding car manufacturers.[228] The Massachusetts law "requires vehicle manufacturers to provide diagnostic and repair information to owners and independent repair facilities for any car made in 2015 or later."[229] The Massachusetts law also requires car manufacturers to make replacement parts available to the public for repair.[230] In 2024, Massachusetts is considering two bills, HD 3826 and SD 793, which would give the state the right to fix mobile phones and tablets.[231]

On December 28, 2022, New York became the first state to pass a Digital Right-to-Repair Act that covers digital electronic products first sold and used in New York on or after July 1, 2023, with a value over ten dollars, excluding motor vehicles, medical devices, off-road and farm equipment, home appliances, and video game consoles. On May 24, 2023, the Minnesota state legislature signed the Minnesota Digital Fair Repair Act. The Act covers "any hardware product made after July 1, 2021, that depends on embedded digital electronics, except farm equipment, video game consoles, motor vehicles, medical devices, and specialized cybersecurity tools" (SF 1598 and HF 1337). When effective on July 1, 2024, the Digital Fair Repair Act will ensure that device owners and independent repair shops can fix their own consumer products and make parts, tools, and repair documentation available.[232]

Home of the tech revolution, California will also lead the repair movement. Governor Newsom signed the Right-to-Repair Act (SB244) on October 10, 2023.[233] This will "significantly expand consumers' and independent repair shops' access to materials and information needed to fix electrics and appliances."[234] The law will go into effect July 1, 2024.[235] Advocates for the movement hope that this bill will protect the environment by keeping electronic waste out of landfills and limiting unsustainable mining and extraction that has a tremendous impact up and down the supply chain.[236] Described as a strong

224. *See STATEMENT: N.Y. governor signs Right to Repair, after trimming it down significantly*, PIRG (Dec. 29, 2022) https://pirg.org/media-center/statement-n-y-governor-signs-right-to-repair-after-trimming-it-down-significantly.

225. *See Colorado Tractor Right to Repair signed into law*, PIRG (Apr. 25, 2022), https://pirg.org/updates/colorado-tractor-right-to-repair-signed-into-law.

226. *Minnesota passes broadest Right to Repair measure to date*, PIRG (May 24, 2023), https://pirg.org/articles/minnesota-passes-broadest-right-to-repair-measure-to-date.

227. *SB-244 Right to Repair Act*, CAL. LEG. INFO., https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB244 (last visited Mar. 10, 2024).

228. Godwin, *supra* note 211.

229. *Id*.

230. Calboli, *supra* note 207.

231. REPAIR.ORG, *supra* note 223.

232. *Id*.

233. *See* CAL. LEG. INFO., *supra* note 227.

234. *Statement: Governor Newsom signs Right to Repair Act*, CALIFORNIANS AGAINST WASTE (Oct. 10, 2023), https://www.cawrecycles.org/press-releases/govsignssb244?eType=EmailBlastContent&eId=c28facac-55ef-4829-9347-bbbc9d6199b7.

235. *Id*.

236. *Id*.

consumer protection legislation, advocates hope that SB244 will foster a thriving market for repair businesses and secondhand sales, making repairing a device the norm.[237] SB244 also aims to save consumers money and reduce their reliance on manufacturers.[238]

SB244 will apply to all appliances and electronics.[239] The new law "requires manufacturers to make the parts, tools, and documentation needed to diagnose, maintain, and repair consumer electronic devices and appliances available to independent repair shops and consumers at fair and reasonable prices."[240] Some manufacturers have also endorsed this policy. During a roundtable with federal and state officials at the White House, Apple advocated for robust federal right-to-repair legislation and declared its intention to implement the standards set by California's recently passed right-to-repair law nationwide across the entire country, extending benefits to consumers nationwide.[241]

4. Concerns About Intellectual Property, Safety, and Cost

Some manufacturers oppose the right-to-repair, citing apprehensions about security, safety, and potential liability concerns, particularly regarding data breaches and cybersecurity threats.[242] These companies argue that their products should be serviced exclusively by certified technicians or their company directly, asserting that only these authorized individuals possess the necessary qualifications to perform repairs.[243] They wish to avoid consumers or third-party repairers being liable for infringing companies' intellectual property rights.[244] All these reasons are valid, but given the evident issues of e-waste, the advantages of this right-to-repair policy should outweigh the potential safety and privacy drawbacks, particularly given that the data privacy risks highlighted by the opponents can be mitigated with sufficient technology and legal enforcement.

Right-to-repair policies are not without their skeptics. Recent research challenges the assumption that the right-to-repair will financially benefit consumers or significantly impact e-waste production.[245] Scholars argue that manufacturers may deliberately modify the pricing of their latest offerings to counterbalance the anticipated decrease in profits resulting from the right-to-repair legislation.[246]

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237. *Id*.

238. *Right to Repair in 2022: What happened in New York, and our top accomplishments,* PIRG (Jan. 4, 2023), https://pirg.org/articles/right-to-repair-in-2022-what-happened-in-new-york-and-our-top-accomplishments.

239. This excludes video game consoles and alarm systems made after July 1, 2021. *See* REPAIR.ORG, *supra* note 223.

240. THE WHITE HOUSE, *supra* note 220.

241. *Id*.

242. Calboli, *supra* note 207; *see also* Yang et al., *supra* note 205.

243. Calboli, *supra* note 207.

244. *Id*.

245. *See generally* Jin et al., *supra* note 205; *see also* Yang et al., *supra* note 205.

246. Yang et al., *supra* note 205.

In one study, researchers built an economic model to analyze manufacturers' reactive pricing strategies and found that how manufacturers respond depends on how much it costs to produce the product.[247] Their model predicts that manufacturers will lower new product prices with lower production costs.[248] They believe consumers would prefer to buy a new product at a lower price rather than repair it, contributing to more e-waste.[249] E-products with higher production costs will be sold at a higher price, but will likely come with a free repair service which can enhance the resale value of the product.[250] Therefore, they argue, the right-to-repair legislation would be unlikely to make a difference in the number of new devices sold or the amount of e-waste generated. The authors of this study also find a "lose-lose-lose" situation with the right-to-repair legislation when higher prices hurt consumers, manufacturers, and the environment because consumers may continue using old, energy-inefficient products that exacerbate environmental impact.[251] Therefore, they urge lawmakers to "examine specific product categories, including their production cost and environmental impact, and guard against sweeping one-size-fits-all legislation."[252]

Cost considerations for products are critical when dealing with matters of consumer law, particularly if there is an effect on the environmental footprint of such products. The repairability index has addressed some of these concerns.

B. The Repairability Index

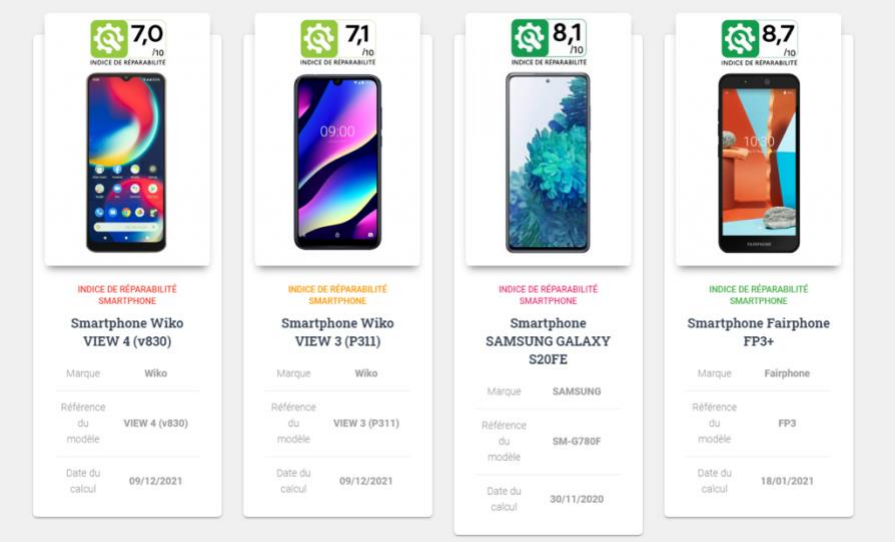
1. France's Anti-Waste Law: The Repairability Index

Whereas some private companies in the United States, such as iFixit,[253] have successfully established a repairability scorecard on WEEE products sold in the United States, France introduced a repairability index as mandatory national law.[254] France enacted the Law Against Waste for the Circular Economy[255] on January 1, 2021;[256] the law mandates display of a repairability index for electrical and electronic equipment on products. The score from one to

247. *Id*.
248. *Id*.
249. *Id*.
250. *Id*.
251. *Id.*
252. *Id*.
253. *See generally* IFIXIT, https://www.ifixit.com/ (last visited Mar. 27, 2024).
254. *Law Against Waste and For the Circular Economy*, n° 2020-105, article 16, Minister of the Ecological Transition (Feb. 10, 2020), https://www.ecologie.gouv.fr/loi-anti-gaspillage-economie-circulaire [hereinafter Anti-waste Law].
255. Anti-waste Law, *supra* note 254; *see also* MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE [MINISTRY OF ECOLOGICAL TRANSITION], LA LOI ANTI-GASPILLAGE DANS LE QUOTIDIEN DES FRANÇAIS: CONCRÈTEMENT ÇA DONNE QUOI? [LAW AGAINST WASTE IN THE DAILY LIVES OF THE FRENCH: CONCRETELY WHAT ARE THE EFFECTS?] 24 (Sept. 2021), https://www.ecologie.gouv.fr/sites/default/files/Document_LoiAntiGaspillage%20_2020.pdf.
256. *Indice de réparabilité* [Repairability index], MINISTÈRES AMÉNAGEMENT DU TERRITOIRE TRANSITION ÉCOLOGIQUE, https://www.ecologie.gouv.fr/indice-reparabilite#scroll-nav__6 (last updated July 18, 2024) [hereinafter Repairability Index].

ten informs consumers about the repairability of the concerned products.[257] The index's score is calculated based on five criteria for all product categories: i) the producer's commitment to making technical documents to repairers and consumers available for free and for a lengthy time frame; ii) the ease to which the product can be disassembled, taking into consideration the tools necessary to do so; iii) the producer's willingness to make spare parts available; iv) the difference between the price of a new product and of the spare parts; and v) and any sub-criteria specific to the product category.[258] The repairability index seeks to educate consumers about their ability to extend the operational duration and overall life span of their e-product. This is primarily achieved by guiding them towards items that offer greater repairability and encouraging them to opt for repair services when products malfunction.[259]

Figure 1: Example of Four Smartphones Rated on a French Website[260]



The following categories of products fall within the scope of this regulation: front-loading washing machines, smartphones, laptops, TV monitors, electric lawnmowers (three types: with electric cable, with battery, robot), and soon, top-loading washing machines, dishwashers, vacuum cleaners (three types: with electric cable, with battery, robot), and high-pressure cleaners.[261] This list will

257. *Id.*
258. *Id.*
259. *Id.*
260. Amandine Jonniaux, *Fairphone: la marque éthique deviant championne de la réparabilité* [*Fairphone: The Ethical Brand Becomes A Champion of Repairability*], J. DU GEEK (Jan. 19, 2021), https://www.journaldugeek.com/2021/01/19/fairphone-la-marque-ethique-devient-championne-de-la-reparabilite.
261. Repairability Index, *supra* note 256.

likely continue to grow.[262] A consumer who wants to buy a repairable smartphone may prefer a product with a display score closer to ten.[263]

Figure 2: The Scope of the Repairability Index in France Introduced by the Anti-Waste Law [264]

The same legislation also includes an incentive of fifteen to sixty euros (calculated according to the e-product) to repair once the warranty has expired.[265] Since January 1, 2022, the legal guarantee of conformity and its duration must be mentioned on the product invoice or sales receipt.[266] Failure to do so may result in an administrative fine of up to €3,000 for a natural person and €15,000 for a legal entity (a company).[267]

The index and the repair incentive seem to be effective tools in the fight against e-product obsolescence and in avoiding trashing toxic products into landfills.[268] Studies on the French repairability index and consumer behavior since its enactment confirmed this effectivity.[269] Among the key findings: (1) 71 percent of consumers had heard about the index; (2) 54 percent of consumers tried to fix an item themselves or with the help of friends or family; (3) 29 percent left the repair to a professional service; (4) 86 percent said that the index impacted their purchasing behavior; and (5) 80 percent said that they would give up their favorite brand for a more repairable product.[270] The repairability index policy appears effective in changing people's behavior and educating them about their product.

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262. Le Parisien Le Guide, *Quels sont les produits concernés par l'indice de réparabilité* [*Which Products are Targeted by the Repairability Index*], LE PARISIEN (June 13, 2023), https://www.leparisien.fr/guide-shopping/pratique/quels-sont-les-produits-concernes-par-lindice-de-reparabilite-13-06-2023-LC4KQA32BVHHPETCX2IRGW3A5I.php.

263. This is regardless of whether the consumer is environmentally conscious or simply does not want to spend another thousand dollars on a mobile phone in three years' time.

264. *See supra* note 255.

265. Bercy Infos, *Tout savoir sur l'indice de réparabilité* [*All You Need to Know About the Repairability Index*], GOUVERNMENT FRA. (June 5, 2024), https://www.economie.gouv.fr/particuliers/tout-savoir-indice-reparabilite.

266. Anti-waste Law, *supra* note 254.

267. *Id.*

268. Repairability Index, *supra* note 256.

269. FAILING THE FIX: GRADING LAPTOP AND CELL PHONE COMPANIES ON THE FIXABILITY OF THEIR PRODUCTS, U.S. PIRG EDUC. FUND 6 (Feb. 2022), https://publicinterestnetwork.org/wp-content/uploads/2022/07/Failing20the20Fix_USPEF_March2022.pdf; *see also Les Français et l'indice de réparabilité: un sondage OpinionWay pour Samsung* [*The French and the Repairability Index: An OpinionWay Survey for Samsung*], SAMSUNG NEWSROOM FRA. (May 8, 2021), https://news.samsung.com/fr/sondage-indice-reparabilite.

270. *Id.*

2. Limitations of the Repairability Index

While some believe the French rating system sets precedent for other nations on the standard for product assessment, some detractors see flaws in the idea that manufacturers rate themselves, as opposed to an independent body.[271] Accusations of greenwashing could arise if a company exaggerates or falsely represents its environmental efforts with a better repairability score.[272] Additionally, there is the possibility that tech product manufacturers bring challenges when they believe a rival company's self-reported repairability score for a product is implausible.[273] Governmental oversight is needed to counteract these behaviors.[274] Evidently, this was not a barrier for the French government, nor does it seem to be a barrier in the EU, since energy labeling requirements will apply to smartphones and tablets in the EU market beginning in June 20, 2025.[275] Additionally, other EU countries, such as Belgium, have also adopted new laws that mandate manufacturers and retailers to provide repairability indices for household appliances.[276]

C. Policy Proposals to Fight Against E-Waste Pollution

When society faces a pollution crisis to the extent of e-waste, efficient and effective regulation is necessary to protect the environment and human health.[277] Regulation encourages a level playing field.[278] This Note puts forward two such policy proposals: a U.S. repairability index and a federal e-waste act.

1. Enact a Federal Repairability Index

Future U.S. federal legislation could include a repairability index based on the successful French policy. Repairability indexes are a good means for manufacturers to improve their products and image by combatting e-waste issues. This policy is also attractive to consumers. Upon purchase of a new e-product, they are provided the information about it, including how to fix it. They can keep objects longer, which is economically more appealing since they do not have to purchase the latest mobile phones that companies sell at high prices.

There is already a Repair Act proposal before Congress, H.R. 906, which would require a motor vehicle manufacturer to provide to owners certain data

271. WASTE360, *supra* note 203.

272. *Greenwashing – The Deceptive Tactics Behind Environmental Claims*, U.N. CLIMATE ACTION, https://www.un.org/en/climatechange/science/climate-issues/greenwashing (last visited Apr. 7, 2024).

273. Maggie Stone, *Why France's New Tech 'Repairability Index' Is a Big Deal*, WIRED (Feb. 28, 2011), https://www.wired.com/story/frances-new-tech-repairability-index-is-a-big-deal/.

274. *Id.*

275. *Id.*

276. João Antonucci Rezende, *The Belgian Repairability Index Includes The Price of Spare Parts: Will the EU Level Up with This Ambition?*, RIGHT TO REPAIR (Feb. 20, 2024), https://repair.eu/news/the-belgian-repairability-index-includes-the-price-of-spare-parts-will-the-eu-level-up-with-this-ambition.

277. CORNELIS P. BALDÉ ET AL., *supra* note 2, at 42.

278. *Id.*

regarding critical repair information and service.[279] While this bill specifically focuses on motor vehicles, a repairability index could be an acceptable addition to it. This kind of legislation empowers consumers to be part of the solution. The European Environmental Bureau has found that extending the lifetime of all washing machines, notebooks, vacuum cleaners, and smartphones in the EU by one year would save four million tons of carbon dioxide annually by 2030.[280] Such a policy could also reduce greenhouse gases emissions and play a role in mitigating further climate change.

2. Enact a Federal Anti-E-Waste Act

Today, e-waste is regulated at the state level in the United States. Only twenty-five states (including California) and the District of Columbia have implemented legislation establishing state-wide recycling programs.[281] Several states have implemented laws that ban the landfilling and incineration of e-waste, mandating instead that it be treated separately.[282] While enacting e-waste laws at the state level allows such states to be laboratories of democracy by testing out different approaches,[283] the absence of a uniform federal law has led to a regulatory patchwork of different laws that makes compliance challenging for producers, collectors, and recyclers.[284] This patchwork also makes it harder and more costly for manufacturers to be good corporate citizens.[285] Additionally, state-level e-waste collection rates per capita have shown a decline,[286] which is another strong indicator of the failings of state-only regulation.

This Note does not dismiss the work that EPA is doing to promote a circular economy, but a federal statute could help set more stringent e-waste standards to ensure protection of human health and the environment. The work of EPA can be a launching point for federal e-waste legislation. For instance, the "Draft National Strategy to Prevent Plastic Pollution," issued in April 2023, is a non-binding measure which sets e-waste dumping standards.[287] This proposal, along

279. H.R. 906, 118th Cong., 1st Sess. (Pa. 2023).

280. *Climate and Revealed: The Climate Cost of 'Disposable Smartphones*, EUROPEAN ENV'T BUREAU (Sept. 18, 2019), https://eeb.org/revealed-the-climate-cost-of-disposable-smartphones/.

281. *Maps of States with Legislation*, ELECS. RECYCLING COORD. CLEARINGHOUSE, https://www.ecycleclearinghouse.org/contentpage.aspx?pageid=10 (last visited Mar. 21, 2024).

282. CORNELIS P. BALDÉ ET AL., *supra* note 2, at 69.

283. *See How U.S. Laws Do (and Don't) Support E-Recycling and Reuse*, KNOWLEDGE AT WHARTON (Apr. 6, 2016) https://knowledge.wharton.upenn.edu/article/how-u-s-laws-do-and-dont-support-e-recycling-and-reuse.

284. As this Note discusses, many used e-products are stored in households or disposed of in landfills. *See* CORNELIS P. BALDÉ ET AL., *supra* note 2, at 69.

285. KNOWLEDGE AT WHARTON, *supra* note 283.

286. Electronics Recycling Coordination Clearinghouse, *Pounds Per Capita of Covered/Eligible Electronics in State Law Programs, ERCC Collection Per Capita 2018-2020*, https://www.ecycleclearinghouse.org/DocRepository/PerCapitaCollections%202018to2020.pdf (last updated Nov. 22, 2024)

287. *National Strategy to Prevent Plastic Pollution*, EPA, https://www.epa.gov/circulareconomy/draft-national-strategy-prevent-plastic-pollution (last updated Nov. 22, 2024).

with the new draft strategy for electronics that is being drafted, could be added to the proposed binding federal anti-e-waste act.[288]

This act could also be modeled in part on the French example while carefully encompassing the lessons learned from state legislatures regarding their right-to-repair acts and electronic recycling laws.[289] Such an anti-e-waste act would also level the playing field between states' e-waste management jurisdictions. The act would send a strong message to the OECD and Basel Convention parties that the United States is taking serious measures to fight the global problems of e-waste and its global environmental pollution. And would enable the United States to be "Basel" compliant and finally ratify this crucial international trade convention.

3. Challenges of the Policy Proposals

The above proposals will undoubtably face opposition. It is likely that a repairing index will be challenged under the First Amendment of the U.S. Constitution as compelled commercial speech.[290] However, some legal scholars believe a repairability index would survive judicial scrutiny because the repair scores are objective assessments based on factual criteria and that greater transparency on repairability is crucial for ensuring optimal performance of a mobile phone market.[291] Additionally, all legislation faces the challenge of current partisan division. Any successful piece of legislation must make economic and social arguments that appeal to the sensibilities of both the political left and right, a daunting task given the politicization of environmental issues.

Federal legislation is ideal to abide by international treaties like the Basel Convention. Nevertheless, encouraging states to enact right-to-repair and repairability indices could have similar effects as federal legislation (which is more difficult to pass). The more that subnational entities enact such laws, the more that repair information will be publicly available and create a de facto federal standard for the right-the-repair for e-products. Additionally, with California's status as the world's fifth-largest economy and its recent enactment of a Right to Repair Act, manufacturers will likely be compelled to produce more repairable goods to meet these standards in such a large market, effectively setting a precedent that could influence more states and nations to follow suit.[292]

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288. *What is a Circular Economy?*, EPA, https://www.epa.gov/circulareconomy/what-circular-economy (last updated Nov. 21, 2024).

289. ELECS. RECYCLING COORD. CLEARINGHOUSE, *supra* note 281.

290. Aaron Perzanowski, *Mandating Repair Scores*, BERKELEY TECH. L.J. 1123, 1137 (2022).

291. *Id* at 1141-3.

292. *California Remains the World's 5th Largest Economy*, GOVERNOR GAVIN NEWSOM, https://www.gov.ca.gov/2024/04/16/california-remains-the-worlds-5th-largest-economy/ (Apr. 16, 2024) (last visited Jan 1. 2025).

CONCLUSION

The right-to-repair is a solution to tackle negative externalities of e-waste. E-waste is the fastest-growing waste stream in the world. Many problems arise from it, including globalized illegal trade, informal recycling labor markets, and human health and environmental degradation. Most countries have come together as parties or observers of international treaties to find solutions. These nations collaborate to trade, negotiate, and treat hazardous waste in an environmentally sound manner. However, international law cannot be the only avenue to tackle these issues.

While the United States is not a party to the Basel Convention and does not have a specific federal law that deals with e-waste, the federal government has endorsed favorable right-to-repair policies through the impulsion of states. The Note proposes two policies that stem from this movement, a mandatory right-to-repair and a repairability index. Numerous challenges stand in the way of these proposals including pushback from industry and political resistance to environmental regulation. Like most environmental policy questions, it is important to weigh the interests of the different actors and stakeholders. It is unlikely that even if enacted, a federal repairability index and a mandatory Federal Anti-E-Waste Act in the United States would eradicate e-waste trade pollution. The goal of this Note is to suggest some solutions that could complement the existing mitigating ones and encourage policymakers to take the circular economy seriously. E-waste management is not an issue with a one-size-fits-all solution. This is evident from the Basel Convention, where most of the world's countries around a table cannot solve the issues together, let alone solve them in their own jurisdiction.

Nevertheless, if more products are repairable thanks to right-to-repair policies, the ones that do get through the loopholes of the illegal e-waste stream will likely be easier and less toxic to disassemble. Additionally, such policies should manage to keep the products in domestic waste streams longer, rather than enter landfills and international markets. Consumers will be able to learn about what composes the e-products they use and spend less by keeping them longer after repair. Mandatory anti-e-waste laws containing a right-to-repair and repairability index present state and federal opportunities to help tackle the global e-waste problem.