WORLD ECONOMIC FORUM

Facilitating Trade Along Circular Electronics Value Chains

WHITE PAPER

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Executive Summary

Circular electronics rely on reverse supply chains, yet firms across the value chain highlight significant challenges to running these.

Electronics are a critical part of our economies and societies. That has become even more the case in response to the COVID-19 pandemic when electronics have helped workers stay connected and ensured digital services delivery. Even before the health crisis, rising incomes had been boosting electronics consumption. In tandem, interest has grown on minimizing the environmental impact of these products, including through circular economy solutions. Such approaches involve making the most of electronics product repair and remanufacturing, designing for longevity and recycling at end-of-life to put materials back into new products.

Unfortunately, too many electronics still wind up in the environment, are recycled in unsafe conditions, or are stored away in households. The latest Global E-Waste Monitor finds that, in 2019, on average most of the e-waste generated (82.6%) was likely not formally collected and managed in an environmentally sound manner, with rates of collection varying between countries and regions. The electronics lifecycle system is greatly in need of a reboot to enable more product life extension, recycling and materials extraction.

The circular economy has become a business priority for many companies and consumers. Circular economy business strategies are being developed involving secondary raw materials use, refurbishing products, accelerating take-back schemes, among others. Yet, firms across the electronics value chain highlight trade-related challenges to these strategies, with new developments on the horizon to navigate.

Circular electronics rely on reverse supply chains since recovery facilities for recycling are not available in all locations. Only a handful of large-scale smelters and refiners globally are able to complete the final step of metals extraction after processing and place these back on international markets. Repair and remanufacturing are also typically done in regional or global sites since economies of scale keep highly technical costs manageable and make a better investment case. When goods cannot easily cross borders to reach safe sites, illegal trade in e-waste to sub-standard facilities or product dumping has thrived to the detriment of local workers, communities and ecosystems.

The following paper presents insights from a series of dialogues, a survey and interviews. Stakeholders from industry, research institutes and international organizations have clarified the trade challenges to reverse supply chains for electronics. These are centred on complexities of product classifications, related factors leading to significant increases in the costs of reverse logistics for used products and those characterized as hazardous versus outbound logistics for new products, and cumbersome trade-permitting processes, particularly for products classified as hazardous.

For example, some actors said reverse logistics for used electronic products were 31% more costly than outbound logistics for new products, and 190% more costly when comparing end-of-life products categorized as hazardous over new products. Others indicated that delays of up to 14 months were not uncommon for completing the necessary paperwork on products classified as hazardous.

An international treaty known as the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal contains requirements regulating and limiting transboundary movement of hazardous e-waste and other wastes. The Basel Convention was developed

to avoid waste dumping in developing countries with cheaper disposal facilities and absent regulations.

The 187 parties to the Basel Convention develop laws based on agreed classifications of waste and hazardous waste classifications – though countries also have the discretion to adjust classifications in domestic implementation and these changes can take place rapidly. Differences in interpretation create a patchwork of regulatory requirements to move used and end-of-life products.

The system's complexity is limiting circular strategies, deterring investment in high-quality repair, refurbishment and recycling infrastructure, in turn limiting service options and hiking costs. When electronic products are classified as hazardous under the Basel Convention, or domestically, these can face trade bans and, if transboundary movements are permitted, are subject to a written prior informed consent (PIC) procedure from the countries of import and transit.

The Basel Convention is widely recognized as a vital piece of global policy architecture for avoiding waste dumping, yet many interviewees suggest that its focus on risky trade could be complemented by measures to facilitate responsible trade for the circular economy which would be complementary to and consistent with the aims of the convention. The community involved in this paper have put forward ideas for doing so that could be further explored. For example, trade facilitation capacity building could help digitalize and automate the PIC procedure, which would make permitting processes for hazardous trade clearer and less prone to corruption.

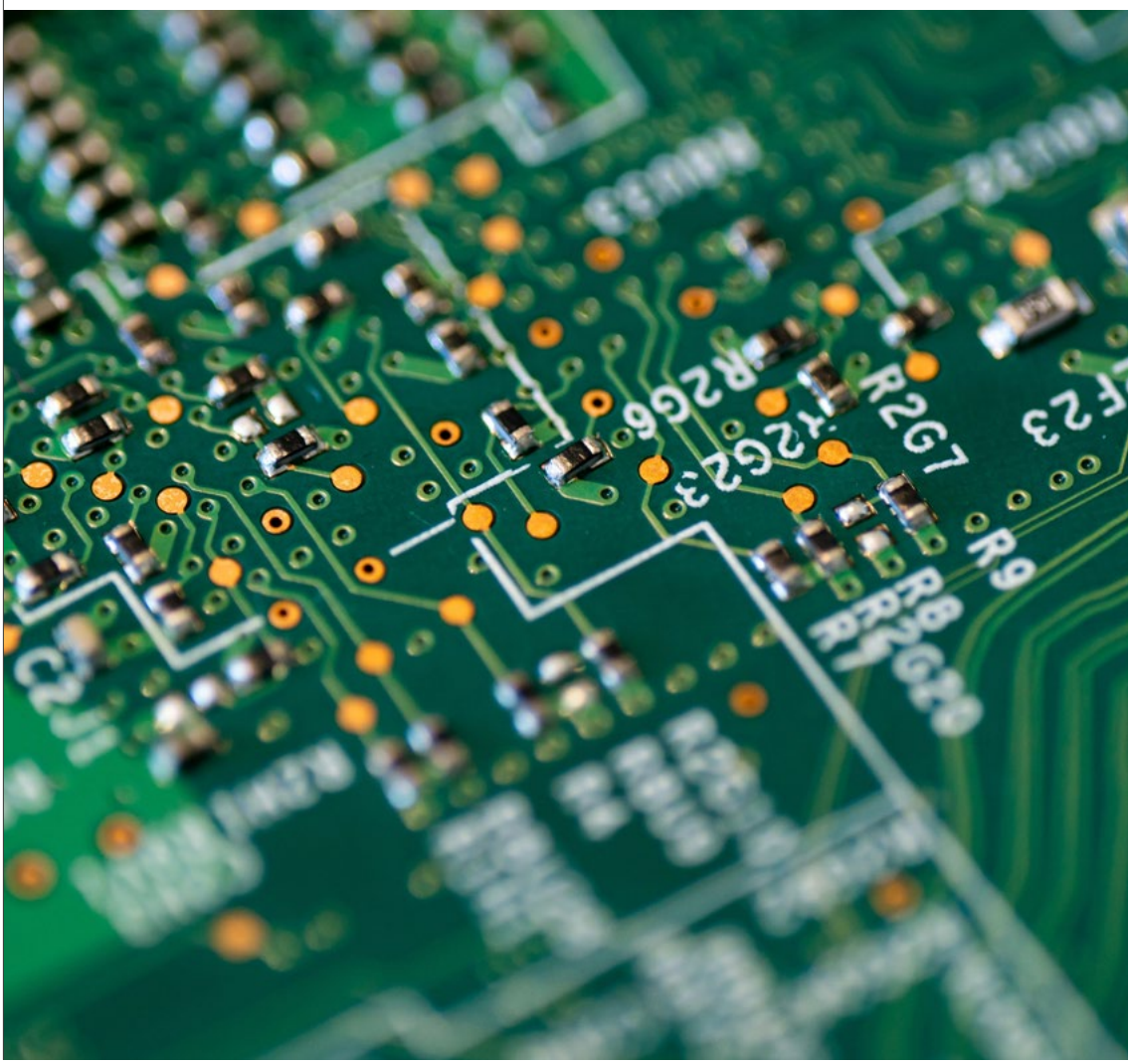
Regulatory cooperation between some countries could involve fast-track systems for permits or longer validity periods where materials are moved to trusted facilities. A regulatory pilot along these lines is under way among some Northern European economies. Harmonization of standards for handling electronic waste would support such initiatives.

Policy-makers could also improve data collection on e-waste based on amendments to customs codes in force from January 2022 for more targeted interventions. Trade commitments can signal consistent market access to and non-discriminatory treatment of foreign repair, remanufacturing and recycling services that could support new investments. Further scoping of the business case for investments at what stage of the circular electronics process could be helpful. Transparency from governments on relevant measures affecting e-waste trade would equally be a step forward in some cases.

There are several avenues countries can use to advance these ideas, ranging from a global initiative at the World Trade Organization (WTO) to bilateral cooperation. Companies can help by sharing insights on circular business models and best practices. COVID-19 offers opportunities to rethink many current governance approaches. Bringing a trade facilitation angle to e-waste legislation would proactively address a growing environmental challenge using economic tools and better target the reality of interconnected value chains. The World Economic Forum will continue to support knowledge exchange to deepen action in this area.

1 Introduction

Electronics usage is growing, but so, too, are discarded products. Accelerated circular electronics strategies that repair, refurbish and recycle are needed



In a circular system, electronic products will be designed for longevity, and repaired or remanufactured.

Electronics are a critical part of economies and societies – products from mobile phones to dishwashers bring convenience, connectivity and a better quality of life. Rising incomes, in turn, are boosting consumption of electronic products. As usage grows, governments, industry and civil society are increasingly looking for ways to minimize environmental impact, including through the development of circular economy solutions that reduce the consumption of new materials and the disposal of used materials. In a circular system, electronic products will be designed for longevity, and repaired or remanufactured. Once they reach end-of-life, the zero-waste solution is to recycle and put recovered materials back into new products.

Unfortunately, many electronics wind up in the environment, or recycled under unsafe conditions, including through illegal dumping or unregulated processes.[1] Doing so can result in toxic materials such as mercury, lead and brominated flame retardants leaking into soil and water, disrupting ecosystems and human health. Informal collection activities where workers are unaware they are handling dangers materials can lead to a host of medical issues.[2] Further, some electronics remain unused and stored away in households because consumers lack information about options for responsible disposal methods and mechanisms to ensure their personal data is secured.

As set out in A New Circular Vision for Electronics, a report put together by the UN E-Waste Coalition, the World Economic Forum and the World Business Council for Sustainable Development (WBCSD), the electronics lifecycle system needs a reboot as demand grows.[3] In 2019, 82.6% of the 53.6 million metric tons of e-waste generated – the total equal to the weight of 125,000 jumbo jets, a figure higher than all those ever built – was likely not formally collected and managed in an environmentally sound manner, with rates of collection varying greatly between countries and regions.[4] By 2050 the volume of e-waste, in a scenario without circular approaches, could top 120 million tonnes annually.[5]

If electronic products are going to be disposed of, it must be done responsibly. Disposal, however, is not the optimal solution. Estimates of the value of raw materials in e-waste generated in 2019 are about $57 billion, mainly involving iron, copper and gold. But only around $10 billion worth of materials are recovered annually based on current documented collection and recycling, indicating that recovery rates remain low.[6] E-waste is too often seen as exactly that, waste, with not enough focus in public debate on the opportunities for life extension and materials extraction. Mining discarded electronics is also considered, on balance, less emission-intensive than virgin materials extraction. For example, 80% fewer emissions of carbon dioxide per unit of gold are produced from extraction from used electronics compared to mining from the ground.[7]

Further, bringing more product life extension, recycling and materials extraction activities into the formal economy could potentially create additional jobs, reduce environmental damage and limit the climate impact of raw materials extraction. The European Union's COVID-19 recovery plan, for example, estimates that 15 jobs and 110 training opportunities could be created for every 1,000 tonnes of electrical and electronic equipment waste collected and sorted.[8] In Rwanda, investment in one e-recycling facility has created employment for more than 400 people, even as the site operates at only 30% capacity to date.[9]

Some in the private sector are acting – the circular economy has become a business priority and is increasingly expected by consumers. Companies are accelerating take-back schemes for old and used electronics redesigning products for long life and using safe materials, refurbishing products under warranty, repairing parts, integrating secondary raw materials into production cycles and using recycled or renewable-based content where technically feasible (See Box 1).

BOX 1: Circular Electronics Business Strategies

Cisco has multiple programmes to repair and replace equipment, take back equipment at customer end-of-use, reuse equipment internally and sell certified remanufactured equipment through Cisco Refresh. These programmes save the company millions of dollars annually and prevent thousands of pounds of material from entering landfill. Cisco's Takeback and Reuse programme, for example, encourages equipment owners to return hardware at end-of use, 99.6% of which is reused or recycled.[10]

Dell Technologies has pledged that by 2030, for every product a customer buys, the company will reuse or recycle an equivalent product, in addition to 100% of packaging, and that more than half of product content will be made from recycled or renewable material.[11] Building on a Closed Loop Plastics programme that was launched in 2014, the scope has expanded to 125 models. The company has also partnered with several other firms to create a new process for closed-loop recycling of rare earth magnets sourced from equipment collected through take-back programmes.[12] The process is being adapted for recycled material use in other industries.

Apple has set a goal of sourcing 100% recycled and renewable materials for products and packages, and has already achieved

significant milestones, including the use of recycled aluminum in MacBook Air, MacMini and iPad enclosures, recycled tin in the main logic boards of many of its most popular products, and recycled rare earth elements in the Taptic Engine of the iPhone 11 series. To achieve the goal, Apple has designed disassembly robots and procedures to de-manufacture its products into constituent components to achieve cleaner, more efficient recycling, and continues to optimize recycling practices, improve disassembly, and advance research and development of the next generation of recycling technologies in its Material Recovery Lab. It is also building a reverse supply chain of best-in-class recyclers to return materials to a state in which they can be rebuilt into new products.[13]

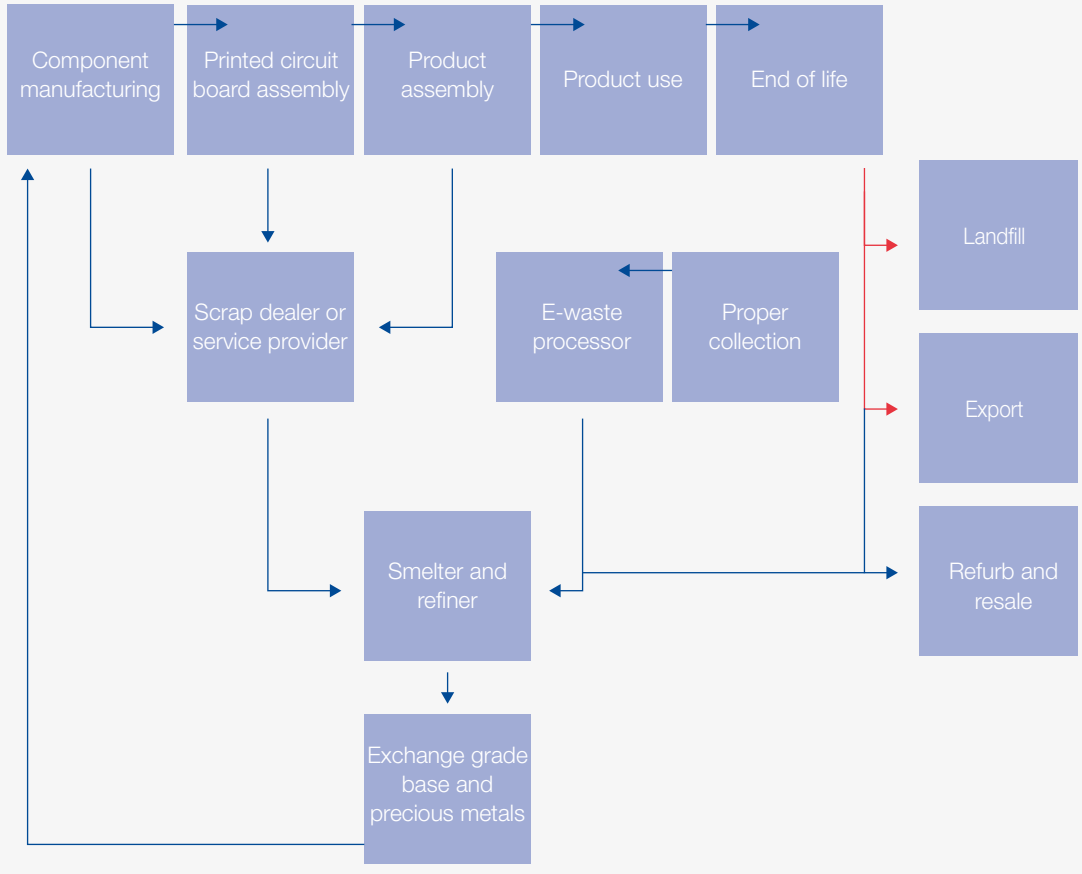
Philips, a large healthcare technology provider, aims to generate 15% of sales from circular products and services by 2020 – including through access to rather than ownership of products.[14]

Huawei has built a global recycling system that allows consumers to recycle their used electronics and reduce environmental impact. By the end of 2019, the company was running 1,300 recycling stations in 48 countries and regions worldwide. Through a paid recycling programme, Huawei's service centres took back from more than 300,000 used spare parts (totalling 60 tons) every month last year.[15] Huawei has further scaled up its product trade-in programme giving consumers a discount on new products in order to increase collection. In China, it has an online credit-based recycling programme where consumers receive coupons in return for recycling. Outside China, the trade-in programme is available in nine countries, including Russia, Italy, Germany and the United Arab Emirates.

Yet firms across the electronics value chain, whether original equipment manufacturers (OEMs) or e-waste processors or end-recyclers, indicate significant trade-related challenges to circular economy initiatives. State of the art, properly regulated and legitimate recovery facilities are rarely available in all locations. Even once processed, there are only a few large-scale smelters and refiners globally able to complete the final step of metals extraction and then place high-quality materials on international markets. Repair and remanufacturing are also typically done in regional or global sites. In many cases, products need to cross borders but face different regulatory requirements and sometimes outright trade bans.

FIGURE 1 **End-of-life diagram**

Red lines indicate product leakage away from the circular economy



2 Purpose and Scope

Outlining the challenges in reverse supply chains can help to frame potential trade policy interventions to address these.

“ The community recognizes that achieving the circular economy requires comprehensive action. This paper will contribute to a broader report on pathways for circular electronics, to be released in January 2021.

This paper is prepared under the aegis of the World Economic Forum by a community of experts. It aims to better understand the role of trade in moving to a more circular economy within the electronics industry. The circular economy is understood here to be a systemic decoupling of growth from the consumption of finite resources, where products are kept at their highest value and waste from one process is an input into another. The “3Rs”, reduce, reuse and recycle, are key pillars.

The first part of the paper looks at cross-border challenges to reverse supply chains for circular electronics. The second part explores trade policy solutions, since transboundary movement needs to be better addressed both in terms of legal and illegal activities. A starting point for these suggestions is that existing well-intentioned regulations could be improved on through new approaches.

While the focus is on trade policy, the paper considers multiple avenues for action, ranging from international agreement between governments to bilateral regulatory pilot projects and public-private initiatives. Insights in the paper were assembled through dialogue and expert interviews as well as background research. Industry from across the electronics value chain was consulted, including OEMs in business-to-business (B2B) and business-to-consumer (B2C) sectors as well as recyclers.

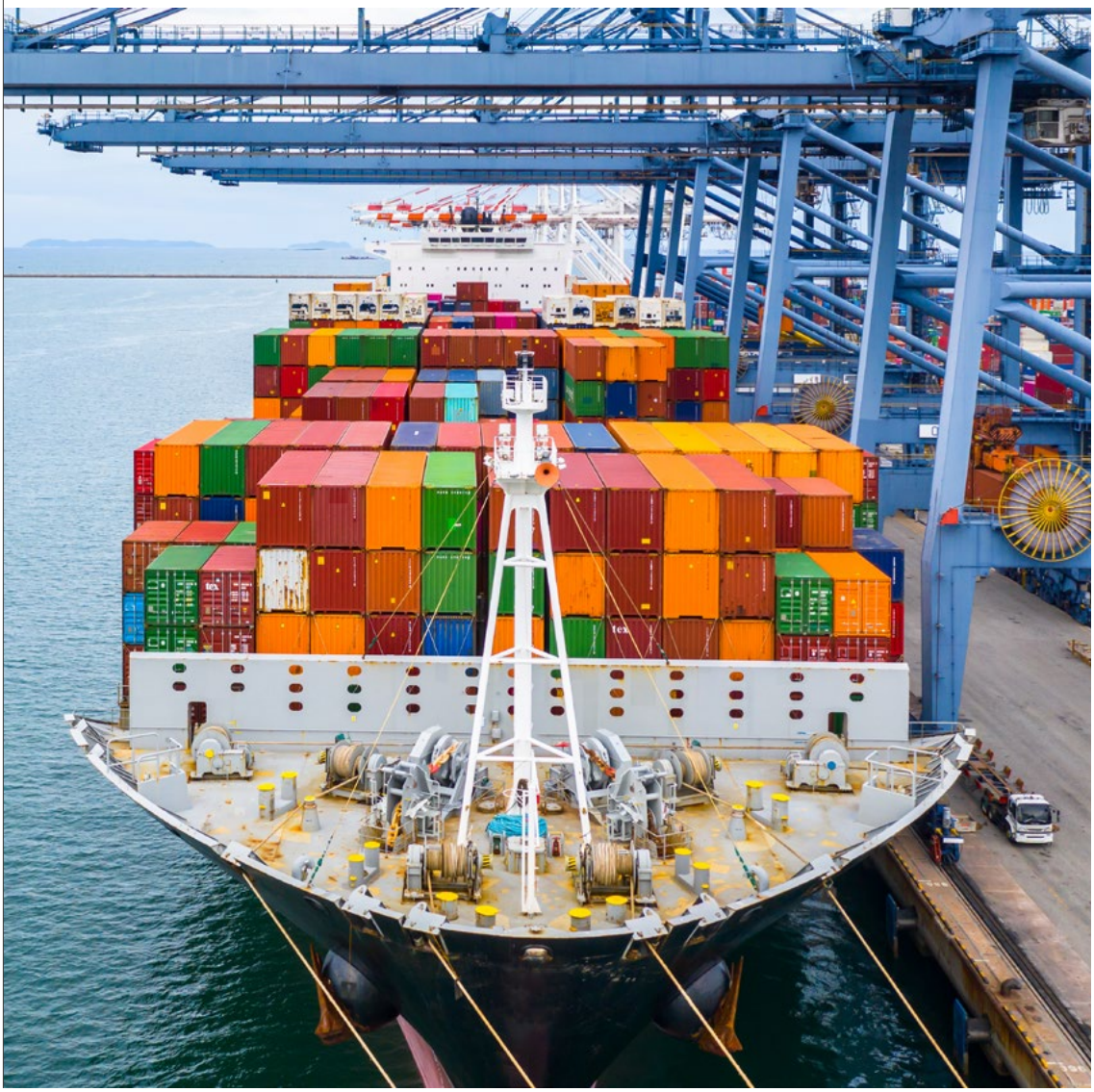
The paper is part of a series on trade and the circular economy. An earlier document published in July 2020 looks at cross-border issues in the circular economy and plastic pollution. Some of the issues raised therein are echoed here, even as differences exist between these waste streams, sectoral dynamics and the economics of secondary materials markets. Separate work done by the Forum scopes sustainable battery value chain options. The emissions reduction potential of scaling battery repair, refurbishment and recovery is significant – reductions of up to 30% in the transport and energy sectors by 2030 – but requires trade policy consideration given the global interconnection of battery and automotive value chains.[16]

The community recognizes that achieving the circular economy requires comprehensive action. This paper will contribute to a broader report on pathways for circular electronics, to be released in January 2021. A chapter on reverse supply chains will complement policy and practical ideas on circular design, circular product demand, distribution, take-back and collection, recycling and sourcing. Several stakeholders emphasised the importance of incentivizing collection as a prerequisite for the interventions discussed herein and on the continued difficulties of doing so.

3

The Trade Landscape

Actions to facilitate responsible, circular trade could help to improve electronics lifecycle systems.



The Basel Convention has the objectives of reducing hazardous waste generation.

Historically, many developed economies exported e-waste to regions with cheaper disposal facilities and lower environmental standards where it quickly became a danger to workers and communities. In response, international and national regulatory interventions have been taken over the past two decades to control waste dumping and have been able to stop the most egregious examples of this practice.[17] As explained in Box 1, the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal contains important requirements regulating and limiting transboundary movement of hazardous e-waste and other wastes.

The Basel Convention has the objectives of reducing hazardous waste generation, promoting the environmentally sound management of hazardous and other wastes, controlling the transboundary movements and disposal of hazardous wastes, except where it is perceived to be in accordance with the principles of environmentally sound management, and creating a regulatory system – through the Prior Informed Consent (PIC) procedure – to apply to cases where transboundary movements are permissible. The Convention is a vital piece of global policy architecture for avoiding illegal hazardous waste dumping. Restrictions on legal transboundary movement of some electronic products that could be traded for resource recovery, however, can lead to waste not being effectively and safely recovered. Even where trade is allowed, the complex, multi-layered permitting regime that has developed over the years significantly increases the time and costs of such trade, which some stakeholders say holds back reuse, repair and high-quality recycling.

BOX 2:

Box 2: The Basel Convention and E-Waste

The **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal** permits the transboundary movement of hazardous and other waste in narrowly defined circumstances: the country of export cannot process the waste in an environmentally sound manner, or the waste is required as raw material for recycling or recovery industries in the country of import. In addition, all movements must comply with other requirements and formalities. As a result, the Convention imposes strict limits on the transboundary movement of used electrical and electronic equipment ("used equipment"), when that equipment is classified as: (1) waste; that is (2) hazardous.[18] Consequently, under the Convention, the distinctions between waste and non-waste and between hazardous and non-hazardous waste are critical. To clarify these distinctions, the Convention parties provisionally agreed Technical Guidelines, which were most recently updated in 2019 and will be considered for final adoption by the parties in 2021.[19]

When is used equipment classified as waste?
Under the Convention's non-binding Technical Guidelines, the classification of used equipment as waste ("e-waste") depends on a consideration of all circumstances, including its intended use and the state of the equipment.[20] When used equipment is destined for disposal or recycling, it is waste. When used equipment is destined for failure analysis, repair, refurbishment or reuse, it is non-waste, provided certain conditions are met. Under the Technical Guidelines, shipments of used equipment destined for failure analysis, repair, or refurbishment are non-waste if: (i) the domestic legislation of any of the countries involved in the transboundary movement (i.e., countries of export, import and transit) do not define the used equipment as waste; (ii) the used equipment in question is accompanied by the required documentation and declarations and a valid contract is in place; and (iii) the used equipment is shipped with appropriate protection against damage. If the used equipment is shipped for direct reuse (e.g., after repair), it must meet the same requirements and the Guidelines provide that it should be tested to demonstrate functionality. Under the Guidelines, a transporter must provide detailed documentation to support a claim that used equipment is not waste – in case of doubt, the equipment could be considered waste. Because each party enjoys discretion to classify used equipment as waste, even when destined for reuse or repair, used equipment may be regarded as waste in some countries but not others.

When is e-waste classified as hazardous?
Under the Basel Convention, waste is classified as hazardous based on the characteristics it exhibits and its physical components. For e-waste, two mirror listings appear in the Convention's annexes: e-waste containing hazardous components or substances, such as those listed in entry A1180 of Annex VIII (e.g., the presence of nickel-cadmium batteries or batteries containing mercury), is classified as hazardous if the waste possess the hazardous characteristics listed in Annex III. On the other hand, pursuant to entry B1110 to Annex IX, e-waste not containing those hazardous components or substances is classified as non-hazardous if the waste does not possess the hazardous characteristics listed in Annex III. To clarify this distinction, the parties are currently considering minor revisions to entries A1180 and B1110. While countries around the world have transcribed entries A1180 and B1110 into their national laws, a party also has discretion to classify e-waste as hazardous for purposes of the Convention, even when it is not so classified under the Convention.[21] This means that used equipment may be classified as "hazardous waste" in one country but not in another.

> The United Nations Environment Programme (UNEP) has suggested between 60%-90% of e-waste is illegally traded or dumped.

What rules apply to hazardous e-waste? The Basel Convention and national implementing legislation impose strict rules on transboundary movements of hazardous e-waste.[22] There is also a pending proposal to amend the Convention to apply similar controls on shipments of all e-waste, which could be considered as early as July 2021. Depending on the countries involved, the transboundary movement of hazardous e-waste is either banned or, when permitted, subject to complex administrative formalities, in each country of movement (i.e., export, import and transit), under the "prior informed consent" process:

1. **The following transboundary movements of hazardous e-waste are banned**: (i) Exports from a party listed in Annex VII to the Convention (i.e., members of the OECD, EU and Lichtenstein) to or through a country (whether or not a party) not listed in Annex VII (e.g., developing countries);[23] (ii) exports from a party that bans the exportation of hazardous e-waste under its domestic legislation;[24] (iii) exports to a party that bans the importation, or through a party that bans the transit, of hazardous e-waste under its domestic legislation;[25] and (iv) exports to and imports from a country that is not a party to the Convention (such as the United States), unless a special agreement exists (see below).[26]
2. **The following transboundary movements are permitted with prior informed consent (PIC)**: Other transboundary movements of hazardous e-waste are permitted provided the country of import and each country of transit separately grant PIC in writing.[27] There is an option for transit countries to provide tacit consent, but this has not been widely used in practice. The countries of import and transit each have broad discretion to permit or refuse a movement (with or without conditions) after seeking any necessary information. In other words, even if a movement is not subject to a general ban under the Convention, movement of e-waste may be banned by any country of import or transit. Each separate application for PIC is typically time-consuming and costly and carries considerable uncertainty over how long it will take to receive a response and whether consent will be provided or refused.

Article 11 of the Basel Convention also allows parties to adopt special agreements or arrangements with other parties or non-parties to reduce the burdens usually placed on transboundary movements under the Convention. These special agreements must not derogate from the environmentally sound management required under the Basel Convention for hazardous e-waste and other wastes.[28] A prominent example is an OECD Council Decision that governs movements of hazardous and other waste for recovery between OECD countries, including the US.[29,30] The OECD Council Decision places most e-waste for recovery on a "green list" (the corresponding codes are GC010 and GC020), which means it is subject to the usual border controls applied to regular commercial transactions and not to the more cumbersome PIC procedure. Another example is the Waigani Convention that provides a waste control regime for Pacific Island states.

In addition to Basel Convention obligations, to which 187 states are party, countries are increasingly developing specific e-waste legislation covering product take-back requirements, extended producer responsibility (EPR) schemes and landfill bans, among others. Around 78 countries, accounting for 71% of the world's population, have legislated to deal with e-waste, up from 44% in 2014. Implementation, legal binding and provisions on transboundary movement vary (see Annex 1). International capacity building and multistakeholder initiatives on e-waste issues have also been launched over the years.[31]

Low enforcement and the complexity of legal trade in used products and hazardous waste have meant that illicit trade thrives.[32] Although exact research has not been done, in 2015, the United Nations Environment Programme (UNEP) has suggested between 60%-90% of e-waste is illegally traded or dumped.[33] Domestic regulatory shifts in Asia have led to an increase of illegal flows to Africa – and to Nigeria and Ghana in particular though, again, the scale of these transboundary flows needs to be quantified.[34] Methods used to conduct illegal trade include labelling hazardous e-waste as second-hand goods for repurposing, mixing hazardous e-waste with other legitimate electronics shipments, mis-labelling shipping containers to divert attention from the shipment of illegal forms of e-waste, and bribing customs officials to facilitate illicit trade. Many stakeholders consider illegal trade is aided by high barriers to legal reverse supply chains. Tackling the latter to reduce associated time and costs could increase the scale and geographic reach of regulated processing.

Increased international attention is being paid to e-waste and trade. The scope of electronic products covered by the Basel Convention is likely to expand as parties explore amendments to the Annexes. Some countries, including Ghana and Switzerland, have proposed listing non-hazardous e-wastes on Annex II (categories of wastes requiring special consideration), which would, in effect, obligate parties to ban certain movements of such non-hazardous e-waste (see Box 2, scenarios 1(ii) to 1(iv)) and, otherwise, permit such movements subject to PIC (see Box 2, scenario 2).[35] The parties to the Convention are also considering amendments to Annex I (waste constituents and categories) and Annex III (hazardous characteristics) that have the potential to expand the universe of e-waste deemed hazardous.

If the focus remains entirely on restricting risky trade, however, these developments could stall existing circular business models and stymie new efforts. Trade officials have not really considered reverse supply chains that companies are beginning to build. Boosting environmental goods and services trade has been done in some free trade agreements (FTAs), which could improve the availability of recovery services, but circular economy concepts are largely still nascent in trade policy. The interventions are on circular electronics, but a broader circular economy approach may ultimately be more effective and use many of the same tools proposed.

4

Reverse Supply Chain Challenges

A set of issues adds complexity and costs and holds up the development of responsible, reverse supply chains for electronics.

4.1 Classification

“ The possibility of materials getting stuck or blocked where slight changes are made to shipment content or routes is very high.

Among the major issues highlighted by stakeholders interviewed for this paper was the complexity of electronic product categorizations across countries that affect how these items are treated in trade transactions. Companies or those offering associated services must navigate a patchwork of regulatory requirements to move used and end-of-life products for circular objectives. Although the Basel Convention offers a reference point, country-level divergences exist particularly on the definition, classification and distinction between hazardous waste, non-hazardous waste, and non-waste goods destined for reuse, failure analysis, repair and refurbishment. In some cases, non-waste goods may be considered waste under a particular country’s legislation and become subject to certain controls affecting cross-border shipment.

Firms stressed that the premature classification of products as waste, when instead destined for legitimate repair, refurbishment and reuse, impacts business models designed to limit virgin materials consumption. The economic viability of reverse supply chains for repair, reuse and remanufacturing shifts if used goods must comply with additional e-waste movement requirements (see below).

Other challenges occur when e-waste is classified as hazardous without regard to whether it exhibits hazardous characteristics. Countries can differ on the definition and requirements for transport of hazardous and non-hazardous e-waste, which adds to reverse supply chain logistics issues. Further, companies said they regularly experienced situations where transit countries do not respond to Basel Convention notifications or overrule the classification of products of the countries of departure and destination. The possibility of materials getting stuck or blocked where slight deviations are made to shipment content or routes is very high. In other cases, companies cited examples of overnight classification changes and refusals for trade permits, even when domestic facilities do not have the capacity for processing and recycling.

Even within the EU, a relatively integrated group, classifications differ between member states, and the Commission has expressed concerns on the methodological inconsistencies of shipment codes.[36] The inconsistency generates confusion and is likely facilitating illegal transboundary shipments, particularly through incorrect classification of e-waste as second-hand goods.

Stakeholders suggest this systemic complexity has several impacts. First, companies and officials may be more likely to opt for a low-risk approach of classifying all used equipment as e-waste, thereby limiting repair, reuse, remanufacturing and recycling opportunities. Border clearance officials, harbour authorities, prosecutors and judges may also not always have the requisite training to properly distinguish used products from e-waste and apply the appropriate classification and requirements. To avoid any risks, officials may err on the side of classifying all products as (hazardous) waste instead of non-waste. Some firms highlighted the risk of legal exposure if classifications are misinterpreted.

Second, it has the spiralling effect that companies may be less inclined to invest in repair or refurbishment infrastructure if there is uncertainty about the regulatory regime, with implications for the economic viability of those programmes. A similar effect is likely for investments in recycling services. Inconsistent product volumes and high friction in moving e-waste results in disassembly and recycling facilities operating at low or fluctuating capacity. In turn, recyclers require a prohibitive amount of capital to run a successful business. Several stakeholders flagged the threat of regulatory changes acting as another brake on investment.

Third, with limited investments in repair, refurbishment and recycling infrastructure, fewer options are available. B2B services to the electronics value chain may only be offered depending on the corresponding product and facility location. Some stakeholders noted that the materials recycling sector is currently concentrated among a few firms due to high regulatory barriers to entry, which drives up prices and reduces supply chain flexibility and resilience. Without legitimate options, informal and illegal networks serve as a ready replacement, with materials processed at lower standards or other forms of sub-optimal disposal.

Some new proposals to broaden the classification of wastes covered under the Basel Convention, as described in the introduction, could inadvertently increase barriers to circular electronics business models. For example, currently, items such as printed circuit boards that are rich in metals may be treated as non-hazardous unless they exhibit a hazardous characteristic, which allows for relatively unimpeded flows for recycling. New requirements could particularly impact B2C electronics that have slimmer margins built into products and fewer “product-as-a-service” associated contracts as is the case with B2B electronics. Transaction costs could become a tipping point whereby decisions are made to incinerate rather than recycle.

Changes in Basel Convention categorizations will also affect options on where materials can flow since parties may not trade controlled waste with non-parties, such as the US, unless an alternative agreement meeting Article 11 requirements is in place (see Box 2).[37]

4.2 Transaction costs

Some actors indicated that reverse logistics for used products represented a 31% increase over outbound logistics of new products, while reverse logistics for products categorized as hazardous waste were a 190% increase over outbound logistics for new products. These differentials are rendered more problematic due to the fact that end-of-life products are not subsidized by the services they provide in the same way that new products support cost of distribution and are worth only the cost of extracted materials. Today's electronics also use fewer precious metals thereby generating a lower value on recycling even as the process costs remain the same.

The nature of the costs include licensing for transporters, sending and receiving facilities, as well as storage and delay costs incurred as a result of paperwork confusion or inconsistent understanding of processes at the border. Indirect transaction costs tend to involve administrative burden for obtaining trade permits (labour cost). Heavy legal transaction costs and legal uncertainty are associated with navigating regulatory differences described above.

4.3 Permitting process

If a product is classified as hazardous under the Basel Convention or by a domestic legislation but movement is allowed, the PIC procedure must be followed, which involves several steps (see Box 2). While firms recognize the overall value of the PIC process in giving states visibility on hazardous waste movement, and the intention to limit illegal trade, several confirmed that the largely paper-based procedure is cumbersome and inefficient. The PIC procedure involves notification of export and written consent by importing and transit states, the use of transboundary movement documents and confirmation of disposal. There is also a requirement to demonstrate the existence of a contract between the exporter and importer ensuring the waste will be managed in an environmentally sound manner (ESM). Import, export and transit states may add conditions, request additional information or deny movement.[38]

The manual exchange of documents, coupled with limited capacity in some countries to efficiently review and process PIC notifications, adds time, costs and legal uncertainty. Delays of up to 14 months for completing the paperwork are not uncommon with the private sector subsequently arranging training to ensure due process. Commentators suggested that even in some advanced economies public officials can be unclear on how to follow domestic Basel Convention implementation. Minor changes in product or shipping routes can require whole new submissions. Several firms also noted that, since shipping lines rarely indicate port stops in advance, the permitting process for transit countries has design flaws. Bribery to obtain permits and paperwork is also rife.

Firms suggested several steps could be taken to improve the process. For example, some parties could make notification processes clearer and more transparent, while capacity building could focus on digitizing document exchange. The parties to the Basel Convention are currently reviewing approaches to e-notifications, and synergies with trade facilitation initiatives could be sought (see below). Additional training and awareness-raising could help transit countries make use of the tacit consent option for transboundary movement (see Box 2).

Some firms flagged that the OECD Council Decision, which streamlines import-export processes and outlines risk-based approaches among member countries, has created a safe, easier alternative to the PIC procedure (see Box 2). The arrangement does not apply to non-OECD countries. Meanwhile, the EU Waste Shipment Regulation (WSR) implements the Basel Convention and the OECD Council Decision under EU law, regulating intra-EU trade and trade with non-EU countries. Yet even intra-EU trade under the WSR still involves time-consuming processes without clear gains, some inefficiencies and a notification procedure that is largely paper-based. One estimate suggests enforcement authorities in some member states spend up to 70% of notification approval time looking at notifications that remain unchanged from the previous year.[39]

The European Commission has also raised concerns on member state enforcement due to disparate systems of inspections and controls. A regulation amending the WSR to strengthen border inspections based on risk assessment has only recently been implemented and it is too early to tell if improvements have been made. There have been challenges reported, too, in relation to the WSR green-listed waste system, where competent authorities do not necessarily monitor the quality of general information requirements applied in third countries.[40] Further proposed revisions to the WSR would make it easier to move waste within the EU for materials recovery but more difficult to move waste out of the region.

5

Scoping Solutions

New trade policy interventions could be further explored to facilitate circular electronics supply chains.

In-depth thinking on trade policy levers for facilitating circular electronics supply chains is still nascent. In community discussions to prepare this paper, border measures, beyond the border measures and transparency emerged as areas for potential further exploration. The Basel Convention is generally understood to be an important baseline that governments use to control the movement of waste into their countries. However, as has already been noted, stakeholders flagged its implementation as the largest obstacle to scaling the circular economy. That includes both classification of products[41] as well as procedures.[42] Parties could consider changes to support circular economy objectives without compromising the protections the Basel Convention enshrines. Interested countries may also wish to explore and implement mechanisms that adapt or modify Basel Convention elements for trusted circular trade among themselves.

5.1 Border measures

Border measures involve policies that affect the treatment of goods at point of entry, departure or transit between countries. The Basel Convention sets out certain paperwork requirements, which countries then translate into national border procedures. There was consensus among firms from across the supply and reverse supply chain on the need to digitalise and automate PIC notification procedures. Synergies could be sought with implementation of the World Trade Organization (WTO) Trade Facilitation Agreement (TFA) and would support circular economy initiatives for other types of materials streams, such as plastic or batteries.[43]

Countries could pursue regulatory cooperation to implement fast-track or streamlined trade permit systems or pre-export verification where materials are being moved to pre-consented (trusted) facilities. Under the OECD Council Decision and EU WSR, “pre-consented” recovery facilities benefit from a longer consent validity for shipments thereby facilitating movements to high-performing recovery operations. A pilot initiative in Europe is now under way to further speed up the trade notification process for these facilities where regulatory criteria are aligned[44] (see below).

The concept was supported by many interviewees for this paper since it validates the quality of the service provider and can be monitored accurately. It could also shift policy-makers’ designation of products as waste merely due to achieving end of first life. If products can be demonstrated to move to legitimate reuse, refurbishment or re-engineering activities through clear disclosure mechanisms, a default waste trigger is avoided. However, there is currently no forum for discussing such approaches at an international level, an omission that fails to reflect the global nature of electronics supply chains. A coalition of countries could choose to do so. Alignment on standards for e-waste handling would be an important part of the approach (see below).

There is also a need for better data collection and classification. Statistics are generally poor on trade in e-waste and this lack of data can inhibit good policy-making. National reporting data under the Basel Convention is often incomplete or uses ambiguous definitions. International trade data cannot currently distinguish between new and waste electronic equipment, or between e-waste and recoverable material. As of January 2022, however, amendments to the World Customs Organization Harmonized System (HS) codes will further enable the identification of e-waste. The Basel Convention Secretariat has also proposed draft amendments to the HS Explanatory Notes to distinguish e-waste and non-waste.[45] And, more generally, it has cooperated with the WCO on a correlation table identifying HS codes that contain wastes covered by the Basel Convention.[46] Improvements in data collection would also support economic analysis of the opportunities for services development in repair, reuse and recycling.

Several firms were supportive of developing better materials traceability throughout the supply and reverse supply chain. Industry partnerships could lead the initiative, creating digital systems to host materials information at point of creation and then onward, with built-in QR codes or other approaches to enable producer and value chain responsibility. One such initiative is being scoped by a Forum-led Global Battery Alliance for stakeholders to create a “battery passport” for tracking. Thought is needed on scope of information to share and how to ensure accountability. Some firms mentioned the need to consider traceability methods that will remain effective as products are de-manufactured and materials are harvested and combined in bulk for recycling. Policy-makers could consider how to leverage track-and-trace initiatives to streamline trade compliance procedures given the associated costs.

Much more work is needed on illegal activities. Systems that allow authorities to spend less time focusing on known recovery or pre-consented facilities are a first step to freeing resources to monitor for illegal trade. Companies suggested that mechanisms for information sharing on legitimate business models and best practices could assist policy-makers in pinpointing illegitimate behaviour. Many OEMs are already undertaking regular audits of recyclers along with contractual arrangements and implementing closed-loop supply chains (in the case of B2B). Others suggested implementing controls on unprocessed e-waste exports that are not headed to certified pre-processing

facilities since there are limited facilities worldwide for pre-processing (dismantling and cleaning) end-of-life electronics, and so much of these are likely to end up in illegal channels.

5.2 Internal measures

Certain domestic policies operate away from the border but are critical in shaping trade and investment flows, including those affecting recycling services and electrical or electronic equipment. On electronics recovery, firms raised the need to develop harmonized standards for handling electronic waste that are recognized and accepted by regulators internationally. To date, most standards are country- or region-specific, or not always tied to the regulatory process. Countries could work together with industry and experts on a recognized standard to tie to-trade facilitation processes.

Existing examples include the Responsible Recycling R2 Standard, developed out of a US Environmental Protection Agency multistakeholder process and administered by the non-profit Sustainable Electronics Recycling International (SERI). It focuses on environmental, health and safety standards for electronics recyclers, and certification is present in over 20 countries.[47] An e-Stewards Standard for e-waste recycling was developed in parallel after differences emerged on best practices. Within Europe, the WEELABEX initiative has produced a set of harmonized standards on collection, transport and recycling of e-waste, as well as training auditors and issuing certificates. The European Committee for Electrotechnical Standardization (CENELEC) has a technical environment committee with a working group revising the standards for WEEE treatment, collection and logistics. Some stakeholders cautioned that the R2, WEELABEX and CENELEC initiatives do not sufficiently consider the situation in developing countries.

Trade commitments can also be used to ensure market access to, and non-discriminatory treatment of, foreign repair, remanufacturing and recycling services.[48] Countries have started to use FTAs to inscribe such commitments.[49] At the same time, during the interviews, stakeholders debated the role of investments in new end-of-life facilities, particularly in countries that lack an adequate regulatory environment for safely handling such waste. For some stakeholders, creating additional sites could come with risks, particularly if these cannot either sustain the large capital volumes required to absorb collection, dismantling and end-process costs, or meet best practices. Waste mismanagement and contamination can occur in underfinanced facilities. Several felt this was a further argument for exploring trade measures so products arrive at facilities with proper capacity.

Others were supportive of capacity building for small-scale recyclers, including on ESM, certification and worker safety. Clearer regulatory landscapes could help these efforts in least-developed countries (LDCs). Without e-waste regulation, professional recyclers must compete with an informal sector following sub-standard practices and cannot demonstrate safeguards or compliance processes to international clients.

Research carried out by the multistakeholder StEP initiative suggests a meeting point between these two camps. Developing economies undertake collection, manual dismantling and pre-processing, with certain e-waste components sent to specialized large smelting facilities that are only available today in some OECD countries and other components are recycled locally. A series of trials suggest the model is more eco-efficient and offers an environmentally responsible transition before the establishment of end-processing facilities in developing countries is feasible.[50]

Another example from Closing the Loop – an initiative offering circular services for IT hardware – involved the collection of over 5,000 kilograms of scrap batteries in Nigeria in collaboration with the local informal sector followed by legal shipment for recycling in Belgium. To make the project financially viable, the company uses a waste-compensation mechanism where fees collected during the purchase of new devices supports waste collection in countries lacking high-quality waste management schemes. Doing so could also help to kick-start investment in better domestic waste collection processes.

Trade and investment facilitation measures could be pursued accordingly, following an assessment of local conditions related to collection, operational scale, dismantling depth and logistics for connection with international end-processors, among other factors. A similar exercise could be done for repair and remanufacturing services.

Many countries are deploying EPR schemes for electronics sales. EPR policies can involve take-back requirements, advanced disposal fees or deposit and refund requirements. Policies are increasingly mandatory, and while some firms establish their own systems to comply, most do so through collective organizations. During the discussions for this paper, companies noted that in the context of global supply chains, EPR schemes can be difficult to manage in terms of diversity of scope, requirements and reporting processes. There are also sometimes complex policy provisions on the formation of producer-responsibility

organizations. Although the Basel Convention has developed a manual on EPR generally, and the OECD has issued EPR guidance for governments, there is no international effort to harmonize best practices for electronics.[51] That said, in theory, EPR systems will encourage the development of responsible, high-quality recycling by generating market demand.

Countries could work together with industry and experts on international standards for EPR schemes or other product aspects; for example, recyclability. International product standards enjoy a privileged status in WTO trade law since their use as a basis for technical regulations can avoid the creation of unnecessary and discriminatory barriers. WTO trade law also contains a code of good practice for industry or private standard-setting bodies to prepare voluntary private standards in a non-discriminatory fashion. Countries could also agree in FTAs to develop or adopt regional product standards to facilitate trade among themselves.[52]

5.3 Transparency

Transparency on domestic requirements for waste classification and movement will help business to plan reverse supply chains. Trade policy can be used to commit to publication, including in electronic form, and notification of relevant measures. For example, the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) Chapter on Technical Barriers to Trade encourages parties to provide transparency in the development of technical regulations, including through electronic tools, public outreach or consultations.

These provisions build on the notification requirements under the WTO TBT Agreement, which require WTO members to publish and notify draft technical regulations that are likely to restrict trade, to take into account any concerns raised by other members, and to publish adopted measures before they enter into force. Commitments to transparency of waste trade-related regulations would need to be rendered meaningful through capacity building depending on the forum. For many developing countries, TBT notifications and general regulatory transparency are lacking, not only for e-waste.

5.4 Policy action

a) International trade instruments

Some WTO members have expressed interest in renewing a trade and environment agenda within the organization. Topics on the table vary but include ideas on a trade policy contribution to addressing plastic pollution as well as trade and the circular economy. Reverse supply chains for electronics has been less discussed within the latter. WTO members could explore trade policy measures suggested above either through the existing Committee on Trade and Environment or a free-standing group (known as a plurilateral in trade terms). A trade ministers' statement on trade and the environment in scope by a group of countries could kick-start momentum in this respect. Links with other WTO deals, such as TFA implementation, is another strategic avenue.

Within a negotiation, members could use a WTO reference paper to outline best practice commitments, which reinforce market access obligations and support additional efforts at regulatory convergence. The approach was applied to the telecommunications sector from 1998 onwards. It was considered to successfully shape competitive services at a time when many countries were introducing new rules. Several stakeholders also noted commitments in certain FTAs limiting prohibitions on the import of remanufactured goods or agreement on criteria for identifying a remanufactured good.[53] Remanufacturing provisions were proposed in the context of WTO negotiations in the late 2000s, but these stalled in part due to a narrow scope.

A WTO intervention would need to complement the Basel Convention by ensuring goods are kept in circulation for as long as possible. Analysis of existing international guidelines and domestic regulations affecting trade for circular electronics could scope where additional global trade interventions are needed.

b) Regulatory cooperation

Regulatory cooperation complements trade policy by putting in place mechanisms that reduce friction between markets and build policy-maker trust. There are some ongoing initiatives between nations on circular trade that could be worth tracking and potentially mirroring elsewhere. For example, France, the Netherlands, the UK and Flanders have established a voluntary international agreement known as the North Sea Resources Roundabout (NSSR) to support a circular economy of secondary resources. The NSSR has launched a fast-track pilot notification for shipments to

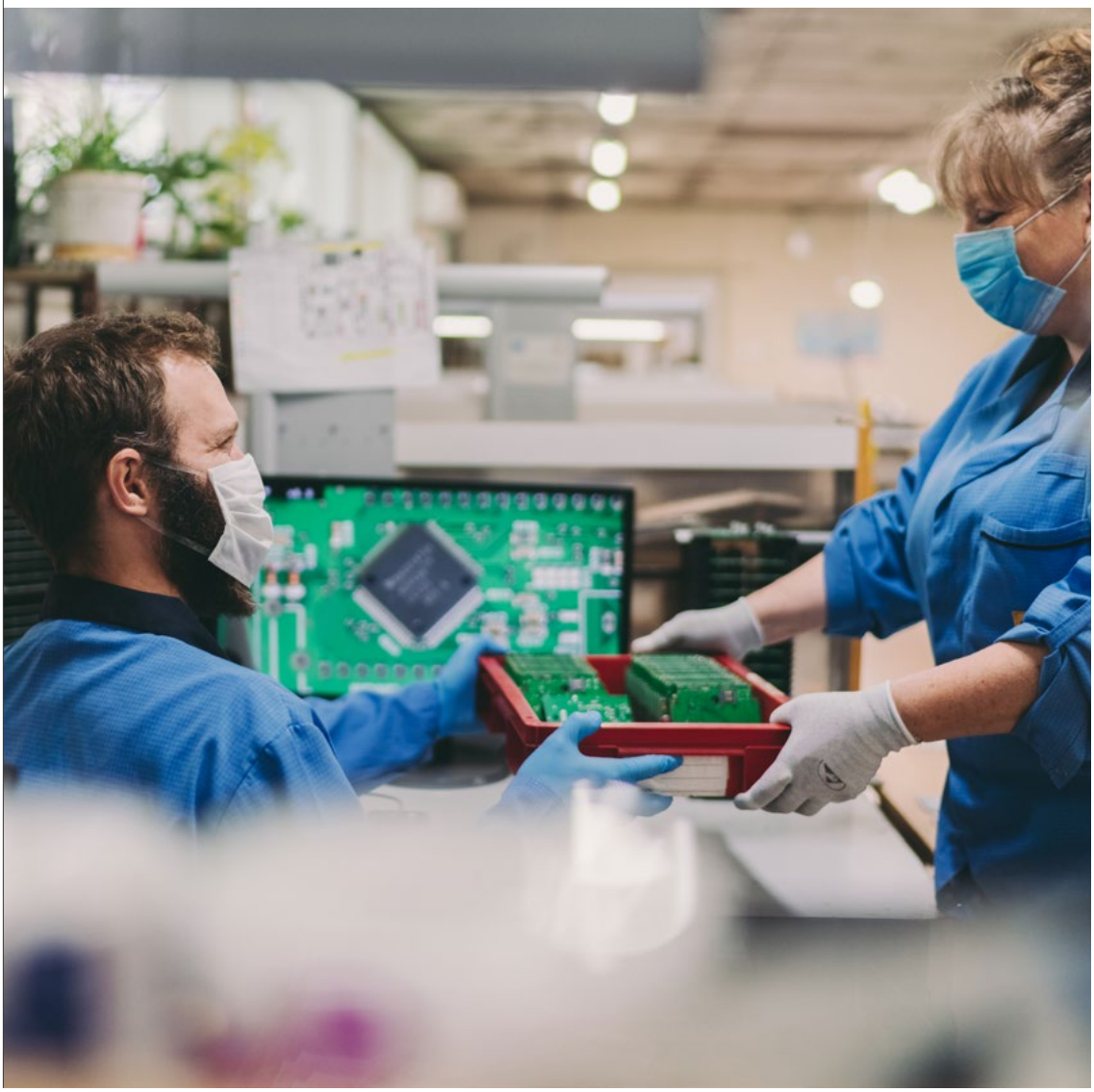
compliant EU e-waste recyclers. Public and private sector experts are working to design common criteria for pre-consented facilities, pledging to recognize each other's pre-consents and correspondingly speed up the regular notification procedure for trade.

The EU's Waste Shipment Regulation (WSR) Article 14 allows for this kind of fast-track notification but has been under-used. It is also hoped that easier notifications will free up border officials' resources for identifying illegal e-waste trade.[54] The first pilot notification and approval for a shipment of e-waste between traders in the Netherlands and Austria took place in March 2019. The time taken to approve documentation was 19 days, a significant reduction compared to regular notifications.

Stakeholders consulted for this paper suggested that similar pilots could build transaction confidence in secondary materials flows. It was recommended to start with certain items, particularly those in the B2B space and where the data is less indicative of dumping. Basel Convention classifications could inform the type of recoverable wastes that would be a focus for such agreements among countries with an interest in furthering more efficient and environmentally protective trading arrangements.[55] Experts again cautioned that changes to Basel Convention classifications would also create challenges for these types of circular economy solutions, particularly where recycling infrastructure would not be viable in certain developing countries, resulting in waste mismanagement. The adoption of bilateral or multilateral Article 11 Agreements could provide an alternative legal framework for materials trade that are priorities for the circular economy.

6 Conclusion

The circular economy can deliver for both environment and job prospects. Trade facilitation can unlock new opportunities.



The first half of this paper listed trade-related challenges for circular electronics. Identifying solutions and collaboration on these is vital if we are to shift towards sustainable development. The circular electronics vision starts from the premise that it is possible to use technology to improve lives all the while limiting harmful improper and unnecessary disposal. The second half of this paper explored potential improvements to the regulatory landscape.

The Basel Convention promotes the achievement of certain goals, notably controlling the transboundary movement of waste, but it was conceived at a time when recovering resources from waste and reusing for new production was not part of mainstream thought. Its structures now place certain constraints on governments and companies working on the circular economy. That could change with a focus on simplifying and digitizing procedures, an examination of classification decisions, and so on.

Engagement of the trade policy community, meanwhile, could encourage country-level implementation that is more balanced between managing risky trade and facilitating circular trade.

As the world continues to battle COVID-19, with many countries facing challenging economic prospects, the circular economy can deliver for both the environment and job prospects. The pandemic represents an opportunity to rethink and reorganize current governance approaches. Bringing a trade facilitation angle to e-waste discussions addresses an environmental challenge with economic tools. Willing partners could transform and enhance existing regulations to deliver sustainable growth pathways at a time when these are needed most. The World Economic Forum stands ready to work with an interested community of governments, companies, civil society and experts to deepen knowledge and execute pilot interventions to assess impact.

Appendix

BOX 2: **Samples of e-waste domestic legislation and initiatives**

Legislation and initiatives	Key features	X-border requirements
WEE Directive - Directive 2012/19/EU[56]	EU member states must devise laws to reach the following goals: Minimize WEEE disposal through: free take-back schemes for consumers; decreased landfilling through advanced collection and clear recovery targets; separating WEEE from other waste streams in collection and treatment cycles; layout eco-design requirements to reduce WEEE and simplify recovery; producer responsibility for design end-of-life treatment of products; and create minimum standards for WEEE treatment to avoid disparities within the EU.	WEEE shipments should adhere to Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on Shipments of Waste (Waste Shipment Regulation). The WSR outlines procedures for the transboundary shipments of waste and implements the EU's obligations under the Basel Convention and the OECD Council Decision. Within the EU, the shipment of all waste for disposal and of hazardous waste (and other wastes under Annex II of the Basel Convention) for recovery is subject to a PIC procedure set out under the WSR, while other waste is "green"-listed and subject only to a general information requirement. The WSR also bans exports from the EU of (I) any waste destined for disposal in third countries (except to EFTA countries, unless they prohibit imports); and (ii) hazardous waste (and other waste under Annex II of the Basel Convention) destined for recovery in non-OECD countries. Exports of waste for disposal in EFTA countries is also subject to PIC. Annex VI to the WEEE Directive (along with Correspondents' Guidelines No. 1 to the WSR) lays out how used equipment shipped for reuse, repair, or refurbishment may be non-waste in the EU.

Legislation and initiatives	Key features	X-border requirements
RoHS Recast Directive 2011/65/EU[57] RoHS 3 (EU 2015/863)[58]	Restricts the use of hazardous substances in EEE (listed in Annex II). Requires the substitution of hazardous materials for safer ones. Supports the collection and recycling of EEE through structured collection mechanisms for consumers to return used electronics for free. *RoHS 3 EU 2015/863 adds 4 more regulated phthalates to the list.	Manufacturers must design EEE in accordance with Article 4 parameters which indicate inclusion and exemption criteria, produce an EU declaration of conformity, and place "CE" mark on goods. Steps for product ID requirements include indications of EEE type, serial/ batch number either on the product, its packaging, or documents attached to the product. Manufacturers must withdraw, recall or take corrective measures to fix EEE that does not conform with Directive if placed on the market. Importers must ensure that EEE placed on union market complies with Directive. Additionally, they must ensure that EEE has undergone conformity assessment procedures and has the required CE marking before bringing goods on the market. In the case that non-compliant EEE imports have been made, importers are required to withdraw, recall or take corrective measures to fix products and inform national authorities of exporting member states. In the same regard, importers must keep a roster of non-compliant EEE and EEE recalls and keep distributors up to date.
National Strategy for Electronics Stewardship (NSES), USA[59]	Aims to improve the management of used electronics in the US and in developing countries. Incentivizes eco-design of electronics through increased research and development, supporting consumer purchasing of certified green electronics, and stewardship prizes for innovative green electronics. Increase transparency in government policy on federal electronics	Limit negative impact of US exports of e-waste to developing countries by filling information gaps on trade flows, partnering with developing countries to provide technical assistance on management and handling of e-waste, introduce regulations to increase compliance with existing regulatory frameworks governing electronic exports destined for reuse and recycling, and promoting ratification of the Basel Convention.
China RoHS: Administrative Measures on Restricted Use of Hazardous Substances in Electrical and Electronic Products, China[60]	Mitigate environmental pollution resulting from discarded EEE, encourage green production and consumption, and promote environmental and health safety. Restrict use of hazardous substances (Lead, Mercury, Cadmium, Hexavalent Chromium, PBB, and PBDE) in EEE.	All products manufactured inland and imported must comply with labelling standards (listing name of hazardous substances contained in product, recyclability of products, and information about impacts of improper disposal). These measures are applicable to imports of electrical and electronic products in PRC, but not in Hong Kong, Macao and Taiwan. However, exports from these territories to PRC should comply.

Legislation and initiatives	Key features	X-border requirements
Import Waste Management Catalogue (Announcement No. 11/2008, by SEPA, MOFCOM, NDRC, GACC and AQSIQ), China[61] * Latest modifications made in Announcement of Adjustment of Imported Waste Administration Catalogue, 2018 Announcement No.6	Aims to improve domestic solid waste treatment and disposal and enforces strict import controls on solid wastes to decrease domestic volumes of solid waste. Promotes ecologically sound management and disposal of solid wastes. In 2018, 16 types of solid wastes, including electrical appliance scraps, were added to the catalogue of prohibited solid waste imports.	Prohibits imports of solid waste scraps listed on catalogue (those linked to WEEE would be metal waste and waste containing metal, and others – specifically No. 68 and 69 on the catalogue), but exports are not prohibited.
Environmental Control Standards for Imported Solid Wastes as Raw Materials, (GB 16487.12-2017), China[62]	Restrict and prohibit imports of solid waste as raw materials to manage waste-related harm to the natural environment, and to human health. Enforcement of Law on the Prevention and Control of Pollution by Solid Wastes and the Law on the Prevention and Control of Radioactive Pollution.	The Catalogue of Restricted Import Solid Wastes that can be used as Raw Materials in China restricts imports of metal scrap, including alloys used as raw materials.
E-waste (management Rules, 2016, India[63] *Amended by E-waste (Management) Amendment Rules, 2018, India[64]	Reduce the use of hazardous substances in EEE products in compliance with the RoHS provisions. Require authorization for e-waste collection, dismantling, and recycling. Manufacturers, producers, importers, transporters, refurbishers, dismantlers and recyclers are liable for any environmental damages from mishandling of e-waste	Importers are required to apply for EPR authorization and comply with RoHS guidelines which requires technical documents including an EPR plan; a permit authorizing sale of materials, a contractual agreement with dealers; waste collection centres, recyclers, treatment, storage and disposal facilities, etc.; a licence or permit from the Directorate General of Foreign Trade; and, a self-declaration on RoHS provision.
National Integrated WEEE Management Strategy, Thailand[65]	Support environmentally friendly EEE through green public procurement. Develop a WEEE database. Create distinct categories for WEEE collection, storage, and transport. Develop processing and recycling units; and, public Education.	Strengthen controls on imports and exports of WEEE (desktop and laptops, mobiles and land lines, air-conditioners, televisions, refrigerators, other EEE listed in minister regulation).
NEA RoHS controls (SG-RoHS), Singapore[66]	Based on EU-RoHS Directive, SG-RoHS lays upstream restrictions on 6 hazardous substances found in some EEE (Lead, Mercury, Hexavalent Chromium, Polybrominated Biphenyls, Polybrominated Diphenyl, and Cadmium).	An HS licence/permit from the National Environment Agency-Pollution Control Department (NEA-PCD) is required for imports or exports of hazardous substances controlled under the environmental Protection and Management Act (EPMA). Importers of controlled substances must declare products by assigning accurate HS classifications and product codes in TradeNet (e-service for customs) and submit a declaration note to the NEA-PCD office.
Ban on some Fluorescent Lamps and Compact Fluorescent Lamps (CFLs), Singapore[67]	Restrictions on import of some fluorescent lamps and fluorescent lamps to better manage waste and ensure that lamps can be discarded safely.	Import ban on lamps with over 10mg of mercury (for straight and circular lamps) and over 5mg of mercury (for CFLs).

Legislation and initiatives	Key features	X-border requirements
National Environmental Standards and Regulations Enforcement Agency (NESREA) approved National Environmental (Electrical/Electronic Sector) Regulations in 2011, Nigeria[68]	Prevent and limit pollution form activities involving the Electrical/ Electronic Sector to the environment (new and used EEE/UEEE included). It takes the 5R approach (Reduce, Repair, Reuse, Recycle, and Recover). Based on EPR and encourages actors (importers, exporters, manufacturers, assemblers, distributors, and retailors of EEE products) to implement buy-back schemes and collaborate with NESREA to effectively carry out a buy-back programme. They have published guidelines for responsible collection and processing of post-consumer EEE goods.	Imported EEE should be functional (even UEEE) and should indicate manufacturing date as well as warranty. They should also display a pin and serial number. EEE importers must register imports with NESREA.
Hazardous and Electronic Waste Control and Management Act (Act 917) + Hazardous and Electronic Waste Control and Management Regulations (LI 2250), Ghana[69]	Regulate the management and disposal of hazardous waste and electrical and electronic waste. Provide a list of hazardous and other wastes, a notification form for cross-border waste trade, a movement document for transboundary waste trade. Classify polychlorinated biphenyls waste for segregation, and lists items which can be levied.	Producers and Importers are required, under this act, to report to the EPA and pay an eco-tax for electronics imports.
Law on Comprehensive Waste Management (2010) (in accordance with OECD/LLEGAL/0147), Costa Rica[70]	Reinforce EPR, waste management law, and polluter pays principle.	Producers and importers of WEEE pay the cost of waste management and treatment.
MADS and MINCIT - Single Regulation of the Environment and Sustainable Development Sector (No.1076/2015), Colombia[71]	Include provisions for WEEE management.	Definitions of producer expanded to include importers of EEE for their own use. ANLA is also permitted to publicly share data on WEEE collection and management.
Law 1672 (2013) for the Integrated Management of WEEE, Colombia[72]	Provide policy guidelines WEEE management. Adopt principles of EPR. Provide incentives for responsible production and consumption. Promote collaboration among producers, retailers, and consumers.	MADS and MINCIT regulate imports of used, refurbished, repaired, or rebuilt EEE and ensure application of EPR.

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22. Art. 1 of the Basel Convention. Non-hazardous e-waste can still be subject to national or regional requirements such as "green-listed" waste in the EU or procedures on pre-movement inspection of recycling materials in China. Technical Guidelines, para. 43.
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24. Art. 4 and Art. 13 of the Basel Convention. See also Revised Standardized Reporting Format for Transmitting Information under Paragraphs 1 (a) and (b) of Article 4 and Paragraphs 2 (c) and (d) of Article 13 of the Convention (Import and Export Prohibitions).
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26. Art. 4.5 and Art. 11 of the Basel Convention.
27. Art. 6 and Art. 7 of the Basel Convention.
28. Art. 11 of the Basel Convention.
29. OECD, 2008, Decision of the Council on the Control of Transboundary Movements of Wastes Destined for Recovery Operations [Accessed 10 August 2020]. For a list of article 11 agreement, see Basel Convention, 2020, Text of the Multilateral/ regional Agreements or Arrangements in Force as Transmitted to the Secretariat [Accessed 10 August 2020].
30. Recovery operations under the OECD Council Decision include recycling, but not disposal. See OECD Guidance Manual for the Implementation of Council Decision C(2001)107/FINAL, as amended, on the Control of Transboundary Movements of Wastes Destined for Recovery Operations.

31. The United Nations runs Solving the E-waste Problem (StEP), a multistakeholder consortium dedicated to research, training and awareness raising on e-waste issues. The UN also runs the International Environmental Technology Centre that supports the application of environmentally sound technologies in developing countries on waste management. The business and non-profit led Global Enabling Sustainability Initiative (GeSI) works to advance sustainability within the ICT industry and includes a focus on e-waste. A multi-agency UN partnership known as the Global E-waste Statistics Partnership (GESP) collects data from countries in an internationally standardized way. The Basel Convention itself is home to two public-private partnerships including the Mobile Phone Partnership Initiative (MPPI), providing guidance on the collection, transboundary movement, material recovery and ESM approaches, and the Partnership for Action on Computing Equipment (PACE), containing ESM criteria recommendations for testing, refurbishment, repair, materials recovery and recycling on computing equipment.
32. ILO, 2012, The Global Impact of E-waste: Addressing the Challenges [Accessed 12 June 2020].
33. UNEP, 2015, Illegally Traded and Dumped E-Waste Worth up to $19 Billion Annually Poses Risks to Health, Deprives Countries of Resources, Says UNEP Report [Accessed 4 August 2020].
34. A 2017 International Telecommunication Union (ITU) report cites data from the Basel Convention Secretariat suggesting between 15-50% of e-waste on the African continent is linked to transboundary illegal import from developed countries. ITU, 2017, Global E-waste Monitor 2017, Chapter 10, Reginal E-waste Status and Trends [Accessed 16 June 2020].
35. Scenarios 1(ii) and 1(iii) of Box 1 apply if the national legislation bans the export, transit, or import of such "other wastes" under Annex II.
36. European Commission , 2020, Commission Staff Working Document Evaluation of Regulation (EC) No 1013 /2006 of the European Parliament and of the Council of 14 June 2006 on Shipments of Waste [Accessed 4 August 2020]; DIGITALEUROPE, 2019, A Circular Economy Card for the Waste Shipment Regulation [Accessed 4 August]; and, de Gier, Marina and IMPEL Waste & TFS, 2015, UEEE and WEEE Classification [Accessed 5 August 2020].
37. Article 11 of the Basel Convention allows parties to enter into bilateral, multilateral or regional agreements on the transboundary movement of controlled wastes – including with non-parties. The provisions of the Convention do not apply to these transboundary movements if the deals are compatible with requirements on environmentally sound management. For more see, Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, Article 4 (General Obligations), paragraph 5.
38. World Economic Forum, 2020, Plastics, the Circular Economy and Global Trade [Accessed 4 August 2020].
39. DIGITALEUROPE, 2019, A Circular Economy Card for the Waste Shipment Regulation [Accessed 17 July 2020].
40. European Commission , 2020, Commission Staff Working Document Evaluation of Regulation (EC) No 1013 /2006 of the European Parliament and of the Council of 14 June 2006 on Shipments of Waste [Accessed 4 August 2020].
41. Virtual sessions of the Basel Convention will pick up in September 2020 and again next year. The next Conference of the Parties (COP) is scheduled for July 2021 where decisions will be made on annex allocations.
42. Beyond classifications, stakeholder suggested looking at procedural elements, including moving to tacit consent for transit (maritime) countries where agreement on shipment has been reached between export and destination parties. Transit countries should not be allowed to over-rule the classification of e-products. A bond system could also be considered to replace the current guarantee requirements to inject more confidence and liquidity in the system.
43. World Economic Forum, 2020, Plastics, the Circular Economy and Global Trade [Accessed 4 August 2020].
44. Other recommendations have been made to improve WSR shipment notifications for the circular economy. For example, the industry-led DIGITALEUROPE group outlines a set of conditions that could backstop a pre-approved shipment procedure, combined with an EU digital platform that would keep track of shipments and empower Member States' inspection, enforcement and statistical efforts. For more see: DIGITALEUROPE, 2019, A Circular Economy Card for the Waste Shipment Regulation [Accessed 17 July 2020]
45. See report on the status of the work of the World Customs Organization on the Harmonized Commodity Description and Coding System in relation to the Basel Convention, UNEP/CHW/OEWG.12/INF/10.
46. World Customs Organization, 2020, Correlations Between the HS and International Conventions [Accessed 4 August 2020].
47. SERI, 2015, Annual Report 2015 [Accessed 4 August 2020].
48. Countries could make such commitments based on a positive list approach (by making explicit commitments for recycling services) or a negative list approach (by not making any reservations for recycling services). For examples of the positive list approach, see endnote l.
49. For instance, the EU has included recycling services as a committed service subsector in FTAs, such as the EU – Korea FTA, the EU – Singapore FTA and the EU – Viet Nam FTA. In addition, Article 24.12(h) of CETA requires parties to cooperate on promoting recycling and reduction of waste. The EU's proposed chapters on energy and raw materials in its negotiations with Australia and New Zealand also include a provision on cooperation to promote recycling of goods.
50. Wang, Feng, Jaco Huisman, Christina E.M. Meskers, Mathias Schluep, Ab Stevels and Christian Hagelüken, 2012, The Best of-2-Worlds Philosophy: Developing Local Dismantling and Global Infrastructure Network for Sustainable E-Waste Treatment in Emerging Economies [Accessed 21 July 2020].
51. For more see OECD, 2016, Extended Producer Responsibility: Updated Guidance for Efficient Waste Management [Accessed 17 August 2020]. Parties to the Basel Convention have also developed various guidance on ESM, including a toolkit, as well as the work done through the MPPI and PACE (see footnote xii).

52. For example, the EU-Mercosur Trade Agreement (agreement in principle) contemplates the development of regional technical standards in order to facilitate trade between the parties. Under the EU – Central America Association Agreement, parties commit to promote the development of regional technical regulations, and adopt the regional technical regulations and conformity assessment procedures listed in the agreement. Similarly, in the COMESA Treaty parties agree to the adoption of "African regional standards". Article 5(1)(c) of the EU – MERCOSUR trade agreement (agreement in principle); Articles 129 (b) and 305 of the EU – Central America Association and Article 113 (b) of the COMESA Treaty.

53. See, for example, CPTPP Article 2.11 on Remanufactured Goods limiting prohibitions on the import of remanufactured goods or CPTPP Article and outlining common criteria for identifying a remanufactured good. CPTPP Article 3.4 outlines rules of origin requirements. USMCA rules on export and import restrictions are also extended to remanufactured goods through Article 2.12, and Article 2.18 of the EU-Japan Economic Partnership Agreement requires that remanufactured goods be treated as new goods.

54. Green Deal, 2020, International Green Deal North Sea Resources Roundabout to Work on New Case [Accessed 4 August]. Also to note, customs, border and harbour officials have many illegal trade streams to tackle, ranging from arms to human trafficking, which can result in less attention to e-waste if resources are squeezed.

55. Beveridge & Diamond, 2019, Basel Ban Amendment to Restrict International Trade in Hazardous Recyclables [Accessed 2 July 2020]. The Ban Amendment prevents the export of certain hazardous wastes for disposal from OECD to non-OECD economies from countries that have agreed to be bound by that amendment. A subset of hazardous wastes defined by the Convention may not be exported for recycling. The Ban Amendment does not apply if waste is considered hazardous by the exporting or importing country but not according to Article 1(1)a of the Convention (wastes categorized on Annex I, controlled wastes, unless they do not have any hazardous characteristics listed in Annex III) if the shipment is for recycling.

56. The European Parliament and the Council of the European Union, 2012, Directive 2012/19/EU of The Parliament and of the Council of 4 July 2012 on Waste Electrical and Electronic Equipment (WEEE) (Recast) (Text with EEA Relevance) [Accessed 30 June 2020].

57. The European Parliament and the Council of the European Union, 2011, Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (Recast) (Text with EEA Relevance) [Accessed 30 June].

58. RoHS Guide, 2015, RoHS 3 (EU 2015/863) [Accessed 30 June].

59. Interagency Task Force on Electronics Stewardship, 2014, Moving Sustainable Electronics Forward: An Update to the National Strategy for Electronics Stewardship [Accessed 30 June].

60. China RoHS, 2016, Administrative Measures on the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products [Accessed 30 June 2020].

61. European Commission,2017, Responses to European Union's Comments Regarding China's Environmental Control Standards for Imported Solid Wastes as Raw Materials [Accessed 4 August 2020]; World Trade Organization, 2018,China – Catalogue of Solid Wastes Forbidden to Import into China [Accessed 4 August 2020]; and, Ministry of Ecology and Environment the People's Republic of China, 2008, Announcement on Releasing Catalogue of Solid Wastes Forbidden to Import, Catalogue of Restricted Solid Wastes that can be Used as Raw Materials, and Catalogue of Automatic-Licensing Import Solid Wastes that can be Used as Raw Materials [Accessed June 30 2020].

62. European Commission, 2017, Responses to European Union's Comments Regarding China's Environmental Control Standards for Imported Solid Wastes as Raw Materials [Accessed 4 August 2020] and Ministry of Ecology and Environment the People's Republic of China, 2018, Solid Wastes Pollution Control Standard [Accessed 4 August 2020].

63. Government of India, 2016, Ministry of Environment, Forest and Climate Change Notification [Accessed 29 July 2020].

64. Government of India, 2018, Ministry of Environment, Forest and Climate Change Notification [Accessed 29 July 2020].

65. Ministry of Natural Resources and Environment Pollution Control Department and Thai Customs, 2015, Updating the National Regulations and Implementation of the Basel Convention in Thailand [Accessed 30 August 2020].

66. National Environment Agency (Singapore), 2017, Frequently Asked Questions (FAQs) on Restriction of Hazardous Substances (RoHS_ in Electrical and Electronic Equipment (EEE) in Singapore [Accessed 29 July 2020].

67 National Environment Agency, 2019, Control of Certain Mercury-Added Products under the Environmental Protection and Management Act [Accessed 29 July 2020].

68. National Environmental Standards and Regulations Enforcement Agency (NESREA), 2011, National Environmental (Electrical/Electronic Sector) Regulations, S. I. No 23, 2011 [Accessed 30 June 2020] and Basel Convention, 2012, E-Waste Country Assessment Nigeria [Accessed 30 June 2020].

69. The Government of Ghana, 2016, Hazardous and Electronic Waste Control and Management Act (ACT 917) [Accessed 29 July 2020] and European Commission, 2019, E-Waste Management in Ghana: from Grave to Cradle [Accessed 29 July 2020].

70. OECD, 2020, OECD Accession Review of Costa Rica in the Fields of Environment and Waste Summary Report [Accessed 4 August 2020] and Heinz Böni, E-Waste in Latin America [Accessed 4 August 2020].

71. Beveridge & Diamond PC, 2017, Latin American Environmental Regulatory Tracker [Accessed 4 August 2020] and Heinz Böni, E-Waste in Latin America [Accessed 4 August 2020].

72. Méndez-Fajardo, Sandra, Heinz Böni, Carlos Hernández, Mathias Schluep and Sonia Valdivia, 2017, A Practical Guide for the Systemic Design of WEEE Management Policies in Developing Countries [Accessed 30 August 2020] and the Congress of the Republic of Colombia, 2013, Law 1672 of 2013 [Accessed 4 August 2020].

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